Foreword

India inhabits 15 per cent of world livestock population on 2 per cent geographical area, which itself is an indicative of the extent of livestock pressure on our resources in comparison to other countries. Recent trend in animal husbandry indicates a rapid and considerable increase in the consumption of livestock products. However, deficiency in quality feed and fodder is major hurdle in achieving desired level of livestock production. The production and quality of feed and fodder will be pivotal in sustaining the incremental growth of animal husbandry sector. Due to competing land use, area under cultivated fodder is static for last two decades because of low priority in comparison to other sectors of agriculture. Hence, only option available is to catalyze horizontal increase in underutilized areas and vertical increase in the forage productivity to meet out the ever increasing demand of the fodder for economic livestock production. In present scenario the productivity of cultivated fodder crops is low as minimal production resources are allocated to these species. This needs to be tackled by educating the farmers about the production packages of fodder crops like selection of appropriate forage species, varieties and management techniques to sustain forage yields and soil fertility. The country has varied agro climatic conditions as well as farming situation. In these circumstances, the objective of improving the forage varieties and forage productivity is complicated. Each crop has to be dealt with concise manner to accommodate the information on sowing technique, varieties, nutrient management, water management, crop protection, quality attributes and harvesting.

AICRP on Forage Crops & Utilization is consistently pursuing the mandate for development of varieties, technique for increasing productivity of cultivated forage crops and grasses of annual and perennial nature and eco-friendly plant protection technologies and bringing different stakeholders under single umbrella.

I would like to sincerely acknowledge Project coordinator and other scientists of PC (FC&U) unit who have contributed in the preparation of the Annual Report *Rabi* 2020-21 and helped in achieving the set targets. This Annual Report is a brief compilation of outcome of activities carried out by different centers and result of various trials during the *Rabi* 2020-21.

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PREFACE

The Annual Report (2020-21), Part II–*Rabi* 2020-21 embodies the results of various research trials conducted in the areas of forage crop improvement, crop production and crop protection with the view to develop and test the technologies for better quality/quantity of forage production in different agro climatic situations. This report is the outcome of sincere efforts made by all contributing scientists and staff at the Coordinating Unit and AICRP-FCU Centers. The trials and activities were successfully conducted as per the technical programme fixed for *Rabi* 2020-21. The forage crops tested during the period under report, included forage cereals and legumes adaptable to a wide range of agro-ecological regions of the country. The report is divided into several chapters, which include Crop Improvement, Crop Production, Crop Protection, Breeder Seed Production etc. The results of multi-locational evaluation of newly developed genetic material for single and perennial forage species are compiled in Crop Improvement chapter. The trials presented in Crop Production chapter focused on optimization of fertilizer levels for forage crop in different cropping system, forage production potential, location specific research on weed management and agronomical trial for AVT entries of Oats, Berseem and Lucerne. The chapter on Crop Protection deals with different aspects of crop protection in important rabi forage crops *viz.*, Berseem, Oats, Lucerne etc. as well as generation of technologies for pest management in the selected crops. The information on breeder seed production against the DAC indent is also provided in Breeder Seed Production chapter. Weather data from coordinating and voluntary centers has also been compiled to correlate the growth and yield of forage crops with weather parameters at different sites during crop period. Other chapters include details of inhouse breeding activities etc.

The contribution and sincere efforts made by each and every member of the team and their associates at the centres deserve appreciation in achieving the objectives of this project. Their valuable contribution for over all outputs of AICRP on Forage Crops and Utilization is gratefully acknowledged.

My colleagues at Project Coordinating unit, Dr. R. K. Agrawal, Principal Scientist (Agronomy), Dr. Nitish R. Bhardwaj, Scientist (Plant Pathology) and technical officers, Shri R. S. Patel and Shri H. K. Agarwal provided support in distribution of seed/planting material for the trials and analysis and tabulation of data of trials conducted at all the locations. Their contributions are thankfully acknowledged.

The administrative support and cooperation received from Dr. Amaresh Chandra, Director, IGFRI during the period is thankfully acknowledged. I also record my sincere thanks to colleagues at IGFRI for their kind support.

Meeting all the targeted activities would not have been possible without the active leadership, support, guidance and encouragement received from Dr. T. Mohapatra, Secretary DARE & DG, ICAR; Dr. T. R. Sharma, DDG (CS); Dr. Y. P. Singh, ADG (FFC) and Dr. D. K.Yadava, ADG (seed) are gratefully acknowledged. Each and every one in the team at AICRP on Forage Crops & Utilization gratefully acknowledges their guidance and support.

A. K. Roy
Project Coordinator

CONTENTS

EXECUTIVE SUMMARY

A. Forage Crop Improvement

IVTB: An Initial Varietal Trial in Berseem comprising of five entries along with one national check (Wardan) and one check in respective zones was conducted at 20 centres located in four different zones (HZ, NWZ, NEZ, CZ) of the country. There were 4 locations in HZ, 6 in NWZ, 5 IN NEZ and 5 in Central zone. For green forage yield (q/ha), in central zone, entry JHB-20-1 was 10.8% better than the best check. At all India level comprising of all 4 zones, entry JHB-20-1 (9.8%), entry JHB-20-2 (8.8%), entry JB-08-17 (6.1%) and entry PC-114 (3.7%) performed better over the national check Wardan. For dry matter yield (q/ha), at all India level combining all 4 zones, entry JHB-20-1 (7.4%), entry JHB-20-2 (6.6%) performed better over the national check Wardan. All other entries were below par or marginally superior in comparison to best check. For crude protein yield (q/ha), JHB-20-2 was best performer, for crude protein percentage, entry PC-114 ranked first. For IVDMD, entry JHB-20-2 ranked first.

AVTB-1: A First stage Advanced Varietal Trial in Berseem comprising of four entries along with one national check (Wardan) and one respective zonal check was conducted at 20 centres located in four zones (Hill, North West, North east and Central zone). There were 4 locations in Hill, 6 locations in NW, 5 in NE zone and 5 in central zone. For green forage yield (q/ha), entry BM-14 (5.3%) in NWZ, and entries BM-14 (10.2%), JB-07-15 (6.4%) at all India level were superior over the best check. For dry matter yield (q/ha), entry JB-07-15 (12.4%) in central zone was superior over the best check. All other entries were below or marginal superior in comparison to best check. For crude protein yield (q/ha), BM-14 was best performer followed by JB-07-15 (12.1 q/ha). For crude protein percentage, entry BM-14 ranked first followed by HFB-16-10. Entry BM-14 ranked first for NDF and ADF whereas entry JB-07-15 ranked first for IVDMD %.

AVTB-2: A Second stage Advanced Varietal Trial in Berseem comprising of five entries along with one national check (Wardan) and one resepctive zonal checks was conducted at 15 centres located in three zones. There were 7 locations in NW, 3 in hill and 5 in central zone. For green forage yield (q/ha), in hill zone, entries JHB-18-1 (11.4%), JHB-18-2 (7.9%), JB-06-11 (5.3%); entries BM-12 (6.5 %), JHB-18-2 (5.3%) in NWZ, were superior than the best check. Combining the all three zones entries BM-12 (10.9%), JHB-18-2 (9.3%), JHB-18-1 (8.4%), were better than the national check Wardan. For dry matter yield (q/ha), entries JHB-18-2 (29.2%), JB-06-11 (18.8%), JHB-18-1 (13.4%), BM-12 (11.5%), HFB-15-5 (1.6%) in HZ, entries BM-12 (10.9%), JHB-18-2 (3.4%), HFB-15-5 (4.3%), JB-06-11 (1.5%) in NWZ were better than the best check. Combining the all three zones, entries BM-12 (9.3%), JHB-18-2 (7.3%), JHB-18-1 (5.1%) were better than the national check Wardan. All other entries were below par or marginally superior in comparison to best check. For crude protein yield (q/ha), BM-12 was best performer followed by JHB-18-. For crude protein percentage, national check Wardan (18.4%) ranked first. Entry JHB-18-1 ranked first for NDF and IVDMD.

AVTB-2 (SEED): A Second stage Advanced Varietal Trial for Seed in Berseem comprising of five entries along with one national check (Wardan) and one respective zonal check [BL-22 (HZ), BB-2 (NWZ and CZ)] was conducted at 8 centres located in three zones. There was single location in HZ, 3 in NW and 4 in locations central zone. For seed yield (q/ha), in NW zone, entries HFB-15-5 (25.5%), BM-12 (21.2%), JHB-18-1 (5.0%), in CZ entry JB-06-11 (5.5%) performed better than the best check. Combining all three zones, entry JB-06-11 gave 5.2% higher yield than the national check Wardan.

IVTO (SC): In **Initial Varietal Trial Oat (single cut) IVTO (SC),** thirteen entries along with two national checks (OS-6 and Kent) and one zonal check for respective zones were evaluated at 28 locations across the five zones. There were 3 locations in hill zone, 5 in NWZ, 7 in NE, 5 in south zone and 8 in central zone. For GFY (q/ha), In NWZ, entry SKO-244 (7.4%), in CZ, entry HFO-1003 (5.2%) were superior over the best check. At all India level entries performing better than the best national check were HFO 1013 (11.4%), HFO 1003 (9.1%), SKO-244 (9.1%), JO-08-37 (7.4%), HFO-1009 (7.2%). For DMY (q/ha), in HZ, entries SKO-244 (9.6%), HFO 1003 (6.5%), in NWZ, entries HFO 1013(6.6%), SKO 244 (5.5%), JO-08-37 (5.1%) and at all India level, the entries HFO 1003 (13.9%), HFO 1013 (10.3%), JO-08-37 (9.9%), SKO-244 (8.9%) showed higher yield than the best check. Other entries were inferior or marginal superior to the best check. Entry HFO-1013 was ranked first for crude protein yield. For crude protein content, JHO-20-1 and OL-1980 ranked joint first. JO-08-37 was best for NDF% whereas UPO-20-1 was best for ADF%. Entry HFO-1009 was best for IVDMD.

AVTO (SC)-1: In **First Advanced Varietal Trial in Oat (single cut),** four entries promoted from IVT were evaluated against two national checks (OS-6 and Kent) and one zonal check in respective zones at 28 locations. There were 3 locations in HZ, 6 in NWZ, 7 in NEZ, 8 in CZ and 4 in SZ. For GFY (q/ha), in south zone entry HFO-904 (7.1%) and at all India level, entries HFO-904 (13.9%), HFO-906 (13.3%), JO-07-28 (11.0%) were better than the best national check. For DMY (q/ha), in south zone, entry HFO-904 (7.9%) and at all India level, entries HFO-904 (17.4%), HFO-906 (14.2%), JO-07-28 (10.5%) were better than the best national check. Entry JO-07-28 was ranked first followed by HFO-904 for crude protein yield. For crude protein content, entry JO-07-28 ranked first. Entry OL-1960 was best for NDF%, ADF% as well as IVDMD%.

AVTO (SC)-2: In Second Advanced Varietal Trial Oat (Single cut) comprising of seven entries along with two national checks (OS-6 and Kent) and one zonal check (SKO-96 for HZ, OS-403 for SZ and RO-11-1 for CZ) for respective zones were evaluated at 14 locations across the three zones. There were 3 locations in HZ, 7 in CZ and 4 locations in South zone. For GFY (q/ha), in HZ, entries RO-11-1-2 (5.4%) and in south zone, entries HFO-806 (11.0%) and SKO-241 (10.1%) were superior over the best check. Combining all three zones, entries SKO-241 (10.5%), RO-11-1-3 (8.3%), RO-11-1-2 (5.0%) were superior over the best national check. For DMY (q/ha), entry RO-11-1-2 (7.6%) in hill zone and HFO-806 (11.9%), SKO-241 (11.4%) in south zone were superior over the best check. Combining the 3 zones, RO-11-1-2 (24.2%), SKO-241 (13.8%), RO-11-1-3 (7.2%), performed better than the best national check. All other entries were below or at par or marginally superior in comparison to best check. Entry SKO-241 was ranked first followed by RO-11-1-3 for crude protein yield. For crude protein content, entry 1874-1 and RO-11-1-2 were joint best. Entry RO-11-1-3 ranked first for NDF, ADF and IVDMD%.

AVTO (SC)-2 (SEED): In Second Advanced Varietal Trial Oat (Single cut) for seed, comprising of seven entries along with two national checks (OS-6 and Kent) and one zonal check for respective zones were evaluated at 10 locations across the three zones. There were 2 locations in HZ, 5 in CZ and 3 locations in South zone. In all the zones, checks were superior to the testing entries.

IVTO-MC: In **Initial Varietal Trial in Oat (Multicut),** nine entries were evaluated against two national checks (RO-19 and UPO-212) at 18 locations in four zones (HZ, NWZ, NEZ, and CZ). There were 3 locations in HZ, 4 in NWZ, 6 in NEZ and 5 in central zone. For GFY (q/ha), entries JHO-20-3 (6.1%), HFO-915 (6.1%), PLP-27 (5.8%), OL-1949 (5.4%), JO-08-329 (5.2%) in Hill Zone and entry JO-08-329 (5.0%) in NWZ were superior over the best check. For DMY (q/ha), in HZ, entries PLP-27 (17.8%), JO-08-329 (14.7%), OL-1949 (9.5%), JHO-20-3 (9.2%), HFO-915 (7.9%), and in NWZ entries JO-08-329 (7.1%), UPO-20-2 (5.4%) were superior over the best check. In other zones and at all India level, all the entries were either inferior or marginal superior to the national checks. For crude protein yield, entry PLP-27 was ranked first, for crude protein content, entry UPO-20-2 ranked first. Entry PLP-27 ranked first for NDF, UPO-20-2 for ADF and JO-08-329 for IVDMD%.

AVTO (MC)-1: In **First Advance Varietal Trial in Oat (Multicut)** six entries were evaluated against two national checks (RO-19 and UPO-212) at 8 locations in two zones (HZ and CZ). There were 3 locations in HZ and 5 locations in CZ. For GFY (q/ha), entry PLP-24 (6.6%) in HZ, entry JO-07-310(5.1%) in CZ were better than the best check. For DMY (q/ha), in central zone, only one entry JO-07-310 was superior by a margin of 6.7%. Combining the two zones JO-07-310 was superior by a margin of 6.0%. All other entries were below or at par or marginally superior in comparison to best check. Entry PLP-24 ranked first for crude protein content. Entry HFO-921 for NDF, Entry JO-07-310 for ADF and OL-1924 for IVDMD were best performers.

AVTO (MC)-2: In **Second Advance Varietal Trial in Oat (Multicut),** two entries were evaluated against two national checks (RO-19 and UPO-212) at 4 locations in North West zone. For GFY, DMY and CPY (q/ha), national check RO-19 was superior over the tested entries. National check UPO-212 and entry HFO-707 ranked first for crude protein content. Entry OL-1082 ranked first for ADF and IVDMD %.

AVTO (MC)-2 (SEED): In **Second Advance Varietal Trial in Oat (Multicut) for seed,** two entries were evaluated against two national checks (RO-19 and UPO-212) at 3 locations in North West zone. For seed yield (q/ha), national check RO-19 was best performer followed closely by entry HFO-707.

IVTO (DUAL): An **Initial Varietal Trial in Oat (Dual)** comprising of eight entries along with two national checks (UPO-212 and JHO-822) was conducted at 14 centres. There were 4 locations in NWZ, 5 locations in NEZ and 5 locations in CZ. For GFY (q/ha), in NWZ, entries HFO-917 (18.0 %), JO-13-513 (10.5%), HFO-1014 (8.5%); in NEZ entries JO-13-513 (18.8%), JHO-20-2 (15.1%), HFO-917 (12.5%), HFO-1014 (11.5%), OL-1931 (8.4%) performed better than the best check. Combining all three zones, entries JO-13-513 was superior over the best check by a margin of 9.4%. For DMY (q/ha), entries HFO-917 (12.7%), JO-13-513 (7.4%) in NWZ, entries JO-13-513 (22.2%), JHO-20-2(17.6%), HFO-917 (16.3%), HFO-1014 (14.2%), OL-1931 (7.3%) in NEZ and combining all the three zones, JO-13-513 (7.9%) was superior over the best check. All other entries were below par or marginally superior in comparison to the best check. Entries JO-13-51, HFO-917, HFO-1014 ranked joint first for crude protein yield. Entries OL-1984 and OL-1992 ranked joint first followed by HFO-1014 for crude protein content. Entry OL-1992 ranked first for ADF, NDF whereas entry HFO-917 ranked first for IVDMD %. For seed yield, entry HFO-1014 ranked first followed by JO-13-513.

VT LUCERNE PERENNIAL: A **varietal trial in Lucerne (Perennial)** was conducted with 5 entries including checks at nine locations including 3 locations in NWZ, 2 in CZ and 4 in SZ. For GFY (q/ha), in NWZ entry VTLu-1 was best performer with 29.6% higher yield than the grand mean. In SZ entry VTLu-5 was better than grand mean by a margin of 11.8%. At all India level entries VTLu-1, VTLu-5, VTLu-2 were best performer in order of merit.

For DMY (q/ha), in NWZ and CZ entry VTLu-1 was superior by a margin of 27% and 6.9% respectively over the grand mean. In South zone entry VTLu-5 was best performed and showed 14.2% superiority over the grand mean. Combining the three zones, entries VTLu-1 and VTLu-5 performed better. For crude protein yield (q/ha) entry VTLu-1 ranked first. For crude protein content, entry VTLu-4 ranked first. Entry VTLu-3 ranked first for ADF and NDF whereas entry VTLu-1 was best performer for IVDMD. The entries are coded and will be decoded after the completion of trial. The trial will continue in coded form.

AVT-1 Lucerne Annual: A **first level advanced Varietal Trial in Lucerne (annual)** comprising of two entries along with two national checks (Anand-2 and RL-88) was conducted at 3 locations in NWZ and 4 locations in SZ. For GFY (q/ha), entry LLC-6 was superior by margin of 16.0% in NW, by 4.4 % in south zone and by 12.4% after combining both the zones. For DMY (q/ha), entry LLC-6 was superior by margin of 8.4% in NW zone, by 7.6 % in south zone and by 11.1% after combining both the zones over the best check. Entry LLC-6 ranked first for crude protein yield. National check RL-88 was superior for crude protein content. Entry AL-66 ranked first for NDF%, whereas national check RL-88 was superior for ADF and IVDMD%.

IVT BAJRA (MULTICUT): In Initial Varietal Trial on Summer Bajra Multicut, four entries were evaluated along with 3 checks (Giant Bajra, Moti Bajra, and BAIF Bajra-1) at 4 locations in central zone and 3 in south zone. For GFY (q/ha), entries SBH-103 and ADV175020 were superior by margin of 8.5% and 7.5% respectively in central zone, by 18.1% and 4.9% respectively in south zone and by margin of 14.2% and 9.1% respectively over the best check in combining both the zones. For DMY (q/ha), entry ADV175020 (7.6%) in central zone, entry SBH-103 (15.2%) in SZ and combining both the zones, entries SBH-103 and ADV175020 were superior by margin of 9.4% and 11.6% respectively over the best check. Entry SBH-103 ranked first for crude protein yield and crude protein content.

AVT-1 BAJRA (MULTICUT): In First stage Advanced Varietal Trial on Summer Bajra Multicut, two entries were evaluated along with 3 checks (Giant Bajra, Moti Bajra, and BAIF Bajra-1) at four locations in central zone and 3 locations in south zone. For GFY, DMY, CPY (q/ha), national check was superior over the tested entries in central and south zone. Entry ADV0111 ranked first with marginal superiority over the best check for crude protein content. Entry SBH-101 ranked first in ADF %, NDF % and IVDMD %.

AVT-2 BAJRA (MULTICUT): In Second Advanced Varietal Trial on Summer Bajra Multicut, three entries were evaluated along with 3 checks (Giant Bajra, Moti Bajra, and Raj Bajra-1) at four locations in Central zone. For GFY and DMY (q/ha), entry BAIF Bajra-5, TSFB-18-1 and BAIF Bajra-6 were marginally superior over the best check. Entry BAIF Bajra-5 ranked first for crude protein yield. For crude protein, entry TSFB-18-1 and check Raj Bajra-1 were ranked first. National check ranked first for ADF, NDF and IVDMD %.

AVT-2 (SEED) BAJRA (MULTICUT): In Second Advanced Varietal Trial on Summer Bajra Multicut for seed, three entries were evaluated along with 3 checks (Giant Bajra, Moti Bajra, and Raj Bajra-1) at four locations in Central zone. For seed yield (q/ha), all entries performed inferior to the checks.

B. Forage Crop Production

The forage crop production programme was executed with 61 trials conducted in five zones. In total 20 experiments were conducted, out of which 13 were in network (9 coordinated and 4 AVT based) and 7 were in location specific mode. The themes included are increase the system productivity and resource use optimization in forages and forage based cropping systems, nutrient management for productivity enhancement in dual purpose oats, varieties and cutting management to improve the forage productivity, quality and seed production of berseem, organic nutrients for fodder cowpea-maize system and Rice bean-oat under irrigated situation, cutting and splitting of nitrogen to enhance the yield and quality of fodder oat cultivars. In addition to above, the results of economical potassium fertilizer sources for fodder maize, optimizing the planting geometry, nitrogen levels and cutting regimes to optimize the fodder productivity of Moringa (*Moringa oleifera*), studies on plant growth regulators on forage yield and quality of maize-oat cropping system have also been presented. The trials were also initiated on precision nitrogen management to increase fodder yield and nitrogen use efficiency in fodder maize, strategies for sustainable organic fodder of sorghum-berseem cropping sequence, stubble management and planting forage oat under zero tillage conditions in rice fallows. The results of studies on bio-fortification of annual cereal fodder crops, intercropping approaches to enhance the seed setting and seed yield in lucerne, magnesium nutrition in Bajra Napier Hybrid, round the year organic fodder production system have been encouraging. The results of four AVT trials on berseem, single cut oat, multicut oat and summer pearlmillet are also summarized. The salient research achievements of the forage crop production trials during Rabi 2020-21 are as follows:

A. COORDINATED TRIALS

R-18-AST-4: Nutrient management for productivity enhancement in dual purpose oats

The trial was conducted at six centres (Kalyani, Jorhat, Imphal, Ayodhya, Jabalpur and Anand) to find out the effect of nutrient management on forage and grain yields, forage quality and production economics of dual purpose Oats. The third year results indicated that among the nine treatments, 75% of RDN + Vermicompost @ 2t + PSB application to Soil @ 1.5 kg + Seed treatment with *Azotobactor* @ 10 g/kg seed + $ZnSO_4$ @ 20 kg/ha (soil application as basal) + foliar spray of $ZnSO_4$ (0.5%) just before flowering proved the best and recorded maximum GFY, DMY, crude protein content and yield as well as highest test weight and seed yield.

R-18-AST-5: Studies on effect of varieties and cutting management on productivity, quality and seed production of berseem

The trial was conducted at Pantnagar & Ranchi with the objective to study the production potential of berseem varieties and to find out the ideal time of last cut of berseem for higher seed production. On locational mean basis, HB- 2 recorded significant cutting higher green (448.6 q/ha), dry matter (67.53 q/ha) and Crude protein yield (19.08 q/ha). However, seed yield and seed yield attributes viz., Filled seed (%), No. of flowers, Seed weight Average number of nodules/plant were superior in BL-10. Last cut on 1stApril (3 cut) provided maximum green and dry matter yields. For seed quality 3 cut with last cut on 2ndmarch and 17 March (3 cut) proved better than other cutting management schedules.

K-19-AST-1: Studies on organic source of nutrients on forage yield and quality of Fodder cowpea-Maize system under irrigated situation

A field experiment was started during *kharif*-2019 at four locations (Mandya, Coimbatore, Vellayani and Hyderabad) to study the effect of organic source of nutrients on forage yield, quality, soil properties and to compare the economics of organic source with inorganic in fodder cowpea-Maize cropping system. On location mean basis, application of 100% RDN through inorganic fertilizer recorded higher green fodder, dry matter and crude protein yield in fodder cowpea (214.3 q, 39.8 q and 7.2 q/ha respectively) and fodder maize (405.7 q, 89.3 q and 9.1 q/ha respectively). Among organic source of nutrients, higher productivity of green fodder, dry matter and crude protein yield was recorded with application of 50% RDN through farm yard manure and remaining 50% RDN through vermi-compost (558.2 q, 112.9 q and 14.5 q/ha respectively).

R-19 AST 1: Effect of cutting and splitting of nitrogen doses on growth, yield and quality of fodder oat cultivars

A Field experiment was initiated during *Rabi* 2019-20 at four locations *i.e.,* Raipur, Ranchi, Ayodhya and Pantnagar with the objectives to study the effect of splitting of nitrogen dose and cutting management on fodder yield and quality of oat varieties. Second year's results indicated that on locational mean basis, maximum green fodder yield and dry matter yield was obtained with RO-19. Result of cutting and splitting of N- management shows that at Raipur and Ranchi significantly maximum green fodder yield was recorded in three cut + 50% Basal+25% at 1st cut+25% at 2nd cut. At Ayodhya, maximum green fodder yield was obtain with three cut + 40% Basal+30% at 1st cut+30% at 2nd cut, whereas, in Pantnagar higher green fodder yield was obtain with two cut + 60% Basal+40% at 1st cut.

K-19-AST-2: Studies on organic source of nutrient on green forage yield and quality of Rice bean-oat under irrigated situation

A field experiment was conducted at five locations to assess the effect of organic sources of nutrient on forage productivity and quality of rice bean – oat cropping system under irrigated condition. The results indicated that in second year, all the treatments improved the green and dry biomass yield significantly over control. On locational mean basis, the highest GFY recorded with 50% RDN through FYM + 50% RDN through vermicompost.

K-19-AST-2: Studies on organic source of nutrient on green forage yield and quality of Rice bean-oat under irrigated situation

A field experiment was started in Kharif 2019 and it was second year (Kharif 2020) of experimentation. It was conducted at five locations to assess the effect of organic sources of nutrient on forage productivity and quality of rice bean – oat cropping system under irrigated condition. On locational mean basis, highest green fodder, dry matter and crude protein yield of maize was observed for the treatment 75 % RDK through Potassium schoenite + 1 % schoenite foliar spray (at 30 and 45 DAS).

R-19-AST-3 Fodder productivity of Moringa (*Moringa oleifera*) as influenced by planting geometry, nitrogen levels and cutting regimes

A Field experiment was initiated during 2019 (Rabi) at Mandya and Dharwad locations to assess the performance of *Moringa* with a view to standardize the plant population, nitrogen requirement and cutting regimes for enhancing the quantity and quality of green forage. On the location mean basis planting geometry at 45cm X 30cm recorded higher GFY, DMY and CPY. Application of nitrogen 150 kg/ha as well as cutting interval of 75 days recorded higher productivity and returns.

K-20-AST-1c: Efficacy of plant growth regulators on forage yield and quality of maize-oat cropping system

A field trial was initiated at six locations namely, Urulikanchan, Srinagar, Pusa, Raipur, Hisar and Ranchi to find out effect of different plant growth regulators on forage yield and quality of maize and oat and work out the economic feasibility of plant growth regulators.

Significant superiority of Mepiquat Chloride@300ppm was noted, which was at par with salicylic acid@100 ppm, salicylic acid@200 ppm and NAA@20 ppm in terms of green dry matter and crude protein yields.

K-20-AST-6: Precision nitrogen management for fodder yield and nitrogen use efficiency enhancement in fodder Maize

A field experiment was started during *Rabi* 2020-21 at two locations (Mandya and Dharwad centre) on precision nitrogen management for enhancing fodder yield and nitrogen use efficiency in forage maize variety African tall.The first year results revealed, application of 150 kg N/ha (40% N as basal + remaining based on SPAD meter critical value of 50 recorded significantly higher green forage yield (468 q/ha) and Dry matter yield (116.8 q/ha) which was on par with 150 Kg N/ha (40% N basal + remaining based on LCC 5). The higher Net monetary returns (66299 Rs. /ha) and B: C ratio (3.43) was recorded with 150 Kg N/ha (40% N basal + remaining based on SPAD meter critical value of 50).

K-16-AST-6 : Organic nutrient management in sorghum-berseem cropping sequence for sustainable fodder production

The experiment was initiated in Kharif 2016 to study the feasibility of organic nutrient management in sorghum-berseem cropping sequence for sustainable fodder production. Application of 7.5 t Vermicompost/ha (5t in sorghum + 2.5t in berseem) + biofertilizer + Green manuring) proved superior in terms of green fodder dry matter, CP yields and economic return.

R-16-AST-4: Effect of stubble management and planting density on establishment and productivity of forage oat under zero tillage conditions in rice fallows

The field experiment was initiated during Rabi 2018-19, to study the effect of different height of rice stubble and planting density on establishment and productivity of forage oat under zero tillage condition in rice fallow. The results indicated that seed rate of 120 kg/ha recorded significantly higher fodder, dry matter and crude protein yield. Bending of rice stubble (without cutting) recorded significantly higher green fodder, dry matter, crude protein yield, crude protein content and plant height.

K-18-AST-4: Bio-fortification of annual cereal fodder crops for enhancing zinc and iron content

A field experiment was started during Kharif, 2019 at Hyderabad with the objective to study the effect of zinc and iron application on bio-fortification of annual cereal fodder crops.20 kg $ZnSO_4$ +20 kg $FeSO_4$ /ha –as basal + 1% $ZnSO_4$ 0.5% $FeSO_4$ as foliar spray at 45 DAS proved the best and recorded higher GFY and DMY.

R-18-AST-7: Effect of intercropping on seed setting and seed yield in Lucerne

The experiment was conducted during *Rabi*season of 2020-21 to study the effect of intercropping on seed setting and seed yield in Lucerne. Results revealedthat maximum seed yield and net returns (340.32 kg and Rs. 81178 /ha, respectively) were obtained in combination of fennel intercrop at 1: 15.

R-19 AST 5: Standardization of Magnesium nutrition in Bajra Napier Hybrid

The trial was initiated at Vellayani centre to assess the impact of varying doses and frequency of application of MgSO4 on the growth, yield and quality attributes of hybrid Napier.First year data shows significantly superior GFY (2638.0 q/ha), DFY (659.59 q/ha) and CPY (64.04q/ha) in T_4 (100kg MgSO4 + application once in 6 months).

K-20-AST-4b: Organic nutrient management for soil health and sustainability of round the year fodder production system

A field experiment was started at Palampur centre in Sorghum- rye grass cropping system (with two rows of Setaria grass on both side of field boundaries) to see the effect of treatments on productivity, soil health and also to maintain round the year fodder supply.

The results revealed that application of FYM @ 10 t/ha (T1) was recorded significantly higher plant height, green and dry fodder yield of both the crops consequently resulted in higher green fodder and dry fodder yield of system.

K-20-AST-4c: Organic nutrient management for soil health and sustainability of round the year fodder production system

The study was undertaken at Ayodhya centrewith the objectives to study the effect of organic systems of nutrition on forage yield quality, economics soil properties of forage based cropping systems. The results indicated that in the first year, application of FYM @10 t/ha recorded maximum green fodder yield of sorghum-oat cropping system in a year.

AVT-2 Trials

R-20-AST-1: Effect of P levels on forage yield of promising entries of Berseem (AVTB-2-MC)

AVT trial on berseem was conducted at eight locations in three zones of the country **(HZ:** Palampur, Srinagar**; NWZ:**Pantnagar, Hisar, Ludhiana; **CZ:**Rahuri,Jabalpur,Raipur)to study the effect of phosphorus fertilizer on yield and quality of promising entries of berseem under multicut cut system.In the trial five entries (JB-06-11, JHB-18-1, JHB-18-2, BM-12, HFB-15-5) along with one national check (Wardan -NC) and two zonal checks *viz.*, BB-2 (NWZ and CZ), BL-22 (HZ), were evaluated under three phosphorus levels (60, 80 and 100 kg /ha) to see the response.

In North West Zone, BM-12 recorded highest GFY, which was at par with JB-06-11 followed by JHB-18-1.

In central zone, JB-06-11 recorded maximum green fodder which was closely followed by JHB-18-2 and JHB-18-1.
On national mean across the zone basis, entry JB-06-11 proved highest yielder and recorded 481.3 q green and 73.36 q dry matter per hectare, which was 9.3 and 12.9% higher over national check.

R-20-AST-2: Effect of N levels on forage yield of promising entries of single cut oat (AVT-2 SC)

AVT trial on single cut oat was conducted at eight locations in three zones of the country**(HZ:** Palampur, Srinagar; **CZ:** Urulikanchan, Anand, Raipur; **SZ:** Hyderabad, Mandya, Coimbatore)to study the effect of nitrogen nutrition on yield and quality of promising entries of single cut oat.In the trial seven entries (OL-1874-1, OL-1876-1, RO-11-1-3, JO-06-23, SKO-241, RO-11-1-2 and HFO-806) along with two national check (Kent andOS-6NC) and three zonal checks *viz.*, SKO-96 (HZ) RO-11-1(CZ) OS-403 (SZ), were evaluated under three nitrogen levels (60, 90 and 120 kg /ha) to see the response.
In Hill Zone, entry RO-11-1-3 yielded maximum green fodder, dry matter and crude protein yields (417.0, 77.4 & 7.9 q/ha). It was significantly superior to all remaining entries & checks.
In central zone entry JO-06-23 recorded highest green fodder, dry matter and crude protein yields followed by OL-1876-1. The entry recorded 371.9, 85.8 and 8.9q green, dry &crude protein yields per hectare, which was 12.9, 8.3 and 20.2% higher over best check RO-11-1(CZ).
SIn south zone, entries JO-06-23, SKO-241, RO-11-1-2 and HFO-806 remained higher yielder**.**
On national level across the zone the entry JO-06-23 proved the best and recorded maximum green fodder, dry matter and crude protein yields (330.7, 68.5 and 7.4 q/ha, respectively).

R-20-AST-2: Effect of N levels on forage yield of promising entries of single cut oat (AVT-2 SC)

AVT trial on single cut oat was conducted at eight locations in three zones of the country **(HZ:** Palampur, Srinagar; **CZ:** Urulikanchan, Anand, Raipur; **SZ:** Hyderabad, Mandya, Coimbatore)to study the effect of nitrogen nutrition on yield and quality of promising entries of single cut oat. In the trial seven entries (OL-1874-1, OL-1876-1, RO-11-1-3, JO-06-23, SKO-241, RO-11-1-2 and HFO-806) along with two national check (Kent andOS-6NC) and three zonal checks *viz.*, SKO-96 (HZ) RO-11-1(CZ) OS-403 (SZ), were evaluated under three nitrogen levels (60, 90 and 120 kg /ha) to see the response.
On locational mean basis no entry could perform better than national checks.

R-20 AST-3: Effect of N levels on forage yield of promising entries of Multi cut oat (AVT-2 MC)

AVT trial on Multi cut oat was conducted at three locations **(**Pantnagar, Hisar and Ludhiana)in North West zone of the country to study the response of nitrogen fertilizer on yield and quality of promising entries of oat.

In the trial, two multi cut entries (HFO-707, OL-1882) along with two national checks namely; UPO-212 and RO-19 were evaluated for their responsiveness to nitrogen fertilizer (70,105, and 140 kg N /ha). The nitrogen was applied in three splits i.e., 1st at 55 DAS, 2nd at 85 DAS, 3rd at 50% flowering as top dressing.

On locational mean basis, all the entries out yielded the national checks. BAIF Bajra -6 recorded maximum green fodder,dry matter and crude protein yields. On overall mean basis, significant response to nitrogen application was noted up to 90 kg N/ha which produced (992.4 q green, 187.8 q dry matter and 13.15 q CP yield per hectare).

C. Forage Crop Protection

During Rabi 2020-21, total nine trials were conducted across five locations. Forage crops evaluated were Berseem, Oat and Lucerne. Forage crops protection trials conducted focuses on (a) Monitoring of diseases and insect pests in forage crops ecosystem; (b) Evaluation of breeding materials for their resistance to diseases and insect-pests under natural conditions (c) Development of location and region specific crop protection technologies and (d) Assessment of yield losses in different forage crops.

Monitoring of diseases and insect pests in Rabi forage crops

The study was carried out with the objectives to record the occurrence and abundance of major diseases and insect-pests in berseem, lucerne and oat.

At Ludhiana, stem rot on berseem first observed in end of December. Disease progressed at faster rate till first week of April with maximum disease incidence of 63.2%. Leaf blight of oat was fast upto first week of April with highest disease severity of 51.0%. Downy mildew of Lucerne severity was 45.2%. The population of *T. orichalcea* has its highest peak observed in the mid April. The population of *H. armigera* appeared on berseem crop has its highest peak during second fortnight of April. Lucerne was infested with weevil during February end to May with peak during second week of March.

At Rahuri, pea aphid was noticed on Lucerne during 1st week of January (1.00 aphids/tiller) and increased steadily at its peak level up to the 4th week of February (172.20 aphids/tiller). Cowpea aphid was observed on Lucerne during 2nd week of February (6.00 aphids/tiller) and reached at its peak during 3rd week of March with 135.20 aphids/tiller. Oat aphid was recorded from 1st week of January to 1st week March in the range of 1.40 to 42.60 aphids/tiller. Pea aphid was noticed on Berseem during 2nd week of January (1.40 aphids/tiller) and increased steadily at its peak level up to the 4th week of March (97.60 aphids/tiller).

At Palampur, Oat crop was severely affected by powdery mildew (49% severity), followed by leaf blight (15%) and sucking pests (18%). In berseem, low incidence of root rot (5%), moderate intensity of leaf spot (15%) and defoliating beetles (3%) was observed. Defoliating beetles (15%) and leaf spot (10%) was observed on Lucerne.

At Bhubaneswar, In oat, maximum leaf blight recorded was 48.4% and maximum root rot incidence was 28.2%. Maximum leaf defoliators were recorded 7.0/10 plants. The Berseem leaf spot and blight severity recorded 40.2% towards 1st week of February, whereas root rot incidence was 30.8% during last week of January 2021. Maximum defoliator recorded was 6.0/10 plants in 4th meteorological week.

At Jhansi, In Berseem, incidence of stem rot started from 4th week of January with small lesions indicative of early infection and continued to increase up to 3rd week of February with a maximum disease incidence of 16.5%. In Oat, leaf blight was the major disease and it appeared during 3rd week of January and maximum severity of 67.8% was observed during 3rd week of March.

Evaluation of Rabi forage crops breeding materials for prevalent diseases and insect pests under natural conditions

In IVT Berseem, At Ludhiana, all the entries showed moderately resistant disease reaction to stem rot. At Rahuri, all the entries were found moderately susceptible to susceptible to aphids. At Palampur, all the entries including checks were resistant to root rot. At Bhubaneswar, JHB-20-1, BB-3, JHB-20-2, PC-114 were found resistant to leaf blight. **In AVT-1 Berseem,** At Ludhiana, all the entries showed moderately resistant disease reaction to stem rot. At Rahuri, all the entries were found moderately susceptible to susceptible to aphids. At Palampur, all the entries including checks were resistant to root rot. At Bhubaneswar, BB-3, BM-14 and JB-07-15 showed resistant reaction to leaf spot and blight. **In AVT-2 Berseem,** At Ludhiana, all the entries showed moderately resistant disease reaction to stem rot. At Palampur, all the entries including checks were resistant to root rot. At Rahuri, all the entries were found susceptible to moderately susceptible against aphids.
Oat – IVTO SC: At Ludhiana, all entries showed moderately resistant disease reaction to leaf blight except OL-1980, UPO-20-1, OL-1974 which were low resistant. At Rahuri, entries RO-11-1, JHO-20-1, SKO-244, Kent, OS-6, HFO-1009, HFO-1013, BAUO-101, OL-1974 were moderately susceptible to aphids while other entries were moderately resistant. At Palampur, JO-08-37, Kent, OS-6 were moderately resistant to powdery mildew. At Bhubaneswar, OS-403, SKO-244, JO-08-37, HFO-1003, HFO-1013, BAUO-101 expressed high resistant reaction; BAUO-103, JHO-20-1, NDO-1902, OL-1980, OL-1977, HFO-1009, UPO-20-1 showed resistant whereas Kent, OS-6, OL-1974 showed moderate resistant reaction to leaf spot and blight, *Sclerotium* root rot and infestation by leaf defoliator. At Jhansi, RO-11-1, JHO-20-1, JO-08-37, Kent, OS-6, OL-1977 were resistant against leaf light.
Oat-IVTO MC: At Ludhiana, OL-1944, JO-08-329, JHO-20-3 entries showed resistant disease reaction. At Rahuri, PLP-27, UPO-212 were susceptible to aphids. At Palampur, RO-19, OL-1944 were moderately resistant to powdery mildew. At Bhubaneswar, RO-19, OL-1949, HFO-915, UPO-20-2, showed high resistance; PLP-27, OL-1944, OL-1942, JO-08-329, HFO-1016 expressed resistant reaction where as JHO-20-3, UPO-212, expressed moderate resistant to leaf blight, *Sclerotium* root rot and infestation by leaf defoliators. At Jhansi, all the entries were resistant to moderately resistant to leaf light.
Oat– IVTO Dual: At Ludhiana, all entries were moderately resistant to leaf blight except UPO-20-3, OL-1931, JO-13-513, HFO-1014 which were low resistant.

At Rahuri, UPO-20-3, JHO-822, OL-1984, HFO-917, HFO-1014, UPO-212 were moderately susceptible to aphids. At Bhubaneswar, OL-1931, JO-13-513, JHO-20-2 expressed high resistant; HFO-917, HFO-1014 showed resistant reaction; UPO-20-3, JHO-822, OL-1984, UPO-212 expressed moderate resistant where as OL-1992 was found low resistant to leaf blight, root rot and leaf defoliators. At Jhansi, entries UPO-20-3, OL-1931, JO-13-513, HFO-1014 were in low resistant category to leaf blight.

Oat-AVTOSC-1: At Ludhiana, all entries were found moderately resistant to leaf blight except Kent, JO-07-28 which were low resistant. At Rahuri, HFO-904, HFO-906, RO-11-1, Kent were moderately resistant to aphids. At Palampur, SKO-96, Kent, OS-6 were moderately resistant to powdery mildew. At Bhubaneswar, HFO-906, OS-6, JO-07-28 expressed high resistance, HFO-904, Kent showed resistant reaction where as OL-1960, OS-403 expressed moderate resistant to both disease and insect infestation.

Oat-AVTOSC-2: At Rahuri, OL-1874-1, Kent, JO-06-23, RO-11-1 were moderately resistant to aphids. At Palampur, SKO-241 was moderately resistant to powdery mildew. At Jhansi, Kent was in low resistant category while rest was in mesothetic to low susceptible category against leaf blight.

Oat-AVTO-1 (Multicut): At Palampur, all the entries were found susceptible to powdery mildew. At Rahuri, HFO-921, RO-19, JO-07-310, HFO-918, PLP-24 were moderately resistant to aphids. At Jhansi, all the entries were resistant to moderately resistant against leaf blight except OL-1924, OL- 1919 which were in low resistant category.

Oat-AVTO-2 (Multicut): At Ludhiana, all entries showed moderately resistant disease reaction to leaf blight except RO-19.

In IVT Lucerne, at Ludhiana, LLC-7, RL-88, BAIF Lucerne-5 showed moderately resistant disease reaction to downy mildew. At Rahuri, all the seven entries were moderately susceptible to susceptible to aphids. All the seven entries were resistant to rust.

AVT-Lucerne, at Ludhiana, all entries showed moderately resistant disease reaction to downy mildew.

To study the pathogenic variability of *Blumeria graminis* f. sp. *avenae* on oat

The virulence pattern of the 24 isolates of *B. graminis* f. sp. *avenae* was studied on developed differential set comprising of 11 lines. These 24 isolates were grouped into 14 pathotypes on the basis of their reaction to the set of 11 differential lines. 75, 60 & 55 F_1 generation and 774, 695 & 636 plants of F_2 population from three crosses *viz.*, OL-1847× HJ-8, OG-77 × HJ-8 and OL-1689 ×HJ-8, respectively were evaluated to study the inheritance of powdery mildew resistance and results indicates that the resistance to powdery mildew was controlled by single dominant gene.

Validation of best treatment of trial entitled "Biological management of oat aphid *Rhopalosiphum padi* on oat"

At Rahuri, at 7 DAS, promising treatments was *L. lecanii* @ 7.5g/lit. were (12.75) and it was at par with *M. anisopilae* @ 7.5g/lit (14.2). Green Forage yield of *L. lecanii* @ 7.5 g/lit (387.76 q/ha) was recorded at par with *M. anisopilae* @ 7.5 g/lit (380.13 q/ha). B:C ratio was high (1:1.80) in T1 compared to T2 (1:1.76). At Ludhiana, least incidence of oat aphid at 5 and 7 days after treatment was recorded in foliar application of *L. lecanii* @ 1X10^8 CFU/g (7.5 g/lit) followed by application of *M. anisopliae* @ 1X10^8 CFU/g (7.5 g/lit).

Green fodder yield in both the treatments was at par with each other and significantly higher than untreated control. B:C ratio was high (1:1.79) in T1 compared to T2 (1:1.55).

Validation of best treatment of trial entitled "Biological management of powdery mildew of oats caused by *Blumeria graminis* f. sp. *avenae*"

At Palampur, three foliar spray of *Trichoderma viride* @ 0.5% gave best control of powdery mildew (26.7% disease severity and 49.7% disease control) with maximum increase (10.8 %) in the fodder yield over the check. B:C ratio of the same treatment was also found to be higher (1:2.57) compared to three foliar sprays of Vitex @ 0.1% (1:2.14).

Eco-friendly pest management techniques in berseem ecosystem

At Ludhiana, treatment T4 (Soil application of *Trichoderma viride* @ 1kg/25kg FYM/acre + foliar spray of NSE @ 5% + Chickpea as trap crop on border row + Bird perches) exhibited least disease incidence of stem rot (20.0%) with 58.82 percent disease control as compared to control (48.12 %) and 16.2 percent increase in green fodder yield. The number of *H. armigera* larvae per metre row length were minimum in T7 (Farmers practice) followed by T6 (T2+ Sunflower as trap crop on border row + Bird perches) and T4 (Soil application of *Trichoderma viride* @ 1kg/25kg FYM/acre + foliar spray of NSE @ 5% + Chickpea as trap crop on border row + Bird perches). At Rahuri, *H. armigera* or other lepidopteran larvae were not observed throughout the crop growth period and hence treatments were not imposed.

Integrated disease management in Berseem

At Ludhiana, for stem rot management, best treatment was T6 (Seed treatment with Chitosan @ 0.05 % + foliar spray of Chitosan @ 0.05%) followed by T8 (Seed treatment with carbendazim @ 0.2 % + foliar spray of Chitosan @ 0.05%) with 21 % and 21.27 % incidence.At Jhansi, for stem rot management, best treatment was T7 (Seed treatment with *Trichoderma* @ 0.5 % + foliar spray of Chitosan @ 0.05 %) followed by T6 (Seed treatment with Chitosan @ 0.05 % + foliar spray of Chitosan @ 0.05%) with 7.85 % and 10.18 % incidence. At Palampur, for root rot management, best treatment was T9 (Seed treatment with carbendazim @ 0.2 % + Seed treatment with carbendazim @ 0.1 %) with 0.8% incidence followed by T8, T5 and T3 (1.3 % incidence). For leaf blight management, best treatment was T9 (2.3 % severity). At Bhubaneswar, for root rot management, best treatment was T5 (Seed treatment with Chitosan @ 0.05% + carbendazim @ 0.1%) with 4.7% incidence. For leaf blight management, best treatment was T9 (Seed treatment with carbendazim @ 0.2% + foliar spray with carbendazim @ 0.1%) having 7.30% severity.

Non chemical management of stem rot of berseem caused by *Sclerotinia trifoliorum*

At Ludhiana, The effect of plant extracts and organic inputs on *S. trifoliorum* under *in vitro* conditions was done. Results showed that highest percent mycelial inhibition of *S. trifoliorum* was provided by *Curcuma longa* (91.67%), *Murraya koenigii* (91.48%), *Aegle marmelos* (92.41%) and *Cymbopogan citrates* (92.96%). Among five organic inputs tested under *in vitro* conditions, Panchgavya provided complete inhibition of mycelial growth of stem rot pathogen and Organic formulation 2 & 1 showed 84.44 and 81.67% inhibition respectively at 10 % concentration.

Assessment of yield losses due to insect-pests and diseases in Lucerne

At Rahuri, Cumulative average yield loss due to aphids, rust, *Spodoptera litura, Helicoverpa armigera* recorded were 9.92%, 20.86%, 24.23%, 14.08%. Cumulative average yield losses in control due to insect-pest and diseases were 36.57%. At Ludhiana, Cumulative average yield loss due to downy mildew, weevil recorded was 10.4% and 6.6%. Cumulative average yield losses in control due to insect-pest and diseases were 15.15%. At Jhansi, aphids and *Helicoverpa armigera* presence do not have any significant effect on yield. Cumulative average yield loss recorded due to weevil was 20.8%. Yield losses in control were 21.9%.

D. Forage Crops Breeder Seed Production

The indent for Breeder Seed Production for [Indent year Rabi 2021-22; Production year Rabi 2020-21] was received from DAC, GOI for 35 varieties in four forage crops *viz*., Oat (22), Berseem (8), Lucerne (4) and rye grass (1). The total quantity allocated was 411.83q. The production target was assigned to different Breeder Seed producing centers of the SAUs/ NGO/ ICAR institutes. The maximum indent was for Oat (373.80q) followed by Berseem (33.16 q), Lucerne (4.32q) and rye grass (0.55q).

The final Breeder Seed Production Report (BSP-IV) received from different seed producing centres revealed that the overall breeder seed production was 562.22q against the indent of 411.83q which is 150.39q surplus or 36.52% higher. **In Oat,** the production was 526.70q against the allocation of 373.80q making a surplus of 152.90q. There is also surplus seed produced in six varieties of oat to the tune of 13.00q which were not indented. **In Berseem,** the total production was 33.00q against the indent of 33.16q making a deficit of 0.16q. **In Lucerne,** the total production was 1.52q which was 2.80q less than the indent. **In rye grass,** there was indent of one variety, PBRG-2 for 0.55q, the production was 1.00q which was 0.45q higher than the indented quantity.

ALL INDIA COORDINATED RESEARCH PROJECT ON FORAGE CROPS & UTILIZATION
ZONE, COORDINATED CENTERS AND TESTING LOCATIONS

Zone	Coordinated Centers				Testing Locations		
	S.N.	Location	Establishment Year	State / Union Territory	S.N.	Location	State/Union Territory
I. Hill State/UT States = 3 Locations = 5	1.	Palampur, CSKHPKV	1970	Himachal Pradesh	1.	Almora, ICAR-VPKAS*	Uttarakhand
					2.	Rajouri, SKUAST-J	J & K
	2.	Srinagar, SKUAS&T-K	2010	Jammu & Kashmir	3.	Bajoura (Kullu), CSKHPKV RRS	H P
II. North West States = 5 Locations = 14	3.	Ludhiana, PAU	1989	Punjab	4.	Meerut, SVBPUA&T	Uttar Pradesh
					5.	Ballowal Sankhari, PAU,RRS	Punjab
	4.	Hisar, CCS HAU	1970	Haryana	6.	Avikanagar, IGFRI-RRS*	Rajasthan
	5.	Pantnagar, GBPUAT	1995	Uttarakhand	7.	Jodhpur, ICAR-CAZRI*	Rajasthan
	6.	Bikaner, SKRAU	1995	Rajasthan	8.	Bhilwara Arjia/DFRS,MPUAT	Rajasthan
					9.	Udaipur, MPUAT	Rajasthan
					10.	Pali-Marwar, ICAR-CAZRI-RRS*	Rajasthan
					11.	Jaisalmer, ICAR-CAZRI-RRS*	Rajasthan
					12.	Fatehpur Shekhawati/ARS SKNAU	Rajasthan
					13.	Jalore, SKRAU ARS	Rajasthan
III. East/North States = 9 Locations = 11	7.	Ayodhya, ANDUAT	1982	Uttar Pradesh	14.	Umiam (Barapani), ICAR Res. Complex for NEH Region*	Meghalaya
	8.	Ranchi, BAU	1970	Jharkhand	15.	Visva Bharti, Shantiniketan	West Bengal
	9.	Kalyani, BCKV	1972	West Bengal	16.	Medziphema, Nagaland University	Nagaland
	10.	Bhubaneswar,OUAT	1987	Orissa	17.	Sabour, BAU	Bihar
	11.	Jorhat, AAU	1970	Assam			
	12.	Imphal, CAU	2010	Manipur			
	13.	Pusa, RPCAU	2017	Bihar			

Zone	Coordinated Centers				Testing Locations		
	S.N.	**Location**	**Establishment Year**	**State / UT**	**S.N.**	**Location**	**State/Union Territory**
IV. Central	14.	Anand, AAU	1970	Gujarat	18.	Kanpur, CSAU&T	Uttar Pradesh
States = 5	15.	Jabalpur, JNKVV	1970	Madhya Pradesh	19.	Jhansi, ICAR-IGFRI*	Uttar Pradesh
Locations = 11	16.	Rahuri, MPKV	1971	Maharashtra	20.	Dhari, JAU	Gujarat
	17.	Urulikanchan, BAIF	1982	Maharashtra	21.	Karjat, RARS, BSKKV	Maharashtra
	18.	Raipur, IGKV	2010	Chhattisgarh	22.	Akola, PDKVV	Maharashtra
					23.	Dapoli, COA	Maharashtra
					24.	Palghar, ARS,DBSKKV	Maharashtra
V. South	19.	Mandya, UAS (B)	1986	Karnataka	25.	Dharwad, ICAR-IGFRI-RRS*	Karnataka
States/UT = 6	20.	Coimbatore, TNAU	1976	Tamil Nadu	26.	Karaikal, PJLNCA & RI,	Pudducherry
Locations = 9	21.	Vellayani, KAU	1971	Kerala	27.	Tirupati/Guntur, ANGRAU	Andhra Pradesh
	22.	Hyderabad, PJTSAU	1970	Telangana	28. 29.	Raichur, UAS, Mattupetty, KLDB	Karnataka Kerala

Summary: Zone = 5, States/UT = 27, Coordinating Centers = 22, Testing Locations = 29

*ICAR Institute

Entries Code for Rabi 2020-21

IVTB:

S. N.	Contributor	Entry name	Code name
1.	(IGFRI, Jhansi)	JHB-20-1	IVTB - 1
2.	(CCS HAU, Hisar)	HFB 17-5	IVTB - 2
3.	ZC (HZ)	BL-22	IVTB - 3
4.	ZC (NWZ)	JB- 05-09	IVTB - 3
5.	ZC (CZ)	Bundel Berseem-2	IVTB - 3
6.	ZC (NEZ)	Bundel Berseem-3	IVTB - 3
7.	(IGFRI, Jhansi)	JHB-20-2	IVTB - 4
8.	(PAU, Ludhiana)	PC-114	IVTB - 5
9.	(JNKVV, Jabalpur)	JB 08-17	IVTB - 6
10.	(NC)	Wardan	IVTB - 7

2. AVTB-1:

S. N.	Contributor	Entry name	Code name
1.	NC	Wardan	AVT-1-B- 1
2.	ZC (HZ)	BL-22	AVT-1-B- 2
3.	ZC (NWZ,CZ)	BB-2	AVT-1-B- 2
4.	ZC (NEZ)	BB-3	AVT-1-B- 2
5.	HAU, Hisar	HFB-16-10	AVT-1-B- 3
6.	PAU, Ludhiana	BM-14	AVT-1-B- 4
7.	HAU, Hisar	HFB-16-1	AVT-1-B- 5
8.	JNKVV, Jabalpur	JB-07-15	AVT-1-B- 6

3. AVTB-2:

S. N.	Contributor	Entry name	Code name
1.	JNKVV, Jabalpur	JB-06-11	AVTB-2- 1
2.	IGFRI, Jhansi	JHB-18-1	AVTB-2- 2
3.	(NC)	Wardan	AVTB-2- 3
4.	PAU, Ludhiana	BM-12	AVTB-2- 4
5.	CCS HAU, Hisar	HFB-15-5	AVTB-2- 5
6.	ZC (HZ)	BL- 22	AVTB-2- 6
7.	ZC (NWZ and CZ)	BB-2	AVTB-2- 6
8.	IGFRI, Jhansi	JHB-18-2	AVTB-2- 7

4. AVT-2 (Seed):

S. N.	Contributor	Entry name	Code name
1.	JNKVV, Jabalpur	JB-06-11	AVTB-2S- 1
2.	IGFRI, Jhansi	JHB-18-1	AVTB-2S- 2
3.	(NC)	Wardan	AVTB-2S- 3
4.	PAU, Ludhiana	BM-12	AVTB-2S- 4
5.	CCS HAU, Hisar	HFB-15-5	AVTB-2S- 5
6.	ZC (HZ)	BL- 22	AVTB-2S- 6
7.	ZC (NWZ and CZ)	BB-2	AVTB-2S- 6
8.	IGFRI, Jhansi	JHB-18-2	AVTB-2S- 7

5. IVTO (SC):

S. N.	Contributor	Entry name	Code name
1.	ZC (HZ)	SKO-225	IVTO –SC- 1
2.	ZC (NWZ, NEZ, SZ)	OS-403	IVTO –SC- 1
3.	ZC (CZ)	RO-11-1	IVTO –SC- 1
4.	BAU, Ranchi	BAUO-103	IVTO –SC- 2
5.	IGFRI, Jhansi	JHO-20-1	IVTO –SC- 3
6.	NDUAT, Ayodhya	NDO-1902	IVTO –SC- 4
7.	SKUAST-K,Srinagar	SKO-244	IVTO –SC- 5
8.	PAU, Ludhiana	OL-1980	IVTO –SC- 6
9.	JNKVV, Jabalpur	JO-08-37	IVTO –SC- 7
10.	(NC)	Kent	IVTO –SC- 8
11.	(NC)	OS-6	IVTO –SC- 9
12.	PAU, Ludhiana	OL-1977	IVTO –SC- 10
11.	CCS HAU, Hisar	HFO-1009	IVTO –SC- 11
12.	CCS HAU, Hisar	HFO-1003	IVTO –SC- 12
13.	CCS HAU, Hisar	HFO-1013	IVTO –SC- 13
14.	BAU, Ranchi	BAUO-101	IVTO –SC- 14
15.	GBPUAT, Pantnagar	UPO-20-1	IVTO –SC- 15
16.	PAU, Ludhiana	OL-1974	IVTO –SC- 16

6. AVTO-1:

S. N.	Contributor	Entry name	Code name
1.	CCS HAU, Hisar	HFO-904	AVTO-1-SC -1
2.	CCS HAU, Hisar	HFO-906	AVTO-1-SC -2
3.	PAU, Ludhiana	OL-1960	AVTO-1-SC -3
4.	(NWZ, NEZ, SZ)	OS-403	AVTO-1-SC -4
5.	(HZ)	SKO-96	AVTO-1-SC -4
6.	ZC (CZ)	RO-11-1	AVTO-1-SC -4
7.	(NC)	Kent	AVTO-1-SC -5
8.	(NC)	OS-6	AVTO-1-SC -6
9.	JNKVV, Jabalpur	JO-07-28	AVTO-1-SC -7

7. AVTO-2:

S. N.	Contributor	Entry name	Code name
1.	PAU, Ludhiana	OL-1874-1	AVTO-2-SC-1- 1
2.	(NC)	Kent	AVTO-2-SC-1- 2
3.	PAU, Ludhiana	OL-1876-1	AVTO-2-SC-1- 3
4.	MPKV, Rahuri	RO-11-1-3	AVTO-2-SC-1- 4
5.	JNKVV, Jabalpur	JO-06-23	AVTO-2-SC-1- 5
6.	SKUAST-K, Srinagar	SKO-241	AVTO-2-SC-1- 6
7.	ZC (HZ)	SKO-96	AVTO-2-SC-1- 7
8.	ZC (CZ)	RO-11-1	AVTO-2-SC-1- 7
9.	ZC (SZ)	OS-403	AVTO-2-SC-1- 7
10.	(NC)	OS-6	AVTO-2-SC-1- 8
11.	MPKV, Rahuri	RO-11-1-2	AVTO-2-SC-1- 9
12.	CCS HAU, Hisar	HFO-806	AVTO-2-SC-1- 10

8. AVTO-2 Forage Oat (SC (Seed):

S. N.	Contributor	Entry name	Code name
1.	PAU, Ludhiana	OL-1874-1	AVTO-2-SCS-1- 1
2.	(NC)	Kent	AVTO-2-SCS-1- 2
3.	PAU, Ludhiana	OL-1876-1	AVTO-2-SCS-1- 3
4.	MPKV, Rahuri	RO-11-1-3	AVTO-2-SCS-1- 4
5.	JNKVV, Jabalpur	JO-06-23	AVTO-2-SCS-1- 5
7.	SKUAST-K, Srinagar	SKO-241	AVTO-2-SCS-1- 6
8.	ZC (HZ)	SKO-96	AVTO-2-SCS-1- 7
9.	ZC (CZ)	RO-11-1	AVTO-2-SCS-1- 7
10.	ZC (SZ)	OS-403	AVTO-2-SCS-1- 7
11.	(NC)	OS-6	AVTO-2-SCS-1- 8
12.	MPKV, Rahuri	RO-11-1-2	AVTO-2-SCS-1- 9
13.	CCS HAU, Hisar	HFO-806	AVTO-2-SCS-1- 10

9. IVTO (Multi cut):

S. N.	Contributor	Entry name	Code name
1.	CSK HPKV, Palampur	PLP-27	IVTO – MC - 1
2.	(NC)	RO-19	IVTO – MC - 2
3.	PAU, Ludhiana	OL-1944	IVTO – MC - 3
1.	PAU, Ludhiana	OL-1942	IVTO – MC - 4
5.	PAU, Ludhiana	OL-1949	IVTO – MC - 5
6.	JNKVV, Jabalpur	JO-08-329	IVTO – MC - 6
7.	IGFRI, Jhansi	JHO-20-3	IVTO – MC - 7
8.	CCS HAU, Hisar	HFO-915	IVTO – MC - 8
9.	CCS HAU, Hisar	HFO-1016	IVTO – MC – 9
10.	GBPUAT, Pantnagar	UPO-20-2	IVTO – MC - 10
11.	(NC)	UPO-212	IVTO – MC - 11

10. AVTO-1 (Multi cut):

S. N.	Contributor	Entry name	Code name
1.	CCS HAU, Hisar	HFO-921	AVTO-1-MC- 1
2.	(NC)	RO-19	AVTO-1-MC- 2
3.	JNKVV, Jabalpur	JO-07-310	AVTO-1-MC- 3
4.	PAU, Ludhiana	OL-1924	AVTO-1-MC- 4
5.	PAU, Ludhiana	OL- 1919	AVTO-1-MC- 5
6.	CCS HAU, Hisar	HFO-918	AVTO-1-MC- 6
7.	CSK HPKV, Palampur	PLP-24	AVTO-1-MC- 7
8.	(NC)	UPO-212	AVTO-1-MC- 8

11. AVTO-2 (Multi cut):

S. N.	Contributor	Entry name	Code name
1.	CCS HAU, Hisar	HFO-707	AVTO-2-MC- 1
2.	(NC)	RO-19	AVTO-2-MC- 2
3.	PAU, Ludhiana	OL-1882	AVTO-2-MC- 3
4.	(NC)	UPO-212	AVTO-2-MC- 4

12. AVTO-2 (Multi cut) (Seed):

S. N.	Contributor	Entry name	Code name
1.	CCS HAU, Hisar	HFO-707	AVTO-2-MC- S-1
2.	(NC)	RO-19	AVTO-2-MC-S- 2
3.	PAU, Ludhiana	OL-1882	AVTO-2-MC-S- 3
4.	(NC)	UPO-212	AVTO-2-MC- S-4

13. IVTO (Dual): Forage Oat:

S. N.	Contributor	Entry name	Code name
1.	GBPUAT, Pantnagar	UPO-20-3	IVTO –D- 1
2.	PAU, Ludhiana	OL-1931	IVTO –D- 2
3.	(NC)	JHO-822	IVTO –D- 3
4.	PAU, Ludhiana	OL-1984	IVTO –D- 4
5.	JNKVV, Jabalpur	JO-13-513	IVTO –D- 5
6.	CCS HAU, Hisar	HFO-917	IVTO –D- 6
7.	CCS HAU, Hisar	HFO-1014	IVTO –D- 7
8.	IGFRI, Jhansi	JHO-20-2	IVTO –D- 8
9.	PAU, Ludhiana	OL-1992	IVTO –D- 9
10.	(NC)	UPO-212	IVTO –D- 10

15. AVT Lucerne-1:

S. N.	Contributor	Entry name	Code name
1.	(NC)	RL-88	AVT-1-Lu – 1
2.	PAU, Ludhiana	LLC-6	AVT-1-Lu – 2
3.	AAU, Anand	AL-66	AVT-1-Lu – 3
4.	(NC)	Anand-2	AVT-1-Lu – 4

16. IVT Summer Bajra:

S. N.	Contributor	Entry name	Code name
1.	(NC)	Moti bajra	IVTMB - 1
2.	(NC)	BAIF Bajra 1	IVTMB - 2
3.	BAIF, Urulikanchan	BAIF Bajra-8	IVTMB - 3
4.	Rasi Seeds	SBH-103	IVTMB - 4
5.	(NC)	Giant bajra	IVTMB - 5
6.	Nuziveedu seeds	NBFH 2277	IVTMB - 6
7.	UPL- Advanta	ADV175020 HIH 5020	IVTMB - 7

17. AVT-1 Summer Bajra:

S. N.	Contributor	Entry name	Code name
1.	UPL - Advanta	ADVO111	AVT1MB - 1
2.	(NC)	Moti bajra	AVT1MB - 2
3.	RASI seed	SBH-101	AVT1MB - 3
4.	(NC)	Giant bajra	AVT1MB - 4
5.	(NC)	BAIF Bajra 1	AVT1MB - 5

18. AVT-2: Summer Bajra (CZ):

S. N.	Contributor	Entry name	Code name
1.	BAIF, Urulikanchan	BAIF Bajra-6	AVT2MB - 1
2.	(NC)	Giant Bajra	AVT2MB - 2
3.	(NC)	Raj Bajra	AVT2MB - 3
4.	(NC)	Moti Bajra	AVT2MB - 4
5.	BAIF, Urulikanchan	BAIF Bajra-5	AVT2MB - 5
6.	PJTSAU, Hyderabad	TSFB-18-1	AVT2MB - 6

19. AVT-2 (Seed): Summer Bajra(CZ):

S. N.	Contributor	Entry name	Code name
1.	BAIF, Urulikanchan	BAIF Bajra-6	AVT2MBS - 1
2.	(NC)	Giant Bajra	AVT2MBS - 2
3.	(NC)	Raj Bajra	AVT2MBS - 3
4.	(NC)	Moti Bajra	AVT2MBS - 4
5.	BAIF, Urulikanchan	BAIF Bajra-5	AVT2MBS - 5
6.	PJTSAU, Hyderabad	TSFB-18-1	AVT2MBS - 6

Entries Code Agronomy (Rabi 2020-21):

R-20-AST-1: (AVTB-2) (MC):

S. N.	Contributor	Entry name	Code name
1.	JNKVV, Jabalpur	JB-06-11	AVTB-2-Agron-1
2.	IGFRI, Jhansi	JHB-18-1	AVTB-2-Agron-2
3.	(NC)	Wardan	AVTB-2-Agron-3
4.	PAU, Ludhiana	Bl-12	AVTB-2-Agron-4
5.	CCSHAU, Hisar	HFB-15-5	AVTB-2-Agron-5
6.	ZC (HZ)	BL-22	AVTB-2-Agron-6
7.	ZC (NWZ and CZ)	BB-2	AVTB-2-Agron-6

R-20-AST-2: AVT-2 Oat (SC):

S. N.	Contributor	Entry name	Code name
1.	PAU, Ludhiana	Ol-1874-1	AVTO-2-SC-Agron-1
2.	(NC)	Kent	AVTO-2-SC-Agron-2
3.	PAU, Ludhiana	Ol-1876-1	AVTO-2-SC-Agron-3
4.	MPKV, Rahuri	RO-11-1-3	AVTO-2-SC-Agron-4
5.	JNKVV, Jabalpur	JO-06-23	AVTO-2-SC-Agron-5
6.	SKUAST-K, Srinagar	SKO-241	AVTO-2-SC-Agron-6
7.	ZC (HZ)	SKO-96	AVTO-2-SC-Agron-7
8.	ZC (CZ)	RO-11-1	AVTO-2-SC-Agron-7
9.	ZC (SZ)	OS-403	AVTO-2-SC-Agron-7
10.	(NC)	OS-6	AVTO-2-SC-Agron-8
11.	MPKV, Rahuri	RO-11-1-2	AVTO-2-SC-Agron-9
12.	CCSHAU, Hisar	HFO-806	AVTO-2-SC-Agron-10

R-20-AST-3: AVT-2 Oat (Multi cut):

S. N.	Contributor	Entry name	Code name
1.	CCSHAU, Hisar	HFO-707	AVTO-2-MC-1
2.	(NC)	RO-19	AVTO-2-MC-2
3.	PAU, Ludhiana	OL-1882	AVTO-2-MC-3
4.	(NC)	UPO-212	AVTO-2-MC-4

R-20-AST-4: AVTPM-2:

S. N.	Contributor	Entry name	Code name
1.	BAIF, Urulikanchan	BAIF Bajra6	AVT2MB-Ag-1
2.	(NC)	Giant Bajra	AVT2MB-Ag-2
3.	(NC)	Raj Bajra	AVT2MB-Ag-3
4.	(NC)	Moti Bajta	AVT2MB-Ag-4
5.	BAIF, Urulikanchan	BAIF Bajra-5	AVT2MB-Ag-5
6.	PJTSAU, Hyderabad	TSFB-18-1	AVT2MB-Ag-6

CHAPTER-1

FORAGE CROP IMPROVEMENT

1. IVTB: INITIAL VARIETAL TRIAL IN BERSEEM

(Reference tables 1.1 to 1.9)

An Initial Varietal Trial in Berseem comprising of five entries along with one national check (Wardan) and one check in respective zones [BL-22 (HZ), Bundel Berseem-2 (CZ), JB-05-9 (NWZ) and Bundel Berseem-3 (NEZ)] was conducted at 20 centres located in four different zones (HZ, NWZ, NEZ, CZ) of the country. There were 4 locations in HZ, 6 in NWZ, 5 IN NEZ and 5 in Central zone.

For green forage yield (q/ha), entry HFB-17-5 (4.2%) showed superiority over the best check (BL 22) in Hill zone. In NW zone Entries JHB 20-2 and PC 114 showed marginal superiority over the best check. In NE zone, zonal check was best performer. In central zone, entry JHB-20-1 was 10.8% better than the best check whereas entries JHB-20-2 and JB-08-17 showed marginal superiority. At all India level comprising of all 4 zones, entry JHB-20-1 (9.8%), entry JHB-20-2 (8.8%), entry JB-08-17 (6.1%) and entry PC-114 (3.7%) performed better over the national check Wardan. All other entries were below or at par or marginally superior in comparison to best check.

For dry matter yield (q/ha), National check Wardan in HZ and zonal check (Bundel Berseem-3) in NEZ were best performer. In NWZ, entry PC 114 (3.0%) and entry JHB-20-2 (1.3%) performed better than the best check. In central zone entry JHB -20-1 and entry JB-08-17 (4.4%) were superior over the best check. At all India level combining all 4 zones, entry JHB-20-1 (7.4%), entry JHB-20-2 (6.6%) and entry JB-08-17 (3.5%) performed better over the national check Wardan. All other entries were below or at par or marginally superior in comparison to best check.

For per day productivity, entry JHB-20-2 (3.52 q/ha/day) ranked first for GFY (q/ha/day) followed by JHB-20-1 (3.49q) and national check (3.40q/ha/day). Similar trend was observed also for DMY (q/ha/day). Entry JHB-20-1 ranked first followed by national check for the character plant height. For the character leafiness, all the entries were almost at par.

In quality parameters, for crude protein yield (q/ha), JHB-20-2 (13.4q/ha) was best performer followed by entry PC-114 (13.2 q/ha). For crude protein percentage, entry PC-114 ranked first with 17.6% CP followed closely by HFB-17-5 (17.5%) and JHB-20-1 (17.4%). For other quality parameters, National check Wardan ranked first for ADF % and NDF %. For IVDMD, entry JHB-20-2 ranked first (59.5%) followed by checks.

Table1.1: IVT Berseem: Initial Varietal Trial in Berseem: Green Forage Yield (q/ha)

Entries	Hill Zone							North West Zone								
	Palampur	Srinagar	Rajouri	**Almora	Average	Rank	Superiority (%)	Bikaner	Hisar	Ludhiana	Pantnagar	Meerut	Udaipur	Average	Rank	Superiority
JHB-20-1	319.4	181.5	330.1	69.9	277.0	7		494.3	585.5	942.5	525.9	784.9	1034.9	728.0	4	
HFB 17-5	388.3	156.1	377.6	39.8	307.3	1	4.2	503.7	598.1	799.9	485.8	618.1	1053.5	676.5	7	
JHB-20-2	370.5	171.9	320.7	51.5	287.7	4		434.7	625.1	1098.0	479.5	772.3	1093.3	750.5	1	1.6
PC-114	338.3	156.4	344.5	74.5	279.7	6		428.3	626.2	1111.0	483.4	702.7	1087.3	739.8	2	0.1
JB 08-17	395.0	154.3	305.6	89.3	285.0	5		428.6	627.4	938.8	411.7	761.2	1075.1	707.1	5	
Wardan (NC)	431.1	156.4	294.0	53.6	293.8	3		469.9	600.3	909.2	432.9	660.9	1016.1	681.5	6	
BL-22 ZC (HZ)	376.1	154.6	353.8	61.9	294.8	2										
JB- 05-09 ZC (NWZ)								365.3	599.9	1094.3	508.2	751.4	1114.2	738.9	3	
Mean	**374.1**	**161.6**	**332.3**	**62.9**	**289.3**			**446.4**	**608.9**	**984.8**	**475.3**	**721.6**	**1067.8**	**717.5**		
CD at 5%	**43.6**	**5.5**		**16.5**				**45.8**	**N/A**	**27.0**	**44.4**		**107.3**			
CV%	**6.5**	**1.9**		**17.5**				**5.7**	**5.7**	**1.6**	**7.9**		**5.7**			

Note: ** Data is not included in zonal and all India average due to low yield of data

Table1.1: IVT Berseem: Initial Varietal Trial in Berseem: Green Forage Yield (q/ha)

Entries	North East Zone						
	Kalyani	Ranchi	Ayodhya	Pusa	**Bhubaneswar	Average	Rank
JHB-20-1	350.9	343.2	303.8	483.3	113.9	370.3	4
HFB 17-5	259.8	314.5	170.6	503.3	109.7	312.1	7
JHB-20-2	365.4	398.3	347.2	440.0	91.7	387.7	2
PC-114	353.2	361.7	257.4	333.3	95.2	326.4	6
JB 08-17	381.0	347.4	292.2	476.7	88.9	374.3	3
Wardan (NC)	332.8	349.8	251.7	403.3	127.1	334.4	5
Bundel Berseem-3 ZC (NEZ)	349.9	402.4	315.3	590.0	136.8	414.4	1
Mean	**341.9**	**359.6**	**276.9**	**461.4**	**109.0**	**359.9**	
CD at 5%	**18.6**	**34.6**	**46.6**	56.6	12.7		
CV%	**10.4**	**5.4**	**9.5**	6.9	6.6		

Note: ** Data is not included in zonal and all India average due to low yield of data

Table1.1: IVT Berseem: Initial Varietal Trial in Berseem: Green Forage Yield (q/ha)

Entries	Central Zone								All India		
	Jha-nsi	Rah-uri	Jabal-pur	Urulikan-chan	Rai-pur	Aver-age	Ra-nk	Super-iority	Aver-age	Ra-nk	Super-iority
JHB-20-1	1188.9	444.8	903.0	510.7	465.9	702.7	1	10.8	566.3	1	9.8
HFB 17-5	994.6	290.0	800.1	265.2	313.7	532.7	7		494.0	6	
JHB-20-2	1035.0	481.5	766.1	492.2	412.0	637.4	3	0.5	561.3	2	8.8
PC-114	929.6	445.4	737.3	522.3	406.8	608.3	5		534.7	4	3.7
JB 08-17	980.3	434.8	839.3	561.6	441.7	651.5	2	2.7	547.4	3	6.1
Wardan (NC)	999.1	434.9	703.4	419.2	418.8	595.1	6		515.8	5	
Bundel Berseem-2 ZC (CZ)	942.2	465.5	889.2	411.1	463.9	634.4	4		563.7		
Mean	**1010.0**	**428.1**	**805.5**	**454.6**	**417.5**	**623.1**			**540.5**		
CD at 5%	**141.6**	**46.9**	**5.4**	**72.3**	**88.4**						
CV%	**7.9**	**6.2**	**9.5**	**8.9**	**11.9**						

Table1.2: IVT Berseem: Initial Varietal Trial in Berseem: Dry Matter Yield (q/ha)

Entries	Hill Zone					North West Zone						
	Palam-pur	Sri-nagar	**Alm-ora	Aver-age	Ra-nk	Bika-ner	His-ar	Ludh-iana	Pant-nagar	Aver-age	Ra-nk	Superi-ority (%)
JHB-20-1	54.4	33.4	12.4	43.9	7	82.0	102.3	119.4	75.4	94.8	4	
HFB 17-5	66.4	31.5	6.1	49.0	2	81.0	105.6	105.3	62.9	88.7	7	
JHB-20-2	64.6	30.7	9.2	47.6	4	83.5	107.0	146.4	67.1	101.0	2	1.3
PC-114	59.4	28.6	12.9	44.0	6	83.8	108.5	149.9	68.6	102.7	1	3.0
JB 08-17	66.7	30.8	15.4	48.8	3	85.7	105.1	117.4	58.1	91.6	6	
Wardan (NC)	77.4	32.2	8.5	54.8	1	85.6	103.5	118.2	61.4	92.2	5	
BL-22 ZC (HZ)	65.9	28.9	9.1	47.4	5							
JB- 05-09 ZC (NWZ)						74.7	108.3	147.6	68.4	99.7	3	
Mean	**65.0**	**30.9**	**10.5**	**47.9**		**82.3**	**105.8**	**129.2**	**66.0**	**95.8**		
CD at 5%	**12.4**	**2.5**	**2.8**			**NS**	**N/A**	**6.3**	**7.2**			
CV%	**10.6**	**4.1**	**17.6**			**5.7**	**5.4**	**2.8**	**9.8**			

Note: ** Data is not included in zonal and all India average due to low yield of data

Table1.2: IVT Berseem: Initial Varietal Trial in Berseem: Dry Matter Yield (q/ha)

Entries	North East Zone						
	Kalyani	Ranchi	Ayodhya	Bhubaneswar	Pusa	Average	Rank
JHB-20-1	45.0	35.5	63.7	25.0	92.4	52.3	3
HFB 17-5	31.9	34.0	34.5	24.6	98.1	44.6	7
JHB-20-2	49.0	39.4	74.5	20.2	89.7	54.6	2
PC-114	45.3	34.2	56.6	23.0	69.2	45.7	6
JB 08-17	48.5	32.8	58.3	19.6	90.1	49.9	4
Wardan (NC)	43.9	31.5	51.2	29.8	86.7	48.6	5
Bundel Berseem-3 ZC (NEZ)	45.1	39.2	70.8	32.1	105.0	58.5	1
Mean	**44.1**	**35.2**	**58.5**	**24.9**	**90.2**	**50.6**	
CD at 5%	**6.3**	**NS**	**10.0**	**3.2**	**13.4**		
CV%	**8.6**	**7.8**	**9.6**	**7.3**	**8.3**		

Table1.2: IVT Berseem: Initial Varietal Trial in Berseem: Dry Matter Yield (q/ha)

Entries	Central Zone								All India		
	Jha-nsi	Rah-uri	Jabal-pur	Urulikan-chan	Rai-pur	Aver-age	Ra-nk	Superi-ority (%)	Aver-age	Ra-nk	Superi-ority (%)
JHB-20-1	200.6	75.5	126.7	69.0	72.8	108.9	1	10.7	79.6	1	7.4
HFB 17-5	154.2	51.6	112.4	41.7	53.3	82.6	7		68.1	6	
JHB-20-2	169.6	79.3	107.2	71.6	63.9	98.3	4		79.0	2	6.6
PC-114	136.0	77.3	103.0	70.9	65.6	90.6	6		73.7	5	
JB 08-17	164.4	76.3	118.0	82.1	72.5	102.6	2	4.4	76.7	3	3.5
Wardan (NC)	171.0	78.3	97.9	51.1	65.8	92.8	5		74.1	4	
Bundel Berseem-2 ZC (CZ)	152.0	81.0	125.3	56.2	77.2	98.4	3				
Mean	**164.0**	**74.2**	**112.9**	**63.2**	**67.3**	**96.3**			**75.2**		
CD at 5%	**19.2**	**8.1**	**29.4**	**10.0**	**13.9**						
CV%	**6.7**	**6.1**	**12.5**	**8.8**	**11.6**						

Table1.3: IVT Berseem: Initial Varietal Trial in Berseem: Green Forage Yield (q/ha/day)

Entries	Bika-ner	His-ar	Ludh-iana	Pant-nagar	Kal-yani	Ran-chi	Ayod-hya	Bhuban-eswar	Pu-sa	Rah-uri	Urulikan-chan	Rai-pur	Aver-age	Ra-nk
JHB-20-1	3.23	3.35	5.21	4.05	2.90	2.33	2.46	1.73	4.21	4.20	4.64	3.58	3.49	2
HFB 17-5	3.29	3.42	4.42	3.74	2.15	2.09	1.38	1.72	4.34	2.74	2.41	2.41	2.84	6
JHB-20-2	2.84	3.57	6.07	3.69	3.02	2.69	2.82	1.47	3.86	4.54	4.47	3.17	3.52	1
PC-114	2.80	3.58	6.14	3.72	2.92	2.37	2.09	1.41	2.79	4.20	4.75	3.13	3.32	4
JB 08-17	2.80	3.59	5.19	3.17	3.15	2.49	2.37	1.46	3.98	4.10	5.10	3.40	3.40	3
Wardan (NC)	3.07	3.43	5.02	3.33	2.75	2.44	2.04	2.13	3.55	4.10	3.81	3.22	3.24	5
JB- 05-09 ZC (NWZ)	2.39	3.43	6.05	3.91										
Bundel Berseem-3 ZC (NEZ)					2.89	2.84	2.56	2.28	4.90					
Bundel Berseem-2 ZC (CZ)										4.39	3.74	3.57		
Mean	**2.92**	**3.48**	**5.44**	**3.66**	**2.83**	**2.46**	**2.25**	**1.74**	**3.95**	**4.04**	**4.13**	**3.21**	**3.30**	

Table1.4: IVT Berseem: Initial Varietal Trial in Berseem: Dry Matter Yield (q/ha/day)

Entries	Bika-ner	His-ar	Ludh-iana	Pant-nagar	Kal-yani	Ran-chi	Ayod-hya	Bhuban-eswar	Pu-sa	Rah-uri	Urulikan-chan	Rai-pur	Aver-age	Ra-nk
JHB-20-1	0.54	0.59	0.66	0.58	0.37	0.24	0.51	0.38	0.37	0.71	0.63	0.56	0.51	2
HFB 17-5	0.53	0.61	0.58	0.48	0.26	0.23	0.28	0.38	0.38	0.49	0.38	0.41	0.42	5
JHB-20-2	0.55	0.61	0.81	0.52	0.40	0.27	0.60	0.32	0.35	0.75	0.65	0.49	0.53	1
PC-114	0.55	0.62	0.83	0.53	0.37	0.22	0.46	0.34	0.23	0.73	0.64	0.50	0.50	3
JB 08-17	0.56	0.60	0.65	0.45	0.40	0.24	0.47	0.32	0.34	0.72	0.75	0.56	0.50	3
Wardan (NC)	0.56	0.59	0.65	0.47	0.36	0.22	0.41	0.50	0.32	0.74	0.46	0.51	0.48	4
JB- 05-09 ZC (NWZ)	0.49	0.62	0.82	0.53										
Bundel Berseem-3 ZC (NEZ)					0.37	0.28	0.57	0.54	0.43					
Bundel Berseem-2 ZC (CZ)										0.76	0.51	0.59		
Mean	**0.54**	**0.61**	**0.71**	**0.51**	**0.36**	**0.24**	**0.47**	**0.40**	**0.35**	**0.70**	**0.57**	**0.52**	**0.49**	

Table1.5: IVT Berseem: Initial Varietal Trial in Berseem: Crude Protein Yield (q/ha)

Entries	Palam-pur	Bika-ner	His-ar	Ludh-iana	Kal-yani	Ran-chi	Ayod-hya	Bhuban-eswar	Rah-uri	Jabal-pur	Urulikan-chan	Rai-pur	Aver-age	Ra-nk
JHB-20-1	10.8	10.6	22.2	22.9	6.3	5.6	10.8	3.7	14.7	18.8	13.7	14.2	12.9	3
HFB 17-5	13.1	12.8	23.0	19.7	3.9	5.2	5.8	3.6	9.8	16.0	9.4	10.5	11.1	6
JHB-20-2	12.4	11.6	23.1	28.8	6.4	6.3	12.7	2.9	15.4	15.2	15.9	10.0	13.4	1
PC-114	12.3	13.5	23.4	28.8	5.1	5.1	9.7	3.6	14.4	14.6	15.2	13.2	13.2	2
JB 08-17	13.0	9.5	22.8	22.2	5.9	4.7	9.6	2.7	12.2	16.9	18.7	14.4	12.7	4
Wardan (NC)	14.7	13.6	22.6	23.5	5.3	4.7	8.6	4.2	14.4	13.8	11.3	11.0	12.3	5
BL-22 ZC (HZ)	11.9													
JB- 05-09 ZC (NWZ)		10.5	23.2	28.3										
Bundel Berseem-3 ZC (NEZ)					6.0	5.7	12.4	4.6						
Bundel Berseem-2 ZC (CZ)									13.8	17.9	12.1	12.0		
Mean	**12.6**	**11.7**	**22.9**	**24.9**	**5.6**	**5.3**	**9.9**	**3.6**	**13.5**	**16.2**	**13.8**	**12.2**	**12.6**	

Table1.6: IVT Berseem: Initial Varietal Trial in Berseem: Crude Protein (%)

Entries	Palampur	Bikaner	Hisar	Ludhiana	Kalyani	Ranchi	Ayodhya	Bhubaneswar	Rahuri	Jabalpur	Urulikanchan	Raipur	Average	Rank
JHB-20-1	19.8	13.0	21.7	19.2	13.9	15.8	16.9	14.9	19.5	14.8	19.9	19.5	17.4	3
HFB 17-5	19.8	15.8	21.8	18.7	12.3	15.2	16.7	14.6	19.0	14.3	22.6	19.7	17.5	2
JHB-20-2	19.3	13.8	21.6	19.7	13.0	16.0	17.0	14.6	19.4	14.2	22.2	15.7	17.2	4
PC-114	20.7	16.1	21.6	19.2	11.3	15.0	17.2	15.5	18.6	14.1	21.4	20.0	17.6	1
JB 08-17	19.5	11.0	21.7	18.9	12.2	14.2	16.5	13.7	16.0	14.3	22.8	19.9	16.7	6
Wardan (NC)	19.0	15.9	21.8	19.9	12.1	14.8	16.8	13.9	18.4	14.0	22.1	16.6	17.1	5
BL-22 ZC (HZ)	18.1													
JB- 05-09 ZC (NWZ)		14.0	21.4	19.2										
Bundel Berseem-3 ZC (NEZ)					13.3	14.4	17.5	14.3						
Bundel Berseem-2 ZC (CZ)									17.0	14.3	21.6	15.4		
Mean	**19.5**	**14.2**	**21.6**	**19.3**	**12.6**	**15.1**	**16.9**	**14.5**	**18.3**	**14.3**	**21.8**	**18.1**	**17.3**	

Table1.7: IVT Berseem: Initial Varietal Trial in Berseem: Plant Height (cm)

Entries	Palampur	Srinagar	Bikaner	Hisar	Ludhiana	Pantnagar	Udaipur
JHB-20-1	37.0	60.0	61.8	55.0	57.4	64.1	59.7
HFB 17-5	38.7	49.7	60.2	56.0	53.2	58.6	55.5
JHB-20-2	39.3	67.3	56.4	56.0	58.1	66.6	60.9
PC-114	34.7	52.0	57.8	55.0	57.3	63.3	57.1
JB 08-17	36.3	50.7	58.6	58.0	62.8	76.3	61.3
Wardan (NC)	38.3	47.7	71.4	58.0	61.8	63.8	60.5
BL-22 ZC (HZ)	41.7	50.0					
JB- 05-09 ZC (NWZ)			63.0	55.0	62.8	68.2	59.8
Mean	**38.0**	**53.9**	**61.3**	**56.1**	**59.1**	**65.8**	**59.3**

Table1.7: IVT Berseem: Initial Varietal Trial in Berseem: Plant Height (cm)

Entries	Kal-yani	Ran-chi	Ayod-hya	Bhuban-eswar	Pu-sa	Rah-uri	Jabal-pur	Urulikan-chan	Rai-pur	Aver-age	Ra-nk
JHB-20-1	86.1	62.4	44.0	74.6	77.3	75.9	57.7	63.0	64.0	62.5	1
HFB 17-5	85.6	58.1	45.2	67.3	67.7	74.4	49.8	55.4	62.0	58.6	6
JHB-20-2	88.7	64.8	43.1	64.3	74.3	66.4	47.7	63.2	64.1	61.3	3
PC-114	82.1	60.4	53.2	65.3	75.7	62.9	45.6	62.5	59.2	59.0	5
JB 08-17	93.8	62.0	50.5	60.3	65.3	64.0	50.8	63.1	70.2	61.5	2
Wardan (NC)	92.0	59.7	48.0	69.6	65.0	65.9	44.0	58.2	67.2	60.7	4
Bundel Berseem-3 ZC (NEZ)	90.1	61.9	47.1	72.5	71.0						
Bundel Berseem-2 ZC (CZ)						81.7	53.0	61.2	65.0		
Mean	**88.3**	**61.3**	**47.3**	**67.7**	**70.9**	**70.2**	**49.8**	**60.9**	**64.5**	**60.6**	

Table1.8: IVT Berseem: Initial Varietal Trial in Berseem: Leaf Stem Ratio

Entries	Palam-pur	Sri-nagar	Bika-ner	His-ar	Ludh-iana	Pant-nagar	Kal-yani	Ran-chi	Ayod-hya	Bhuban-eswar	Pu-sa	Jabal-pur	Urulikan-chan	Rai-pur	Aver-age	Ra-nk
JHB-20-1	0.48	0.84	0.37	2.01	0.91	0.91	0.52	0.82	0.65	0.92	0.63	0.84	0.64	0.57	0.79	2
HFB 17-5	0.67	0.75	0.47	2.11	0.82	0.88	0.56	0.89	0.69	0.84	0.56	0.75	0.77	0.58	0.81	1
JHB-20-2	0.44	0.86	0.59	1.90	0.96	0.85	0.89	0.78	0.68	0.76	0.69	0.72	0.68	0.53	0.81	1
PC-114	0.33	0.86	0.81	1.90	0.98	0.78	0.64	0.80	0.72	0.79	0.57	0.72	0.86	0.57	0.81	1
JB 08-17	0.55	0.65	0.79	1.96	0.96	0.77	0.51	0.80	0.66	0.72	0.68	0.76	0.66	0.45	0.78	3
Wardan (NC)	0.43	0.70	0.66	1.92	0.94	0.76	0.49	0.76	0.67	0.98	0.72	0.67	1.07	0.51	0.81	1
BL-22 ZC (HZ)	0.54	0.80														
JB- 05-09 ZC (NWZ)			0.64	2.08	0.98	0.80										
Bundel Berseem-3 ZC (NEZ)							0.67	0.76	0.63	1.04	0.64					
Bundel Berseem-2 ZC (CZ)												0.79	0.71	0.53		
Mean	**0.49**	**0.78**	**0.62**	**1.98**	**0.94**	**0.82**	**0.61**	**0.80**	**0.67**	**0.86**	**0.64**	**0.75**	**0.77**	**0.53**	**0.80**	

Table1.9: IVT Berseem: Initial Varietal Trial in Berseem: ADF (%), NDF & IVDMD (%)

Entries	ADF (%)		NDF (%)		IVDMD (%)			
	Ludhiana	Rank	Ludhiana	Rank	Ludhiana	Hisar	Average	Rank
JHB-20-1	41.9	3	63.4	5	55.9	54.6	55.3	5
HFB 17-5	44.6	7	64.3	6	54.3	56.2	55.2	6
JHB-20-2	42.8	4	62.9	4	57.9	61.1	59.5	1
PC-114	43.2	5	62.3	2	56.3	56.0	56.2	4
JB 08-17	43.7	6	65.6	7	54.1	56.4	55.2	6
Wardan (NC)	41.3	1	61.8	1	58.2	55.9	57.0	3
JB- 05-09 ZC (NWZ)	41.7	2	62.7	3	56.8	57.8	57.3	2
Mean	**42.7**		**63.3**		**56.2**	**56.8**	**56.5**	

2. AVTB-1: FIRST ADVANCED VARIETAL TRIAL IN BERSEEM

(Reference tables 2.1 to 2.9)

A First stage Advanced Varietal Trial in Berseem comprising of four entries along with one national check (Wardan) and one zonal check [BL-22 (HZ), BB-2 (NWZ, CZ, BB 3 in NEZ)] was conducted at 20 centres located in four zones (Hill, North West, North east and Central zone). There were 4 locations in Hill, 6 locations in NW, 5 in NE zone and 5 in central zone.

For green forage yield (q/ha), zonal check was best performer in hill zone, whereas entry BM-14 (5.3%) in NWZ, entries JB-07-15 (2.7%), BM-14 (1.5%) in NEZ, entries JB-07-15 (2.8%), BM-14 (2.0%) in central zone and entries BM-14 (10.2%), JB-07-15 (6.4%) at all India level were superior over the best check. All other entries were below or at par in comparison to best check.

For dry matter yield (q/ha), zonal check was best performer in hill zone, and national check in NEZ. Entry BM-14 (3.2%) in NW zone, entries JB-07-15 (12.4%), BM-14 (1.6%) in central zone and entries JB-07-15 (3.3%), BM-14 (2.8%) at all India level was superior over the best check. All other entries were below or at par in comparison to best check.

In green forage production potential (q/ha/day), entry BM-14 ranked first followed by JB-07-15, wheres for dry forage production potential (q/ha/day), JB-07-15 ranked first followed by BM-14. Entry JB-07-15 ranked first for the character plant height. For leafiness, entry BM-14 and JB-07-15 ranked joint first.

In quality parameters, for crude protein yield (q/ha), BM-14 (12.6q/ha) was best performer followed by JB-07-15 (12.1 q/ha). For crude protein percentage, entry BM-14 (17.5%) ranked first followed by HFB-16-10 (17.2%) and Wardan and JB-07-15(17.1%). For other quality parameters, entry BM-14 ranked first for NDF and ADF whereas entry JB-07-15 ranked first for IVDMD %.

Table 2.1 AVT-1: First Advanced Varietal Trial in Berseem: Green Forage Yield (q/ha)

Entries	Hill Zone						North West Zone								
	Palam-pur	Sri-nagar	Rajo-uri	**Alm-ora	Aver-age	Ra-nk	Pant-nagar	Bika-ner	His-ar	Ludh-iana	Mee-rut	**Udai-pur	Aver-age	Ra-nk	Superi-ority%
HFB-16-10	258.3	151.9	352.2	35.5	254.1	4	551.3	444.4	418.4	658.1	194.9	1664.5	453.4	6	
BM-14	340.2	154.1	328.3	54.3	274.2	2	589.7	553.1	448.8	1089.1	212.4	1649.1	578.6	1	5.3
HFB-16-1	332.6	157.9	305.8	45.4	265.4	3	611.4	493.6	454.4	871.5	209.7	1597.5	528.1	4	
JB-07-15	300.0	175.4	262.2	71.3	245.8	6	575.6	471.5	443.8	926.5	230.8	1397.6	529.6	3	
Wardan (NC)	288.2	173.4	276.1	66.3	245.9	5	572.8	518.6	415.7	830.9	217.0	1613.2	511.0	5	
BL-22 ZC (HZ)	386.1	156.9	290.5	53.3	277.8	1									
BB-2 ZC (NWZ-CZ)							631.2	536.2	434.4	900.7	245.8	1652.2	549.7	2	
Mean	**317.5**	**161.6**	**302.5**	**54.3**	**260.5**		**588.7**	**502.9**	**435.9**	**879.5**	**218.4**	**1595.7**	**525.1**		
CD at 5%	**61.9**	**4.0**		**16.1**			**59.3**	**62.4**	**N/A**	**12.3**		**140.1**			
CV%	**12.8**	**1.4**		**19.5**			**12.1**	**8.2**	**4.5**	**1.9**		**5.8**			

Note: ** Data is not icluded in zonal and all India average due to low yield of data

Table 2.1 AVT-1: First Advanced Varietal Trial in Berseem: Green Forage Yield (q/ha)

Entries	North East Zone							
	Kalyani	Ranchi	Ayodhya	Bhubaneswar	Pusa	Average	Rank	Superiority%
HFB-16-10	302.4	250.2	275.6	115.7	402.5	269.3	6	
BM-14	303.2	341.8	453.3	148.0	427.5	334.7	2	1.5
HFB-16-1	284.1	285.1	395.1	117.8	345.0	285.4	5	
JB-07-15	339.1	296.2	392.0	130.8	535.0	338.6	1	2.7
Wardan (NC)	299.9	391.8	356.8	143.3	435.0	325.4	4	
BB-3 ZC (NEZ)	298.8	365.8	349.1	127.7	507.5	329.8	3	
Mean	**304.6**	**321.8**	**370.3**	**130.5**	**442.1**	**313.9**		
CD at 5%	**6.9**	**24.3**	**75.9**	**19.3**	**21.4**			
CV%	**9.2**	**5.0**	**13.6**	**9.8**	**6.5**			

Table 2.1 AVT-1: First Advanced Varietal Trial in Berseem: Green Forage Yield (q/ha)

Entries	Central Zone								All India		
	Jhansi	Rahuri	Jabalpur	Urulikanchan	Raipur	Average	Rank	Superiority%	Average	Rank	Superiority%
HFB-16-10	960.1	302.5	380.8	168.2	359.6	434.3	6		363.7	5	
BM-14	758.2	384.0	890.3	428.3	456.5	583.5	2	2.0	461.5	1	10.2
HFB-16-1	758.4	300.6	754.6	201.7	431.6	489.4	5		406.2	4	
JB-07-15	840.6	443.7	813.5	332.4	511.6	588.3	1	2.8	445.6	2	6.4
Wardan (NC)	841.2	382.1	785.5	227.2	384.6	524.1	4		418.9	3	
BB-2 ZC (NWZ-CZ)	789.1	441.5	773.8	357.8	498.7	572.2	3				
Mean	**824.6**	**375.7**	**733.1**	**285.9**	**440.4**	**532.0**			**419.2**		
CD at 5%	**NS**	**47.2**	**2.1**	**57.3**	**88.2**						
CV%	**12.9**	**8.3**	**24.0**	**13.2**	**13.3**						

Table 2.2: AVT-1: First Advanced Varietal Trial in Berseem : Dry Matter Yield (q/ha)

Entries	Hill Zone					North West Zone						
	Palam-pur	Sri-nagar	**Alm-ora	Aver-age	Ra-nk	Pant-nagar	Bika-ner	His-ar	Ludh-iana	Aver-age	Ra-nk	Superi-ority%
HFB-16-10	43.4	32.4	6.0	37.9	6	96.5	100.5	62.7	80.6	85.1	6	
BM-14	61.4	30.5	9.5	45.9	2	101.4	118.5	66.2	151.1	109.3	1	3.2
HFB-16-1	58.9	28.3	7.5	43.6	3	113.1	120.1	68.8	118.7	105.2	3	
JB-07-15	53.7	31.1	12.4	42.4	4	94.9	110.7	65.8	120.5	98.0	4	
Wardan (NC)	48.8	31.4	10.9	40.1	5	104.3	111.1	60.7	106.0	95.5	5	
BL-22 ZC (HZ)	65.0	31.3	9.1	48.2	1							
BB-2 ZC (NWZ-CZ)						113.6	126.1	64.5	119.4	105.9	2	
Mean	**55.2**	**30.8**	**9.2**	**43.0**		**104.0**	**114.5**	**64.8**	**116.1**	**99.8**		
CD at 5%	**13.0**	**1.4**	**2.7**	**2.7**		**11.5**	**13.8**	**NA**	**5.4**			
CV%	**15.5**	**2.6**	**19.3**	**19.3**		**13.3**	**7.9**	**6.9**	**2.9**			

Note: ** Data is not included in zonal and all India average due to low yield of data

Table 2.2: AVT-1: First Advanced Varietal Trial in Berseem : Dry Matter Yield (q/ha)

Entries	North East Zone						
	Kal-yani	Ran-chi	Ayod-hya	Bhuban-eswar	Pu-sa	Aver-age	Ra-nk
HFB-16-10	50.1	37.9	56.4	25.6	61.2	46.3	5
BM-14	46.5	47.2	88.3	35.1	33.3	50.1	4
HFB-16-1	42.6	47.0	75.1	25.2	35.0	45.0	6
JB-07-15	53.4	49.3	79.5	29.8	50.0	52.4	3
Wardan (NC)	49.9	50.5	76.7	33.0	83.4	58.7	1
BB-3 ZC (NEZ)	44.2	49.9	73.3	28.1	96.9	58.5	2
Mean	**47.8**	**47.0**	**74.9**	**29.5**	**60.0**	**51.8**	
CD at 5%	**3.3**		**15.5**	**4.4**	**7.9**		
CV%	**7.8**		**13.7**	**9.9**	**8.8**		

Table 2.2: AVT-1: First Advanced Varietal Trial in Berseem : Dry Matter Yield (q/ha)

Entries	Central Zone								All India		
	Jhansi	Rahuri	Jabalpur	Urulikanchan	Raipur	Average	Rank	Superiority%	Average	Rank	Superiority%
HFB-16-10	150.3	49.0	56.9	22.9	47.1	65.2	6		60.8	5	
BM-14	113.4	67.7	141.9	55.6	64.1	88.5	2	1.6	76.4	2	2.8
HFB-16-1	124.5	48.0	117.7	28.6	59.6	75.7	5		69.5	4	
JB-07-15	140.2	91.2	131.2	50.9	76.2	97.9	1	12.4	76.8	1	3.3
Wardan (NC)	138.4	76.7	127.1	38.3	52.3	86.6	4		74.3	3	
BB-2 ZC (NWZ-CZ)	124.8	74.0	121.2	48.8	66.9	87.2	3				
Mean	**131.9**	**67.8**	**116.0**	**40.9**	**61.0**	**83.5**			**71.5**		
CD at 5%	**NS**	**8.8**	**0.4**	8.0	**10.7**						
CV%	**14.8**	**8.6**	**24.6**	12.8	**11.7**						

Table 2.3 AVT-1: First Advanced Varietal Trial in Berseem: Green Forage Yield (q/ha/day)

Entries	Pantnagar	Bikaner	Hisar	Ludhiana	Kalyani	Ranchi	Ayodhya	Bhubaneswar	Pusa	Rahuri	Urulikanchan	Raipur	Average	Rank
HFB-16-10	4.24	2.91	2.42	3.64	2.54	1.71	2.29	1.93	3.53	2.75	1.53	2.72	2.68	5
BM-14	4.54	3.62	2.64	6.02	2.55	2.26	3.77	2.17	3.85	3.49	3.90	3.46	3.52	1
HFB-16-1	4.70	3.23	2.63	4.82	2.39	1.92	3.29	2.00	3.16	2.73	1.84	3.27	3.00	4
JB-07-15	4.43	3.08	2.58	5.12	2.85	2.15	3.26	2.39	4.53	4.03	3.33	3.88	3.47	2
Wardan (NC)	4.41	3.39	2.43	4.59	2.52	2.78	2.97	2.50	3.92	3.47	2.07	2.91	3.16	3
BB-2 ZC (NWZ-CZ)	4.86	3.50	2.52	4.98						4.01	3.26	3.78		
BB-3 ZC (NEZ)					2.51	2.59	2.90	1.94	4.40					
Mean	**4.53**	**3.29**	**2.54**	**4.86**	**2.56**	**2.24**	**3.08**	**2.16**	**3.90**	**3.42**	**2.66**	**3.34**	**3.17**	

Table 2.4 AVT-1: First Advanced Varietal Trial in Berseem: Dry Matter Yield (q/ha/day)

Entries	Pant-nagar	Bika-ner	His-ar	Ludh-iana	Kal-yani	Ran-chi	Ayo-dhya	Bhuban-eswar	Pu-sa	Rah-uri	Urulikan-chan	Rai-pur	Aver-age	Ra-nk
HFB-16-10	0.74	0.66	0.36	0.45	0.42	0.26	0.47	0.43	0.25	0.45	0.21	0.36	0.42	5
BM-14	0.78	0.78	0.39	0.83	0.39	0.31	0.73	0.51	0.28	0.62	0.51	0.49	0.55	2
HFB-16-1	0.87	0.79	0.40	0.66	0.36	0.32	0.62	0.43	0.29	0.44	0.26	0.45	0.49	4
JB-07-15	0.74	0.72	0.38	0.67	0.45	0.36	0.66	0.54	0.42	0.83	0.51	0.58	0.57	1
Wardan (NC)	0.81	0.73	0.35	0.59	0.42	0.36	0.63	0.58	0.35	0.70	0.35	0.40	0.52	3
BB-2 ZC (NWZ-CZ)	0.87	0.83	0.37	0.66						0.67	0.44	0.51		
BB-3 ZC (NEZ)					0.37	0.35	0.61	0.43	0.37					
Mean	**0.80**	**0.75**	**0.38**	**0.64**	**0.40**	**0.33**	**0.62**	**0.49**	**0.33**	**0.62**	**0.38**	**0.47**	**0.51**	

Table 2.5 AVT-1: First Advanced Varietal Trial in Berseem: Crude Protein Yield (q/ha)

Entries	Palam-pur	Pant-nagar	Bika-ner	His-ar	Ludh-iana	Kal-yani	Ran-chi	Ayo-dhya	Bhuba-neswar	Rah-uri	Jabal-pur	Urulikan-chan	Rai-pur	Aver-age	Ra-nk
HFB-16-10	8.9	20.3	17.4	13.2	6.5	6.5	6.2	9.5	3.5	8.3	8.0	4.2	8.8	9.3	5
BM-14	12.0	20.4	20.1	13.8	6.2	6.2	8.0	14.8	4.5	14.3	20.1	12.4	10.6	12.6	1
HFB-16-1	10.8	21.8	15.1	14.8	5.3	5.3	7.9	12.5	3.5	8.2	16.5	5.2	9.3	10.5	4
JB-07-15	10.1	18.3	17.0	13.6	7.7	7.7	7.9	13.1	4.0	16.5	18.6	9.8	13.1	12.1	2
Wardan (NC)	9.2	20.1	18.1	13.2	5.9	5.9	8.5	13.2	4.4	15.7	18.1	7.2	9.8	11.5	3
BL-22 ZC (HZ)	13.2														
BB-2 ZC (NWZ-CZ)		23.9	21.0	13.6	5.5					16.0	17.1	8.6	10.7		
BB-3 ZC (NEZ)						5.5	8.6	12.5	3.9						
Mean	**10.7**	**20.8**	**18.1**	**13.7**	**6.2**	**6.2**	**7.9**	**12.6**	**4.0**	**13.2**	**16.4**	**7.9**	**10.4**	**11.2**	

Table 2.6 AVT-1: First Advanced Varietal Trial in Berseem: Crude Protein (%)

Entries	Palam-pur	Pant-nagar	Bika-ner	His-ar	Ludh-iana	Kal-yani	Ran-chi	Ayod-hya	Bhuban-eswar	Rah-uri	Jabal-pur	Urulikan-chan	Rai-pur	Aver-age	Ra-nk
HFB-16-10	20.6	21.0	17.3	21.0	16.0	13.0	16.4	16.9	13.8	17.0	14.1	18.2	18.9	17.2	2
BM-14	19.5	20.1	17.0	20.9	16.4	13.4	17.0	16.8	12.8	21.1	14.2	22.2	16.5	17.5	1
HFB-16-1	18.4	19.3	12.6	21.6	17.3	12.5	16.8	16.6	14.0	17.2	14.0	18.2	16.7	16.5	4
JB-07-15	18.8	19.3	15.4	20.7	19.7	14.4	16.0	16.5	13.3	18.1	14.2	19.2	17.3	17.1	3
Wardan (NC)	19.0	19.3	16.3	21.8	15.0	11.9	16.8	17.2	13.2	20.5	14.2	18.7	18.6	17.1	3
BL-22 ZC (HZ)	20.3														
BB-2 ZC (NWZ-CZ)		21.0	16.6	21.1	15.2					21.6	14.1	17.5	15.3		
BB-3 ZC (NEZ)						12.4	17.2	17.0	13.8						
Mean	**19.4**	**20.0**	**15.9**	**21.2**	**16.6**	**12.9**	**16.7**	**16.8**	**13.5**	**19.3**	**14.1**	**19.0**	**17.2**	**17.1**	

Table 2.7 AVT-1: First Advanced Varietal Trial in Berseem : Plant Height (cm)

Entries	Palam-pur	Sri-nagar	Pant-nagar	Bika-ner	His-ar	Ludh-iana	Udai-pur
HFB-16-10	34.0	47.7	59.0	77.0	55.0	46.3	62.3
BM-14	35.5	47.0	63.1	83.0	53.0	54.3	62.6
HFB-16-1	35.0	52.0	53.6	85.6	53.0	52.0	61.5
JB-07-15	33.0	44.7	75.3	90.0	56.0	62.8	56.5
Wardan (NC)	32.5	48.0	63.6	79.8	55.0	58.8	61.5
BL-22 ZC (HZ	35.3	47.3					
BB-2 ZC (NWZ-CZ)			57.8	74.8	55.0	53.8	63.4
Mean	**34.2**	**47.8**	**62.1**	**81.7**	**54.5**	**54.7**	**61.3**

Table 2.7 AVT-1: First Advanced Varietal Trial in Berseem: Plant Height (cm)

Entries	Kal-yani	Ran-chi	Ayod-hya	Bhuban-eswar	Pu-sa	Rah-uri	Jabal-pur	Urulikan-chan	Rai-pur	Aver-age	Ra-nk
HFB-16-10	72.3	40.0	44.0	63.5	69.0	52.8	53.9	55.5	47.1	55.0	5
BM-14	73.0	43.3	41.3	78.3	72.0	59.9	48.6	60.9	45.4	57.6	3
HFB-16-1	73.8	44.2	51.0	66.5	67.0	53.5	46.5	53.9	45.9	55.9	4
JB-07-15	74.2	53.3	58.2	71.3	77.3	61.2	51.7	63.1	52.2	61.3	1
Wardan (NC)	79.7	59.3	64.5	74.4	69.5	61.5	58.6	56.6	47.6	60.7	2
BB-2 ZC (NWZ-CZ)						62.9	50.7	57.0	51.4		
BB-3 ZC (NEZ)	70.6	60.5	48.6	68.1	76.0						
Mean	**73.9**	**50.1**	**51.3**	**70.3**	**71.8**	**58.6**	**51.6**	**57.8**	**48.3**	**58.1**	

Table 2.8 AVT-1: First Advanced Varietal Trial in Berseem: Leaf Stem Ratio

Entries	Palam-pur	Sri-nagar	Pant-nagar	Bika-ner	His-ar	Ludh-iana
HFB-16-10	0.56	0.75	0.78	0.89	2.06	0.89
BM-14	0.63	0.75	0.73	0.70	2.08	0.95
HFB-16-1	0.42	0.80	0.87	0.66	2.04	0.93
JB-07-15	0.66	0.83	0.71	1.18	1.96	0.92
Wardan (NC)	0.56	0.80	0.84	0.72	2.04	0.92
BL-22 ZC (HZ)	0.64	0.85				
BB-2 ZC (NWZ-CZ)			0.80	0.80	2.05	0.84
Mean	**0.58**	**0.80**	**0.79**	**0.83**	**2.04**	**0.91**

Table 2.8 AVT-1: First Advanced Varietal Trial in Berseem: Leaf Stem Ratio

Entries	Ran-chi	Ayod-hya	Bhuban-eswar	Pu-sa	Rah-uri	Jabal-pur	Urulikan-chan	Rai-pur	Aver-age	Ra-nk
HFB-16-10	0.87	0.66	0.81	0.49	0.44	1.00	0.78	0.47	0.82	3
BM-14	0.88	0.70	1.07	0.53	0.56	0.93	0.74	0.50	0.84	1
HFB-16-1	0.86	0.65	0.85	0.56	0.50	0.93	0.74	0.49	0.81	4
JB-07-15	0.76	0.67	0.94	0.75	0.48	0.97	0.64	0.32	0.84	1
Wardan (NC)	0.76	0.68	1.01	0.65	0.43	1.05	0.67	0.47	0.83	2
BB-2 ZC (NWZ-CZ)					0.44	0.96	0.76	0.44		
BB-3 ZC (NEZ)	0.82	0.69	0.87	0.68						
Mean	**0.82**	**0.68**	**0.93**	**0.61**	**0.47**	**0.97**	**0.72**	**0.45**	**0.83**	

Table 2.9 AVT-1: First Advanced Varietal Trial in Berseem: NDF (%)

Entries	NDF (%)						
	Pant-nagar	Rah-uri	Ludh-iana	Palam-pur	Ran-chi	Aver-age	Ra-nk
HFB-16-10	63.8	43.1	69.2	63.4	35.8	55.1	5
BM-14	64.6	36.5	65.4	61.4	32.5	52.1	1
HFB-16-1	62.2	41.5	65.2	64.0	38.4	54.3	3
JB-07-15	63.4	40.8	63.8	62.6	39.1	53.9	2
Wardan (NC)	63.4	38.0	67.2	61.6	41.5	54.3	3
BL-22 ZC (HZ)				62.2		54.9	4
BB-2 ZC (NWZ-CZ)	64.2	44.1	68.6				
BB-3 ZC (NEZ)					35.2		
Mean	**63.6**	**40.6**	**66.6**	**62.5**	**37.1**	**54.1**	

Table 2.9 AVT-1: First Advanced Varietal Trial in Berseem: ADF (%), & IVDMD (%)

Entries	ADF (%)							IVDMD (%)					
	Pant-nagar	**Rah-uri**	**Ludh-iana**	**Palam-pur**	**Ran-chi**	**Aver-age**	**Ra-nk**	**Ludh-iana**	**His-ar**	**Rah-uri**	**Ran-chi**	**Aver-age**	**Ra-nk**
HFB-16-10	52.4	33.0	44.6	54.2	27.4	42.3	3	53.0	55.2	63.2	66.1	59.4	3
BM-14	53.8	28.5	45.3	55.4	25.6	41.7	1	53.2	55.2	66.6	65.4	60.1	2
HFB-16-1	54.6	32.4	43.2	56.0	30.5	43.3	5	54.3	54.9	63.7	64.2	59.3	4
JB-07-15	53.2	31.2	42.2	53.2	31.1	42.2	2	58.0	57.1	64.2	62.3	60.4	1
Wardan (NC)	55.4	28.6	46.2	54.4	31.8	43.3	5	51.0	55.2	66.6	63.5	59.1	6
BL-22 ZC (HZ)				52.6		42.9	4					59.2	5
BB-2 ZC (NWZ-CZ)	56.2	34.4	43.9					51.9	56.7	61.8			
BB-3 ZC (NEZ)					27.5						66.3		
Mean	**54.3**	**31.3**	**44.2**	**54.3**	**29.0**	**42.6**		**53.6**	**55.7**	**64.4**	**64.6**	**59.6**	

3. AVTB-2: SECOND ADVANCED VARIETAL TRIAL IN BERSEEM

(Reference tables 3.1 to 3.9)

A Second stage Advanced Varietal Trial in Berseem comprising of five entries along with one national check (Wardan) and one resepctive zonal checks [BL-22 (HZ), BB-2 (NWZ and CZ)] was conducted at 15 centres located in three zones. There were 7 locations in NW, 3 in hill and 5 in central zone.

For green forage yield (q/ha), in hill zone, entries JHB-18-1 (11.4%), JHB-18-2 (7.9%), JB-06-11 (5.3%), BM-12 (3.8%) performed better than the best check. Similarly in NWZ, entries BM-12 (6.5 %), JHB-18-2 (5.3%), HFB-15-5 (2.7%), JHB-18-1 (0.8%), JB-06-11 (0.4%) were superior than the best check. In central zone, zonal check was the best performer and no entry could surpass the green forage yield of zonal check Bundel Berseem-2. Combining the all three zones entries BM-12 (10.9%), JHB-18-2 (9.3%), JHB-18-1 (8.4%), JB-06-11 (4.8%) were better than the national check Wardan.

For dry matter yield (q/ha), entries JHB-18-2 (29.2%), JB-06-11 (18.8%), JHB-18-1 (13.4%), BM-12 (11.5%), HFB-15-5 (1.6%) performed better than the best check in HZ. Entries BM-12 (10.9%), JHB-18-2 (3.4%), HFB-15-5 (4.3%), JB-06-11 (1.5%) were better than the best check in NWZ. As in case of GFY zonal check was superior in central zone for DMY also. Combining the all three zones, entries BM-12 (9.3%), JHB-18-2 (7.3%), JHB-18-1 (5.1%), JB-06-11 (2.9%) were better than the national check Wardan.

For green and dry forage production potential (q/ha/day), entry BM-12 ranked first followed by JHB-18-2. Entry JB-06-11 ranked first for the character plant height followed by JHB-18-1. For leafiness, JHB-18-1 ranked first.

In quality parameters, for crude protein yield (q/ha), BM-12 (17.4q/ha) was best performer followed by JHB-18-1 (16.3 q/ha). For crude protein percentage, national check Wardan (18.4%) ranked first. For other quality parameters, entry JHB-18-1 ranked first for NDF and IVDMD followed by check. For ADF, national check ranked first

4. AVTB-2 (SEED): SECOND ADVANCED VARIETAL TRIAL IN BERSEEM FOR SEED

(Reference tables 4.1)

A Second stage Advanced Varietal Trial for Seed in Berseem comprising of five entries along with one national check (Wardan) and one respective zonal check [BL-22 (HZ), BB-2 (NWZ and CZ)] was conducted at 8 centres located in three zones. There was single location in HZ, 3 in NW and 4 in locations central zone.

For seed yield (q/ha), zonal check performed best in hill zone. In NW zone, entries HFB-15-5 (25.5%), BM-12 (21.2%), JHB-18-1 (5.0%) and JB-06-11 (4.2%) performed better than the best check. In CZ entries JB-06-11 (5.5%) was best performer. Combining all three zones, entry JB-06-11 gave 5.2% higher yield than the national check Wardan.

Table 3.1 AVT-2: Second Advanced Varietal Trial in Berseem: Green Forage Yield (q/ha)

Entries	Hill Zone						North West Zone									
	Palam-pur	Sri-nagar	Rajo-uri	Aver-age	Ra-nk	Superi-ority (%)	Pant-nagar	Bika-ner	His-ar	Ludh-iana	Uda-ipur	Mee-rut	**Jal-ore	Aver-age	Ra-nk	Superi-ority%
JB-06-11	358.3	154.0	261.1	257.8	3	5.3	512.2	414.8	576.4	981.6	1315.2	664.5	68.1	744.1	5	0.4
JHB-18-1	327.7	170.6	319.7	272.7	1	11.4	468.8	491.1	560.9	949.6	1350.2	662.8	80.1	747.2	4	0.8
BM-12	320.3	155.7	286.4	254.1	4	3.8	561.9	490.8	586.7	1117.6	1331.8	648.9	46.8	789.6	1	6.5
HFB-15-5	263.9	157.2	233.6	218.2	7		498.1	481.5	566.2	1045.4	1299.8	675.1	70.8	761.0	3	2.7
JHB-18-2	359.2	178.9	254.4	264.2	2	7.9	501.4	507.3	583.1	1006.5	1416.9	667.1	94.9	780.4	2	5.3
Wardan (NC)	268.5	152.8	313.0	244.8	5		432.2	386.4	568.4	934.3	1319.0	565.6	79.2	701.0	7	
BL- 22 ZC (HZ)	271.2	155.9	263.1	230.1	6											
BB-2 ZC (NWZ-CZ)							471.8	499.5	559.2	982.9	1269.7	664.6	70.8	741.3	6	
Mean	**309.9**	**160.7**	**275.9**	**248.8**			**492.3**	**467.3**	**571.6**	**1002.6**	**1328.9**	**649.8**	**72.9**	**752.1**		
CD at 5%	**55.3**	**5.0**					**46.6**	**46.6**	**N/A**	**14.9**	**88.0**		**17.0**			
CV%	**9.9**	**1.8**					**11.5**	**5.5**	**6.5**	**1.8**	**3.7**		**12.9**			

Note: ** Data is not included in zonal and all India average due to low yield of data

Table 3.1 AVT-2: Second Advanced Varietal Trial in Berseem: Green Forage Yield (q/ha)

Entries	Central Zone							All India		
	Jha-nsi	Rah-uri	Jabal-pur	Urulikan-chan	Rai-pur	Aver-age	Ra-nk	Aver-age	Ra-nk	Superi-ority%
JB-06-11	755.9	405.8	879.4	485.2	438.0	592.9	5	585.9	4	4.8
JHB-18-1	920.7	421.1	848.9	558.2	431.6	636.1	2	605.8	3	8.4
BM-12	857.6	389.2	820.1	655.4	451.2	634.7	3	619.5	1	10.8
HFB-15-5	783.1	298.0	760.2	545.4	327.5	542.9	7	566.8	5	1.4
JHB-18-2	886.3	431.4	825.1	473.2	461.1	615.4	4	610.9	2	9.3
Wardan (NC)	805.6	381.4	882.2	401.4	415.4	577.2	6	559.0	6	
BB-2 ZC (NWZ-CZ)	925.1	411.8	882.5	518.8	448.8	637.4	1			
Mean	**847.8**	**391.2**	**842.6**	**519.7**	**424.8**	**605.2**		**591.3**		
CD at 5%	**81.6**	**61.7**	**6.7**	**113.4**	**77.6**					
CV%	**5.4**	**8.9**	**6.3**	**12.1**	**10.3**					

Table 3.2: AVT-2: Second Advanced Varietal Trial in Berseem: Dry Matter Yield (q/ha)

Entries	Hill Zone					North West Zone							
	Palampur	Srinagar	Average	Rank	Superiority (%)	Pantnagar	Bikaner	Hisar	Ludhiana	**Jalore	Average	Rank	Superiority%
JB-06-11	57.9	32.6	45.2	2	18.8	84.5	99.3	100.6	130.9	12.0	103.8	4	1.5
JHB-18-1	52.2	34.1	43.2	3	13.4	78.8	103.5	95.4	125.0	14.1	100.7	7	
BM-12	55.3	29.6	42.5	4	11.5	96.1	105.9	99.2	152.7	8.3	113.5	1	10.9
HFB-15-5	48.4	29.1	38.7	5	1.6	84.3	101.5	99.7	141.1	12.0	106.7	2	4.3
JHB-18-2	62.2	36.2	49.2	1	29.2	83.8	105.7	101.1	132.5	15.4	105.8	3	3.4
Wardan (NC)	46.1	29.3	37.7	7		79.9	101.8	99.4	126.1	13.2	101.8	6	
BL- 22 ZC (HZ),	47.0	29.2	38.1	6									
BB-2 ZC (NWZ-CZ)						78.7	106.1	99.9	124.5	12.7	102.3	5	
Mean	**52.7**	**31.4**	**42.1**			**83.7**	**103.4**	**99.3**	**133.3**	**12.5**	**104.9**		
CD at 5%	**10.9**	**2.1**				**7.3**	**NS**	**N/A**	**4.1**	**2.8**			
CV%	**11.5**	**3.7**				**11.6**	**5.7**	**8.0**	**1.7**	**12.3**			

Note: ** Data is not included in zonal and all India average due to low yield of data

Table 3.2: AVT-2: Second Advanced Varietal Trial in Berseem: Dry Matter Yield (q/ha)

Entries	Central Zone							All India		
	Jhansi	Rahuri	Jabalpur	Urulikanchan	Raipur	Average	Rank	Average	Rank	Superiority%
JB-06-11	123.8	72.6	125.2	59.4	93.0	94.8	5	89.1	4	2.9
JHB-18-1	144.4	81.4	120.5	74.6	90.7	102.3	2	91.0	3	5.1
BM-12	128.2	76.9	115.9	91.8	88.2	100.2	3	94.5	1	9.3
HFB-15-5	111.2	53.1	107.3	72.0	67.6	82.3	7	83.2	6	
JHB-18-2	147.2	81.9	115.4	63.0	91.7	99.9	4	92.8	2	7.3
Wardan (NC)	128.1	74.2	125.9	54.5	86.5	93.8	6	86.5	5	
BB-2 ZC (NWZ-CZ)	150.6	78.2	125.7	72.3	85.2	102.4	1			
Mean	**133.4**	**74.1**	**119.4**	**69.7**	**86.1**	**96.5**		**89.5**		
CD at 5%	**13.9**	**11.8**	**0.9**	**15.4**	**14.2**					
CV%	**5.9**	**8.9**	**6.6**	**12.3**	**9.3**					

Table 3.3 AVT-2: Second Advanced Varietal Trial in Berseem: Green Forage Yield (q/ha/day)

Entries	Pantnagar	Bikaner	Hisar	Ludhiana	Rahuri	Urulikanchan	Raipur	Average	Rank
JB-06-11	3.94	2.69	3.39	5.42	3.69	4.41	3.40	3.85	4
JHB-18-1	3.61	3.19	3.30	5.25	3.83	5.07	3.35	3.94	3
BM-12	4.32	3.19	3.45	6.17	3.54	5.95	3.50	4.30	1
HFB-15-5	3.83	3.13	3.33	5.78	2.71	4.95	2.54	3.75	5
JHB-18-2	3.86	3.29	3.43	5.56	3.92	4.30	3.57	3.99	2
Wardan (NC)	3.32	2.51	3.34	5.16	3.47	3.65	3.22	3.52	6
BB-2 ZC (NWZ-CZ)	3.63	3.24	3.29	5.43	3.74	4.71	3.48		
Mean	**3.79**	**3.03**	**3.36**	**5.54**	**3.56**	**4.72**	**3.29**	**3.89**	

Table 3.4 AVT-2: Second Advanced Varietal Trial in Berseem: Dry Matter Yield (q/ha/day)

Entries	Pantnagar	Bikaner	Hisar	Ludhiana	Rahuri	Urulikanchan	Raipur	Average	Rank
JB-06-11	0.65	0.65	0.59	0.72	0.66	0.54	0.72	0.65	4
JHB-18-1	0.61	0.67	0.56	0.69	0.74	0.68	0.7	0.66	3
BM-12	0.74	0.69	0.58	0.84	0.70	0.83	0.68	0.72	1
HFB-15-5	0.65	0.66	0.59	0.78	0.48	0.65	0.52	0.62	6
JHB-18-2	0.64	0.69	0.59	0.73	0.74	0.57	0.71	0.67	2
Wardan (NC)	0.62	0.66	0.59	0.70	0.67	0.49	0.67	0.63	5
BB-2 ZC (NWZ-CZ)	0.61	0.69	0.59	0.69	0.71	0.66	0.66		
Mean	**0.65**	**0.67**	**0.58**	**0.74**	**0.67**	**0.63**	**0.67**	**0.66**	

Table 3.5 AVT-2: Second Advanced Varietal Trial in Berseem: Crude Protein Yield (q/ha)

Entries	Palampur	Pantnagar	Bikaner	Hisar	Ludhiana	Rahuri	Jabalpur	Urulikanchan	Raipur	Average	Rank
JB-06-11	11.5	17.0	14.1	22.3	20.0	14.3	18.5	11.2	15.6	16.0	3
JHB-18-1	10.7	15.2	14.0	20.8	20.1	15.5	17.3	15.1	17.8	16.3	2
BM-12	9.9	19.3	12.8	21.4	25.0	14.5	16.6	20.5	17.0	17.4	1
HFB-15-5	9.9	17.7	12.8	22.8	21.2	9.0	15.3	15.5	11.1	15.0	5
JHB-18-2	12.1	16.1	14.6	22.7	18.6	14.0	16.4	14.0	16.0	16.0	3
Wardan (NC)	8.8	16.1	13.4	21.6	20.7	14.4	18.0	12.2	16.7	15.7	4
BL- 22 ZC (HZ)	9.5										
BB-2 ZC (NWZ-CZ)		14.5	14.9	21.7	17.8	14.9	18.0	15.2	13.0		
Mean	**10.3**	**16.6**	**13.8**	**21.9**	**20.5**	**13.8**	**17.2**	**14.8**	**15.3**	**16.1**	

Table 3.6 AVT-2: Second Advanced Varietal Trial in Berseem: Crude Protein (%)

Entries	Palampur	Pantnagar	Bikaner	Hisar	Ludhiana	Rahuri	Jabalpur	Urulikanchan	Raipur	Average	Rank
JB-06-11	19.8	20.1	14.2	22.2	15.3	19.6	14.8	18.8	17.0	18.0	4
JHB-18-1	20.4	19.3	13.5	21.8	16.1	19.0	14.4	20.3	19.6	18.2	2
BM-12	17.8	20.1	12.1	21.6	16.4	18.8	14.3	22.3	19.2	18.1	3
HFB-15-5	20.4	21.0	12.6	22.9	15.0	17.0	14.3	21.5	16.5	17.9	5
JHB-18-2	19.5	19.3	13.8	22.5	14.0	17.0	14.2	22.2	17.4	17.8	6
Wardan (NC)	19.0	20.1	13.1	21.7	16.4	19.4	14.3	22.5	19.1	18.4	1
BL- 22 ZC (HZ)	20.1										
BB-2 ZC (NWZ-CZ)		18.4	14.0	21.8	14.3	19.0	14.3	21.1	15.3		
Mean	**19.6**	**19.7**	**13.3**	**22.0**	**15.4**	**18.6**	**14.4**	**21.2**	**17.7**	**18.1**	

Table 3.7 AVT-2: Second Advanced Varietal Trial in Berseem: Plant Height (cm)

Entries	Palam-pur	Sri-nagar	Pant-nagar	Bika-ner	His-ar	Ludh-iana	Udai-pur	Rah-uri	Jabal-pur	Urulikan-chan	Rai-pur	Aver-age	Ra-nk
JB-06-11	30.0	49.0	71.6	81.6	58.0	60.0	54.5	67.3	58.9	70.4	75.3	61.5	1
JHB-18-1	27.0	48.0	76.3	83.4	55.0	56.3	56.2	67.7	51.0	68.9	68.0	59.8	2
BM-12	23.7	45.7	66.3	80.4	56.0	60.4	55.5	63.3	48.9	73.2	62.0	57.7	5
HFB-15-5	26.0	46.7	57.0	80.2	56.0	57.9	55.2	61.7	46.9	63.9	60.6	55.6	6
JHB-18-2	30.0	47.0	69.1	86.4	57.0	60.5	57.0	66.2	45.2	67.0	71.3	59.7	3
Wardan (NC)	23.3	45.7	63.8	79.4	56.0	61.5	54.7	69.5	54.2	67.1	73.9	59.0	4
BL- 22 ZC (HZ)	30.3	55.7											
BB-2 ZC (NWZ-CZ)			67.6	83.0	57.0	59.7	53.0	63.1	52.0	65.6	71.0		
Mean	**27.2**	**48.2**	**67.4**	**82.1**	**56.4**	**59.5**	**55.2**	**65.5**	**51.0**	**68.0**	**68.9**	**58.9**	

Table 3.8 AVT-2: Second Advanced Varietal Trial in Berseem: Leaf Stem Ratio

Entries	Palam-pur	Sri-nagar	Pant-nagar	Bika-ner	His-ar	Ludh-iana	Rah-uri	Jabal-pur	Urulikan-chan	Rai-pur	Aver-age	Ra-nk
JB-06-11	0.37	0.75	0.69	0.78	2.06	0.95	0.51	0.9	0.50	0.43	0.79	3
JHB-18-1	0.53	0.82	0.81	0.75	2.08	0.92	0.51	0.9	0.55	0.49	0.84	1
BM-12	0.45	0.71	0.75	0.67	2.10	0.97	0.54	0.8	0.53	0.57	0.81	2
HFB-15-5	0.52	0.67	0.83	0.67	2.05	0.93	0.46	0.8	0.63	0.55	0.81	2
JHB-18-2	0.33	0.67	0.78	0.75	2.07	0.91	0.47	0.8	0.54	0.48	0.78	4
Wardan (NC)	0.69	0.75	0.72	0.55	2.11	0.90	0.45	0.9	0.56	0.48	0.81	2
BL- 22 ZC (HZ)	0.45	0.62										
BB-2 ZC (NWZ-CZ)			0.66	0.72	2.00	0.89	0.42	0.9	0.65	0.43		
Mean	**0.48**	**0.71**	**0.75**	**0.70**	**2.07**	**0.92**	**0.48**	**0.86**	**0.57**	**0.49**	**0.81**	

Table 3.9 AVT-2: Second Advanced Varietal Trial in Berseem: ADF (%), NDF (%) & IVDMD (%)

Entries	NDF (%)						ADF (%)						IVDMD (%)				
	Pant-nagar	Ludh-iana	Rah-uri	Palam-pur	Aver-age	Ra-nk	Pant-nagar	Ludh-iana	Rah-uri	Palam-pur	Aver-age	Ra-nk	Ludh-iana	His-ar	Rah-uri	Aver-age	Ra-nk
JB-06-11	64.6	68.2	44.4	62.2	59.9	6	57.4	48.2	34.5	52.6	48.2	7	53.3	58.1	61.8	57.7	5
JHB-18-1	63.8	63.8	38.9	64.6	57.8	1	54.6	44.2	28.5	54.2	45.4	2	55.6	57.9	66.1	59.9	1
BM-12	61.8	64.6	42.8	63.8	58.3	3	56.2	44.4	32.3	52.6	46.4	4	56.9	55.9	63.2	58.7	3
HFB-15-5	62.2	65.2	42.9	63.0	58.3	3	54.4	45.6	33.1	53.2	46.6	5	56.2	56.3	63.1	58.5	4
JHB-18-2	63.0	66.3	44.9	62.0	59.1	4	53.4	45.9	34.7	55.4	47.4	6	52.3	55.4	62.2	56.6	7
Wardan (NC)	65.4	63.4	41.9	61.8	58.1	2	52.6	43.6	30.5	54.0	45.2	1	54.2	53.9	64.4	57.5	6
BL- 22 ZC (HZ)				64.6	59.5	5				54.2	46.0	3				58.9	2
BB-2 ZC (NWZ-CZ)	64.0	67.2	42.2				52.4	45.8	31.4				55.2	57.4	64.0		
Mean	**63.5**	**65.5**	**42.6**	**63.1**	**58.7**		**54.4**	**45.4**	**32.1**	**53.7**	**46.4**		**54.8**	**56.4**	**63.5**	**58.3**	

Table 4.1 AVT-2 (Seed): Second Advanced Varietal Trial in Berseem (Seed): Seed Yield (q/ha)

Entries	Seed Yield (q/ha)																	
	Hill Zone		North West Zone						Central Zone							All India		
	Sri-nagar	Ra-nk	Pant-nagar	Ludh-iana	His-ar	Aver-age	Ra-nk	Super-iority%	Jha-nsi	Jabal-pur	Rai-pur	**Rah-uri	Aver-age	Ra-nk	Superi-ority%	Aver-age	Ra-nk	Superi-ority%
JB-06-11	4.2	3	3.8	3.4	2.4	3.2	3	4.2	4.2	5.2	5.7	1.5	5.0	1	5.5	4.1	1	5.2
JHB-18-1	3.5	7	4.3	3.2	2.2	3.2	3	5.0	2.5	5.2	5.1	1.6	4.3	4		3.7	3	
BM-12	3.8	6	3.7	5.2	2.3	3.7	2	21.2	1.0	5.0	2.2	1.3	2.7	6		3.3	4	
HFB-15-5	3.9	5	4.4	4.9	2.3	3.9	1	25.5	1.1	3.2	1.9	1.0	2.1	7		3.1	5	
JHB-18-2	4.6	2	3.3	3.6	2.7	3.2	3		2.6	4.5	4.9	1.8	4.0	5		3.7	3	
Wardan (NC)	4.0	4	3.1	3.6	2.5	3.1	4		4.0	4.0	6.3	1.6	4.8	2		3.9	2	
BL- 22 ZC (HZ)	4.7	1																
BB-2 ZC (NWZ-CZ)			3.1	3.1	2.5	2.9	5		2.5	5.1	6.3	1.7	4.6	3				
Mean	**4.1**		**3.7**	**3.8**	**2.4**	**3.3**			**2.5**	**4.6**	**4.6**	**1.5**	**3.9**			**3.7**		
CD at 5%	**0.7**		**0.3**	**1.8**	**N/A**				**0.5**		**1.2**	**0.3**						
CV%	**9.3**		**11.9**	**6.2**	**11.1**				**10.0**		**14.2**	**9.8**						

5. IVTO (SC): INITIAL VARIETAL TRIAL IN OAT (SINGLE CUT)

(Reference tables 5.1 to 5.9)

In **Initial Varietal Trial Oat (single cut) IVTO (SC),** thirteen entries along with two national checks (OS-6 and Kent) and one zonal check for respective zones *viz.*, SKO-225 (HZ), RO-11-1 (CZ), OS-403 (NEZ, NWZ, SZ) were evaluated at 28 locations across the five zones. There were 3 locations in hill zone, 5 in NWZ, 7 in NE, 5 in south zone and 8 in central zone.

For GFY (q/ha), entry JO-08-37 showed marginal superiority by 1.1% over the best check in hill zone. In NWZ, entry SKO-244 (7.4%), HFO-1009 (2.1%) and HFO-1013 (1.1%) were superior over the best check. In NEZ and SZ, the zonal check was best performer and no entry could surpass it for GFY. In CZ, entries HFO-1003 (5.2%), HFO-1013(4.0%), SKO-244 (2.5%) were superior over the best check. At all India level entries performing better than the best national check were HFO 1013 (11.4%), HFO 1003 (9.1%), SKO-244 (9.1%), JO-08-37 (7.4%), HFO-1009 (7.2%).

For DMY (q/ha), In HZ, entries SKO-244 (9.6%), HFO 1003 (6.5%), HFO 1009 (1.5%) performed better than the best check. In NWZ, entries showing higher yield than the best check were HFO 1013(6.6%), SKO 244 (5.5%), JO-08-37 (5.1%), HFO 1009 (4.5%), JHO-20-1 (4.4%), HFO 1003 (3.3%), OL 1980 (1.9%), BAUO -101 (1.3%). In south, central and north east zones, zonal check were the best performer and no entry could surpass them for dry matter yield. At all India level, the entries performing better than the best national checks were HFO 1003 (13.9%), HFO 1013 (10.3%), JO-08-37 (9.9%), SKO-244 (8.9%), BAUO-101 (4.0%), JHO-20-1 (3.8%), BAUO-103 (3.7%). Other entries were inferior to the national or zonal check in their respective zones for dry matter yield.

For green fodder production potential (q/ha/day), HFO 1013 (4.72 q/ha/day) ranked first followed closely by BAUO-101 (4.71 q/ha/day) as against 4.43 q/ha/day of best national check which ranked 7th. Similar trend was observed for dry matter production potential also and entry HFO 1013 (0.98 q/ha/day) ranked first followed closely by BAUO-101 (0.94 q/ha/day) as against 0.87 q/ha/day of best national check which ranked 7th. Entry BAUO-101 ranked first for plant height. Entry SKO 244 ranked first for leafiness.

For quality parameters, entry HFO-1013 (7.7 q/ha) was ranked first for crude protein yield followed by JO-08-37 (7.5 q/ha) whereas best national check ranked 7th with value of 6.7 q/ha. For crude protein content, JHO-20-1 and OL-1980 ranked joint first (9.0%) which was slightly better than National check Kent (8.8%). JO-08-37 was best for NDF% whereas UPO-20-1 was best for ADF%. Entry HFO-1009 was best for IVDMD followed by OL 1980.

Table 5.1 IVT Oat (SC): Initial Varietal Trial in Oat (Single Cut): Green Forage Yield (q/ha)

Entries	Hill Zone					
	Palampur	**Srinagar**	**Rajouri**	**Average**	**Rank**	**Superiority%**
BAUO-103	181.7	325.7	172.6	226.7	16	
JHO-20-1	223.3	373.0	219.4	271.9	4	
NDO-1902	177.5	374.7	153.3	235.2	14	
SKO-244	281.7	384.0	156.7	274.1	3	
OL-1980	183.3	351.0	228.7	254.4	9	
JO-08-37	225.0	372.3	235.3	277.5	1	1.1
OL-1977	220.8	352.3	203.4	258.8	8	
HFO-1009	227.5	348.0	167.4	247.6	10	
HFO-1003	262.5	376.0	150.0	262.8	7	
HFO-1013	219.2	374.3	200.3	264.6	6	
BAUO-101	183.3	376.3	160.3	240.0	13	
UPO-20-1	195.8	345.7	195.6	245.7	11	
OL-1974	244.2	373.7	183.1	267.0	5	
Kent (NC)	202.5	376.0	143.1	240.5	12	
OS-6 (NC)	183.3	374.7	140.1	232.7	15	
SKO-225 ZC (HZ)	265.0	377.7	181.1	274.6	2	
Mean	**217.3**	**366.0**	**180.6**	**254.6**		
CD at 5%	**43.8**	**15.6**	**2.5**			
CV%	**12.0**	**6.7**	**9.3**			

Table 5.1 IVT Oat (SC): Initial Varietal Trial in Oat (Single Cut): Green Forage Yield (q/ha)

Entries	North West Zone							
	Bika-ner	His-ar	Ludh-iana	Pant-nagar	Mee-rut	Aver-age	Ra-nk	Super-iority%
BAUO-103	376.2	477.0	767.8	444.4	570.9	527.3	15	
JHO-20-1	383.3	513.7	764.1	501.6	675.1	567.6	9	
NDO-1902	263.3	414.0	615.2	391.5	423.5	421.5	16	
SKO-244	512.7	607.7	831.5	471.9	744.0	633.6	1	7.4
OL-1980	386.2	585.1	804.8	493.4	648.3	583.6	6	
JO-08-37	375.4	550.7	828.1	488.1	678.8	584.2	5	
OL-1977	352.1	524.8	775.9	393.1	793.4	567.9	8	
HFO-1009	419.7	615.1	800.7	480.7	694.7	602.2	2	2.1
HFO-1003	318.5	598.1	804.8	506.8	561.8	558.0	10	
HFO-1013	370.5	532.2	821.5	542.9	714.0	596.2	3	1.1
BAUO-101	341.2	542.9	813.0	461.2	622.5	556.2	11	
UPO-20-1	362.2	491.1	715.2	438.9	678.3	537.1	14	
OL-1974	374.0	524.4	685.2	551.3	734.7	573.9	7	
Kent (NC)	353.7	498.8	753.0	455.6	658.1	543.8	12	
OS-6 (NC)	342.2	513.7	771.1	463.3	618.6	541.8	13	
OS-403 ZC (NWZ, NEZ, SZ)	375.0	523.7	745.9	512.6	792.5	589.9	4	
Mean	**369.1**	**532.1**	**768.6**	**474.8**	**663.1**	**561.5**		
CD at 5%	**50.6**	**N/A**	**89.2**	**59.7**				
CV%	**8.2**	**14.1**	**11.5**	**12.3**				

Table 5.1 IVT Oat (SC): Initial Varietal Trial in Oat (Single Cut): Green Forage Yield (q/ha)

Entries	North East Zone								
	Jor-hat	**Kal-yani**	**Bhuban-eswar**	**Ran-chi**	**Pu-sa**	**Ayod-hya**	**Imp-hal**	**Aver-age**	**Ra-nk**
BAUO-103	255.4	337.7	291.3	381.8	540.4	341.3	426.0	367.7	10
JHO-20-1	290.4	316.6	246.6	376.4	500.5	333.3	487.7	364.5	11
NDO-1902	307.1	226.6	280.6	294.7	460.1	277.3	355.3	314.5	16
SKO-244	253.8	360.0	349.3	316.4	520.4	293.3	457.7	364.4	12
OL-1980	266.7	335.5	297.3	378.2	630.3	352.0	416.0	382.3	7
JO-08-37	340.4	390.0	334.6	457.3	490.6	320.0	435.7	395.5	5
OL-1977	306.7	342.2	327.9	505.3	590.3	309.3	450.3	404.6	2
HFO-1009	331.3	386.6	249.9	438.2	440.8	400.0	475.3	388.9	6
HFO-1003	289.2	336.6	374.6	366.7	605.6	373.3	453.0	399.8	4
HFO-1013	282.1	472.2	390.6	469.3	450.3	304.0	454.7	403.3	3
BAUO-101	366.7	326.6	408.6	352.9	420.2	293.3	465.3	376.2	8
UPO-20-1	267.5	297.7	243.3	516.9	435.6	192.0	406.0	337.0	15
OL-1974	319.6	340.0	208.0	494.2	455.1	288.0	395.3	357.2	13
Kent (NC)	372.5	304.4	214.6	433.3	510.0	368.0	427.7	375.8	9
OS-6 (NC)	329.2	317.0	211.3	337.3	513.3	336.0	398.3	348.9	14
OS-403 ZC (NWZ, NEZ, SZ)	305.8	457.0	433.2	487.5	600.3	344.0	456.3	440.6	1
Mean	**305.3**	**346.7**	**303.8**	**412.9**	**510.2**	**320.3**	**435.0**	**376.3**	
CD at 5%	**6.2**	**19.9**	40.8	**46.5**	**70.3**	**63.8**	15.4		
CV%	**5.7**	**10.5**	8.1	**6.8**	**8.3**	**12.0**	2.9		

Table 5.1 IVT Oat (SC): Initial Varietal Trial in Oat (Single Cut): Green Forage Yield (q/ha)

Entries	Central Zone										
	Jha-nsi	Rah-uri	Urulikan-chan	Dha-ri	Ana-nd	Jabal-pur	Rai-pur	Kar-jat	Aver-age	Ra-nk	Superi-ority%
BAUO-103	525.3	351.5	397.8	571.1	532.6	529.3	277.8	176.4	420.2	12	
JHO-20-1	550.6	391.3	366.9	490.4	522.6	587.9	285.2	157.2	419.0	13	
NDO-1902	477.8	303.7	425.6	460.0	382.2	563.9	250.0	141.9	375.6	16	
SKO-244	643.5	370.2	604.8	493.0	628.9	548.4	270.4	192.5	468.9	3	2.5
OL-1980	483.3	304.7	500.8	568.2	541.9	501.0	307.4	154.9	420.3	11	
JO-08-37	550.6	390.8	470.9	458.2	621.9	639.3	285.2	164.7	447.7	7	
OL-1977	554.9	353.3	518.4	542.2	573.0	583.0	201.9	166.0	436.6	9	
HFO-1009	584.6	378.5	405.8	615.9	571.1	569.7	305.6	202.2	454.2	5	
HFO-1003	577.2	431.4	554.6	508.9	653.7	662.3	307.4	154.3	481.2	1	5.2
HFO-1013	571.6	405.8	451.2	585.9	678.9	640.6	325.9	145.2	475.6	2	4.0
BAUO-101	453.1	346.4	505.6	608.9	538.5	610.0	407.4	140.6	451.3	6	
UPO-20-1	496.3	356.8	338.1	467.4	332.6	635.3	251.9	182.9	382.7	15	
OL-1974	457.4	300.1	520.5	680.7	511.5	701.4	224.1	139.2	441.9	8	
Kent (NC)	501.2	288.9	404.2	530.7	530.7	553.3	268.5	162.4	405.0	14	
OS-6 (NC)	474.7	336.0	427.7	525.6	559.6	601.2	292.6	156.3	421.7	10	
RO-11-1 ZC (CZ)	588.9	452.6	531.2	578.5	427.8	550.6	348.2	181.7	457.4	4	
Mean	**530.7**	**360.1**	**464.0**	**542.8**	**538.0**	**592.3**	**288.1**	**163.7**	**435.0**		
CD at 5%	**27.1**	**53.5**	**77.7**		**127.9**	**3.5**	**57.6**	**35.1**			
CV%	**16.2**	**8.8**	**10.0**		**14.3**	**9.6**	**12.0**	**12.1**			

Table 5.1 IVT Oat (SC): Initial Varietal Trial in Oat (Single Cut): Green Forage Yield (q/ha)

Entries	South Zone							All India		
	Hyderabad	Mandya	Coimbatore	Mattupetty	**Tirupati	Average	Rank	Average	Rank	Superiority%
BAUO-103	247.9	232.9	335.2	444.0	31.5	315.0	3	389.3	11	0.2
JHO-20-1	247.9	276.5	318.5	359.0	19.5	300.5	6	398.5	10	2.5
NDO-1902	159.1	257.3	292.6	185.0	54.4	223.5	16	330.1	15	
SKO-244	229.4	261.2	270.4	397.0	17.9	289.5	10	424.1	2	9.1
OL-1980	240.5	217.1	363.0	389.0	49.9	302.4	5	404.8	7	4.1
JO-08-37	255.3	241.1	339.3	330.0	55.6	291.4	8	417.4	4	7.4
OL-1977	307.1	199.2	273.3	333.0	14.5	278.2	14	409.4	6	5.3
HFO-1009	303.4	234.1	349.3	256.0	52.2	285.7	11	416.7	5	7.2
HFO-1003	329.3	229.6	353.7	308.0	27.5	305.1	4	424.0	3	9.1
HFO-1013	325.6	237.0	321.5	407.0	39.0	322.8	2	433.1	1	11.4
BAUO-101	296.0	239.2	326.3	274.0	33.0	283.9	13	403.0	8	3.7
UPO-20-1	247.9	227.7	274.1	331.0	30.5	270.2	15	367.5	14	
OL-1974	207.2	241.9	287.4	403.0	36.1	284.9	12	401.7	9	3.3
Kent (NC)	336.7	239.3	329.6	278.0	23.0	295.9	7	388.7	12	
OS-6 (NC)	266.4	230.2	288.5	378.0	45.3	290.8	9	384.7	13	
OS-403 ZC (NWZ, NEZ, SZ)	344.1	228.4	396.7	363.0	35.8	333.0	1			
Mean	**271.5**	**237.0**	**320.0**	**339.7**	**35.3**	**292.0**		**399.5**		
CD at 5%	**73.1**	**32.8**	**30.3**	**1.4**	**524.0**					
CV%	**16.1**	**8.3**	**5.7**	**7.9**	**8.8**					

Note: ** Data is not included in zonal and all India average due to low yield of data

Table 5.2 IVT Oat (SC): Initial Varietal Trial in Oat (Single Cut): Dry Matter Yield (q/ha)

Entries	Hill Zone					North West Zone						
	Palam-pur	Sri-nagar	Aver-age	Ra-nk	Superi-ority%	Bika-ner	His-ar	Ludh-iana	Pant-nagar	Aver-age	Ra-nk	Superi-ority%
BAUO-103	44.8	66.9	55.8	16		107.9	112.8	157.4	71.6	112.4	10	
JHO-20-1	54.2	75.2	64.7	5		113.8	123.6	158.2	82.3	119.5	5	4.4
NDO-1902	42.1	72.7	57.4	13		76.9	89.6	120.6	64.6	87.9	16	
SKO-244	69.5	74.2	71.9	1	9.6	115.8	131.4	162.1	73.6	120.7	2	5.5
OL-1980	45.5	67.9	56.7	14		83.9	134.9	165.8	81.9	116.6	7	1.9
JO-08-37	54.7	67.0	60.8	9		109.6	121.8	171.4	78.6	120.3	3	5.1
OL-1977	51.9	69.8	60.8	10		80.3	124.5	153.6	58.2	104.1	14	
HFO-1009	54.1	79.0	66.5	3	1.5	97.4	146.0	163.4	71.8	119.7	4	4.5
HFO-1003	64.2	75.4	69.8	2	6.5	102.6	135.8	161.0	73.7	118.3	6	3.3
HFO-1013	51.7	68.9	60.3	11		120.6	119.6	165.1	82.7	122.0	1	6.6
BAUO-101	44.5	67.4	55.9	15		102.2	124.7	166.7	70.1	115.9	8	1.3
UPO-20-1	46.9	72.5	59.7	12		93.2	103.1	143.0	65.4	101.2	15	
OL-1974	51.0	71.6	61.3	7		97.9	116.4	139.1	80.4	108.4	12	
Kent (NC)	53.3	72.5	62.9	6		105.0	104.5	150.6	67.5	106.9	13	
OS-6 (NC)	43.8	78.4	61.1	8		98.2	113.0	155.0	68.3	108.6	11	
SKO-225 ZC (HZ)	62.3	68.7	65.5	4								
OS-403 ZC (NWZ, NEZ, SZ)						102.7	118.2	149.9	87.1	114.5	9	
Mean	**52.1**	**71.7**	**61.9**			**100.5**	**120.0**	**155.2**	**73.6**	**112.3**		
CD at 5%	**11.1**	**5.6**				**14.0**	**N/A**	**46.8**	**6.4**			
CV%	**12.7**	**4.7**				**8.3**	**16.4**	**9.7**	**9.6**			

Table 5.2 IVT Oat (SC): Initial Varietal Trial in Oat (Single Cut): Dry Matter Yield (q/ha)

Entries	North East Zone								
	Jor-hat	**Kal-yani**	**Bhuban-eswar**	**Ran-chi**	**Pu-sa**	**Ayod-hya**	**Imp-hal**	**Aver-age**	**Ra-nk**
BAUO-103	44.3	72.6	67.1	47.7	114.1	81.9	83.9	73.1	10
JHO-20-1	50.7	60.8	56.5	50.3	102.3	76.6	94.8	70.3	12
NDO-1902	56.3	50.9	63.5	38.7	98.5	62.2	68.7	62.7	16
SKO-244	41.4	67.1	74.5	41.9	110.0	71.4	92.8	71.3	11
OL-1980	42.1	75.1	70.6	54.4	125.6	82.6	81.1	75.9	7
JO-08-37	64.6	88.1	77.7	74.3	101.8	76.8	85.2	81.2	3
OL-1977	49.7	61.3	70.0	72.0	118.8	54.6	86.7	73.3	9
HFO-1009	59.4	84.3	53.1	53.1	96.1	93.9	96.9	76.7	6
HFO-1003	54.5	70.3	86.2	50.9	122.9	83.8	90.9	79.9	4
HFO-1013	50.3	105.3	90.1	73.3	97.2	73.0	83.1	81.8	2
BAUO-101	65.6	75.8	93.7	52.1	93.9	69.0	94.4	77.8	5
UPO-20-1	47.5	58.3	56.5	82.1	94.8	44.8	77.6	65.9	15
OL-1974	60.2	66.0	43.2	66.1	97.2	65.3	79.3	68.2	13
Kent (NC)	62.3	69.0	48.8	59.6	105.2	90.1	88.7	74.8	8
OS-6 (NC)	59.5	69.7	48.7	37.1	107.3	73.9	78.1	67.8	14
OS-403 ZC (NWZ, NEZ, SZ)	57.6	93.7	96.1	58.5	120.2	77.3	89.1	84.6	1
Mean	**54.1**	**73.0**	**68.5**	**57.0**	**106.6**	**73.6**	**85.7**	**74.1**	
CD at 5%	**3.6**	**10.3**	**8.6**		**14.7**	**14.4**	**15.4**		
CV%	**7.9**	**8.4**	**7.5**		**8.3**	**11.7**	**4.4**		

Table 5.2 IVT Oat (SC): Initial Varietal Trial in Oat (Single Cut): Dry Matter Yield (q/ha)

Entries	Central Zone									
	Jhansi	**Rahuri**	**Urulikanchan**	**Dhari**	**Anand**	**Jabalpur**	**Raipur**	**Karjat**	**Average**	**Rank**
BAUO-103	55.7	73.9	49.1	143.0	94.8	119.1	63.0	44.7	80.4	8
JHO-20-1	53.8	64.3	58.0	142.2	95.0	132.0	67.0	33.1	80.7	7
NDO-1902	50.3	56.6	61.0	131.1	90.9	126.6	51.8	27.3	74.5	16
SKO-244	64.4	72.3	111.5	143.0	99.5	122.6	68.1	46.2	90.9	3
OL-1980	46.4	59.8	98.1	129.3	83.4	111.9	74.1	27.2	78.8	10
JO-08-37	57.9	79.7	75.4	170.0	77.2	142.4	62.0	37.4	87.7	5
OL-1977	56.5	70.7	69.1	126.3	102.1	128.8	44.7	31.4	78.7	11
HFO-1009	64.0	84.7	52.1	152.6	100.2	124.5	77.0	48.0	87.9	4
HFO-1003	55.9	85.1	99.1	168.9	101.2	144.1	77.9	32.9	95.6	2
HFO-1013	56.0	76.8	66.3	139.3	113.1	135.2	82.1	27.4	87.0	6
BAUO-101	51.9	62.6	57.6	125.2	106.5	128.5	78.1	27.9	79.8	9
UPO-20-1	47.3	71.2	67.1	149.6	56.1	129.0	63.3	43.3	78.4	12
OL-1974	45.8	60.3	65.6	145.9	67.3	148.3	51.4	28.3	76.6	14
Kent (NC)	50.4	52.8	62.8	111.1	107.8	122.7	63.3	32.1	75.4	15
OS-6 (NC)	48.4	56.2	64.3	98.1	126.7	133.0	54.3	32.8	76.7	13
RO-11-1 ZC (CZ)	63.1	104.9	103.7	164.1	91.4	124.0	82.6	44.9	97.3	1
Mean	**54.2**	**70.7**	**72.5**	**140.0**	**94.6**	**129.5**	**66.3**	**35.3**	**82.9**	
CD at 5%	**18.0**	**10.8**	**13.0**		**24.1**	**0.8**	**13.3**	**10.5**		
CV%	**10.6**	**9.1**	**10.7**		**15.3**	**8.1**	**12.0**	**16.8**		

Table 5.2 IVT Oat (SC): Initial Varietal Trial in Oat (Single Cut): Dry Matter Yield (q/ha)

Entries	South Zone							All India		
	Hydera-bad	Man-dya	Coimb-atore	Mattu-petty	**Tiru-pati	Aver-age	Ra-nk	Aver-age	Ra-nk	Superi-ority%
BAUO-103	48.6	52.1	67.3	111.1	11.3	69.8	2	79.8	8	3.7
JHO-20-1	42.8	52.7	67.0	89.8	6.8	63.1	7	79.9	7	3.8
NDO-1902	35.4	58.0	63.2	46.4	20.1	50.7	16	68.2	14	
SKO-244	39.0	46.8	56.8	99.0	6.3	60.4	12	83.8	5	8.9
OL-1980	44.5	39.5	72.3	97.3	17.5	63.4	4	79.8	8	
JO-08-37	46.4	39.6	72.9	82.4	18.9	60.3	13	84.6	3	9.9
OL-1977	53.8	41.9	58.0	83.3	5.1	59.3	14	76.7	10	
HFO-1009	65.0	46.1	73.3	64.0	19.3	62.1	8	84.0	4	9.1
HFO-1003	64.7	40.2	73.4	76.9	9.6	63.8	3	87.7	1	13.9
HFO-1013	64.6	40.2	68.2	72.8	12.9	61.5	9	84.9	2	10.3
BAUO-101	59.6	47.7	68.3	68.5	10.9	61.0	11	80.1	6	4.0
UPO-20-1	51.0	38.5	55.4	82.8	10.1	56.9	15	73.6	13	
OL-1974	40.4	49.7	61.9	100.9	12.6	63.2	6	76.0	11	
Kent (NC)	56.6	48.8	69.8	69.3	8.1	61.1	10	77.0	9	
OS-6 (NC)	40.6	56.9	61.5	94.4	15.9	63.3	5	75.9	12	
OS-403 ZC (NWZ, NEZ, SZ)	66.7	51.6	83.0	90.8	12.5	73.0	1			
Mean	**51.2**	**46.9**	**67.0**	**83.1**	**12.4**	**62.1**		**79.5**		
CD at 5%	**16.1**	**9.6**	**5.9**	**5.0**	**182.0**					
CV%	**18.7**	**12.3**	**5.3**	**7.4**	**9.6**					

Note: ** Data is not included in zonal and all India average due to low yield of data

Table 5.3 VT Oat (SC): Initial Varietal Trial in Oat (Single Cut): Green Forage Yield (q/ha/day)

Entries	Palam-pur	Bika-ner	His-ar	Ludh-iana	Pant-nagar	Jor-hat	Kal-yani	Bhuban-eswar	Ran-chi	Pu-sa	Ayod-hya
BAUO-103	1.53	3.69	4.31	6.30	5.05	3.08	3.71	4.05	7.53	6.23	3.25
JHO-20-1	1.77	3.76	4.59	6.30	4.91	3.30	3.48	3.47	6.31	5.35	3.36
NDO-1902	1.56	2.58	3.77	5.00	4.50	3.74	2.31	4.13	6.91	5.98	2.94
SKO-244	2.19	5.03	5.24	6.80	4.18	2.33	3.67	4.58	4.26	7.39	2.52
OL-1980	1.53	3.79	5.40	6.60	5.09	3.03	3.42	4.05	6.45	6.75	3.32
JO-08-37	1.76	3.68	4.87	6.80	4.48	3.78	3.98	4.65	6.41	5.53	2.73
OL-1977	1.80	3.45	5.00	6.40	3.97	3.48	3.76	4.24	8.66	6.97	2.97
HFO-1009	1.88	4.12	5.91	6.60	4.91	3.76	4.25	3.64	7.87	4.91	3.73
HFO-1003	2.15	3.12	5.53	6.60	5.07	3.21	3.43	5.06	5.29	5.34	3.69
HFO-1013	1.73	3.63	5.13	6.70	5.54	3.21	4.82	5.16	7.61	5.02	2.81
BAUO-101	1.59	3.35	5.24	6.70	4.75	4.47	3.59	5.81	6.62	5.91	2.93
UPO-20-1	1.54	3.55	4.64	5.90	3.95	2.97	3.04	3.33	7.68	5.05	1.68
OL-1974	1.90	3.67	4.72	5.60	5.20	3.63	3.47	2.79	7.09	5.10	2.57
Kent (NC)	1.63	3.47	4.61	6.20	5.18	4.54	3.11	2.93	7.93	5.78	3.14
OS-6 (NC)	1.52	3.36	4.67	6.30	4.64	3.92	3.48	3.05	6.32	6.39	3.42
SKO-225 ZC (HZ)	2.11										
OS-403 ZC (NWZ, NEZ, SZ)		3.68	4.55	6.10	4.66	3.48	4.66	5.96	8.04	6.80	2.99
Mean	**1.76**	**3.62**	**4.89**	**6.31**	**4.76**	**3.50**	**3.64**	**4.18**	**6.94**	**5.91**	**3.00**

Table 5.3 VT Oat (SC): Initial Varietal Trial in Oat (Single Cut): Green Forage Yield (q/ha/day)

Entries	Jhansi	Rahuri	Urulikanchan	Anand	Raipur	Dhari	Karjat	Hyderabad	Mandya	Coimbatore	Mattupetty	Average	Rank
BAUO-103	5.27	4.03	4.63	6.83	3.35	6.59	2.68	3.26	3.16	4.09	5.43	4.46	5
JHO-20-1	5.23	4.45	4.27	6.70	3.44	5.66	2.49	3.15	4.31	3.75	4.37	4.29	10
NDO-1902	4.99	4.05	5.83	5.79	4.17	7.62	2.31	2.45	3.64	3.57	2.27	4.10	12
SKO-244	5.96	3.91	7.96	6.48	2.68	5.36	2.92	3.37	3.72	3.07	4.77	4.47	4
OL-1980	4.72	3.39	5.33	6.02	3.49	6.34	2.35	3.30	2.95	4.12	4.73	4.37	8
JO-08-37	5.10	4.23	5.01	6.91	3.10	5.04	2.49	3.77	3.19	3.61	4.00	4.32	9
OL-1977	5.27	3.94	6.03	6.90	2.46	6.12	2.48	3.87	3.11	2.94	4.10	4.45	6
HFO-1009	5.41	4.24	4.72	6.56	3.73	7.17	3.16	3.99	3.36	4.01	3.10	4.59	3
HFO-1003	5.33	4.67	5.90	6.74	3.34	5.61	2.17	4.73	3.22	3.93	3.73	4.45	6
HFO-1013	5.77	4.51	5.25	7.89	3.97	6.61	2.31	4.38	3.18	3.61	4.97	4.72	1
BAUO-101	4.20	4.29	6.93	6.82	6.08	7.77	2.31	3.89	3.20	3.88	3.33	4.71	2
UPO-20-1	4.60	3.88	4.45	3.43	3.36	5.12	2.65	3.61	3.07	3.01	4.03	3.84	13
OL-1974	4.24	3.29	6.05	6.24	2.61	7.70	2.02	2.98	3.70	3.19	4.87	4.21	11
Kent (NC)	5.10	3.23	4.70	6.72	3.24	6.50	2.54	4.88	3.34	3.97	3.37	4.37	8
OS-6 (NC)	4.52	4.24	4.97	7.00	4.37	7.09	2.48	4.03	3.88	3.28	4.63	4.43	7
RO-11-1 ZC (CZ)	5.45	4.97	5.65	5.09	4.05	6.29	2.49						
OS-403 ZC (NWZ, NEZ, SZ)								4.71	3.57	4.27	5.47		
Mean	**5.07**	**4.08**	**5.48**	**6.38**	**3.59**	**6.41**	**2.49**	**3.77**	**3.41**	**3.64**	**4.20**	**4.39**	

Table 5.4 IVT Oat (SC): Initial Varietal Trial in Oat (Single Cut): Dry Matter Yield (q/ha/day)

Entries	Bika-ner	His-ar	Ludh-iana	Pant-nagar	Jor-hat	Kal-yani	Ran-chi	Pu-sa	Ayod-hya	Bhuban-eswar	Ran-chi
BAUO-103	1.06	1.02	1.30	0.81	0.53	0.80	0.94	1.32	0.78	0.93	0.94
JHO-20-1	1.12	1.10	1.30	0.81	0.58	0.67	0.84	1.19	0.77	0.80	0.84
NDO-1902	0.75	0.82	1.00	0.74	0.69	0.52	0.91	1.13	0.66	0.93	0.91
SKO-244	1.14	1.13	1.30	0.65	0.41	0.68	0.56	1.29	0.62	0.98	0.56
OL-1980	0.82	1.25	1.40	0.84	0.48	0.77	0.93	1.40	0.78	0.96	0.93
JO-08-37	1.07	1.08	1.40	0.72	0.72	0.90	1.04	1.15	0.65	1.08	1.04
OL-1977	0.79	1.19	1.30	0.59	0.56	0.67	1.23	1.40	0.51	0.91	1.23
HFO-1009	0.96	1.41	1.30	0.73	0.68	0.93	0.95	1.07	0.93	0.77	0.95
HFO-1003	1.01	1.26	1.30	0.74	0.61	0.72	0.73	1.46	0.78	1.16	0.73
HFO-1013	1.18	1.15	1.40	0.84	0.57	1.07	1.19	1.16	0.69	1.19	1.19
BAUO-101	1.00	1.20	1.40	0.72	0.80	0.83	0.98	1.11	0.69	1.33	0.98
UPO-20-1	0.91	0.97	1.20	0.59	0.53	0.60	1.22	1.10	0.39	0.77	1.22
OL-1974	0.96	1.05	1.10	0.76	0.68	0.67	0.95	1.09	0.58	0.58	0.95
Kent (NC)	1.03	0.96	1.20	0.77	0.76	0.70	1.09	1.19	0.92	0.67	1.09
OS-6 (NC)	0.96	1.03	1.30	0.68	0.73	0.77	0.70	1.34	0.71	0.70	0.70
OS-403 ZC (NWZ, NEZ, SZ)	1.01	1.03	1.20	0.79	0.65	0.96	0.96	1.36	0.67	1.32	0.96
Mean	**0.99**	**1.10**	**1.28**	**0.74**	**0.62**	**0.77**	**0.95**	**1.24**	**0.70**	**0.94**	**0.95**

Table 5.4 IVT Oat (SC): Initial Varietal Trial in Oat (Single Cut): Dry Matter Yield (q/ha/day)

Entries	Jha-nsi	Rah-uri	Urulikan-chan	Ana-nd	Rai-pur	Dha-ri	Kar-jat	Hydera-bad	Man-dya	Coimb-atore	Mattu-petty	Aver-age	Ra-nk
BAUO-103	0.56	0.85	0.57	1.22	0.76	1.65	0.68	0.65	0.71	0.82	1.37	0.92	4
JHO-20-1	0.51	0.73	0.67	1.22	0.81	1.64	0.53	0.54	0.82	0.79	1.10	0.88	6
NDO-1902	0.53	0.75	0.84	1.38	0.86	2.16	0.45	0.54	0.82	0.77	0.57	0.85	8
SKO-244	0.60	0.76	1.47	1.03	0.67	1.56	0.70	0.57	0.67	0.63	1.23	0.87	7
OL-1980	0.45	0.66	1.04	0.93	0.84	1.44	0.41	0.61	0.54	0.80	1.17	0.88	6
JO-08-37	0.54	0.86	0.80	0.86	0.67	1.87	0.57	0.69	0.52	0.76	1.00	0.91	5
OL-1977	0.54	0.79	0.80	1.23	0.55	1.42	0.47	0.68	0.65	0.61	1.00	0.87	7
HFO-1009	0.59	0.95	0.61	1.15	0.94	1.78	0.75	0.85	0.66	0.82	0.77	0.93	3
HFO-1003	0.52	0.92	1.05	1.04	0.85	1.86	0.46	0.91	0.56	0.80	0.93	0.93	3
HFO-1013	0.57	0.85	0.77	1.32	1.00	1.57	0.43	0.87	0.54	0.75	1.23	0.98	1
BAUO-101	0.48	0.78	0.79	1.35	1.16	1.60	0.46	0.79	0.64	0.80	0.83	0.94	2
UPO-20-1	0.44	0.77	0.88	0.58	0.84	1.64	0.63	0.74	0.52	0.60	1.00	0.82	9
OL-1974	0.42	0.66	0.76	0.82	0.60	1.65	0.41	0.59	0.76	0.67	1.23	0.82	9
Kent (NC)	0.51	0.59	0.73	1.36	0.76	1.36	0.50	0.83	0.68	0.84	0.83	0.88	6
OS-6 (NC)	0.46	0.71	0.75	1.58	0.81	1.34	0.52	0.61	0.96	0.68	1.13	0.87	7
RO-11-1 ZC (CZ)	0.58	1.15	1.10	1.09	0.96	1.78	0.62						
OS-403 ZC (NWZ, NEZ, SZ)								0.91	0.81	0.87	1.11		
Mean	**0.52**	**0.80**	**0.85**	**1.14**	**0.82**	**1.65**	**0.54**	**0.71**	**0.68**	**0.75**	**1.03**	**0.89**	

Table 5.5 IVT Oat (SC): Initial Varietal Trial in Oat (Single Cut): Crude Protein Yield (q/ha)

Entries	Palam-pur	Bika-ner	His-ar	Ludh-iana	Jor-hat	Kal-yani	Bhuban-eswar	Ran-chi	Ayod-hya	Imp-hal
BAUO-103	4.6	16.2	8.7	7.9	6.3	7.8	5.9	3.5	6.5	7.5
JHO-20-1	4.9	19.5	8.7	11.7	6.8	7.6	5.0	4.1	6.0	7.3
NDO-1902	3.9	10.2	6.6	7.0	7.1	5.3	5.7	3.2	4.8	5.1
SKO-244	7.7	13.8	12.0	11.8	6.0	6.2	7.1	3.2	6.0	7.3
OL-1980	5.1	12.5	11.9	12.9	6.5	9.5	6.0	3.9	6.5	6.7
JO-08-37	5.7	16.4	9.7	12.7	7.2	10.2	6.8	4.8	6.2	6.3
OL-1977	5.0	10.1	9.9	10.3	6.9	7.2	6.6	4.1	3.9	6.5
HFO-1009	5.2	13.4	12.6	11.9	6.7	9.7	5.1	3.0	7.3	7.3
HFO-1003	5.8	10.2	12.2	10.6	6.6	6.1	7.6	3.2	6.5	7.0
HFO-1013	5.3	14.4	9.3	9.9	6.7	10.1	7.9	5.4	6.0	7.0
BAUO-101	4.9	10.6	10.1	9.8	7.5	8.6	8.3	3.9	5.4	7.0
UPO-20-1	5.1	11.0	7.6	11.9	6.5	7.4	4.9	4.8	3.4	6.3
OL-1974	5.7	13.8	9.5	11.1	7.3	7.6	3.8	3.9	5.3	6.4
Kent (NC)	4.6	12.3	7.7	8.9	7.7	9.1	4.3	4.4	4.8	7.1
OS-6 (NC)	4.7	12.0	7.9	11.5	7.2	6.6	4.3	3.0	5.5	6.3
SKO-225 ZC (HZ)	6.0									
OS-403 ZC (NWZ, NEZ, SZ)		17.9	9.6	10.6	7.2	10.6	8.6	3.5	5.9	7.7
Mean	**5.3**	**13.4**	**9.6**	**10.7**	**6.9**	**8.1**	**6.1**	**3.9**	**5.6**	**6.8**

Table 5.5 IVT Oat (SC): Initial Varietal Trial in Oat (Single Cut): Crude Protein Yield (q/ha)

Entries	Rah-uri	Urulikan-chan	Ana-nd	Jabal-pur	Rai-pur	Hydera-bad	Man-dya	Coimba-tore	Aver-age	Ra-nk
BAUO-103	5.4	4.7	10.4	9.6	4.1	3.8	4.1	4.4	6.8	6
JHO-20-1	5.2	4.7	10.9	10.7	4.5	3.5	4.4	5.0	7.2	4
NDO-1902	4.7	5.2	10.6	10.2	3.7	2.4	3.8	2.5	5.7	11
SKO-244	4.6	10.1	12.2	9.9	4.6	3.3	3.9	5.0	7.5	2
OL-1980	4.2	7.1	10.9	9.1	5.0	3.5	3.1	4.4	7.2	4
JO-08-37	5.1	6.5	9.8	11.6	4.3	3.1	2.5	5.8	7.5	2
OL-1977	4.2	5.7	11.8	10.5	3.9	3.6	3.0	4.1	6.5	9
HFO-1009	5.0	4.6	12.4	10.2	6.0	5.5	4.2	4.8	7.5	2
HFO-1003	5.3	7.1	12.0	11.8	5.2	5.3	3.3	5.1	7.3	3
HFO-1013	5.9	6.1	15.2	11.1	5.8	4.1	2.5	6.0	7.7	1
BAUO-101	4.9	5.3	12.0	10.6	5.5	4.1	3.1	4.8	7.0	5
UPO-20-1	4.3	5.6	6.9	10.6	4.1	3.1	2.4	3.9	6.1	10
OL-1974	3.7	6.3	9.3	12.0	4.0	2.9	3.9	4.3	6.7	7
Kent (NC)	3.9	6.0	11.7	10.0	5.2	4.7	4.2	4.3	6.7	7
OS-6 (NC)	4.5	5.8	13.0	10.8	4.1	3.0	4.5	3.8	6.6	8
RO-11-1 ZC (CZ)	6.3	7.4	8.4	10.0	7.0					
OS-403 ZC (NWZ, NEZ, SZ)						4.6	3.4	7.3		
Mean	**4.8**	**6.1**	**11.1**	**10.5**	**4.8**	**3.8**	**3.5**	**4.7**	**6.9**	

Table 5.6 IVT Oat (SC): Initial Varietal Trial in Oat (Single Cut): Crude Protein (%)

Entries	Palam-pur	Bika-ner	His-ar	Ludh-iana	Jor-hat	Kal-yani	Bhuban-eswar	Ran-chi	Ayod-hya	Imp-hal
BAUO-103	10.2	15.0	7.8	5.0	10.0	10.8	8.8	7.4	7.9	8.9
JHO-20-1	9.0	17.1	7.0	7.4	10.1	12.6	8.9	8.2	7.8	7.6
NDO-1902	9.3	13.3	7.3	5.8	9.8	10.3	9.0	8.2	7.7	7.4
SKO-244	11.1	11.9	9.1	7.3	9.9	9.3	9.5	7.7	8.4	7.8
OL-1980	11.1	14.9	8.9	7.8	10.4	12.7	8.5	7.2	7.9	8.2
JO-08-37	10.5	15.0	8.0	7.4	9.2	11.6	8.7	6.4	8.0	7.4
OL-1977	9.6	12.5	8.0	6.7	10.5	11.7	9.5	5.7	7.2	7.5
HFO-1009	9.6	13.7	8.7	7.3	9.3	11.5	9.6	5.7	7.8	7.6
HFO-1003	9.0	10.0	9.0	6.6	9.6	8.7	8.8	6.2	7.7	7.7
HFO-1013	10.2	12.0	7.8	6.0	9.9	9.6	8.8	7.4	8.2	8.4
BAUO-101	11.1	10.4	8.1	5.9	10.1	11.4	8.8	7.4	7.8	7.4
UPO-20-1	10.8	11.9	7.4	8.3	9.8	12.7	8.7	5.9	7.6	8.2
OL-1974	9.9	14.1	8.2	8.0	9.8	11.5	8.8	5.9	8.1	8.0
Kent (NC)	9.3	11.8	7.3	5.9	10.5	13.3	8.9	7.4	8.7	8.0
OS-6 (NC)	10.8	12.2	7.0	7.4	10.0	9.5	8.8	8.2	7.4	8.1
SKO-225 ZC (HZ)	9.6									
OS-403 ZC (NWZ, NEZ, SZ)		17.5	8.2	7.1	10.0	11.3	9.0	5.9	7.6	8.7
Mean	**10.1**	**13.3**	**8.0**	**6.9**	**9.9**	**11.1**	**8.9**	**6.9**	**7.9**	**7.9**

Table 5.6 IVT Oat (SC): Initial Varietal Trial in Oat (Single Cut): Crude Protein (%)

Entries	Rah-uri	Urulikan-chan	Ana-nd	Jabal-pur	Rai-pur	Hydera-bad	Man-dya	Coimb-atore	Aver-age	Ra-nk
BAUO-103	7.3	9.5	11.0	8.1	6.6	7.9	7.9	6.6	8.7	4
JHO-20-1	8.1	8.2	11.4	8.1	6.6	8.2	8.3	7.4	9.0	1
NDO-1902	8.3	8.6	11.4	8.1	7.1	6.8	6.6	3.9	8.3	8
SKO-244	6.4	9.0	12.1	8.1	6.7	8.4	8.3	8.8	8.9	2
OL-1980	7.1	7.3	12.8	8.1	6.7	7.9	7.9	6.1	9.0	1
JO-08-37	6.4	8.7	12.5	8.1	6.9	6.7	6.1	7.9	8.6	5
OL-1977	5.9	8.3	11.5	8.2	8.8	6.8	7.0	7.0	8.5	6
HFO-1009	5.9	8.8	11.8	8.2	7.8	8.5	8.8	6.6	8.7	4
HFO-1003	6.3	7.2	11.9	8.2	6.7	8.1	8.3	7.0	8.2	9
HFO-1013	7.7	9.2	13.2	8.2	7.2	6.5	6.1	8.8	8.6	5
BAUO-101	7.8	9.1	11.2	8.2	7.0	6.9	6.6	7.0	8.5	6
UPO-20-1	6.0	8.3	12.1	8.3	6.5	6.1	6.1	7.0	8.4	7
OL-1974	6.1	9.6	13.9	8.2	7.8	7.2	7.9	7.0	8.9	2
Kent (NC)	7.3	9.5	10.6	8.1	8.3	8.5	9.2	6.1	8.8	3
OS-6 (NC)	8.0	9.0	10.0	8.1	7.5	7.4	7.9	6.1	8.5	6
RO-11-1 ZC (CZ)	6.0	7.1	9.1	8.1	8.5					
OS-403 ZC (NWZ, NEZ, SZ)						6.9	6.6	8.8		
Mean	**6.9**	**8.6**	**11.6**	**8.1**	**7.3**	**7.4**	**7.5**	**7.0**	**8.6**	

Table 5.7 IVT Oat (SC): Initial Varietal Trial in Oat (Single Cut): Plant Height (cm)

Entries	Palam-pur	Sri-nagar	Bika-ner	His-ar	Ludh-iana	Pant-nagar	Mee-rut	Jor-hat	Kal-yani	Bhuban-eswar	Ran-chi	Pu-sa	Ayod-hya	Imp-hal
BAUO-103	94.0	103.3	112.4	136.0	133.8	145.7	185.0	133.1	156.4	129.9	97.8	131.4	106.9	138.4
JHO-20-1	96.3	111.0	96.2	134.0	130.7	144.5	180.0	123.7	142.0	116.3	113.5	125.7	106.8	128.8
NDO-1902	70.3	109.0	92.2	153.0	125.4	143.6	181.0	123.9	141.7	127.7	121.1	131.1	143.2	126.1
SKO-244	105.3	146.0	111.0	138.0	148.2	141.5	182.0	135.6	128.0	149.2	112.2	112.2	115.4	111.0
OL-1980	112.0	108.3	128.4	145.0	145.6	162.2	177.0	116.6	160.6	135.6	113.4	120.4	113.3	141.7
JO-08-37	98.7	127.7	110.8	144.0	155.8	141.7	180.0	157.7	150.4	147.3	121.7	115.7	138.0	138.4
OL-1977	95.3	107.7	111.4	132.0	141.8	142.5	185.0	138.4	164.7	141.1	130.7	148.0	147.4	144.0
HFO-1009	110.3	140.3	110.4	145.0	142.9	151.3	195.0	129.5	164.7	125.8	144.3	147.0	155.0	142.9
HFO-1003	112.0	137.7	111.8	138.0	143.7	155.2	186.0	132.8	137.2	152.4	122.1	123.6	101.1	126.8
HFO-1013	83.7	149.3	106.6	143.0	156.7	153.8	187.0	131.1	168.7	155.1	118.6	146.3	133.5	132.7
BAUO-101	94.3	143.7	121.2	151.0	154.2	158.7	200.0	164.7	160.0	156.3	109.7	128.6	151.8	153.4
UPO-20-1	96.0	106.3	95.8	154.0	137.6	144.9	176.0	117.1	151.5	109.7	121.1	134.3	75.0	125.7
OL-1974	113.7	108.0	107.4	132.0	126.0	156.2	181.0	123.7	159.8	81.4	118.7	143.3	119.0	123.0
Kent (NC)	101.3	122.0	108.0	145.0	130.2	143.3	180.0	174.9	148.1	98.2	97.7	110.5	136.8	130.6
OS-6 (NC)	105.0	134.7	109.8	153.0	139.4	140.4	182.0	139.5	154.5	93.1	133.6	144.9	108.2	125.8
SKO-225 ZC (HZ)	103.3	124.3												
OS-403 ZC (NWZ, NEZ, SZ)			98.4	125.0	122.8	154.4	209.0	126.2	175.7	158.4	144.6	150.2	131.9	155.7
Mean	**99.5**	**123.7**	**108.2**	**141.8**	**139.7**	**148.7**	**185.4**	**135.5**	**154.0**	**129.8**	**120.0**	**132.1**	**124.0**	**134.1**

Table 5.7 IVT Oat (SC): Initial Varietal Trial in Oat (Single Cut): Plant Height (cm)

Entries	Jhansi	Rahuri	Urulikanchan	Dhari	Anand	Jabalpur	Raipur	Karjat	Hyderabad	Tirupati	Mandya	Coimbatore	Mattupetty	Average	Rank
BAUO-103	119.8	132.5	75.3	170.0	126.1	112.5	130.9	119.3	94.2	64.9	104.3	124.0	121.0	124.4	10
JHO-20-1	138.9	113.3	56.1	151.7	127.5	128.6	124.7	119.2	96.5	58.0	103.5	126.4	116.0	118.9	14
NDO-1902	114.1	110.9	64.9	165.7	126.4	119.9	99.2	113.3	100.7	78.3	83.9	120.5	119.0	118.7	15
SKO-244	159.2	121.1	74.2	133.7	126.1	116.3	130.9	119.9	96.3	58.9	104.2	110.0	87.0	121.2	12
OL-1980	136.4	123.5	79.1	166.7	137.1	104.0	133.6	129.3	98.1	64.5	95.4	132.5	124.0	126.1	7
JO-08-37	162.6	130.3	81.6	161.7	127.8	139.4	128.0	124.1	97.5	66.6	98.6	131.5	104.0	128.9	5
OL-1977	145.9	119.1	81.3	153.3	137.7	122.4	131.1	118.9	101.2	61.0	95.1	122.0	114.0	129.7	4
HFO-1009	144.6	121.3	76.6	171.7	132.1	119.1	139.5	119.5	102.6	68.3	102.9	130.0	126.0	131.8	2
HFO-1003	158.2	121.9	68.6	157.7	123.2	141.4	127.9	120.9	91.7	48.5	100.1	131.0	117.0	125.5	8
HFO-1013	142.1	111.2	78.6	165.0	138.7	136.4	144.7	118.9	100.4	72.4	101.9	129.0	127.0	130.8	3
BAUO-101	125.0	128.4	82.6	164.0	140.0	123.7	125.8	126.3	109.8	75.7	90.9	126.0	117.0	134.9	1
UPO-20-1	164.7	124.8	77.2	151.0	128.5	126.3	118.3	119.8	91.7	47.4	99.9	118.5	111.0	119.4	13
OL-1974	151.1	127.5	74.6	158.3	140.3	147.4	123.5	109.2	88.4	70.8	89.4	117.0	133.0	125.1	9
Kent (NC)	154.5	106.3	66.2	144.3	128.7	116.5	123.3	111.9	94.7	59.8	101.1	133.0	109.0	121.3	11
OS-6 (NC)	122.9	123.0	81.6	153.0	137.1	133.9	123.1	119.5	110.3	81.1	98.8	130.4	129.0	126.2	6
RO-11-1 ZC (CZ)	164.6	137.3	99.0	179.7	122.2	117.6	143.8	148.3							
OS-403 ZC (NWZ, NEZ, SZ)									115.8	66.5	106.1	135.5	100.0		
Mean	**144.0**	**122.0**	**76.1**	**159.2**	**131.2**	**125.3**	**128.0**	**121.1**	**99.4**	**64.0**	**98.5**	**126.1**	**115.9**	**125.5**	

Table 5.8 IVT Oat (SC): Initial Varietal Trial in Oat (Single Cut): Leaf Stem Ratio

Entries	Palam-pur	Sri-nagar	Bika-ner	His-ar	Ludh-iana	Pant-nagar	Jor-hat	Kal-yani	Bhuban-eswar	Ran-chi	Pu-sa	Ayod-hya	Imp-hal
BAUO-103	0.29	0.36	0.90	0.51	0.76	0.84	0.85	0.54	1.08	0.61	0.33	0.80	0.35
JHO-20-1	0.26	0.32	1.06	0.51	0.81	0.92	0.70	0.66	1.03	0.65	0.2	0.72	0.38
NDO-1902	0.44	0.3	0.58	0.49	0.72	0.80	0.78	0.84	1.08	0.59	0.28	0.78	0.31
SKO-244	0.35	0.35	1.82	0.52	0.78	0.91	0.74	0.89	1.14	0.77	0.43	0.69	0.32
OL-1980	0.27	0.34	1.28	0.45	0.88	0.91	0.88	0.74	1.10	0.62	0.49	0.83	0.30
JO-08-37	0.22	0.32	1.06	0.50	0.96	0.76	0.82	0.64	1.18	0.73	0.30	0.79	0.35
OL-1977	0.29	0.33	0.78	0.53	0.84	0.84	0.69	0.75	1.16	0.56	0.22	0.82	0.34
HFO-1009	0.27	0.35	0.77	0.53	0.90	0.92	0.88	0.98	1.06	0.64	0.63	0.80	0.36
HFO-1003	0.3	0.33	0.47	0.62	0.81	0.93	0.74	0.62	1.19	0.68	0.25	0.81	0.34
HFO-1013	0.28	0.34	0.57	0.49	0.86	0.89	0.64	0.61	1.26	0.62	0.38	0.80	0.35
BAUO-101	0.38	0.36	0.57	0.52	0.90	0.83	0.83	0.84	1.21	0.57	0.54	0.68	0.33
UPO-20-1	0.48	0.32	1.29	0.48	0.72	0.91	0.77	0.83	0.97	0.74	0.53	0.71	0.32
OL-1974	0.27	0.34	0.59	0.49	0.75	0.94	0.88	0.99	0.81	0.65	0.37	0.73	0.33
Kent (NC)	0.28	0.33	1.00	0.44	0.78	0.78	0.70	0.73	0.89	0.62	0.36	0.71	0.33
OS-6 (NC)	0.26	0.37	0.48	0.42	0.88	0.81	0.79	0.68	0.85	0.63	0.23	0.68	0.33
SKO-225 ZC (HZ)	0.29	0.32											
OS-403 ZC (NWZ, NEZ, SZ)			0.59	0.51	0.78	0.90	0.79	0.65	1.29	0.71	0.62	0.75	0.35
Mean	**0.31**	**0.34**	**0.86**	**0.50**	**0.82**	**0.87**	**0.78**	**0.75**	**1.08**	**0.65**	**0.39**	**0.76**	**0.34**

Table 5.8 IVT Oat (SC): Initial Varietal Trial in Oat (Single Cut): Leaf Stem Ratio

Entries	Rahuri	Urulikanchan	Anand	Jabalpur	Raipur	Dhari	Karjat	Hyderabad	Mandya	Coimbatore	Mattupetty	Average	Rank
BAUO-103	0.27	0.61	1.16	0.59	0.48	0.44	0.65	0.24	0.48	0.40	0.42	0.58	10
JHO-20-1	0.32	0.91	1.31	0.7	0.48	0.46	0.49	0.48	0.77	0.35	0.33	0.62	6
NDO-1902	0.35	0.87	0.64	0.65	0.36	0.52	0.62	0.30	0.65	0.32	0.19	0.56	11
SKO-244	0.49	0.54	1.49	0.59	0.45	0.79	0.48	0.59	0.69	0.34	0.64	0.70	1
OL-1980	0.39	0.73	1.61	0.54	0.58	0.39	0.46	0.61	0.56	0.40	0.41	0.66	2
JO-08-37	0.48	0.75	1.18	0.79	0.59	0.41	0.50	0.50	0.67	0.39	0.45	0.64	4
OL-1977	0.30	0.62	1.30	0.66	0.48	0.49	0.44	0.38	0.75	0.35	0.47	0.60	8
HFO-1009	0.67	0.75	1.10	0.64	0.48	0.47	0.59	0.41	0.70	0.39	0.38	0.65	3
HFO-1003	0.34	0.76	1.30	0.81	0.58	0.68	0.57	0.57	0.66	0.40	0.46	0.63	5
HFO-1013	0.47	0.80	0.97	0.77	0.65	0.48	0.54	0.51	0.65	0.41	0.36	0.61	7
BAUO-101	0.45	0.86	0.97	0.67	0.50	0.46	0.42	0.36	0.60	0.34	0.31	0.60	8
UPO-20-1	0.32	0.58	1.49	0.68	0.62	0.44	0.59	0.52	0.73	0.36	0.48	0.66	2
OL-1974	0.34	0.76	1.00	0.83	0.65	0.46	0.48	0.45	0.67	0.37	0.31	0.60	8
Kent (NC)	0.55	0.56	1.15	0.61	0.53	0.66	0.50	0.42	0.66	0.32	0.30	0.59	9
OS-6 (NC)	0.43	0.55	0.96	0.72	0.47	0.62	0.45	0.26	0.62	0.35	0.26	0.55	12
RO-11-1 ZC (CZ)	0.34	0.60	1.26	0.63	0.45	0.46	0.48						
OS-403 ZC (NWZ, NEZ, SZ)								0.50	0.42	0.41	0.51		
Mean	**0.41**	**0.70**	**1.18**	**0.68**	**0.52**	**0.51**	**0.52**	**0.44**	**0.64**	**0.37**	**0.39**	**0.62**	

Table 5.9 IVT Oat (SC): Initial Varietal Trial in Oat (Single Cut): NDF (%), ADF (%) & IVDMD (%)

Entries	NDF (%)				ADF (%)				IVDMD (%)			
	Ludh-iana	Ana-nd	Aver-age	Ra-nk	Ludh-iana	Ana-nd	Aver-age	Ra-nk	Ludh-iana	His-ar	Aver-age	Ra-nk
BAUO-103	65.6	72.9	69.3	7	47.7	36.9	42.3	13	45.3	62.4	53.9	10
JHO-20-1	63.4	72.5	67.9	2	45.3	36.9	41.1	11	47.3	62.8	55.1	7
NDO-1902	70.0	75.2	72.6	14	45.7	35.8	40.8	10	42.3	64.8	53.6	11
SKO-244	68.2	71.7	70.0	9	44.9	33.6	39.2	6	49.2	63.6	56.4	3
OL-1980	65.3	70.8	68.1	4	43.3	32.2	37.7	3	49.8	63.4	56.6	2
JO-08-37	62.8	72.0	67.4	1	45.0	33.1	39.0	5	50.0	60.2	55.1	7
OL-1977	65.6	73.6	69.6	8	43.4	37.2	40.3	9	48.2	63.4	55.8	5
HFO-1009	65.2	73.2	69.2	6	42.1	35.9	39.0	5	49.3	65.0	57.2	1
HFO-1003	67.5	72.9	70.2	10	43.0	33.1	38.1	4	47.9	62.2	55.1	7
HFO-1013	67.9	72.8	70.3	11	45.4	34.2	39.8	8	46.4	64.4	55.4	6
BAUO-101	68.4	75.1	71.7	12	48.9	35.1	42.0	12	43.2	65.8	54.5	9
UPO-20-1	63.6	74.1	68.8	5	40.2	31.9	36.1	1	53.4	59.4	56.4	3
OL-1974	64.2	71.8	68.0	3	40.4	34.3	37.4	2	52.3	60.0	56.2	4
Kent (NC)	70.3	74.5	72.4	13	47.2	34.9	41.1	11	43.0	63.9	53.5	12
OS-6 (NC)	64.2	74.9	69.6	8	42.0	36.7	39.4	7	48.3	61.2	54.8	8
RO-11-1 ZC (CZ)		75.4				37.7						
OS-403 ZC (NWZ, NEZ, SZ)	63.9				41.3				46.8	64.7		
Mean	**66.0**	**73.3**	**69.7**		**44.1**	**35.0**	**39.5**		**47.7**	**63.0**	**55.3**	

6. AVTO (SC)-1: FIRST ADVANCED VARIETAL TRIAL IN OAT (SINGLE CUT) (Reference tables 6.1 to 6.9)

In **First Advanced Varietal Trial in Oat (single cut), AVTO (SC)-1,** four entries promoted from IVT were evaluated against two national checks (OS-6 and Kent) and one zonal check [SKO-96 (HZ), RO-11-1 (CZ), and OS-403 (NWZ, NEZ, SZ)] in respective zones at 28 locations. There were 3 locations in HZ, 6 in NWZ, 7 in NEZ, 8 in CZ and 4 in SZ.

For GFY (q/ha), in Hill, north east, central zones, zonal or national checks were best, In NWZ, two entries viz., JO-07-28 and HFO-906 showed marginal superiority by 2.4% and 0.5% respectively over the best check. In south zone entry HFO-904 was better than the best check by a margin of 7.1%. At all India level, entries HFO-904 (13.9%), HFO-906 (13.3%), JO-07-28 (11.0%) were better than the best national check.

For DMY (q/ha), in hill and central zone, Zonal check was best performer. In NWZ, entries JO-07-28 (4.9%), HFO-904 (4.8%), HFO-906 (2.1%) performed better than the best check. In NE, one entry HFO-906 showed marginal superiority (0.6%) over the best check. In south zone, entry HFO-904 was better than the best check by a margin of 7.9%. At all India level, entries HFO-904 (17.4%), HFO-906 (14.2%), JO-07-28 (10.5%) were better than the best national check. For fodder production potential (q/ha/day), HFO-904 ranked first followed by JO-07-28 for both green and dry matter. Entry JO-07-28 ranked first for plant height. Entry HFO-906 ranked first followed by OL-1960 for leafiness.

For quality parameters, entry JO-07-28 (8.0 q/ha) was ranked first followed by HFO-904 (7.8 q/ha) for crude protein yield. For crude protein content, entry JO-07-28 ranked first followed closely by national check OS-6. Entry OL-1960 was best for NDF%, ADF% as well as IVDMD%.

7. AVTO (SC)-2: SECOND ADVANCED VARIETAL TRIAL IN OAT (SINGLE CUT) (Reference tables 7.1 to 7.9)

In Second Advanced Varietal Trial Oat (Single cut) comprising of seven entries along with two national checks (OS-6 and Kent) and one zonal check (SKO-96 for HZ, OS-403 for SZ and RO-11-1 for CZ) for respective zones were evaluated at 14 locations across the three zones. There were 3 locations in HZ, 7 in CZ and 4 locations in South zone.

For GFY (q/ha), entries in HZ, entries RO-11-1-2 (5.4%), JO-06-23 (2.7%) were better than the best check. IN central zone, Entries RO-11-1-3 and SKO-241 showed marginal superiority over the best check. In south zone, entries HFO-806 (11.0%) and SKO-241 (10.1%) were superior over the best check. Combining all three zones, entries SKO-241 (10.5%), RO-11-1-3 (8.3%), RO-11-1-2 (5.0%), HFO-806 (4.3%), JO-06-23 (4.1%) were superior over the best national check. All other entries were below or at par or marginally superior in comparison to best check.

For DMY (q/ha), entry RO-11-1-2 (7.6%), SKO-241 (1.4%), in hill zone and HFO-806 (11.9%), SKO-241 (11.4%) in south zone were superior over the best check whereas check was best in central zone. Combining the 3 zones, RO-11-1-2 (24.2%), SKO-241 (13.8%), RO-11-1-3 (7.2%), JO-06-23 (4.0%), HFO-806 (3.4%) performed better than the best national check. All other entries were below or at par in comparison to best check.

For green and dry fodder production potential (q/ha/day), RO-11-1-3 ranked first followed by RO-11-1-2 for green matter andSKO-241 for dry matter. Entry OL-1876-1 ranked first for plant height.

For quality parameters, entry SKO-241 (7.4 q/ha) was ranked first followed by RO-11-1-3 (6.9 q/ha) for crude protein yield. For crude protein content, entry 1874-1 and RO-11-1-2 were joint best with 9.1%. Entry RO-11-1-3 ranked first for NDF, ADF and IVDMD%.

Table 6.1 AVT Oat (SC-1): First Advanced Varietal Trial in Oat (Single Cut): Green Forage Yield (q/ha)

Entries	Hill Zone					North West Zone								
	Palam-pur	Sri-nagar	Rajo-uri	Aver-age	Ra-nk	Bika-ner	His-ar	Ludh-iana	Pant-nagar	Udai-pur	Mee-rut	Aver-age	Ra-nk	Super-iority (%)
HFO-904	202.8	372.7	190.7	255.4	5	339.7	606.3	660.0	703.6	769.1	684.7	627.2	4	
HFO-906	197.2	373.3	201.7	257.4	4	330.8	605.9	610.8	859.3	858.6	642.8	651.4	2	0.5
OL-1960	118.3	382.0	186.0	228.8	7	297.4	597.6	383.3	603.0	750.5	371.9	500.6	7	
JO-07-28	253.9	376.0	152.3	260.7	3	505.5	582.9	639.9	802.5	866.3	585.0	663.7	1	2.4
Kent (NC)	215.5	375.0	195.1	261.9	2	296.1	562.1	555.8	711.3	706.7	494.4	554.4	6	
OS-6 (NC)	221.3	373.0	158.0	250.8	6	430.3	573.9	576.1	668.8	720.6	520.9	581.8	5	
SKO-96 ZC (HZ)	263.9	374.7	175.1	271.2	1									
OS-403 (NWZ, NEZ, SZ)						524.6	579.7	678.1	552.8	909.4	644.2	648.1	3	
Mean	**210.4**	**375.2**	**179.8**	**255.2**		**389.2**	**586.9**	**586.3**	**700.2**	**797.3**	**563.4**	**603.9**		
CD at 5%	**48.2**	**2.3**	**3.2**			**55.3**	**N/A**	**71.2**	**53.6**	**82.1**				
CV%	**12.7**	**0.9**	**8.2**			**7.9**	**3.0**	**11.2**	**12.1**	**5.8**				

Table 6.1 AVT Oat (SC-1): First Advanced Varietal Trial in Oat (Single Cut): Green Forage Yield (q/ha)

Entries	North East Zone								
	Jor-hat	Kal-yani	Bhuban-eswar	Ran-chi	Pu-sa	Ayod-hya	Imp-hal	Aver-age	Ra-nk
HFO-904	259.7	464.1	366.5	336.6	576.7	588.1	446.7	434.1	3
HFO-906	276.9	414.1	425.0	364.2	546.3	565.3	579.0	453.0	2
OL-1960	286.6	217.5	65.0	256.5	483.3	338.7	390.7	291.2	7
JO-07-28	251.5	355.0	453.0	323.9	444.7	578.5	467.7	410.6	4
Kent (NC)	221.2	345.0	332.5	338.0	533.3	513.9	394.3	382.6	5
OS-6 (NC)	232.1	347.5	386.5	294.2	430.0	502.5	455.3	378.3	6
OS-403 (NWZ, NEZ, SZ)	301.5	447.5	302.5	393.4	630.3	571.0	570.0	459.5	1
Mean	**261.4**	**370.1**	**333.0**	**329.5**	**520.7**	**522.6**	**472.0**	**401.3**	
CD at 5%	**6.3**	**22.5**	**48.7**	**29.7**	**75.3**	**100.4**	**7.4**		
CV%	**8.4**	**8.3**	**8.2**	**5.1**	**8.1**	**10.8**	**3.1**		

Table 6.1 AVT Oat (SC-1): First Advanced Varietal Trial in Oat (Single Cut): Green Forage Yield (q/ha)

Entries	Central Zone									
	Jhansi	Rahuri	Urulikanchan	Dhari	Karjat	Anand	Jabalpur	Raipur	Average	Rank
HFO-904	695.7	415.7	579.1	592.8	145.1	698.9	621.7	415.3	520.5	2
HFO-906	716.0	421.1	566.9	412.2	137.8	660.8	655.3	352.8	490.4	3
OL-1960	492.6	270.1	506.0	439.4	86.1	288.6	400.7	291.7	346.9	7
JO-07-28	643.8	358.2	540.3	540.5	140.5	699.2	513.7	444.4	485.1	4
Kent (NC)	555.6	318.3	507.5	566.5	118.3	555.8	465.0	380.6	433.4	6
OS-6 (NC)	523.5	283.5	499.9	566.3	123.7	535.0	591.0	384.7	438.4	5
RO-11-1 ZC (CZ)	666.7	402.3	636.3	699.1	131.5	723.6	686.3	416.7	545.3	1
Mean	**613.4**	**352.7**	**548.0**	**545.3**	**126.1**	**594.6**	**562.0**	**383.7**	**465.7**	
CD at 5%	**34.1**	**54.4**	**89.6**		**23.5**	**124.6**	**5.3**	**58.0**		
CV%	**19.2**	**8.7**	**9.1**		**10.5**	**11.8**	**18.3**	**8.5**		

Table 6.1 AVT Oat (SC-1): First Advanced Varietal Trial in Oat (Single Cut): Green Forage Yield (q/ha)

Entries	South Zone							All India		
	Hyderabad	Mandya	Coimbatore	Mattupetty	Average	Rank	Superiority%	Average	Rank	Superiority%
HFO-904	369.3	281.4	382.8	431.0	366.1	1	7.1	471.3	1	13.9
HFO-906	338.8	249.4	369.7	392.0	337.5	3		468.7	2	13.3
OL-1960	211.0	225.9	348.1	300.0	271.2	7		342.4	6	
JO-07-28	283.2	291.6	408.1	361.0	336.0	4		459.4	3	11.0
Kent (NC)	308.2	267.9	361.1	369.0	326.5	5		413.0	5	
OS-6 (NC)	269.3	268.6	348.6	303.0	297.4	6		413.9	4	
OS-403 (NWZ, NEZ, SZ)	455.4	259.3	319.4	333.0	341.8	2				
Mean	**319.3**	**263.5**	**362.5**	**355.6**	**325.2**			**428.1**		
CD at 5%	**80.5**	**37.5**	**37.7**	**1.4**						
CV%	**14.0**	**8.0**	**5.9**	**8.6**						

Table 6.2 AVT Oat (SC-1): First Advanced Varietal Trial in Oat (Single Cut): Dry Matter Yield (q/ha)

Entries	Hill Zone				North West Zone						
	Palampur	Srinagar	Average	Rank	Bikaner	Hisar	Ludhiana	Pantnagar	Average	Rank	Superiority (%)
HFO-904	50.5	75.1	62.8	4	85.9	122.6	130.7	121.0	115.0	2	4.8
HFO-906	48.5	74.4	61.5	6	73.1	115.0	119.1	140.9	112.0	3	2.1
OL-1960	29.6	73.5	51.5	7	65.7	111.6	73.6	94.7	86.4	7	
JO-07-28	61.3	78.2	69.8	2	108.7	100.7	126.7	124.4	115.1	1	4.9
Kent (NC)	49.6	79.9	64.8	3	74.0	89.3	110.6	112.4	96.6	6	
OS-6 (NC)	53.2	71.0	62.1	5	90.4	96.6	116.4	107.0	102.6	5	
SKO-96 ZC (HZ)	62.7	77.7	70.2	1	108.6	101.1	139.7	89.6	109.7	4	
OS-403 (NWZ, NEZ, SZ)											
Mean	**50.8**	**75.7**	**63.2**		**86.6**	**105.3**	**116.7**	**112.9**	**105.4**		
CD at 5%	**11.6**	**3.5**			**11.6**	**14.1**	**31.5**	**10.7**			
CV%	**12.6**	**5.7**			**7.5**	**10.3**	**9.8**	**9.5**			

Table 6.2 AVT Oat (SC-1): First Advanced Varietal Trial in Oat (Single Cut): Dry Matter Yield (q/ha)

Entries	North East Zone									
	Jorhat	Kalyani	Bhubaneswar	Ranchi	Pusa	Ayodhya	Imphal	Average	Rank	Superiority (%)
HFO-904	48.3	78.0	86.7	61.2	122.4	132.2	93.6	88.9	3	
HFO-906	52.2	67.1	97.2	67.4	117.3	130.0	126.6	94.0	1	0.6
OL-1960	53.9	41.3	15.8	50.9	108.8	79.6	66.2	59.5	7	
JO-07-28	44.9	62.1	102.2	54.5	98.9	133.0	92.1	84.0	4	
Kent (NC)	42.2	54.9	80.2	56.9	114.1	123.3	85.9	79.6	5	
OS-6 (NC)	43.3	61.2	91.2	48.1	95.7	112.9	81.1	76.2	6	
OS-403 (NWZ, NEZ, SZ)	53.9	73.8	68.4	68.2	131.2	128.9	129.4	93.4	2	
Mean	**48.4**	**62.6**	**77.4**	**58.2**	**112.6**	**120.0**	**96.4**	**82.2**		
CD at 5%	**3.6**	**5.4**	**10.9**		**16.2**	**22.8**	**7.4**			
CV%	**10.9**	**11.4**	**7.9**		**8.1**	**10.7**	**6.9**			

Table 6.2 AVT Oat (SC-1): First Advanced Varietal Trial in Oat (Single Cut): Dry Matter Yield (q/ha)

Entries	Central Zone									
	Jhansi	Rahuri	Urulikanchan	Dhari	Karjat	Anand	Jabalpur	Raipur	Average	Rank
HFO-904	79.1	93.5	69.3	173.1	37.4	139.7	142.1	76.4	101.3	2
HFO-906	71.3	74.4	70.9	182.8	42.9	99.1	151.3	69.5	95.3	3
OL-1960	58.4	49.1	65.8	86.1	15.1	41.6	80.6	47.8	55.6	7
JO-07-28	74.1	66.2	85.4	163.3	32.6	113.1	111.6	76.5	90.4	4
Kent (NC)	66.7	62.4	56.0	149.7	31.9	89.4	94.6	68.5	77.4	6
OS-6 (NC)	56.8	66.8	55.4	136.4	29.1	108.0	133.3	78.9	83.1	5
RO-11-1 ZC (CZ)	74.4	80.3	83.9	198.1	33.3	122.6	158.7	79.9	103.9	1
Mean	**68.7**	**70.4**	**69.5**	**155.6**	**31.8**	**101.9**	**124.6**	**71.1**	**86.7**	
CD at 5%	**8.3**	**10.8**	**11.6**		**5.9**	**23.1**	**1.1**	**10.9**		
CV%	**4.7**	**8.6**	**9.3**		**10.4**	**12.7**	**22.9**	**8.6**		

Table 6.2 AVT Oat (SC-1): First Advanced Varietal Trial in Oat (Single Cut): Dry Matter Yield (q/ha)

Entries	South Zone							All India		
	Hyderabad	Mandya	Coimbatore	Mattupetty	Average	Rank	Superiority%	Average	Rank	Superiority%
HFO-904	71.0	56.1	80.2	107.7	78.7	1	7.9	93.3	1	17.4
HFO-906	65.9	41.6	73.1	98.0	69.6	4		90.8	2	14.2
OL-1960	41.8	48.4	74.2	75.1	59.9	7		62.0	6	
JO-07-28	52.4	59.0	84.8	90.3	71.6	3		87.9	3	10.5
Kent (NC)	58.2	50.4	76.9	92.3	69.5	5		78.8	5	
OS-6 (NC)	54.4	52.1	73.0	75.7	63.8	6		79.5	4	
OS-403 (NWZ, NEZ, SZ)	91.3	51.0	66.2	83.4	73.0	2				
Mean	**62.1**	**51.2**	**75.5**	**88.9**	**69.4**			**82.0**		
CD at 5%	**21.0**	**9.2**	**7.2**	**5.4**						
CV%	**18.8**	**10.1**	**5.4**	**8.6**						

Table 6.3 AVT Oat (SC-1): First Advanced Varietal Trial in Oat (Single Cut): Green Forage Yield (q/ha/day)

Entries	Palam-pur	Bika-ner	His-ar	Ludh-iana	Pant-nagar	Jor-hat	Kal-yani	Bhuban-eswar	Ran-chi	Pu-sa	Ayod-hya
HFO-904	1.83	3.47	5.29	5.40	7.49	3.09	4.60	5.00	4.09	7.09	6.00
HFO-906	1.60	3.38	5.39	5.00	8.26	3.15	4.10	6.07	4.12	6.53	5.28
OL-1960	1.02	3.04	5.37	3.10	6.28	3.26	2.15	0.84	3.23	5.92	3.49
JO-07-28	2.27	5.16	5.10	5.20	8.19	2.99	3.51	6.04	3.83	5.38	5.56
Kent (NC)	1.99	3.02	5.16	4.60	7.49	2.70	3.71	4.80	4.33	6.40	5.40
OS-6 (NC)	2.05	4.39	5.09	4.70	6.97	2.83	3.74	5.37	3.68	5.14	5.23
SKO-96 ZC (HZ)	2.09										
OS-403 (NWZ, NEZ, SZ)		5.35	5.18	5.60	4.94	3.59	4.43	4.26	4.45	7.44	5.05
Mean	**1.84**	**3.97**	**5.23**	**4.80**	**7.09**	**3.09**	**3.75**	**4.62**	**3.96**	**6.27**	**5.14**

Table 6.3 AVT Oat (SC-1): First Advanced Varietal Trial in Oat (Single Cut): Green Forage Yield (q/ha/day)

Entries	Jha-nsi	Rah-uri	Urulikan-chan	Dha-ri	Kar-jat	Ana-nd	Rai-pur	Hydera-bad	Man-dya	Coimb-atore	Mattu-petty	Aver-age	Ra-nk
HFO-904	6.58	4.93	7.42	7.00	2.10	8.63	5.61	4.88	4.67	4.50	5.23	5.22	1
HFO-906	6.63	4.59	6.23	4.53	2.19	7.03	4.15	4.67	3.88	4.11	4.77	4.80	3
OL-1960	5.03	3.07	5.56	4.92	1.37	3.17	3.84	2.65	3.20	3.96	3.63	3.55	6
JO-07-28	6.09	4.16	5.94	6.09	2.30	8.04	5.85	3.93	4.84	4.74	4.40	4.98	2
Kent (NC)	5.56	4.03	6.51	7.08	1.71	6.78	5.21	4.40	3.72	4.30	4.30	4.69	4
OS-6 (NC)	5.36	3.49	6.41	7.01	1.57	6.60	5.42	3.40	3.52	4.25	3.67	4.54	5
OS-403 (NWZ, NEZ, SZ)								6.19	4.14	3.47	4.07		
RO-11-1 ZC (CZ)	6.17	4.79	8.16	7.63	2.16	7.95	5.08						
Mean	**5.92**	**4.15**	**6.60**	**6.32**	**1.91**	**6.89**	**5.02**	**4.30**	**4.00**	**4.19**	**4.30**	**4.63**	

Table 6.4 AVT Oat (SC-1): First Advanced Varietal Trial in Oat (Single Cut): Dry Matter Yield (q/ha/day)

Entries	Bika-ner	His-ar	Ludh-iana	Pant-nagar	Jor-hat	Kal-yani	Bhuban-eswar	Ran-chi	Pu-sa	Ayod-hya
HFO-904	0.88	1.07	1.10	1.29	0.58	0.77	1.18	0.74	1.51	1.34
HFO-906	0.75	1.02	1.00	1.35	0.59	0.66	1.39	0.76	1.40	1.21
OL-1960	0.67	1.00	0.60	0.99	0.61	0.41	0.20	0.64	1.33	0.82
JO-07-28	1.11	0.88	1.00	1.27	0.53	0.62	1.36	0.64	1.20	1.27
Kent (NC)	0.76	0.82	0.90	1.18	0.51	0.59	1.16	0.73	1.37	1.29
OS-6 (NC)	0.92	0.86	1.00	1.11	0.53	0.66	1.27	0.60	1.14	1.17
OS-403 (NWZ, NEZ, SZ)	1.11	0.90	1.10	0.80	0.64	0.73	0.96	0.77	1.55	1.14
Mean	**0.89**	**0.94**	**0.96**	**1.14**	**0.57**	**0.63**	**1.07**	**0.70**	**1.36**	**1.18**

Table 6.4 AVT Oat (SC-1): First Advanced Varietal Trial in Oat (Single Cut): Dry Matter Yield (q/ha/day)

Entries	Jha-nsi	Rah-uri	Urulikan-chan	Dha-ri	Kar-jat	Ana-nd	Rai-pur	Hydera-bad	Man-dya	Coimb-atore	Mattu-petty	Aver-age	Ra-nk
HFO-904	0.75	1.11	0.89	2.04	0.54	1.73	1.03	0.94	0.93	0.94	1.30	1.08	1
HFO-906	0.66	0.81	0.78	2.01	0.68	1.05	0.82	0.91	0.65	0.81	1.20	0.98	3
OL-1960	0.60	0.56	0.72	0.96	0.24	0.46	0.63	0.53	0.69	0.84	0.93	0.69	6
JO-07-28	0.70	0.77	0.94	1.84	0.53	1.30	1.01	0.73	0.98	0.99	1.10	0.99	2
Kent (NC)	0.67	0.79	0.72	1.87	0.46	1.09	0.94	0.83	0.70	0.92	1.13	0.92	4
OS-6 (NC)	0.58	0.82	0.71	1.68	0.37	1.33	1.11	0.69	0.68	0.89	0.93	0.91	5
OS-403 (NWZ, NEZ, SZ)								1.24	0.81	0.72	1.00		
RO-11-1 ZC (CZ)	0.69	0.96	1.08	2.16	0.55	1.35	0.97						
Mean	**0.66**	**0.83**	**0.83**	**1.79**	**0.48**	**1.19**	**0.93**	**0.84**	**0.78**	**0.87**	**1.08**	**0.93**	

Table 6.5 AVT Oat (SC-1): First Advanced Varietal Trial in Oat (Single Cut): Crude Protein Yield (q/ha)

Entries	Palam-pur	Bika-ner	Ludh-iana	Pant-nagar	Jor-hat	Kal-yani	Bhuban-eswar	Ran-chi	Ayod-hya	Imp-hal
HFO-904	4.7	10.9	9.1	12.7	5.1	7.9	8.2	3.9	10.1	7.0
HFO-906	4.4	9.6	10.7	13.6	5.3	6.5	9.5	5.0	10.1	10.5
OL-1960	3.1	7.9	5.4	8.3	5.5	4.7	1.5	3.4	6.1	5.2
JO-07-28	6.6	15.7	9.2	13.1	4.5	6.1	10.1	4.0	10.0	7.0
Kent (NC)	5.1	9.5	7.5	11.8	4.3	5.6	7.4	4.1	9.1	6.6
OS-6 (NC)	5.3	11.2	9.5	9.4	4.5	7.5	8.6	3.1	8.9	6.8
SKO-96 ZC (HZ)	6.8									
OS-403 (NWZ, NEZ, SZ)		14.9	9.2	7.8	5.4	8.7	6.8	4.1	9.8	9.5
Mean	**5.1**	**11.4**	**8.7**	**10.9**	**4.9**	**6.7**	**7.4**	**3.9**	**9.2**	**7.5**

Table 6.5 AVT Oat (SC-1): First Advanced Varietal Trial in Oat (Single Cut): Crude Protein Yield (q/ha)

Entries	Rah-uri	Urulikan-chan	Ana-nd	Jabal-pur	Rai-pur	Hydera-bad	Man-dya	Coimb-atore	Aver-age	Ra-nk
HFO-904	6.9	6.6	12.8	11.6	6.9	5.0	4.2	7.0	7.8	2
HFO-906	6.0	5.1	8.5	12.3	6.6	5.3	3.5	5.8	7.7	3
OL-1960	3.8	5.3	4.8	6.5	3.7	3.9	5.1	6.5	5.0	6
JO-07-28	5.4	6.9	12.0	9.0	4.9	4.5	5.5	9.2	8.0	1
Kent (NC)	5.3	4.0	9.7	7.7	5.2	4.4	4.2	8.1	6.6	5
OS-6 (NC)	5.1	4.8	11.3	10.7	7.0	4.6	4.6	5.8	7.1	4
OS-403 (NWZ, NEZ, SZ)						8.1	4.7	6.9		
RO-11-1 ZC (CZ)	5.2	6.2	11.9	13.0	5.5					
Mean	**5.4**	**5.6**	**10.1**	**10.1**	**5.7**	**5.1**	**4.5**	**7.0**	**7.0**	

Table 6.6 AVT Oat (SC-1): First Advanced Varietal Trial in Oat (Single Cut): Crude Protein (%)

Entries	Palam-pur	Bika-ner	Ludh-iana	Pant-nagar	Jor-hat	Kal yani	Bhuban-eswar	Ran-chi	Ayod-hya	Imp-hal
HFO-904	9.3	12.7	7.0	10.5	10.6	10.1	9.5	6.4	7.6	7.5
HFO-906	9.0	13.1	9.0	9.6	10.3	9.8	9.8	7.4	7.8	8.3
OL-1960	10.5	12.0	7.3	8.8	10.3	11.3	9.2	6.6	7.7	7.9
JO-07-28	10.8	14.4	7.3	10.5	10.1	9.8	9.9	7.4	7.5	7.6
Kent (NC)	10.2	12.9	6.8	10.5	10.2	10.1	9.3	7.2	7.4	7.7
OS-6 (NC)	9.9	12.4	8.2	8.8	10.6	12.2	9.5	6.4	7.9	8.4
SKO-96 ZC (HZ)	10.8									
OS-403 (NWZ, NEZ, SZ)		13.7	6.6	8.8	10.2	11.8	9.9	6.0	7.6	7.4
Mean	**10.1**	**13.0**	**7.5**	**9.6**	**10.3**	**10.7**	**9.6**	**6.8**	**7.6**	**7.8**

Table 6.6 AVT Oat (SC-1): First Advanced Varietal Trial in Oat (Single Cut): Crude Protein (%)

Entries	Rah-uri	Urulikan-chan	Ana-nd	Jabal-pur	Rai-pur	Hydera-bad	Man-dya	Coimb-atore	**Mattu-petty	Aver-age	Ra-nk
HFO-904	7.3	9.6	9.1	8.2	9.0	7.0	7.4	8.7	4.5	8.8	5
HFO-906	8.1	7.2	8.6	8.1	9.6	8.1	8.3	7.9	5.5	8.9	4
OL-1960	7.7	8.1	11.1	8.1	7.8	9.3	10.5	8.7	3.5	9.0	3
JO-07-28	8.1	8.1	10.7	8.0	6.5	8.5	9.2	10.9	4.9	9.2	1
Kent (NC)	8.4	7.1	10.8	8.1	7.6	7.5	8.3	10.5	5.7	8.9	4
OS-6 (NC)	7.7	8.6	10.4	8.0	8.8	8.5	8.8	7.9	5.4	9.1	2
OS-403 (NWZ, NEZ, SZ)						8.9	9.2	10.5	6.4		
RO-11-1 ZC (CZ)	6.5	7.4	9.7	8.2	7.0						
Mean	**7.7**	**8.0**	**10.1**	**8.1**	**8.0**	**8.3**	**8.8**	**9.3**	**5.1**	**9.0**	

Note: ** Data is not included in zonal and all India average due to low yield of data

Table 6.7 AVT Oat (SC-1): First Advanced Varietal Trial in Oat (Single Cut): Plant Height (cm)

Entries	Palam-pur	Sri-nagar	Bika-ner	His-ar	Ludh-iana	Pant-nagar	Udai-pur	Mee-rut	Jor-hat	Kal-yani	Bhuban-eswar	Ran-chi	Pu-sa	Ayod-hya	Imp-hal
HFO-904	80.7	137.3	144.4	154.0	149.2	166.3	131.4	190.0	115.1	173.8	138.1	99.2	135.0	135.0	146.2
HFO-906	85.0	103.7	149.4	157.0	145.4	168.2	142.2	173.0	97.9	167.2	150.2	98.5	131.0	129.5	146.8
OL-1960	101.3	155.3	165.2	151.0	122.5	178.6	127.6	197.0	106.0	171.6	130.5	82.1	156.0	144.3	143.2
JO-07-28	83.3	144.7	144.8	145.0	144.7	178.6	143.8	179.0	121.7	162.4	155.5	94.2	160.7	149.0	140.6
Kent (NC)	70.0	129.0	151.4	141.0	137.6	150.0	108.6	158.0	99.9	160.1	125.1	86.1	151.0	123.4	130.8
OS-6 (NC)	77.0	152.7	158.2	139.0	136.2	161.6	126.4	163.0	108.5	157.5	142.7	91.9	150.0	127.3	134.1
SKO-96 ZC (HZ)	93.7	107.0													
OS-403 (NWZ, NEZ, SZ)			176.6	137.0	155.6	155.4	148.0	177.0	140.4	169.5	133.2	88.9	163.3	142.5	146.2
Mean	**84.4**	**132.8**	**155.7**	**146.3**	**141.6**	**165.5**	**132.6**	**176.7**	**112.8**	**166.0**	**139.3**	**91.5**	**149.6**	**135.9**	**141.1**

Table 6.7 AVT Oat (SC-1): First Advanced Varietal Trial in Oat (Single Cut): Plant Height (cm)

Entries	Jha-nsi	Rah-uri	Urulikan-chan	Dha-ri	Kar-jat	Ana-nd	Jabal-pur	Rai-pur	Hydera-bad	Man-dya	Coimb-atore	Mattu-petty	Aver-age	Ra-nk
HFO-904	152.4	110.1	88.2	169.3	124.4	141.6	146.1	148.0	89.4	92.0	130.5	144.0	134.5	2
HFO-906	164.1	125.9	81.4	176.7	94.6	135.1	141.0	157.5	89.2	93.4	131.0	127.0	131.9	4
OL-1960	121.7	121.4	78.6	161.7	131.4	106.7	137.2	121.5	91.3	95.5	128.0	145.0	132.3	3
JO-07-28	154.6	119.2	86.7	174.3	126.6	129.7	115.2	139.0	88.5	95.5	132.6	141.0	135.2	1
Kent (NC)	118.7	114.7	90.0	143.3	125.6	136.4	122.4	127.9	79.6	99.9	125.0	128.0	123.5	6
OS-6 (NC)	119.8	126.4	87.0	158.3	104.6	125.8	118.6	137.3	92.4	95.3	127.0	123.0	127.5	5
OS-403 (NWZ, NEZ, SZ)									87.1	100.6	105.4	126.0		
RO-11-1 ZC (CZ)	163.0	124.3	94.1	174.7	125.2	109.3	157.0	159.8						
Mean	**142.0**	**120.3**	**86.6**	**165.5**	**118.9**	**126.4**	**133.9**	**141.6**	**88.2**	**96.0**	**125.6**	**133.4**	**130.8**	

Table 6.8 AVT Oat (SC-1): First Advanced Varietal Trial in Oat (Single Cut): Leaf Stem Ratio

Entries	Palam-pur	Sri-nagar	Bika-ner	His-ar	Ludh-iana	Pant-nagar	Jor-hat	Kal-yani	Bhuban-eswar	Ran-chi	Pu-sa	Ayod-hya	Imp-hal
HFO-904	0.40	0.44	0.76	0.49	0.80	0.89	0.67	0.70	0.98	0.58	0.24	0.75	0.40
HFO-906	0.37	0.37	0.76	0.44	0.77	1.01	0.72	0.94	1.29	0.66	0.55	0.79	0.37
OL-1960	0.40	0.42	0.65	0.51	0.80	0.87	0.86	0.63	0.90	0.83	0.37	0.72	0.42
JO-07-28	0.54	0.35	0.72	0.49	0.92	0.89	0.77	0.63	1.35	0.60	0.34	0.79	0.38
Kent (NC)	0.39	0.36	0.47	0.52	0.70	0.77	0.74	0.64	0.89	0.55	0.26	0.69	0.34
OS-6 (NC)	0.36	0.42	0.53	0.50	0.90	0.80	0.61	0.68	1.21	0.72	0.28	0.73	0.37
SKO-96 ZC (HZ)	0.38	0.38											
OS-403 (NWZ, NEZ, SZ)			0.90	0.52	0.68	1.17	0.81	0.72	1.15	0.65	0.49	0.78	0.32
Mean	**0.41**	**0.39**	**0.68**	**0.50**	**0.80**	**0.91**	**0.74**	**0.71**	**1.11**	**0.66**	**0.36**	**0.75**	**0.37**

Table 6.8 AVT Oat (SC-1): First Advanced Varietal Trial in Oat (Single Cut): Leaf Stem Ratio

Entries	Rah-uri	Urulikan-chan	Dha-ri	Kar-jat	Ana-nd	Jabal-pur	Rai-pur	Hydera-bad	Man-dya	Coimb-atore	Mattu-petty	Aver-age	Ra-nk
HFO-904	0.50	0.63	0.52	0.39	1.01	0.78	0.47	0.43	0.64	0.40	0.33	0.59	6
HFO-906	0.70	0.74	0.41	0.42	1.91	0.78	0.55	0.68	0.62	0.38	0.60	0.70	1
OL-1960	0.54	0.75	0.46	0.56	1.88	0.75	0.66	0.62	0.70	0.36	0.33	0.67	2
JO-07-28	0.48	0.49	0.49	0.48	1.26	0.59	0.57	0.43	0.64	0.41	0.40	0.63	4
Kent (NC)	0.56	0.59	0.60	0.46	1.76	0.66	0.42	0.61	0.70	0.38	0.42	0.60	5
OS-6 (NC)	0.37	0.62	0.50	0.70	2.26	0.65	0.43	0.41	0.61	0.34	0.29	0.64	3
OS-403 (NWZ, NEZ, SZ)								0.49	0.51	0.36	0.59		
RO-11-1 ZC (CZ)	0.46	0.67	0.45	0.49	2.01	0.84	0.29						
Mean	**0.52**	**0.64**	**0.49**	**0.50**	**1.73**	**0.72**	**0.48**	**0.52**	**0.63**	**0.38**	**0.42**	**0.64**	

Table 6.9 AVT Oat (SC-1): First Advanced Varietal Trial in Oat (Single Cut): NDF (%)

Entries	NDF (%)							
	Pant-nagar	Ludh-iana	Ana-nd	Rah-uri	Palam-pur	Ran-chi	Aver-age	Ra-nk
HFO-904	66.2	65.1	73.5	62.9	66.2	62.2	66.0	6
HFO-906	65.8	60.2	72.4	62.7	67.2	61.4	65.0	3
OL-1960	65.4	62.9	70.1	57.9	65.8	52.1	62.4	1
JO-07-28	67.4	62.1	71.8	61.8	65.8	63.7	65.4	4
Kent (NC)	64.2	63.9	73.3	64.1	67.4	62.1	65.8	5
OS-6 (NC)	65.8	62.5	73.0	62.8	65.4	59.2	64.8	2
SKO-96 ZC (HZ)					66.2			
OS-403 (NWZ, NEZ, SZ)	66.0	64.2				60.5		
RO-11-1 ZC (CZ)			72.8	61.9				
Mean	**65.8**	**63.0**	**72.4**	**62.0**	**66.3**	**60.2**	**65.0**	

Table 6.9 AVT Oat (SC-1): First Advanced Varietal Trial in Oat (Single Cut): ADF (%), & IVDMD (%)

Entries	ADF (%)								IVDMD (%)				
	Pant-nagar	Ludh-iana	Ana-nd	Rah-uri	Palam-pur	Ran-chi	Aver-age	Ra-nk	Ludh-iana	Rah-uri	Ran-chi	Aver-age	Ra-nk
HFO-904	56.0	45.9	36.4	40.6	55.8	35.9	52.8	5	43.9	56.3	60.2	53.5	5
HFO-906	55.8	42.1	37.3	40.5	56.6	35.5	51.8	3	51.4	56.7	62.1	56.7	2
OL-1960	56.6	46.2	34.2	36.6	56.0	25.2	49.5	1	46.8	59.8	68.4	58.3	1
JO-07-28	56.0	44.2	35.4	40.7	57.2	38.1	52.5	4	48.2	56.5	59.4	54.7	4
Kent (NC)	54.6	47.1	35.0	42.2	55.8	37.8	52.8	5	46.3	55.4	58.6	53.4	6
OS-6 (NC)	55.8	43.4	34.0	41.5	57.6	35.8	51.7	2	49.3	56	61.8	55.7	3
SKO-96 ZC (HZ)					57.4								
OS-403 (NWZ, NEZ, SZ)	57.4	46.2				35.2			45.4		61.5		
RO-11-1 ZC (CZ)			37.1	40.4						56.5			
Mean	**56.0**	**45.0**	**35.6**	**40.4**	**56.6**	**34.8**	**51.9**		**47.3**	**56.7**	**61.7**	**55.3**	

Table 7.1: AVT Oat (SC)-2: Second Advanced Varietal Trial in Oats (Single Cut): Green Forage Yield (q/ha)

Entries	Hill Zone					
	Palampur	Srinagar	Rajouri	Average	Rank	Superiority%
OL-1874-1	182.8	371.0	183.0	245.6	10	
OL-1876-1	157.4	379.0	205.0	247.1	9	
RO-11-1-3	177.8	372.0	236.7	262.2	3	
JO-06-23	186.0	379.3	231.0	265.4	2	2.7
SKO-241	192.3	377.0	195.0	254.8	6	
RO-11-1-2	226.0	376.0	215.8	272.6	1	5.4
HFO-806	163.8	378.7	210.0	250.8	8	
Kent (NC)	186.0	372.7	208.5	255.7	5	
OS-6 (NC)	180.9	372.7	222.2	258.6	4	
SKO-96 ZC (HZ)	186.0	380.7	187.5	251.4	7	
Mean	**183.9**	**375.9**	**209.5**	**256.4**		
CD at 5%	**31.7**	**5.2**	**3.7**			
CV%	**10.0**	**1.9**	**8.6**			

Table 7.1: AVT Oat (SC)-2: Second Advanced Varietal Trial in Oats (Single Cut): Green Forage Yield (q/ha)

Entries	Central Zone								
	Jhansi	Rahuri	Urulikanchan	Karjat	Anand	Jabalpur	Raipur	Average	Rank
OL-1874-1	563.6	374.2	353.6	123.1	565.8	618.9	239.6	405.5	9
OL-1876-1	621.0	290.2	385.2	121.1	589.4	551.1	236.4	399.2	10
RO-11-1-3	600.6	466.2	609.6	151.3	655.6	631.3	378.5	499.0	1
JO-06-23	700.6	440.3	408.1	144.9	727.2	637.1	252.4	472.9	4
SKO-241	700.6	394.8	510.5	162.1	841.9	600.3	268.3	496.9	2
RO-11-1-2	592.0	471.3	477.0	122.7	625.0	590.1	389.7	466.8	5
HFO-806	623.5	469.9	446.9	117.5	639.4	626.4	239.6	451.9	6
Kent (NC)	598.8	444.8	421.4	150.5	594.4	545.3	332.2	441.1	8
OS-6 (NC)	680.9	398.1	483.9	118.0	450.3	626.0	356.2	444.8	7
RO-11-1 ZC (CZ)	685.2	458.5	529.6	165.9	662.8	664.6	268.3	490.7	3
Mean	**636.7**	**420.8**	**462.6**	**137.7**	**635.2**	**609.1**	**296.1**	**456.9**	
CD at 5%	**25.4**	**46.7**	**69.7**	**26.9**	**144.7**	**4.0**	**64.8**		
CV%	**14.8**	**6.5**	**8.7**	**11.0**	**13.3**	**9.0**	**12.8**		

Table 7.1: AVT Oat (SC)-2: Second Advanced Varietal Trial in Oats (Single Cut): Green Forage Yield (q/ha)

Entries	South Zone							All India		
	Hydera-bad	Man-dya	Coimb-atore	Matttu-petty	Aver-age	Ra-nk	Supeio-rity(%)	Aver-age	Ra-nk	Superi-ority%
OL-1874-1	183.3	263.8	365.3	430.0	310.6	6		344.1	8	
OL-1876-1	199.9	260.2	416.9	387.0	316.0	3	0.4	342.8	9	
RO-11-1-3	277.7	296.0	329.2	336.0	309.7	7		394.2	2	8.3
JO-06-23	238.8	288.6	377.5	292.0	299.2	9		378.8	5	4.1
SKO-241	277.7	299.3	392.5	417.0	346.6	2	10.1	402.1	1	10.5
RO-11-1-2	249.9	296.5	362.5	353.0	315.5	4	0.2	382.0	3	5.0
HFO-806	224.9	282.2	412.5	478.0	349.4	1	11.0	379.5	4	4.3
Kent (NC)	252.7	263.0	343.9	250.0	277.4	10		354.6	7	
OS-6 (NC)	263.8	270.8	353.9	317.0	301.4	8		363.9	6	
OS-403 ZC (SZ)	261.0	283.8	386.4	328.0	314.8	5				
Mean	**243.0**	**280.4**	**374.1**	**358.8**	**314.1**			**371.3**		
CD at 5%	**35.7**	**38.5**	**36.4**	**1.0**						
CV%	**8.5**	**8.0**	**5.7**	**6.7**						

Table 7.2: AVT Oat (SC)-2: Second Advanced Varietal Trial in Oats (Single Cut): Dry Matter Yield (q/ha)

Entries	Hill Zone				
	Palampur	Srinagar	Average	Rank	Superiority%
OL-1874-1	40.6	77.4	59.0	4	
OL-1876-1	37.1	75.5	56.3	9	
RO-11-1-3	42.3	74.4	58.4	6	
JO-06-23	43.0	71.1	57.1	8	
SKO-241	46.5	74.2	60.3	2	1.4
RO-11-1-2	52.1	76.0	64.1	1	7.6
HFO-806	38.8	73.2	56.0	10	
Kent (NC)	42.3	76.8	59.5	3	
OS-6 (NC)	42.8	74.5	58.6	5	
SKO-96 ZC (HZ)	43.6	72.2	57.9	7	
Mean	**42.9**	**74.5**	**58.7**		
CD at 5%	**NS**	**4.1**			
CV%	**12.4**	**7.3**			

Table 7.2: AVT Oat (SC)-2: Second Advanced Varietal Trial in Oats (Single Cut): Dry Matter Yield (q/ha)

Entries	Central Zone								
	Jhansi	Rahuri	Urulikanchan	Karjat	Anand	Jabalpur	Raipur	Average	Rank
OL-1874-1	59.8	71.1	61.0	31.2	83.0	135.3	56.9	71.2	8
OL-1876-1	67.1	57.6	68.0	29.8	88.0	119.1	55.8	69.3	9
RO-11-1-3	67.5	93.9	85.3	43.4	119.1	143.2	69.4	88.8	2
JO-06-23	78.4	92.4	70.2	46.1	106.1	145.0	63.2	85.9	3
SKO-241	74.7	88.0	102.1	50.6	123.5	130.9	64.7	90.7	1
RO-11-1-2	67.0	87.2	64.3	26.7	107.1	128.3	65.8	78.0	5
HFO-806	65.2	96.7	56.6	28.0	101.1	141.3	55.4	77.7	6
Kent (NC)	65.4	77.8	53.4	41.0	114.8	112.9	72.8	76.9	7
OS-6 (NC)	78.9	96.7	53.3	28.1	91.1	139.3	64.9	78.9	4
RO-11-1 ZC (CZ)	73.1	103.5	81.9	47.4	114.4	151.2	63.3	90.7	1
Mean	**69.7**	**86.5**	**69.6**	**37.2**	**104.8**	**134.7**	**63.2**	**80.8**	
CD at 5%	**6.7**	**9.6**	**10.9**	**7.7**	**NS**	**0.9**	**10.1**		
CV%	**3.9**	**6.4**	**9.1**	**11.6**	**14.6**	**10.9**	**9.3**		

Table 7.2: AVT Oat (SC)-2: Second Advanced Varietal Trial in Oats (Single Cut): Dry Matter Yield (q/ha)

Entries	South Zone							All India		
	Hydera-bad	Man-dya	Coimb-atore	Matttu-petty	Aver-age	Ra-nk	Supeio-rity(%)	Average	Rank	Superiority%
OL-1874-1	36.2	53.8	76.1	107.6	68.4	5		68.5	8	
OL-1876-1	35.3	53.7	86.6	96.6	68.0	6		66.9	9	
RO-11-1-3	52.6	67.3	64.6	84.0	67.2	8		77.5	2	7.2
JO-06-23	50.2	64.5	73.9	72.9	65.4	9		75.2	3	4.0
SKO-241	54.8	73.7	80.5	104.2	78.3	2	11.4	82.2	1	13.8
RO-11-1-2	46.5	68.8	77.2	88.2	70.2	4		73.5	5	24.2
HFO-806	42.8	62.8	89.4	119.5	78.6	1	11.9	74.7	4	3.4
Kent (NC)	50.2	60.0	73.6	62.5	61.6	10		69.5	7	
OS-6 (NC)	56.2	57.8	76.3	79.3	67.4	7		72.3	6	
OS-403 ZC (SZ)	53.3	66.2	79.6	82.0	70.3	3				
Mean	**47.8**	**62.9**	**77.8**	**89.7**	**69.5**			**73.3**		
CD at 5%	**13.8**	**10.2**	7.8	**5.2**						
CV%	**16.6**	**9.4**	5.9	**8.0**						

Table 7.3: AVT Oat (SC)-2: Second Advanced Varietal Trial in Oats (Single Cut): Green Forage Yield (q/ha/day)

Entries	Palam-pur	Rah-uri	Urulikan-chan	Ana-nd	Rai-pur	Kar-jat	Hydera-bad	Man-dya	Coimb-atore	Matttu-petty	Aver-age	Ra-nk
OL-1874-1	1.50	3.83	3.80	6.29	2.72	1.79	2.69	4.37	4.01	5.20	3.62	8
OL-1876-1	1.21	3.01	4.14	6.41	2.75	1.92	2.91	3.68	4.53	4.70	3.53	9
RO-11-1-3	1.39	6.33	8.35	7.99	4.21	2.48	3.61	4.65	4.01	4.07	4.71	1
JO-06-23	1.52	5.18	4.39	7.74	2.74	2.1	3.50	4.01	4.19	3.53	3.89	7
SKO-241	1.52	3.95	6.72	8.34	2.53	2.05	2.80	3.92	4.36	5.03	4.12	4
RO-11-1-2	1.96	6.07	5.48	7.62	4.33	1.95	3.33	4.04	4.26	4.30	4.33	2
HFO-806	1.36	5.02	5.14	7.35	2.60	1.78	3.36	3.52	4.63	5.83	4.06	6
Kent (NC)	1.65	5.73	4.84	7.25	4.26	2.39	3.59	4.09	4.09	3.00	4.09	5
OS-6 (NC)	1.54	5.13	6.63	5.63	5.02	1.81	3.88	3.71	4.26	4.00	4.16	3
SKO-96 ZC (HZ)	1.43											
RO-11-1 ZC (CZ)		5.44	6.09	7.05	3.23	2.72						
OS-403 ZC (SZ)							3.48	4.51	4.55	4.00		
Mean	**1.51**	**4.97**	**5.56**	**7.17**	**3.44**	**2.10**	**3.32**	**4.05**	**4.29**	**4.37**	**4.06**	

Table 7.4: AVT Oat (SC)-2: Second Advanced Varietal Trial in Oats (Single Cut): Dry Matter Yield (q/ha/day)

Entries	Rah-uri	Urulikan-chan	Ana-nd	Rai-pur	Kar-jat	Hydera-bad	Man-dya	Coimb-atore	Matttu-petty	Aver-age	Ra-nk
OL-1874-1	0.73	0.66	0.92	0.65	0.45	0.53	0.89	0.84	1.33	0.78	6
OL-1876-1	0.60	0.73	0.96	0.65	0.47	0.51	0.76	0.94	1.13	0.75	7
RO-11-1-3	1.27	1.17	1.45	0.77	0.71	0.68	1.05	0.79	1.00	0.99	1
JO-06-23	1.09	0.76	1.13	0.69	0.67	0.74	0.90	0.82	0.87	0.85	5
SKO-241	0.88	1.34	1.22	0.61	0.64	0.55	0.97	0.89	0.90	0.89	2
RO-11-1-2	1.12	0.74	1.31	0.73	0.42	0.62	0.94	0.91	1.07	0.87	4
HFO-806	1.03	0.65	1.16	0.60	0.42	0.64	0.86	1.00	1.47	0.87	4
Kent (NC)	1.00	0.61	1.40	0.93	0.65	0.71	0.94	0.88	0.77	0.88	3
OS-6 (NC)	1.24	0.73	1.14	0.91	0.46	0.83	0.79	0.92	0.97	0.89	2
RO-11-1 ZC (CZ)	1.23	0.94	1.22	0.76	0.78						
OS-403 ZC (SZ)						0.71	1.05	0.94	1.00		
Mean	**1.02**	**0.83**	**1.19**	**0.73**	**0.57**	**0.65**	**0.92**	**0.89**	**1.05**	**0.86**	

Table 7.5: AVT Oat (SC)-2: Second Advanced Varietal Trial in Oats (Single Cut): Crude Protein Yield (q/ha)

Entries	Palam-pur	Rah-uri	Urulikan-chan	Ana-nd	Jabal-pur	Rai-pur	Hydera-bad	Man-dya	Coimb-atore	Mattu-petty	Aver-age	Ra-nk
OL-1874-1	4.3	6.6	5.3	8.0	11.0	4.8	3.1	4.7	7.7	6.7	6.2	5
OL-1876-1	3.8	4.0	6.1	7.9	9.6	4.9	2.5	3.7	9.1	4.7	5.6	7
RO-11-1-3	3.4	8.4	8.5	12.2	11.7	6.0	4.3	5.7	4.5	4.4	6.9	2
JO-06-23	4.9	6.2	5.3	8.9	11.9	5.0	3.8	5.1	4.5	4.1	6.0	6
SKO-241	4.7	7.1	9.0	12.2	10.7	4.0	4.6	6.5	8.8	6.8	7.4	1
RO-11-1-2	5.3	6.0	5.7	10.7	10.4	6.0	4.2	6.6	7.8	3.9	6.7	3
HFO-806	3.6	7.3	5.2	8.3	11.6	4.7	3.9	5.8	6.6	5.8	6.3	4
Kent (NC)	3.9	5.4	4.6	11.1	9.1	4.6	4.1	5.0	5.2	3.5	5.6	7
OS-6 (NC)	4.2	7.6	4.8	8.8	11.4	5.8	4.6	4.8	5.6	4.2	6.2	5
SKO-96 ZC (HZ)	4.7											
RO-11-1 ZC (CZ)		6.5	6.5	10.1	11.9	4.9						
OS-403 ZC (SZ)							4.8	6.1	8.4	3.6		
Mean	**4.3**	**6.5**	**6.1**	**9.8**	**10.9**	**5.1**	**4.0**	**5.4**	**6.8**	**4.8**	**6.3**	

Table 7.6: AVT Oat (SC)-2: Second Advanced Varietal Trial in Oats (Single Cut): Crude Protein (%)

Entries	Palam-pur	Rah-uri	Urulikan-chan	Ana-nd	Jabal-pur	Rai-pur	Hydera-bad	Man-dya	Coimb-atore	**Matttu-petty	Aver-age	Ra-nk
OL-1874-1	10.5	9.2	8.7	9.8	8.2	8.4	8.5	8.8	10.1	6.2	9.1	1
OL-1876-1	10.2	6.9	9.0	8.9	8.1	8.8	7.2	7.0	10.5	4.8	8.5	4
RO-11-1-3	8.2	9.0	9.9	10.1	8.2	8.8	8.2	8.3	7.0	5.2	8.6	3
JO-06-23	11.4	6.7	7.5	8.4	8.2	7.9	7.6	7.9	6.1	5.7	8.0	5
SKO-241	10.2	8.0	8.8	9.8	8.2	6.2	8.3	8.8	10.9	6.6	8.8	2
RO-11-1-2	10.2	6.9	8.9	10.0	8.1	9.2	9.1	9.6	10.1	4.4	9.1	1
HFO-806	9.3	7.5	9.1	8.2	8.2	8.5	9.0	9.2	7.4	4.9	8.5	4
Kent (NC)	9.3	6.9	8.7	9.5	8.1	6.3	8.1	8.3	7.0	5.6	8.0	5
OS-6 (NC)	9.9	7.9	8.9	9.7	8.2	9.1	8.2	8.3	7.4	5.3	8.6	3
SKO-96 ZC (HZ)	10.8											
RO-11-1 ZC (CZ)		6.3	7.9	8.9	8.2	7.8						
OS-403 ZC (SZ)							9.0	9.2	10.5	4.4		
Mean	**10.0**	**7.5**	**8.8**	**9.3**	**8.2**	**8.1**	**8.3**	**8.5**	**8.7**	**5.3**	**8.6**	

Note: ** Data is not included in zonal and all India average due to low yield of data

Table 7.7: AVT Oat (SC)-2: Second Advanced Varietal Trial in Oats (Single Cut): Plant Height (cm)

Entries	Palam pur	Sri-nagar	Jha-nsi	Rah-uri	Urulikan chan	Ana-nd	Jabal-pur	Rai-pur	Kar-jat	Hydera bad	Man-dya	Coimb-atore	Matttu-petty	Aver-age	Ra-nk
OL-1874-1	106.7	104.7	160.8	122.7	79.1	130.7	123.6	140.0	124.4	65.8	96.7	128.5	135.0	116.8	4
OL-1876-1	110.3	111.3	173.8	138.7	75.1	135.9	113.1	141.2	131.4	77.1	96.4	138.5	147.0	122.3	1
RO-11-1-3	118.0	108.7	111.0	102.6	83.0	126.3	134.0	106.9	125.2	71.6	102.5	102.0	121.0	108.7	7
JO-06-23	114.3	108.0	150.1	106.6	90.9	131.3	141.5	135.4	125.6	74.4	92.4	122.4	128.0	117.0	3
SKO-241	99.3	133.3	141.6	119.0	96.0	121.7	120.8	105.8	104.6	65.2	106.8	131.5	108.0	111.8	5
RO-11-1-2	91.0	138.7	122.4	109.6	74.1	117.3	116.1	109.8	121.8	78.9	107.3	105.5	123.0	108.9	6
HFO-806	106.3	138.7	157.7	121.7	72.8	139.4	130.5	130.9	117.2	69.7	97.7	136.7	129.0	119.1	2
Kent (NC)	82.0	106.7	115.3	108.5	72.9	131.1	116.7	117.0	94.6	66.7	94.6	115.5	119.0	103.1	9
OS-6 (NC)	80.7	104.7	114.7	110.7	77.9	134.9	125.6	115.3	121.5	79.0	83.3	128.5	133.0	108.4	8
SKO-96 ZC (HZ)	112.3	134.3													
RO-11-1 ZC (CZ)			156.0	118.1	93.8	129.5	145.5	127.3	126.6						
OS-403 ZC (SZ)										75.6	100.3	134.4	128.0		
Mean	**102.1**	**118.9**	**140.3**	**115.8**	**81.6**	**129.8**	**126.7**	**122.9**	**119.3**	**72.4**	**97.8**	**124.4**	**127.1**	**112.9**	

Table 7.8: AVT Oat (SC)-2: Second Advanced Varietal Trial in Oats (Single Cut): Leaf Stem Ratio

Entries	Palam-pur	Sri-nagar	Rah-uri	Urulikan-chan	Ana-nd	Jabal-pur	Rai-pur	Kar-jat	Hydera-bad	Man-dya	Coimb-atore	Matttu-petty	Aver-age	Ra-nk
OL-1874-1	0.25	0.37	0.57	0.68	1.58	0.76	0.53	0.39	0.70	0.70	0.38	0.62	0.63	3
OL-1876-1	0.29	0.38	0.54	0.73	1.56	0.6	0.47	0.56	0.58	0.68	0.41	0.42	0.60	5
RO-11-1-3	0.33	0.36	0.78	0.79	1.23	0.58	0.42	0.49	0.50	0.72	0.35	0.39	0.58	6
JO-06-23	0.28	0.37	0.43	0.82	1.79	0.65	0.38	0.46	0.52	0.73	0.36	0.51	0.61	4
SKO-241	0.32	0.39	0.52	0.48	1.60	0.64	0.5	0.70	0.6	0.68	0.39	0.50	0.61	4
RO-11-1-2	0.33	0.36	0.47	0.53	1.15	0.66	0.51	0.54	0.65	0.86	0.36	0.33	0.56	7
HFO-806	0.27	0.42	0.70	0.77	1.67	0.59	0.63	0.62	0.77	0.68	0.39	0.57	0.67	1
Kent (NC)	0.45	0.35	0.75	0.53	1.48	0.68	0.55	0.42	0.52	0.80	0.35	0.46	0.61	4
OS-6 (NC)	0.38	0.38	0.52	0.81	2.24	0.69	0.46	0.52	0.46	0.64	0.35	0.35	0.65	2
SKO-96 ZC (HZ)	0.32	0.36												
RO-11-1 ZC (CZ)			0.62	0.78	1.62	0.75	0.48	0.48						
OS-403 ZC (SZ)									0.63	0.72	0.37	0.70		
Mean	**0.32**	**0.37**	**0.59**	**0.69**	**1.59**	**0.66**	**0.49**	**0.52**	**0.59**	**0.72**	**0.37**	**0.49**	**0.61**	

Table 7.9: AVT Oat (SC)-2: Second Advanced Varietal Trial in Oats (Single Cut): NDF (%), ADF (%) & IVDMD (%)

Entries	NDF (%)					ADF (%)					IVDMD (%)	
	Palam-pur	Rah-uri	Ana-nd	Aver-age	Ra-nk	Ana-nd	Palam-pur	Rah-uri	Aver-age	Ra-nk	Rah-uri	Ra-nk
OL-1874-1	67.6	60.1	71.3	66.3	4	33.8	55.6	40.5	43.3	2	57.0	4
OL-1876-1	68.2	62.2	72.4	67.6	8	35.2	59.0	42.4	45.5	8	55.5	7
RO-11-1-3	66.0	58.5	71.8	65.4	1	34.6	56.0	38.5	43.0	1	58.6	1
JO-06-23	68.4	61.9	71.3	67.2	7	36.0	58.6	41.3	45.3	7	56.4	5
SKO-241	66.2	59.1	71.1	65.5	2	35.7	58.0	39.3	44.3	6	58.0	2
RO-11-1-2	65.0	62.9	72.1	66.7	5	33.8	55.0	42.5	43.8	4	55.5	7
HFO-806	65.8	59.3	72.1	65.8	3	35.5	56.2	39.2	43.7	3	58.0	2
Kent (NC)	67.4	60.9	72.3	66.9	6	33.7	58.2	40.5	44.1	5	57.3	3
OS-6 (NC)	68.0	61.7	73.7	67.8	9	34.6	55.4	41.4	43.8	4	56.3	6
SKO-96 ZC (HZ)	65.4						56.0					
RO-11-1 ZC (CZ)		58.7	72.7			34.1		39.5			57.8	
Mean	**66.8**	**60.5**	**72.1**	**66.5**		**34.7**	**56.8**	**40.5**	**44.0**		**57.0**	

8. AVTO (SC)-2 (SEED): SECOND ADVANCED VARIETAL TRIAL IN OAT (SINGLE CUT) FOR SEED (Reference table 8.1)

In Second Advanced Varietal Trial Oat (Single cut) for seed, comprising of seven entries along with two national checks (OS-6 and Kent) and one zonal check (SKO-96 for HZ, OS-403 for SZ and RO-11-1 for CZ) for respective zones were evaluated at 10 locations across the three zones. There were 2 locations in HZ, 5 in CZ and 3 locations in South zone. In all the zones, checks were superior to the testing entries.

9. IVTO-MC: INITIAL VARIETAL TRIAL IN OAT (MULTI CUT)

(Reference tables 9.1 to 9.9)

In **Initial Varietal Trial in Oat (Multicut)** [**IVTO-MC],** nine entries were evaluated against two national checks (RO-19 and UPO-212) at 18 locations in four zones (HZ, NWZ, NEZ, and CZ). There were 3 locations in HZ, 4 in NWZ, 6 in NEZ and 5 in central zone.

For GFY (q/ha), entries JHO-20-3 (6.1%), HFO-915 (6.1%), PLP-27 (5.8%), OL-1949 (5.4%), JO-08-329 (5.2%), OL-1942 (0.5%) were superior over the best check in Hill Zone. In NWZ, JO-08-329 (5.0%), JHO-20-3 (4.0%), UPO-20-2 (3.6%), PLP-27 (1.8%), HFO-915 (1.3%), OL-1942 (0.8%) were superior over the best check. In NEZ and CZ, national check was superior. At all India level, all the entries were either inferior to the national checks. Only one entry HFO-915 was at par.

For DMY (q/ha), in HZ, entries PLP-27 (17.8%), JO-08-329 (14.7%), OL-1949 (9.5%), JHO-20-3 (9.2%), HFO-915 (7.9%), OL-1944 (2.3%), OL-1942 (2.3%) were superior over the best check. IN NWZ, entries JO-08-329 (7.1%), UPO-20-2 (5.4%), HFO-1016 (4.4%), HFO-915 (4.2%), JHO-20-3(3.6%) and PLP-27 (1.7%) were superior over the best check. In NEZ, CZ and at all India level, the national checks performed best.

For fodder production potential (q/ha/day), entry HFO-915 ranked first for green fodder yield whereas HFO-1016 was best for dry matter. Entry OL-1944 ranked first for plant height. Entry JHO-20-3 ranked first followed by JO-08-329 for leafiness.

For quality parameters, for crude protein yield, entry PLP-27 (9.5 q/ha) was ranked first followed by HFO-915 (9.2q/ha) whereas best check produced 9.0 q/ha and was ranked 4th. For crude protein content, entry UPO-20-2 (10.0%) ranked first followed closely by HFO-1016 (9.9%). Entry PLP-27 ranked first for NDF, UPO-20-2 for ADF and JO-08-329 for IVDMD%.

Table 8.1: AVT Oat (SC)-2 (Seed): Second Advanced Varietal Trial in Oats (Single Cut) (Seed): Seed Yield (q/ha)

Entries	Seed Yield (q/ha)																	
	Hill Zone				Central Zone							South Zone					All India	
	Palam-pur	Sri-nagar	Aver-age	Ra-nk	Jha-nsi	Rah-uri	Ana-nd	Jabal-pur	Rai-pur	Aver-age	Ra-nk	Hydera-bad	Man-dya	Coimb-atore	Aver-age	Ra-nk	Aver-age	Ra-nk
OL-1874-1	16.9	17.4	17.2	10	10.5	8.0	22.1	21.0	11.2	14.6	8	8.1	7.0	18.3	11.1	4	14.1	9
OL-1876-1	17.6	17.6	17.6	9	15.2	8.9	21.3	24.0	14.6	16.8	7	6.5	6.5	17.2	10.1	7	14.9	7
RO-11-1-3	19.1	17.2	18.1	8	9.9	13.8	20.3	27.3	14.5	17.2	6	8.0	10.1	15.6	11.2	3	15.6	6
JO-06-23	27.7	17.3	22.5	5	15.3	16.3	27.1	34.0	13.3	21.2	2	8.9	10.0	13.1	10.6	6	18.3	2
SKO-241	28.3	17.2	22.7	4	15.6	11.1	19.5	14.7	10.0	14.2	9	4.2	9.5	16.4	10.0	8	14.6	8
RO-11-1-2	28.5	17.8	23.2	3	11.1	15.0	33.9	22.3	15.4	19.5	3	9.4	9.9	14.4	11.3	2	17.8	3
HFO-806	29.8	18.0	23.9	2	13.2	15.7	29.2	20.3	10.4	17.8	5	5.2	9.2	14.2	9.5	10	16.5	4
Kent (NC)	20.1	18.0	19.1	7	15.3	13.4	37.6	48.7	15.9	26.2	1	6.7	6.9	18.9	10.8	5	20.1	1
OS-6 (NC)	21.5	17.3	19.4	6	11.0	16.4	23.7	25.3	14.1	18.1	4	4.3	7.8	17.5	9.9	9	15.9	5
SKO-96 ZC (HZ)	34.4	17.3	25.8	1													14.1	9
RO-11-1 ZC (CZ)					9.9	7.9	20.2	8.7	8.3	11.0	10							
OS-403 ZC (SZ)												3.1	9.4	21.9	11.5	1		
Mean	**24.4**	**17.5**	**21.0**		**12.7**	**12.7**	**25.5**	**24.6**	**12.8**	**17.6**		**6.4**	**8.6**	**16.7**	**10.6**		**16.2**	
CD at 5%	**8.3**	**0.4**			**5.9**	**2.4**	**7.4**	**0.3**	**2.1**			**1.6**	**1.5**	**1.7**				
CV%	**19.6**	**1.3**			**3.5**	**10.9**	**16.9**	**42.9**	**9.5**			**14.0**	**9.9**	**5.8**				

Table 9.1: IVTO (MC): Initial Varietal Trial in Oat (Multi cut): Green Forage Yield (q/ha)

Entries	Hill Zone						North West Zone						
	Palam-pur	Sri-nagar	Alm-ora	Aver-age	Ra-nk	Superi-ority%	His-ar	Ludh-iana	Pant-nagar	Jal-ore	Aver-age	Ra-nk	Super-iority%
PLP-27	177.1	346.0	235.7	252.9	3	5.8	745.9	771.5	612.8	376.4	626.6	4	1.8
OL-1944	225.4	374.0	116.7	238.7	8		678.8	565.4	603.8	400.4	562.1	11	
OL-1942	160.0	373.3	186.8	240.0	6	0.5	634.0	721.5	745.9	381.1	620.6	6	0.8
OL-1949	180.3	374.0	201.4	251.9	4	5.4	681.4	668.9	628.8	318.6	574.4	10	
JO-08-329	163.8	373.3	217.1	251.4	5	5.2	613.3	857.2	666.6	447.7	646.2	1	5.0
JHO-20-3	196.8	372.3	191.4	253.5	2	6.1	635.9	689.6	782.3	452.8	640.1	2	4.0
HFO-915	144.7	375.0	241.0	253.6	1	6.1	634.0	787.2	668.7	403.7	623.4	5	1.3
HFO-1016	149.1	373.3	189.6	237.3	9		696.2	771.9	642.8	342.1	613.3	8	
UPO-20-2	160.0	376.3	151.9	229.4	11		611.1	782.0	761.3	396.8	637.8	3	3.6
RO-19 (NC)	172.6	374.3	169.9	239.0	7		734.4	698.3	633.3	396.3	615.6	7	
UPO-212 (NC)	154.2	373.3	163.7	230.4	10			719.6	663.1	404.7	595.8	9	
Mean	**171.3**	**371.4**	**187.7**	**243.5**			**666.5**	**730.3**	**673.6**	**392.8**	**614.2**		
CD at 5%	**45.3**	**15.6**	**29.5**				**84.5**	**82.6**	**54.3**	**72.0**			
CV%	**15.4**	**2.5**	**9.2**				**7.3**	**13.8**	**12.8**	**10.7**			

Table 9.1: IVTO (MC): Initial Varietal Trial in Oat (Multi cut): Green Forage Yield (q/ha)

Entries	North East Zone							
	Ayodhya	Jorhat	Bhubaneswar	Imphal	Pusa	Ranchi	Average	Rank
PLP-27	586.7	312.1	375.2	607.3	510.0	446.8	473.0	5
OL-1944	570.7	341.3	323.9	427.0	586.7	308.6	426.4	10
OL-1942	608.0	325.8	343.9	568.0	493.3	392.3	455.2	7
OL-1949	536.0	270.4	408.6	517.7	666.7	347.9	457.9	6
JO-08-329	602.7	321.7	310.6	499.0	690.0	446.1	478.3	4
JHO-20-3	448.0	369.6	312.6	519.0	723.3	322.0	449.1	9
HFO-915	642.7	360.8	455.2	547.3	563.3	451.2	503.4	2
HFO-1016	536.0	382.5	366.6	480.7	396.7	347.8	418.4	11
UPO-20-2	586.7	360.0	462.6	601.3	593.3	330.4	489.0	3
RO-19 (NC)	629.3	473.8	421.2	703.7	603.3	417.7	541.5	1
UPO-212 (NC)	666.7	322.1	305.9	525.7	553.3	321.3	449.2	8
Mean	**583.0**	**349.1**	**371.5**	**545.2**	**580.0**	**375.6**	**467.4**	
CD at 5%	**132.6**	**13.1**	**1.8**	**7.5**	**130.9**	**45.6**		
CV%	**13.4**	**12.4**	**3.9**	**7.0**	**11.0**	**7.1**		

Table 9.1: IVTO (MC): Initial Varietal Trial in Oat (Multi cut): Green Forage Yield (q/ha)

Entries	Central Zone							All India		
	Jhansi	Anand	Jabalpur	Rahuri	Urulikanchan	Average	Rank	Average	Rank	Superiority%
PLP-27	381.7	471.9	670.3	349.3	540.8	482.8	7	473.2	4	
OL-1944	407.8	459.6	487.7	363.7	589.8	461.7	9	435.1	11	
OL-1942	413.2	468.1	587.0	364.1	633.0	493.1	5	466.6	7	
OL-1949	395.8	563.3	559.9	299.6	619.2	487.5	6	457.7	8	
JO-08-329	376.9	493.3	493.0	389.6	510.4	452.6	10	470.7	5	
JHO-20-3	372.4	626.7	550.2	303.3	680.0	506.5	3	474.9	3	
HFO-915	410.5	519.6	676.1	441.2	604.8	530.4	2	495.9	1	0.1
HFO-1016	393.1	508.5	463.3	435.2	589.8	478.0	8	448.1	10	
UPO-20-2	395.0	438.5	423.4	401.3	393.0	410.3	11	456.9	9	
RO-19 (NC)	407.6	399.3	618.5	404.1	656.0	497.1	4	495.2	2	
UPO-212 (NC)	414.4	563.7	669.4	446.5	694.4	557.7	1	468.3	6	
Mean	**397.1**	**501.1**	**563.5**	**381.6**	**591.9**	**487.1**		**467.5**		
CD at 5%	**29.0**	**NS**	**4.7**	**65.7**	131.3					
CV%	**17.3**	**15.0**	**16.1**	**10.3**	12.9					

Table 9.2: IVTO (MC): Initial Varietal Trial in Oat (Multi cut): Dry Matter Yield (q/ha)

Entries	Hill Zone						North West Zone						
	Palam-pur	Sri-nagar	Alm-ora	Aver-age	Ra-nk	Superi-ority%	His-ar	Ludh-iana	Pant-nagar	Jal-ore	Aver-age	Ra-nk	Super-iority%
PLP-27	32.5	78.2	50.9	53.9	1	17.8	170.6	155.1	104.2	62.6	123.1	7	1.7
OL-1944	44.2	72.6	23.6	46.8	7	2.3	157.5	116.5	100.2	69.9	111.0	10	
OL-1942	30.1	72.0	38.3	46.8	7	2.3	159.7	150.1	124.6	65.5	125.0	6	
OL-1949	36.9	70.3	43.1	50.1	3	9.5	159.0	137.1	106.3	55.8	114.5	9	
JO-08-329	31.7	79.0	46.7	52.5	2	14.7	150.8	178.3	112.0	77.3	129.6	1	7.1
JHO-20-3	39.7	68.3	41.7	49.9	4	9.2	155.8	137.9	126.7	81.0	125.4	5	3.6
HFO-915	26.4	71.0	50.6	49.3	5	7.9	161.7	159.8	113.7	69.4	126.2	4	4.2
HFO-1016	27.5	75.0	43.8	48.8	6		178.7	158.2	108.6	60.0	126.4	3	4.4
UPO-20-2	30.4	68.0	27.9	42.1	10		154.0	158.0	129.4	69.0	127.6	2	5.4
RO-19 (NC)	32.2	71.5	32.8	45.5	9		169.6	142.5	104.5	67.6	121.1	8	
UPO-212 (NC)	31.1	73.2	32.9	45.7	8			147.5	110.1	69.2	108.9	11	
Mean	**33.0**	**72.6**	**39.3**	**48.3**			**161.7**	**149.2**	**112.8**	**67.9**	**121.7**		
CD at 5%	**10.0**	**3.8**	**6.1**				**N/A**	**38.9**	**9.6**	**11.2**			
CV%	**17.7**	**6.6**	**9.1**				**10.4**	**10.7**	**8.8**	**9.6**			

Table 9.2: IVTO (MC): Initial Varietal Trial in Oat (Multi cut): Dry Matter Yield (q/ha)

Entries	North East Zone							
	Ayodhya	Jorhat	Bhubaneswar	Imphal	Pusa	Ranchi	Average	Rank
PLP-27	134.9	88.6	82.2	113.8	101.2	57.0	96.3	4
OL-1944	134.0	98.5	72.5	72.6	109.3	41.7	88.1	9
OL-1942	145.9	95.7	76.0	95.8	98.7	52.0	94.0	5
OL-1949	123.2	76.6	89.9	85.8	126.1	48.7	91.7	8
JO-08-329	135.6	81.4	70.7	90.3	133.9	65.8	96.3	4
JHO-20-3	109.7	108.8	70.0	88.5	144.2	40.7	93.6	6
HFO-915	144.5	91.5	94.8	100.9	107.0	56.4	99.2	2
HFO-1016	117.9	96.0	81.1	82.3	92.4	52.6	87.0	10
UPO-20-2	137.8	96.9	102.2	97.2	113.1	44.6	98.6	3
RO-19 (NC)	141.6	122.7	91.4	120.6	115.4	48.6	106.7	1
UPO-212 (NC)	151.9	89.3	67.3	89.4	107.2	47.0	92.0	7
Mean	**134.3**	**95.1**	**81.6**	**94.3**	**113.5**	**50.4**	**94.9**	
CD at 5%	**30.8**	**5.4**	0.4		19.3			
CV%	**13.5**	**9.7**	4.2		8.3			

Table 9.2: IVTO (MC): Initial Varietal Trial in Oat (Multi cut): Dry Matter Yield (q/ha)

Entries	Central Zone							All India	
	Jhansi	Anand	Jabalpur	Rahuri	Urulikanchan	Average	Rank	Average	Rank
PLP-27	71.7	72.5	142.8	68.4	80.1	87.1	5	92.6	3
OL-1944	77.4	62.7	105.3	48.4	70.5	72.9	9	82.1	11
OL-1942	81.7	72.9	125.2	80.0	88.0	89.5	2	91.8	4
OL-1949	81.3	79.7	120.9	55.7	69.8	81.5	7	87.0	10
JO-08-329	72.4	88.7	107.0	67.8	57.5	78.7	8	91.5	6
JHO-20-3	81.3	102.3	118.1	51.1	83.6	87.3	4	91.6	5
HFO-915	80.6	76.4	145.1	76.7	67.7	89.3	10	94.1	2
HFO-1016	86.6	76.2	100.1	98.9	84.9	89.3	3	90.0	7
UPO-20-2	75.9	63.8	92.2	54.9	60.0	69.4	3	87.5	9
RO-19 (NC)	84.3	55.1	132.0	80.5	83.3	87.0	6	94.2	1
UPO-212 (NC)	86.9	84.0	142.9	83.0	77.1	94.8	1	87.7	8
Mean	**80.0**	**75.8**	**121.1**	**69.6**	**74.8**	**84.3**		**90.0**	
CD at 5%	**15.5**	**20.9**	**1.0**	**11.5**	**16.4**				
CV%	**9.3**	**16.2**	**15.6**	**9.9**	**12.8**				

Table 9.3: IVTO (MC): Initial Varietal Trial in Oat (Multi cut): Green Forage Yield (q/ha/day)

Entries	Hisar	Ludhiana	Pantnagar	Ayodhya	Jorhat	Bhubaneswar	Pusa	Ranchi	Anand	Rahuri	Urulikanchan	Average	Rank
PLP-27	6.04	6.30	5.06	5.64	3.29	4.89	5.90	4.57	4.45	3.53	5.69	5.03	9
OL-1944	5.54	4.60	4.99	5.43	3.63	4.15	7.10	3.23	4.34	3.55	6.21	4.80	11
OL-1942	5.36	5.90	6.16	5.73	3.47	4.37	5.90	3.77	4.46	3.75	6.66	5.05	8
OL-1949	5.64	5.40	5.20	5.36	2.88	4.98	8.80	3.73	5.37	3.23	6.52	5.19	4
JO-08-329	5.28	7.00	5.51	5.63	3.42	3.87	9.20	4.32	4.25	3.91	5.37	5.25	2
JHO-20-3	5.26	5.60	6.47	4.07	3.93	4.11	8.50	3.04	5.55	3.02	7.16	5.16	6
HFO-915	5.42	6.40	5.53	6.23	3.57	5.62	6.80	4.31	4.81	4.35	6.37	5.40	1
HFO-1016	5.68	6.30	5.31	5.25	3.79	4.84	5.10	3.81	4.84	4.73	6.21	5.08	7
UPO-20-2	5.07	6.40	6.30	5.14	3.46	5.69	7.50	3.38	3.99	3.91	4.14	5.00	10
RO-19 (NC)	6.00	5.70	5.23	5.11	4.69	5.03	7.20	3.99	3.63	3.86	6.90	5.21	3
UPO-212 (NC)		5.90	5.48	6.47	3.43	3.72	6.50	3.23	5.17	4.57	7.31	5.18	5
Mean	**5.53**	**5.95**	**5.57**	**5.46**	**3.60**	**4.66**	**7.14**	**3.76**	**4.62**	**3.86**	**6.23**	**5.12**	

Table 9.4: IVTO (MC): Initial Varietal Trial in Oat (Multi cut): Dry Matter Yield (q/ha/day)

Entries	Hisar	Ludhiana	Pantnagar	Ayodhya	Jorhat	Bhubaneswar	Pusa	Ranchi	Anand	Rahuri	Urulikanchan	Average	Rank
PLP-27	1.38	1.30	0.86	1.29	0.93	1.07	1.20	0.58	0.68	0.69	0.84	0.98	5
OL-1944	1.29	0.90	0.83	1.27	1.05	0.93	1.30	0.44	0.59	0.47	0.74	0.89	8
OL-1942	1.35	1.20	1.03	1.37	1.02	0.97	1.20	0.50	0.69	0.82	0.93	1.01	2
OL-1949	1.31	1.10	0.88	1.23	0.82	1.10	1.70	0.52	0.76	0.60	0.74	0.98	5
JO-08-329	1.30	1.40	0.93	1.26	0.87	0.88	1.80	0.64	0.76	0.68	0.61	1.01	2
JHO-20-3	1.29	1.10	1.05	0.99	1.16	0.92	1.70	0.38	0.91	0.51	0.88	0.99	4
HFO-915	1.38	1.30	0.94	1.40	0.91	1.17	1.30	0.54	0.71	0.76	0.71	1.01	2
HFO-1016	1.46	1.30	0.90	1.15	0.95	1.07	1.20	0.58	0.73	1.08	0.89	1.03	1
UPO-20-2	1.28	1.30	1.07	1.20	0.93	1.26	1.40	0.46	0.58	0.53	0.63	0.97	6
RO-19 (NC)	1.39	1.20	0.86	1.15	1.21	1.09	1.40	0.46	0.50	0.77	0.88	0.99	4
UPO-212 (NC)		1.20	0.91	1.47	0.95	0.82	1.30	0.47	0.77	0.85	0.81	0.96	7
Mean	**1.34**	**1.21**	**0.93**	**1.25**	**0.98**	**1.03**	**1.41**	**0.51**	**0.70**	**0.71**	**0.79**	**0.98**	

Table 9.5: IVTO (MC): Initial Varietal Trial in Oat (Multi cut): Crude Protein Yield (q/ha)

Entries	Palam-pur	Ludh-iana	His-ar	Ayod-hya	Jor-hat	Bhuban-eswar	Imp-hal	Ran-chi	Ana-nd	Jabal-pur	Rah-uri	Urulikan-chan	Aver-age	Ra-nk
PLP-27	3.4	27.9	15.0	10.7	3.8	7.5	10.5	4.7	6.8	10.9	5.7	6.9	9.5	1
OL-1944	4.1	18.5	13.9	10.7	4.8	6.4	6.5	2.7	6.5	8.0	4.4	6.4	7.7	7
OL-1942	3.0	24.3	12.2	11.8	4.5	6.8	9.0	3.0	7.9	9.4	5.2	8.0	8.8	5
OL-1949	3.9	23.3	12.3	10.6	3.7	8.1	7.9	3.4	7.7	9.3	4.0	5.9	8.3	6
JO-08-329	3.4	31.2	12.4	10.4	3.5	6.2	8.3	4.5	6.4	8.1	5.6	5.5	8.8	5
JHO-20-3	3.5	22.1	12.9	9.0	5.2	6.2	8.3	4.1	9.6	8.8	3.6	6.8	8.3	6
HFO-915	2.7	27.2	13.4	11.3	4.2	9.0	8.8	4.3	6.6	11.2	6.1	6.1	9.2	2
HFO-1016	2.8	25.9	14.6	9.0	4.0	7.3	7.0	4.3	9.9	7.1	8.8	8.4	9.1	3
UPO-20-2	3.0	28.1	13.0	10.7	4.1	9.2	8.5	3.6	8.4	6.6	4.5	5.9	8.8	5
RO-19 (NC)	3.1	22.4	13.2	10.8	5.2	8.3	10.7	3.8	6.0	10.0	6.6	8.3	9.0	4
UPO-212 (NC)	3.2	24.6		11.7	4.1	6.1	7.8	3.5	8.7	10.3	6.3	7.5	8.5	5
Mean	**3.3**	**25.0**	**13.3**	**10.6**	**4.3**	**7.4**	**8.5**	**3.8**	**7.7**	**9.1**	**5.5**	**6.9**	**8.7**	

Table 9.6: IVTO (MC): Initial Varietal Trial in Oat (Multi cut): Crude Protein (%)

Entries	Palam-pur	Ludh-iana	His-ar	Ayod-hya	Jor-hat	Bhuban-eswar	Imp-hal	Ran-chi	Ana-nd	Jabal-pur	Rah-uri	Urulikan-chan	Aver-age	Ra-nk
PLP-27	10.2	18.0	8.8	7.9	10.5	9.1	9.4	8.2	12.0	7.6	8.4	8.6	9.9	2
OL-1944	9.0	15.9	8.8	8.0	10.6	8.9	9.4	6.4	12.5	7.6	9.0	9.1	9.6	5
OL-1942	10.2	16.2	7.7	8.1	10.7	9.0	9.8	5.8	13.2	7.5	6.5	9.1	9.5	6
OL-1949	10.5	17.0	7.7	7.8	11.0	9.0	9.9	7.0	12.1	7.7	7.1	8.5	9.6	5
JO-08-329	10.8	17.5	8.2	7.7	10.7	8.7	9.5	6.8	11.9	7.5	8.2	9.5	9.8	3
JHO-20-3	8.8	16.0	8.3	8.2	11.5	8.9	9.6	10.0	13.2	7.5	7.0	8.2	9.8	3
HFO-915	10.2	17.0	8.3	7.8	10.9	9.5	8.9	7.6	11.1	7.7	8.0	9.0	9.7	4
HFO-1016	10.5	16.4	8.2	7.6	10.8	9.0	8.6	8.2	13.9	7.1	8.9	9.9	9.9	2
UPO-20-2	9.9	17.8	8.5	7.8	11.1	9.0	9.2	8.0	13.7	7.1	8.2	9.8	10.0	1
RO-19 (NC)	9.6	15.7	7.8	7.6	10.7	9.1	9.0	7.8	12.1	7.6	8.1	10.0	9.6	5
UPO-212 (NC)	10.2	16.7		7.7	10.8	9.1	9.0	7.4	12.6	7.2	7.5	9.7	9.8	4
Mean	**10.0**	**16.7**	**8.2**	**7.8**	**10.8**	**9.0**	**9.3**	**7.6**	**12.6**	**7.5**	**7.9**	**9.2**	**9.7**	

Table 9.7: IVTO (MC): Initial Varietal Trial in Oat (Multi cut): Plant Height (cm)

Entries	Palam-pur	Sri-nagar	His-ar	Ludh-iana	Pant-nagar	Ayod-hya	Jor-hat	Bhuban-eswar	Imp-hal	Pu-sa	Ran-chi	Jha-nsi	Ana-nd	Jabal-pur	Rah-uri	Urulikan-chan	Aver-age	Ra-nk
PLP-27	47.0	159.7	88.0	132.4	136.6	128.0	83.8	117.2	90.0	145.9	98.2	100.2	87.8	105.7	75.4	64.8	103.8	4
OL-1944	60.0	155.7	93.0	118.6	161.5	143.0	86.6	104.2	92.9	141.7	120.8	105.0	92.9	121.4	86.2	61.2	109.0	1
OL-1942	44.7	129.0	92.0	128.6	159.5	133.2	91.5	107.3	90.1	133.3	107.6	108.2	94.7	128.2	84.9	57.1	105.6	3
OL-1949	48.3	135.7	91.0	120.6	160.1	136.6	89.8	114.4	85.3	135.0	119.5	105.3	93.0	118.8	84.0	52.3	105.6	3
JO-08-329	48.7	141.7	86.0	142.6	128.3	115.9	84.1	98.7	88.6	131.3	94.7	101.1	94.3	116.7	78.5	54.1	100.3	7
JHO-20-3	38.7	137.3	85.0	124.5	127.6	107.1	78.8	96.5	71.9	130.0	82.3	91.7	88.0	79.6	67.8	52.6	91.2	10
HFO-915	54.3	111.3	87.0	133.6	142.3	134.0	93.6	121.5	87.3	126.7	96.2	93.4	91.1	117.0	85.1	51.0	101.6	5
HFO-1016	46.7	107.3	88.0	130.9	137.0	114.3	83.8	109.3	82.6	121.7	89.8	96.8	91.1	84.3	80.0	62.8	95.4	8
UPO-20-2	39.0	140.3	80.0	133.5	129.6	99.0	80.3	119.7	76.4	125.6	74.7	97.2	84.9	96.4	73.5	65.1	94.7	9
RO-19 (NC)	52.7	148.7	100.0	122.4	154.3	124.7	97.6	116.1	100.3	140.0	95.7	101.7	99.2	132.4	78.4	68.6	108.3	2
UPO-212 (NC)	55.0	109.3		130.0	147.2	143.2	87.5	94.4	83.3	125.0	81.4	102.3	92.3	125.0	84.3	61.8	101.5	6
Mean	**48.6**	**134.2**	**89.0**	**128.9**	**144.0**	**125.4**	**87.0**	**109.0**	**86.2**	**132.4**	**96.4**	**100.3**	**91.8**	**111.4**	**79.8**	**59.2**	**101.5**	

Table 9.8: IVTO (MC): Initial Varietal Trial in Oat (Multi cut): Leaf Stem Ratio

Entries	Palam-pur	Sri-nagar	His-ar	Ludh-iana	Pant-nagar	Ayod-hya	Jor-hat	Bhuban-eswar	Imp-hal	Pu-sa	Ran-chi	Ana-nd	Jabal-pur	Rah-uri	Urulikan-chan	Aver-age	Ra-nk
PLP-27	0.24	0.32	0.46	1.17	0.84	0.68	0.71	1.27	0.39	0.35	0.70	1.90	0.82	0.72	0.69	0.75	5
OL-1944	0.36	0.3	0.47	1.33	0.88	0.78	0.69	1.15	0.41	0.27	0.54	2.03	0.68	1.10	0.83	0.79	4
OL-1942	0.38	0.33	0.49	1.22	0.86	0.65	0.79	1.11	0.36	0.39	0.66	2.23	0.76	0.81	0.85	0.79	4
OL-1949	0.28	0.34	0.46	1.27	0.87	0.77	0.64	1.17	0.44	0.79	0.53	2.16	0.78	1.03	0.87	0.83	3
JO-08-329	0.27	0.36	0.46	1.23	0.95	0.76	0.66	1.07	0.39	0.63	0.62	2.30	0.77	1.05	1.07	0.84	2
JHO-20-3	0.32	0.33	0.46	1.07	0.93	0.78	0.74	1.01	0.46	0.28	0.71	3.90	0.74	1.05	0.53	0.89	1
HFO-915	0.24	0.34	0.46	0.97	0.91	0.75	0.71	1.32	0.38	0.3	0.69	1.59	0.8	0.77	0.65	0.73	6
HFO-1016	0.29	0.37	0.44	1.17	0.98	0.80	0.65	1.19	0.43	0.52	0.53	1.85	0.69	0.76	0.61	0.75	5
UPO-20-2	0.37	0.38	0.44	1.07	0.90	0.74	0.83	1.30	0.33	0.34	0.57	1.62	0.68	0.71	0.66	0.73	6
RO-19 (NC)	0.26	0.33	0.47	1.37	0.92	0.72	0.76	1.24	0.38	0.31	0.63	1.34	0.81	0.70	0.58	0.72	7
UPO-212 (NC)	0.28	0.30		1.17	0.78	0.73	0.69	0.97	0.46	0.35	0.56	1.88	0.79	0.82	0.72	0.75	5
Mean	**0.30**	**0.34**	**0.46**	**1.19**	**0.89**	**0.74**	**0.71**	**1.16**	**0.40**	**0.41**	**0.61**	**2.07**	**0.76**	**0.86**	**0.73**	**0.78**	

Table 9.9: IVTO (MC): Initial Varietal Trial in Oat (Multi cut): NDF (%), ADF (%) & IVDMD (%)

Entries	NDF (%)				ADF (%)				IVDMD (%)			
	Ludhiana	Anand	Average	Rank	Ludhiana	Anand	Average	Rank	Ludhiana	Hisar	Average	Rank
PLP-27	49.6	69.3	59.5	1	29.9	32.5	31.2	2	60.2	57.8	59.0	**7**
OL-1944	53.2	69.2	61.2	6	33.0	32.2	32.6	6	57.3	62.5	59.9	5
OL-1942	52.9	69.2	61.0	5	33.2	32.5	32.8	7	59.3	62.2	60.8	3
OL-1949	51.9	69.7	60.8	4	32.3	32.8	32.5	5	60.0	62.0	61.0	2
JO-08-329	52.2	69.7	61.0	5	31.5	32.0	31.7	3	60.0	64.7	62.4	1
JHO-20-3	52.1	68.4	60.2	3	33.3	30.2	31.7	3	57.3	54.5	55.9	10
HFO-915	50.3	70.0	60.2	3	31.2	33.9	32.5	5	58.0	56.0	57.0	9
HFO-1016	53.2	69.4	61.3	7	32.9	31.0	32.0	4	57.0	57.0	57.0	9
UPO-20-2	51.2	69.2	60.2	3	30.0	31.9	30.9	1	59.8	59.8	59.8	6
RO-19 (NC)	54.2	69.5	61.8	8	34.2	33.6	33.9	8	58.2	59.3	58.7	8
UPO-212 (NC)	51.4	68.8	60.1	2	31.9	33.1	32.5	5	60.1		60.1	4
Mean	**52.0**	**69.3**	**60.7**		**32.1**	**32.3**	**32.2**		**58.8**	**59.6**	**59.2**	

10. AVTO (MC)-1: FIRST ADVANCED VARIETAL TRIAL IN OAT (MULTI CUT) (Reference tables 10.1 to 10.9)

In **First Advance Varietal Trial in Oat (Multicut)** [**AVTO-1 (MC)]** six entries were evaluated against two national checks (RO-19 and UPO-212) at 8 locations in two zones (HZ and CZ). There were 3 locations in HZ and 5 locations in CZ.

For GFY (q/ha), entry PLP-24 (6.6%), HFO-921 (3.9%), JO-07-310 (2.8%), HFO-918 (1.2%), OL-1924 (0.6%) performed better than the best check RO-19. In CZ, entry JO-07-310 was better than the best check RO-19 by a margin of 5.1%. All other entries were below in comparison to best check.

For DMY (q/ha), entry PLP-24 (3.1%), HFO-921 (2.4%) were superior to the best check in hill zone whereas in central zone, only one entry JO-07-310 was superior by a margin of 6.7%. Combining the two zones JO-07-310 was superior by a margin of 6.0%. All other entries were below or at par or marginally superior in comparison to best check.

For fodder production potential (q/ha/day), entry JO-07-310 ranked first for both green and dry matter. Entry OL-1919 ranked first for plant height. Entry PLP-24 ranked first for leafiness.

For quality parameters, national chcck ranked first for crude protein yield and entry PLP-24 for crude protein content. Entry HFO-921 for NDF, Entry JO-07-310 for ADF and OL-1924 for IVDMD were best performers.

11. AVTO (MC)-2: SECOND ADVANCED VARIETAL TRIAL IN OAT (MULTI CUT) (Reference tables 11.1 to 11.9)

In **Second Advance Varietal Trial in Oat (Multicut)** [**AVTO-2 (MC)]** two entries were evaluated against two national checks (RO-19 and UPO-212) at 4 locations in North West zone. For GFY and DMY (q/ha), national check RO-19 was superior over the tested entries.

For green and dry fodder production potential (q/ha/day) also, national check RO-19 ranked first. National check RO-19 and entry HFO-707 ranked joint first for plant height whereas national check RO-19 was best for leafiness.

For quality parameters, National check RO-19 ranked first for crude protein yield followed closely by entry HFO-707. National check UPO-212 and entry HFO-707 ranked first for crude protein content with 11.6%. National check UPO-212 was best for NDF whereas entry OL-1082 ranked first for ADF and IVDMD %.

12. AVTO (MC)-2 (SEED): SECOND ADVANCED VARIETAL TRIAL IN OAT (MULTI CUT) FOR SEED (Reference tables 12.1)

In **Second Advance Varietal Trial in Oat (Multicut)** [**AVTO-2 (MC)] for seed,** two entries were evaluated against two national checks (RO-19 and UPO-212) at 3 locations in North West zone.

For seed yield (q/ha), national check RO-19 (23.9 q/ha) was best performer followed closely by entry HFO-707 (23.8q/ha).

Table 10.1: AVTO-1 (MC): First Advanced Varietal Trial in Oat (Multi cut): Green Forage Yield (q/ha)

Entries	Hill Zone					
	Palampur	**Srinagar**	**Almora**	**Average**	**Rank**	**Superiority%**
HFO-921	231.7	376.7	288.2	298.8	2	3.9
JO-07-310	244.2	372.7	270.1	295.7	3	2.8
OL-1924	208.3	374.3	285.7	289.4	5	0.6
OL- 1919	222.5	379.3	241.0	280.9	7	
HFO-918	229.2	375.3	269.4	291.3	4	1.2
PLP-24	280.0	372.7	267.4	306.7	1	6.6
RO-19 (NC)	235.0	379.3	248.8	287.7	6	
UPO-212 (NC)	224.2	374.3	242.4	280.3	8	
Mean	**234.4**	**375.6**	**264.1**	**291.4**		
CD at 5%	**32.6**	**4.2**	**18.0**			
CV%	**7.9**	**1.0**	**3.9**			

Table 10.1: AVTO-1 (MC): First Advanced Varietal Trial in Oat (Multi cut): Green Forage Yield (q/ha)

Entries	Central Zone								All India		
	Jhansi	**Anand**	**Jabalpur**	**Rahuri**	**Urulikanchan**	**Average**	**Rank**	**Superiority%**	**Average**	**Rank**	**Superiority%**
HFO-921	213.9	631.1	599.3	447.9	584.5	495.3	3		421.6	3	
JO-07-310	232.0	645.3	703.7	432.8	669.8	536.7	1	5.1	446.3	1	4.5
OL-1924	207.3	558.6	585.0	364.9	555.9	454.3	7		392.5	8	
OL- 1919	198.6	570.8	622.0	359.0	549.4	460.0	5		392.8	7	
HFO-918	217.0	581.4	556.3	351.5	566.2	454.5	6		393.3	6	
PLP-24	209.3	542.2	661.7	304.3	541.0	451.7	8		397.3	5	
RO-19 (NC)	213.8	620.8	738.3	467.6	512.8	510.7	2		427.1	2	
UPO-212 (NC)	205.7	603.9	611.7	444.1	560.1	485.1	4		408.3	4	
Mean	**212.2**	**594.3**	**634.8**	**396.5**	**567.5**	**481.0**			**409.9**		
CD at 5%	**34.5**	**NS**	**1.7**	**48.9**	**77.1**						
CV%	**19.7**	**10.8**	**9.4**	**7.0**	**7.7**						

Table 10.2: AVTO-1 (MC): First Advanced Varietal Trial in Oat (Multi cut): Dry Matter Yield (q/ha)

Entries	Hill Zone					
	Palampur	Srinagar	Almora	Average	Rank	Superiority%
HFO-921	55.1	73.6	54.2	61.0	2	2.4
JO-07-310	59.8	71.9	44.8	58.8	5	
OL-1924	49.9	73.3	50.3	57.8	7	
OL- 1919	53.0	79.0	44.1	58.7	6	
HFO-918	55.5	76.1	45.8	59.1	4	
PLP-24	65.3	71.4	47.3	61.3	1	3.1
RO-19 (NC)	55.5	70.1	40.8	55.5	8	
UPO-212 (NC)	53.0	77.7	47.8	59.5	3	
Mean	**55.9**	**74.1**	**46.9**	**59.0**		
CD at 5%	**7.7**	**3.2**	**3.2**			
CV%	**7.8**	**6.9**	**3.9**			

Table 10.2: AVTO-1 (MC): First Advanced Varietal Trial in Oat (Multi cut): Dry Matter Yield (q/ha)

Entries	Central Zone								All India		
	Jha-nsi	Ana-nd	Jabal-pur	Rah-uri	Urulikan-chan	Aver-age	Ra-nk	Superi-ority%	Aver-age	Ra-nk	Superi-ority%
HFO-921	43.8	94.7	129.4	82.0	67.7	83.5	5		75.1	4	
JO-07-310	51.4	86.5	152.3	77.2	94.9	92.5	1	6.7	79.8	1	6.0
OL-1924	47.1	74.9	126.3	69.6	69.6	77.5	7		70.1	7	
OL- 1919	49.7	78.5	134.7	89.8	78.2	86.2	3		75.9	2	0.8
HFO-918	53.3	81.2	118.4	71.2	75.1	79.8	6		72.1	6	
PLP-24	39.6	76.8	143.2	48.7	64.9	74.6	8		69.6	8	
RO-19 (NC)	46.4	82.6	160.7	86.6	56.8	86.6	2		75.0	5	
UPO-212 (NC)	40.9	83.9	132.3	87.6	79.2	84.8	4		75.3	3	
Mean	**46.5**	**82.4**	**137.2**	**76.6**	**73.3**	**83.2**			**74.1**		
CD at 5%	**12.8**	**NS**	**0.4**	**9.4**	9.7						
CV%	**7.3**	**13.5**	**9.9**	**7.0**	7.5						

Table 10.3: AVTO-1 (MC): First Advanced Varietal Trial in Oat (Multi cut): Green Forage Yield (q/ha/day)

Entries	Anand	Rahuri	Urulikanchan	Average	Rank
HFO-921	5.39	4.65	6.15	5.40	2
JO-07-310	5.42	4.40	7.05	5.62	1
OL-1924	4.66	3.94	5.85	4.82	6
OL- 1919	4.84	3.83	5.78	4.82	6
HFO-918	4.89	3.64	5.96	4.83	5
PLP-24	4.52	3.12	5.69	4.44	7
RO-19 (NC)	5.26	4.54	5.4	5.07	4
UPO-212 (NC)	5.21	4.78	5.9	5.30	3
Mean	**5.02**	**4.11**	**5.97**	**5.04**	

Table 10.4: AVTO-1 (MC): First Advanced Varietal Trial in Oat (Multi cut): Dry Matter Yield (q/ha/day)

Entries	Anand	Rahuri	Urulikanchan	Average	Rank
HFO-921	0.81	0.85	0.71	0.79	4
JO-07-310	0.73	0.78	1.00	0.84	1
OL-1924	0.62	0.75	0.73	0.70	7
OL- 1919	0.67	0.96	0.82	0.82	3
HFO-918	0.68	0.74	0.79	0.74	5
PLP-24	0.64	0.50	0.68	0.61	8
RO-19 (NC)	0.70	0.84	0.60	0.71	6
UPO-212 (NC)	0.72	0.94	0.83	0.83	2
Mean	**0.70**	**0.80**	**0.77**	**0.75**	

Table 10.5: AVTO-1 (MC): First Advanced Varietal Trial in Oat (Multi cut): Crude Protein Yield (q/ha)

Entries	Palampur	Anand	Jabalpur	Rahuri	Urulikanchan	Average	Rank
HFO-921	5.9	12.3	10.3	9.5	6.5	8.9	2
JO-07-310	6.8	10.6	12.7	2.0	9.3	8.3	4
OL-1924	5.5	9.6	10.0	2.0	5.8	6.6	8
OL- 1919	5.4	10.1	11.1	9.0	7.6	8.6	3
HFO-918	5.5	10.4	9.2	7.1	7.1	7.9	6
PLP-24	6.9	10.0	11.8	6.3	6.3	8.2	5
RO-19 (NC)	6.0	10.7	13.4	2.0	5.3	7.5	7
UPO-212 (NC)	5.3	10.8	10.8	11.3	7.5	9.1	1
Mean	**5.9**	**10.6**	**11.2**	**6.2**	**6.9**	**8.1**	

Table 10.6: AVTO-1 (MC): First Advanced Varietal Trial in Oat (Multi cut): Crude Protein (%)

Entries	Palampur	Anand	Jabalpur	Rahuri	Urulikanchan	Average	Rank
HFO-921	10.8	12.8	8.0	11.6	9.6	10.6	4
JO-07-310	11.4	12.3	8.3	10.0	9.8	10.4	5
OL-1924	11.1	13.0	7.9	12.4	8.3	10.5	4
OL- 1919	10.2	12.6	8.2	10.0	9.7	10.1	6
HFO-918	9.9	12.5	7.8	10.0	9.4	9.9	7
PLP-24	10.5	13.0	8.2	12.9	9.7	10.9	1
RO-19 (NC)	10.8	12.8	8.3	12.1	9.3	10.7	2
UPO-212 (NC)	9.9	12.7	8.2	12.9	9.5	10.6	3
Mean	**10.6**	**12.7**	**8.1**	**11.5**	**9.4**	**10.5**	

Table 10.7: AVTO-1 (MC): First Advanced Varietal Trial in Oat (Multi cut): Plant Height (cm)

Entries	Palampur	Srinagar	Jhansi	Anand	Jabalpur	Rahuri	Urulikanchan	Average	Rank
HFO-921	172.0	83.0	90.9	103.5	85.0	69.2	59.3	94.7	8
JO-07-310	147.0	103.7	103.8	104.9	104.9	77.4	65.1	101.0	3
OL-1924	176.0	105.7	101.0	107.0	82.0	70.9	75.5	102.6	2
OL- 1919	169.0	98.3	104.0	112.0	96.4	78.6	64.1	103.2	1
HFO-918	151.0	113.0	97.4	108.0	74.6	69.7	64.9	96.9	6
PLP-24	139.0	101.3	98.6	100.5	98.6	76.1	60.0	96.3	7
RO-19 (NC)	146.0	101.0	97.9	109.7	106.8	72.0	61.0	99.2	5
UPO-212 (NC)	171.0	86.7	99.1	108.4	92.3	75.0	62.4	99.3	4
Mean	**158.9**	**99.1**	**99.1**	**106.8**	**92.6**	**73.6**	**64.0**	**99.1**	

Table 10.8: AVTO-1 (MC): First Advanced Varietal Trial in Oat (Multi cut): Leaf Stem Ratio

Entries	Palampur	Srinagar	Anand	Jabalpur	Rahuri	Urulikanchan	Average	Rank
HFO-921	0.35	0.35	2.06	0.70	1.01	0.66	0.85	4
JO-07-310	0.27	0.36	1.81	0.82	0.80	0.74	0.80	6
OL-1924	0.32	0.36	2.40	0.67	1.12	0.93	0.97	2
OL- 1919	0.33	0.39	1.45	0.75	0.63	0.77	0.72	7
HFO-918	0.39	0.38	1.80	0.64	1.15	0.69	0.84	5
PLP-24	0.39	0.37	2.18	0.80	1.15	1.07	0.99	1
RO-19 (NC)	0.40	0.35	1.63	0.85	0.80	0.77	0.80	6
UPO-212 (NC)	0.32	0.40	1.87	0.74	1.19	0.74	0.88	3
Mean	**0.35**	**0.37**	**1.90**	**0.75**	**0.98**	**0.80**	**0.86**	

Table 10.9: AVTO-1 (MC): First Advanced Varietal Trial in Oat (Multi cut): ADF (%), NDF (%) & IVDMD (%)

Entries	NDF (%)					ADF (%)					IVDMD (%)	
	Anand	Rahuri	Palampur	Average	Rank	Anand	Rahuri	Palampur	Average	Rank	Rahuri	Rank
HFO-921	67.4	54.5	64.8	62.2	1	35.0	35.6	56.4	42.3	4	60.1	4
JO-07-310	70.1	54.2	66.2	63.5	4	34.9	34.1	55	41.3	1	61.3	2
OL-1924	69.6	53.2	65.8	62.9	2	32.7	33.6	58.0	41.4	2	61.7	1
OL- 1919	69.3	55.7	65.8	63.6	5	34.2	35.6	55.2	41.7	3	60.1	4
HFO-918	69.8	57.7	64.8	64.1	8	34.9	37.4	56.4	42.9	6	58.7	6
PLP-24	68.7	55.6	67.8	64.0	7	34.9	37.6	57.2	43.3	7	58.5	7
RO-19 (NC)	69.4	54.3	65.4	63.0	3	35.2	34.4	55.6	41.7	3	61.1	3
UPO-212 (NC)	67.9	57.2	66.4	63.8	6	35.0	36.6	55.8	42.5	5	59.5	5
Mean	**69.0**	**55.3**	**65.9**	**63.4**		**34.6**	**35.6**	**56.2**	**42.1**		**60.1**	

Table 11.1: AVTO-2 (MC): Second Advanced Varietal Trial in Oat (Multi cut): Green Forage Yield (q/ha)

Entries	North West Zone					
	Hisar	Ludhiana	Pantnagar	Jalore	Average	Rank
HFO-707	587.6	728.3	722.2	412.2	612.6	2
OL-1882	600.6	719.9	665.4	369.4	588.8	3
RO-19 (NC)	575.1	734.3	776.8	385.3	617.9	1
UPO-212 (NC)	605.1	670.1	582.9	390.6	562.2	4
Mean	**592.1**	**713.2**	**686.8**	**389.4**	**595.4**	
CD at 5%	**NS**	**40.2**	**61.6**	**NS**		
CV%	**3.89**	**8.1**	**12.9**	**12.2**		

Table 11.2: AVTO-2 (MC): Second Advanced Varietal Trial in Oat (Multi cut): Dry Matter Yield (q/ha)

Entries	North West Zone					
	Hisar	Jalore	Ludhiana	Pantnagar	Average	Rank
HFO-707	127.9	69.6	150.0	116.3	116.0	2
OL-1882	136.6	63.5	145.4	109.1	113.6	3
RO-19 (NC)	127.7	65.7	152.7	126.6	118.2	1
UPO-212 (NC)	133.8	65.3	137.4	97.3	108.4	4
Mean	**131.5**	**66.0**	**146.4**	**112.3**	**114.1**	
CD at 5%	**N/A**	**NS**	**14.7**	**9.2**		
CV%	**7.7**	**13.0**	**9.2**	**11.7**		

Table 11.3: AVTO-2 (MC): Second Advanced Varietal Trial in Oat (Multi cut): Green Forage Yield (q/ha/day)

Entries	Hisar	Ludhiana	Pantnagar	Average	Rank
HFO-707	4.72	6.00	5.64	5.45	2
OL-1882	4.90	5.90	5.20	5.33	3
RO-19 (NC)	4.69	6.10	6.07	5.62	1
UPO-212 (NC)	4.94	5.50	4.55	5.00	4
Mean	**4.81**	**5.88**	**5.37**	**5.35**	

Table 11.4: AVTO-2 (MC): Second Advanced Varietal Trial in Oat (Multi cut): Dry Matter Yield (q/ha/day)

Entries	Hisar	Ludhiana	Pantnagar	Average	Rank
HFO-707	1.03	1.20	0.91	1.05	2
OL-1882	1.11	1.20	0.85	1.05	2
RO-19 (NC)	1.04	1.30	0.99	1.11	1
UPO-212 (NC)	1.09	1.10	0.76	0.98	3
Mean	**1.07**	**1.20**	**0.88**	**1.05**	

Table 11.5: AVTO-2 (MC): Second Advanced Varietal Trial in Oat (Multi cut): Crude Protein Yield (q/ha)

Entries	Ludhiana	Pantnagar	Hisar	Average	Rank
HFO-707	24.0	11.2	11.6	15.6	2
OL-1882	24.0	9.5	11.7	15.1	3
RO-19 (NC)	22.9	13.3	10.9	15.7	1
UPO-212 (NC)	24.0	8.5	11.3	14.6	4
Mean	**23.7**	**10.6**	**11.4**	**15.2**	

Table 11.6: AVTO-2 (MC): Second Advanced Varietal Trial in Oat (Multi cut): Crude Protein (%)

Entries	Ludhiana	Pantnagar	Hisar	Average	Rank
HFO-707	16.0	9.6	9.1	11.6	1
OL-1882	16.5	8.8	8.5	11.3	3
RO-19 (NC)	15.0	10.5	8.6	11.4	2
UPO-212 (NC)	17.5	8.8	8.5	11.6	1
Mean	**16.3**	**9.4**	**8.7**	**11.4**	

Table 11.7: AVTO-2 (MC): Second Advanced Varietal Trial in Oat (Multi cut): Plant Height (cm)

Entries	Hisar	Ludhiana	Pantnagar	Average	Rank
HFO-707	92.0	125.8	142.3	120.0	1
OL-1882	85.0	132.1	140.2	119.1	2
RO-19 (NC)	94.0	130.9	135.0	120.0	1
UPO-212 (NC)	92.0	124.2	138.5	118.2	3
Mean	**90.8**	**128.3**	**139.0**	**119.3**	

Table 11.8: AVTO-2 (MC): Second Advanced Varietal Trial in Oat (Multi cut): Leaf Stem Ratio

Entries	Hisar	Ludhiana	Pantnagar	Average	Rank
HFO-707	0.49	1.16	0.91	0.85	2
OL-1882	0.50	1.20	0.74	0.81	3
RO-19 (NC)	0.49	1.20	0.88	0.86	1
UPO-212 (NC)	0.51	1.00	0.77	0.76	4
Mean	**0.50**	**1.14**	**0.83**	**0.82**	

Table 11.9: AVTO-2 (MC): Second Advanced Varietal Trial in Oat (Multi cut): NDF (%), ADF (%) & IVDMD (%)

Entries	NDF (%)				ADF (%)				IVDMD (%)			
	Pant-nagar	Ludh-iana	Aver-age	Ra-nk	Pant-nagar	Ludh-iana	Aver-age	Ra-nk	Ludh-iana	His-ar	Aver-age	Ra-nk
HFO-707	65.8	50.0	57.9	2	55.8	30.9	43.4	2	59.0	63.9	61.5	2
OL-1882	65.4	50.3	57.9	2	55.8	30.2	43.0	1	60.0	63.1	61.6	1
RO-19 (NC)	66.0	52.3	59.2	3	56.6	31.4	44.0	3	57.3	59.7	58.5	4
UPO-212 (NC)	66.6	48.9	57.8	1	57.4	29.4	43.4	2	60.4	62.1	61.2	3
Mean	**66.0**	**50.4**	**58.2**		**56.4**	**30.5**	**43.4**		**59.2**	**62.2**	**60.7**	

Table 12.1: AVTO-2 (MC) (Seed): Second Advanced Varietal Trial in Oat (Multi cut) (Seed): Seed Yield (q/ha)

Entries	Seed Yield (q/ha)				
	North West Zone				
	Hisar	Ludhiana	Pantnagar	Average	Rank
HFO-707	18.0	30.8	22.7	23.8	2
OL-1882	18.5	31.2	18.3	22.7	3
RO-19 (NC)	23.3	28.7	19.8	23.9	1
UPO-212 (NC)	12.2	30.2	24.6	22.3	4
Mean	**18.0**	**30.2**	**21.4**	**23.2**	
CD at 5%	**4.3**	**1.6**	**1.5**		
CV%	**17.1**	**7.5**	**9.6**		

13. IVTO (DUAL): INITIAL VARIETAL TRIAL IN OAT (DUAL)

(Reference tables 13.1 to 13.10)

An **Initial Varietal Trial in Oat (Dual)** [**IVTO (DUAL)]** comprising of eight entries along with two national checks (UPO-212 and JHO-822) was conducted at 14 centres located at three zones (NW, NE and central zones). There were 4 locations in NWZ, 5 locations in NEZ and 5 locations in CZ.

For GFY (q/ha), in NWZ, entries HFO-917 (18.0 %), JO-13-513 (10.5%), HFO-1014 (8.5%) were superior over the best check. Entries JO-13-513 (18.8%), JHO-20-2 (15.1%), HFO-917 (12.5%), HFO-1014 (11.5%), OL-1931 (8.4%) performed better than the best check in NEZ. In CZ, JO-13-513 was marginally superior over the best check by a margin of 0.9%. Combining all three zones, entries JO-13-513 was superior over the best check by a margin of 9.4% whereas, entries HFO-917 (3.4%), HFO-1014 (1.0%) showed marginal superiority.

For DMY (q/ha), entries HFO-917 (12.7%), JO-13-513 (7.4%), HFO-1014 (3.2%), JHO-20-2 (0.7%) performed better than the best check in NWZ, whereas in NEZ, entries JO-13-513 (22.2%), JHO-20-2(17.6%), HFO-917 (16.3%), HFO-1014 (14.2%), OL-1931 (7.3%) were superior. In CZ, national check UPO-212 was best performer. Combining all the three zones, JO-13-513 (7.9%) and HFO-917 (0.9%) were superior over the best check. All other entries were below par in comparison to the best check.

For fodder production potential (q/ha/day), entry JO-13-513 ranked first for both green and dry matter, whereas entry HFO-917 was second. Entry JO-13-513 ranked first for plant height. Entry JHO-20-2 ranked first followed by HFO-1014 for leafiness.

For quality parameters, entries JO-13-51, HFO-917, HFO-1014 ranked joint first for crude protein yield. Entries OL-1984 and OL-1992 (11.7%) ranked joint first followed by HFO-1014 (11.4%) for crude protein content. Entry OL-1992 ranked first for ADF, NDF whereas entry HFO-917 ranked first for IVDMD %.

For seed yield, entry HFO-1014 (19.8 q/ha) ranked first followed by JO-13-513 (19.6 q/ha) as compared to best national check UPO-212 (18.7 q/ha).

Table 13.1 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Green Forage Yield (q/ha)

Entries	North West Zone							North East Zone							
	Ludhiana	Hisar	Bikaner	Pantnagar	Average	Rank	Superiority%	Jorhat	Bhubaneswar	Ranchi	Ayodhya	Pusa	Average	Rank	Superiority%
UPO-20-3	147.2	223.7	137.7	176.6	171.3	7		192.1	221.9	154.7	96.0	284.5	189.8	7	
OL-1931	120.2	197.8	163.3	185.9	166.8	8		145.0	287.3	180.6	114.6	312.7	208.0	5	8.4
OL-1984	99.4	184.1	107.0	205.8	149.1	9		126.3	221.3	142.9	96.0	288.0	174.9	9	
JO-13-513	168.1	198.9	213.0	242.6	205.6	2	10.5	153.3	294.6	207.5	133.3	351.6	228.1	1	18.8
HFO-917	179.1	195.5	227.2	276.4	219.6	1	18.0	152.5	270.6	152.4	144.0	360.3	216.0	3	12.5
HFO-1014	142.6	218.9	183.9	262.1	201.9	3	8.5	167.5	239.9	193.8	138.6	330.2	214.0	4	11.5
JHO-20-2	157.4	177.0	148.8	251.1	183.6	5		184.6	305.9	172.4	117.3	324.8	221.0	2	15.1
OL-1992	48.0	174.1	24.2	161.3	101.9	10		108.3	204.0	124.7	77.3	292.4	161.3	10	
JHO-822 (NC)	123.3	217.0	155.3	221.3	179.2	6		180.4	205.3	151.8	117.3	280.9	187.1	8	
UPO-212 (NC)	153.0	201.8	171.8	217.5	186.0	4		157.9	231.9	121.9	128.0	320.1	192.0	6	
Mean	**133.8**	**198.9**	**153.2**	**220.1**	**176.5**			**156.8**	**248.3**	**160.3**	**116.2**	**314.6**	**199.2**		
CD at 5%	**76.6**	**27.9**	**20.6**	**25.6**				**4.7**	**1.5**	**29.1**	**16.3**	**40.9**			
CV%	**12.2**	**8.1**	**7.8**	**13.3**				**7.0**	**4.8**	**10.6**	**13.2**	**7.6**			

Table 13.1 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Green Forage Yield (q/ha)

Entries	Central Zone								All India		
	Jhansi	Rahuri	Anand	Jabalpur	Raipur	Average	Rank	Superiority	Average	Rank	Superiority
UPO-20-3	239.5	139.3	311.9	159.2	166.7	203.3	3		189.4	7	
OL-1931	233.3	83.7	375.2	125.5	181.5	199.8	5		193.3	6	
OL-1984	230.2	82.8	217.4	131.2	92.6	150.9	9		158.9	9	
JO-13-513	268.5	149.9	351.9	168.5	216.7	231.1	1	0.9	222.7	1	9.4
HFO-917	254.9	102.2	334.8	119.7	175.9	197.5	6		210.4	2	3.4
HFO-1014	256.2	53.1	358.1	143.6	190.7	200.3	4		205.7	3	1.0
JHO-20-2	256.8	118.1	267.0	129.9	192.6	192.9	8		200.3	5	
OL-1992	234.6	17.8	14.8	114.8	55.6	87.5	10		118.0	10	
JHO-822 (NC)	245.7	118.1	297.4	140.5	166.7	193.7	7		187.2	8	
UPO-212 (NC)	238.9	155.8	372.6	198.6	179.6	229.1	2		203.5	4	
Mean	**245.9**	**102.1**	**290.1**	**143.2**	**161.9**	**188.6**			**188.9**		
CD at 5%	**27.5**	**17.2**	**73.9**	**1.2**	**23.8**						
CV%	**16.1**	**9.8**	**14.9**	**18.5**	**8.6**						

Table 13.2 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Dry Matter Yield (q/ha)

Entries	North West Zone							North East Zone							
	Ludhiana	Hisar	Bikaner	Pantnagar	Average	Rank	Superiority%	Jorhat	Bhubaneswar	Ranchi	Ayodhya	Pusa	Average	Rank	Superiority%
UPO-20-3	27.4	28.4	16.7	26.8	24.8	7		32.8	44.2	25.1	15.4	33.5	30.2	9	
OL-1931	22.4	22.2	18.9	29.0	23.1	8		24.8	62.6	29.7	17.2	44.9	35.8	5	7.3
OL-1984	18.5	25.1	11.4	32.3	21.8	9		23.3	46.0	35.3	13.4	35.4	30.7	8	
JO-13-513	31.3	25.5	20.4	38.3	28.9	2	7.4	28.1	61.8	38.4	20.7	55.0	40.8	1	22.2
HFO-917	33.3	21.8	22.2	44.0	30.3	1	12.7	29.1	58.8	25.8	20.0	60.6	38.8	3	16.3
HFO-1014	26.5	23.9	18.5	42.2	27.8	3	3.2	31.3	47.3	40.5	19.4	52.1	38.1	4	14.2
JHO-20-2	29.3	22.8	15.8	40.4	27.1	4	0.7	31.1	66.4	33.6	16.7	48.7	39.3	2	17.6
OL-1992	8.9	24.9	2.9	25.2	15.5	10		18.2	42.8	26.0	10.1	38.3	27.1	10	
JHO-822 (NC)	22.9	28.2	14.7	34.3	25.0	6		33.6	43.3	28.9	17.0	32.1	31.0	7	
UPO-212 (NC)	28.5	25.6	18.9	34.6	26.9	5		28.3	47.4	28.7	**18.4**	44.2	33.4	6	
Mean	**24.9**	**24.8**	**16.0**	**34.7**	**25.1**			**28.1**	**52.0**	**31.2**	**16.8**	**44.5**	**34.5**		
CD at 5%	**19.3**	**3.8**	**2.2**	**3.3**				**2.0**	**0.3**	**10.3**	**3.7**	**5.7**			
CV%	**9.9**	**8.9**	**8.0**	**11.3**				**7.1**	**4.6**	**19.3**	**12.9**	**7.5**			

Table 13.2 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Dry Matter Yield (q/ha)

Entries	Central Zone							All India		
	Jhansi	Rahuri	Anand	Jabalpur	Raipur	Average	Rank	Average	Rank	Superiority
UPO-20-3	33.3	26.9	38.4	29.1	26.1	30.7	4	28.8	7	
OL-1931	32.4	15.6	51.9	22.7	31.8	30.9	3	30.4	6	
OL-1984	31.4	15.1	27.6	23.7	16.7	22.9	9	25.4	9	
JO-13-513	37.4	25.0	46.2	30.8	35.7	35.0	2	35.3	1	7.9
HFO-917	34.6	19.1	42.1	21.8	29.6	29.5	6	33.1	2	0.9
HFO-1014	35.5	10.9	43.2	26.2	33.7	29.9	5	32.2	5	
JHO-20-2	35.9	22.2	33.7	23.6	31.3	29.3	7	32.3	4	
OL-1992	31.0	3.6	2.2	20.8	10.0	13.5	10	18.9	10	
JHO-822 (NC)	33.5	23.0	33.8	25.5	27.2	28.6	8	28.4	8	
UPO-212 (NC)	33.1	31.9	47.6	37.8	33.6	36.8	1	32.8	3	
Mean	**33.8**	**19.3**	**36.7**	**26.2**	**27.6**	**28.7**		**29.8**		
CD at 5%	**3.7**	**3.3**	**9.5**	**0.2**	**4.0**					
CV%	**2.1**	**9.9**	**15.1**	**20.1**	**8.5**					

Table 13.3 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Green Forage Yield (q/ha/day)

Entries	Ludh-iana	His-ar	Bika-ner	Pant-nagar	Jor-hat	Bhuban-eswar	Ran-chi	Ayod-hya	Pu-sa	Rah-uri	Ana-nd	Rai-pur	Aver-age	Ra-nk
UPO-20-3	2.40	1.94	2.46	2.76	3.26	4.04	1.63	1.74	3.32	2.36	4.33	2.98	2.77	7
OL-1931	1.90	1.73	2.92	2.90	2.46	5.22	1.94	2.08	3.54	1.42	5.21	3.24	2.88	6
OL-1984	1.60	1.59	1.91	3.22	2.14	4.02	1.49	1.74	3.38	1.40	3.02	1.65	2.26	9
JO-13-513	2.70	1.76	3.80	3.79	2.60	5.36	2.12	2.42	4.06	2.54	4.89	3.87	3.33	1
HFO-917	2.90	1.75	4.06	4.32	2.58	4.92	1.43	2.61	4.11	1.73	4.65	3.14	3.18	2
HFO-1014	2.30	1.94	3.28	4.10	2.84	4.36	1.85	2.51	3.74	0.90	4.97	3.41	3.02	3
JHO-20-2	2.50	1.54	2.66	3.92	3.13	5.56	1.63	2.13	3.79	2.00	3.71	3.44	3.00	4
OL-1992	0.80	1.50	0.43	2.52	1.84	3.71	1.14	1.40	3.40	0.30	0.21	0.99	1.52	10
JHO-822 (NC)	2.00	1.89	2.77	3.46	3.06	3.73	1.65	2.13	3.24	2.00	4.13	2.98	2.75	8
UPO-212 (NC)	2.50	1.75	3.07	3.40	2.68	4.22	1.24	2.32	3.63	2.64	5.18	3.21	2.99	5
Mean	**2.16**	**1.74**	**2.74**	**3.44**	**2.66**	**4.51**	**1.61**	**2.11**	**3.62**	**1.73**	**4.03**	**2.89**	**2.77**	

Table 13.4 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Dry Matter Yield (q/ha/day)

Entries	Ludh-iana	His-ar	Bika-ner	Pant-nagar	Jor-hat	Bhuban-eswar	Ayod-hya	Pu-sa	Rah-uri	Ana-nd	Rai-pur	Aver-age	Ra-nk
UPO-20-3	0.40	0.25	0.30	0.42	0.56	0.80	0.27	0.39	0.46	0.53	0.47	0.44	5
OL-1931	0.40	0.19	0.34	0.45	0.42	1.14	0.31	0.51	0.27	0.72	0.57	0.48	4
OL-1984	0.30	0.22	0.20	0.50	0.39	0.84	0.24	0.42	0.26	0.38	0.30	0.37	7
JO-13-513	0.50	0.23	0.36	0.60	0.48	1.12	0.37	0.63	0.42	0.64	0.64	0.55	1
HFO-917	0.50	0.19	0.40	0.69	0.49	1.07	0.36	0.69	0.32	0.59	0.53	0.53	2
HFO-1014	0.40	0.21	0.33	0.66	0.53	0.86	0.35	0.59	0.19	0.60	0.60	0.48	4
JHO-20-2	0.50	0.20	0.28	0.63	0.53	1.21	0.30	0.57	0.38	0.47	0.56	0.51	3
OL-1992	0.10	0.22	0.05	0.39	0.31	0.78	0.18	0.45	0.06	0.03	0.18	0.25	7
JHO-822 (NC)	0.40	0.24	0.26	0.54	0.57	0.79	0.30	0.37	0.39	0.47	0.49	0.44	5
UPO-212 (NC)	0.50	0.22	0.34	0.54	0.48	0.86	0.33	0.50	0.54	0.66	0.60	0.51	3
Mean	**0.40**	**0.22**	**0.29**	**0.54**	**0.48**	**0.95**	**0.30**	**0.51**	**0.33**	**0.51**	**0.49**	**0.46**	

Table 13.5 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Crude Protein Yield (q/ha)

Entries	Ludh-iana	Bika-ner	His-ar	Jor-hat	Bhuban-eswar	Ran-chi	Ayod-hya	Rah-uri	Ana-nd	Jabal-pur	Rai-pur	Aver-age	Ra-nk
UPO-20-3	4.7	2.5	2.5	3.7	4.2	1.4	1.2	2.0	5.0	2.4	2.3	2.9	5
OL-1931	4.0	2.9	2.1	2.7	5.4	1.8	1.4	1.4	6.9	1.8	3.0	3.1	3
OL-1984	3.4	2.1	2.0	2.6	4.2	2.2	1.1	1.6	4.5	1.9	2.3	2.5	6
JO-13-513	4.8	2.9	2.0	3.2	5.6	2.3	1.7	2.5	5.7	2.5	3.5	3.3	1
HFO-917	5.3	3.9	2.1	3.0	5.1	1.7	1.7	2.2	6.0	1.8	3.4	3.3	1
HFO-1014	4.3	3.9	1.9	3.2	4.5	2.3	1.6	0.9	7.0	2.2	4.7	3.3	1
JHO-20-2	4.5	2.6	2.0	3.5	5.8	2.2	1.5	2.3	5.2	1.9	3.4	3.2	2
OL-1992	1.7	0.5	2.2	2.1	3.9	1.8	0.8	0.4	0.4	1.7	1.3	1.5	7
JHO-822 (NC)	3.9	2.4	2.5	3.8	3.9	1.8	1.5	2.6	5.1	2.1	3.3	3.0	4
UPO-212 (NC)	4.6	3.3	2.3	3.2	4.4	1.8	1.5	2.9	5.9	3.1	3.6	3.3	1
Mean	**4.1**	**2.7**	**2.2**	**3.1**	**4.7**	**1.9**	**1.4**	**1.9**	**5.2**	**2.1**	**3.1**	**2.9**	

Table 13.6 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Crude Protein (%)

Entries	Ludh-iana	Bika-ner	His-ar	Jor-hat	Bhuban-eswar	Ran-chi	Ayod-hya	Rah-uri	Ana-nd	Jabal-pur	Rai-pur	Aver-age	Ra-nk
UPO-20-3	17.2	14.9	9.0	11.4	9.5	5.4	7.8	7.5	13.1	8.2	8.8	10.2	8
OL-1931	17.9	15.4	9.6	11.2	8.7	6.2	8.0	9.2	13.3	8.1	9.5	10.6	7
OL-1984	18.3	18.6	8.0	11.5	9.1	6.2	8.4	10.4	16.3	8.1	13.4	11.7	1
JO-13-513	15.3	14.0	7.8	11.5	9.0	5.9	8.1	10.1	12.4	8.3	9.8	10.2	8
HFO-917	16.0	17.3	9.6	10.5	8.7	6.7	8.7	11.4	14.1	8.2	11.5	11.2	4
HFO-1014	16.4	20.8	8.0	10.3	9.6	5.7	8.4	8.0	16.1	8.2	14.0	11.4	2
JHO-20-2	15.3	16.3	9.0	11.3	8.7	6.4	8.9	10.2	15.5	8.2	11.0	11.0	5
OL-1992	18.6	16.6	9.0	11.7	9.0	6.9	7.9	11.9	16.2	8.2	13.1	11.7	1
JHO-822 (NC)	16.9	16.3	8.8	11.4	9.0	6.4	8.8	11.2	14.9	8.2	12.0	11.3	3
UPO-212 (NC)	16.2	17.5	9.2	11.6	9.3	6.2	8.0	9.1	12.4	8.2	10.8	10.8	6
Mean	**16.8**	**16.8**	**8.8**	**11.2**	**9.1**	**6.2**	**8.3**	**9.9**	**14.4**	**8.2**	**11.4**	**11.0**	

Table 13.7 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Plant Height (cm)

Entries	Ludhiana	Hisar	Bikaner	Pantnagar	Jorhat	Bhubaneswar	Ranchi	Ayodhya	Pusa	Rahuri	Anand	Jabalpur	Raipur	Average	Rank
UPO-20-3	130.1	71.0	42.2	135.2	86.1	101.2	101.7	147.5	97.3	61.7	95.1	61.8	98.0	94.5	8
OL-1931	98.2	76.0	56.2	131.6	89.4	114.6	132.5	148.3	130.0	57.8	119.7	58.1	103.9	101.3	3
OL-1984	110.2	75.0	39.8	144.5	83.2	94.6	119.9	156.6	126.4	58.5	97.5	52.4	78.0	95.1	7
JO-13-513	135.6	79.0	56.0	133.3	93.8	119.3	138.1	160.2	123.1	59.6	110.7	50.5	91.5	103.9	1
HFO-917	140.0	80.0	48.6	145.6	84.4	109.5	132.6	149.0	118.2	52.8	103.0	48.9	84.7	99.8	4
HFO-1014	132.6	72.0	37.2	132.3	83.0	107.3	134.7	140.9	116.6	60.8	95.7	45.5	79.9	95.3	6
JHO-20-2	135.3	74.0	42.6	145.1	87.2	118.7	130.2	159.5	111.3	63.6	92.7	43.4	86.9	99.3	5
OL-1992	78.0	68.0	23.0	147.2	63.1	79.2	126.2	160.4	128.8	46.3	55.7	37.5	58.9	82.5	10
JHO-822 (NC)	102.4	80.0	52.0	126.2	91.9	89.3	129.5	146.9	90.1	66.1	102.1	54.4	91.7	94.0	9
UPO-212 (NC)	129.4	80.0	52.8	133.9	90.8	108.1	104.0	162.4	125.7	62.3	109.3	63.5	98.7	101.6	2
Mean	**119.2**	**75.5**	**45.0**	**137.5**	**85.3**	**104.2**	**124.9**	**153.2**	**116.8**	**59.0**	**98.2**	**51.6**	**87.2**	**96.7**	

Table 13.8 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Leaf Stem Ratio

Entries	Ludhiana	Pantnagar	Jorhat	Bhubaneswar	Ranchi	Ayodhya	Pusa	Rahuri	Anand	Jabalpur	Raipur	Average	Rank
UPO-20-3	1.37	1.03	0.70	0.94	0.65	0.98	0.48	1.17	1.82	3.43	0.84	1.22	4
OL-1931	1.40	0.96	0.64	1.09	0.68	0.96	0.51	0.89	2.12	3.12	0.83	1.20	6
OL-1984	1.28	0.92	0.74	0.89	0.47	0.86	0.32	1.27	2.21	3.16	1.20	1.21	5
JO-13-513	1.40	0.91	0.79	1.11	0.66	0.88	0.40	1.17	1.91	3.53	0.81	1.23	3
HFO-917	1.42	0.95	0.84	1.06	0.69	0.89	0.38	1.00	1.25	3.03	1.17	1.15	9
HFO-1014	1.17	0.88	0.78	1.04	0.65	0.86	0.31	1.78	2.11	3.37	1.11	1.28	2
JHO-20-2	1.22	1.17	0.82	1.14	0.63	0.90	0.34	1.94	1.95	3.26	0.92	1.30	1
OL-1992	1.14	0.89	0.68	0.81	0.56	0.91	0.41	2.03	0.93	3.01	1.44	1.16	8
JHO-822 (NC)	1.24	1.07	0.71	0.85	0.57	0.95	0.31	1.27	1.84	3.32	0.91	1.18	7
UPO-212 (NC)	1.32	0.88	0.78	0.98	0.52	0.89	0.37	1.86	1.67	4.06	0.97	1.30	1
Mean	**1.30**	**0.97**	**0.75**	**0.99**	**0.61**	**0.91**	**0.38**	**1.44**	**1.78**	**3.33**	**1.02**	**1.22**	

Table 13.9 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): NDF (%), ADF (%) & IVDMD (%)

Entries	NDF (%)				ADF (%)				IVDMD (%)			
	Ludh-iana	Ana-nd	Aver-age	Ra-nk	Ludh-iana	Ana-nd	Aver-age	Ra-nk	Ludh-iana	His-ar	Aver-age	Ra-nk
UPO-20-3	53.8	66.6	60.2	5	31.3	33.9	32.6	5	56.8	55.2	56.0	9
OL-1931	49.4	67.6	58.5	2	28.5	35.7	32.1	2	58.2	63.2	60.7	4
OL-1984	52.6	65.8	59.2	3	30.5	34.3	32.4	9	56.6	63.8	60.2	5
JO-13-513	55.3	68.0	61.7	9	33.3	35.2	34.2	8	60.0	61.6	60.8	3
HFO-917	51.8	66.6	59.2	3	31.8	34.3	33.0	7	59.4	64.2	61.8	1
HFO-1014	54.2	65.8	60.0	4	32.9	31.9	32.4	3	55.9	65.4	60.7	4
JHO-20-2	54.4	66.7	60.5	6	31.6	33.3	32.5	4	55.3	61.8	58.6	7
OL-1992	48.6	65.7	57.1	1	27.7	29.5	28.6	1	58.5	64.4	61.5	2
JHO-822 (NC)	56.6	66.3	61.4	8	30.5	35.0	32.7	6	54.9	63.2	59.1	6
UPO-212 (NC)	55.1	66.6	60.8	7	30.7	34.6	32.6	5	55.8	61.2	58.5	8
Mean	**53.2**	**66.6**	**59.9**		**30.9**	**33.8**	**32.3**		**57.1**	**62.4**	**59.8**	

Table 13.10 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Seed Yield (q/ha)

Entries	Ludh -iana	His-ar	Bika -ner	Pant-nagar	Jor-hat	Bhuban -eswar	Ran-chi	Ayod-hya	Pu-sa	Jha-nsi	Rah -uri	Ana -nd	Jabal -pur	Rai-pur	Aver-age	Ra -nk
UPO-20-3	29.9	29.2	19.4	21.8	14.4	8.9	25.1	15.2	17.6	7.8	7.0	1.2	36.8	5.1	17.1	7
OL-1931	30.2	29.2	24.0	17.2	12.6	11.2	29.7	19.3	20.7	8.7	9.9	2.4	34.8	12.0	18.7	4
OL-1984	24.2	31.9	13.6	19.6	11.0	8.7	35.3	22.4	18.1	7.1	10.1	5.7	37.9	15.0	18.6	5
JO-13-513	29.4	27.6	22.3	22.3	11.2	11.4	38.4	21.3	21.3	8.8	10.2	3.8	37.1	9.4	19.6	2
HFO-917	30.4	35.0	26.4	16.8	11.9	10.5	25.8	20.0	22.4	6.8	7.2	0.3	36.2	7.6	18.4	6
HFO-1014	28.6	33.7	21.4	19.4	14.6	9.9	40.5	22.1	20.6	8.6	8.1	1.5	32.5	15.3	19.8	1
JHO-20-2	30.8	39.6	18.5	18.7	14.3	12.0	33.6	18.7	20.5	9.1	9.5	0.6	29.5	11.7	19.1	3
OL-1992	20.1	26.4	11.3	20.3	14.1	7.9	26.0	20.8	18.5	6.4	6.2	3.6	28.6	6.6	15.5	8
JHO-822 (NC)	28.7	30.3	17.6	26.9	9.2	8.5	28.9	19.2	15.3	9.7	11.0	2.9	35.0	14.5	18.4	6
UPO-212 (NC)	30.2	31.4	22.2	18.1	13.4	9.3	28.7	19.5	21.0	9.0	7.4	1.9	38.4	11.8	18.7	4
Mean	**28.3**	**31.4**	**19.7**	**20.1**	**12.7**	**9.8**	**31.2**	**19.8**	**19.6**	**8.2**	**8.7**	**2.4**	**34.7**	**10.9**	**18.4**	
CD at 5%	**2.5**	**3.6**	**3.1**	**2.1**	**1.1**	**0.1**	**10.3**	**2.4**	**2.1**	**1.7**	**1.6**	**0.7**	**0.3**	**2.1**		
CV%	**11.2**	**6.7**	**9.2**	**14.1**	**5.8**	**8.3**	**19.3**	**7.1**	**6.4**	**1.0**	**10.8**	**17.5**	**10.5**	**11.0**		

14. VT LUCERNE PERENNIAL: VARIETAL TRIAL IN LUCERNE PERENNIAL (NEW) (Reference tables 14.1 to 14.9)

A varietal trial in Lucerne (Perennial) was conducted with 5 entries including checks at nine locations including 3 locations in NWZ, 2 in CZ and 4 in SZ

For GFY (q/ha), in NWZ entry VTLu-1 was best performer with 29.6% higher yield than the grand mean. In CZ also it performed best showing 4.4% higher yield than grand mean. Entry VTLu-2 was also better than grand mean by a margin of 3.83%. IN SZ entry VTLu-5 was better than grand mean by a margin of 11.8%. At all India level entries VTLu-1, VTLu-5, VTLu-2 were best performer in order of merit.

For DMY (q/ha), in NWZ and CZ entry VTLu-1 was superior by a margin of 27% and 6.9% respectively over the grand mean. In South zone entry VTLu-5 was best performed and showed 14.2% superiority over the grand mean. Combining the three zones, entries VTLu-1 and VTLu-5 performed better than the checks.

For production potential (q/ha/day) entry VTLu-1 ranked first for both green and dry matter. For plant height, VTLu-5 was best whereas VTLu-2 was best for leafiness.

For crude protein yield (q/ha) entry VTLu-1 ranked first (19.1q/ha) closely followed by VTLu-5 (19.0 q/ha). For crude protein content, entry VTLu-4 ranked first with a value of 18.5%. Entry VTLu-3 ranked first for ADF and NDF whereas entry VTLu-1 was best performer for IVDMD.

The entries are coded and will be decoded after the completion of trial. The trial will continue in coded form.

15 AVT-1 Lucerne Annual: Varietal Trial in Annual Lucerne

(Reference tables 15.1 to 15.8)

A **first level advanced Varietal Trial in Lucerne (annual)** comprising of two entries along with two national checks (Anand-2 and RL-88) was conducted at 7 centres located at two zones. There were 3 locations in NWZ and 4 locations in SZ.

For GFY (q/ha), entry LLC-6 was superior by margin of 16.0% over the best check (RL-88) in NW zone. In south zone, same entry LLC-6 was superior by margin of 4.4 % over the best check (Anand-2). Combining both the zones, entry LLC-6 (12.4%) showed superiority over the best check (Anand-2). The other entry was below or at par or marginally superior in comparison to best check.

For DMY (q/ha), entry LLC-6 was superior by margin of 8.4% over the best check (RL-88) in NW zone. In south zone, same entry LLC-6 was superior by margin of 7.6 % over the best check (Anand -2). Combining both the zones, entry LLC-6 (11.1%) showed superiority over the best check (Anand-2).

For fodder production potential (q/ha/day), entry LLC-6 ranked first for both green and dry matter. National check Anand-2 ranked first for plant height. National check RL-88 ranked first followed by LLC-6 for leafiness.

For quality parameters, entry LLC-6 (19.0 q/ha) ranked first followed by national check RL-88 (18.8 q/ha) for crude protein yield. National check RL-88 was superior followed by LLC-6 for crude protein content. Entry AL-66 ranked first for NDF%, whereas national check RL-88 was superior for ADF and IVDMD%.

Table 14.1 VT Lucerne Perennial: Varietal Trial in Lucerne Perennial (New): Green Forage Yield (q/ha)

Entries	North West Zone						Central Zone				
	Ludh-iana	Bika-ner	**Jal-ore	Aver-age	Ra-nk	Superi-ority (%)	Rah-uri	Urulikan-chan	Aver-age	Ra-nk	Superi-ority (%)
VTLu-1	934.2	590.2	93.5	539.3	1	29.6	457.2	583.1	520.1	1	4.4
VTLu-2	631.6	464.2	102.1	399.3	2		438.5	596.3	517.4	2	3.83
VTLu-3	608.7	448.0	83.3	380.0	4		400.8	558.3	479.5	5	
VTLu-4	519.3	491.9	99.7	370.3	5		428.8	544.2	486.5	4	
VTLu-5	592.9	503.3	76.9	391.0	3		410.7	565.3	488.0	3	
Mean	**657.3**	**499.5**	**91.1**	**416.0**			**427.2**	**569.4**	**498.3**		
CD at 5%	**25.7**	**62.0**	**15.9**				**57.8**	**NS**			
CV%	**2.0**	**8.0**	**12.9**				**8.8**	**9.5**			

Note: ** Data is not included in zonal and all India average due to low yield of data

Table 14.1 VT Lucerne Perennial: Varietal Trial in Lucerne Perennial (New): Green Forage Yield (q/ha)

Entries	South Zone							All India		
	Hydera-bad	Coimb-atore	Man-dya	Dhar-wad	Aver-age	Ra-nk	Superi-ority (%)	Aver-age	Ra-nk	Superi-ority (%)
VTLu-1	294.7	581.2	295.2	233.1	351.1	5		496.1	1	8.0
VTLu-2	309.3	619.8	367.4	261.5	389.5	2		461.1	3	0.3
VTLu-3	295.9	627.1	313.4	260.2	374.2	3		439.1	4	
VTLu-4	307.4	580.2	342.0	224.6	363.5	4		429.8	5	
VTLu-5	393.6	740.6	308.5	259.6	425.6	1	11.8	471.8	2	2.7
Mean	**320.2**	**629.8**	**325.3**	**247.8**	**380.8**			**459.6**		
CD at 5%	**37.5**	**48.6**	**45.1**	**13.3**						
CV%	**7.5**	**5.0**	**9.3**	**3.5**						

Table 14.2 VT Lucerne Perennial: Varietal Trial in Perennial Lucerne (New): Dry Matter Yield (q/ha)

Entries	North West Zone						Central Zone				
	Ludh-iana	Bika-ner	**Jal-ore	Aver-age	Ra-nk	Superi-ority(%)	Rah-uri	Urulikan-chan	Aver-age	Ra-nk	Superi-ority (%)
VTLu-1	164.4	139.8	14.9	106.4	1	26.9	92.2	128.7	110.5	1	6.9
VTLu-2	108.6	104.3	13.9	75.6	5		94.2	105.4	99.8	5	
VTLu-3	109.6	119.5	11.7	80.3	2		83.3	122.3	102.8	3	
VTLu-4	95.6	131.2	13.1	80.0	3		90.3	117.1	103.7	2	
VTLu-5	100.8	117.4	12.8	77.0	4		85.6	114.1	99.9	4	
Mean	**115.8**	**122.4**	**13.3**	**83.8**			**89.1**	**117.5**	**103.3**		
CD at 5%	**5.4**	**15.7**	**1.9**				**12.1**	**NS**			
CV%	**3.0**	**8.3**	**10.8**				**8.8**	**9.6**			

Note: ** Data is not included in zonal and all India average due to low yield of data

Table 14.2 VT Lucerne Perennial: Varietal Trial in Perennial Lucerne (New): Dry Matter Yield (q/ha)

Entries	South Zone							All India		
	Hydera-bad	Coimb-atore	Man-dya	Dhar-wad	Aver-age	Ra-nk	Superi-ority(%)	Aver-age	Ra-nk	Superi-ority(%)
VTLu-1	58.1	134.9	57.5	63.8	78.6	5		104.9	1	6.9
VTLu-2	60.9	139.6	64.5	70.0	83.8	3		93.4	5	
VTLu-3	58.3	146.2	65.1	71.0	85.1	2		96.9	3	
VTLu-4	61.7	131.3	69.0	61.2	80.8	4		94.7	4	
VTLu-5	81.2	175.3	62.2	70.0	97.2	1	14.2	100.8	2	2.7
Mean	**64.0**	**145.5**	**63.7**	**67.2**	**85.1**			**98.2**		
CD at 5%	**9.8**	**10.9**	**7.2**	**4.5**						
CV%	**9.8**	**4.9**	**7.6**	**4.3**						

Table 14.3 VT Lucerne Perennial: Varietal Trial in Perennial Lucerne (New): Green Forage Yield (q/ha/day)

Entries	Ludhiana	Bikaner	Rahuri	Mandya	Coimbatore	Dharwad	Average	Rank
VTLu-1	4.60	3.14	2.61	3.51	3.44	2.59	3.32	1
VTLu-2	3.11	2.47	2.51	4.35	3.75	2.91	3.18	2
VTLu-3	3.00	2.38	2.29	3.71	3.74	2.89	3.00	4
VTLu-4	2.56	2.62	2.45	4.01	3.48	2.50	2.94	5
VTLu-5	2.92	2.68	2.35	3.59	4.45	2.88	3.14	3
Mean	**3.24**	**2.66**	**2.44**	**3.83**	**3.77**	**2.75**	**3.12**	

Table 14.4 VT Lucerne Perennial: Varietal Trial in Perennial Lucerne (New): Dry Matter Yield (q/ha/day)

Entries	Ludhiana	Bikaner	Rahuri	Mandya	Coimbatore	Dharwad	Average	Rank
VTLu-1	0.81	0.74	0.53	0.68	0.80	0.71	0.71	1
VTLu-2	0.54	0.56	0.54	0.76	0.84	0.78	0.67	4
VTLu-3	0.54	0.64	0.48	0.77	0.87	0.79	0.68	3
VTLu-4	0.47	0.70	0.52	0.82	0.79	0.68	0.66	5
VTLu-5	0.50	0.63	0.49	0.72	1.05	0.78	0.70	2
Mean	**0.57**	**0.65**	**0.51**	**0.75**	**0.87**	**0.75**	**0.68**	

Table 14.5 VT Lucerne Perennial: Varietal Trial in Perennial Lucerne (New) : Crude Protein Yield (q/ha)

Entries	Ludhiana	Bikaner	Rahuri	Urulikanchan	Hyderabad	Coimbatore	Mandya	Average	Rank
VTLu-1	24.2	21.3	20.8	22.7	10.6	23.6	10.3	19.1	1
VTLu-2	16.0	19.4	21.1	19.3	10.8	26.2	11.3	17.7	4
VTLu-3	15.5	18.6	18.7	23.5	11.2	28.2	12.0	18.2	3
VTLu-4	15.4	19.5	19.0	21.5	12.3	26.4	13.2	18.2	3
VTLu-5	15.6	15.8	17.1	20.3	17.1	34.5	12.8	19.0	2
Mean	**17.3**	**18.9**	**19.3**	**21.5**	**12.4**	**27.8**	**11.9**	**18.5**	

Table 14.6 VT Lucerne Perennial: Varietal Trial in Perennial Lucerne (New): Crude Protein (%)

Entries	Ludhiana	Bikaner	Rahuri	Urulikanchan	Hyderabad	Coimbatore	Mandya	Average	Rank
VTLu-1	14.7	15.2	22.5	17.6	18.2	17.5	18.0	17.7	3
VTLu-2	14.7	18.6	22.4	18.3	17.7	18.8	17.5	18.3	2
VTLu-3	14.1	15.6	22.4	19.2	19.2	19.3	18.4	18.3	2
VTLu-4	16.1	14.9	21.0	18.4	20.0	20.1	19.3	18.5	1
VTLu-5	15.5	13.5	19.9	17.8	21.1	19.7	20.6	18.3	2
Mean	**15.0**	**15.5**	**21.7**	**18.3**	**19.2**	**19.1**	**18.7**	**18.2**	

Table 14.7 VT Lucerne Perennial: Varietal Trial in Perennial Lucerne (New): Plant Height (cm)

Entries	Ludhiana	Bikaner	Rahuri	Urulikanchan	Hyderabad	Mandya	Coimbatore	Average	Rank
VTLu-1	80.0	94.4	54.9	84.8	83.2	59.2	74.5	75.9	2
VTLu-2	74.0	81.6	59.4	83.3	76.3	65.0	76.5	73.7	4
VTLu-3	75.0	83.6	57.8	78.9	66.1	61.6	75.6	71.2	5
VTLu-4	76.0	90.0	59.4	84.0	73.3	68.6	73.2	74.9	3
VTLu-5	86.0	95.0	60.1	89.0	84.5	64.6	80.5	80.0	1
Mean	**78.2**	**88.9**	**58.3**	**84.0**	**76.7**	**63.8**	**76.1**	**75.1**	

Table 14.8 VT Lucerne Perennial: Varietal Trial in Perennial Lucerne (New): Leaf Stem Ratio

Entries	Ludhiana	Bikaner	Rahuri	Urulikanchan	Hyderabad	Mandya	Coimbatore	Average	Rank
VTLu-1	1.21	1.48	1.14	0.87	0.61	0.40	0.46	0.88	2
VTLu-2	1.12	1.62	1.33	0.85	0.58	0.49	0.49	0.93	1
VTLu-3	1.05	1.08	1.25	0.87	0.71	0.40	0.50	0.84	4
VTLu-4	1.13	1.14	1.23	0.87	0.5	0.46	0.46	0.83	5
VTLu-5	1.22	1.18	1.11	0.88	0.59	0.48	0.51	0.85	3
Mean	**1.15**	**1.30**	**1.21**	**0.87**	**0.60**	**0.45**	**0.48**	**0.86**	

Table 14.9 VT Lucerne Perennial: Varietal Trial in Perennial Lucerne (New): ADF (%), NDF (%), & IVDMD (%)

Entries	ADF (%)		NDF (%)		IVDMD (%)	
	Ludhiana	Rank	Ludhiana	Rank	Ludhiana	Rank
VTLu-1	38.3	3	60.1	4	55.2	2
VTLu-2	39.7	4	59.9	3	52.9	5
VTLu-3	36.2	1	59.3	1	53.6	4
VTLu-4	37.4	2	59.7	2	56.3	1
VTLu-5	38.3	3	61.1	5	55.1	3
Mean	**38.0**		**60.0**		**54.6**	

Table 15.1 AVT-1 Lucerne Annual: Varietal Trial in Annual Lucerne (New): Green Forage Yield (q/ha)

Entries	North West Zone						South Zone							All India		
	Ludh-iana	Bika-ner	**Jal-ore	Aver-age	Ra-nk	Superi-ority%	Hydera-bad	Coimb-atore	Man-dya	Dhar-wad	Aver-age	Ra-nk	Super-iority%	Aver-age	Ra-nk	Superi-ority%
LLC-6	881.7	518.0	76.7	492.1	1	16.0	353.0	745.8	245.2	196.5	385.1	1	4.4	490.0	1	12.4
AL-66	580.5	534.6	98.1	404.4	4		312.4	666.6	234.1	166.0	344.8	3		415.7	4	
RL-88 (NC)	676.7	516.5	79.4	424.2	2		293.6	596.6	254.4	234.7	344.8	3		428.8	3	
Anand-2 (NC)	633.3	506.1	81.9	407.1	3		334.2	708.3	243.6	189.3	368.8	2		435.8	2	
Mean	**693.1**	**518.8**	**84.0**	**432.0**			**323.3**	**679.3**	**244.3**	**196.6**	**360.9**			**442.6**		
CD at 5%	**15.7**	**NS**	**15.0**				**NS**	**51.5**	**31.0**	**10.3**						
CV%	**1.9**	**4.9**	**12.8**				**10.5**	**5.7**	**9.2**	**3.8**						

Note: ** Data is not included in zonal and all India average due to low yield of data

Table 15.2 AVT-1 Lucerne Annual: Varietal Trial in Annual Lucerne (New): Dry Matter Yield (q/ha)

Entries	North West Zone						South Zone							All India		
	Ludh-iana	Bika-ner	**Jal-ore	Aver-age	Ra-nk	Super-iority%	Hydera-bad	Coimb-atore	Man-dya	Dhar-wad	Aver-age	Ra-nk	Superi-ority%	Aver-age	Ra-nk	Superi-ority%
LLC-6	164.0	113.2	13.4	96.9	1	8.4	69.8	176.1	52.6	52.8	87.8	1	7.6	104.7	1	11.1
AL-66	110.3	127.4	17.1	84.9	3		61.6	149.9	42.9	45.1	74.9	4		89.5	4	
RL-88 (NC)	120.4	133.8	13.8	89.3	2		58.1	134.1	52.1	64.2	77.1	3		93.8	3	
Anand-2 (NC)	111.5	127.7	14.3	84.5	4		67.1	161.2	47.0	51.3	81.6	2		94.3	2	
Mean	**126.6**	**125.5**	**14.6**	**88.9**			**64.2**	**155.3**	**48.6**	**53.4**	**80.4**			**95.6**		
CD at 5%	**5.4**	**8.8**	**2.7**				**NS**	**8.2**	**7.4**	**3.3**						
CV%	**2.9**	**5.1**	**13.4**				**13.7**	**3.9**	**11.0**	**4.4**						

Note: ** Data is not included in zonal and all India average due to low yield of data

Table 15.3 AVT-1 Lucerne Annual: Varietal Trial in Annual Lucerne (New): Green Forage Yield (q/ha/day)

Entries	Ludhiana	Bikaner	Mandya	Coimbatore	Dharwad	Average	Rank
LLC-6	4.34	2.76	2.95	4.43	2.18	3.33	1
AL-66	2.86	2.84	2.77	3.93	1.84	2.85	4
RL-88 (NC)	3.33	2.75	3.07	3.53	2.61	3.06	2
Anand-2 (NC)	3.12	2.69	2.92	4.25	2.10	3.02	3
Mean	**3.41**	**2.76**	**2.93**	**4.04**	**2.18**	**3.06**	

Table 15.4 AVT-1 Lucerne Annual: Varietal Trial in Annual Lucerne (New): Dry Matter Yield (q/ha/day)

Entries	Ludhiana	Bikaner	Mandya	Coimbatore	Dharwad	Average	Rank
LLC-6	0.81	0.60	0.63	1.05	0.59	0.74	1
AL-66	0.54	0.68	0.51	0.89	0.50	0.62	4
RL-88 (NC)	0.59	0.71	0.63	0.79	0.71	0.69	2
Anand-2 (NC)	0.55	0.68	0.56	0.97	0.57	0.67	3
Mean	**0.62**	**0.67**	**0.58**	**0.92**	**0.59**	**0.68**	

Table 15.5 AVT-1 Lucerne Annual: Varietal Trial in Annual Lucerne (New): Crude Protein Yield (q/ha)

Entries	Bikaner	Hyderabad	Coimbatore	Mandya	Average	Rank
LLC-6	15.5	13.6	37.0	9.8	19.0	1
AL-66	16.3	12.3	29.5	7.9	16.5	4
RL-88 (NC)	18.0	11.4	28.7	10.0	17.0	3
Anand-2 (NC)	17.0	13.5	35.3	9.2	18.8	2
Mean	**16.7**	**12.7**	**32.6**	**9.2**	**17.8**	

Table 15.6 AVT-1 Lucerne Annual: Varietal Trial in Annual Lucerne (New): Crude Protein (%)

Entries	Ludhiana	Bikaner	Hyderabad	Coimbatore	Mandya	Average	Rank
LLC-6	15.5	13.7	19.6	21.0	18.8	17.7	2
AL-66	13.8	12.8	20.0	19.7	18.4	16.9	4
RL-88 (NC)	15.9	13.5	19.5	21.4	19.3	17.9	1
Anand-2 (NC)	11.7	13.3	20.0	21.9	19.7	17.3	3
Mean	**14.2**	**13.3**	**19.8**	**21.0**	**19.0**	**17.5**	

Table 15.7 AVT-1 Lucerne Annual: Varietal Trial in Annual Lucerne (New): Plant Height (cm)

Entries	Ludhiana	Bikaner	Hyderabad	Mandya	Coimbatore	Average	Rank
LLC-6	85.0	94.0	92.2	47.7	80.4	79.9	2
AL-66	80.0	105.6	61.5	44.3	76.8	73.6	4
RL-88 (NC)	78.0	97.6	78.8	51.7	74.8	76.2	3
Anand-2 (NC)	78.0	98.6	102.9	45.7	78.2	80.7	1
Mean	**80.3**	**99.0**	**83.9**	**47.4**	**77.6**	**77.6**	

Table 15.7 AVT-1 Lucerne Annual: Varietal Trial in Annual Lucerne (New): Leaf Stem Ratio

Entries	Ludhiana	Bikaner	Hyderabad	Mandya	Coimbatore	Average	Rank
LLC-6	1.15	1.42	0.23	0.37	0.51	0.74	2
AL-66	1.16	1.08	0.33	0.54	0.49	0.72	3
RL-88 (NC)	1.11	1.14	0.49	0.58	0.46	0.76	1
Anand-2 (NC)	1.25	0.95	0.26	0.47	0.50	0.69	4
Mean	**1.17**	**1.15**	**0.33**	**0.49**	**0.49**	**0.72**	

Table 15.8 AVT-1 Lucerne Annual: Varietal Trial in Annual Lucerne (New): ADF (%), NDF (%) & IVDMD (%)

Entries	ADF (%)		NDF (%)		IVDMD (%)	
	Ludhiana	Rank	Ludhiana	Rank	Ludhiana	Rank
LLC-6	39.8	2	56.1	3	53.3	3
AL-66	40.7	3	55.7	1	53.0	4
RL-88 (NC)	39.5	1	56.0	2	56.2	1
Anand-2 (NC)	43.7	4	58.9	4	54.6	2
Mean	**40.9**		**56.7**		**54.3**	

16. IVT BAJRA (MULTICUT): INITIAL VARIETAL TRIAL IN FODDER BAJRA (MULTICUT) IN SUMMER (Reference tables 16.1 to 16.7)

In Initial Varietal Trial on Summer Bajra Multicut, four entries were evaluated along with 3 checks (Giant Bajra, Moti Bajra, and BAIF Bajra-1) at seven locations in central and south zone. There were 4 locations in central zone and 3 in south zone.

For GFY (q/ha), entries SBH-103 and ADV175020 were superior by margin of 8.5% and 7.5% respectively over the best check in central zone. Same entries SBH-103 and ADV175020 were superior by a margin of 18.1% and 4.9% respectively over the best check in south zone. Combining both the zones, entries SBH-103 and ADV175020 were superior by margin of 14.2% and 9.1% respectively over the best check (BAIF Bajra 1).

For DMY (q/ha), entry ADV175020 was superior over the best check (Moti Bajra) in central zone by a margin of 7.6%. In SZ, entries SBH-103 and ADV175020 were superior by a margin of 15.2% and 2.3% respectively over the best check in south zone. Combining both the zones, entries SBH-103 and ADV175020 were superior by margin of 9.4% and 11.6% respectively over the best check (BAIF Bajra-1).

For fodder production potential (q/ha/day), entry SBH 103 ranked first for green matter, while entry ADV 175020 ranked first for dry matter. Entry SBH-103 ranked first for plant height followed by National check BAIF Bajra-1. Entry NBFH-227 ranked first for leafiness.

For quality parameters, entry SBH-103 (15.4 q/ha) ranked first followed by ADV 175020 (14.8 q/ha) for crude protein yield. Entry SBH-103 (11.2%) ranked first followed by National check BAIF Bajra-1 (11.0%) for crude protein content.

17. AVT-1 BAJRA (MULTICUT): FIRST ADVANCED VARIETAL TRIAL IN FODDER BAJRA (MULTICUT) IN SUMMER

(Reference tables 17.1 to 17.8)

In First stage Advanced Varietal Trial on Summer Bajra Multicut, two entries were evaluated along with 3 checks (Giant Bajra, Moti Bajra, and BAIF Bajra-1) at four locations in central zone and 3 locations in south zone.

For GFY (q/ha), DMY (q/ha), national check was superior over the tested entries in central and south zone.

For fodder production potential (q/ha/day), national check BAIF Bajra-1 ranked first for green and dry matter. National check BAIF Bajra-1 ranked first for plant height and leafiness.

For quality parameters, national check BAIF Bajra-1 ranked first for crude protein yield, whereas entry ADV0111 ranked first with marginal superiority over the best check for crude protein content. Entry SBH-101 ranked first in ADF %, NDF % and IVDMD %.

Table 16.1 IVT Bajra (Multi cut): Initial Varietal Trial in fodder bajra (Multi cut) in summer: Green Forage Yield (q/ha)

Entries	Central Zone							South Zone						All India		
	Rah-uri	Urulikan-chan	Ana-nd	Jabal-pur	Aver-age	Ra-nk	Superi-ority%	Hydera-bad	Man-dya	Vella-yani	Aver-age	Ra-nk	Superi-ority%	Aver-age	Ra-nk	Superi-ority%
BAIF Bajra-8	774.1	1019.4	742.7	474.3	752.6	6		583.4	755.9	226.0	521.8	4		653.7	4	
SBH-103	699.3	1284.2	928.1	597.7	877.3	1	8.5	753.5	823.6	292.0	623.0	1	18.1	768.4	1	14.2
NBFH 2277	669.3	1268.3	695.5	420.7	763.5	5		569.5	665.7	285.0	506.7	5		653.4	5	
ADV175020 HIH 5020	714.2	1331.4	791.7	641.5	869.7	2	7.5	625.1	775.9	260.0	553.7	2	4.9	734.2	2	9.1
Moti Bajra (NC)	652.0	1293.4	613.2	676.5	808.8	3		329.9	634.9	181.0	381.9	6		625.9	6	
BAIF Bajra 1 (NC)	691.2	1097.3	814.2	523.8	781.6	4		600.7	711.1	271.0	527.6	3		672.8	3	
Giant Bajra (NC)	715.1	1272.0	529.2	610.2	781.6	4		388.9	507.3	156.0	350.7	7		597.0	7	
Mean	**702.2**	**1223.7**	**730.7**	**563.5**	**805.0**			**550.1**	**696.3**	**238.7**	**495.1**			**672.2**		
CD at 5%	**65.3**	**212.0**	**141.3**	**4.2**				**99.3**	**127.0**	**5.8**						
CV%	**6.3**	**11.6**	**13.0**	**10.4**				**12.0**	**12.3**	**1.6**						

Table 16.2 IVT Bajra (Multi cut): Initial Varietal Trial in fodder bajra (Multi cut) in summer: Dry Matter Yield (q/ha)

Entries	Central Zone							South Zone						All India		
	Rah-uri	Urulikan-chan	Ana-nd	Jabal-pur	Aver-age	Ra-nk	Super-iority%	Hydera-bad	Man-dya	Vella-yani	Aver-age	Ra-nk	Superi-ority%	Aver-age	Ra-nk	Superi-ority%
BAIF Bajra-8	167.9	177.8	109.9	101.6	139.3	4		112.6	103.8	56.0	90.8	5		118.5	5	
SBH-103	126.2	195.9	144.8	119.7	146.6	3		146.3	151.9	73.0	123.7	1	15.2	136.8	2	9.4
NBFH 2277	135.9	190.9	115.3	85.2	131.8	7		112.0	124.7	70.0	102.2	4		119.1	4	
ADV175020 HIH 5020	156.2	235.7	126.3	129.3	161.9	1	7.6	113.1	152.7	64.0	109.9	2	2.3	139.6	1	11.6
Moti Bajra (NC)	131.6	238.5	93.5	138.3	150.5	2		61.5	112.5	45.0	73.0	7		117.3	6	
BAIF Bajra 1 (NC)	156.2	168.8	121.1	107.0	138.3	5		112.6	142.7	67.0	107.4	3		125.0	3	
Giant Bajra (NC)	134.0	200.2	74.7	128.2	134.3	6		71.1	116.9	39.0	75.7	6		109.2	7	
Mean	**144.0**	**201.1**	**112.2**	**115.6**	**143.2**			**104.2**	**129.3**	**59.1**	**97.5**			**123.6**		
CD at 5%	**13.2**	**34.6**	**23.0**	**1.1**				**24.5**	**19.7**	**4.5**						
CV%	**6.2**	**11.5**	**13.8**	**13.2**				**15.7**	**10.3**	**5.0**						

Table 16.3 IVT Bajra (Multi cut): Initial Varietal Trial in fodder bajra (Multi cut) in summer: Green Forage Yield (q/ha/day) & Dry Matter Yield (q/ha/day)

Entries	GFY (q/ha/day)					DMY (q/ha/day)				
	Rahuri	Anand	Vellayani	Average	Rank	Rahuri	Anand	Vellayani	Average	Rank
BAIF Bajra-8	7.04	6.24	5.00	6.09	4	1.53	0.92	1.30	1.25	5
SBH-103	6.36	7.80	6.50	6.89	1	1.15	1.22	1.60	1.32	2
NBFH 2277	6.08	5.84	6.30	6.07	5	1.24	0.97	1.60	1.27	4
ADV175020 HIH 5020	6.49	6.65	5.80	6.31	3	1.42	1.06	1.50	1.33	1
Moti Bajra (NC)	5.93	5.15	4.00	5.03	6	1.20	0.79	1.00	1.00	6
BAIF Bajra 1 (NC)	6.28	6.84	6.00	6.37	2	1.42	1.02	1.50	1.31	3
Giant Bajra (NC)	6.50	4.45	3.50	4.82	7	1.22	0.63	0.90	0.92	7
Mean	**6.38**	**6.14**	**5.30**	**5.94**		**1.31**	**0.94**	**1.34**	**1.20**	

Table 16.4 IVT Bajra (Multi cut): Initial Varietal Trial in fodder bajra (Multi cut) in summer: Crude Protein Yield (q/ha)

Entries	Rahuri	Urulikanchan	Anand	Jabalpur	Hyderabad	Mandya	Average	Rank
BAIF Bajra-8	17.5	14.5	13.9	8.1	10.1	9.5	12.3	4
SBH-103	14.9	17.1	17.9	9.6	14.9	17.8	15.4	1
NBFH 2277	16.3	15.8	14.0	6.7	9.2	10.3	12.1	5
ADV175020 HIH 5020	18.2	22.6	14.8	10.3	9.9	13.3	14.8	2
Moti Bajra (NC)	12.1	18.9	11.9	11.1	5.1	9.4	11.4	6
BAIF Bajra 1 (NC)	18.5	13.5	14.6	8.6	10.9	16.3	13.7	3
Giant Bajra (NC)	12.3	17.9	9.5	10.2	6.5	11.2	11.2	7
Mean	**15.7**	**17.2**	**13.8**	**9.2**	**9.5**	**12.5**	**13.0**	

Table 16.5 IVT Bajra (Multi cut): Initial Varietal Trial in fodder bajra (Multi cut) in summer: Crude Protein (%)

Entries	Rahuri	Urulikanchan	Anand	Hyderabad	Mandya	Average	Rank
BAIF Bajra-8	10.4	8.2	14.0	9.0	9.2	10.2	4
SBH-103	11.8	8.7	13.6	10.2	11.8	11.2	1
NBFH 2277	12.0	8.3	13.6	8.3	8.3	10.1	5
ADV175020 HIH 5020	11.6	9.6	13.3	8.8	8.7	10.4	3
Moti Bajra (NC)	9.2	7.9	14.2	8.3	8.3	9.6	6
BAIF Bajra 1 (NC)	11.8	8.0	13.8	9.7	11.4	11.0	2
Giant Bajra (NC)	9.2	8.9	14.1	9.1	9.6	10.2	4
Mean	**10.9**	**8.5**	**13.8**	**9.1**	**9.6**	**10.4**	

Table 16.6 IVT Bajra (Multi cut): Initial Varietal Trial in fodder bajra (Multi cut) in summer: Plant Height (cm)

Entries	Rahuri	Urulikanchan	Anand	Jabalpur	Hyderabad	Mandya	Vellayani	Average	Rank
BAIF Bajra-8	153.4	163.5	129.7	159.6	84.1	132.4	168.0	141.5	3
SBH-103	144.3	170.2	131.3	165.6	83.6	172.0	160.0	146.7	1
NBFH 2277	130.0	160.6	130.8	141.6	81.7	140.2	202.0	141.0	4
ADV175020 HIH 5020	137.4	150.8	130.4	136.9	64.7	156.9	201.0	139.7	5
Moti Bajra (NC)	155.3	165.5	132.4	151.7	83.8	117.6	171.0	139.6	6
BAIF Bajra 1 (NC)	143.5	172.9	122.7	151.9	82.5	151.0	185.0	144.2	2
Giant Bajra (NC)	135.5	158.6	136.2	148.3	90.8	148.1	145.0	137.5	7
Mean	**142.8**	**163.1**	**130.5**	**150.8**	**81.6**	**145.4**	**176.0**	**141.5**	

Table 16.7 IVT Bajra (Multi cut): Initial Varietal Trial in fodder bajra (Multi cut) in summer: Leaf Stem Ratio

Entries	Rahuri	Urulikanchan	Anand	Jabalpur	Hyderabad	Mandya	Vellayani	Average	Rank
BAIF Bajra-8	0.39	0.47	2.31	0.63	0.45	0.24	0.60	0.73	2
SBH-103	0.34	0.57	2.09	0.68	0.44	0.26	0.60	0.71	4
NBFH 2277	0.48	0.54	2.99	0.59	0.45	0.24	0.60	0.84	1
ADV175020 HIH 5020	0.37	0.56	2.04	0.72	0.57	0.27	0.50	0.72	3
Moti Bajra (NC)	0.28	0.66	1.74	0.76	0.46	0.22	0.70	0.69	6
BAIF Bajra 1 (NC)	0.33	0.58	1.99	0.67	0.47	0.24	0.60	0.70	5
Giant Bajra (NC)	0.45	0.64	1.69	0.69	0.43	0.24	0.80	0.71	4
Mean	**0.38**	**0.57**	**2.12**	**0.68**	**0.47**	**0.24**	**0.63**	**0.73**	

Table 17.1 AVT-1 Bajra (Multi cut): Advanced Varietal Trial-1 in fodder bajra (Multi cut) in summer: Green Forage Yield (q/ha)

Entries	Central Zone						South Zone					All India	
	Rah-uri	Urulikan-chan	Ana-nd	Jabal-pur	Aver-age	Ra-nk	Hydera-bad	Man-dya	Vella-yani	Aver-age	Ra-nk	Aver-age	Ra-nk
ADVO111	871.5	936.1	711.5	515.2	758.6	3	354.0	631.0	233.0	406.0	3	607.5	4
SBH-101	607.3	1140.2	641.7	580.8	742.5	4	351.9	684.9	263.0	433.3	2	610.0	3
Moti Bajra (NC)	918.1	1079.5	592.0	696.5	821.5	1	385.3	520.5	111.0	338.9	4	614.7	2
Giant Bajra (NC)	561.5	1159.2	321.5	635.4	669.4	5	393.6	429.2	116.0	312.9	5	516.6	5
BAIF Bajra 1 (NC)	767.5	1209.5	778.8	457.6	803.3	2	435.2	865.2	330.0	543.5	1	692.0	1
Mean	**745.2**	**1104.9**	**609.1**	**577.1**	**759.1**		**384.0**	**626.1**	**210.6**	**406.9**		**608.1**	
CD at 5%	**108.4**	**156.5**	**119.1**	**6.0**			**46.6**	**97.4**	**5.6**				
CV%	**9.4**	**9.1**	**12.7**	**13.8**			**7.8**	**10.5**	**1.7**				

Table 17.2 AVT-1 Bajra (Multi cut): Advanced Varietal Trial-1 in fodder bajra (Multi cut) in summer: Dry Matter Yield (q/ha)

Entries	Central Zone						South Zone					All India	
	Rah-uri	Urulikan-chan	Ana-nd	Jabal-pur	Aver-age	Ra-nk	Hydera-bad	Man-dya	Vella-yani	Aver-age	Ra-nk	Aver-age	Ra-nk
ADVO111	189.5	174.8	138.0	109.4	152.9	3	66.2	133.6	58.0	85.9	3	124.2	3
SBH-101	119.9	225.6	130.8	122.8	149.8	4	67.0	161.2	65.0	97.7	2	127.5	2
Moti Bajra (NC)	161.2	195.9	115.1	148.1	155.1	2	71.8	100.6	26.0	66.1	5	117.0	4
Giant Bajra (NC)	112.1	217.0	52.6	134.5	129.0	5	76.2	104.4	29.0	69.9	4	103.7	5
BAIF Bajra 1 (NC)	174.2	234.2	142.9	95.7	161.7	1	79.5	165.3	82.0	108.9	1	139.1	1
Mean	**151.4**	**209.5**	**115.9**	**122.1**	**149.7**		**72.1**	**133.0**	**52.0**	**85.7**		**122.3**	
CD at 5%	**21.2**	**29.1**	**32.4**	**1.3**			**9.6**	**21.2**	**4.6**				
CV%	**9.1**	**8.9**	**18.1**	**14.0**			**8.5**	**10.7**	**5.7**				

Table 17.3 AVT-1 Bajra (Multi cut): Advanced Varietal Trial-1 in fodder bajra (Multi cut) in summer: Green Forage Yield (q/ha/day) & Dry Matter Yield (q/ha/day)

Entries	GFY (q/ha/day)					DMY (q/ha/day)				
	Rahuri	Anand	Vellayani	Average	Rank	Rahuri	Anand	Vellayani	Average	Rank
ADVO111	6.14	5.98	5.20	5.77	2	1.33	1.16	1.30	1.26	2
SBH-101	4.28	5.39	5.90	5.19	3	0.84	1.10	1.50	1.15	3
Moti Bajra (NC)	6.47	4.98	2.60	4.68	4	1.14	0.97	0.60	0.90	4
Giant Bajra (NC)	3.95	2.70	2.60	3.09	5	0.79	0.44	0.60	0.61	5
BAIF Bajra 1 (NC)	5.41	6.55	7.30	6.42	1	1.23	1.20	1.80	1.41	1
Mean	**5.25**	**5.12**	**4.72**	**5.03**		**1.07**	**0.97**	**1.16**	**1.07**	

Table 17.4 AVT-1 Bajra (Multi cut): Advanced Varietal Trial-1 in fodder bajra (Multi cut) in summer: Crude Protein Yield (q/ha)

Entries	Rahuri	Urulikanchan	Anand	Jabalpur	Hyderabad	Mandya	Average	Rank
ADVO111	23.5	17.1	16.5	8.8	5.9	12.8	14.1	2
SBH-101	14.6	18.4	15.9	9.2	6.2	16.6	13.5	3
Moti Bajra (NC)	17.3	16.1	13.4	11.1	6.7	9.3	12.3	4
Giant Bajra (NC)	13.8	18.2	6.7	10.1	7.3	9.8	11.0	5
BAIF Bajra 1 (NC)	20.5	21.9	16.5	7.2	7.5	16.4	15.0	1
Mean	**18.0**	**18.3**	**13.8**	**9.3**	**6.7**	**13.0**	**13.2**	

Table 17.5 AVT-1 Bajra (Multi cut): Advanced Varietal Trial-1 in fodder bajra (Multi cut) in summer: Crude Protein (%)

Entries	Rahuri	Urulikanchan	Anand	Hyderabad	Mandya	Average	Rank
ADVO111	12.4	9.8	13.7	8.9	9.6	10.9	1
SBH-101	12.2	8.2	13.9	9.3	10.3	10.8	2
Moti Bajra (NC)	10.7	8.2	13.7	9.4	9.2	10.3	4
Giant Bajra (NC)	12.3	8.4	13.9	9.6	9.3	10.7	3
BAIF Bajra 1 (NC)	11.8	9.3	13.7	9.4	9.9	10.8	2
Mean	**11.9**	**8.8**	**13.8**	**9.3**	**9.7**	**10.6**	

Table 17.6 AVT-1 Bajra (Multi cut): Advanced Varietal Trial-1 in fodder bajra (Multi cut) in summer: Plant Height (cm)

Entries	Rahuri	Urulikanchan	Anand	Jabalpur	Hyderabad	Mandya	Vellayani	Average	Rank
ADVO111	147.7	149.7	133.1	149.7	129.8	153.0	163.0	146.6	2
SBH-101	130.9	149.8	142.3	147.3	96.1	159.2	162.0	141.1	4
Moti Bajra (NC)	110.0	164.2	135.1	168.0	82.4	123.6	176.0	137.0	5
Giant Bajra (NC)	104.4	155.5	140.1	156.8	137.3	151.8	168.0	144.8	3
BAIF Bajra 1 (NC)	129.1	159.4	140.3	138.5	118.3	159.8	191.0	148.1	1
Mean	**124.4**	**155.7**	**138.2**	**152.1**	**112.8**	**149.5**	**172.0**	**143.5**	

Table 17.7 AVT-1 Bajra (Multi cut): Advanced Varietal Trial-1 in fodder bajra (Multi cut) in summer: Leaf Stem Ratio

Entries	Rahuri	Urulikanchan	Anand	Jabalpur	Hyderabad	Mandya	Vellayani	Average	Rank
ADVO111	0.28	0.76	2.18	0.62	0.27	0.23	0.70	0.72	3
SBH-101	0.30	0.78	1.85	0.67	0.45	0.26	0.80	0.73	2
Moti Bajra (NC)	0.52	0.65	1.48	0.77	0.47	0.26	0.50	0.66	4
Giant Bajra (NC)	0.39	0.55	2.16	0.72	0.36	0.23	0.60	0.72	3
BAIF Bajra 1 (NC)	0.55	0.62	2.08	0.58	0.38	0.32	0.70	0.75	1
Mean	**0.41**	**0.67**	**1.95**	**0.67**	**0.39**	**0.26**	**0.66**	**0.72**	

Table 17.8 AVT-1 Bajra (Multi cut): Advanced Varietal Trial-1 in fodder bajra (Multi cut) in summer: ADF (%), NDF (%) and IVDMD (%)

Entries	ADF (%)		NDF (%)		IVDMD (%)	
	Rahuri	Rank	Rahuri	Rank	Rahuri	Rank
ADVO111	36.1	2	61.8	3	60.4	3
SBH-101	33.1	1	57.6	1	63.0	1
Moti Bajra (NC)	36.2	3	60.9	2	60.7	2
Giant Bajra (NC)	38.7	4	65.6	4	58.8	4
BAIF Bajra 1 (NC)	40.8	5	67.7	5	57.1	5
Mean	**37.0**		**62.7**		**60.0**	

18. AVT-2 BAJRA (MULTICUT): SECOND ADVANCED VARIETAL TRIAL IN FODDER BAJRA (MULTICUT) IN SUMMER

(Reference tables 18.1 to 18.9)

In Second Advanced Varietal Trial on Summer Bajra Multicut, three entries were evaluated along with 3 checks (Giant Bajra, Moti Bajra, and Raj Bajra-1) at four locations in Central zone.

For GFY (q/ha), entry BAIF Bajra-5 (4.5%), TSFB-18-1 (4.3%) and BAIF Bajra-6 (1.2%) were superior over the best check. For DMY (q/ha), entry BAIF Bajra -5 and TSFB-18-1 showed marginal superiority of 1.9% and 0.1% respectively over the best check Raj Bajra-1.

For fodder production potential (q/ha/day), Check ranked first for both green and dry matter. Check Raj Bajra-1 ranked first for plant height. Whereas entry BAIF Bajra-6 ranked first for leafiness

For quality parameters, entry BAIF Bajra-5 (15.5q/ha) ranked first followed by national check Raj Bajra-1 (15.4 q/ha) for crude protein yield. For crude protein, entry TSFB-18-1 and check Raj Bajra-1 were ranked first with the value of 9.8% followed by entry BAIF Bajra-6 (9.7%). National check Raj Bajra-1 ranked first for ADF, NDF and IVDMD %.

19. AVT-2 (SEED) BAJRA (MULTICUT): SECOND ADVANCED VARIETAL TRIAL IN FODDER BAJRA (MULTICUT) IN SUMMER FOR SEED

(Reference tables 19.1)

In Second Advanced Varietal Trial on Summer Bajra Multicut for seed, three entries were evaluated along with 3 checks (Giant Bajra, Moti Bajra, and Raj Bajra-1) at four locations in Central zone.

For seed yield (q/ha), all entries performed inferior to the checks.

Table 18.1 AVT-2 Bajra (Multi cut): Advanced Varietal Trial-2 in fodder bajra (Multi cut) in summer: Green Forage Yield (q/ha)

Entries	Central Zone						
	Rahuri	Urulikanchan	Anand	Jabalpur	Average	Rank	Superiority (%)
BAIF Bajra-6	768.4	1082.6	811.8	528.2	797.8	3	1.2
BAIF Bajra-5	792.9	1072.8	987.8	440.2	823.4	1	4.5
TSFB-18-1	899.5	1032.9	785.8	569.8	822.0	2	4.3
Giant Bajra (NC)	1048.2	528.4	497.6	637.5	677.9	6	
Raj Bajra (NC)	976.0	871.7	827.4	476.7	788.0	4	
Moti Bajra (NC)	914.8	857.6	809.0	494.9	769.1	5	
Mean	**900.0**	**907.7**	**786.6**	**524.6**	**779.7**		
CD at 5%	**141.9**	**138.1**	**145.8**	**3.6**			
CV%	**10.5**	**10.0**	**12.3**	**9.4**			

Table 18.2 AVT-2 Bajra (Multi cut): Advanced Varietal Trial-2 in fodder bajra (Multi cut) in summer: Dry Matter Yield (q/ha)

Entries	Central Zone						
	Rahuri	Urulikanchan	Anand	Jabalpur	Average	Rank	Superiority (%)
BAIF Bajra-6	175.8	200.3	132.8	108.9	154.4	5	
BAIF Bajra-5	184.8	207.4	182.1	87.3	165.4	1	1.9
TSFB-18-1	193.1	196.1	141.9	118.8	162.4	2	0.1
Giant Bajra (NC)	234.0	99.7	79.4	129.5	135.6	6	
Raj Bajra (NC)	227.6	157.6	168.9	95.2	162.3	3	
Moti Bajra (NC)	207.2	165.2	159.9	96.6	157.2	4	
Mean	**203.7**	**171.0**	**144.2**	**106.0**	**156.2**		
CD at 5%	**31.8**	**26.2**	**26.7**	**0.9**			
CV%	**10.4**	**10.1**	**12.3**	**11.1**			

Table 18.3 AVT-2 Bajra (Multi cut): Advanced Varietal Trial-2 in fodder bajra (Multi cut) in summer: Green Forage Yield (q/ha/day)

Entries	Rahuri	Anand	Average	Rank
BAIF Bajra-6	6.99	6.82	6.90	5
BAIF Bajra-5	7.21	8.30	7.75	2
TSFB-18-1	8.18	6.60	7.39	4
Giant Bajra (NC)	9.53	4.18	6.86	6
Raj Bajra (NC)	8.87	6.95	7.91	1
Moti Bajra (NC)	8.32	6.80	7.56	3
Mean	**8.18**	**6.61**	**7.40**	

Table 18.4 AVT-2 Bajra (Multi cut): Advanced Varietal Trial-2 in fodder bajra (Multi cut) in summer: Dry Matter Yield (q/ha/day)

Entries	Rahuri	Anand	Average	Rank
BAIF Bajra-6	1.60	1.12	1.36	5
BAIF Bajra-5	1.68	1.53	1.61	2
TSFB-18-1	1.76	1.19	1.47	3
Giant Bajra (NC)	2.13	0.67	1.40	4
Raj Bajra (NC)	2.07	1.42	1.74	1
Moti Bajra (NC)	1.88	1.34	1.61	2
Mean	**1.85**	**1.21**	**1.53**	

Table 18.5 AVT-2 Bajra (Multi cut): Advanced Varietal Trial-2 in fodder bajra (Multi cut) in summer: Crude Protein Yield (q/ha)

Entries	Rahuri	Urulikanchan	Anand	Jabalpur	Average	Rank
BAIF Bajra-6	14.3	16.9	15.8	9.9	14.2	5
BAIF Bajra-5	13.7	17.4	23.4	7.5	15.5	1
TSFB-18-1	15.9	16.9	18.1	10.2	15.2	3
Giant Bajra (NC)	15.9	9.1	10.2	11.3	11.6	6
Raj Bajra (NC)	17.3	14.8	21.1	8.4	15.4	2
Moti Bajra (NC)	16.2	13.9	19.3	8.4	14.5	4
Mean	**15.6**	**14.8**	**18.0**	**9.3**	**14.4**	

Table 18.6 AVT-2 Bajra (Multi cut): Advanced Varietal Trial-2 in fodder bajra (Multi cut) in summer: Crude Protein (%)

Entries	Rahuri	Urulikanchan	Anand	Jabalpur	Average	Rank
BAIF Bajra-6	8.1	8.5	13.3	9.1	9.7	2
BAIF Bajra-5	7.4	8.4	14.1	8.5	9.6	3
TSFB-18-1	8.2	8.6	13.7	8.6	9.8	1
Giant Bajra (NC)	6.8	9.2	13.7	8.7	9.6	3
Raj Bajra (NC)	7.6	9.4	13.3	8.9	9.8	1
Moti Bajra (NC)	7.8	8.4	13.5	8.7	9.6	3
Mean	**7.7**	**8.7**	**13.6**	**8.7**	**9.7**	

Table 18.7 AVT-2 Bajra (Multi cut): Advanced Varietal Trial-2 in fodder bajra (Multi cut) in summer: Plant Height (cm)

Entries	Rahuri	Urulikanchan	Anand	Jabalpur	Average	Rank
BAIF Bajra-6	149.3	135.3	132.8	167.9	146.3	2
BAIF Bajra-5	113.9	145.7	131.4	147.7	134.7	6
TSFB-18-1	140.2	147.8	130.1	162.8	145.2	3
Giant Bajra (NC)	153.9	135.5	136.2	147.7	143.3	4
Raj Bajra (NC)	165.2	159.9	144.7	157.2	156.8	1
Moti Bajra (NC)	143.3	148.5	141.6	135.8	142.3	5
Mean	**144.3**	**145.4**	**136.1**	**153.2**	**144.8**	

Table 18.8 AVT-2 Bajra (Multi cut): Advanced Varietal Trial-2 in fodder bajra (Multi cut) in summer: Leaf Stem Ratio

Entries	Rahuri	Urulikanchan	Anand	Jabalpur	Average	Rank
BAIF Bajra-6	0.40	0.80	2.94	0.68	1.21	1
BAIF Bajra-5	0.38	0.79	2.82	0.48	1.12	2
TSFB-18-1	0.38	0.64	2.23	0.65	0.98	3
Giant Bajra (NC)	0.33	0.75	1.61	0.60	0.82	5
Raj Bajra (NC)	0.29	0.58	1.25	0.48	0.65	6
Moti Bajra (NC)	0.34	0.60	1.89	0.53	0.84	4
Mean	**0.35**	**0.69**	**2.12**	**0.57**	**0.94**	

Table 18.9 AVT-2 Bajra (Multi cut): Advanced Varietal Trial-2 in fodder bajra (Multi cut) in summer: ADF (%) NDF (%), and IVDMD (%)

Entries	ADF (%)		NDF (%)		IVDMD (%)	
	Rahuri	Rank	Rahuri	Rank	Rahuri	Rank
BAIF Bajra-6	41.3	6	65.4	6	56.7	6
BAIF Bajra-5	40.2	3	64.3	3	57.6	3
TSFB-18-1	40.3	4	64.4	4	57.5	4
Giant Bajra (NC)	40.4	5	64.5	5	57.4	5
Raj Bajra (NC)	38.0	1	62.1	1	59.3	1
Moti Bajra (NC)	38.5	2	62.6	2	58.9	2
Mean	**39.8**		**63.9**		**57.9**	

Table 19.1 AVT-2 Bajra (Multi cut) (Seed): Advanced Varietal Trial-2 in fodder bajra (Multi cut) (Seed) in summer: Seed Yield (q/ha)

Entries	Central Zone					
	Rahuri	**Urulikanchan**	**Anand**	**Jabalpur**	**Average**	**Rank**
BAIF Bajra-6	9.7	8.7	13.9	11.8	11.0	6
BAIF Bajra-5	10.2	7.5	17.8	10.3	11.4	4
TSFB-18-1	10.1	7.9	17.6	9.8	11.3	5
Giant Bajra (NC)	11.5	23.4	24.6	7.9	16.8	3
Raj Bajra (NC)	11.4	24.8	26.0	12.8	18.7	1
Moti Bajra (NC)	9.6	28.3	26.0	8.5	18.1	2
Mean	**10.4**	**16.8**	**21.0**	**10.2**	**14.6**	
CD at 5%	**1.4**	**2.6**	**5.1**	**0.14**		
CV%	**8.8**	**10.3**	**16.2**	**18.8**		

CHAPTER-2

FORAGE CROP PRODUCTION

FORAGE CROP PRODUCTION

The forage crop production programme was executed at 61 locations in five zones. In total 20 experiments were conducted, out of which 13 were in network (9 coordinated and 4 AVT based) and 7 were in location specific mode. The main emphasis was to increase the system productivity and resource use optimization in forages and forage based cropping systems. In addition to above, the results of nutrient management for productivity enhancement in dual purpose oats, varieties and cutting management to improve the productivity, quality and seed production of berseem, organic nutrients for fodder cowpea-maize system and Rice bean-oat under irrigated situation, cutting and splitting of nitrogen to enhance the yield and quality of fodder oat cultivars, economical potassium fertilizer sources for fodder maize, optimizing the planting geometry, nitrogen levels and cutting regimes to optimize the fodder productivity of Moringa (*Moringa oleifera*), studies on plant growth regulators on forage yield and quality of maize-oat cropping system have also been presented. The trials were also initiated on precision nitrogen management for fodder yield and nitrogen use efficiency enhancement in fodder maize, strategies for sustainable organic fodder of sorghum-berseem cropping sequence, stubble management and planting density of forage oat under zero tillage conditions in rice fallows. The results of studies on bio-fortification of annual cereal fodder crops, intercropping approaches to enhance the seed setting and seed yield in lucerne, magnesium nutrition in Bajra Napier Hybrid, round the year organic fodder production system have been encouraging. The salient research achievements of the forage crop production trials during Rabi 2020-21 are as follows:

A. COORDINATED TRIALS

R-18-AST-4: Nutrient management for productivity enhancement in dual purpose oats
[Table Reference: R-18-AST-4 (a)-(o)]

Locations: Kalyani, Jorhat, Imphal, Ayodhya, Jabalpur, Anand

The trial was initiated at six centres (Kalyani, Jorhat, Imphal, Ayodhya, Jabalpur and Anand) to find out the effect of nutrient management on forage and grain yields, forage quality and production economics of dual purpose Oats in Rabi 2018-19.This is the 3rd year (Rabi 2020-2021) of experimentation.The treatments included T_1–Control, T_2-RDF (N: P_2O_5: K_2O -80:40:40 kg/ha), T_3-75% of RDN + Vermicompost @ 2t/ha, T_4-T_3 + PSB $_{(Soil)}$ @ 1.5 kg/ha, T_5-T_4 + Seed treatment with *Azotobacter* @ 10 g/kg seed, T_6-T_5 + $ZnSO_4$ @ 20 kg/ha (soil application as basal), T_7-T_5 + $ZnSO_4$ @ 15 kg/ha (soil application as basal), T_8-T_6 + Foliar spray of $ZnSO_4$ (0.5%)at just before flowering and T_9-T_7 + Foliar spray of $ZnSO_4$ (0.5%) at just before flowering treatments were replicated thrice in Randomized Block Design. The 1st cut was taken after 60 DAS then crop left for seed production. 50% nitrogen was applied at basal + 25% after 40 DAS + 25 % after 1st cut. The crop was sown at 25 cm X 5 cm spacing using 80kg seed per hectare.

The third (3rd) year results indicated that among the nine treatments, T_8- 75% of RDN + Vermicompost @ 2t + PSB application to Soil @ 1.5 kg + Seed treatment with *Azotobacter* @ 10 g/kg seed + $ZnSO_4$ @ 20 kg/ha (soil application as basal) + Foliar spray of $ZnSO_4$ (0.5%) just before flowering proved the best. It recorded maximum GFY, DMY, crude protein content and yield as well as highest test weight and seed yield.This was closely followed by T_4, T_5, T_7 and T_9. T_8-75% of RDN + Vermicompost @ 2t + PSB application to Soil @ 1.5 kg + Seed treatment with *Azotobacter* @ 10 g/kg seed+ $ZnSO_4$ @ 20 kg/ha (soil application as basal) + Foliar spray of $ZnSO_4$ (0.5%) just before flowering also recorded Maximum net monetary return (RS.55,179/-) and BC Ratio (2.78).

Table R-18-AST-4 (a): Effect of Nutrient management on green fodder yield of dual purpose oat

Treatments	Green Fodder Yield (q/ha)						
	Anand	Ayodhya	Kalyani	Jabalpur	Imphal	Jorhat	Mean
T_1	357	14.93	47.2	164.96	56.85	97.17	123.02
T_2	576	49.96	72.7	199.76	93.45	120.13	185.33
T_3	539	65.00	82.7	212.16	103.40	124.33	187.77
T_4	552	72.90	89.2	218.26	105.25	125.47	193.85
T_5	563	77.20	92.3	221.16	109.62	127.33	198.44
T_6	492	85.16	99.3	229.16	114.81	131.03	191.91
T_7	522	79.06	94.9	224.76	123.63	128.10	195.41
T_8	635	91.56	112.9	230.16	130.33	132.60	222.09
T_9	603	80.83	98.7	225.96	126.46	131.57	211.09
SE(m) ±	27.32	3.39	1.88	1.44	1.27	0.927	--
C.D. (P=0.05)	81.91	10.17	5.64	3.72	2.70	2.892	--
CV (%)	8.80	8.47	10.2	5.02	2.06	13.2	--

Table R-18-AST-4 (b): Effect of Nutrient management on dry matter yield of dual purpose oat

Treatments	Dry Matter Yield (q/ha)						
	Anand	Ayodhya	Kalyani	Jabalpur	Imphal	Jorhat	Mean
T_1	46.09	2.81	6.30	34.12	12.34	19.43	20.18
T_2	73.54	9.55	10.3	40.55	12.63	24.03	28.43
T_3	78.19	12.50	11.8	42.86	14.60	24.87	30.80
T_4	73.60	14.56	12.8	43.98	13.72	25.10	30.63
T_5	72.07	15.26	13.4	44.51	13.83	25.47	30.76
T_6	66.39	16.83	14.6	45.99	14.31	26.20	30.72
T_7	69.38	15.64	13.9	45.18	17.34	25.63	31.18
T_8	82.81	18.27	17.0	46.18	18.70	26.50	34.91
T_9	74.63	15.95	14.5	45.4	12.62	26.30	31.57
SE(m) ±	4.76	0.56	0.42	0.48	1.30	0.182	--
C.D. (P=0.05)	14.27	1.63	1.26	0.84	2.75	0.567	--
CV (%)	11.65	7.21	8.32	6.04	15.53	7.71	--

Table R-18-AST-4 (c): Effect of Nutrient management on crude protein content of oat fodder

Treatments	Crude Protein (%)						
	Anand	Ayodhya	Kalyani	Jabalpur	Imphal	Jorhat	Mean
T_1	14.10	7.61	8.65	9.68	9.40	6.42	9.31
T_2	15.01	9.07	10.7	12.88	9.20	7.34	10.70
T_3	14.80	9.733	11.4	13.68	8.73	7.58	10.99
T_4	13.84	9.933	11.9	14.28	9.37	7.65	11.16
T_5	14.53	10.61	12.5	14.78	10.53	7.34	11.72
T_6	14.28	11.45	13.2	15.78	8.93	7.51	11.86
T_7	15.48	11.02	12.9	15.08	9.10	7.67	11.88
T_8	15.48	11.80	14.1	16.28	9.07	7.98	12.45
T_9	15.02	11.23	13.3	15.28	8.77	7.61	11.87
SE(m) ±	0.87	0.28	0.1	0.37	0.09	0.091	--
C.D. (P=0.05)	NS	0.85	0.3	0.51	0.20	0.285	--
CV (%)	10.28	4.81	6.45	4.93	1.74	4.21	--

Table R-18-AST-4 (d): Effect of Nutrient management on crude protein yield of oat

Treatments	Crude Protein Yield (q/ha)						
	Anand	Ayodhya	Kalyani	Jabalpur	Imphal	Jorhat	Mean
T_1	6.52	0.21	0.56	0.95	1.16	1.23	1.77
T_2	11.06	0.86	1.10	1.83	1.16	1.74	2.96
T_3	11.51	1.22	1.35	2.18	1.27	1.83	3.23
T_4	10.24	1.43	1.54	2.39	1.29	1.85	3.12
T_5	10.43	1.61	1.69	2.52	1.45	1.84	3.26
T_6	9.52	1.92	1.93	2.85	1.28	1.92	3.24
T_7	10.71	1.72	1.81	2.64	1.58	1.89	3.39
T_8	12.81	2.15	2.42	2.97	1.70	2.00	4.01
T_9	11.06	1.78	1.92	2.69	1.11	1.94	3.42
SE(m) ±	0.82	0.04	0.08	0.94	0.13	0.018	--
C.D. (P=0.05)	2.46	0.12	0.24	2.22	0.27	0.055	--
CV (%)	13.62	5.17	7.14	5.89	16.25	3.7	--

Table R-18-AST-4 (e): Effect of Nutrient management on seed yield of oat

Treatments	Seed Yield (q/ha)						
	Anand	Ayodhya	Kalyani	Jabalpur	Imphal	Jorhat	Mean
T_1	8.15	6.38	8.14	47.27	11.20	1.60	13.79
T_2	15.83	12.73	14.1	48.17	13.29	11.31	19.24
T_3	13.48	13.56	15.5	48.67	13.76	12.64	19.60
T_4	14.05	14.25	16.1	49.37	13.42	13.04	20.04
T_5	15.60	14.73	16.8	50.17	13.52	12.88	20.62
T_6	14.40	15.91	17.8	51.37	13.64	13.97	21.18
T_7	15.24	14.96	17.7	50.77	13.21	13.56	20.91
T_8	17.67	16.86	18.9	51.67	16.22	14.32	22.61
T_9	16.93	15.46	18.2	50.87	14.36	13.87	21.62
SE(m) ±	6.5	0.49	0.38	1.72	0.71	0.351	--
C.D. (P=0.05)	19.6	1.47	1.14	NS	1.50	1.051	--
CV (%)	7.76	6.13	11.6	6.84	9.02	6.21	--

Table R-18-AST-4 (f): Effect of Nutrient management on straw yield of oat

	Straw Yield (q/ha)						
	Anand	Ayodhya	Kalyani	Jabalpur	Imphal	Jorhat	Mean
T_1	45.07	28.39	29.9	36.52	50.74	11.65	33.71
T_2	63.98	52.78	56.2	60.24	53.93	27.90	52.51
T_3	66.81	57.57	59.3	65.24	59.31	33.19	56.90
T_4	60.86	60.54	61.0	66.24	58.37	34.03	56.84
T_5	69.76	62.09	62.9	67.74	52.96	36.00	58.58
T_6	68.10	65.41	64.5	71.44	59.60	38.83	61.31
T_7	76.26	62.69	64.1	68.84	59.34	38.20	61.57
T_8	90.12	70.32	65.9	73.14	60.90	40.60	66.83
T_9	79.17	63.85	65.3	71.74	62.62	39.14	63.64
SE(m) ±	5.75	2.11	1.36	1.14	1.30	0.481	--
C.D. (P=0.05)	17.25	6.33	4.08	3.36	2.76	1.590	--
CV (%)	14.16	6.48	6.72	7.44	3.92	6.87	--

Table R-18-AST-4 (g): Effect of Nutrient management on plant height of dual purpose oat at harvest

Treatments	Plant Height (cm) at 55 DAS				
	Anand	Ayodhya	Kalyani	Jorhat	Mean
T_1	86	48.8	71.2	39.58	61.40
T_2	124	71.9	88.0	46.13	82.51
T_3	104	74.0	92.7	46.29	79.25
T_4	112	74.7	93.6	46.31	81.65
T_5	122	76.2	97.5	47.54	85.81
T_6	116	79.3	100.7	52.11	87.03
T_7	116	77.7	99.8	54.11	86.90
T_8	141	79.0	103.3	52.78	94.02
T_9	130	77.7	100.2	52.53	90.11
SE(m) ±	5.22	3.29	1.84	1.079	--
C.D. (P=0.05)	15.66	9.88	5.52	3.368	--
CV (%)	7.75	7.79	8.64	8.31	--

Table R-18-AST-4 (g): Effect of Nutrient management on plant height of dual purpose oat at harvest

Treatments	Plant Height (cm) at harvest						
	Anand	Ayodhya	Kalyani	Jabalpur	Imphal	Jorhat	Mean
T_1	75	101.7	125.2	116.86	80.30	62.91	93.66
T_2	96	120.8	136.5	123.16	79.24	107.76	110.58
T_3	88	123.7	139.7	126.06	78.71	116.81	112.16
T_4	86	126.9	143.3	128.86	80.70	128.66	115.74
T_5	90	127.5	144.9	129.16	83.90	130.64	117.68
T_6	113	131.3	147.4	132.86	97.30	132.79	125.78
T_7	87	128.8	146.7	130.56	98.20	131.36	120.44
T_8	100	134.3	150.9	135.46	101.81	135.58	126.34
T_9	96	130.8	147.3	133.36	107.20	134.06	124.79
SE(m) ±	4.51	4.46	0.78	0.94	1.57	1.091	--
C.D. (P=0.05)	13.53	13.37	2.34	2.22	3.34	3.404	--
CV (%)	8.48	6.19	7.82	5.02	3.04	6.16	--

Table R-18-AST-4 (h): Effect of Nutrient management on plant height of dual purpose oat at harvest

Treatments	Tillers/ Meter Square				ADF (%)	NDF (%)
	Anand	Kalyani	Jorhat	Mean	Anand	Anand
T_1	91	166.3	119	125.43	36.76	69.49
T_2	125	193.1	152	156.7	35.57	69.05
T_3	119	198.8	154	157.27	35.50	69.54
T_4	120	213.2	158	163.73	37.22	69.20
T_5	127	209.1	156	164.03	36.30	69.27
T_6	123	230.4	167	173.47	36.49	68.93
T_7	128	238.1	171	179.03	35.64	69.84
T_8	139	251.2	175	188.4	35.39	69.11
T_9	132	234.3	149	171.77	37.35	70.44
SE(m) ±	4.27	3.42	2.02	--	1.25	0.89
C.D. (P=0.05)	12.80	10.26	6.31	--	NS	NS
CV (%)	6.03	7.24	8.23	--	5.95	2.21

Table R-18-AST-4(i): Effect of Nutrient management on seed yield attributes of dual purpose oat

Treatments	Panicle length (cm)					Panicle weight (g)				
	Ayodhya	Jabalpur	Kalyani	Imphal	Mean	Ayodhya	Jabalpur	Kalyani	Imphal	Mean
T_1	27.6	28.87	27.3	26.33	27.53	4.43	6.27	4.30	4.89	4.97
T_2	31.76	33.47	32.3	27.80	31.33	6.56	8.37	6.60	4.90	6.61
T_3	33.10	34.67	32.9	27.32	32.0	7.60	9.27	7.57	5.08	7.38
T_4	34.43	34.87	33.2	28.40	32.73	8.03	9.77	7.90	5.60	7.83
T_5	34.70	35.27	33.6	28.70	33.07	8.66	10.27	8.37	5.18	8.12
T_6	36.10	36.17	34.4	26.73	33.35	9.23	10.67	8.77	5.29	8.49
T_7	34.83	35.57	33.8	30.80	33.75	8.90	10.47	8.57	5.43	8.34
T_8	37.43	37.47	36.1	32.20	35.8	9.70	11.47	9.63	5.81	9.15
T_9	35.43	35.87	34.4	28.90	33.65	8.96	11.17	9.33	5.76	8.81
SE(m) ±	0.85	0.12	0.12	1.43	--	0.27	0.06	0.06	0.20	--
C.D.(P=0.05)	2.52	0.33	0.36	NS	--	0.81	0.15	0.18	0.42	--
CV (%)	4.35	5.63	10.7	8.67	--	5.89	8.42	8.2	6.48	--

Table R-18-AST-4 (j): Effect of nutrient management on seed yield attributes of dual purpose oat

Treatments	No. of grains /panicle					1000-seed weight (g)				
	Ayodhya	Jabalpur	Kalyani	Imphal	Mean	Ayodhya	Kalyani	Jabalpur	Imphal	Mean
T_1	38.40	37.27	37.2	52	41.22	42.80	45.9	47.27	31.71	41.92
T_2	43.63	43.87	42.7	46	44.05	43.50	46.4	48.17	33.35	42.86
T_3	45.70	45.77	44.9	54	47.59	44.86	46.9	48.67	32.79	43.31
T_4	47.93	49.77	49.0	57	50.93	46.06	47.6	49.37	35.22	44.56
T_5	48.73	50.27	50.2	56	51.30	47.13	48.7	50.17	32.81	44.70
T_6	52.23	53.77	53.2	53	53.05	48.03	49.5	51.37	35.11	46.00
T_7	49.56	52.27	52.5	54	52.08	47.50	49.0	50.77	33.82	45.27
T_8	55.90	57.57	57.2	43	53.42	48.53	49.7	51.67	35.87	46.44
T_9	50.73	54.67	54.6	48	52.00	47.70	49.4	50.87	34.73	45.68
SE(m) ±	1.40	0.42	0.62	1.85	--	1.88	2.14	1.72	0.82	--
C.D.(P=0.05)	4.20	1.26	1.86	3.92	--	NS	NS	NS	1.73	--
CV (%)	5.03	4.83	9.4	6.21	--	7.04	8.68	6.84	4.17	--

Table R-18-AST-4 (k): Effect of nutrient management on gross return of dual purpose oat

Treatments	Gross return (Rs./ha)					Mean
	Ayodhya	Kalyani	Jabalpur	Imphal	Jorhat	
T_1	27093	50,408/-	34700	81079	18898	42435.6
T_2	56934	85,008/-	46750	87839	71353	69576.8
T_3	63274	93,578/-	49500	92431	78952	75547.0
T_4	67317	98,117/-	50250	91064	81166	77582.8
T_5	69813	1,02,845/-	52000	92167	80733	79511.6
T_6	76206	1,08,835/-	56750	94144	86837	84554.4
T_7	70881	1,06,995/-	54000	93736	84447	82011.8
T_8	80311	1,15,942/-	59500	110207	88903	90972.6
T_9	72821	1,09,985/-	57250	100248	86437	85348.2

Table R-18-AST-4 (l): Effect of nutrient management on gross return of dual purpose oat

Treatments	Cost of Cultivation (Rs./ha)			Mean
	Ayodhya	Kalyani	Jabalpur	
T_1	17175	20,145/-	18656	18658.7
T_2	21385	28,578/-	26585	25516.0
T_3	25670	30,717/-	27550	27979.0
T_4	25870	30,678/-	27775	28107.7
T_5	25155	31,187/-	28060	28134.0
T_6	27355	32,783/-	29350	29829.3
T_7	27055	32,653/-	28760	29489.3
T_8	28003	33,540/-	29820	30454.3
T_9	27703	33,007/-	29220	29976.7

Table R-18-AST-4 (m): Effect of nutrient management on net return and B:Cofdual purpose oat

Treatments	Net return(Rs./ha)						B:C Ratio					
	Ayod-hya	Kal-yani	Jor-hat	Jabal-pur	Imp-hal	Mean	Ayod-hya	Kal-yani	Jabal-pur	Imp-hal	Jor-hat	Mean
T_1	9918	30,263/-	6398	16544	42679	21160.4	1.576	2.50	1.86	2.11	1.51	1.91
T_2	35549	56,430/-	55753	20665	42840	42247.4	2.66	2.96	1.76	1.95	4.57	2.78
T_3	37604	62,862/-	61442	22450	29091	42689.8	2.46	3.03	1.80	1.46	4.51	2.65
T_4	41447	67,438/-	61636	22975	27679	44235	2.60	3.18	1.81	1.44	4.16	2.64
T_5	43991	71,658/-	61063	24440	28282	45886.8	2.71	3.28	1.85	1.44	4.10	2.68
T_6	47848	76,118/-	64167	27900	29659	49138.4	2.75	3.31	1.93	1.46	3.83	2.66
T_7	43816	74,342/-	62527	25740	28801	47045.2	2.62	3.26	1.88	1.44	3.85	2.61
T_8	52308	82,402/-	66033	30180	44972	55179.0	2.87	3.45	2.00	1.69	3.89	2.78
T_9	45119	76,812/-	64317	28530	34713	49898.2	2.63	3.33	1.96	1.53	3.91	2.67

Table R-18-AST-4 (n): Effect of Nutrient management on soil fertility parameters after harvest

Treatments	Ayodhya							Kalyani						
	pH	EC (ds m^{-1})	OC (%)	Available nutrient insoil (kg/ha)				pH	EC (dsm^{-1})	OC (%)	Available nutrient in soil (kg/ha)			
				N	P	K	Zinc (mg kg^{-1})				N	P	K	Zn (mg kg^{-1})
T_1	8.7	0.86	0.23	120.27	15.50	240.00	0.43	6.85	0.14	0.48	160.2	26.8	162.5	0.24
T_2	8.6	0.85	0.24	126.33	16.36	258.66	0.44	6.86	0.14	0.51	175.4	34.2	194.3	0.29
T_3	8.5	0.83	0.25	131.96	16.83	264.00	0.45	6.84	0.15	0.54	190.2	36.6	198.4	0.55
T_4	8.5	0.83	0.26	132.80	17.40	269.00	0.46	6.87	0.14	0.53	192.8	37.2	200.3	0.61
T_5	8.6	0.84	0.25	134.03	17.53	272.66	0.46	6.84	0.15	0.54	202.3	38.4	201.7	0.64
T_6	8.5	0.83	0.26	135.23	18.13	275.33	0.54	6.85	0.16	0.55	204.6	38.6	202.5	2.34
T_7	8.6	0.84	0.25	134.30	17.60	273.00	0.52	6.84	0.14	0.56	195.2	39.3	208.6	1.86
T_8	8.5	0.82	0.26	136.26	18.43	279.00	0.54	6.87	0.15	0.57	208.5	40.6	211.4	2.44
T_9	8.6	0.83	0.26	134.76	17.73	275.00	0.52	6.86	0.16	0.55	204.6	39.5	206.2	1.88
Initial	**8.7**	**0.86**	**0.23**	**120.60**	**15.50**	**240.33**	**0.43**	**6.86**	**0.14**	**0.52**	**221.8**	**45.4**	**234.6**	**0.33**

Table of R-18-AST-4(o): Effect of Nutrient management on soil fertility parameters after harvest

Treatments	Imphal				
	pH	OC (%)	Available nutrient in soil (kg/ha)		
			N	P	K
T_1	5.20	0.89	228.7	10.2	138.3
T_2	5.23	1.12	262.3	10.9	164.8
T_3	5.18	1.53	263.8	11.2	164.9
T_4	5.19	1.56	267.9	11.9	166.3
T_5	5.18	1.57	283.4	11.9	171.2
T_6	5.19	1.56	289.4	12.3	184.3
T_7	5.20	1.53	265.3	12.4	187.2
T_8	5.20	1.56	293.2	12.8	192.7
T_9	5.18	1.54	280.1	12.2	187.4
Initial	**5.31**	**1.07**	**268.5**	**11.2**	**169.4**

R-18-AST-5: Studies on effect of varieties and cutting management on productivity, quality and seed production of berseem

[Table Reference: R-18-AST-5 (a)-(e)]

Locations: Pantnagar and Ranchi

The trial was started in Rabi 2018-19 at two centres (Pantnagar & Ranchi) with the objective to study the production potential of berseem varieties and to find out the ideal time of last cut of berseem for higher seed production. The treatments involved combinations of two varieties of berseem (BL-10 and HB-2) and four cutting management i.e., 15 February (2 cut), 2 March (3 cut), 17 March (3 cut) and 1 April (3 cut). The treatments were replicated thrice in Randomized complete block design.

Among the varieties,on locational mean basis, HB- 2 recorded significant cutting higher green (448.6 q/ha), dry matter (67.53 q/ha) and Crude protein yield (19.08 q/ha). The increase was 7.3 in terms of GFY. The HB-2 also recorded significantly higher net return of Rs. 112968.00/ ha and B: C ratio (4.52).

The seed yield and seed yield attributes viz., Filled seed (%), No. of flowers, Seed weight Average number of nodules/plant were superior in BL-10 over HB-2. As regards to cutting management and date of last cut, last cut on 1stApril (3 cut) provided maximum green and dry matter yields. The CP yields were was also significant higher in above cutting management. For seed quality 3 cut with last cut on 2ndmarch and 17 March (3 cut) proved better than other cutting management schedules. The seed yield was higher with 17 March (3 cut) system. It also recorded significantly higher return and BC ratio.

Table R-18-AST-5 (a): Effect of varieties and cutting management on growth parameters of berseem

Treatment	No. of plants/m row	Plant height (cm)			L:S ratio		
	Pantnagar	Pantnagar	Ranchi	Mean	Pantnagar	Ranchi	Mean
A. Varieties							
BL-10	91	41.35	25.92	33.64	0.88	0.62	0.75
HB-2	98	38.01	30.34	34.18	0.83	0.56	0.70
SE(m)±	2.61	0.74	0.91		0.004	0.04	
C.D (P=0.05)	17	NS	NS		0.02	0.02	
B. Cutting management/ Last cut on							
15 February (2 cut)	93	35.19	40.20	37.70	0.85	0.65	0.75
2 March (3 cut)	97	32.59	33.0	32.80	0.84	0.60	0.72
17 March (3 cut)	98	45.30	27.17	36.24	0.87	0.56	0.72
1 April (3 cut)	91	45.64	12.17	28.91	0.87	0.54	0.71
SE(m) ±	6.32	0.5	0.93		0.02	0.02	
C.D. (P=0.05)	20	1.56	2.90		0.05	0.07	
Interaction							
SE(m)±		0.89				0.03	
C.D (P=0.05)		3.43				0.11	

Table R-18-AST-5 (b): Effect of varieties and cutting management on productivity and monetary returns of berseem

Varieties	Green fodder yield (q/ha)			Dry matter yield (q/ha)			Pantnagar			
	Pant-nagar	Ran-chi	Mean	Pant-nagar	Ran-chi	Mean	Germination count (%)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C ratio
BL-10	444.32	391.70	418.01	59.10	70.32	64.71	62	137958	105958	4.30
HB-2	480.89	415.82	448.36	62.03	73.02	67.53	59	144968	112968	4.52
SE(m) ±	1.27	2.13		0.18	1.79		02	426	426	0.15
C.D. (P=0.05)	8.34	13.98		1 .56	NS		NS	2791	2791	0.95
Cutting management/Last cut										
15 February (2 cut)	329.58	269.62	299.60	43.15	47.81	45.48	56	114461	86961	4.16
2 March (3 cut)	471.65	385.0	428.33	61.75	56.51	59.13	64	145149	111649	4.33
17 March (3 cut)	476.73	451.50	464.12	62.45	81.38	71.92	65	155025	121525	4.63
1 April (3 cut)	572.45	508.92	540.69	74.91	88.98	81.95	60	151216	117716	4.51
SE(m) ±	6.56	3.63		0.86	1.10		02	1098	1098	0.03
C.D. (P=0.05)	20.43	11.32		2.67	3.53		05	3423	3423	0.10
Interaction										
SE(m) ±		4.93			2.22			1411	1411	0.05
C.D. (P=0.05)	S	18.51		S	11.89		NS	4839	4839	0.15

Table R-18-AST-5 (c): Effect of varieties and cutting management on seed production and seed quality of berseem

S N	Treatment	1000 seed weight (g)			Seed yield (q/ha)			Filled seed (%)	Unfilled Seed (%)
A.	**Varieties**	**Ranchi**	**Pantnagar**	**Mean**	**Pantnagar**	**Ranchi**	**Mean**	**Pantnagar**	**Pantnagar**
1	BL-10	2.45	1.77	2.11	0.65	1.14	0.90	39.83	57.67
2	HB-2	2.54	1.70	2.12	0.57	1.17	0.87	36.75	63.25
	SE(m) ±	0.03	0.04		0.01	0.02		1.39	0.51
	C.D. (P=0.05)	NS	NS		0.05			NS	3.36
B	**Cutting management/ Last cut**								
1	15 February (2 cut)	2.67	1.70	2.19	0.50	1.34	0.92	38.17	61.83
2	2 March (3 cut)	2.57	1.85	2.21	0.70	1.40	1.05	52.17	47.83
3	17 March (3 cut)	2.38	1.77	2.08	0.95	1.20	1.08	39.83	60.17
4	1 April (3 cut)	2.42	1.61	2.02	0.29	0.69	0.49	23.00	72.00
	SE(m) ±	0.03	0.02		0.03	0.02		2.19	3.97
	C.D. (P=0.05)	0.09	0.07		0.09	0.06		6.84	12.38
C	**Interaction**								
	SE(m) ±	0.05				0.03			
	C.D. (P=0.05)	0.24	NS		S	0.15		NS	NS

Table R-18-AST-5 (d): Effect of varieties and cutting management on seed quality of berseem

A. Varieties	No. of flowers/plant	Seed weight (g/pl)	Av. no. of nodules/pl	Crude protein content (%)			Crude protein yield (q/ha)		
	Pantnagar	Pantnagar	Pantnagar	Pantnagar	Ranchi	Mean	Pantnagar	Ranchi	Mean
BL-10	46.68	0.54	30.29	19.18	20.46	11.12	11.34	14.68	13.01
HB-2	41.21	0.49	22.25	18.63	17.41	9.56	11.57	12.70	19.08
SE(m) ±	1.18	0.01	0.42	0.05	0.23		0.04	0.33	
C.D. (P=0.05)	NS	0.04	2.76	0.37	1.50		NS	NS	
B. Cutting management/ Last cut									
15 February (2 cut)	57.32	0.35	26.28	18.57	19.12	18.85	8.01	9.12	5.62
2 March (3 cut)	48.87	0.59	27.79	19.10	19.05	19.08	11.90	13.08	7.57
17 March (3 cut)	38.93	0.79	23.79	19.00	18.62	18.81	11.74	15.10	7.44
1 April (3 cut)	30.65	0.33	27.24	18.93	19.78	19.36	14.18	17.48	8.69
SE(m) ±	1.75	0.02	0.50	0.12	0.24		0.17	0.16	
C.D. (P=0.05)	5.46	0.05	1.57	0.39	0.76		0.51	0.50	
C. Interaction									
SE(m) ±					0.37			0.38	
C.D. (P=0.05)	NS	NS	NS	S	1.64		S	2.18	

R-18-AST-5 (e): Interaction effect of varieties and cutting management on green fodder of berseem Pantnagar

Varieties	Cutting Management				
	15 February (2 cut)	2 March (3 cut)	17 March (3 cut)	1 April (3 cut)	Mean
BL-10	314.1	455.4	477.8	530.0	**444.3**
HB-2	345.1	487.9	475.7	614.9	**480.9**
Mean B	**329.6**	**471.7**	**476.7**	**572.5**	
SE(m) ±	8.1				
C.D. (P=0.05)	26.0				

K-19-AST-1: Studies on organic source of nutrients on forage yield and quality of Fodder cowpea-Maize system under irrigated situation

[Table Reference: K-19-AST-1 (a)-(e)]

Locations: Mandya, Coimbatore, Vellayani and Hyderabad

Preamble: The current agriculture system is largely affected due to unsustainability in food and fodder production due to over use of toxic chemicals, pesticides, fertilizers, which resulted in deterioration of soil health, pollution of ground water sources and more soil erosion which leads to leaching of mobile nutrients resulted in low soil productivity and decreased farm income. Hence there is need for farmers to adopt a healthier way of crop production by utilizing locally available organic source of nutrients so that soil and plant health will be retained and rejuvenated. Apart from these organically grown products fetches more value than normal. Therefore organic agriculture gaining importance in present food & fodder production. Keeping these things in view, the present investigation was carried out to know the effect of different organic source of nutrients on fodder yields and quality and soil health in fodder cowpea –maize cropping system.

A field experiment was started during *kharif*-2019 at four locations to study the effect of organic source of nutrients on forage yield, quality,soil properties and to compare the economics of organic source with inorganic in fodder cowpea-Maize cropping system. The treatments included are T_1-100% RDN through inorganic fertilizers, T_2-100% RDN through FYM, , T_3-75% RDN through FYM+ 25% RDN through vermin compost, T_4-75% RDN through FYM + 25% RDN through bio-compost, T_5-50% RDN through FYM + 50% RDN through vermin compost, T_6-50% RDN through FYM + 50% RDN through bio-compost, T_7-75% RDN of T_2 (both source), T_8-75% RDN of T_3 (both source), T_9-75% RDN of T_4 (both source), T_{10}-75% of RDN T_5 (both source), T_{11}-75% RDN of T_6 (both source) and T_{12}-50% RDN through FYM+ 25% RDN through vermin compost + 25% RDN through bio-compost. The trial was laid out in Randomized block design with replicated thrice.

The data revealed that, on location mean basis, application of 100% RDN through inorganic fertilizer recorded higher green fodder, dry matter and crude protein yield in fodder cowpea (214.3 q, 39.8 q and 7.2 q/ha respectively) and fodder maize (405.7 q, 89.3 q and 9.1 q/ha respectively). The same treatment recorded higher system productivity of green fodder, dry matter and crude protein yield (620.0 q, 129.2 q and 16.3 q/ha respectively) and gross returns (126427 Rs./ha) Net returns (71459 Rs./ha) and B:C ratio of 2.4.

Among organic source of nutrients the higher productivity with respect to green fodder, dry matter and crude protein yield were higher with application of 50% RDN through farm yard manure and remaining 50% RDN through vermi-compost (558.2 q, 112.9 q and 14.5 q/ha respectively). Application of 50% RDN through farm yard manure and remaining 50% RDN through vermi-compost recorded higher gross returns (115100 Rs./ha), Whereas, 50% RDN through farm yard manure and remaining 50% RDN through Bio-compost recorded higher net returns (45300 Rs./ha), and B:C ratio of 1.8.

The data revealed that on centre mean basis, at Mandya centre among organic nutrient sources application of 50% RDN through FYM + 25 % RDN through bio-compost + 25 % RDN through vermin compost (T_{12}) recorded higher total green forage (616.7 q/ha), dry matter (137.6 q/ha) and crude protein yield (15.4 q/ha). The same treatment recorded higher net monetary returns (86741 Rs/ha) and B: C (2.80).

At Coimbatore centre among organic nutrient sources application of 50% RDN through FYM + 50% RDN through vermicompost (T_5) recorded higher total green forage (612.0 q/ha), dry matter (137.1 q/ha) and crude protein yield (21.6 q/ha). The same treatment recorded higher net monetary returns (36022 Rs/ha) and B: C (1.36).

At Vellayani centre among organic nutrient sources application of 50% RDN through FYM + 50% RDN through bio-compost (T_5) recorded higher total green forage (615.3 q/ha). Whereas, higher dry matter (117.2 q/ha) and crude protein yield (15.4 q/ha) with application of 75% RDN through FYM + 25% RDN through vermi-compost (T_3). The higher net monitory returns (64421 Rs/ha) and B: C (1.9) recorded with 75% RDN of T_3 (Both source).

At Hyderabad centre, among organic nutrient sources application of 50% RDN through FYM + 50% RDN through vermin compost (T_5) recorded higher system productivity of green forage yield (462.9 q/ha), dry matter (86.6 q/ha) and crude protein yield (9.1 q/ha). The higher net monetary returns (18350 Rs/ha) and B: C (1.4) was recorded with 50% RDN through FYM + 50% RDN through bio-compost (T_6).

K-19-AST-1(a): Green forage yield as influenced by organic source of nutrients in fodder cowpea-maize system

Treatments	Green forage yield (q/ha)														
	Fodder Cowpea					Fodder Maize					System Total				
	Man-dya	Coimb-atore	Vella-yani	Hydera bad	Mean	Man-dya	Coimb atore	Vellay ani	Hyder abad	Mean	Man-dya	Coim-batore	Vella-yani	Hyder-abad	Mean
T_1	255.6	263.0	181.0	157.5	**214.3**	444.0	423.0	358.7	397.3	**405.7**	699.6	686.0	539.7	554.8	**620.0**
T_2	241.6	190.0	177.7	98.6	**177.0**	335.0	334.0	265.0	281.8	**303.9**	576.5	524.0	442.7	380.4	**480.9**
T_3	228.1	230.0	237.0	121.4	**204.1**	322.0	340.0	377.3	290.8	**332.5**	550.1	570.0	614.3	412.2	**536.7**
T_4	206.1	194.0	153.0	116.4	**167.4**	353.3	311.0	359.0	300.3	**330.9**	559.3	505.0	512.0	416.7	**498.2**
T_5	226.4	246.0	195.3	129.9	**199.4**	316.2	366.0	420.0	333.0	**358.8**	542.5	612.0	615.3	462.9	**558.2**
T_6	237.7	208.0	236.3	122.0	**201.0**	326.6	323.0	335.7	332.8	**329.5**	564.3	531.0	572.0	454.8	**530.5**
T_7	162.4	177.0	223.0	93.5	**164.0**	300.1	283.0	298.0	238.0	**279.8**	462.4	460.0	521.0	331.5	**443.7**
T_8	154.9	188.0	209.0	108.6	**165.1**	269.2	300.0	403.3	276.5	**312.3**	424.1	488.0	612.3	385.1	**477.4**
T_9	146.9	170.0	195.0	107.7	**154.9**	275.6	298.0	212.3	268.8	**263.7**	422.5	468.0	407.3	376.5	**418.6**
T_{10}	152.5	203.0	205.7	116.3	**169.4**	264.3	317.0	362.0	258.1	**300.3**	416.8	520.0	567.7	374.4	**469.7**
T_{11}	192.9	186.0	167.3	114.5	**165.2**	274.1	322.0	324.0	263.5	**295.9**	467.0	508.0	491.3	378.0	**461.1**
T_{12}	230.4	212.0	230.3	105.4	**194.5**	386.3	326.0	350.7	304.3	**341.8**	616.7	538.0	581.0	409.7	**536.3**
S. Em$\pm$	**12.28**	**14.90**	**2.38**	**2.10**	**12.26**	**24.96**	**10.70**	**11.40**	**13.66**	**17.50**	**34.08**	**25.50**	**10.27**	**13.75**	**24.44**
C.D. (P=0.05)	**36.02**	**31.60**	**7.02**	**6.20**	**35.44**	**73.20**	**32.40**	**33.65**	**40.32**	**50.56**	**99.96**	**63.40**	**30.31**	**40.60**	**70.63**

K-19-AST-1(b): Dry matter yield as influenced by organic source of nutrients in fodder cowpea-maize system

Treatments	Dry Matter yield (q/ha)														
	Fodder Cowpea					Fodder Maize					System Total				
	Mandya	Coimbatore	Vellayani	Hyderabad	Mean	Mandya	Coimbatore	Vellayani	Hyderabad	Mean	Man-dya	Coimbatore	Vellayani	Hyderabad	Mean
T_1	50.0	44.4	29.4	35.5	**39.8**	108.3	110.4	72.7	66.0	**89.3**	158.3	154.8	102.1	101.6	**129.2**
T_2	45.2	32.1	28.9	21.2	**31.8**	69.0	87.1	54.6	49.1	**65.0**	114.2	119.2	83.5	70.3	**96.8**
T_3	44.3	38.9	41.8	25.5	**37.6**	66.5	88.8	75.4	49.7	**70.1**	110.9	127.7	117.2	75.2	**107.7**
T_4	41.5	32.8	23.1	26.1	**30.9**	70.2	81.1	71.5	50.6	**68.4**	111.6	113.9	94.6	76.7	**99.2**
T_5	45.9	41.6	31.4	29.7	**37.1**	65.2	95.5	85.5	56.9	**75.8**	111.2	137.1	116.8	86.6	**112.9**
T_6	47.2	35.1	39.8	25.4	**36.9**	71.7	84.4	65.3	58.9	**70.1**	118.8	119.5	105.1	84.4	**106.9**
T_7	31.1	29.8	37.2	18.6	**29.2**	61.7	73.9	59.9	38.9	**58.6**	92.8	103.7	97.1	57.5	**87.8**
T_8	29.3	31.8	34.8	14.7	**27.6**	56.8	78.3	80.5	49.0	**66.1**	86.0	110.1	115.3	63.6	**93.8**
T_9	27.5	28.8	31.3	16.2	**25.9**	56.7	77.7	42.5	50.0	**56.7**	84.1	106.5	73.8	66.2	**82.6**
T_{10}	28.9	34.3	34.5	21.0	**29.7**	55.1	82.7	72.4	47.9	**64.5**	84.0	117.0	106.9	68.8	**94.2**
T_{11}	34.6	31.3	26.7	22.0	**28.6**	55.8	84.1	64.7	46.0	**62.7**	90.3	115.4	91.4	68.0	**91.3**
T_{12}	44.7	35.9	37.1	19.0	**34.2**	92.9	85.2	71.7	57.7	**76.9**	137.6	121.1	108.8	76.7	**111.0**
S. Em±	**3.09**	**1.90**	**0.92**	**0.58**	**2.48**	**4.32**	**2.10**	**1.37**	**3.39**	**4.32**	**6.21**	**4.60**	**1.69**	**3.24**	**5.60**
C.D. (P=0.05)	**9.06**	**5.20**	**2.71**	**1.71**	**7.17**	**12.67**	**6.20**	**4.04**	**10.08**	**12.47**	**18.22**	**11.40**	**4.89**	**9.57**	**16.19**

K-19-AST-1(c): Crude protein yield as influenced by organic source of nutrients in fodder cowpea-maize system

Treatments	Crude Protein Yield (q/ha)														
	Fodder Cowpea					Fodder Maize					System Total				
	Man-dya	Coimb-atore	Vellay ani	Hydera bad	Mea n	Mand ya	Coimb atore	Vellay ani	Hyder abad	Mean	Man-dya	Coimb-atore	Vellay ani	Hydera bad	Mean
T_1	7.75	9.7	5.88	5.53	**7.2**	9.52	14.50	6.54	5.68	**9.1**	17.27	24.2	12.42	11.21	**16.3**
T_2	7.17	7	5.88	2.01	**5.5**	5.96	11.40	4.92	3.51	**6.4**	13.12	18.4	10.69	5.52	**11.9**
T_3	6.99	8.5	5.77	3.4	**6.2**	5.81	11.60	6.79	3.70	**7.0**	12.8	20.1	15.14	7.1	**13.8**
T_4	6.34	7.2	8.35	3.48	**6.3**	5.94	10.60	6.44	3.76	**6.7**	12.28	17.8	11.06	7.24	**12.1**
T_5	7.64	9.1	4.62	4.31	**6.4**	5.81	12.50	7.69	4.81	**7.7**	13.46	21.6	13.96	9.12	**14.5**
T_6	8.17	7.7	6.27	3.61	**6.4**	6.40	11.10	5.87	4.81	**7.0**	14.57	18.8	13.83	8.42	**13.9**
T_7	4.96	6.5	7.96	1.75	**5.3**	5.24	9.70	5.38	2.49	**5.7**	10.21	16.2	12.82	4.24	**10.9**
T_8	4.82	7	7.44	1.71	**5.2**	5.04	10.30	7.25	3.00	**6.4**	9.86	17.3	14.20	4.71	**11.5**
T_9	4.28	6.3	6.96	1.66	**4.8**	4.80	10.20	3.82	3.21	**5.5**	9.09	16.5	10.08	4.87	**10.1**
T_{10}	4.35	7.5	6.26	2.55	**5.2**	4.86	10.80	6.52	3.14	**6.3**	9.22	18.3	13.41	5.69	**11.7**
T_{11}	5.23	6.9	6.89	2.56	**5.4**	5.05	11.00	5.91	3.09	**6.3**	10.29	17.9	11.25	5.65	**11.3**
T_{12}	7.08	7.9	5.34	1.86	**5.5**	8.34	11.20	6.45	4.38	**7.6**	15.42	19.1	13.87	6.24	**13.7**
S. Em$\pm$	**0.54**	**0.60**	**0.55**	**0.12**	**0.56**	**0.37**	**0.40**	**0.39**	**0.18**	**0.40**	**0.80**	**1.00**	**0.23**	**0.23**	**0.71**
C.D. (P=0.05)	**1.59**	**1.10**	**0.19**	**0.37**	**NS**	**1.09**	**1.30**	**0.13**	**0.53**	**1.15**	**2.33**	**2.70**	**0.68**	**0.67**	**2.05**

K-19-AST-1(d): Plant height (cm) as influenced by organic source of nutrients in fodder cowpea-maize system

Treatments	Plant height (cm)									
	Fodder Cowpea					Fodder Maize				
	Mandya	Coimbatore	Vellayani	Hyderabad	Mean	Mandya	Coimbatore	Vellayani	Hyderabad	Mean
T_1	86.77	89.20	107.0	157.2	110.0	230.8	235.1	212.0	221.1	224.8
T_2	68.37	71.00	108.7	123.8	93.0	195.0	227.8	215.3	176.6	203.7
T_3	74.23	82.40	116.7	136.7	102.5	204.9	208.9	236.7	185.7	209.0
T_4	68.27	75.68	108.7	138.5	97.8	185.3	212.1	222.3	189.2	202.2
T_5	76.33	89.13	116.7	153.8	109.0	200.8	229.3	231.7	198.9	215.2
T_6	79.93	78.60	145.7	140	111.0	207.9	209.7	244.7	198.7	215.3
T_7	52.87	64.71	104.0	115.5	84.3	176.3	189.3	203.0	174.4	185.7
T_8	49.33	71.00	108.7	134.5	90.9	166.3	194.9	217.7	166.1	186.2
T_9	45.2	62.51	97.7	113.5	79.7	167.2	210.4	208.3	171.5	189.4
T_{10}	41.83	69.24	117.0	126.3	88.6	183.2	197.8	226.3	162.1	192.4
T_{11}	40.53	63.98	117.0	128.4	87.5	184.2	192.2	208.3	176.6	190.3
T_{12}	79.4	76.85	114.3	125.3	99.0	204.7	212.2	227.3	181.8	206.5
S. Em±	4.34	2.44	2.34	5..40	4.48	12.06	6.62	2.43	9.60	5.32
C.D. (P=0.05)	12.72	7.25	6.90	15.96	12.95	35.37	19.41	7.17	28.35	15.4

K-19-AST-1(e): Economics of fodder Cowpea-Maize system

Treatments	Economics of fodder Cowpea-Maize system														
	Gross Returns (Rs./ha)					Net Returns (Rs./ha)					B: C ratio				
	Man-dya	Coimb-atore	Vella-yani	Hydera bad	Mean	Man-dya	Coimb -atore	Vella-yani	Hyder-abad	Mean	Man-dya	Coimb atore	Vella yani	Hyder abad	Mean
T_1	152703	150345	118580	84081	126427	111244	75077	61465	38049	71459	3.68	2.00	2.07	1.80	2.4
T_2	127382	114280	97240	56348	98813	75062	28894	25915	3250	33280	2.43	1.34	1.36	1.10	1.6
T_3	121433	125565	135694	63073	111441	69496	33515	56084	8930	42006	2.34	1.36	1.7	1.20	1.7
T_4	122169	110729	113664	62874	102359	74416	21933	44883	11535	38192	2.56	1.25	1.65	1.20	1.7
T_5	119826	134718	135915	69940	115100	68766	36022	52010	14754	42888	2.35	1.36	1.62	1.30	1.7
T_6	124751	116610	125840	67930	108783	79136	24423	59290	18350	45300	2.73	1.26	1.89	1.40	1.8
T_7	100603	100767	115141	52643	92289	54699	19536	48366	2350	31238	2.19	1.24	1.72	1.00	1.5
T_8	92553	107051	134640	58264	98127	46672	20843	64421	7194	34783	2.02	1.24	1.91	1.10	1.6
T_9	91842	102177	89540	57163	85181	49159	18402	25929	8194	25421	2.15	1.22	1.41	1.20	1.5
T_{10}	90982	114226	125307	58119	97159	45759	23031	50347	6276	31353	2.01	1.25	1.67	1.10	1.5
T_{11}	103052	110836	109002	58256	95287	62333	24509	47284	10605	36183	2.53	1.28	1.77	1.20	1.7
T_{12}	134853	118359	128982	60576	110693	86741	28094	53593	8367	44199	2.80	1.31	1.71	1.20	1.8

R-19 AST 1: Effect of cutting and splitting of nitrogen doses on growth, yield and quality of fodder oat cultivars

[Table Reference: R-19-AST-1 (a)-(n)]

Location: Raipur, Ranchi, Ayodhya, Pantnagar

Preamble:

Majority of recommended fodder oat varieties have been released based on their single cut performance, but now the farmers are preferring 2-3 cuts in according to their need. Harvest from single cut crop is obtained in bulk, which may pose storage issue before the farmer. Therefore, assessment of oat varieties for three cut is the need of farmers. Nitrogen plays an important role in increasing all the growth and growth attributing characters which finally leads to increased green fodder yield. Nitrogen enhances the photosynthesis, biomass accumulations as well as quick regeneration. For better yield potential knowledge of splitting of nitrogen in proper ratio is necessary for the oat crop for quick regeneration. So that, present study on oat cultivars with cutting and splitting of nitrogen doses was taken in the study**.**

Result:

A Field experiment was initiated during *Rabi* 2019-20 at four locations *i.e.,* Raipur, Ranchi, Ayodhya and Pantnagar to assess the performance of different oat cultivars with cutting and splitting of nitrogen doses with the objectives to study the effect of splitting of nitrogen dose and cutting management on fodder yield and quality of oat varieties. To study the interaction effect on oat varieties and splitting of nitrogen, cutting management on fodder oat and to work out the economics of different treatments of oat cultivars. The experiment was laid out in split plot design with three replications. Oat cultivars RO-19, JHO-851 and UPO-212 was taken at Ranchi, Raipur, Ayodhya and UPO-06-1, JHO 851 and UPO-212 were taken at Pantnagar center. Two cuts and three cuts of oat cultivars with the splitting of nitrogen, two cut + 60% basal+40% at 1st cut, two cut + 50% basal+50% at 1st cut, three cut + 50% basal+25% at 1st cut+25% at 2nd cut and three cut + 40% basal+30% at 1st cut+30% at 2nd cut was applied. For cutting management in case of two cuts, first cut was taken at 50DAS and second cut at 50% flowering. Whereas, for three cuts, first cut was taken at 50DAS second cut at 35 days after first cut and third cut was taken at 50% flowering. The crops were supplemented with 140:60:40 kg NPK /ha.

Second year's results indicated that plant height of different oat varieties differed greatly at different cuts. Number of leaves was influenced significantly by oat varieties at 1st and 2nd cut and 3rd cut. On locational mean basis maximum green fodder yield was obtained with oat cultivar RO-19 i.e. 602.8 q/ha. The corresponding dry matter yields per hectare was 106.8 q/ha. Result of cutting and splitting of N- management shows that at Raipur and Ranchi significantly maximum green fodder yield was recorded with treatment three cut + 50% Basal+25% at 1st cut+25% at 2nd cut. In case of Ayodhya, maximum green fodder yield was obtain with three cut + 40% Basal+30% at 1st cut+30% at 2nd cut. Whereas, in Pantnagar higher green fodder yield was obtain with two cut + 60% Basal+40% at 1st cut. In case of cutting three cuts gives higher GFY as compared two cuts. Per day productivity of green fodder (q/ ha/day) was maximum in RO-19 at Raipur,Ayodhya and Pantnagar (8.4 and 8.6. and 4.71). Significantly higher crude protein yield (15.26 q/ha) was recorded with oat cultivar RO-19. However, higher total crude protein yield (14.34q/ha) was recorded with two cut + 60% basal+40% at 1st cut.

Table: R-19-AST-1 (a): Effect of cutting and splitting of nitrogen doses on green fodder yield of fodder oat cultivars

Treatments	GFY Total (q/ha)				
	Ranchi	**Raipur**	**Ayodhya**	**Pantnagar**	**Mean**
Varieties					
RO-19	490.0	635.4	680.2	605.7	602.8
JHO-851	419.1	431.2	582.7	594.9	507.0
UPO-212	464.7	552.1	582.5	598.3	549.4
SEm±	**2.10**	**9.12**	**10.81**	**10.75**	
CD (P = 0.05)	**8.40**	**35.81**	**42.45**	**NS**	
Cutting and splitting of N- management					
Two cut + 60% Basal+40% at 1st cut	450.5	519.4	586.6	714.1	567.6
Two cut + 50% Basal+50% at 1st cut	456.2	505.6	597.3	702.4	565.4
Three cut + 50% Basal+25% at 1st cut+25% at 2nd cut	464.3	570.4	627.3	490.4	538.1
Three cut + 40% Basal+30% at 1st cut+30% at 2nd cut	460.7	563.0	649.3	491.6	541.2
SEm±	**4.60**	**10.82**	**9.66**	**14.75**	
C.D. (P=0.05)	**NS**	**32.16**	**28.69**	**44.17**	
Interaction(VXN)	**NS**	**S**	**S**	**NS**	

Table: R-19-AST-1 (b): Effect of cutting and splitting of nitrogen doses on dry matter yield of fodder oat cultivars

Treatments	**DMY Total (q/ha)**				
	Ranchi	**Raipur**	**Ayodhya**	**Pantnagar**	**Mean**
Varieties					
RO-19	92.13	120.7	123.62	90.94	106.8
JHO-851	79.04	73.3	107.92	93.26	88.4
UPO-212	86.89	104.5	103.82	91.6	96.7
SEm±	**0.33**	**3.25**	**2.62**	**1.43**	
C.D. (P=0.05)	**1.33**	**12.78**	**10.3**	**NS**	
Cutting and splitting of N- management					
Two cut + 60% Basal+40% at 1st cut	85.31	89.5	112.11	115.1	100.5
Two cut + 50% Basal+50% at 1st cut	85.9	91.6	115.55	107.97	100.3
Three cut + 50% Basal+25% at 1st cut+25% at 2nd cut	87.06	108.4	107.87	74.37	94.4
Three cut + 40% Basal+30% at 1st cut+30% at 2nd cut	85.82	108.5	111.63	70.29	94.1
SEm±	**0.83**	**2.22**	**2.48**	**2.00**	
C.D. (P=0.05)	**NS**	**6.6**	**NS**	**6.00**	
Interaction(VXN)	**NS**	**S**	**NS**	**S**	

Table: R-19-AST-1 (c): Effect of cutting and splitting of nitrogen doses on per day productivity of fodder oat cultivars

Treatments	GFY Per day productivity (q/ ha/day)			
	Raipur	**Ayodhya**	**Pantnagar**	**Mean**
Varieties				
RO-19	8.4	8.62	4.71	7.24
JHO-851	5.5	6.72	4.50	5.57
UPO-212	7.4	7.3	4.75	6.48
SEm±	**0.15**	**0.13**	**0.08**	
C.D. (P=0.05)	**0.6**	**0.53**	**NS**	
Cutting and splitting of N- management				
Two cut + 60% Basal+40% at 1st cut	6.9	6.99	5.74	6.54
Two cut + 50% Basal+50% at 1st cut	6.5	7.02	5.67	6.40
Three cut + 50% Basal+25% at 1st cut+25% at 2nd cut	7.5	7.98	3.57	6.35
Three cut + 40% Basal+30% at 1st cut+30% at 2nd cut	7.4	8.19	3.63	6.41
SEm±	**0.14**	**0.12**	**0.12**	
C.D. (P=0.05)	**0.42**	**0.35**	**0.35**	
Interaction(VXN)	**S**	**S**	**NS**	

Table: R-19-AST-1 (d): Effect of cutting and splitting of nitrogen doses on per day productivity of fodder oat cultivars

Treatments	DFY Per day productivity (q/ ha/day)			
	Raipur	Ayodhya	Pantnagar	Mean
Varieties				
RO-19	1.6	1.42	0.71	1.24
JHO-851	0.9	1.16	0.71	0.92
UPO-212	1.4	1.19	0.73	1.11
SEm±	**0.05**	**0.03**	**0.01**	
C.D. (P=0.05)	**0.19**	**0.12**	**NS**	
Cutting and splitting of N- management				
Two cut + 60% Basal+40% at 1st cut	1.2	1.21	0.92	1.11
Two cut + 50% Basal+50% at 1st cut	1.4	1.23	0.87	1.17
Three cut + 50% Basal+25% at 1st cut+25% at 2nd cut	1.4	1.27	0.54	1.07
Three cut + 40% Basal+30% at 1st cut+30% at 2nd cut	1.2	1.31	0.52	1.01
SEm±	**0.02**	**0.028**	**0.02**	
C.D. (P=0.05)	**0.07**	**0.08**	**0.05**	
Interaction(VXN)	**S**	**NS**	**NA**	

Table: R-19-AST-1 (e): Effect of cutting and splitting of nitrogen doses on quality of fodder oat cultivars

Treatments	Total crude protein yield (q ha-1)				Crude protein Content (%)			
	Raipur	Ayodhya	Pantnagar	Mean	Raipur	Ayodhya	Pantnagar	Mean
Entries								
RO-19	12.97	12.64	20.17	15.26	11.2	10.2	10.03	10.48
JHO-85	7.85	11.1	18.43	12.46	11.6	10.5	10.08	10.73
UPO-212	11.53	10.4	17.01	12.98	11.5	10.1	9.99	10.53
SEm±	**0.42**	**0.29**	**0.51**		0.10	--	0.06	
C.D. (P=0.05)	**1.64**	**1.12**	**2.08**		0.39	--	NS	
Cutting and splitting of N- management								
Two cut + 60% Basal+40% at 1st cut	10.08	11.92	21.01	14.34	12.1	11.4	9.6	11.03
Two cut + 50% Basal+50% at 1st cut	10.16	12.09	20.43	14.23	12.0	11.2	9.9	11.03
Three cut + 50% Basal+25% at 1st cut+25% at 2nd cut	11.43	10.62	17.48	13.18	10.9	10.3	10.2	10.47
Three cut + 40% Basal+30% at 1st cut+30% at 2nd cut	11.45	10.89	15.23	12.52	10.8	10.2	10.4	10.47
SEm±	**0.26**	**0.26**	**0.9**		**0.12**	--	0.13	
C.D. (P=0.05)	**0.76**	**0.77**	**2.66**		**0.36**	--	0.39	
Interaction(VXN)	**S**	**S**	**NS**		**NS**	--	S	

Table: R-19-AST-1 (f): Gross and net monitory return of oat cultivars as influenced by cutting management and splitting of nitrogen

Treatments	Gross monitory return (Rs)					Net monitory return (Rs)				
	Ranchi	Raipur	Ayodhya	Pantnagar	Mean	Ranchi	Raipur	Ayodhya	Pantnagar	Mean
Varieties										
RO-19	73499	95312	102038	121138	97997	47814	65217	72677	86,858	68142
JHO-851	62868	64687	87412	118978	83486	37183	34592	58302	84,689	53692
UPO-212	69697	82812	87375	119667	89888	44012	52717	58265	85,687	60170
SEm±	**312**	**1368**	**1409.12**	**2150**		312	**1368**	**972.41**	2,150	
C.D. (P=0.05)	**1259**	**5372**	**55318**	**NS**		1259	**5372**	**2888.85**	NS	
Cutting and splitting of N- management										
Two cut + 60% Basal+40% at 1st cut	67545	77916	88000	142822	94,071	43795	50100	60950	103,917	64691
Two cut + 50% Basal+50% at 1st cut	68452	75833	89600	140478	93591	44702	48017	62550	107,573	65711
Three cut + 50% Basal+25% at 1st cut+25% at 2nd cut	69649	85555	94100	98084	86,847	42029	53181	62596	62,429	55059
Three cut + 40% Basal+30% at 1st cut+30% at 2nd cut	69104	84444	97400	98327	87319	41484	52070	66230	62,672	55614
SEm±	**694**	**1624**	**1239.56**	2951		694	**1624**	**801.13**	2950	
C.D. (P=0.05)	**NS**	**4824**	**3682.5**	8835		2079	**4824**	**2380**	8835	
Interaction(VXN)	**NS**	**S**	**S**	**NS**		**NS**	**S**	**S**	**NS**	

Table: R-19-AST-1 (g): B: C ratio and cost of cultivation of oat cultivars

Treatments	B:C(Gross)					Cost of Cultivation (Rs)			
	Ranchi	**Raipur**	**Ayodhya**	**Pantnagar**	**Mean**	**Raipur**	**Ayodhya**	**Pantnagar**	**Mean**
Varieties									
RO-19	2.88	3.17	3.51	3.57	3.28	30096	29110	34280	31162
JHO-851	2.46	2.17	3.00	3.51	2.79	30096	29110	34280	31162
UPO-212	2.73	2.75	3.03	3.52	3.01	30096	29110	34280	31162
SEm±	0.01	**0.05**	**0.056**	0.06		30096	29110	34280	31162
C.D. (P=0.05)	0.04	**0.18**	**0.22**	NS					
Cutting and splitting of N- management									
Two cut + 60% Basal+40% at 1st cut	2.84	2.8	3.25	4.34	3.31	27817	27050	32905	29,257
Two cut + 50% Basal+50% at 1st cut	2.88	2.73	3.33	4.27	3.30	27817	27050	32905	29,257
Three cut + 50% Basal+25% at 1st cut+25% at 2nd cut	2.52	2.64	3.01	2.75	2.73	32375	31170	35655	33,067
Three cut + 40% Basal+30% at 1st cut+30% at 2nd cut	2.5	2.61	3.12	2.76	2.75	32375	31170	35655	33,067
SEm±	0.03	**0.06**	**0.04**	0.09					
C.D. (P=0.05)	0.08	**0.16**	**0.12**	0.27					
Interaction(VXN)	**NS**	**S**	**S**	**NS**					

Table: R-19-AST-1 (h): Green fodder yield as influenced by cutting management and splitting of nitrogen on oat cultivars.

Treatment	Green fodder yield (q ha^{-1})							
	Raipur				Ayodhya			
	1st cut	2nd cut	3rd cut	Total	1st cut	2nd cut	3rd cut	Total
Main plot : Variety								
V1: RO-19	214.6	332.6	176.4	**635.4**	220.5	337.5	244.5	**680.2**
V1: JHO-851	120.1	265.3	91.7	**431.2**	121.5	356.0	210.5	**582.7**
V1: UPO-212	191.0	290.3	141.7	**552.1**	171.5	328.0	166.0	**582.5**
SEm±	6.11	4.52	6.86	**9.12**	4.02	6.03	5.16	**10.81**
C.D. (P=0.05)	23.98	17.74	27.66	**35.81**	15.77	23.69	20.26	**42.45**
Cutting management and splitting of nitrogen								
C_1: Two cutting+60% Basal+40% at 1st cut	197.2	322.2	0.0	**519.4**	171.3	415.33	0	**586.6**
C_2: Two cutting+50% Basal+50% at 1st cut	170.4	335.2	0.0	**505.6**	169.0	428.33	0	**597.3**
C_3:Three cutting +50% Basal+25% at 1st cut+25%at 2nd cut	165.7	271.3	133.3	**570.4**	172.0	252.33	203	**627.3**
C_4:Three cutting +40% Basal+30% at 1st cut+30%at 2nd cut	167.6	255.6	139.8	**563.0**	172.3	266.00	211	**649.3**
SEm±	4.34	9.17	3.27	**10.82**	3.34	5.74	3.40	**9.66**
C.D. (P=0.05)	12.90	27.25	NS	**32.16**	NS	17.06	NS	**28.69**
Interaction	NS	NS	NS	**S**	NS	S	NS	**S**

Table: R-19-AST-1 (i): Dry fodder yield as influenced by cutting management and splitting of nitrogen on oat cultivars.

Treatment	Dry fodder yield (q ha^{-1})							
	Raipur				Ayodhya			
	1st cut	2nd cut	3rd cut	Total	1st cut	2nd cut	3rd cut	Total
Main plot : Variety								
V1: RO-19	36.7	64.6	39.0	**120.7**	28.60	67.82	54.52	**123.62**
V1: JHO-851	17.5	46.2	19.2	**73.3**	15.75	70.29	44.84	**107.92**
V1: UPO-212	33.5	56.6	28.9	**104.5**	22.05	65.99	32.03	**103.82**
SEm±	1.46	1.84	.960	**3.25**	0.50	1.39	1.45	**2.62**
C.D. (P=0.05)	5.72	7.24	3.70	**12.78**	1.96	NS	5.69	**10.30**
Cutting management and splitting of nitrogen								
C_1: Two cutting+60% Basal+40% at 1st cut	31.1	58.4	0.0	**89.5**	22.11	90.38	0	**112.11**
C_2: Two cutting+50% Basal+50% at 1st cut	28.0	63.6	0.0	**91.6**	22.00	93.63	0	**115.55**
C_3:Three cutting +50% Basal+25% at 1st cut+25%at 2nd cut	28.4	52.3	27.6	**108.4**	22.28	42.79	128.2 4	**107.87**
C_4:Three cutting +40% Basal+30% at 1st cut+30%at 2nd cut	29.3	48.7	30.4	**108.5**	22.13	45.34	134.5 6	**111.63**
SEm±	0.86	2.19	.92	**2.22**	0.39	1.19	0.94	**2.48**
C.D. (P=0.05)	2.55	6.50	NS	**6.60**	NS	3.54	NS	**NS**
Interaction	NS	NS	NS	**S**	NS	S	NS	**NS**

Table: R-19-AST-1 (j): Dry matter content (%)as influenced by cutting management and splitting of nitrogen on oat cultivars.

Treatment	Dry matter content (%)							
	Raipur				Ayodhya			
	1st cut	2nd cut	3rd cut	Average	1st cut	2nd cut	3rd cut	Average
Main plot : Variety								
V1: RO-19	17.1	19.4	22.1	**18.8**	12.97	19.40	22.3	**18.20**
V1: JHO-851	14.7	17.5	20.9	**16.8**	12.95	19.17	21.3	**18.57**
V1: UPO-212	17.5	19.5	20.5	**18.8**	12.83	19.55	19.3	**17.85**
SEm±	0.31	0.43	.699	**0.35**	**0.18**	**0.27**	**0.77**	**0.48**
C.D. (P=0.05)	1.22	1.69	NS	**1.36**	**NS**	**NS**	**NS**	**NS**
Cutting management and splitting of nitrogen								
C_1: Two cutting+60% Basal+40% at 1st cut	15.5	18.1	0	**16.8**	12.90	21.77	0	**19.13**
C_2: Two cutting+50% Basal+50% at 1st cut	16.2	18.9	0	**17.6**	12.97	21.87	0	**19.37**
C_3:Three cutting +50% Basal+25% at 1st cut+25%at 2nd cut	16.9	19.2	20.6	**18.9**	12.93	16.97	20.87	**17.17**
C_4:Three cutting +40% Basal+30% at 1st cut+30%at 2nd cut	17.2	19.0	21.7	**19.3**	12.87	16.90	21.07	**17.17**
SEm±	0.36	0.23	.399	**0.17**	**0.15**	**0.22**	**0.48**	**0.39**
C.D. (P=0.05)	1.08	0.67	NS	**0.50**	NS	**0.68**	NS	1.15
Interaction	NS	NS	NS	**S**	NS	NS	NS	NS

Table: R-19-AST-1 (k): Per day productivity of green fodder and dry fodder as influenced by cutting management and splitting of nitrogen on oat cultivars

Treatment	GFY Per day productivity (q/ ha/day)							
	Raipur				Ayodhya			
	1st cut	2nd cut	3rd cut	Total	1st cut	2nd cut	3rd cut	Total
Main plot : Variety								
V1: RO-19	4.3	3.5	0.65	8.4	4.41	3.27	1.87	**8.62**
V1: JHO-851	2.4	2.7	0.35	5.5	2.43	3.46	1.66	**6.72**
V1: UPO-212	3.8	3.1	0.52	7.4	3.43	3.24	1.25	**7.30**
SEm±	**0.12**	**0.05**	**1.92**	**0.15**	**0.07**	**0.05**	**0.04**	**0.13**
C.D. (P=0.05)	**0.48**	**0.20**	**NS**	**0.60**	**0.28**	**0.19**	**0.15**	**0.53**
Cutting management and splitting of nitrogen								
C_1Two cut (N60+40)	3.9	3.0	0.00	6.9	3.42	3.57	0	**6.99**
C_2Two cut (N50+50)	3.4	3.1	0.00	6.5	3.38	3.64	0	**7.02**
C_3Three cut (N50+25+25)	3.3	3.2	0.99	7.5	3.44	2.97	1.23	**7.98**
C_4Three cut (N40+30+30)	3.4	3.0	1.03	7.4	3.44	3.12	1.27	**8.19**
SEm±	**0.09**	**0.10**	**1.55**	**0.14**	**0.06**	**0.04**	**0.02**	**0.12**
C.D. (P=0.05)	**0.26**	**0.29**	**NS**	**0.42**	**NS**	**0.11**	**NS**	**0.35**
Interaction	**NS**	**NS**	NS	**S**	NS	**S**	NS	**S**

Table: R-19-AST-1 (l): Per day productivity of dry fodder as influenced by cutting management and splitting of nitrogen on oat cultivars

Treatment	DFY Per day productivity (q/ ha/day)							
	Raipur				Ayodhya			
	1st cut	2nd cut	3rd cut	Total	1st cut	2nd cut	3rd cut	Total
Main plot : Variety								
V1: RO-19	0.73	0.67	0.14	**1.6**	0.57	0.64	0.41	**1.42**
V1: JHO-851	0.35	0.48	0.07	**0.9**	0.31	0.67	0.35	**1.16**
V1: UPO-212	0.67	0.60	0.11	**1.4**	0.44	0.63	0.24	**1.19**
SEm±	0.03	0.02	.007	**0.05**	0.01	0.02	0.01	**0.03**
C.D. (P=0.05)	0.11	0.08	.030	**0.19**	0.04	NS	0.04	**0.12**
Cutting management and splitting of nitrogen				**13.3**				
C_1Two cut (N60+40)	0.62	0.54	0.00		0.44	0.77	0	**1.21**
C_2Two cut (N50+50)	0.56	0.59	0.00	**1.2**	0.44	0.79	0	**1.23**
C_3Three cut (N50+25+25)	0.57	0.62	0.20	**1.4**	0.44	0.50	0.33	**1.27**
C_4Three cut (N40+30+30)	0.59	0.58	0.23	**1.4**	0.44	0.53	0.34	**1.31**
SEm±	0.02	0.02	.006	**1.2**	0.01	0.01	0.007	**0.028**
C.D. (P=0.05)	0.05	0.07	NS	**0.02**	NS	0.04	NS	**0.08**
Interaction	NS	NS	NS	**0.07**	NS	S	NS	**NS**

Table: R-19-AST-1 (m): Plant height as influenced by cutting management and splitting of nitrogen on oat cultivars

Treatment	Plant height (cm)					
	Raipur			Ayodhya		
	1st cut	2nd cut	3rd cut	1st cut	2nd cut	3rd cut
Main plot : Variety						
V1: RO-19	69.35	91.83	105.4	108.57	122.25	119.90
V1: JHO-851	40.17	108.92	107.3	55.42	108.55	100.70
V1: UPO-212	82.42	104.92	97.0	93.95	122.65	119.10
SEm±	**0.50**	**0.97**	**1.61**	**1.84**	**2.79**	**3.61**
C.D. (P=0.05)	**1.98**	**3.81**	**6.52**	**7.22**	**10.95**	**14.17**
Cutting management and splitting of nitrogen						
C_1Two cut (N60+40)	65.46	104.26	0.0	86.73	130.43	0
C_2Two cut (N50+50)	64.48	104.44	0.0	85.40	131.93	0
C_3Three cut (N50+25+25)	64.70	98.96	103.4	86.60	102.26	111.83
C_4Three cut (N40+30+30)	61.26	99.89	103.0	85.20	106.63	114.63
SEm±	**0.77**	**0.89**	**0.91**	**1.64**	**2.51**	**2.27**
C.D. (P=0.05)	**2.29**	**2.63**	**NS**	**NS**	**7.47**	**NS**
Interaction	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

Table: R-19-AST-1 (n): Number of Leaves m^{-1} as influenced by cutting management and splitting of nitrogen on oat cultivars

Treatment	No of Leaves m^{-1}					
	Raipur			Ayodhya		
	1st cut	2nd cut	3rd cut	1st cut	2nd cut	3rd cut
Main plot : Variety						
V1: RO-19	765.50	645.25	446.8	579.87	621.82	637.10
V1: JHO-851	1150.58	729.75	594.0	996.47	944.83	941.65
V1: UPO-212	759.25	653.17	549.3	647.65	654.05	646.40
SEm±	**51.67**	**65.72**	23.16	**16.71**	**18.40**	**23.95**
C.D. (P=0.05)	**202.87**	**258.04**	93.37	**65.60**	**72.22**	**94.01**
Cutting management and splitting of nitrogen						
C_1Two cut (N60+40)	950.56	670.56	0.0	742.46	725.90	0
C_2Two cut (N50+50)	873.78	711.67	0.0	741.76	739.26	0
C_3Three cut (N50+25+25)	906.33	678.11	528.6	741.06	743.70	739.00
C_4Three cut (N40+30+30)	836.44	643.89	531.6	740.03	752.06	744.43
SEm±	**35.51**	**22.78**	**8.13**	**14.41**	**16.68**	**15.15**
C.D. (P=0.05)	**105.52**	**67.67**	**NS**	**NS**	**NS**	**NS**
Interaction	**NS**	**NS**	**NS**	**5.83**	**6.76**	**6.13**

K-19-AST-2: Studies on organic source of nutrient on green forage yield and quality of Rice bean-oat under irrigated situation

[Table Reference: K-19-AST-2 (a)-(i)]

Locations: Kalyani, Jorhat, Imphal, Pusa and Ranchi

A field experiment was started in Kharif 2019 and it was second year (Kharif 2020) of experimentation. It was conducted at five locations to assess the effect of organic sources of nutrient on forage productivity and quality of rice bean – oat cropping system under irrigated condition. The treatments consisted of twelve nutrient management combinations of inorganic fertilizer and organic sources like FYM, vermicompost and bio compost. The treatments are T_1- 100% RDN through inorganic fertilizers, T_2- 100% RDN through FYM , T_3- 75% RDN through FYM + 25% RDN through vermicompost, T_4- 75% N through FYM + 25% RDN through Bio-compost, T_5- 50% RDN through FYM + 50% RDN through vermicompost, T_6- 50% RDN through FYM + 50% RDN through Bio-compost, T_7- 75% of T_2, T_8- 75% of T_3 (both sources), T_9- 75% of T_4 (both sources), T_{10}- 75% of T_5 (both sources), T11 - 75% of T_6 (both sources) and T12 - 50% N through FYM + 25% RDN through vermicompost + 25% RDN through Poultry manure as top dress at 30 DAS.

The treatments were replicated thrice in randomized block design (RBD). The rice bean was sown during kharif, 2020 in 25 cm apart lines using 30 kg seed/ha. Succeeding crop of oat was sown during Rabi. The results indicated that all the treatments improved the green and dry biomass yield significantly over control. This was the second year of experimentation. The highest GFY recorded in T_5 - 50% RDN through FYM + 50% RDN through vermicompost followed by T_6- 50% RDN through FYM + 50% RDN through Bio-compost at all the centres except Ranchi where application of RDF recorded the highest GFY followed by $T_{3.}$ In respect of dry matter yield the highest DMY were recorded in T_5 at Jorhat and Kalyani. However, at Imphal the highest DMY was recorded in T_6 followed by T_5 (but statistically at par) and at Ranchi T_1 recorded the highest DMY followed by T_3. In respect of CPY, the highest total CPY was recorded in T_5 and T_6 both at Jorhat, Imphal and Kalyani. On the other hand at Ranchi the highest total CPY was recorded in T_1 followed by T_2.

Economic analysis of the experiment indicated that at Jorhat, Imphal, Kalyani and Pusa, the highest gross income was obtained in T_5 followed by T_6. On the other hand the highest gross income at Ranchi was recorded in T_1 followed by T_3. The highest net income was recorded in T_8 at Jorhat but at Imphal and Kalyani T_5 recorded the highest net income. At Pusa and Ranchi the highest net income was recorded in T_1. B:C ratio of different treatments revealed that at Jorhat T_8 recorded the highest B:C ratio but at Imphal and Kalyani the highest B:C ratio was recorded in T_7 and T_3, respectively. Again T_1 recorded the highest B:C ratio at Pusa and Ranchi.

In respect of soil fertility status after completion of the sequence, slight increase in pH and Organic carbon was noted as compared to initial status. However there was variations in N, P and K status after the sequence depending upon treatments. However, there is increase in the value of MBC at Kalyani and the highest being observed in T_5 (178 mg/kg) as compared to initial value of MBC (143 mg/kg).

Treatments

T_1 : 100% RDN through inorganic fertilizers
T_2 : 100% RDN through FYM
T_3 : 75% RDN through FYM+ 25% RDN through vermicompost
T_4 : 75% N through FYM+ 25% RDN through Bio-compost
T_5 : 50% RDN through FYM+ 50% RDN through vermicompost
T_6 : 50% RDN through FYM+ 50% RDN through Bio-compost
T_7 : 75% of T_2 (both sources)
T_8 : 75% of T_3 (both sources)
T_9 : 75% of T_4 (both sources)
T_{10} : 75% of T_5 (both sources)
T_{11} : 75% of T_6 (both sources)
T_{12} : 50% N through FYM+ 25% RDN through VC+ 25% RDN through PM

Table K-19-AST- 2(a): Effect of organic source of nutrients on Green forage yield (q/ha) of rice bean-oat system.

Treatment	Jorhat			Imphal			Kalyani			Pusa			Ranchi			Mean		
	Rice bean	Oat	Total	Rice bean	Oat	Total	Rice bean	Oat	Total	Rice bean	Oat	Total	Rice bean	Oat	Total	Rice bean	Oat	Total
T_1	292.8	298.1	591	292.17	268.71	561	320	296.2	616	-	395.8	396	259.78	513.82	774	233	355	588
T_2	280.8	264.2	545	307.67	251.8	559	316	292.8	609	-	330.1	330	167.15	443.4	611	214	316	531
T_3	265.8	281.6	547	342.33	311.7	654	341.6	316.5	658	-	357.9	358	197.09	441	638	229	342	571
T_4	313.5	308.9	622	331.83	301.83	634	336.6	311.4	648	-	342.3	342	168.59	414.01	583	230	336	566
T_5	341.7	313.4	655	365.67	351.32	717	395	372.6	768	-	390.3	390	161.46	452.61	614	253	376	629
T_6	333.3	295.4	629	348.33	329.72	678	365.6	338.2	704	-	370.9	371	139.59	388.52	528	237	345	582
T_7	262.8	236.6	499	268.83	199.8	469	288.3	219.4	508	-	288.7	289	112.45	291.14	404	186	247	434
T_8	303.9	282.8	587	259.5	211.3	471	308.7	242.2	551	-	313.2	313	120.2	289.05	409	198	268	466
T_9	292.5	238.4	531	280.33	213.7	494	306.9	226.3	533	-	306.3	306	106.45	283.73	390	197	254	451
T_{10}	289.8	290	580	283.17	219.33	503	311.6	273.2	585	-	328.6	329	134.31	319.45	454	204	286	490
T_{11}	273.3	284	557	266.5	203.73	470	310	258.4	568	-	314.5	315	99.7	295.48	395	190	271	461
T_{12}	311.7	299.9	612	273.33	252.8	526	313.3	302.8	616	-	371.6	372	155.71	324.16	480	211	310	521
SE(m) ±	14.02	12.954	-	6.27	1.34	6.15	2.62	4.12	6.74	-	16	-	3.76	8	9.54	-	-	-
C.D. (P=0.05)	43.742	40.417	-	18.4	3.94	18.05	7.86	12.4	20.2	-	46.8	-	11.1	23.62	28.2	-	-	-

Table K-19-AST- 2(b): Effect of organic source of nutrients on Dry Matter yield (q/ha) of ricebean-oat system.

	Jorhat			Imphal			Kalyani			Pusa			Ranchi			Mean		
	Rice bean	**Oat**	**Total**	**Rice bean**	**Oat**	**Total**	**Rice bean**	**Oat**	**Total**	**Rice bean**	**Oat**	**Total**	**Rice bean**	**Oat**	**Total**	**Rice bean**	**Oat**	**Total**
T_1	55.37	62.95	118	55.48	64.83	120	59.2	54.2	113	-	65.1	65	56.19	99.36	156	45	69	114
T_2	53.1	55.45	109	51.7	53.9	106	66.9	52.9	120	-	54.9	55	36.11	84.6	121	42	60	102
T_3	50.27	59.3	110	63.39	56.72	120	74.8	59.4	134	-	59.8	60	42.67	86.64	129	46	64	111
T_4	59.27	65.34	125	63.87	49.31	113	73	58.4	131	-	56.7	57	36.5	81.32	118	47	62	109
T_5	64.57	66.33	131	67.43	73.81	141	103.5	73.1	177	-	64.2	64	34.95	86.28	121	54	73	127
T_6	63	62.36	125	62.79	79.3	142	85.9	65	151	-	62.5	63	30.24	76.46	107	48	69	118
T_7	49.7	49.35	99	48.29	48.7	97	47.3	35.9	83	-	47.1	47	24.31	57.36	82	34	48	82
T_8	57.43	59.57	117	46.08	51.24	97	52.2	42.7	95	-	51.4	51	25.97	57.12	83	36	52	89
T_9	55.3	49.75	105	51.52	49.71	101	49.7	38.5	88	-	50.1	50	23.06	56.18	79	36	49	85
T_{10}	54.8	61.16	116	54.93	43.61	99	62	49.3	111	-	54.1	54	29.09	63.33	92	40	54	94
T_{11}	51.67	59.83	112	50.44	40.84	91	59.8	45.8	106	-	51.4	51	21.56	58.76	80	37	51	88
T_{12}	58.93	63.35	122	49.17	43.8	93	61.5	55.9	117	-	63.1	63	33.68	63.77	97	41	58	98
SE(m) ±	2.647	2.864	-	1.47	1.2	1.98	2.41	2.45	4.86	-	2.3	-	0.78	1.2	1.80	-	-	-
C.D. (P=0.05)	8.258	8.936	-	4.32	3.51	5.80	7.23	7.35	14.6	-	6.9	-	2.29	3.54	5.3	-	-	-

Table K-19-AST- 2(c): Effect of organic source of nutrients on CPY (q/ha) of ricebean-oat system

	Jorhat			Imphal			Kalyani			Pusa			Ranchi			Mean		
Treatments	**Rice bean**	**Oat**	**Total**	**Rice bean**	**Oat**	**Total**	**Rice bean**	**Oat**	**Total**	**Rice bean**	**Oat**	**Total**	**Rice bean**	**Oat**	**Total**	**Rice bean**	**Oat**	**Total**
T_1	8.14	4.36	13	7.35	7.24	15	9.3	6.1	15	-	7.8	8	7.71	15.76	23	7	8	15
T_2	8.37	4.06	12	6.37	6.09	12	11.5	5.65	17	-	5.4	5	6.02	11.23	17	6	6	13
T_3	7.48	4.19	12	8.11	6.88	15	7.7	7.31	15	-	6.3	6	4.71	10.62	15	6	7	13
T_4	9.26	5.35	15	9	5.94	15	9.6	7.05	17	-	5.8	6	3.44	8.09	12	6	6	13
T_5	10.24	5.93	16	9.65	8.66	18	11.2	9.82	21	-	7.2	7	2.9	8.97	12	7	8	15
T_6	10.06	5.62	16	8.98	8.78	18	12.5	8.29	21	-	6.9	7	4.48	9.2	14	7	8	15
T_7	7.99	4.38	12	7.13	6	13	5.8	3.39	9	-	4	4	2.25	7.54	10	5	5	10
T_8	9.31	5.9	15	6.44	5.86	12	7.4	4.24	12	-	4.5	5	2.86	6.63	9	5	5	11
T_9	8.85	4.5	13	6.9	5.72	13	7.9	3.78	12	-	4.3	4	2.36	6.07	8	5	5	10
T_{10}	9.02	6.09	15	7.53	5.06	13	10.9	5.14	16	-	4.9	5	2.58	6.62	9	6	6	12
T_{11}	8.47	5.59	14	6.75	4.68	11	6.2	4.75	11	-	4.6	5	1.77	5.26	7	5	5	10
T_{12}	9.26	5.24	15	6.51	5	12	10.3	6.32	17	-	6.9	7	4.31	8.38	13	6	6	13
SE(m) ±	0.464	0.241	-	0.23	0.2	0.31	0.28	0.32	0.60	-	0.3	-	0.15	0.19	0.2	-	-	-
C.D. (P=0.05)	1.449	0.752	-	0.67	0.58	0.92	0.84	0.96	1.8	-	0.8	-	0.45	0.56	0.6	-	-	-

Table K-19-AST- 2(d): Effect of organic source of nutrients on Gross Income (Rs/ha), Net Income (Rs/ha) and B:C ratio of rice bean-oat system

Treatment	Jorhat			Imphal			Kalyani		
	Gross Income	Net Income	B:C ratio	Gross Income	Net Income	B:C ratio	Gross Income	Net Income	B:C ratio
T_1	88635	23335	1.36	126784	61484	0.94	93090	43940	1.90
T_2	84265	8565	1.12	127277	51577	0.68	102790	48070	1.88
T_3	87110	8610	1.11	147923	69423	0.88	117280	60430	2.06
T_4	93360	22600	1.32	143325	72565	1.03	112180	57300	2.04
T_5	98265	17025	1.21	161681	80441	0.99	131626	67026	2.04
T_6	94305	12745	1.15	153027	71467	0.88	120160	58790	1.95
T_7	74910	28450	1.61	107168	60708	1.31	82676	39850	1.94
T_8	88005	39685	1.82	107135	58815	1.22	89780	44596	1.99
T_9	79635	28075	1.54	112823	61263	1.19	85358	38178	1.81
T_{10}	86970	24310	1.39	114658	51998	0.83	97390	43266	1.81
T_{11}	83595	30535	1.58	107372	54312	1.02	93256	44352	1.91
T_{12}	91740	25400	1.38	118893	52553	0.79	99490	44380	1.80

Table K-19-AST- 2(e): Effect of organic source of nutrients on Gross Income (Rs/ha), Net Income (Rs/ha) and B: C ratio of ricebean-oat system

Treatment	Pusa			Ranchi			Mean		
	Gross Income	Net Income	B:C ratio	Gross Income	Net Income	B:C ratio	Gross Income	Net Income	B:C ratio
T_1	59365	33158	2.27	155007	104593	3.08	104576	53302	1.91
T_2	49520	20364	1.70	116655	56443	1.94	96101	37004	1.46
T_3	53685	20618	1.62	125276	53986	1.76	106255	42613	1.49
T_4	51338	21348	1.71	112678	54022	1.92	102576	45567	1.60
T_5	58550	21021	1.56	116331	33965	1.41	113291	43896	1.44
T_6	55640	24267	1.77	100156	43054	1.75	104658	42065	1.50
T_7	43310	16354	1.61	77405	20691	1.37	77094	33211	1.57
T_8	46977	17088	1.57	79419	14397	1.22	82263	34916	1.56
T_9	45948	18367	1.67	74494	18946	1.34	79652	32966	1.51
T_{10}	49283	16460	1.50	88210	14882	1.20	87302	30183	1.35
T_{11}	47180	18974	1.67	74231	21209	1.40	81127	33876	1.52
T_{12}	55745	23787	1.74	95338	34640	1.57	92241	36152	1.46

Table K-19-AST- 2(f): Effect of organic source of nutrients on Plant Height (cm) of rice bean-oat system

Treatment	Jorhat		Imphal		Kalyani		Pusa		Ranchi		Mean	
	Rice bean	Oat	Rice bean	Oat	Rice bean	Oat	Rice bean	Oat	Rice bean	Oat	Rice bean	Oat
T_1	146.9	115.6	180.37	109.3	105.7	149.9	-	130.5	161	121	119	125
T_2	161.9	106.6	191.44	108.22	108.1	129.6	-	122	142	108	121	115
T_3	158.4	110.1	168.89	117.5	117.7	121.5	-	125	126	104	114	116
T_4	164.5	117.2	170.62	111.56	109.9	130.9	-	124	121	102	113	117
T_5	171.5	121.1	198.78	129.83	118.5	116.2	-	129	125	109	123	121
T_6	162.2	105.6	178.33	119.34	119.8	124.1	-	128	126	100	117	115
T_7	158.4	108.8	182.78	181.67	100.8	126.2	-	116	113	85	111	124
T_8	161	111.4	134.11	113.4	105.7	125.8	-	119.9	115	83	103	111
T_9	164.2	110.8	152.78	109.9	103.9	119.7	-	118	116	81	107	108
T_{10}	154.9	107.8	172.11	107.7	107.9	136.3	-	123	111	87	109	112
T_{11}	161.3	102.7	154.89	102.6	103.7	126.5	-	121	112	80	106	107
T_{12}	163.5	107.2	148.67	109.2	112.3	126.9	-	127	124	90	110	112
SE(m) ±	4.445	2.853	4.09	2.02	0.51	1.45	-	3	3	1	-	-
C.D. (P=0.05)	NS	8.902	12	5.94	1.53	4.35	-	8.7	8	4	-	-

Table- K-19-AST- 2(g: Effect of organic source of nutrient on soil fertility parameters after *rabi* 2020-21 harvest (CAU, Imphal)

Treatment	Soil properties		Available nutrient (kg/ha)		
	pH	OC (%)	N	P	K
T_1	5.32	0.98	263.7	11.10	158.3
T_2	5.36	1.10	270.9	12.08	149.3
T_3	5.32	1.50	268.3	13.81	159.7
T_4	5.48	1.01	267.9	12.71	167.8
T_5	5.35	1.14	275.3	13.90	169.5
T_6	5.36	1.11	263.5	11.90	161.8
T_7	5.37	1.09	262.7	11.81	165.5
T_8	5.36	1.06	260.4	11.31	169.4
T_9	5.37	1.03	268.5	12.32	167.2
T_{10}	5.33	1.02	268.9	11.78	162.3
T_{11}	5.48	1.01	272.7	11.93	164.5
T_{12}	5.35	1.00	265.3	12.21	168.7
Initial	**5.33**	**1.07**	**268.5**	**11.2**	**169.4**

Table K-19-AST- 2(h): Effect of organic source of nutrient in forage Oats on soil fertility parameters after harvest (BCKV, Kalyani)

Treatments	Soil parameters			Available nutrient in soil (kg/ha)			Zn Content in Soil (mg Kg^{-1})	MBC (mg/kg)
	pH	EC (dsm^{-1})	OC (%)	N	P	K		
T_1	6.86	0.16	0.47	145.2	30.4	152.3	0.32	145
T_2	6.87	0.15	0.49	163.7	37.2	162.7	0.31	173
T_3	6.88	0.17	0.48	168.8	36.7	168.4	0.33	164
T_4	6.89	0.16	0.49	170.6	33.1	167.7	0.32	163
T_5	6.92	0.15	0.51	175.8	37.8	158.4	0.32	178
T_6	6.85	0.18	0.50	164.2	35.2	161.6	0.31	169
T_7	6.86	0.14	0.49	156.5	34.6	157.2	0.32	166
T_8	6.87	0.17	0.48	147.6	35.3	162.7	0.33	158
T_9	6.89	0.16	0.48	158.7	34.6	154.4	0.31	165
T_{10}	6.88	0.17	0.49	162.4	32.4	152.3	0.31	164
T_{11}	6.87	0.17	0.49	148.5	32.1	157.7	0.33	168
T_{12}	6.86	0.16	0.50	162.8	33.5	158.6	0.32	173
Initial	**6.88**	**0.17**	**0.53**	**195.6**	**43.6**	**211.3**	**3.4**	**143**

Table K-19-AST- 2(i): Effect of organic source of nutrients on soil properties after harvest of fodder oat (RPCAU, Pusa)

Treatments	pH	EC (dS m^{-1})	OC (%)	Available macro-nutrients (kg/ha)		
				N	P	K
T_1	8.30	0.44	0.56	284.4	17.5	133.7
T_2	8.26	0.48	0.62	297.5	19.6	137.2
T_3	8.28	0.46	0.59	294.5	19.8	139.5
T_4	8.27	0.47	0.58	293.2	19.4	138.6
T_5	8.26	0.46	0.63	303.3	23.7	143.3
T_6	8.27	0.47	0.61	296.1	22.4	140.9
T_7	8.28	0.45	0.59	292.6	19.2	136.1
T_8	8.27	0.45	0.56	286.2	19.4	138.6
T_9	8.29	0.46	0.55	290.8	19.2	137.9
T_{10}	8.27	0.46	0.56	292.7	19.5	138.5
T_{11}	8.28	0.46	0.56	291.3	19.5	137.1
T_{12}	8.28	0.46	0.61	300.5	22.1	140.1
Initial value	**8.31**	**0.45**	**0.55**	**290.0**	**18.35**	**135.5**

R-19 AST-2: Effect of different potassium fertilizer sources on green fodder production and quality of fodder maize **[Table reference: {R-19 AST-2(a) to(c)]**

Locations: Anand and Hyderabad

An experiment was conducted at Anand and Hyderabad location during *Rabi* season with 11 (eleven) different potassic fertilizer treatment under Randomized block design and experiment was replicated three time. $\mathbf{T_1}$ **:** Control (Only N and P applied), $\mathbf{T_2}$ **:** 1% schoenite foliar spray (at 30 and 45 DAS), $\mathbf{T_3}$ **:** 100 % RDK through KCL, $\mathbf{T_4}$ **:** 100 % RDK through KCL + 1 % schoenite foliar spray (at 30 and 45 DAS), $\mathbf{T_5}$ **:** 75 % RDK through KCL + 1 % schoenite foliar spray (at 30 and 45 DAS),$\mathbf{T_6}$ **:** 100 % RDK through K_2So_4,$\mathbf{T_7}$ **:** 100 % RDK through K_2So_4 +1 % schoenite foliar spray (at 30 and 45 DAS), $\mathbf{T_8}$ **:** 75 % RDK through K_2So_4 +1 % schoenite foliar spray (at 30 and 45 DAS), $\mathbf{T_9}$ **:** 100 % RDK through Potassium schoenite, $\mathbf{T_{10}}$ **:** 100 % RDK through Potassium schoenite +1% schoenite foliar spray (at 30 and 45 DAS), $\mathbf{T_{11}}$ **:** 75 % RDK through Potassium schoenite + 1 % schoenite foliar spray (at 30 and 45 DAS). Except treatments standard and uniform agronomic package of practices were followed for the crop production. Potassium Schoenite is a double sulphate of potassium and magnesium. It is composed of 22.24% potassium oxide and 90% magnesium oxide.
Statistical analysis of data on growth attributes, green fodder yield and crude protein content indicated that, at the Anand location, the tallest plants at 30 DAS (162 cm) and harvest (245 cm) were observed with the treatment 75 % RDK through Potassium schoenite + 1 % schoenite foliar spray (at 30 and 45 DAS). However, the significantly taller plants (i.e., 202 cm) was observed with treatment T_{10} statistically followed by the treatment 100 % RDK through K_2So_4 +1 % schoenite foliar spray (at 30 and 45 DAS) at Hyderabad location. The numbers of leaves per plant was significantly greater with treatment 75 % RDK through KCL + 1 % schoenite foliar spray (at 30 and 45 DAS) at Anand location.

On locational mean basis, highest green fodder yield of maize was observed (604 q/ha) for the treatment 75 % RDK through Potassium schoenite + 1 % schoenite foliar spray (at 30 and 45 DAS), followed by T8 and 100 % RDK through Potassium schoenite +1% schoenite foliar spray (at 30 and 45 DAS). 75 % RDK through Potassium schoenite + 1 % schoenite foliar spray (at 30 and 45 DAS) also recorded maximum dry matter yield followed by 100 % RDK through Potassium schoenite +1% schoenite foliar spray (at 30 and 45 DAS). The crude protein yield also demonstrated similar trend to that of dry matter yield. With respect to the crude protein content in the maize fodder, it was found statistically higher with treatment 75 % RDK through K_2So_4 +1 % schoenite foliar spray (at 30 and 45 DAS) at Anand location, and with treatment 100 % RDK through Potassium schoenite +1% schoenite foliar spray (at 30 and 45 DAS) at Hyderabad location, i.e., respectively 5.98% and 9.20%. However the maximum net return and B:C ratio was recorded in 100 % RDK through Potassium schoenite.

R-19 AST-2 (a): Maize growth attributes as influenced by different treatments

Treatments	Plant height (cm) at 30 DAS	Plant height (cm) at harvest			Plant population per meter row length (No.)	No. of leaves per plant
	Anand	Anand	Hyderabad	Mean	Anand	Anand
T_1 : Control (Only N and P applied)	128.0	195	173	184	14.8	13.2
T_2 : 1% schoenite foliar spray (at 30 and 45 DAS)	134.0	222	179	201	14.2	13.0
T_3 : 100 % RDK through KCL	132.5	207	179	193	15.3	13.5
T_4 : 100 % RDK through KCL + 1 % schoenite foliar spray (at 30 and 45 DAS)	140.3	232	151	191	15.3	15.0
T_5 : 75 % RDK through KCL + 1 % schoenite foliar spray (at 30 and 45 DAS)	154.5	237	177	207	15.5	15.8
T_6 : 100 % RDK through K_2So_4	138.3	208	181	194	15.3	13.1
T_7 : 100 % RDK through K_2So_4 +1 % schoenite foliar spray (at 30 and 45 DAS	145.8	227	196	212	15.3	14.0
T_8 : 75 % RDK through K_2So_4 +1 % schoenite foliar spray (at 30 and 45 DAS)	158.0	235	178	206	15.0	15.2
T_9 : 100 % RDK through potassium schoenite	143.3	205	192	198	15.5	13.2
T_{10} : 100 % RDK through potassium schoenite +1% schoenite foliar spray (at 30 and and 45 DAS)	153.3	237	202	219	15.8	12.7
T_{11} : 75 % RDK through potassium schoenite + 1% schoenite foliar spray (at 30 and 45 DAS)	162.0	245	176	211	14.8	15.3
S.Em±	**4.06**	**6.79**	**9.00**	**8.0**	**0.62**	**0.45**
C.D.	**11.71**	**19.60**	**26.40**	**23**	**NS**	**1.29**

R-19 AST-2 (b): Maize biomass and crude protein yields as influenced by different treatments

Treatment	Green Fodder yield (q/ha)			Dry matter yield (q/ha)			Crude protein yield (q/ha)		
	Anand	Hyderabad	Mean	Anand	Hyderabad	Mean	Anand	Hyderabad	Mean
T_1 : Control (Only N and P applied)	597	311	454	119.1	50.8	85.0	6.09	3.60	4.85
T_2 : 1% schoenite foliar spray (at 30 and 45 DAS)	717	308	513	127.9	51.3	89.6	6.85	4.30	5.58
T_3 : 100 % RDK through KCL	713	342	528	137.5	55.7	96.6	7.62	4.50	6.06
T_4 : 100 % RDK through KCL + 1 % schoenite foliar spray (at 30 and 45 DAS)	750	354	552	137.5	58.1	97.8	7.88	4.90	6.39
T_5 : 75 % RDK through KCL + 1 % schoenite foliar spray (at 30 and 45 DAS)	822	321	572	179.5	52.0	115.8	10.33	4.20	7.27
T_6 : 100 % RDK through K_2So_4	700	356	528	122.6	60.4	91.5	6.77	4.70	5.74
T_7 : 100 % RDK through K_2So_4 +1 % schoenite foliar spray (at 30 and 45 DAS	763	356	559	164.6	61.1	112.9	9.28	5.40	7.34
T_8 : 75 % RDK through K_2So_4 +1 % schoenite foliar spray (at 30 and 45 DAS)	833	340	586	172.0	56.4	114.2	10.28	4.70	7.49
T_9 : 100 % RDK through potassium schoenite	715	397	556	138.1	66.2	102.2	7.73	5.80	6.77
T_{10} : 100 % RDK through potassium schoenite +1% schoenite foliar spray (at 30 and and 45 DAS)	775	397	586	175.8	64.6	120.2	10.31	5.90	8.11
T_{11} : 75 % RDK through potassium schoenite + 1% schoenite foliar spray (at 30 and 45 DAS)	860	348	604	208.7	57.9	133.3	12.44	5.20	8.82
S.Em±	**23**	**18**	**21**	7.99	3.9		0.43	0.3	
C.D.	**67**	**53**	**60**	23.06	11.6		1.23	0.8	

R-19 AST-2(c): Maize forage quality and economics of production as influenced by different treatments

Treatment	Crude Protein Content			NDF %	Gross Returns (Rs.)	Net Returns (Rs.)	B:C Ratio
	Anand	Hyderabad	Mean	Anand	Hyderabad		
T_1 : Control (Only N and P applied)	5.13	7.10	6.12	76.4	78333	36235	1.9
T_2 : 1% schoenite foliar spray (at 30 and 45 DAS)	5.37	8.40	6.89	77.7	77667	34416	1.8
T_3 : 100 % RDK through KCL	5.55	8.10	6.83	84.3	86200	42796	2.0
T_4 : 100 % RDK through KCL + 1 % schoenite foliar spray (at 30 and 45 DAS)	5.75	8.60	7.18	83.4	89133	44576	2.0
T_5 : 75 % RDK through KCL + 1 % schoenite foliar spray (at 30 and 45 DAS)	5.75	8.20	6.98	84.3	81000	36923	1.8
T_6 : 100 % RDK through K_2So_4	5.54	7.90	6.72	80.5	89733	46254	2.1
T_7 : 100 % RDK through K_2So_4 +1 % schoenite foliar spray (at 30 and 45 DAS	5.65	8.80	7.23	81.4	89600	44968	2.0
T_8 : 75 % RDK through K_2So_4 +1 % schoenite foliar spray (at 30 and 45 DAS)	5.98	8.40	7.19	86.7	85667	41379	1.9
T_9 : 100 % RDK through potassium schoenite	5.61	8.80	7.21	82.0	100133	51915	2.1
T_{10} : 100 % RDK through potassium schoenite +1% schoenite foliar spray (at 30 and and 45 DAS)	5.87	9.20	7.54	85.0	100000	50629	2.0
T_{11} : 75 % RDK through potassium schoenite + 1% schoenite foliar spray (at 30 and 45 DAS)	5.96	8.90	7.43	86.7	87800	39959	1.8
S.Em±	**0.09**	**0.40**	**0.25**	1.35			
C.D at 5%	**0.26**	**1.00**	**0.63**	3.89			

R-19-AST-3 Fodder productivity of Moringa (*Moringa oleifera*) as influenced by planting geometry, nitrogen levels and cutting regimes

[Table Reference: R-19-AST-3 (a)-(c)]

Locations: Mandya and Dharwad

A Field experiment was initiated during 2019 (Rabi) at **Mandya and Dharwad** locations to assess the performance of *Moringa* with a view to standardise the plant population, nitrogen requirement and cutting regimes for enhancing the quantity and quality of green forage. The experiment was laid out in Split – Split Plot Design with three replications. The treatments consisted of three planting geometry (P_1-22.5cm x 15cm, P_2-30cm x 30 cm, P_3-45cm X 30cm), two nitrogen levels (N_1- 100 Kg/ha and N_2-150 Kg/ha) and three cutting regimes (C_1-45 days Interval, C_2-60 days Interval and C_3-75 days Interval). The first year data related to growth, yield and quality parameters were recorded and presented.

The results revealed that green forage yield and quality of Moringa was significantly influenced by planting geometry, Nitrogen levels and cutting regimes. On the location mean basis planting geometry at 45cm X 30cm recorded higher GFY (591.4 q/ha) which was on par with planting geometry of 30cm x 30 cm (576.2 q/ha) and superior over closer spacing of 22.5cm x 15cm (519.1 q/ha). The 13.9 % improvement in GFY was observed with wider spacing. The similar trend was observed with respect to DMY, CPY and CFY. On the location mean basis planting geometry at 45cm X 30cm recorded higher DMY (130.3 q/ha), CPY (27.1 q/ha) and CFY (20.8 q/ha) which was on par with planting geometry of 30cm x 30 cm (123.9 q, 25.3 q and 19.6 q/ha respectively). Among the locations Dharwad recorded higher GFY with planting geometry of 30cm x 30 cm (653.5 q/ha). The trend was similar with respect to DMY (135.3 q/ha), CPY (29.0 q/ha) and CFY (20.8 q/ha).Whereas at Mandya centre planting geometry of 45 cm x 30 cm recorded higher GFY (550.4 q/ha), DMY (134.6 q/ha), CPY (27.3 q/ha) and CFY (21.9 q/ha).

On the location mean basis application of nitrogen 150 kg/ha recorded higher GFY (582.6 q/ha) over nitrogen 100 kg/ha (541.9 q/ha). The 7.5 % improvement in GFY with nitrogen 150 kg/ha was observed. The trend was similar with respect to DMY (126.5 q/ha), CPY (26.1 q/ha) and CFY (19.8 q/ha). Among the locations Dharwad recorded higher GFY (642.6 q/ha) followed by Mandya (522.6 q/ha). The trend was similar with respect to DMY, CPY and CFY.As regards to cutting regimes on the location mean basis cutting intervals of 60 days recorded higher GFY (576.0 q/ha) which was on par with 75 days cutting interval (573.7 q/ha). The trend was similar with respect to DMY (125.9 q/ha). The cutting intervals of 75 days recorded higher CPY (26.1 q/ha) and CFY (21.3q/ha) which was on par with 60 days cutting interval (25.7 q/ha and 19.9 q/ha respectively). Among the locations Dharwad recorded higher GFY (657.7 q/ha) and DMY (134.3 q/ha) with 60 days cutting interval. Whereas at Mandya centre cutting interval of 75 days recorded higher GFY (513.2 q/ha), DMY (118.3 q/ha), CPY (22.9 q/ha) and CFY (19.9 q/ha) which was on par with cutting interval of 60 days (494.2 q/ha, 117.5 q/ha, 22.1 q/ha and 19.2q/ha respectively).

On the location mean basis planting geometry at 45 x 30 cm recorded higher net monetary returns (85893 Rs./ha) and B:C ratio (1.94). Among the locations Dharwad recorded higher net monitory returns (94544 Rs./ha) and B:C ratio (1.93) with planting geometry at 30 x 30 cm. Whereas, Mandya recorded higher net monitory returns (80540 Rs./ha) and B:C ratio (1.95) with planting geometry at 45 x 30 cm. on the location mean basis nitrogen 150 kg/ha recorded higher net monitory returns (76981 Rs./ha) and B:c ratio (1.79) over nitrogen 100 kg/ha (Rs. 65777/ha and 1.67 respectively). The trend was similar at both the locations. As regards to cutting intervals on the location mean basis cutting at 75 days intervals recorded higher net monetary returns (81164 Rs./ha) and B:C ratio (1.90). Among the location Dharwad recorded higher net monitory returns with 60 days cutting intervals (94687 Rs./ha) whereas, Mandya recorded at 75 days cutting interval (70513 Rs./ha).

R-19-AST 3 (a): Growth and yield of moringa as influenced by planting geometry, nitrogen levels and cutting intervals

	GFY (q/ha)			DMY (q/ha)		
Treatments	**Mandya**	**Dharwad**	**Mean**	**Mandya**	**Dharwad**	**Mean**
A) Planting geometry						
P_1-22.5cm x 15cm	408.5	629.7	519.1	89.2	127.6	108.4
P_2-30cm x 30 cm	498.8	653.5	576.2	112.5	135.3	123.9
P_3-45cm X 30cm	550.4	632.4	591.4	134.6	125.9	130.3
S. Em±	11.8	3.2	7.5	5.2	0.6	2.9
C.D (p=0.05)	37.2	9.1	23.1	16.3	1.8	9.0
B) Nitrogen levels (Kg/ha)						
N_1 - 100	449.3	634.4	541.9	102.3	128.3	115.3
N_2 – 150	522.6	642.6	582.6	121.9	131.0	126.5
S. Em±	9.6	2.6	6.1	4.2	0.5	2.4
C.D (p=0.05)	30.3	7.4	18.8	13.3	1.5	7.4
C) Cutting regimes (days)						
C_1-45 days Interval	450.4	623.7	537.1	100.6	122.2	111.4
C_2-60 days Interval	494.2	657.7	576.0	117.5	134.3	125.9
C_3-75 days Interval	513.2	634.1	573.7	118.3	132.2	125.3
S. Em±	9.2	3.2	6.2	2.4	0.6	1.5
C.D (p=0.05)	26.7	9.1	17.9	6.7	1.8	4.2
Interaction						
A x B	NS	NS	-	NS	NS	-
A x C	NS	NS	-	NS	NS	-
B x C	NS	NS	-	NS	NS	-
A x B x C	NS	NS	-	NS	NS	-

R-19-AST 3 (b): Quality parameters of Moringa as influenced by planting geometry, nitrogen levels and cutting intervals

Treatments	CPY (q/ha)			CFY (q/ha)		
	Mandya	Dharwad	Mean	Mandya	Dharwad	Mean
A) Planting geometry						
P_1-22.5cm x 15cm	16.5	26.0	21.3	14.6	19.5	17.1
P_2-30cm x 30 cm	21.7	29.0	25.3	18.3	20.8	19.6
P_3-45cm X 30cm	27.3	26.9	27.1	21.9	19.7	20.8
S. Em±	1.2	0.2	0.7	0.8	0.2	0.5
C.D (p=0.05)	3.9	0.7	2.3	2.6	0.5	1.6
B) Nitrogen levels (Kg/ha)						
N_1 - 100	19.6	26.4	23.0	16.9	19.9	18.4
N_2 – 150	24.0	28.2	26.1	19.5	20.1	19.8
S. Em±	1.0	0.2	0.6	0.7	0.2	0.4
C.D (p=0.05)	3.2	0.6	1.9	2.2	NS	2.2
C) Cutting regimes (days)						
C_1-45 days Interval	20.5	23.5	22.0	15.7	16.8	16.3
C_2-60 days Interval	22.1	28.5	25.7	19.2	20.5	19.9
C_3-75 days Interval	22.9	30.0	26.1	19.9	22.7	21.3
S. Em±	0.6	0.2	0.4	0.4	0.2	0.3
C.D (p=0.05)	1.6	0.7	1.1	1.2	0.5	0.9
Interaction						
A x B	NS	NS	-	NS	NS	-
A x C	NS	NS	-	NS	NS	-
B x C	NS	NS	-	NS	NS	-
A x B x C	NS	NS	-	NS	NS	-

R-19-AST 3 (c): Economics of Moringa as influenced by planting geometry, nitrogen levels and cutting intervals

Treatments	Gross returns (Rs./ha)			Net returns (Rs./ha)			B:C ratio		
	Mandya	Dharwad	Mean	Mandya	Dharwad	Mean	Mandya	Dharwad	Mean
A) Planting geometry									
P_1-22.5cm x 15cm	122556	188902	155729	29578	80981	55280	1.32	1.75	1.54
P_2-30cm x 30 cm	149640	196035	172838	61512	94544	78028	1.7	1.93	1.82
P_3-45cm X 30cm	165135	189712	177424	80540	91246	85893	1.95	1.93	1.94
B) Nitrogen levels (Kg/ha)									
N_1 - 100	134781	190314	162548	43716	87838	65777	1.48	1.86	1.67
N_2 – 150	156771	192784	174778	63953	90009	76981	1.69	1.88	1.79
C) Cutting regimes (days)									
C_1-45 days Interval	135123	187095	161109	40929	80269	60599	1.43	1.75	1.59
C_2-60 days Interval	148257	197313	172785	59101	94687	76894	1.66	1.93	1.80
C_3-75 days Interval	153948	190240	172094	70513	91814	81164	1.85	1.94	1.90

K-20-AST-1c: Efficacy of plant growth regulators on forage yield and quality of maize-oat cropping system

[Table reference: K-20-AST-1C (j) – (m)]

Locations: Urulikanchan, Srinagar, Pusa, Raipur, Hisar and Ranchi

Preamble

In India, only 4% of the total cultivated area is under fodder production. To increase the fodder availability, it is required to increase the area under the fodder cultivation by 8-10% or the productivity per unit area. Use of various plant growth regulators is one of the ways to increase productivity and break yield plateau. The plant growth regulators play an important role in increasing growth characters like plant height, leaf area index, green and dry biomass. Hence, the study on efficacy of different plant growth regulators on forage yield and quality of fodder maize-oat cropping system is proposed.

A field trial was initiated at six locations namely, Urulikanchan, Srinagar, Pusa, Raipur, Hisar and Ranchi to find out effect of different plant growth regulators on forage yield and quality of maize and oat and work out the economic feasibility of plant growth regulators. The trial was initiated during Kharif 2020 for three years. The eleven treatments included T1: Triacontanol @ 10 ppm, T_2: Triacontanol @ 20 ppm, T_3: Mepiquat, chloride @ 200 ppm, T_4: Mepiquat chloride @ 300 ppm, T_5: Salicylic acid 100 ppm, T_6: Salicylic acid 200 ppm, T_7: NAA @ 20 ppm, T_8: Whip Super 4 g a.i,. /ha, T_9 - GA_3 200 ppm, T_{10} - GA_3 400 ppm and T_{11}: Control- spray of water. The treatments were replicated thrice in complete Randomized Block Design.

The growth promoters were sprayed at 30 day stage on each crop i.e., Maize as well as Oat.Standard package of practices and Recommended dose offertilizers were (considering suitable correction in low or high nutrient availability soils) were followed for raising the crop in plot of: 4 m x 3 m.

The perusal of data on forage maize indicated significant superiority of T4-Mepiquat Chloride@300 ppm which was at par with T5-Salicylic acid@100 ppm, T6-Salicylic acid@200 ppm and T7-NAA@20 ppm in terms of green and dry matter yields. Above treatments also recorded higher crude protein yields. However, T3-Mepiquat Chloride@200 ppm recorded higher crude protein content. The T4-Mepiquat Chloride@300 ppm recorded highest net return, which was closely followed by T7-NAA@20 ppm. T7-NAA@20 ppm recorded highest BC ratio. As regards to oat, all the growth regulators improved the growth and yield over control. T4-Mepiquat Chloride@300 ppm recorded the maximum green (448.6q/ha), whereas, T6-Salicylic acid@200 ppm recorded the maximum dry matter yield (80.8q/ha). Application of Salicylic acid@200 ppm also recorded maximum crude protein yield. Application of T6-Salicylic acid@200 ppm and T7-NAA@20 ppm proved its superiority in giving maximum net return and BC Ratio.

Table K-20-AST-1C (a): Effect of different PGRs on forage yields of fodder maize

Treatments	GFY (q/ha)					DMY (q/ha)				
	Urulikanchan	Pusa	Raipur	Hisar	Mean	Urulikanchan	Pusa	Raipur	Hisar	Mean
T1-Triacontanol@10 ppm	443.22	407.6	352.9	363.1	391.71	66.93	75.0	73.6	90.6	76.53
T2-Triacontanol@20 ppm	447.72	415.9	350.0	375.3	397.23	61.56	77.4	70.7	94.0	75.92
T3-Mepiquat Chloride@200 ppm	467.32	436.7	414.2	283.2	400.36	68.88	82.8	88.6	79.9	80.05
T4-Mepiquat Chloride@300 ppm	541.67	454.5	457.9	308.1	440.54	78.60	86.4	96.9	83.3	86.30
T5-Salicylic acid@100 ppm	507.36	413.9	428.7	373.6	430.89	70.37	78.4	91.4	93.5	83.42
T6-Salicylic acid@200 ppm	515.53	417.4	390.8	386.1	427.46	87.02	78.8	81.9	96.5	86.06
T7-NAA@20 ppm	471.82	422.6	455.0	382.4	432.96	62.85	79.9	92.0	95.7	82.61
T8-Fenoxaprop@4g a.i./ha	296.16	381.1	315.0	332.2	331.12	45.19	67.8	65.0	86.6	66.15
T9-GA3@200 ppm	468.14	412.6	378.3	325.6	396.16	67.74	74.5	77.0	85.8	76.26
T10-GA3@400 ppm	490.20	410.3	418.3	337.8	414.15	68.14	75.9	87.1	87.5	79.66
T11-Waterspray (control)	416.67	394.0	371	265.3	361.74	56.29	72.6	76.6	77.3	70.70
SEm±	21.62	12.6	15.72	10.8		3.19	3.0	5.05	2.9	
CD (P=0.05)	64.22	37.2	46.70	32.2		9.47	8.8	15.02	8.7	

Table K-20-AST-1C (b): Effect of different PGRs on crude protein content and yield of fodder maize

Treatments	CPY (q/ha)				CP (%)		
	Urulikanchan	Pusa	Hisar	Mean	Urulikanchan	Hisar	Mean
T1-Triacontanol@10 ppm	5.90	5.00	6.13	5.68	8.82	8.34	8.58
T2-Triacontanol@20 ppm	4.11	5.10	5.61	4.94	6.68	7.90	7.29
T3-Mepiquat Chloride@200 ppm	6.25	6.20	7.40	6.62	9.07	8.35	8.71
T4-Mepiquat Chloride@300 ppm	5.28	6.40	8.25	6.64	6.72	8.50	7.61
T5-Salicylic acid@100 ppm	6.00	5.40	7.72	6.37	8.53	8.44	8.49
T6-Salicylic acid@200 ppm	7.01	5.50	6.81	6.44	8.06	8.31	8.19
T7-NAA@20 ppm	5.08	6.00	7.82	6.30	8.09	8.50	8.30
T8-Fenoxaprop@4g a.i./ha	4.30	4.30	5.09	4.56	9.52	7.87	8.70
T9-GA3@200 ppm	5.62	4.90	6.56	5.69	8.30	8.51	8.41
T10-GA3@400 ppm	4.61	5.00	7.30	5.64	6.76	8.38	7.57
T11-Waterspray (control)	4.30	4.70	6.29	5.10	7.64	8.19	7.92
SEm±	0.27	0.2	0.47			0.17	
CD (P=0.05)	0.79	0.7	1.39			0.51	

Table K-20-AST-1C (c): Effect of different PGRs on Plant height and Leaf stem ratio of fodder maize at harvest

Treatments	Plant height (cm)					Leaf stem ratio				
	Urulikanchan	Pusa	Raipur	Hisar	Mean	Urulikanchan	Pusa	Raipur	Hisar	Mean
T1-Triacontanol@10 ppm	279.3	194.5	260.4	253.8	247.0	0.57	0.54	0.56	0.26	0.48
T2-Triacontanol@20 ppm	264.1	193.3	267.9	259.7	246.3	0.50	0.52	0.61	0.27	0.48
T3-Mepiquat Chloride@200 ppm	297.5	209.1	266.0	229.1	250.4	0.63	0.59	0.58	0.18	0.50
T4-Mepiquat Chloride@300 ppm	275.1	193.4	271.7	233.7	243.5	0.50	0.54	0.65	0.19	0.47
T5-Salicylic acid@100 ppm	264.8	199.8	269.1	257.8	247.9	0.52	0.51	0.57	0.27	0.47
T6-Salicylic acid@200 ppm	257.1	197.2	260.0	263.3	244.4	0.56	0.51	0.47	0.28	0.46
T7-NAA@20 ppm	266.1	203.1	261.7	261.9	248.2	0.56	0.55	0.70	0.28	0.52
T8-Fenoxaprop@4g a.i./ha	147.1	184.4	125.3	238.6	173.9	0.57	0.46	0.50	0.23	0.44
T9-GA3@200 ppm	292.9	201.7	256.5	236.3	246.8	0.46	0.51	0.59	0.21	0.44
T10-GA3@400 ppm	273.8	200.5	264.6	239.8	244.7	0.47	0.51	0.54	0.23	0.44
T11-Waterspray (control)	280.4	196.6	268.1	223.1	242.1	0.55	0.51	0.52	0.16	0.44
SEm±		7.8	9.03	7.7			0.02	0.06	0.01	
CD (P=0.05)		NS	26.84	22.9			0.06	0.19	0.02	

Table K-20-AST-1C (d): Effect of different PGRs on number of Leaves at harvest of fodder maize

Treatments	No. of Leaves at harvest				
	Urulikanchan	Pusa	Raipur	Hisar	Mean
T1-Triacontanol@10 ppm	14.67	13.90	10.70	12.17	12.86
T2-Triacontanol@20 ppm	14.44	14.10	10.80	12.33	12.92
T3-Mepiquat Chloride@200 ppm	16.11	15.60	11.30	11.33	13.59
T4-Mepiquat Chloride@300 ppm	15.34	15.20	11.90	11.53	13.49
T5-Salicylic acid@100 ppm	14.89	14.50	11.20	12.30	13.22
T6-Salicylic acid@200 ppm	13.78	14.20	10.90	12.53	12.85
T7-NAA@20 ppm	14.00	15.10	10.80	12.53	13.11
T8-Fenoxaprop@4g a.i./ha	13.22	13.40	5.70	11.80	11.03
T9-GA3@200 ppm	15.33	14.40	10.60	11.67	13.00
T10-GA3@400 ppm	14.00	13.90	11.50	11.93	12.83
T11-Waterspray (control)	15.11	13.80	11.20	10.17	12.57
SEm±		0.4	0.36	0.43	
CD (P=0.05)		1.2	1.07	1.28	

Table K-20-AST-1C (e): Effect of different PGRs on economic parameters of fodder maize

Treatments	Cost of cultivation (Rs./ha)				Gross Return (Rs./ha)			
	Urulikanchan	Pusa	Raipur	Mean	Urulikanchan	Pusa	Raipur	Mean
T1-Triacontanol@10 ppm	50409	34701	30807	38639	110806	61143	52937	74962
T2-Triacontanol@20 ppm	56002	40201	36807	44337	111929	62379	52500	75603
T3-Mepiquat Chloride@200 ppm	48050	31841	27207	35699	116831	65507	62125	81488
T4-Mepiquat Chloride@300 ppm	50917	33161	28407	37495	135418	68180	68687	90762
T5-Salicylic acid@100 ppm	46353	29311	24905	33523	126839	62078	64312	84410
T6-Salicylic acid@200 ppm	46633	29421	25002	33685	128882	62604	58625	83370
T7-NAA@20 ppm	45758	29455	25093	33435	117954	63390	68250	83198
T8-Fenoxaprop@4g a.i./ha	41971	29322	24925	32073	74041	57170	47250	59487
T9-GA3@200 ppm	50751	34525	30131	38469	117035	61889	56750	78558
T10-GA3@400 ppm	56534	39849	35455	43946	122550	61547	62750	82282
T11-Waterspray (control)	45087	29201	24807	33032	104168	59105	55625	72966
SEm±		-				1889	2358	
CD (P=0.05)		-				5573	7006	

Table K-20-AST-1C (f): Effect of different PGRs on economic parameters of fodder maize

Treatments	Net Return (Rs./ha)				B:C Ratio			
	Urulikanchan	Pusa	Raipur	Mean	Urulikanchan	Pusa	Raipur	Mean
T1-Triacontanol@10 ppm	60397	26442	22130	36323	2.20	1.76	1.72	1.89
T2-Triacontanol@20 ppm	55927	22178	15693	31266	2.00	1.55	1.43	1.66
T3-Mepiquat Chloride@200 ppm	68781	33665	34918	45788	2.42	2.06	2.28	2.25
T4-Mepiquat Chloride@300 ppm	84501	35018	40280	53266	2.66	2.06	2.42	2.38
T5-Salicylic acid@100 ppm	80486	32766	39408	50887	2.74	2.12	2.58	2.48
T6-Salicylic acid@200 ppm	82249	33183	33623	49685	2.76	2.13	2.34	2.41
T7-NAA@20 ppm	72197	33935	43157	49763	2.58	2.15	2.72	2.48
T8-Fenoxaprop@4g a.i./ha	32070	27848	22325	27414	1.76	1.95	1.90	1.87
T9-GA3@200 ppm	66284	27363	26619	40089	2.30	1.79	1.88	1.99
T10-GA3@400 ppm	66016	21697	27295	38336	2.17	1.54	1.77	1.83
T11-Waterspray (control)	59080	29903	30818	39934	2.31	2.02	2.24	2.19
SEm±	4953.23	1889	2358		0.09	0.06	0.08	
CD (P=0.05)	14714.89	5573	7006		0.26	0.17	0.18	
CV (%)	12.96		12.15		6.55		6.06	

Table K-20-AST-1C (g): Effect of different PGRs on green forage yield of fodder Oat

Treatments	GFY (q/ha)						
	Urulikanchan	**Srinagar**	**Pusa**	**Raipur**	**Hisar**	**Ranchi**	**Mean**
T1-Triacontanol@10 ppm	579.7	433.0	378.3	364.4	359.4	426.4	423.5
T2-Triacontanol@20 ppm	568.6	445.9	384.8	369.4	371.1	452.3	432.0
T3-Mepiquat Chloride@200 ppm	615.2	413.2	422.8	409.7	278.4	438.5	429.6
T4-Mepiquat Chloride@300 ppm	680.2	413.2	431.4	423.8	305.5	437.6	448.6
T5-Salicylic acid@100 ppm	591.9	372.9	398.1	396.4	368.8	434.6	427.1
T6-Salicylic acid@200 ppm	603.0	402.3	405.3	386.1	381.1	430.2	434.7
T7-NAA@20 ppm	623.0	389.6	413.4	398.6	377.2	413.0	435.8
T8-Fenoxaprop@4g a.i./ha	198.9	376.2	369.6	261.1	330.5	402.9	323.2
T9-GA3@200 ppm	597.6	422.9	388.9	395.8	322.2	405.9	422.2
T10-GA3@400 ppm	553.1	445.1	380.4	331.9	335.4	416.0	410.3
T11-Waterspray (control)	514.7	366.9	375.4	363.9	253.1	393.8	378.0
SEm±	18.53	5.05	13.3	10.77	10.9	4.96	
CD (P=0.05)	56.00	14.9	39.3	31.77	32.3	14.74	

Table K-20-AST-1C (g): Effect of different PGRs on dry matter yield of fodder Oat

Treatments	DMY (q/ha)						
	Urulikanchan	Srinagar	Pusa	Raipur	Hisar	Ranchi	Mean
T1-Triacontanol@10 ppm	78.2	86.6	60.6	62.0	88.0	76.8	75.4
T2-Triacontanol@20 ppm	90.9	89.2	61.9	63.3	90.7	81.4	79.6
T3-Mepiquat Chloride@200 ppm	70.6	82.7	65.4	69.7	55.9	78.9	70.5
T4-Mepiquat Chloride@300 ppm	93.3	84.6	69.1	74.1	68.9	78.8	78.1
T5-Salicylic acid@100 ppm	73.5	74.7	65.5	68.2	88.9	78.2	74.8
T6-Salicylic acid@200 ppm	101.2	77.9	67.3	65.9	95.2	77.4	80.8
T7-NAA@20 ppm	78.4	80.5	67.6	67.6	93.4	74.3	77.0
T8-Fenoxaprop@4g a.i./ha	26.5	75.3	54.5	41.9	79.8	72.5	58.4
T9-GA3@200 ppm	68.7	84.7	60.0	67.7	72.5	73.1	71.1
T10-GA3@400 ppm	64.1	89.0	58.9	56.1	82.6	74.9	70.9
T11-Waterspray (control)	66.3	73.4	56.4	62.5	45.0	70.9	62.4
SEm±	2.44	**1.19**	2.5	2.85	2.4	0.89	
CD (P=0.05)	7.23	**3.5**	7.4	8.40	7.3	2.65	

Table K-20-AST-1C (h): Effect of different PGRs on crude protein content and yield of fodder Oat

Treatments	CPY (q/ha)						CP (%)				
	Urulikan-chan	Sri-nagar	Pu-sa	Rai-pur	Ran-chi	Mean	Urulikan-chan	Sri-nagar	Rai-pur	Ran-chi	Mean
T1-Triacontanol@10 ppm	7.41	9.42	6.00	5.51	3.96	6.46	9.48	9.47	8.87	5.20	8.26
T2-Triacontanol@20 ppm	8.32	10.01	6.10	5.51	4.19	6.83	9.15	9.73	8.71	5.20	8.20
T3-Mepiquat Chloride@200 ppm	7.03	8.92	6.80	6.24	3.78	6.55	9.95	9.27	8.92	4.80	8.24
T4-Mepiquat Chloride@300 ppm	8.47	9.05	7.00	6.78	3.34	6.93	9.08	9.33	9.15	4.20	7.94
T5-Salicylic acid@100 ppm	6.90	8.47	6.50	6.13	3.70	6.34	9.38	8.17	8.97	4.80	7.83
T6-Salicylic acid@200 ppm	9.61	8.47	6.70	5.81	4.51	7.02	9.50	9.17	8.85	5.80	8.33
T7-NAA@20 ppm	7.14	8.56	7.10	6.02	3.83	6.53	9.11	9.20	8.89	6.00	8.30
T8-Fenoxaprop@4g a.i./ha	2.95	7.56	5.00	3.57	3.43	4.50	11.10	8.23	8.53	5.40	8.32
T9-GA3@200 ppm	6.28	9.26	5.90	6.01	3.51	6.19	9.15	9.40	8.89	4.80	8.06
T10-GA3@400 ppm	6.30	9.55	5.70	5.02	3.90	6.09	9.83	9.53	8.95	5.20	8.38
T11-Waterspray (control)	5.77	6.77	5.40	5.52	3.58	5.41	8.70	8.17	8.81	5.00	7.67
SEm±	0.22	0.28	0.3	0.39	0.20			0.20	0.38	0.30	
CD (P=0.05)	0.67	0.8	0.9	1.14	0.59			0.6	NS	0.88	

Table K-20-AST-1C (i): Effect of different PGRs on Plant height of fodder Oat (at harvest)

Treatments	Plant height (cm)						
	Urulikanchan	Srinagar	Pusa	Raipur	Hisar	Ranchi	Mean
T1-Triacontanol@10 ppm	70.8	122.7	149.9	120.8	113.8	123.0	116.8
T2-Triacontanol@20 ppm	72.5	137.3	151.9	119.8	116.1	127.0	120.8
T3-Mepiquat Chloride@200 ppm	72.2	111.3	154.2	125.1	97.9	122.0	113.8
T4-Mepiquat Chloride@300 ppm	74.9	116.0	152.9	128.6	101.8	123.0	116.2
T5-Salicylic acid@100 ppm	70.7	103.0	150.8	126.1	115.4	130.0	116.0
T6-Salicylic acid@200 ppm	68.6	107.3	152.8	124.9	118.4	125.0	116.2
T7-NAA@20 ppm	78.0	107.3	157.5	125.1	117.6	119.0	117.4
T8-Fenoxaprop@4g a.i./ha	44.9	104.0	144.7	109.4	107.1	117.0	104.5
T9-GA3@200 ppm	76.6	116.7	154.5	124.4	104.8	118.0	115.8
T10-GA3@400 ppm	74.9	125.7	151.0	122.2	108.1	120.0	117.0
T11-Waterspray (control)	73.6	102.7	148.7	121.2	94.2	107.0	107.9
SEm±		3.26	4.0	4.63	3.4	2.0	
CD (P=0.05)		9.6	NS	13.64	10.2	5.0	

Table K-20-AST-1C (j): Effect of different PGRs on Leaf stem ratio of fodder Oat (at harvest)

Treatments	Leaf stem ratio					ADF (%)	NDF (%)
	Urulikanchan	Pusa	Raipur	Ranchi	Mean	Ranchi	Ranchi
T1-Triacontanol@10 ppm	0.72	0.35	0.57	0.71	0.59	47.4	75.8
T2-Triacontanol@20 ppm	0.61	0.34	0.56	0.63	0.54	49.1	77.2
T3-Mepiquat Chloride@200 ppm	0.47	0.35	0.62	0.61	0.51	48.3	76.1
T4-Mepiquat Chloride@300 ppm	0.68	0.31	0.63	0.62	0.56	52.4	79.6
T5-Salicylic acid@100 ppm	0.62	0.34	0.61	0.64	0.55	50.1	78.2
T6-Salicylic acid@200 ppm	0.62	0.32	0.62	0.68	0.56	45.1	72.1
T7-NAA@20 ppm	0.56	0.35	0.64	0.63	0.55	46.6	73.8
T8-Fenoxaprop@4g a.i./ha	0.76	0.31	0.52	0.61	0.55	47.2	76.1
T9-GA3@200 ppm	0.69	0.32	0.62	0.62	0.56	45.5	75.4
T10-GA3@400 ppm	0.55	0.29	0.63	0.64	0.53	53.3	82.7
T11-Waterspray (control)	0.72	0.34	0.62	0.63	0.58	48.7	76.4
SEm±		0.02	0.04	0.04		0.84	0.98
CD (P=0.05)		NS	0.11	NS		2.48	2.90

Table K-20-AST-1C (k) Effect of different PGRs on economic parameters of fodder Oat

Treatments	Cost of cultivation (Rs./ha)					Gross Return (Rs./ha)					
	Urulikan-chan	Pu-sa	Rai-pur	His-ar	Mean	Urulikan-chan	Pu-sa	Rai-pur	His-ar	Ran-chi	Mean
T1-Triacontanol@10 ppm	59279	36137	29050	76900	50342	127526	56738	54667	108375	85285	86518
T2-Triacontanol@20 ppm	64208	41637	35050	77051	54487	125099	57725	55417	111958	90451	88130
T3-Mepiquat Chloride@200 ppm	57574	33277	25450	76950	48313	135344	63419	61458	84238	87699	86432
T4-Mepiquat Chloride@300 ppm	61005	34597	26650	77150	49851	149634	64707	63575	92042	87525	91497
T5-Salicylic acid@100 ppm	54287	30747	23148	76926	46277	130222	59721	59458	111358	86916	89535
T6-Salicylic acid@200 ppm	54756	30857	23245	77103	46490	132648	60791	57916	115075	86043	90495
T7-NAA@20 ppm	55440	30891	23336	76934	46650	137052	62009	59792	113938	82601	91078
T8-Fenoxaprop@4g a.i./ha	41526	30757	23168	76992	43111	43767	55442	39167	99408	80577	63672
T9-GA3@200 ppm	59687	35961	28374	96750	55193	131480	58329	59375	97167	81184	85507
T10-GA3@400 ppm	63564	41285	33698	116750	63824	121684	57063	49791	100975	83208	82544
T11-Waterspray (control)	51668	30637	23050	76750	45526	113236	56304	54583	77750	78754	76125
SEm±		-					1996	1855		993	
CD (P=0.05)		-					5888	5473		2949	
								5.82			

Table K-20-AST-1C (l): Effect of different PGRs on Net Return at 30 DAS of fodder Oat

Treatments	Net Return (Rs./ha)					
	Urulikanchan	Pusa	Raipur	Hisar	Ranchi	Mean
T1-Triacontanol@10 ppm	68247	20601	25616	31475	55855	40359
T2-Triacontanol@20 ppm	60891	16088	20366	34907	60821	38615
T3-Mepiquat Chloride@200 ppm	77770	30142	36008	7288	58149	41871
T4-Mepiquat Chloride@300 ppm	88629	30110	36925	14892	57775	45666
T5-Salicylic acid@100 ppm	75934	28974	36311	34432	57316	46593
T6-Salicylic acid@200 ppm	77892	29934	34671	37972	56243	47342
T7-NAA@20 ppm	81611	31118	36455	37004	53051	47848
T8-Fenoxaprop@4g a.i./ha	2241	24684	15999	22416	50927	23253
T9-GA3@200 ppm	71793	22368	31001	417	51384	35393
T10-GA3@400 ppm	58120	15778	16093	-15775	53258	25495
T11-Waterspray (control)	61568	25667	31533	1000	49454	33844
SEm±	3537.06	1996	1855		993	
CD (P=0.05)	10507.79	5888	5473		2949	

Table K-20-AST-1C (m): Effect of different PGRs on B:C Ratio at 30 DAS of fodder Oat

Treatments	B:C Ratio					
	Urulikanchan	**Pusa**	**Raipur**	**Hisar**	**Ranchi**	**Mean**
T1-Triacontanol@10 ppm	2.15	1.57	1.88	1.41	2.90	1.98
T2-Triacontanol@20 ppm	1.95	1.39	1.58	1.45	3.05	1.88
T3-Mepiquat Chloride@200 ppm	2.35	1.91	2.41	1.09	2.97	2.15
T4-Mepiquat Chloride@300 ppm	2.45	1.87	2.39	1.19	2.94	2.17
T5-Salicylic acid@100 ppm	2.40	1.94	2.57	1.45	2.94	2.26
T6-Salicylic acid@200 ppm	2.42	1.97	2.49	1.49	2.89	2.25
T7-NAA@20 ppm	2.47	2.01	2.56	1.48	2.80	2.26
T8-Fenoxaprop@4g a.i./ha	1.05	1.80	1.69	1.29	2.72	1.71
T9-GA3@200 ppm	2.20	1.62	2.09	1.00	2.73	1.93
T10-GA3@400 ppm	1.91	1.38	1.48	0.86	2.78	1.68
T11-Waterspray (control)	2.19	1.84	2.37	1.01	2.69	2.02
SEm±	0.05	0.06	0.07		0.03	
CD (P=0.05)	0.15	0.18	0.22		0.10	
	4.11		6.06			

K-20-AST-6: Precision nitrogen management for fodder yield and nitrogen use efficiency enhancement in fodder Maize

Locations: Mandya and Dharwad

[Table Reference: K-20-AST-6 (a)-(b)]

Preamble

Fodder grasses are highly responsive to nitrogen application in terms of growth, quality and yield. Fertilizer nitrogen is a common input used by farmers in different agro-climatic conditions in India with varied use efficiency (30-50%). Nitrogen exhibits high synergistic effect in combination with water and other inputs. Application of inadequate dose of nitrogen results in yield reduction and application in excess leads to increased cost of cultivation and environmental pollution. Hence, the present study on precision management of nitrogen for efficient management and increasing NUE is proposed.

A field experiment was started during *Rabi* 2020-21 at two locations (Mandya and Dharwad centre) on precision nitrogen management for enhancing fodder yield and nitrogen use efficiency in forage maize variety African tall planted in a spacing of 30 x10 cm. The treatments consisted of $\mathbf{T_1}$ (No N), $\mathbf{T_2}$ 50 kg N/ha (40% N basal) + remaining based on SPAD meter critical value of 40, $\mathbf{T_3}$ 50 kg N/ha (40% N basal) + remaining based on SPAD meter critical value of 50, $\mathbf{T_4}$ 50 kg N/ha (40% N basal) + remaining based on LCC 4, $\mathbf{T_5}$ 50 kg N/ha (40% N basal) + remaining based on LCC 5, $\mathbf{T_6}$ 100 kg N/ha (40% N basal) + remaining based on SPAD meter critical value of 40, $\mathbf{T_7}$ 100 kg N/ha (40% N basal) + remaining based on SPAD meter critical value of 50, $\mathbf{T_8}$ 100 kg N/ha (40% N basal) + remaining based on LCC 4, $\mathbf{T_9}$ 100 kg N/ha (40% N basal) + remaining based on LCC 5, $\mathbf{T_{10}}$ 150 kg N/ha (40% N basal) + remaining based on SPAD meter critical value of 40, $\mathbf{T_{11}}$ 150 kg N/ha (40% N basal) + remaining based on SPAD meter critical value of 50, $\mathbf{T_{12}}$ 150 kg N/ha (40% N basal) + remaining based on LCC 4, $\mathbf{T_{13}}$150 kg N/ha (40% N basal) + remaining based on LCC 5, $\mathbf{T_{14}}$ As per recommended package of practices (50% N as basal, remaining 50% at 30 days after sowing).The treatments were replicated thrice in a randomized block design. The totan nitrogen applied in different treatments is given in table.

The results recorded during the year indicated that production of fodder maize was better for the treatment T_{11} (150 kg N/ha (40% N basal) + remaining based on LCC 4. It recorded 215.9 q green and 120.0 q dry matter yield per hectare on locational mean basis. The growth parameters namely; plant height; number of leaves per plant and quality were also improved with this treatment as compared to other treatments. The treatment T_{11} (150 kg N/ha (40% N basal) + remaining based on LCC 4 also recorded highest also recored highest Net returns (Rs. 66299/ha) and B:C ratio (3.43)

K-20-AST-6 (a): Growth parameters and yield of fodder maize at harvest as influenced by the precision nitrogen management treatments during *rabi* 2020-21

Treatment	Plant height (cm)			Leaf: Stem ratio			Dharwad			Total N applied
	Dharwad	Mandya	Mean	Dharwad	Mandya	Mean	No. of leaves/ plant	Leaf area(LA) /plant (dm^2)	LAI	
T1	144.6	116.2	130.4	0.29	0.28	0.29	11.3	27.62	9.2	0
T2	254.7	144.7	199.7	0.33	0.37	0.35	13.7	37.66	12.6	80
T3	253.2	157.8	205.5	0.32	0.37	0.35	13.9	42.57	14.2	110
T4	235.4	154.9	195.2	0.31	0.39	0.35	13.3	36.64	12.2	80
T5	237.8	172.8	205.3	0.37	0.40	0.39	14.3	44.73	14.9	110
T6	244.6	203.8	224.2	0.34	0.49	0.42	14.7	45.12	15.0	100
T7	268.5	199.7	234.1	0.36	0.50	0.43	14.6	47.97	16.0	130
T8	228.0	205.2	216.6	0.34	0.49	0.42	14.1	46.36	15.5	100
T9	251.7	202.1	226.9	0.37	0.48	0.43	14.3	48.09	16.0	130
T10	273.5	226.8	250.2	0.38	0.54	0.46	14.7	49.72	16.6	120
T11	291.8	197.8	244.8	0.39	0.56	0.48	15.9	59.41	19.8	150
T12	269.5	226.5	248.0	0.36	0.54	0.45	14.5	50.66	16.9	120
T13	283.2	230.7	257.0	0.40	0.62	0.51	16.5	64.77	21.6	150
T14	265.6	221.9	243.8	0.35	0.56	0.46	14.3	53.82	17.9	150
S. Em±	8.0	15.2		0.04	0.03		0.7	3.21	1.1	
C.D (p=0.05)	23.4	44.5		0.11	0.08		1.9	9.35	3.1	

K-20-AST-6 (b): Economics of precision nitrogen management in fodder maize

Treatments	Green fodder yield (q/ha)			Dry fodder yield (q/ha)			Mandya			
	Dharwad	Mandya	Mean	Dharwad	Mandya	Mean	Total cost of cultivation (Rs./ha)	Gross return (Rs./ha)	Net returns (Rs./ha)	B:C ratio
T_1	267.71	160.9	214.3	53.54	31.9	42.7	22469	32180	9711	1.43
T_2	382.87	218.9	300.9	89.47	51.4	70.4	23773	43780	20007	1.84
T_3	439.14	224.2	331.7	97.24	63.9	80.6	23710	44840	21130	1.89
T_4	370.35	222.4	296.4	80.07	45.8	62.9	23480	44480	21000	1.89
T_5	436.11	244.0	340.1	94.22	54.7	74.5	23667	48800	25133	2.06
T_6	469.03	364.9	417.0	105.14	91.6	98.4	24925	72980	48055	2.93
T_7	461.98	384.6	423.3	109.72	82.0	95.9	25138	76920	51782	3.06
T_8	461.81	384.3	423.1	102.36	90.7	96.5	25664	76860	51196	2.99
T_9	465.97	404.2	435.1	105.14	95.6	100.4	25902	80840	54938	3.12
T_{10}	460.82	454.0	457.4	96.90	113.7	105.3	27277	90800	63523	3.33
T_{11}	557.83	468.0	512.9	123.13	116.8	120.0	27301	93600	66299	3.43
T_{12}	457.18	443.2	450.2	88.51	89.7	89.1	27496	88640	61144	3.22
T_{13}	552.77	447.4	500.1	117.56	102.6	110.1	27802	89480	61678	3.22
T_{14}	515.42	412.3	102.1	108.42	95.8	102.1	26325	82460	56135	3.13
S. Em$\pm$	25.87	15.91		4.81						
C.D (p=0.05)	75.19	46.51		13.98						

B. LOCATION SPECIFIC TRIALS

K-16-AST-6 : Organic nutrient management in sorghum-berseem cropping sequence for sustainable fodder production [Table Reference: K-16-AST-6 (a)-(h)]

Location: Hisar

Results achieved during five years: Data presented in Table 3 and 4 revealed that during *kharif*, highest green fodder and dry matter yield (Pooled mean of five years) of sorghum was recorded with T_5 (488.0 q/ha and 130.8 q/ha, respectively) which was significantly higher than all other treatments except T_9, T_1 and T_4. During *Rabi*, highest green fodder and dry matter yield (Pooled mean of five years) of berseem (total five cuts taken) was recorded with T_9 (770.8 q/ha and 113.2q/ha, respectively) which was significantly higher than all other treatments except T_5. Maximum total green fodder yield of the cropping sequence was recorded with T_9 (1253.7 q/ha) followed by T_5 and $T_{4.}$ Economic analysis of sorghum-berseem cropping sequence given in table 7 and 8 revealed that maximum net returns was fetched in T_5 followed by T_1 and T_4 whereas, highest B: C ratio (Pooled mean of five years) was fetched in T_1 followed by T_5 and $T_{3.}$

Conclusion: T_9 (7.5 t Vermicompost/ha (5t in sorghum + 2.5t in berseem) + biofertilizer + Green manuring) proved superior in terms of green fodder yield of the cropping sequence followed by T_5 and $T_{4.}$ Whereas, highest B: C ratio was fetched in T_1 (Recommended dose of fertilizers through inorganic source (75 kg N+15 kg P_2O_5/ha in sorghum and 25 kg N+70 kg P_2O_5/ha in berseem) followed by T_5 and $T_{3.}$

Table K-16-AST-6 (a): Effect of organic nutrient management on numbers of tillers of sorghum-berseem cropping sequence

Treatments	No. of tillers/m row length						No. of tillers/ft^2					
	Sorghum						Berseem					
	2016	2017	2018	2019	2020	Pooled	2016-17	2017-18	2018-19	2019-20	2020-21	Pooled
T_1	18.3	10.0	10.4	9.5	9.1	11.5	51.8	49.1	57.3	46.5	47.0	50.3
T_2	16.8	10.3	8.5	8.9	9.2	10.8	51.1	41.0	52.6	45.9	48.3	47.8
T_3	16.1	9.4	9.8	10.0	10.0	11.1	55.7	43.0	55.2	51.5	52.7	51.6
T_4	17.4	10.0	10.5	10.6	10.5	11.8	50.2	46.6	57.4	53.8	53.9	52.4
T_5	17.3	9.7	11.4	11.4	10.9	12.1	54.7	49.5	61.1	55.3	54.0	54.9
T_6	15.7	9.9	8.8	9.3	9.9	10.7	47.7	42.3	54.4	46.0	50.4	48.2
T_7	15.6	10.1	10.4	10.4	10.7	11.5	53.3	44.9	55.7	53.0	54.1	52.2
T_8	15.4	10.0	10.5	11.0	10.9	11.6	48.9	46.4	60.5	54.6	54.5	53.0
T_9	16.6	10.3	11.6	11.5	10.9	12.2	52.7	48.6	61.3	56.5	58.5	55.5
SEm$\pm$	1.0	0.6	0.6	0.3	0.3	0.3	1.6	1.1	1.6	1.6	1.5	0.7
CD (P=0.05)	NS	NS	1.8	1.0	1.0	0.8	4.8	3.3	4.7	4.8	4.6	2.1

Table K-16-AST-6 (b): Effect of organic nutrient management on plant height of sorghum-berseem cropping sequence

Treatments	Plant height (cm)											
	Sorghum						Berseem					
	2016	2017	2018	2019	2020	Pooled	2016-17	2017-18	2018-19	2019-20	2020-21	Pooled
T_1	277.5	241.9	248.8	234.0	242.0	248.8	63.1	64.9	60.1	51.0	51.3	58.1
T_2	260.0	211.6	226.3	222.9	243.2	232.8	61.8	57.9	56.2	49.0	51.4	55.2
T_3	256.2	222.0	230.0	238.4	251.6	239.6	64.7	60.4	59.5	54.2	53.8	58.5
T_4	258.8	225.7	250.8	248.0	254.1	247.5	61.5	62.7	60.7	56.4	55.2	59.3
T_5	266.1	228.1	259.8	258.7	256.5	253.8	63.3	63.9	62.5	58.5	55.5	60.7
T_6	245.0	214.3	228.3	231.9	250.6	234.0	58.6	58.5	58.6	50.2	51.7	55.5
T_7	237.7	217.0	249.9	245.7	257.0	241.4	61.7	60.5	60.1	55.6	55.6	58.7
T_8	235.2	219.1	252.8	252.2	259.8	243.8	57.9	62.4	60.8	57.5	56.9	59.1
T_9	232.1	232.1	262.2	259.6	272.6	251.7	61.4	64.0	62.8	59.8	60.3	61.7
SEm$\pm$	4.7	5.6	5.4	7.2	5.5	2.9	1.0	0.9	1.2	1.0	1.6	0.5
CD (P=0.05)	14.3	16.9	16.3	21.9	16.6	8.8	2.9	2.6	3.7	3.1	4.9	1.6

Table K-16-AST-6 (c): Effect of organic nutrient management on green fodder yield of sorghum-berseem cropping

Treatments	Green fodder yield (q/ha)												
	Sorghum						Berseem						Sorghum + Berseem
	2016	2017	2018	2019	2020	Pooled	2016-17	2017-18	2018-19	2019-20	2020-21	Pooled	
T_1	451.2	427.2	545.3	493.8	474.8	478.5	953.4	645.0	732.9	584.0	656.3	714.3	1192.8
T_2	350.5	359.9	476.3	458.0	480.9	425.1	954.7	538.4	568.7	576.9	658.7	659.5	1084.6
T_3	359.8	380.2	534.3	501.6	508.4	456.9	1011.8	576.1	658.3	674.1	683.6	720.8	1177.7
T_4	366.8	383.5	572.0	543.1	520.6	477.1	932.4	600.2	736.6	707.4	700.3	735.3	1212.4
T_5	381.5	395.4	580.0	555.4	527.8	488.0	998.2	625.8	772.4	715.5	713.4	765.1	1253.1
T_6	342.3	347.5	509.0	473.6	500.5	434.6	850.5	529.4	628.3	579.2	677.9	653.1	1087.7
T_7	307.6	360.9	556.0	509.4	528.9	452.6	953.9	563.1	685.3	684.4	714.3	720.2	1172.8
T_8	275.6	371.8	574.0	550.2	542.5	462.8	859.0	598.5	744.0	712.1	730.1	728.7	1191.5
T_9	281.6	402.1	590.3	561.9	578.6	482.9	952.6	622.7	783.5	721.0	774.1	770.8	1253.7
SEm$\pm$	8.5	13.7	22.4	22.0	16.9	6.6	22.9	15.7	19.9	25.2	20.1	9.2	
CD (P=0.05)	25.6	41.5	67.6	66.6	51.0	20.0	69.1	47.4	60.1	76.3	60.7	27.9	

Table K-16-AST-6 (d): Effect of organic nutrient management on dry matter yield of sorghum-berseem cropping sequence

Treatments	Dry matter yield (q/ha)											
	Sorghum						Berseem					
	2016	2017	2018	2019	2020	Pooled	2016-17	2017-18	2018-19	2019-20	2020-21	Pooled
T_1	168.1	109.5	120.3	126.2	117.3	128.3	141.9	91.0	122.0	68.1	86.6	101.9
T_2	130.5	88.0	106.0	119.7	121.0	113.0	135.8	70.3	87.5	62.1	87.5	88.6
T_3	133.2	92.8	116.7	129.8	129.0	120.3	148.9	75.8	104.9	83.0	98.2	102.2
T_4	143.5	96.2	127.7	134.0	130.3	126.3	129.1	85.3	123.3	90.9	100.4	105.8
T_5	141.7	100.3	134.7	140.9	136.5	130.8	148.0	88.9	128.4	95.6	101.7	112.5
T_6	125.2	84.9	113.0	123.2	126.8	114.6	120.6	68.5	98.6	64.5	89.7	88.4
T_7	119.0	91.6	125.7	132.2	136.8	121.1	136.2	75.6	110.4	86.3	101.8	102.1
T_8	104.3	92.9	130.0	138.2	142.9	121.7	124.2	85.5	125.0	93.7	103.8	106.5
T_9	101.2	102.9	136.0	142.9	149.1	126.4	139.3	88.4	130.4	98.0	109.9	113.2
SEm±	5.1	3.1	5.7	4.6	4.2	1.9	5.6	2.3	4.0	3.9	2.7	2.0
CD (P=0.05)	15.5	9.4	17.4	14.0	12.7	5.7	16.9	7.0	12.1	11.7	8.3	6.0

Table K-16-AST-6 (e): Cost of cultivation of sorghum-berseem cropping sequence

Treatments	Cost of cultivation (Rs/ha)					
	2016-17	2017-18	2018-19	2019-20	2020-21	Pooled
T_1	96947	97697	103832	116125	116125	106145
T_2	98892	100665	105778	127100	127100	111907
T_3	99045	100819	105931	127200	127200	112039
T_4	105392	100665	112478	132800	132800	116827
T_5	105545	100819	112631	132900	132900	116959
T_6	123555	125328	127714	141100	141100	131759
T_7	123708	125481	127867	141200	141200	131891
T_8	130055	125328	134414	146800	146800	136679
T_9	130208	125481	134567	146900	146900	136811

Table K-16-AST-6 (f): Gross returns of sorghum-berseem cropping sequence

Treatments	Gross returns (Rs/ha)					
	2016-17	2017-18	2018-19	2019-20	2020-21	Pooled
T_1	175569	134026	159775	190868	202481	172544
T_2	163149	112287	130619	184089	203876	158804
T_3	171446	119549	149104	210052	212992	172629
T_4	162402	122961	163534	222941	218132	177994
T_5	172462	127652	169067	226418	221848	183489
T_6	149101	109606	142164	186889	210649	159682
T_7	157689	115497	155169	213302	222178	172767
T_8	141828	121287	164772	224937	227387	176042
T_9	154280	128098	171721	228488	241622	184842

Table K-16-AST-6 (g): Net returns of sorghum-berseem cropping sequence

Treatments	Net returns (Rs/ha)					
	2016-17	2017-18	2018-19	2019-20	2020-21	Pooled
T_1	78622	36328	55943	74743	86356	66398
T_2	64257	11622	24841	56989	76776	46897
T_3	72401	18730	43173	82852	85792	60590
T_4	57010	22296	51056	90141	85332	61167
T_5	66917	26833	56436	93518	88948	66530
T_6	25546	-15722	14450	45789	69549	27922
T_7	33981	-9984	27301	72102	80978	40876
T_8	11773	-4041	30359	78137	80587	39363
T_9	24072	2616	37154	81588	94722	48030

Table K-16-AST-6 (h): B: C ratio of sorghum-berseem cropping sequence

Treatments	B: C ratio					
	2016-17	2017-18	2018-19	2019-20	2020-21	Pooled
T_1	1.81	1.37	1.54	1.64	1.74	1.62
T_2	1.65	1.12	1.23	1.45	1.60	1.41
T_3	1.73	1.19	1.41	1.65	1.67	1.53
T_4	1.54	1.22	1.45	1.68	1.64	1.51
T_5	1.63	1.27	1.50	1.70	1.67	1.55
T_6	1.21	0.87	1.11	1.32	1.49	1.20
T_7	1.27	0.92	1.21	1.51	1.57	1.30
T_8	1.09	0.97	1.23	1.53	1.55	1.27
T_9	1.18	1.02	1.28	1.56	1.64	1.34

R-16-AST-4: Effect of stubble management and planting density on establishment and productivity of forage oat under zero tillage conditions in rice fallows

[Table Reference: R-16-AST-4 (a)-(b)]

Location: Imphal

Preamble: Zero tillage practices protect the soil from erosion, conserve water, air and nutrients, promote soil biological activity and contribute to integrated pest management (IPM), diversification of crops in associations, sequences and rotations to enhance system resilience and controlled traffic, while optimizing yields. Thus, Zero tillage/No tillage avoids straw burning, improves soil organic carbon (SOC) content, enhances input-use efficiency, and has the potential to reduce greenhouse gas emissions.

Experimental details

Objectives:

1) The trial was initially initiated in Rabi 2016-17 with the objective to find out the optimum seed rate of lathyrus and effect of stubble management on its productivity and quality. However the lathyrus did not performed well. So it was suggested to change the *lathyrus* crop with oat crop as heavy winter rainfall during the early cropping period adversely affected the growth and development of *lathyrus* in the region (Proc Rabi 2018-19, HAU, and Hisar)*. Hence, the field experiment was initiated during Rabi 2018-19, to study the effect of different height of rice stubble and planting density on establishment and productivity of forage oat under zero tillage condition in rice fallow. The experiment consisted of three seed rates (80, 100 and 120 kg ha^{-1}) and four different rice stubble height (10 cm, 25 cm, 40 cm and bending of rice stubble) was laid out in randomized block design with three replications. The results indicated that Seed rate of 120 kg/ha recorded significantly higher fodder, dry matter and crude protein yield. Bending of rice stubble (without cutting) recorded significantly higher green fodder, dry matter, crude protein yield, crude protein content and plant height.

Table R-16-AST-4 (a): Pooled mean data on effect of stubble management and planting density on yield, quality and economics of oat

Treatment	Green forage yield (q/ha)				Dry matter yield (q/ha)				Crude protein yield (q/ha)				Crude protein content (%)				Plant height (cm)			
	2019	2020	2021	Pooled	2019	2020	2021	Pooled	2019	2020	2021	Pooled	2019	2020	2021	Pooled	2019	2020	2021	Pooled
A. Rice Stubble Management																				
Rice stubble at 10 cm above ground level	120.2	116.7	108.6	115.2	23.9	24.1	22.1	23.4	3.8	1.8	2.0	1.9	7.6	7.6	8.9	8.0	110.4	108.6	100.7	106.6
Rice stubble at 25 cm above ground level	164.4	147.6	131.1	147.7	34.7	33.5	32.4	33.5	2.6	2.5	2.9	2.7	7.6	7.6	9.0	8.0	110.5	116.6	113.8	113.6
Rice stubble at 40 cm above ground level	213.4	183.2	176.8	191.1	43.1	43.6	38.0	41.6	3.3	3.4	3.4	3.4	7.8	7.7	8.9	8.1	114.4	123.4	120.0	119.3
Bending of rice stubbles (without cutting)	262.9	238.5	223.4	241.6	53.1	51.9	49.7	51.6	4.2	4.0	4.6	4.3	7.8	7.8	9.2	8.3	115.2	129.0	124.0	122.7
SEm(±)	**1.72**	**2.02**	**0.66**	**0.69**	**0.48**	**2.32**	**0.28**	**0.82**	**0.07**	**0.18**	**0.03**	**0.07**	**0.08**	**0.25**	**0.04**	**0.09**	**1.71**	**2.22**	**2.35**	**1.35**
CD (P=0.05)	**5.95**	**6.99**	**2.28**	**2.37**	**1.66**	**8.03**	**0.97**	**2.83**	**0.23**	**0.62**	**0.10**	**0.26**	**NS**	**NS**	**0.14**	**NS**	**5.91**	**7.70**	**8.15**	**4.66**
B. Seed rate																				
80 Kg/ha	179.2	163.4	145.1	162.6	35.6	34.6	32.3	34.1	2.7	2.7	2.9	2.8	7.7	7.7	8.9	8.1	110.3	117.4	112.7	113.4
100 Kg/ha	190.4	169.1	162.8	174.1	40.3	41.0	35.5	38.9	3.0	3.1	3.2	3.1	7.5	7.5	9.0	8.0	112.8	119.3	116.1	116.1
120 Kg/ha	201.0	182.0	171.9	185.0	40.1	39.2	38.9	39.4	4.7	3.1	3.5	3.3	7.9	7.8	9.0	8.2	114.8	121.5	115.1	117.1
SEm(±)	**1.15**	**2.28**	**0.49**	**0.94**	**0.54**	**1.70**	**0.55**	**0.70**	**0.04**	**0.15**	**0.05**	**0.06**	**0.04**	**0.16**	**0.05**	**0.06**	**1.56**	**1.69**	**1.74**	**1.21**
CD (P=0.05)	**3.45**	**6.84**	**1.46**	**2.82**	**1.61**	**5.10**	**1.66**	**2.09**	**0.12**	**NS**	**0.14**	**0.18**	**0.13**	**NS**	**NS**	**NS**	**4.68**	**NS**	**NS**	**NS**
C. Interaction																				
Rice Stubble Management at Seed rate level																				
SEm(±)	**2.55**	**4.24**	**1.03**	**1.68**	**1.00**	**3.62**	**0.95**	**1.40**	**0.09**	**0.30**	**0.08**	**0.12**	**0.10**	**0.36**	**0.09**	**0.13**	**3.07**	**3.54**	**3.69**	**2.40**
CD (P=0.05)	**8.17**	**NS**	**3.29**	**5.17**	**3.11**	**NS**	**2.87**	**4.42**	**0.30**	**NS**	**0.25**	**0.39**	**0.33**	**NS**	**NS**	**NS**	**9.64**	**NS**	**NS**	**NS**
Seed rate at Rice Stubble Management																				
SEm(±)	**2.30**	**4.56**	**0.97**	**1.88**	**1.08**	**3.41**	**1.11**	**1.40**	**0.08**	**0.29**	**0.10**	**0.12**	**0.09**	**0.31**	**0.10**	**0.12**	**3.12**	**3.38**	**3.48**	**2.43**
CD (P=0.05)	**6.90**	**NS**	**2.91**	**5.64**	**3.23**	**NS**	**3.32**	**4.19**	**0.24**	**NS**	**0.29**	**0.36**	**0.26**	**NS**	**NS**	**NS**	**9.37**	**NS**	**NS**	**NS**

Table R-16-AST-4 (b): Pooled mean data on effect of stubble management and planting density on yield, quality and economics of oat

Treatment	No. of tillers/m^2				Gross return (Rs./ha)				Net return (Rs./ha)				B:C ratio			
	2019	2020	2021	Pooled	2019	2020	2021	Pooled	2019	2020	2021	Pooled	2019	2020	2021	Pooled
A. Rice Stubble Management																
T1	141.55	164.00	143	149	24038	23342	21720	23033	5608	4912	3290	2321	0.30	0.27	0.18	0.25
T2	164.78	175.22	169	170	32870	29525	26216	29537	14440	11095	7786	8825	0.78	0.60	0.42	0.60
T3	175.22	179.22	179	177	42672	36632	35351	38218	24242	18202	16921	17506	1.32	0.99	0.91	1.07
T4	188.11	181.22	179	183	52586	47701	44673	48320	34156	29271	26243	27608	1.85	1.59	1.43	1.62
SEm(±)	**0.64**	**1.74**	**0.63**	**0.63**	**344**	**404**	**132**	**137**	**344**	**404**	**132**	**137**	**0.02**	**0.02**	**0.01**	**0.01**
CD 5%	**2.22**	**6.01**	**2.19**	**2.19**	**1191**	**1398**	**456**	**475**	**1191**	**1398**	**456**	**475**	**0.07**	**0.08**	**0.02**	**0.03**
B. Seed rate																
S1	169.67	168.17	170	169	35844	32682	29028	32518	18414	15252	11598	12873	1.06	0.88	0.67	0.87
S2	167.59	176.25	167	170	38085	33827	32555	34822	19655	15397	14125	14110	1.07	0.84	0.77	0.89
S3	165.00	180.33	165	170	40195	36391	34387	36991	20765	16961	14957	15213	1.07	0.87	0.77	0.90
SEm(±)	**0.64**	**2.29**	**0.64**	**0.86**	**230**	**456**	**97**	**188**	**230**	**456**	**97**	**188**	**0.01**	**0.02**	**0.01**	**0.01**
CD 5%	**1.92**	**6.88**	**1.93**	**NS**	**690**	**1367**	**291**	**564**	**690**	**NS**	**291**	**564**	**NS**	**NS**	**0.02**	**0.03**
C. Interaction																
Rice Stubble Management at Seed rate level																
SEm(±)	**1.23**	**4.13**	**1.23**	**1.54**	**510**	**847**	**206**	**336**	**510**	**847**	**206**	**336**	**0.03**	**0.05**	**0.01**	**0.02**
CD 5%	**3.84**	**NS**	**NS**	**NS**	**1635**	**NS**	**657**	**1034**	**1635**	**NS**	**657**	**1034**	**0.09**	**NS**	**0.04**	**NS**
Seed rate at Rice Stubble Management																
SEm(±)	**1.28**	**4.59**	**1.29**	**1.72**	**460**	**912**	**194**	**376**	**460**	**912**	**194**	**376**	**0.03**	**0.05**	**0.01**	**0.02**
CD 5%	**NS**	**NS**	**NS**	**NS**	**1380**	**NS**	**583**	**1127**	**1380**	**NS**	**583**	**1127**	**0.08**	**NS**	**0.03**	**NS**

Recommendation

In Manipur and similar situation of NEH Region, sowing of oat @ 120kg/ha seed with bending of rice stubble (without cutting) is recommended under zero tillage conditions in rice fallows.

K-18-AST-4: Bio-fortification of annual cereal fodder crops for enhancing zinc and iron content

[(Table Reference: K-18-AST-4 (a)]

Locations: Hyderabad

A field experiment was started during Kharif, 2019 at Hyderabad with the objective to study the effect of zinc and iron application on bio-fortification of annual cereal fodder crops. The treatments consisted 14 combinations of zinc and iron compound applied on Maize var. African tall and Jowarvar SSV74 at different crop stages. The treatments were T_1 : Control no Zn or Iron, T_2 :10 kg $ZnSO_4$/ha as basal + 1% $ZnSO_4$ foliar spray at 45 DAS, T_3 :10 kg $FeSO_4$/ha as basal + 1% $FeSO_4$ foliar spray at 45 DAS, T_4 : 10 kg $ZnSO_4$/ha as basal +10 kg $FeSO_4$/ha as basal +1% $ZnSO_4$ +1% $FeSO_4$ foliar spray at 45 DAS, T_5 : 20 kg $ZnSO_4$/ha as basal + 1% $ZnSO_4$ foliar spray at 45 DAS, T_6 : 20 kg $FeSO_4$/ha as basal + 1% $FeSO_4$ foliar spray at 45 DAS and T_7 : 20 kg $ZnSO_4$/ha as basal +20 kg $FeSO_4$/ha as basal + 1% $ZnSO_4$ +1% $FeSO_4$ foliar spray at 45 DAS. The treatments were replicated thrice in randomized block design. The crop was sown at 30cm x 10 cm spacing and plot size was 4.0 m x 3.6 m. The crops were also supplemented with 90:40:40 kg NPK /ha. Second year's results indicated that, Maize var African tall resulted in higher yields, net return and B: C Ratio.

In general, zinc exhibited better effect the iron application. Among the Zn and Fe application levels, $\mathbf{T_7}$-20 kg $ZnSO_4$ + 20 kg $FeSO_4$ /ha –as basal + 1% $ZnSO_4$ 0.5% $FeSO_4$ as foliar spray at 45 DAS proved the best and recorded higher GFY and DMY which was at par with $\mathbf{T_4}$- 10kg Zn SO_4+ 10 kg FeSO4 (Basal) + 1% $ZnSO_4$ +1% FeSO4 foliar spray at 45 DAS, $\mathbf{T_5}$-20 kg $ZnSO_4$ /ha –as basal + 1% $ZnSO_4$ foliar spray at 45 DAS and $\mathbf{T_2}$- 20kg Zn SO_4 (Basal) + 1% $FeSO_4$ foliar spray at 45 DAS. No significant difference was observed between various treatments in plant height. No significant difference was observed between treatments $\mathbf{T_4}$, $\mathbf{T_5}$, $\mathbf{T_6}$ and $\mathbf{T_7}$ in terms of net return and B: C ratio.

K-18-AST-4 (a): Bio fortification of annual cereal fodder crops for enhancing zinc and iron content for the year *rabi*, 2020

Treatments	Plant height (cm)	GFY (q ha^{-1})	DMY (q ha^{-1})	CP (%)	CPY (q ha^{-1})	Gross Returns (Rs.)	Net Returns (Rs.)	B:C Ratio
Maize var African tall								
T_1 : Control no Zn or Iron:	156.4	288.3	46.3	4.7	2.2	72064	28660	1.7
T_2 :10 kg $ZnSO_4$/ha as basal + 1% $ZnSO_4$ foliar spray at 45 DAS	174.5	296.3	45.5	5.1	2.3	74081	29597	1.7
T_3 :10 kg $FeSO_4$/ha as basal + 1% $FeSO_4$ foliar spray at 45 DAS	169.1	284	46.9	4.9	2.3	70989	26935	1.6
T_4 : 10 kg $ZnSO_4$/ha as basal +10 kg $FeSO_4$/ha as basal +1% $ZnSO_4$ +1% $FeSO_4$ foliar spray at 45 DAS	181.4	296.6	51.0	5.3	2.7	74156	29522	1.7
T_5 : 20 kg $ZnSO_4$/ha as basal + 1% $ZnSO_4$ foliar spray at 45 DAS	176.8	289.4	47.3	5.7	2.7	72339	27275	1.6
T_6 : 20 kg $FeSO_4$/ha as basal + 1% $FeSO_4$ foliar spray at 45 DAS	169.4	283.3	46.8	4.9	2.2	70831	26627	1.6
T_7 : 20 kg $ZnSO_4$/ha as basal +20 kg $FeSO_4$/ha as basal + 1% $ZnSO_4$ +1% $FeSO_4$ foliar spray at 45 DAS	187.4	304.7	50.3	5.9	3.0	76164	30800	1.7
Jowarvar SSV74								
T_8 : Control no Zn or Iron:	136.4	252.3	41.9	5.3	2.2	63081	19977	1.5
T_9 : 10 kg $ZnSO_4$/ha as basal + 1% $ZnSO_4$ foliar spray at 45 DAS	148.2	260.8	42.1	5.9	2.5	65206	21022	1.5
T_{10} :10 kg $FeSO_4$/ha as basal + 1% $FeSO_4$ foliar spray at 45 DAS	146.1	251.1	40.3	5.4	2.2	62764	19010	1.4
T_{11} : 10 kg $ZnSO_4$/ha as basal +10 kg $FeSO_4$/ha as basal + 1% $ZnSO_4$ +1% $FeSO_4$ foliar spray at 45 DAS	153.4	270.3	44.8	6.4	2.8	67573	23239	1.5
T_{12} : 20 kg $ZnSO_4$/ha as basal + 1% $ZnSO_4$ foliar spray at 45 DAS	151.0	256.6	42.8	5.9	2.5	64139	19375	1.4
T_{13}:20 kg $FeSO_4$/ha as basal + 1% $FeSO_4$ foliar spray at 45 DAS	146.4	252.9	42.7	5.1	2.2	63214	19310	1.4
T_{14} : 20 kg $ZnSO_4$/ha as basal +20 kg $FeSO_4$/ha as basal + 1% $ZnSO_4$ +1% $FeSO_4$ foliar spray at 45 DAS	159.5	268.7	45.7	6.2	2.8	67177	22113	1.5
S.Em$\pm$	5.3	4.1	1.2	0.2	0.1			
CD (P=0.05)	15.3	14.8	3.5	0.7	0.3			

R-18-AST-7: Effect of intercropping on seed setting and seed yield in Lucerne
[Table Reference: R-18-AST-7 (a)-(e)]

Location: Bikaner

The experiment was conducted during *rabi* season of 2020-21 to study the effect of intercropping on seed setting and seed yield in Lucerne at Agricultural Research Station, SKRAU, Bikaner on sandy soil with the objectives-(i) To find out effect of intercropping on Lucerne through improving pollinators (ii) To find out suitable intercrop for enhancing seed setting in Lucerne through improving microclimate. The treatments included T_1: Control (without intercrop); T_2: Fennel Intercrop at 1:5; T_3: Fennel Intercrop at 1: 10; T_4: Fennel Intercrop at 1:15; T_5 :Dill Intercrop at 1:5; T_6 :Dill Intercrop at 1: 10; T_7 :Dill Intercrop at 1:15; T_8 : Mustard Intercrop at 1:5; T_9 : Mustard Intercrop at 1: 10 and T_{10} :Mustard Intercrop at 1:15. these were replicated thrice in randomized block design. Sowing was done on November 5-6, 2020 and harvested on May, 10-15, 2020 using recommended seed rates. Fertilizers @ 20 kg N, 40 kg P_2O_5 and 20 kg K_2O as basal were drilled at sowing. Further 20 kg N in two equal splits at 30DAS and 55 DAS was broadcasted. The result reveal that seed setting was better in the combination of Fennel as well as dill intercrop with lucerne and gave highest seed yield as compared to other combinations. The maximum seed yield and net returns (340.32 kg and Rs. 81178 /ha, respectively) were obtained in combination of fennel intercrop at 1: 15.

Further on the mean basis of three years data, maximum seed yield was obtained with fennel intercrop with lucerne at 1:15 ratio. In terms of monetary returns, intercrop of fennel with lucerne at 1:15 ratio proved best as compare to other combinations. In first year pearlmillet was taken as intercrop, but due to poor growth it was replaced with fennel

Table R-18-AST-7 (a): Effect of intercropping on yield attribute, yield and economics of lucerne

Treatment Combination	No. of branches per plant	No. of pods per plant	No. of seeds per pod	1000 seed weight (g)	Seed yield (kg/ha)	Economics			
						Cost of Cultivation (Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C Ratio
Control (sole lucerne)	5.73	71.27	4.00	4.17	226.67	45348	106196	61548	2.38
Fennel Intercrop (1:5)	5.73	73.60	5.00	4.50	199.37	43595	95150	52254	2.22
Fennel Intercrop (1: 10)	6.00	72.13	4.93	4.83	271.75	44048	108747	65399	2.51
Fennel Intercrop (1:15)	5.47	79.00	5.27	4.93	340.32	44983	121556	77273	2.74
Dill Intercrop (1:5)	5.33	74.27	4.93	4.67	238.10	43382	94520	51839	2.21
Dill Intercrop (1: 10)	5.73	75.73	4.73	4.60	257.78	44118	101686	58268	2.34
Dill Intercrop (1:15)	5.73	73.27	4.67	4.07	205.71	44946	97611	53365	2.21
Mustard Intercrop (1:5)	5.40	71.13	4.20	3.87	163.81	43417	88761	46044	2.08
Mustard Intercrop (1: 10)	5.27	72.53	3.87	4.40	165.08	44168	95129	51662	2.19
Mustard Intercrop (1:15)	5.40	70.60	4.07	3.73	169.52	45056	101281	56925	2.28
SEm±	0.26	2.00	0.19	0.20	12.74	--	3250	3250	0.07
CD (P=0.05)	NS	NS	0.58	0.59	37.84	--	9657	9657	0.22

Table R-18-AST-7 (b): Effect of intercropping on yield attribute, yield and economics of lucerne

Treatment Combination	No. of branches per plant				No. of pods per plant				No. of seeds per pod			
	2018-19	2019-20	2020-21	Mean	2018-19	2019-20	2020-21	Mean	2018-19	2019-20	2020-21	Mean
Control (Single lucerne)	5.53	5.87	5.73	5.71	40.60	41.27	71.27	51.05	3.13	3.73	4.00	3.62
Fennel Intercrop at (1:5)	5.80	5.67	5.73	5.73	40.73	44.27	73.60	52.87	3.80	5.07	5.00	4.62
Fennel Intercrop at (1: 10)	5.40	5.60	6.00	5.67	39.47	42.67	72.13	51.42	3.73	4.20	4.93	4.29
Fennel Intercrop at (1:15)	6.20	5.33	5.47	5.67	42.20	43.13	79.00	54.78	4.27	3.87	5.27	4.47
Dill Intercrop at (1:5)	5.00	5.40	5.33	5.24	51.13	43.60	74.27	56.33	5.40	4.33	4.93	4.89
Dill Intercrop at (1: 10)	5.20	5.67	5.73	5.53	50.33	42.13	75.73	56.06	4.93	4.07	4.73	4.58
Dill Intercrop at (1:15)	6.20	5.67	5.73	5.87	47.73	42.73	73.27	54.58	4.73	3.93	4.67	4.44
Mustard Intercrop at (1:5)	4.07	5.00	5.40	4.82	32.27	42.67	71.13	48.69	3.07	4.07	4.20	3.78
Mustard Intercrop at (1: 10)	5.27	5.33	5.27	5.29	36.60	41.87	72.53	50.33	3.33	3.80	3.87	3.67
Mustard Intercrop at (1:15)	5.60	5.60	5.40	5.53	39.60	42.00	70.60	50.73	4.13	3.80	4.07	4.00
SEm±	0.31	0.26	0.26	--	2.09	1.96	2.00	--	0.27	0.23	0.19	--
CD (P=0.05)	0.92	0.77	NS	--	6.22	5.82	NS	--	0.79	0.67	0.58	--

1st year Pearl millet was an intercrop on place of fennel

Table R-18-AST-7 (c): Effect of intercropping on yield attribute, yield and economics of lucerne

Treatment Combination	1000 seed weight (g)				Seed yield (kg/ha)			
	2018-19	2019-20	2020-21	Mean	2018-19	2019-20	2020-21	Mean
Control (Single lucerne)	2.89	2.68	4.17	3.25	42.84	49.21	226.67	106.24
Fennel Intercrop at (1:5)	2.85	3.39	4.50	3.58	42.06	65.99	199.37	102.47
Fennel Intercrop at (1: 10)	2.88	3.37	4.83	3.69	51.99	73.47	271.75	132.40
Fennel Intercrop at (1:15)	2.76	3.37	4.93	3.69	50.07	74.15	340.32	154.85
Dill Intercrop at (1:5)	3.10	3.36	4.67	3.71	61.79	64.40	238.10	121.43
Dill Intercrop at (1: 10)	3.04	3.35	4.60	3.66	62.59	70.52	257.78	130.30
Dill Intercrop at (1:15)	3.00	3.36	4.07	3.48	60.20	69.84	205.71	111.92
Mustard Intercrop at (1:5)	2.65	2.87	3.87	3.13	20.50	42.63	163.81	75.65
Mustard Intercrop at (1: 10)	2.80	2.79	4.40	3.33	25.09	45.35	165.08	78.51
Mustard Intercrop at (1:15)	2.89	2.78	3.73	3.13	29.95	44.67	169.52	81.38
SEm$\pm$	0.09	0.05	0.20	--	2.74	2.84	12.74	--
CD (P=0.05)	0.28	0.16	0.59	--	8.14	8.44	37.84	--

- 1st year Pearl millet was an intercrop on place of fennel

Table R-18-AST-7 (d): Effect of intercropping on yield attribute, yield and economics of lucerne

Treatment Combination	Cost of Cultivation (Rs/ha)				Gross return (Rs/ha)			
	2018-19	2019-20	2020-21	Mean	2018-19	2019-20	2020-21	Mean
Control (Single lucerne)	45348	45348	45348	**45348**	88523	92068	106196	95596
Fennel Intercrop at (1:5)	41682	43595	43595	42957	84196	118037	95150	99128
Fennel Intercrop at (1: 10)	42922	44048	44048	43673	92478	113650	108747	104958
Fennel Intercrop at (1:15)	44173	44983	44983	44713	91993	108800	121556	107450
Dill Intercrop at (1:5)	43527	43382	43382	43430	120341	123982	94520	112948
Dill Intercrop at (1: 10)	44432	44118	44118	44223	117815	121814	101686	**113772**
Dill Intercrop at (1:15)	45186	44946	44946	45026	105929	110275	97611	104605
Mustard Intercrop at (1:5)	43437	43417	43417	43424	89842	100550	88761	93051
Mustard Intercrop at (1: 10)	44450	44168	44168	44262	96634	103458	95129	98407
Mustard Intercrop at (1:15)	44943	45056	45056	45018	85010	94142	101281	93478
SEm$\pm$	---	--	--	--	1646	3442	3250	--
CD (P=0.05)	---	--	--	--	4892	10228	9657	--

- 1st year Pearl millet was an intercrop on place of fennel

R-19 AST 5: Standardization of Magnesium nutrition in Bajra Napier Hybrid

[Table Reference R-19-AST-5 (a)]

Location: Vellayani

The trial was initiated in Rabi 2019 at Vellayani centre to assess the impact of varying doses and frequency of application of MgSO4 on the growth, yield and quality attributes of hybrid Napier. The first year was the establishment year. The treatments consisted of nine combinations of three levels of MgSO4 and three frequency of application of MgSO4 and one control. The levels were 80, 100 and 120 kg/ha and the frequency of application was 2 (once in 6 months), 3 (once in 4 months), and 4 (once in 3 months). The treatments were replicated thrice in Randomised Block Design. Bajra Napier hybrid Variety Suguna was used for the study. The crop was grown in 4 x 4m sq. plot with standard package of practices recommended for the area (Application of 25 t/ha FYM and 200:50:50 kg/ha NPK was applied split in 7 equal doses each applied after cut i.e., 7 cuts. The soil of the experimental site was strongly acidic, low in nitrogen and magnesium, medium in phosphorus and potassium content.

First year data shows significantly superior GFY (2638.0 q/ha), DFY (659.59 q/ha) and CPY (64.04q/ha) in T_4 (100kg MgSO4 + application once in 6 months). Highest number of tillers was also recorded in T_4 (37.33) and was on par with T_8 and T_2. From the data, it is clear that $MgSO_4$ application @ 100kg/ha, once in 6 months has resulted in 32% increase in GFY and 38% increase in DFY and CPY over control.

Table R-19-AST-5 (a): Standardization of Magnesium nutrition in Bajra Napier Hybrid

Treatments	Plant height (cm)	LSR	Number of tillers	GFY(q/ha)	DFY (q/ha)	CPY(q/ha)
T_1	182.33	1.14	31.67	2178.67	544.75	53.84
T_2	204.33	1.53	36.00	2145.33	536.45	52.20
T_3	187.00	1.27	34.00	2006.67	501.71	49.44
T_4	205.00	1.00	37.33	2638.00	659.59	64.04
T_5	235.00	1.40	36.00	2252.00	563.09	54.64
T_6	211.67	1.23	34.67	2338.67	584.80	57.90
T_7	180.33	1.60	32.00	2112.00	528.05	51.93
T_8	204.33	1.40	36.33	2400.67	600.30	59.23
T_9	203.67	1.07	33.00	1916.00	479.09	46.88
T_{10}	188.33	1.30	32.00	1903.33	475.83	46.25
S.Em +_	1.763	0.162	0.668	8.273	14.417	1.385
CD (P=0.05)	5.239	NS	1.984	24.582	42.835	4.115

K-20-AST-4b: Organic nutrient management for soil health and sustainability of round the year fodder production system **[Table Reference: K-20-AST-4b (a)-(d)]**

Location: Palampur

Preamble

Forage-based cropping systems are high-input demanding and mainly grown under inorganic nutrition conditions. However, high cost of fertilizers and concern about soil exhaustion, environmental deterioration and nutritional imbalance arising from continuous use of inorganic fertilizers, necessitate the research on other sources of nutrition. Organic nutrient management can help in arresting the decline in productivity through correction of deficiency of secondary and micro nutrients and improving the physical and biological health of the soil as well. Recently, a concept of "Natural Farming" embedding farming *with* nature and *without* chemicals has been promoted. In this system, soil is supplemented with the inoculums like *Beejamrut* and *Jeevamrut*to accelerate the propagation of existing soil micro flora. The information on the comparative performance of organic and natural farming systems nutrient on the productivity of forage-based cropping system is not available; therefore, the present study was undertaken with the objectives to study the effect of organic systems of nutrition on forage yield quality, economics soil properties of forage based cropping systems.

A field experiment was started during Kharif, 2020 at Palampur centre in Sorghum- rye grass cropping system (with two rows of Setaria grass on both side of field boundaries) to see the effect of treatments on productivity, soil health and also to maintain round the year fodder supply . The treatments consisted of seven combinations of different organic nutrition approaches. These were T_1 - FYM @10 t/ha, T_2- Natural farming with mulch, T_3- Natural farming without mulch, T_4 - FYM @ 5 t/ha basal + natural farming (T_2), T_5- FYM @ 5 t/ha basal + natural farming (T_3), T_6- FYM @ 5 t/ha + foliar application of compost tea and T_7 – Control. Natural farming included *Beejamrit* (seed treatment with *beejamrit*); basal application of *Ghana jeevamrit* @500 kg/ha; mulching @10 t/ha; Foliar application of 10% *Jeevamrit*4 weeks after sowing and after each cut i.e. 10 days after cut in kharif and 15 days after cut in rabi crops. Foliar application of compost tea was done after 4 weeks of sowing and after each cut i.e. 10 days after cut in kharif and 15 days after cut in rabi crops. All the treatments were imposed in both the crops. The treatments were replicated thrice in randomized block design.

In sorghum two cuts and in rye grass three cuts were taken. For setaria grass planting on the boundaries of the field was considered as year of establishment. The results revealed that application of FYM @ 10 t/ha (T1) was recorded significantly higher plant height, green and dry fodder yield of both the crops consequently resulted in higher green fodder and dry fodder yield of system. Application of FYM @10 t/ha was increased total green fodder yield of system by 63.21%, 94.47%, 38.08%, 61.34% .50.14% and 207.68% over Natural farming with mulch (T2), Natural farming without mulch (T3), FYM @ 5 t/ha basal+ - Natural farming with mulch (T4), FYM @ 5 t/ha basal + Natural farming without mulch (T5), FYM @ 5 t/ha + foliar application of compost tea (T6)and Control (T7), respectively. Similar trend was also observed in terms crude protein content and yield, ADF yield and NDF yield, net return and benefit cost ratio. All the treatments had shown improvement in soil properties over their initial values except control (T7). Maximum improvement in soil available nitrogen, phosphorus,potassium, organic carbon, microbial population i.e. bacteria, fungi and Actinomycetes was observed with application of FYM @ 10 t/ha (T1).

Table K-20-AST-4b (a): Effect of organic nutrient management on growth and fodder production under sorghum-rye grass cropping system

Treatments	Emergence count m^{-2}		Mean Plant height(cm)		GFY(q/ha)			DMY(q/ha)		
	Sorghum	Rye grass	Sorghum	Rye grass	Sorghum	Rye grass	Total	Sorghum	Rye grass	Total
T_1	59	128	147.0	41.5	328.54	429.23	757.77	79.59	79.05	158.64
T_2	60	132	139.3	32.8	196.35	267.93	464.28	45.95	49.69	95.63
T_3	60	127	132.0	30.7	159.47	230.16	389.64	37.76	48.94	86.70
T_4	60	131	142.5	37.4	223.10	325.70	548.80	52.93	51.19	104.12
T_5	59	125	137.0	34.1	203.06	266.60	469.66	47.93	48.05	95.99
T_6	59	125	134.3	36.5	207.01	297.70	504.72	49.65	54.30	103.95
T_7	58	125	126.5	24.4	113.22	133.07	246.29	24.51	24.75	49.27
SEm ±	1.53	4.23	5.59	0.66	7.53	4.18	10.39	2.13	3.88	4.58
CD (P=0.05)	NS	NS	17.23	2.03	23.21	12.87	32.03	6.56	11.95	14.10

Table K-20-AST-4b (b): Effect of organic nutrient management on quality parameters under sorghum-rye grass cropping system

Treatments	CP (%)		CPY(q/ha)			ADF yield (q/ha)			NDF yield (q/ha)		
	Sorghum	Rye grass	Sorghum	Rye grass	Total	Sorghum	Rye grass	Total	Sorghum	Rye grass	Total
T_1	8.77	10.44	7.01	5.64	12.65	37.09	33.54	70.63	47.25	42.10	89.36
T_2	8.58	10.31	3.97	2.64	6.61	20.94	20.71	41.65	27.27	26.34	53.61
T_3	8.43	10.19	3.23	3.24	6.47	17.26	20.46	37.72	22.29	25.80	48.09
T_4	8.68	10.40	4.61	3.83	8.43	24.42	21.53	45.95	31.47	27.21	58.69
T_5	8.47	10.30	4.10	3.12	7.22	22.14	20.30	42.45	28.41	25.39	53.80
T_6	8.83	10.53	4.43	4.22	8.65	22.65	22.57	45.22	28.98	28.33	57.31
T_7	8.27	10.12	2.03	2.54	4.57	10.90	10.05	20.95	14.38	12.93	27.32
SEm ±	0.12	0.06	0.20	0.40	0.47	0.97	1.72	2.14	1.35	2.14	2.71
CD (P=0.05)	0.33	0.19	0.61	1.23	1.43	3.00	5.30	6.60	4.18	6.47	8.37

Table K-20-AST-4b (c): Effect of organic nutrient management on monetary returns under sorghum-rye grass cropping system

Treatments	Cost of cultivation (Rs.)			GMR (Rs.)			NMR (Rs.)			B: C ratio of the system
	Sorghum	Rye grass	Total	Sorghum	Rye grass	Total	Sorghum	Rye grass	Total	
T_1	57779	68720	126499	98562	150229	248791	40784	81509	122293	1.97
T_2	40294	51235	91529	58905	93777	152682	18611	42541	61153	1.67
T_3	35794	46735	82529	47841	80558	128399	12048	33822	45870	1.56
T_4	53404	64345	117749	66930	113994	180924	13526	49648	63175	1.54
T_5	48904	59845	108749	60918	93310	154228	12014	33465	45479	1.42
T_6	51869	62810	114679	62104	104196	166301	10236	41386	51622	1.45
T_7	31559	42500	74059	33965	46575	80540	2406	4075	6481	1.09
SEm ±	-	-	-	2263	1459	3285	2263	1459	3285	0.03
CD (P=0.05)	-	-	-	6976	4498	10125	6976	4498	10125	0.11

Table K-20-AST-4b (d): Effect of organic nutrient management on physicochemical and biological properties of soil after harvest of the crops under sorghum-rye grass cropping system

Treatments	Soil pH	Available nutrients (kg/ha)			OC (%)	Microbial population (No. * 10^2) cfu/g		
		N	P	K		Bacteria	Fungi	Actinomycetes
T_1	5.60	247	21.78	179	0.85	22.4	9.17	53
T_2	5.48	249	13.32	134	0.72	21.5	8.32	39
T_3	5.48	181	13.08	128	0.71	18.9	7.46	38
T_4	5.60	218	14.54	172	0.76	20.5	8.50	45
T_5	5.62	212	14.44	170	0.76	20.1	8.34	42
T_6	5.52	218	14.21	164	0.74	19.6	8.28	38
T_7	5.46	186	11.15	134	0.68	18.5	6.29	21
Initial	5.47	232	17.64	172	0.70	18.5	7.30	32

K-20-AST-4c: Organic nutrient management for soil health and sustainability of round the year fodder production system **[Table Reference: K-20-AST-4c (a)-(d)]**

Location: Ayodhya

Preamble

Keeping in view the high cost of fertilizers and concern about ill effect of chemical fertilisers on soil health and environment, the present study was undertaken with the objectives to study the effect of organic systems of nutrition on forage yield quality, economics soil properties of forage based cropping systems. The experimental study has been initiated in sorghum-oat cropping system at Ayodhya centre from Kharif 2020.

The treatments consisted of seven combinations of different organic nutrition approaches. These were T_1 - FYM @10 t/ha, T_2- Natural farming with mulch, T_3- Natural farming without mulch, T_4 - FYM @ 5 t/ha basal + natural farming (T_2), T_5- FYM @ 5 t/ha basal + natural farming (T_3), T_6- FYM @ 5 t/ha + foliar application of compost tea and T_7 – Control. Natural farming included *Beejamrit* (seed treatment with *beejamrit*); basal application of *Ghana jeevamrit* @500 kg/ha; mulching @10 t/ha; Foliar application of 10% *Jeevamrit*4 weeks after sowing and after each cut i.e. 10 days after cut in kharif and 15 days after cut in rabi crops. Foliar application of compost tea was done after 4 weeks of sowing and after each cut i.e. 10 days after cut in kharif and 15 days after cut in rabi crops. All the treatments were imposed in both the crops. The treatments were replicated thrice in randomized block design.
The results indicated that in the first year, T_1 - FYM @10 t/ha recorded maximum green fodder yield of both the crops as well as total green fodder in a year. Whereas, T_7 – Control (no nutrition) remained the poor yielder. The treatments T_2- Natural farming with mulch, T_4 - FYM @ 5 t/ha basal + natural farming (T_2) and T5- FYM @ 5 t/ha basal + natural farming (T_3) remained on par with T1. Similar trend was recorded for dry matter, and crude protein yields. T_1 - FYM @10 t/ha also recorded higher OC (%) and Microbial population (cfu/100gm). However the treatment T_2- Natural farming with mulch and T_3- Natural farming without mulch recorded higher net monetary return and BC ratio.

Table k-20-AST-4c (a): Effect of organic nutrient management on growth and fodder production under sorghum-oat cropping system

Treatments	Emergence count m^{-1} row length		Plant height(cm)			GFY(q/ha)			DMY(q/ha)		
	Sorghum	Oat	Sorghum	Oat		Sorghum	Oat	Total	Sorghum	Oat	Total
				55DAS	Harvest						
T_1	31	36	147.0	55	107.5	242.0	223.0	465.00	64.85	45.71	110.56
T_2	29	34	139.3	50.5	105.5	232.6	210.6	443.34	61.89	42.55	104.44
T_3	30	33	132.0	57.5	102.5	195.0	182.5	377.50	50.11	35.77	85.88
T_4	28	36	142.5	52.0	106.3	237.5	215.5	453.00	63.41	43.74	107.15
T_5	31	35	137.0	49.0	104.0	225.5	206.5	432.00	59.08	41.33	100.38
T_6	29	34	134.3	48.3	103.5	208.6	198.6	407.34	54.25	39.34	93.59
T_7	30	35	126.5	46.5	91.3	181.5	145.5	327.00	46.28	28.37	74.65
SEm ±	0.95	1.24	5.59	2.51	4.80	11.08	8.30	17.58	2.62	1.78	4.05
CD (P=0.05)	NS	NS	17.23	7.79	14.79	34.14	25.57	54.17	8.08	5.48	12.48
CV%	5.57	6.21	7.07	8.74	8.07	8.82	7.28	7.34	7.95	7.79	7.26

Table K-20-AST-4c (b): Effect of organic nutrient management on quality parameters under sorghum-oat cropping system

Treatments	CP (%)		CPY(q/ha)			ADF (%)		NDF (%)	
	Sorghum	Oat	Sorghum			Sorghum	Oat	Sorghum	Oat
				Oat	Total				
T_1	8.2	7.2	5.32	3.29	8.61	38.92	43.6	62.96	68.9
T_2	7.8	6.9	4.83	2.93	7.76	38.12	41.7	62.13	67.8
T_3	7.7	6.7	3.86	2.39	6.25	36.90	39.5	60.67	65.6
T_4	8.0	7.0	5.07	3.06	8.13	38.40	42.8	62.54	68.3
T_5	7.9	6.9	4.67	2.85	7.52	37.95	41.4	61.85	67.2
T_6	7.8	6.8	4.23	2.67	6.90	37.34	40.8	61.07	66.42
T_7	7.8	6.7	3.51	1.90	5.41	36.70	38.9	60.258	64.2
SEm ±	0.24	0.21	0.19	0.12	0.31	1.17	1.53	1.58	1.85
CD (P=0.05)	NS	NS	0.59	0.36	0.95	NS	NS	NS	NS
CV%	5.23	5.41	7.37	7.41	7.39	5.37	6.42	4.46	4.80

Table K-20-AST-4c (c): Effect of organic nutrient management on monetary returns under sorghum-oat cropping system

Treatments	Cost of cultivation (Rs.) Total (Rs.)			GMR (Rs.)			NMR (Rs.)			B: C ratio
	Sorghum	Oat	Total	Sorghum	Oat	Total	Sorghum	Oat	Total	
T_1	28398	27523	55921	36300	33450	69750	7902	5927	13829	1.25
T_2	23098	22223	45321	34900	31600	66500	11802	9377	21179	1.46
T_3	19498	18623	38121	29250	27375	56625	9752	8702	18494	1.48
T_4	27098	26623	53721	35625	32325	67950	8527	5702	14229	1.26
T_5	23498	22623	46121	33825	30975	64800	10327	8352	18679	1.40
T_6	23548	22678	46246	31300	29800	61100	7752	7122	14974	1.32
T_7	18080	17175	35255	27225	21825	49050	9145	4650	13795	1.39

Table K-20-AST-4c (d): Effect of organic nutrient management on physicochemical and biological properties of soil after harvest of the crops under sorghum-oat cropping system

Treatments	Soil pH	Available nutrients (kg/ha)			OC (%)	Microbial population (cfu/100gm)	
		N	P	K		Bacteria	Fungi
T_1	8.6	127.6	17.6	267	0.26	22.4	11.0
T_2	8.7	127.5	17.0	269	0.25	21.5	10.5
T_3	8.9	1215	16.4	269	0.24	18.9	9.6
T_4	8.7	128.2	17.8	256	0.26	20.5	10.7
T_5	8.8	127.3	17.1	263	0.25	20.1	10.0
T_6	8.8	122.8	16.5	258	0.25	19.6	9.8
T_7	8.9	116.5	15.5	242	0.24	18.5	9.5
Initial	8.9	116.5	15.5	242	0.24	18.5	9.5

C. AVT-2 Trials

R-20-AST-1: Effect of P levels on forage yield of promising entries of Berseem (AVTB-2-MC) [Table Reference: R-20-AST-1 (a) to (i)]

Locations: (8)
HZ: Palampur, Srinagar
NWZ: Pantnagar, Hisar, Ludhiana
CZ: Rahuri,Jabalpur,Raipur

AVT trial on berseem was conducted in three zones of the country (Hill, North West and Central Zone) to study the effect of phosphorus fertilizer on yield and quality of promising entries of berseem under multicut cut system. In the trial five entries (JB-06-11, JHB-18-1, JHB-18-2, BM-12, HFB-15-5) along with one national check (Wardan -NC) and two zonal checks *viz.*, BB-2 (NWZ and CZ), BL-22 (HZ), were evaluated at eight locations in the country. The three phosphorus levels (60, 80 and 100 kg /ha) were imposed on entries to see the response. The entire dose of phosphorus was applied as basal near to crop strip. The experiment was conducted in split plot design with entries in main plot and replicated thrice.

In hill zone, entry HFB-15-5 proved superior and recorded maximum GFY (255.6q/ha), which was at par with JHB-18-1 and JB-06-11. However, in terms of dry matter yield, JB-06-11 recorded maximum yields followed by JHB-18-1 and HFB-15-5. All the above entries recorded higher GFY and DMY over national as well as zonal checks. Entry JHB-18-1 recorded maximum crude protein yield followed by HFB-15-5.

In North West Zone, BM-12 recorded highest GFY, which was at par with JB-06-11 followed by JHB-18-1. The dry matter and crude protein yields also demonstrated similar pattern to that of green fodder yield.

In central zone, JB-06-11 recorded maximum green fodder which was closely followed by JHB-18-2 andJHB-18-1. The dry matter and crude protein yields also demonstrated similar pattern to that of green fodder yield.

On national mean across the zone basis, entry JB-06-11 proved highest yield and recorded 481.3 q green and 73.36 q dry matter per hectare, which was 9.3 and 12.9% higher over national check. All the entries except HFB-15-5 out yielded the checks. In terms of crude protein yields also all the entries proved superior over national checks. The entry JHB-18-1 recorded maximum CP yields.

The interaction effect of entries with phosphorus remained significant at some centre in terms of GFY, DMY and CP Yields.

As regards to response of entries to increasing level of phosphorus, all the entries responded significantly to increasing level. On overall mean, the significant response was noted up to 80 kg Phosphorus /ha, beyond which the increase was insignificant in terms of green and dry matter yields. Application of 80 kg Phosphorus per hectare produced 471.1 q green and 70.22 q dry matter per hectare. The increase was to the tune of 10.6 and 14.5 over 60 kg Phosphorus /ha on overall mean basis.

The response equation, Agronomic Maxima, Agronomic Optima was worked for different zone and across the zones and given in table

Polynomial response equation for different zones and across the zone based on green forage yield of promising entries of Berseem (AVTB-2-MC)

Zones	Polynomial response equation	Y_{Maxima}	Y_{Optima}
HZ	$y = -0.0426x^2 + 8.4375x - 147.9$	99	94
	$R^2 = 1$		
NWZ	$y = -0.046x^2 + 8.385x + 241.2$	91.1	86.5
	$R^2 = 1$		
CZ	$y = -0.0499x^2 + 9.2025x + 124.3$	92.2	87.9
	$R^2 = 1$		
OVERALL BASIS	$y = -0.0462x^2 + 8.69x + 71.9$	94	89.4
	$R^2 = 1$		

R-20-AST-1 (a): Effect of phosphorus levels on green forage yield of promising entries of Berseem (AVTB-2-MC)

Entries	**Green fodder yield (q/ha)**											
	HZ			**NWZ**				**CZ**				**Overall Mean**
	Palampur	**Srinagar**	**Mean**	**Pantnagar**	**Hisar**	**Ludhiana**	**Mean**	**Jabalpur**	**Raipur**	**Rahuri**	**Mean**	
JB-06-11	226.7	273.5	250.1	481.4	575.2	868.2	641.6	834.2	501.0	321.0	552.1	481.3
JHB-18-1	293.8	212.0	252.9	452.8	576.5	855.1	628.1	831.4	435.8	328.6	531.9	471.0
BM-12	249.0	235.8	242.4	487.8	550.9	911.2	650.0	795.9	427.6	367.1	530.2	474.2
HFB-15-5	253.6	257.5	255.6	377.6	499.8	874.4	583.9	826.2	366.3	268.0	486.8	442.1
JHB-18-2	255.5	220.0	237.8	450.4	504.6	861.9	605.6	818.0	452.2	329.5	533.2	458.9
Wardan(NC)	220.4	246.4	233.4	326.6	558.2	794.8	559.9	858.2	404.8	324.3	529.1	440.8
BL-22 (ZC-HZ)	230.5	226.1	228.3									
BB-2 (ZC-NWZ)				363.7	530.8	810.0	568.2					
BB-2 (ZC-CZ)								868.2	451.5	278.0	532.6	
S.Em (±)	9.2	9.1		4.9	10.0	10.9		8.4	13.0	12.2		
C.D. (P=0.05)	28.6	28.3		15.4	31.1	33.5		24.6	40.4	37.5		
Phosphorus levels (kg /ha)												
60	185.2	224.7	204.9	394.2	520.7	821.2	578.7	796.8	417.3	276.5	496.9	426.8
80	264.1	244.5	254.3	439.8	548.9	864.0	617.6	866.4	436.9	320.7	541.3	471.1
100	292.0	247.1	269.6	426.1	557.2	875.8	619.7	836.2	448.3	352.8	545.8	478.4
S.Em (±)	2.81	4.94		3.73	6.90	5.9		6.32	4.35	9.28		
C.D. (P=0.05)	8.18	14.37		10.87	20.20	17.1		19.85	13.66	26.89		
Interaction												
Factor(A) at same level of B												
SEm (±)	11.01			9.46	18.0	15.6		8.74	22.46			
CD (P=0.05)	33.62			28.06	NS	NS		25.36	NS			

Table -R-20-AST-1 (b): Effect of phosphorus levels on dry matter yield of promising entries of Berseem (AVTB-2-MC)

Treatments	Dry matter yield (q/ha)											
	HZ			NWZ				CZ				Overall Mean
	Palampur	Srinagar	Mean	Pantnagar	Hisar	Ludhiana	Mean	Jabalpur	Raipur	Rahuri	Mean	
Entries												
JB-06-11	56.89	47.61	52.25	65.51	79.80	105.49	83.60	99.83	85.00	67.83	84.22	73.36
JHB-18-1	64.17	35.80	49.99	64.88	79.90	103.34	82.71	101.52	72.60	67.57	80.56	71.09
BM-12	53.05	39.83	46.44	73.56	74.50	106.32	84.79	97.45	70.50	79.42	82.46	71.23
HFB-15-5	53.35	43.48	48.41	54.61	60.30	102.59	72.50	100.56	61.30	59.46	73.77	64.89
JHB-18-2	51.03	37.14	44.09	67.37	61.40	104.47	77.75	103.13	75.40	69.05	82.53	68.12
Wardan (NC)	46.12	41.53	43.83	45.22	75.30	94.65	71.72	103.85	67.30	67.10	79.42	64.99
BL-22 (ZC-HZ)	49.71	38.16	43.93									
BB-2 (ZC-NWZ)				52.86	68.20	97.96	73.01					
BB-2 (ZC-CZ)								110.21	75.40	59.98	81.86	
S.Em (±)	2.08	1.01		1.16	1.80	1.05		4.36	1.75	2.36		
C.D. (P=0.05)	6.46	3.15		3.62	5.70	3.24		12.53	5.45	7.29		
Phosphorus levels (kg /ha)												
60	36.16	38.54	37.35	56.87	65.80	96.57	73.08	93.33	69.70	57.70	73.58	61.34
80	53.76	41.30	47.53	64.17	73.00	102.54	79.90	108.94	72.60	68.11	83.22	70.22
100	70.51	41.69	56.10	60.68	75.30	107.25	81.08	104.82	75.20	75.79	85.27	74.15
S.Em (±)	0.85	0.685		1.23	1.0	0.8		4.55	0.84	2.19		
C.D. (P=0.05)	2.50	1.995		3.59	2.9	2.4		13.74	2.46	6.35		
Interaction												
Factor(A) at same level of B												
SEm (±)	2.78			2.90	2.8	2.19		3.65	1.46			
CD (P=0.05)	8.41			NS	NS	NS		9.56	NS			

Table -R-20-AST-1 (c): Effect of phosphorus levels on per day green forage yield of promising entries of Berseem (AVTB-2-MC)

Entries	Green fodder yield (q/ha/day)							
	HZ			NWZ				Overall Mean
	Palampur	Srinagar	Mean	Pantnagar	Hisar	Ludhiana	Mean	
JB-06-11	1.30	1.57	1.44	3.19	3.84	5.33	4.12	2.78
JHB-18-1	1.68	1.21	1.45	3.00	3.84	5.25	4.03	2.74
BM-12	1.42	1.35	1.38	3.23	3.67	5.59	4.16	2.77
HFB-15-5	1.45	1.47	1.46	2.50	3.33	5.36	3.73	2.60
JHB-18-2	1.46	1.26	1.36	2.98	3.36	5.29	3.88	2.62
Wardan (NC)	1.26	1.41	1.33	2.16	3.72	4.88	3.59	2.46
BL-22 (ZC-HZ)	1.32	1.29	1.31					
BB-2 (ZC-NWZ)				2.41	3.54	4.97	3.64	
S.Em (±)	0.05	0.01		0.03	0.07	0.07		
C.D. (P=0.05)	0.16	0.04		0.10	0.21	0.21		
Phosphorus levels (kg /ha)								
60	1.06	1.29	1.17	2.61	3.47	5.04	3.71	2.44
80	1.51	1.40	1.45	2.91	3.66	5.30	3.96	2.70
100	1.67	1.41	1.54	2.82	3.71	5.37	3.97	2.75
S.Em (±)	0.02	0.005		0.02	0.05	0.04		
C.D. (P=0.05)	0.05	0.014		0.07	0.13	0.10		
Interaction								
Factor(A) at same level of B								
SEm (±)	0.11			0.056	0.12	0.10		
CD (P=0.05)	NS			0.196	NS	NS		

Table -R-20-AST-1 (d): Effect of phosphorus levels on per day dry matter yield of promising entries of Berseem (AVTB-2-MC)

Entries	Dry fodder yield (q/ha/day)							
	HZ			NWZ				Overall Mean
	Palampur	Srinagar	Mean	Pantnagar	Hisar	Ludhiana	Mean	
JB-06-11	0.28	0.27	0.27	0.43	0.53	0.65	0.54	0.40
JHB-18-1	0.35	0.21	0.28	0.43	0.53	0.63	0.53	0.41
BM-12	0.28	0.23	0.25	0.49	0.50	0.65	0.55	0.40
HFB-15-5	0.29	0.25	0.27	0.36	0.40	0.63	0.46	0.37
JHB-18-2	0.29	0.21	0.25	0.45	0.41	0.64	0.50	0.38
Wardan (NC)	0.25	0.24	0.24	0.30	0.50	0.58	0.46	0.35
BL-22 (ZC-HZ)	0.26	0.22	0.24					
BB-2 (ZC-NWZ)				0.35	0.45	0.60	0.47	0.35
S.Em (±)	0.01	0.00		0.01	0.01	0.01		
C.D. (P=0.05)	0.04	0.01		0.02	0.04	0.02		
Phosphorus levels (kg /ha)								
60	0.20	0.22	0.21	0.38	0.44	0.59	0.47	0.34
80	0.30	0.24	0.27	0.43	0.49	0.63	0.52	0.39
100	0.35	0.24	0.29	0.40	0.50	0.66	0.52	0.41
S.Em (±)	0.01	0.001		0.01	0.01	0.01		
C.D. (P=0.05)	0.02	0.003		0.02	0.02	0.01		
Interaction								
Factor(A) at same level of B								
SEm (±)	0.028			0.02	0.02	0.01		
CD (P=0.05)	NS			NS	NS	NS		

Table -R-20-AST-1 (e): Effect of phosphorus levels on Crude protein yieldof promising entries of Berseem (AVTB-2-MC)

Entries	Crude protein yield (q/ha)								
	HZ	NWZ			CZ				Overall Mean
	Palampur	Pantnagar	Ludhiana	Mean	Rahuri	Jabalpur	Raipur	Mean	
JB-06-11	9.44	11.63	18.90	15.25	11.95	14.56	19.60	15.37	13.35
JHB-18-1	12.26	12.14	19.37	15.53	11.71	14.91	15.80	14.14	13.98
BM-12	8.81	14.09	19.64	17.26	14.62	13.76	14.60	14.33	13.47
HFB-15-5	10.24	9.41	19.58	14.65	11.28	14.54	13.70	13.17	12.69
JHB-18-2	9.88	12.59	20.45	16.64	12.31	15.21	18.10	15.21	13.91
Wardan (NC)	8.30	8.35	18.20	13.01	11.63	15.26	14.80	13.90	11.74
BL-22 (ZC-HZ)	9.11								
BB-2 (ZC-NWZ)		9.34	19.18	13.71					
BB-2 (ZC-CZ)					11.03	15.15	17.50	14.56	
S.Em (±)	0.42	0.27	0.205		0.50	0.56	0.39		
C.D. (P=0.05)	1.30	0.83	0.632		1.56	1.15	1.19		
Phosphorus levels (kg /ha)									
60	6.85	10.15	18.59	14.40	10.25	13.16	14.80	12.74	6.85
80	10.41	11.83	19.18	15.29	12.24	15.86	16.80	14.97	10.41
100	11.89	11.25	20.22	15.76	13.73	15.30	17.30	15.44	11.89
S.Em (±)	0.19	0.24	0.158		0.45	0.4	0.186		
C.D. (P=0.05)	0.54	0.71	0.458		1.31	1.11	0.542		
Interaction									
S.Em (±)	0.57	0.59	0.42			0.33	0.667		
C.D. (P=0.05)	1.74	NS	1.2			0.98	1.48		

Table -R-20-AST-1 (f): Effect of phosphorus levels on Crude protein (%) of promising entries of Berseem (AVTB-2-MC)

Entries	Crude protein (%)				
	Palampur	Pantnagar	Ludhiana	Rahuri	Mean
JB-06-11	19.56	17.71	17.9	17.63	18.20
JHB-18-1	20.05	18.70	18.8	17.30	18.71
BM-12	17.84	19.17	18.5	18.35	18.47
HFB-15-5	20.14	17.21	19.1	18.88	18.83
JHB-18-2	19.65	18.69	19.6	17.77	18.93
Wardan (NC)	18.88	18.46	19.2	17.32	18.47
BL-22 (ZC-HZ)	21.12				
BB-2 (ZC-NWZ)		17.63	19.6		
BB-2 (ZC-CZ)				18.35	
S.Em (±)	1.21	0.28		0.36	
C.D. (P=0.05)	3.58	0.86		NS	
Phosphorus levels (kg /ha)					
60	19.12	17.74	19.3	17.75	18.48
80	19.61	18.39	18.7	17.98	18.67
100	19.66	18.54	18.9	18.10	18.80
S.Em (±)	0.66	0.12		0.16	
C.D. (P=0.05)	NS	0.36		NS	
Interaction					
S.Em (±)	2.12	0.39			
C.D. (P=0.05)	NS	NS			

Table -R-20-AST-1 (g): Effect of phosphorus levels on Plant height (cm) of promising entries of Berseem (AVTB-2-MC)

Entries	Plant height (cm)										
	HZ			NWZ			CZ				Overall Mean
	Palampur	Srinagar	Mean	Pantnagar	Hisar	Mean	Jabalpur	Raipur	Rahuri	Mean	
JB-06-11	42.70	61.21	51.96	49.00	53.30	51.15	50.00	66.20	59.78	58.66	53.92
JHB-18-1	42.00	45.09	43.54	46.00	53.60	49.80	48.39	60.20	63.89	57.49	50.28
BM-12	43.80	54.49	49.14	47.00	50.60	48.80	48.42	56.90	69.78	58.37	52.10
HFB-15-5	44.20	63.22	53.71	45.00	43.30	44.15	48.88	58.80	54.44	54.04	50.63
JHB-18-2	41.80	54.57	48.18	48.00	43.70	45.85	49.74	60.90	64.78	58.47	50.84
Wardan (NC)	41.60	65.63	53.62	45.00	51.70	48.35	49.26	60.30	61.78	57.11	53.03
BL-22 (ZC-HZ)	44.10	50.41	47.26								
BB-2 (ZC-NWZ)				45.00	47.60	46.30					
BB-2 (ZC-CZ)							50.10	60.30	61.44	57.28	
S.Em (±)	1.70	2.05		1.09	1.10		0.41	1.08	1.44		
C.D. (P=0.05)	NS	6.37		NS	3.30		14.25	3.36	4.44		
Phosphorus levels (kg /ha)											
60											
80	38.60	48.78	43.69	45.00	47.00	46.00	48.08	59.40	58.29	55.26	48.31
100	44.10	58.75	51.43	47.00	49.50	48.25	49.98	60.70	62.71	57.80	52.49
S.Em (±)	45.90	61.60	53.75	47.00	50.70	48.85	49.71	61.40	65.81	58.97	53.86
C.D. (P=0.05)	1.00	0.75		0.99	0.70		0.60	0.57	0.63		
Interaction											
Factor(A) at same level of B											
SEm (±)	2.4			1.88	1.8		0.5	1.08	1.08		
CD (P=0.05)	NS			NS	NS		1.15	NS	NS		

Table -R-20-AST-1 (h): Effect of phosphorus levels on leaf stem ratio of promising entries of Berseem (AVTB-2-MC)

Entries	Leaf stem ratio										
	HZ			NWZ			CZ				Overall Mean
	Palampur	Srinagar	Mean	Pantnagar	Hisar	Mean	Jabalpur	Raipur	Rahuri	Mean	
JB-06-11	0.68	0.75	0.71	0.68	0.79	0.74	0.77	0.61	0.59	0.66	0.70
JHB-18-1	0.68	0.63	0.65	0.88	0.80	0.84	0.80	0.55	0.61	0.65	0.72
BM-12	0.71	0.71	0.71	0.79	0.76	0.78	0.73	0.62	0.71	0.69	0.72
HFB-15-5	0.68	0.63	0.66	0.81	0.66	0.74	0.75	0.65	0.50	0.63	0.67
JHB-18-2	0.71	0.62	0.67	0.73	0.67	0.70	0.73	0.59	0.66	0.66	0.68
Wardan (NC)	0.70	0.68	0.69	0.65	0.77	0.71	0.76	0.57	0.57	0.63	0.68
BL-22 (ZC-HZ)	0.71	0.58	0.65								
BB-2 (ZC-NWZ)				0.67	0.72	0.70					0.65
BB-2 (ZC-CZ)							0.75	0.56	0.52	0.61	
S.Em (±)	0.02	0.02		0.08	0.01		0.02	0.02	0.02		
C.D. (P=0.05)	0.06	0.07		NS	0.04		0.06	NS	0.05		
Phosphorus levels (kg /ha)											
60	0.64	0.579	0.61	0.68	0.70	0.69	0.75	0.59	0.46	0.63	0.64
80	0.68	0.579	0.63	0.71	0.74	0.73	0.77	0.59	0.61	0.67	0.67
100	0.77	0.708	0.74	0.85	0.77	0.81	0.75	0.60	0.72	0.75	0.77
S.Em (±)	0.01	0.008		0.08	0.01		0.75	0.59	0.46		
C.D. (P=0.05)	0.029	0.024		NS	0.03		0.03	NS	0.05		
Interaction											
Factor(A) at same level of B											
SEm (±)	0.029			0.130	0.02		0.01	0.42			
CD (P=0.05)	NS			NS	NS		0.03	NS			

Table -R-20-AST-1 (i): Effect of phosphorus levels on growth parametersof promising entries of Berseem (AVTB-2-MC)

Entries	No. of Tillers/ row				Plant Population per /m row length		
	NWZ		CZ	Mean			
	Pantnagar	Hisar	Raipur		Palampur	Rahuri	Mean
JB-06-11	89	82.80	133.60	108.20	75.40	95.89	85.65
JHB-18-1	88	83.80	121.60	102.70	68.10	104.00	86.05
BM-12	97	80.30	125.50	102.90	64.90	100.78	82.84
HFB-15-5	97	73.80	117.20	95.50	68.40	95.33	81.87
JHB-18-2	109	74.80	122.00	98.40	65.80	103.67	84.74
Wardan (NC)	100	81.00	132.20	106.60	66.40	101.33	83.87
BL-22 (ZC-HZ)							
BB-2 (ZC-NWZ)	87	76.50			64.00		
BB-2 (ZC-CZ)			135.50			97.78	
S.Em (±)	1.88	1.60	2.87		2.20	2.28	
C.D. (P=0.05)	06	5.10	8.95		6.50	NS	
Phosphorus levels (kg /ha)							
60	94	75.90	123.40	99.65	55.90	100.43	78.17
80	95	79.70	126.40	103.05	69.10	98.86	83.98
100	98	81.40	130.50	105.95	77.80	100.19	89.00
S.Em (±)	1.13	1.0	1.43		1.3	0.89	
C.D. (P=0.05)	03	2.8	4.17		3.8	NS	
Interaction							
Factor(A) at same level of B							
SEm (±)	3.26	2.8	4.98		3.8		
CD (P=0.05)	NS	NS	NS		NS		

Table R 20- AST-1(j): Interaction effect of entries and P levels on Green fodder yield (q/ha), and Dry matter yield (q/ha) (AVTB-2MC) Palampur

Entries	Green fodder yield (q/ha)					Dry matter yield (q/ha)			
	P levels (kg/ha)					P levels (kg/ha)			
	60		80	100	Mean	60	80	100	Mean
JB-06-11	176.35		237.35	266.54	226.75	34.84	51.05	58.68	48.19
JHB-18-1	196.46		326.79	358.07	293.78	39.16	67.90	75.72	60.93
BM-12	177.45		272.42	297.11	249.00	34.43	53.56	59.60	49.20
HFB-15-5	205.89		264.27	290.78	253.65	39.33	51.79	60.95	50.69
JHB-18-2	178.19		281.17	307.26	255.54	33.51	54.50	62.58	50.20
Wardan (NC)	186.61		223.54	251.09	220.42	36.34	44.50	50.77	43.87
BL-22 (ZC-HZ)	175.14		243.23	273.13	230.50	33.14	47.90	54.18	45.07
Mean	185.16		264.11	292.00		35.82	53.03	60.36	
	V	**N**	**VXN**			**V**	**N**	**VXN**	
SEm±	9.18	2.81	11.01			2.08	0.85	2.78	
CD at 5%	28.61	8.18	33.62			6.46	2.50	8.41	

Table R 20- AST-(k): Interaction effect of entries and P levels on crude protein yield (q/ha) (AVTB-2MC) Palampur

Entries	CP yield				
	P levels (kg/ha)				
	60		80	100	Mean
JB-06-11	6.74		10.03	11.54	9.44
JHB-18-1	7.73		13.72	15.32	12.26
BM-12	6.00		9.66	10.76	8.81
HFB-15-5	7.72		10.55	12.44	10.24
JHB-18-2	6.51		10.74	12.39	9.88
Wardan (NC)	6.75		8.43	9.71	8.30
BL-22 (ZC-HZ)	6.52		9.76	11.04	9.11
Mean	6.85		10.41	11.89	
	V	**N**	**VXN**		
SEm±	0.42	0.19	0.57		
CD at 5%	1.30	0.54	1.74		

Table-R-20-AST-1 (l): Interaction Effect of phosphorus levels on green forage yield (q/ha)of promising entries of Berseem (AVTB-2-MC) Pantnagar

Green forage yield(q/ha)				
Entries	**P levels(kg/ha)**			**Mean A**
	60	**80**	**100**	
JB-06-11	439.3	498.8	506.2	481.4
JHB-18-1	435.9	466.7	455.8	452.8
BM-12	488.6	495.0	479.7	487.8
HFB-15-5	364.0	394.6	374.3	377.6
Wardan (NC)	300.2	351.4	328.2	326.6
BB-2 (ZC-NWZ)	317.6	389.0	384.6	363.7
JHB-18-2	414.0	483.0	454.1	450.4
Mean B	394.2	439.8	426.1	

Table R 20- AST-1 (m): Interaction effect of entries and P levels on crude protein yield (q/ha) (AVTB-2MC) Ludhiana

Entries	**CP yield (q/ha)**			
	P levels(kg/ha)			
	60	**80**	**100**	**Mean**
JB-06-11	17.72	19.47	19.5	18.9
JHB-18-1	18.69	19.82	19.6	19.37
BM-12	19.59	18.86	20.46	19.64
HFB-15-5	19.63	18.46	20.65	19.58
JHB-18-2	18.96	20.73	21.66	20.45
Wardan (NC)	17.69	17.82	19.09	18.2
BB-2 (ZC-NWZ)	17.85	19.13	20.56	19.18
Mean	18.59	19.18	20.22	19.33
SE(m)	0.42			
CD (P=0.05)	1.20			

Table -R-20-AST-1 (n): Interaction Effect of phosphorus levels on Green forage yield and Dry matter yield (q/ha) of promising entries of Berseem (AVTB-2-MC) Raipur

Entries	GFY (q/ha) Total				DMY (q/ha)			
	P levels(kg/ha)				P levels(kg/ha)			
	60	80	100	Mean	60	80	100	Mean
JB-06-11	480.5	503.6	519.0	501.0	81.2	85.8	87.9	85.0
JHB-18-1	426.9	433.9	446.6	435.8	71.0	72.5	74.3	72.6
BM-12	413.7	434.0	435.1	427.6	66.6	70.9	74.0	70.5
HFB-15-5	354.2	368.5	376.1	366.3	59.6	61.4	62.8	61.3
JHB-18-2	433.7	452.8	470.0	452.2	72.6	75.1	78.5	75.4
Wardan (NC)	393.8	406.2	414.3	404.8	64.6	67.5	69.8	67.3
BB-2 (ZC-CZ)	418.3	459.3	476.9	451.5	72.5	74.9	78.7	75.4
Mean	417.3	436.9	448.3		69.7	72.6	75.2	
SE(m)	22.46				1.46			
CD (P=0.05)	NS				NS			

R-20-AST-2: Effect of N levels on forage yield of promising entries of single cut oat (AVT-2 SC) [Table Reference: R-20-AST-2(a)-(n)]

Locations: (8)

HZ: Palampur, Srinagar

CZ: Urulikanchan, Anand, Raipur

SZ: Hyderabad, Mandya, Coimbatore

AVT trial on single cut oat was conducted in three zones of the country (Hill, Central Zone and South Zone) to study the effect of nitrogen nutrition on yield and quality of promising entries of single cut oat. In the trial seven entries (OL-1874-1, OL-1876-1, RO-11-1-3, JO-06-23, SKO-241, RO-11-1-2 and HFO-806) along with two national check (Kent andOS-6NC) and three zonal checks *viz.*, SKO-96 (HZ) RO-11-1(CZ) OS-403 (SZ), were evaluated at eight locations in the country. The three nitrogen levels (60, 90 and 120 kg /ha) were imposed on entries to see the response. The entire dose of nitrogen was applied as basal near to crop strip. The experiment was conducted in split plot design with entries in main plot and replicated thrice.

The data presented in following tables, indicates that in Hill Zone, entry RO-11-1-3yielded maximum green fodder, dry matter and crude protein yields (417.0, 77.4 & 7.9 q/ha). It was significantly superior to all remaining entries & checks. It was followed by entry HFO-806. The entry RO-11-1-3 recorded 16.3, 10.6 & 12.9 % higher green fodder, dry matter and crudeprotein yields respectively, over best check Kent (NC).

In central zone entry JO-06-23 recorded highest green fodder, dry matter and crude protein yields followed by OL-1876-1. The entry recorded 371.9, 85.8 and 8.9q green, dry &crude protein yieldsper hectare, which was 12.9, 8.3 and 20.2% higher over best check RO-11-1(CZ). In terms of green fodder, dry matter and crude protein yields, respectively. In south zone, entries JO-06-23, SKO-241, RO-11-1-2 and HFO-806remained higher yielder and recorded higher green fodder, dry matter and crude protein yields over other entries but remained on par with OS-6 (NC)in terms of GFY & DMY.

On national level across the zone the entryJO-06-23 proved the best and recorded maximum green fodder, dry matter and crude protein yields (330.7, 68.5 and 7.4 q/ha, respectively). On overall mean basis, linear response to nitrogen application was noted up to 120 kg N/ha which produced (353.7 q green, 68.5 q dry matter and 7.4 q CP yield per hectare).

The response equation, Agronomic Maxima, Agronomic Optima was worked for different zone and across the zones and given in table.

Polynomial response equation for different zones and across the zone based on green forage yield of promising entries of single cut Oat (AVTO-2)

Zones	Polynomial response equation	Y_{Maxima}	Y_{Optima}
HZ	$y = -0.0812x^2 + 17.465x - 494.9$	107.5	106.8
	$R^2 = 1$		
SZ	$y = -0.0172x^2 + 3.765x + 80$	109.4	106.1
	$R^2 = 1$		
OVERALL BASIS	$y = -0.0242x^2 + 5.885x + 7.7$	121.6	119.2
	$R^2 = 1$		

R-20-AST-2 (a): Effect of nitrogen levels on green forage yield of promising entries of single cut Oat (AVTO-2)

Treatments	Green forage yield (q/ha)											
	HZ			CZ				SZ				Overall mean
	Palam-pur	Sri-nagar	Mean	Urulikan chan	Ana-nd	Rai-pur	Mean	Hyder abad	Man-dya	Coimb atore	Mean	
Entries												
OL-1874-1	296.7	303.9	300.3	420.1	165.0	448.9	344.7	194.9	196.7	364.2	251.9	298.8
OL-1876-1	345.6	331.5	338.5	491.1	222.0	357.1	356.7	217.1	209.3	363.0	263.1	317.1
RO-11-1-3	413.1	420.9	417.0	462.5	242.0	294.6	333.0	219.8	226.2	334.8	260.3	326.7
JO-06-23	435.3	283.7	359.5	521.0	190.0	404.8	371.9	218.9	233.9	358.2	270.3	330.7
SKO-241	388.9	329.5	359.2	514.1	242.0	249.3	335.1	228.6	254.4	332.6	271.9	317.4
RO-11-1-2	418.1	336.5	377.3	528.3	177.0	307.1	337.5	232.3	234.2	346.6	271.0	322.5
HFO-806	405.0	359.1	382.1	396.4	178.0	388.8	321.1	233.6	231.9	355.6	273.7	318.6
Kent (NC)	380.3	337.0	358.6	465.2	216.0	261.9	314.4	210.9	223.7	357.8	264.1	306.6
OS-6 (NC)	375.3	337.7	356.5	463.6	222.0	249.5	311.7	233.7	207.0	379.2	273.3	308.5
SKO-96 (HZ)	364.4	350.2	357.3									
RO-11-1(CZ)				501.1	193.0	293.9	329.3					
OS-403 (SZ)								232.4	233.8	322.0	262.7	
S.Em (±)	10.0	6.3		9.9	0.9	7.8		3.1	8.1	8.1		
C.D. (P=0.05)	29.9	18.9		35.7	2.7	23.3		8.8	24.4	23.9		
Nitrogen levels (kg N/ha)												
60.0	294.9	226.1	260.5	469.2	163.0	303.8	312.0	209.0	195.9	326.4	243.8	273.5
90.0	404.9	359.7	382.3	473.1	208.0	328.1	336.4	222.0	232.9	357.6	270.8	323.3
120.0	446.9	431.3	439.1	486.7	268.0	344.9	366.5	235.0	246.6	370.4	284.0	353.7
S.Em (±)	5.3	3.8		7.6	0.5	3.4		1.8	3.3	5.2		
C.D. (P=0.05)	15.1	10.8		NS		9.7		7.1	9.5	20.2		
Interaction					1.3							
M x S												
S.Em (±)	16.8	11.6				10.8		5.4	14.1	15.5		
C.D. (P=0.05)	NS	33.7				30.8		15.3	NS	NS		

Table R-20-AST-2 (b): Effect of nitrogen levels on Dry matter yield of promising entries of single cut Oat (AVTO-2)

Treatments	Dry matter yield (q/ha)											
	HZ			CZ				SZ				Overall mean
	Palam-pur	Sri-nagar	Mean	Urulikan-chan	Ana-nd	Rai-pur	Mean	Hydera-bad	Man-dya	Coimb-atore	Mean	
Entries												
OL-1874-1	58.6	60.2	59.4	92.8	47.6	94.2	78.2	40.2	33.9	75.8	50.0	62.9
OL-1876-1	45.2	64.2	54.7	91.3	49.0	68.7	69.7	44.1	43.3	75.2	54.2	60.1
RO-11-1-3	76.4	78.4	77.4	87.8	49.7	63.0	66.8	44.6	38.7	65.6	49.6	63.0
JO-06-23	84.5	54.8	69.6	117.8	52.1	87.3	85.8	43.9	37.5	69.8	50.4	68.5
SKO-241	72.7	64.5	68.6	96.4	66.5	65.5	76.1	45.3	53.9	68.2	55.8	66.6
RO-11-1-2	83.2	62.3	72.8	89.4	42.3	67.1	66.3	46.3	39.7	74.6	53.5	63.1
HFO-806	78.2	68.9	73.6	86.5	47.5	86.1	73.4	49.5	40.3	77.2	55.7	66.8
OS-6 (NC)	73.5	66.5	70.0	90.1	59.9	56.1	68.7	46.9	40.7	81.6	56.4	64.4
Kent (NC)	72.7	64.8	68.8	90.2	57.0	53.9	67.0	40.4	44.5	76.6	53.8	62.5
SKO-96 (HZ)	71.3	67.0	69.2									
RO-11-1(CZ)				86.6	51.8	62.3	66.9					
OS-403 (SZ)								48.8	45.1	66.0	53.3	
S.Em (±)	2.6	1.2		1.8	0.7	1.7		1.2	1.7	1.7		
C.D. (P=0.05)	7.7	3.6		5.3	2.1	5.1		3.3	5.1	5.0		
Nitrogen levels (kg N/ha)												
60	55.4	43.1	49.2	91.5	35.4	64.6	63.8	41.4	36.3	67.8	48.5	54.4
90	76.0	69.8	72.9	93.9	50.3	70.4	71.5	44.6	39.8	74.4	52.9	64.9
120	83.5	82.6	83.0	93.2	76.3	76.3	81.9	49.0	49.2	77.0	58.4	73.4
S.Em (±)	1.1	0.7		1.1	0.2	0.9		0.7	0.7	1.1		
C.D. (P=0.05)	3.2	2.1		NS		2.4		2.7	2.1	4.1		
Interaction					0.66							
M x S												
S.Em (±)	8.1	2.2		-		2.7		2.0	2.9	3.2		
C.D. (P=0.05)	NS	6.5		10.0		7.7		5.8	6.77	NS		

Table R-20-AST-2 (c): Effect of nitrogen levels on crude protein yield of promising entries of single cut Oat (AVTO-2)

Treatments	Crude Protein Yield (q/ha)										
	Palam-pur	Sri-nagar	Mean	Urulikan-chan	Ana-nd	Rai-pur	Mean	Hydera-bad	Man-dya	Coimb-atore	Mean	Overall Mean
OL-1874-1	5.6	6.4	6.0	7.3	7.0	10.0	8.1	4.5	3.8	6.0	4.8	6.3
OL-1876-1	4.2	6.9	5.6	7.8	7.5	6.9	7.4	4.1	3.9	7.4	5.1	6.1
RO-11-1-3	7.5	8.2	7.9	8.2	8.0	7.0	7.7	4.1	3.5	5.8	4.5	6.5
JO-06-23	7.9	5.7	6.8	9.6	8.0	9.1	8.9	4.5	4.0	10.2	6.2	7.4
SKO-241	7.3	6.7	7.0	8.3	10.4	6.8	8.5	4.9	5.7	5.0	5.2	6.9
RO-11-1-2	7.3	6.3	6.8	7.4	6.9	7.0	7.1	4.7	4.3	8.9	6.0	6.6
HFO-806	7.3	7.2	7.3	6.9	6.7	9.4	7.7	4.5	4.0	5.6	4.7	6.4
OS-6 (NC)	6.7	7.2	7.0	8.0	9.2	5.7	7.6	4.6	4.2	9.7	6.2	6.9
Kent (NC)	6.6	6.5	6.6	7.2	9.1	5.7	7.3	3.9	4.4	5.4	4.6	6.1
SKO-96 (HZ)	6.7	7.1	6.9									
RO-11-1(CZ)				7.4	7.7	7.0	7.4					
OS-403 (SZ)								4.0	4.3	8.3	5.5	
S.Em (±)	0.2	0.2		0.2	0.2	0.3		0.1	0.2	0.2		
C.D. (P=0.05)	0.6	0.6		0.5	0.5	0.8		0.4	0.7	0.6		
Nitrogen levels (kg N/ha)												
60	4.8	6.8	5.8	7.6	4.9	6.5	6.3	3.7	3.3	6.8	4.6	5.5
90	7.1	6.8	7.0	7.6	7.7	7.3	7.5	4.5	4.3	7.2	5.3	6.6
120	8.2	6.8	7.5	8.3	12.3	8.5	9.7	4.9	5.0	7.7	5.9	7.7
S.Em (±)	0.1	0.1		0.1	0.1	0.1		0.1	0.1	0.2		
C.D. (P=0.05)	0.4	0.3		0.3		0.4		0.4	0.3	NS		
Interaction					0.18							
M x S												
S.Em (±)	0.78	0.318		0.28		0.38		0.23	0.4	0.5		
C.D. (P=0.05)	NS	0.926		0.87		1.1		0.65	0.96	NS		

Table R-20-AST-2 (d): Effect of nitrogen levels on per day productivity of promising entries of single cut Oat (AVTO-2)

Treatments	Green forage yield (q/ha/day)						Dry matter yield (q/ha/day)					
	Palampur	Srinagar		Raipur	Coimbatore	Mean	Palampur	Srinagar	Mean	Raipur	Coimbatore	Mean
OL-1874-1	2.39	1.70	2.05	5.00	3.96	3.26	0.47	0.31	0.39	1.00	0.82	0.65
OL-1876-1	2.79	1.98	2.39	4.00	3.94	3.18	0.36	0.33	0.35	0.80	0.82	0.58
RO-11-1-3	3.33	2.17	2.75	3.70	3.90	3.27	0.62	0.40	0.51	0.80	0.76	0.65
JO-06-23	3.51	1.59	2.55	4.40	3.90	3.35	0.68	0.28	0.48	0.90	0.76	0.66
SKO-241	2.90	1.70	2.30	2.40	3.50	2.62	0.54	0.33	0.44	0.60	0.72	0.55
RO-11-1-2	3.37	1.74	2.56	3.60	4.18	3.22	0.55	0.32	0.44	0.80	0.90	0.64
HFO-806	3.27	1.85	2.56	4.00	4.28	3.35	0.62	0.36	0.49	0.90	0.94	0.70
OS-6 (NC)	3.03	1.74	2.39	2.90	4.56	3.06	0.53	0.34	0.44	0.70	0.98	0.64
Kent (NC)	3.07	1.74	2.41	3.10	4.20	3.03	0.59	0.33	0.46	0.60	0.90	0.61
SKO-96 (HZ)	2.72	1.81	2.27				0.53	0.35	0.44			
RO-11-1(CZ)				3.70	3.36	2.90				0.80		
OS-403 (SZ)											0.68	
S.Em (±)	0.08	0.04		0.09	0.08		0.06	0.01		0.02	0.01	
C.D. (P=0.05)	0.24	0.12		0.27	0.26		0.02	0.02		0.06	0.06	
Nitrogen levels (kg N/ha)												
60	2.34	1.33	2.34	3.40	3.68	2.69	0.43	0.22	0.33	0.70	0.76	0.53
90	3.22	1.33	3.22	3.70	4.04	3.07	0.58	0.36	0.47	0.80	0.84	0.65
120	3.55	1.33	3.55	3.90	4.18	3.24	0.64	0.43	0.54	0.90	0.86	0.71
S.Em (±)	0.04	0.02		0.04	0.06		0.05	0.00		0.01	0.04	
C.D. (P=0.05)	0.12	0.06		0.11	0.22		0.02	0.01		0.03		
Interaction												
M x S												
S.Em (±)	0.13	0.07		0.12	0.12		0.06	0.01		0.03	0.04	
C.D. (P=0.05)	NS	0.19		0.35	NS		NS	0.03		0.09	NS	

Table R-20-AST-2 (e): Effect of nitrogen levels on Crude protein content of promising entries of single cut Oat (AVTO-2)

Treatments	Crude Protein (%)							
	Palampur	Srinagar	Mean	Anand	Raipur	Mean	Mandya	Overall Mean
OL-1874-1	9.4	10.4	9.90	14.5	10.5	12.50	11.1	11.2
OL-1876-1	9.3	10.6	9.95	15.1	10.1	12.60	9.2	10.9
RO-11-1-3	9.7	10.4	10.05	15.9	11.1	13.50	9.0	11.2
JO-06-23	9.3	9.9	9.60	15.1	10.4	12.75	10.5	11.0
SKO-241	10.0	10.7	10.35	15.3	10.4	12.85	10.8	11.4
RO-11-1-2	8.8	10.0	9.40	15.6	10.5	13.05	10.8	11.1
HFO-806	9.2	10.0	9.60	13.7	10.8	12.25	9.8	10.9
OS-6 (NC)	9.1	10.8	9.95	15.2	10.1	12.65	10.2	11.1
Kent (NC)	9.0	9.5	9.25	15.7	10.6	13.15	9.9	10.9
SKO-96 (HZ)	9.3	10.4	9.85					
RO-11-1(CZ)				14.5	11.2	12.85		
OS-403 (SZ)							9.5	
S.Em (±)	0.12	0.272		0.24	0.28		0.28	
C.D. (P=0.05)	0.37	N/A		0.71	0.82		0.84	
Nitrogen levels (kg N/ha)								
60	8.7	9.8	9.25	14.3	10.1	12.20	9.1	10.4
90	9.4	10.4	9.90	15.4	10.5	12.95	10.9	11.3
120	9.8	10.7	10.25	16.1	11.1	13.60	10.2	11.6
S.Em (±)	0.09	0.12		0.12	0.12		0.12	
C.D. (P=0.05)	0.27	0.35			0.35		0.34	
Interaction				0.35				
M x S								
S.Em (±)	0.27	0.41			0.39		0.49	
C.D. (P=0.05)	NS	1.20			1.12		1.09	

Table R-20-AST-2 (f): Effect of nitrogen levels on Plant height of promising entries of single cut Oat (AVTO-2)

Treatments	Plant Height (cm)										
	Palampur	Srinagar	Mean	Anand	Raipur	Mean	Hyderabad	Mandya	Coimbatore	Mean	Overall Mean
OL-1874-1	141.0	121.0	131.0	116.0	147.3	131.7	93.8	92.4	138.4	108.2	121.4
OL-1876-1	147.4	118.3	132.9	119.0	152.7	135.9	100.5	96.8	137.9	111.7	124.7
RO-11-1-3	125.6	104.1	114.9	117.0	110.2	113.6	95.4	90.9	127.2	104.5	110.1
JO-06-23	132.4	125.8	129.1	111.0	126.3	118.7	101.0	97.8	136.1	111.6	118.6
SKO-241	128.5	125.5	127.0	124.0	105.0	114.5	97.2	96.2	126.4	106.6	114.7
RO-11-1-2	132.4	85.7	109.1	105.0	110.7	107.9	89.7	87.0	131.7	102.8	106.0
HFO-806	129.1	119.8	124.5	107.0	106.4	106.7	102.6	99.6	135.1	112.4	114.2
OS-6 (NC)	132.3	138.0	135.2	109.0	113.3	111.2	108.4	100.0	144.1	117.5	120.7
Kent (NC)	134.5	126.0	130.3	111.0	107.7	109.4	87.7	81.1	136.0	101.6	112.0
SKO-96 (HZ)	137.2	134.3	135.8								118.0
RO-11-1(CZ)				119.0	106.3	112.7	106.6	100.6	122.4	109.9	
OS-403 (SZ)											
S.Em (±)	1.38	1.79		0.56	7.25		1.73	3.00	3.04		
C.D. (P=0.05)	4.13	5.35		1.65	21.54		4.93	8.97	9.10		
Nitrogen levels (kg N/ha)											
60	124.8	99.0	111.9	104.0	118.2	111.1	92.8	88.6	124.0	101.8	107.3
90	136.1	125.6	130.9	116.0	118.0	117.0	99.1	93.0	135.9	109.3	117.7
120	141.2	135.0	138.1	129.0	119.6	124.3	103.1	101.1	140.8	115.0	124.3
S.Em (±)	0.66	1.05		0.30	1.20		0.32	1.71	1.98		
C.D. (P=0.05)	1.90	3.02			3.42		1.25	4.92	7.70		
Interaction				0.87							
M x S											
S.Em (±)	2.38	3.20			3.78		3.01	5.19	5.87		
C.D. (P=0.05)	NS	9.40			10.82		8.54	NS	NS		

Table R-20-AST-2 (g): Effect of nitrogen levels on leaf stem ratio of promising entries of single cut Oat (AVTO-2)

Treatments	Leaf Stem Ratio					
	Palampur	Srinagar	Raipur	Hyderabad	Mandya	Mean
OL-1874-1	0.61	0.68	0.59	0.50	0.57	0.59
OL-1876-1	0.62	0.94	0.61	0.52	0.59	0.66
RO-11-1-3	0.99	1.74	0.61	0.55	0.59	0.90
JO-06-23	0.64	0.70	0.67	0.61	0.48	0.62
SKO-241	1.28	0.71	0.50	0.58	0.72	0.76
RO-11-1-2	0.63	1.47	0.55	0.70	0.72	0.81
HFO-806	0.83	1.03	0.63	0.65	0.49	0.73
OS-6 (NC)	0.72	0.83	0.48	0.68	0.72	0.69
Kent (NC)	0.72	0.74	0.58	0.59	0.56	0.64
SKO-96 (HZ)	0.74	0.75				0.69
RO-11-1(CZ)			0.63			
OS-403 (SZ)				0.63	0.72	
S.Em (±)	0.03	0.04	0.01	0.01	0.02	
C.D. (P=0.05)	0.09	0.12	0.03	0.04	0.05	
Nitrogen levels (kg N/ha)						
60	0.63	0.77	0.56	0.54	0.55	0.61
90	0.79	0.92	0.59	0.59	0.62	0.70
120	0.91	1.19	0.61	0.67	0.68	0.81
S.Em (±)	0.01	0.01	0.01	0.01	0.01	
C.D. (P=0.05)	0.02	0.04	0.02	0.03	0.03	
Interaction						
M x S						
S.Em (±)	0.04	0.05	0.02	0.02	0.03	
C.D. (P=0.05)	0.11	0.15	0.05	0.07	NS	

Table R-20-AST-2 (h): Effect of nitrogen levels on No. of tillers of promising entries of single cut Oat (AVTO-2)

Treatments	No. of Tillers				
	Palampur	Srinagar	Anand	Coimbatore	Mean
OL-1874-1	74.90	84.87	38.00	4.30	50.52
OL-1876-1	67.00	93.52	53.00	4.30	54.46
RO-11-1-3	65.40	102.94	54.00	4.00	56.59
JO-06-23	66.00	93.06	46.00	4.20	52.32
SKO-241	76.80	101.90	54.00	4.00	59.17
RO-11-1-2	68.60	100.95	58.00	4.10	57.91
HFO-806	71.40	99.01	56.00	4.20	57.65
OS-6 (NC)	60-8	101.47	54.00	4.50	53.32
Kent (NC)	71.20	83.74	44.00	4.30	50.81
SKO-96 (HZ)	74.70	104.66			
RO-11-1(CZ)			59.00		
OS-403 (SZ)				3.80	
S.Em (±)	1.29	1.86	0.46	0.10	
C.D. (P=0.05)	3.87	5.58	1.35	0.28	
Nitrogen levels (kg N/ha)					
60	58.00	81.25	38.00	4.20	45.36
90	72.70	101.65	46.00	4.30	56.16
120	78.30	106.93	61.00	4.40	62.66
S.Em (±)	0.79	0.81	0.76	0.08	
C.D. (P=0.05)	2.26	2.33		NS	
Interaction			2.18		
M x S					
S.Em (±)	2.23	2.80		0.18	
C.D. (P=0.05)	NS	8.20		NS	

R 20- AST-2(h): Interaction effect of entries and nitrogen levels on green fodder yield (q/ha) and dry matter yield (AVT-2SC) -Palampur

Entries	Green fodder yield				Dry matter yield			
	N levels (kg/ha)				N levels (kg/ha)			
	60	**90**	**120**	**Mean**	**60**	**90**	**120**	**Mean**
OL-1874-1	208.33	308.33	373.33	296.67	39.65	56.55	33.89	57.33
OL-1876-1	249.17	363.33	424.17	345.56	74.42	86.64	53.74	91.16
RO-11-1-3	315.00	436.67	487.50	413.06	58.61	72.74	45.16	76.43
JO-06-23	329.17	467.50	509.17	435.28	39.65	56.55	33.89	57.33
SKO-241	316.67	415.00	435.00	388.89	61.77	75.02	47.84	80.78
RO-11-1-2	336.67	439.17	478.33	418.06	39.65	56.55	33.89	57.33
HFO-806	310.00	437.50	467.50	405.00	61.77	75.02	47.84	80.78
OS-6 (NC)	274.17	410.83	440.83	375.28	58.61	72.74	45.16	76.43
Kent (NC)	314.17	394.17	432.50	380.28	61.77	75.02	47.84	80.78
SKO-96 (HZ)	295.83	376.67	420.83	364.44	74.42	86.64	53.74	91.16
Mean	294.92	404.92	446.92		74.42	86.64	53.74	91.16
	V	**N**	**VXN**		**V**	**N**	**VXN**	
SEm±	9.99	5.25	16.83		2.57	1.13	8.11	
CD at 5%	29.21	15.05	NS		7.69	3.24	NS	

Table R 20- AST-2(i): Interaction effect of entries and nitrogen levels on CP yield (q/ha) (AVT-2SC) -Palampur

Entries	CP Yield				
	N levels (kg/ha)				
	60		90	120	Mean
OL-1874-1	3.53		4.79	2.82	5.20
OL-1876-1	7.22		8.32	5.21	9.30
RO-11-1-3	5.56		6.60	4.21	7.50
JO-06-23	3.53		4.79	2.82	5.20
SKO-241	5.93		6.70	4.59	8.01
RO-11-1-2	3.53		4.79	2.82	5.20
HFO-806	5.93		6.70	4.59	8.01
OS-6 (NC)	5.56		6.60	4.21	7.50
Kent (NC)	5.93		6.70	4.59	8.01
SKO-96 (HZ)	7.22		8.32	5.21	9.30
Mean	7.22		8.32	5.21	9.30
	V	**N**	**VXN**		
SEm±	0.21	0.12	0.78		
CD at 5%	0.63	0.35	NS		

Table R-20-AST-2 (j): Interaction affect of N levels on forage yield of promising entries of single cut oat (AVT-2 SC) Raipur

GFY (q/ha)					DFY (q/ha)			
Entries	**N60**	**N90**	**N120**	**MEAN**	**N60**	**N90**	**N120**	**MEAN**
OL-1874-1	427.8	455.3	463.6	**448.9**	89.6	93.3	99.8	**94.2**
OL-1876-1	328.6	355.3	387.5	**357.1**	61.7	68.8	75.6	**68.7**
RO-11-1-3	290.3	301.1	292.5	**294.6**	60.5	63.5	64.9	**63.0**
JO-06-23	386.7	399.2	428.6	**404.8**	82.7	85.3	94.0	**87.3**
SKO-241	216.7	262.5	268.6	**249.3**	55.6	67.4	73.6	**65.5**
RO-11-1-2	306.1	290.3	325.0	**307.1**	64.7	63.6	73.1	**67.1**
HFO-806	368.1	386.9	411.4	**388.8**	78.2	86.1	93.9	**86.1**
OS-6 (NC)	209.7	266.7	272.2	**249.5**	48.0	58.3	62.0	**56.1**
Kent (NC)	216.7	270.6	298.3	**261.9**	45.4	56.2	60.1	**53.9**
RO-11-1(CZ)	287.2	293.1	301.4	**293.9**	59.3	62.0	65.8	**62.3**
Grand Mean	**303.8**	**328.1**	**344.9**	325.59	**64.6**	**70.4**	**76.3**	70.43
			Sem	**CD**	**Sem**	**CD**		
Factor(B)at same level of A			**10.76**	**30.75**	**2.70**	**7.72**		
Factor(A)at same level of B			**11.78**	**33.66**	**2.80**	**8.00**		

Table R-20-AST-2 (k): Interaction affect of N levels on biomass yield of promising entries of single cut oat (AVT-2 SC) Mandya

	GFY (q/ha)				DFY (q/ha)			
	Nitrogen Levels (Kg/ha)				Nitrogen Levels (Kg/ha)			
Varieties	**60**	**90**	**120**	**Mean**	**60**	**90**	**120**	**Mean**
OL-1874-1	170.96	203.08	216.05	**196.70**	28.70	25.84	37.03	**33.86**
OL-1876-1	182.98	216.33	228.69	**209.33**	41.52	37.43	50.92	**43.29**
RO-11-1-3	198.14	238.27	242.10	**226.17**	35.52	43.77	36.75	**38.67**
JO-06-23	204.00	237.57	260.26	**233.94**	28.85	34.59	49.15	**37.53**
SKO-241	206.75	267.20	289.16	**254.37**	45.75	45.56	70.44	**53.92**
RO-11-1-2	208.50	240.79	253.29	**234.19**	36.91	38.30	43.99	**39.74**
HFO-806	196.73	243.77	255.32	**231.94**	31.19	40.03	49.63	**40.28**
OS-6 (NC)	182.71	216.52	221.88	**207.04**	32.63	36.96	52.52	**40.71**
Kent (NC)	200.89	227.66	242.68	**223.74**	42.25	47.44	43.75	**44.48**
OS-403 (SZ)	207.14	237.41	256.95	**233.83**	39.41	38.39	57.48	**45.09**
Mean	**195.88**	**232.86**	**246.64**	**-**	**36.27**	**39.83**	**49.17**	**-**
	Varieties	**Nitrogen**	**Interaction**	**Interaction**	**Varieties**	**Nitrogen**	**Interaction**	**Interaction**
			V X N	**V X N**			**V X N**	**V X N**
S.Em±	8.14	3.30	14.09	11.78	1.69	0.73	2.92	2.53
C.D(p=0.05)	24.37	9.47	NS	NS	5.06	2.10	6.77	7.41

Table R-20-AST-2 (l): Interaction affect of N levels on forage yield of promising entries of single cut oat (AVT-2 SC) Coimbatore

Treatments	**GFY (q/ha)**				**DMY (q/ha)**			
	Nitrogen Levels (Kg/ha)				**Nitrogen Levels (Kg/ha)**			
	60	**90**	**120**	Mean	**60**	**90**	**120**	**Mean**
OL-1874-1	335.6	364.4	392.8	364.2	69.8	75.8	81.6	75.8
OL-1876-1	335.6	371.2	382.2	363	69.4	76.8	79.2	75.2
RO-11-1-3	313.4	337.8	353.4	334.8	61.4	66.2	69.2	65.6
JO-06-23	327.8	371.2	375.6	358.2	64	72.4	73.2	69.8
SKO-241	313.4	331.2	353.4	332.6	64.2	67.8	72.4	68.2
RO-11-1-2	315.6	357.8	366.6	346.6	67.8	77	78.8	74.6
HFO-806	331.2	360	375.6	355.6	71.8	78.2	81.4	77.2
OS-6 (NC)	364.4	384.4	388.8	379.2	78.4	82.6	83.6	81.6
Kent (NC)	331.2	366.6	375.6	357.8	70.8	78.4	80.4	76.6
OS-403 (SZ)	295.6	331.2	340	322.2	60.4	67.8	69.6	66
Mean	326.4	357.6	370.4		67.8	74.4	77.1	
	M at S	**S at M**			**M at S**	**S at M**		
S.Ed.	15.49	8.61			3.18	1.78		
C.D.(P=0.05)	NS	NS			NS	NS		

Table R-20-AST-2 (I): Interaction affect of N levels on green forage yield of promising entries of single cut oat (AVT-2 SC) Anand

Green fodder yield (q/ha)				
	Nitrogen Levels (Kg/ha)			
Treatments	**60**	**90**	**120**	**Mean**
OL-1874-1	140	164	191	165
OL-1876-1	164	218	285	222
RO-11-1-3	176	256	295	242
JO-06-23	150	177	244	190
SKO-241	179	231	317	242
RO-11-1-2	124	165	242	177
HFO-806	130	184	219	178
OS-6 (NC)	183	222	262	222
Kent (NC)	166	203	277	216
RO-11-1(CZ)	155	189	236	193
Mean	140	164	191	165
SEm ±	**1.43**			
CD at 5%	**4.07**			
CV %	**17.25**			

R-20 AST-3: Effect of N levels on forage yield of promising entries of Multi cut oat (AVT-2 MC) Table Reference: R-20-AST-3(a)-(n)]

Locations: (3)
NWZ: Pantnagar, Hisar and Ludhiana

AVT trial on Multi cut oatwas conducted at three locations spread in North Westzoneof the country to study the response of nitrogen fertilizer on yield and quality of promising entries of oat under fodder and seed purpose. In the trial, two multi cut entries (HFO-707, OL-1882) along with two national checks namely; UPO-212 and RO-19 were evaluated for their responsiveness to nitrogen fertilizer. The three nitrogen levels (70,105, and 140 kg N /ha) were imposed on entries to see the response. The nitrogen was applied in three splits i.e., 1st at 55 DAS, 2nd at 85 DAS, 3rd at 50% floweringas top dressing. The experiment was conducted in split plot design with entries in main plot.

Among the entry and check RO-19 (NC) proved highest yielder. At Ludhiana entry HFO-707 performed better than UPO-212 (NC) but was inferior to RO- 19. On locational mean basis no entry could perform better than national checks.
On overall mean basis, linear response to nitrogen application was noted up to 140 kg N/ha which produced (528.7 q green, 113.5 q dry matter and 12.35 q CP yield per hectare).
The response equation for Central zone was worked out to be y = y = y = $-0.0211x^2 + 7.4883x + 295.1(R^2\text{-}1)$ with Agronomic Maxima of177.4 kg N ha^{-1} and Agronomic Optima 174.8 kg N ha^{-1}.

R-20-AST-3 (a): Effect of N levels on forage yield of promising entries of Multi cut oat (AVT-2 MC)

Treatments	Green fodder yield (q/ha)				Dry Matter Yield (q/ha)			
Entries	**Ludhiana**	**Hisar**	**Pantnagar**	**Mean**	**Ludhiana**	**Hisar**	**Pantnagar**	**Mean**
HFO-707	593.2	454.5	422.2	496.1	106.1	147.1	57.5	103.6
OL-1882	562.6	448.2	522.5	521.9	98.0	145.4	69.7	104.4
RO-19 (NC)	707.9	480.0	498.9	560.5	104.8	156.8	64.7	108.8
UPO-212 (NC)	573.9	462.8	546.1	528.7	114.0	150.6	75.9	113.5
SE(M)	17.5	13.4	16.4	16.7	2.7	4.1	2.3	
CD(P=0.05)	60.7	NS	48.5		**9.2**	NS	6.9	
Nitrogen levels (kg/ha)								
70	579.6	420.0	440.1	479.9	106.7	135.8	60.0	100.8
105	618.5	463.2	497.8	526.5	107.5	151.4	66.6	108.5
140	630.1	500.8	554.5	561.8	103.0	162.7	74.3	113.3
SE(m)	8.4	11.6	14.2		1.5	3.5	2.0	
CD(P=0.05)	25.1	35.0	42.0		NS	10.6	6.0	
Factor(A) at same level of B								
SE(m)		23.1				7.0		
CD(P=0.05)	NS	NS	NS		7.3	NS	NS	

Table R-20-AST-3 (b): Effect of N levels on per day productivity of promising entries of Multi cut oat (AVT-2 MC)

Treatments	**Green fodder yield (q/ha/day)**				**Dry Matter Yield (q/ha/day)**			
Entries	**Ludhiana**	**Hisar**	**Pantnagar**	**Mean**	**Ludhiana**	**Hisar**	**Pantnagar**	**Mean**
HFO-707	4.46	3.76	2.99	3.78	0.80	1.22	0.41	0.81
OL-1882	4.23	3.70	3.71	3.96	0.74	1.20	0.49	0.82
RO-19 (NC)	5.32	3.97	3.54	4.26	0.79	1.30	0.46	0.85
UPO-212 (NC)	4.31	3.83	3.87	4.01	0.86	1.24	0.54	0.88
SE(M)	0.13	0.11	0.12		0.02	0.03	0.02	
CD(P=0.05)	0.46	NS	0.34		**0.03**	NS	0.05	
Nitrogen levels (kg/ha)								
70	4.36	3.47	3.12	3.62	0.80	1.12	0.43	0.77
105	4.65	3.83	3.53	4.01	0.81	1.25	0.47	0.85
140	4.74	4.14	3.93	4.38	0.77	1.35	0.53	0.89
SE(m)	0.06	0.10	0.10		0.01	0.03	0.02	
CD(P=0.05)	0.19	0.29	0.30		NS	0.09	0.04	
Factor(A) at same level of B								
SE(M)		0.19	3.12			0.06		
CD(P=0.05)	NS	NS	NS		0.1	NS	NS	

Table R-20-AST-3 (c): Effect of N levels on crude protein yield (q/ha) and crude protein (%) of promising entries of Multi cut oat (AVT-2 MC)

Entries	Crude Protein Yield (q/ha)			Crude Protein (%)		
	Ludhiana	Pantnagar	Mean	Ludhiana	Pantnagar	Mean
HFO-707	16.84	5.26	11.06	15.90	9.13	12.52
OL-1882	15.49	6.57	11.28	15.80	9.33	12.57
RO-19 (NC)	16.94	6.51	11.63	16.17	10.02	13.10
UPO-212 (NC)	18.68	7.67	13.15	16.37	10.09	13.23
SE(M)	0.44	0.23		-	0.02	
CD(P=0.05)	1.51	0.68		-	0.34	
Nitrogen levels (kg/ha)						
70	16.69	5.38	10.72	15.65	8.96	12.31
105	17.81	6.50	12.27	16.55	9.73	13.14
140	16.46	7.62	12.35	15.98	10.24	13.11
SE(m)	0.25	0.20		-	0.10	
CD(P=0.05)	0.74	0.59		-	0.30	

Table R-20-AST-3 (d): Effect of N levels on growth parameters of promising entries of Multi cut oat (AVT-2 MC)

Entries	Plant Height (cm)				No. of Tillers per row meter length				Leaf Stem Ratio
	Ludhiana	Hisar	Pantnagar	Mean	Ludhiana	Hisar	Pantnagar	Mean	Ludhiana
HFO-707	45.8	110.0	92.0	82.60	110.8	55.0	108	91.27	0.38
OL-1882	49.7	108.8	85.5	81.33	83.4	54.4	107	81.60	0.37
RO-19 (NC)	49.0	115.8	91.7	85.50	100.7	58.5	90	83.07	0.43
UPO-212 (NC)	46.9	112.0	84.9	81.27	102.2	56.7	108	88.97	0.40
SE(M)		2.4	1.6			1.6	03		0.01
CD(P=0.05)		NS	4.7			NS	10		NS
Nitrogen levels (kg/ha)									
70	45.0	105.5	82.2	77.57	95.0	51.8	90	78.93	0.33
105	48.4	112.1	89.3	83.27	98.3	56.5	104	86.27	0.40
140	50.2	117.4	94.0	87.20	104.4	60.2	114	92.87	0.45
SE(m)		1.7	1.4			1.2	03		0.01
CD(P=0.05)		5.0	4.0			3.5	09		0.04
Factor(A) at same level of B									
SE(M)		3.6	2.8		2.5	2.3			0.02
CD(P=0.05)		NS	NS		NS	NS			NS

Table R-20-AST-3 (e): Interaction effect of entries and nitrogen levels on green fodder yields (q/ha) of Pantnagar and Ludhiana

	GFY (q/ha)				GFY (q/ha)			
	Pantnagar				Ludhiana			
Entries	Nitrogen levels (kg/ha)				Nitrogen levels (kg/ha)			
	70	**105**	**140**	**Mean**	**70**	**105**	**140**	**Mean**
HFO-707	363.8	412.4	490.5	422.2	560.8	601.9	616.9	593.2
OL-1882	459.6	515.1	592.9	522.5	536.0	572.2	579.7	562.6
RO-19 (NC)	448.3	495.8	552.7	498.9	678.1	719.2	726.4	707.9
UPO-212 (NC)	488.7	567.8	581.8	546.1	543.6	580.6	597.5	573.9
Mean (N Level)	440.1	497.8	554.5		477.7	515.8	532.1	
SE(m)	28.46				**SE(m)**	16.74		
C.D.	NS				**C.D.**	NS		

Table R-20-AST-3 (f): Interaction effect of entries and nitrogen levels on dry matter and crude protein yields (q/ha) of Ludhiana

Entries	**Dry matter yield**				**Entries**	**Crude protein yield**			
	Nitrogen levels (kg/ha)					**Nitrogen levels (kg/ha)**			
	70	**105**	**140**	**Mean**		**70**	**105**	**140**	**Mean**
HFO-707	114.8	99.2	104.4	106.1	HFO-707	17.44	16.36	16.7	16.8
OL-1882	86.6	108.1	99.1	97.9	OL-1882	13.6	17.41	15.46	15.5
RO-19 (NC)	110.7	102.2	101.6	104.8	RO-19 (NC)	17.71	16.86	16.25	16.9
UPO-212 (NC)	114.6	120.6	106.9	114.0	UPO-212 (NC)	17.99	20.62	17.42	18.7
Mean (N Level)	106.7	107.5	103.0		Mean (N Level)	16.7	17.8	16.5	
SE(m)	2.87				SE(m)	0.49			
C.D.	8.61				C.D.	1.5			

Table R-20-AST-3 (d): Effect of N levels on growth parameters of promising entries of Multi cut oat (AVT-2 MC)

Entries	Plant Height (cm)				No. of Tillers per row meter length				Leaf Stem Ratio
	Ludhiana	Hisar	Pantnagar	Mean	Ludhiana	Hisar	Pantnagar	Mean	Ludhiana
HFO-707	45.8	110.0	92.0	82.60	110.8	55.0	108	91.27	0.38
OL-1882	49.7	108.8	85.5	81.33	83.4	54.4	107	81.60	0.37
RO-19 (NC)	49.0	115.8	91.7	85.50	100.7	58.5	90	83.07	0.43
UPO-212 (NC)	46.9	112.0	84.9	81.27	102.2	56.7	108	88.97	0.40
SE(M)		2.4	1.6			1.6	03		0.01
CD(P=0.05)		NS	4.7			NS	10		NS
Nitrogen levels (kg/ha)									
70	45.0	105.5	82.2	77.57	95.0	51.8	90	78.93	0.33
105	48.4	112.1	89.3	83.27	98.3	56.5	104	86.27	0.40
140	50.2	117.4	94.0	87.20	104.4	60.2	114	92.87	0.45
SE(m)		1.7	1.4			1.2	03		0.01
CD(P=0.05)		5.0	4.0			3.5	09		0.04
Factor(A) at same level of B									
SE(M)		3.6	2.8		2.5	2.3			0.02
CD(P=0.05)		NS	NS		NS	NS			NS

Table R-20-AST-3 (d): Effect of N levels on growth parameters of promising entries of Multi cut oat (AVT-2 MC)

Entries	Plant Height (cm)				No. of Tillers per row meter length				Leaf Stem Ratio
	Ludhiana	Hisar	Pantnagar	Mean	Ludhiana	Hisar	Pantnagar	Mean	Ludhiana
HFO-707	45.8	110.0	92.0	82.60	110.8	55.0	108	91.27	0.38
OL-1882	49.7	108.8	85.5	81.33	83.4	54.4	107	81.60	0.37
RO-19 (NC)	49.0	115.8	91.7	85.50	100.7	58.5	90	83.07	0.43
UPO-212 (NC)	46.9	112.0	84.9	81.27	102.2	56.7	108	88.97	0.40
SE(M)		2.4	1.6			1.6	03		0.01
CD(P=0.05)		NS	4.7			NS	10		NS
Nitrogen levels (kg/ha)									
70	45.0	105.5	82.2	77.57	95.0	51.8	90	78.93	0.33
105	48.4	112.1	89.3	83.27	98.3	56.5	104	86.27	0.40
140	50.2	117.4	94.0	87.20	104.4	60.2	114	92.87	0.45
SE(m)		1.7	1.4			1.2	03		0.01
CD(P=0.05)		5.0	4.0			3.5	09		0.04
Factor(A) at same level of B									
SE(M)		3.6	2.8		2.5	2.3			0.02
CD(P=0.05)		NS	NS		NS	NS			NS

R-20-AST-4: Second Advanced Varietal Trial in Forage Pearl millet AVTPM-2 (Agronomy) [Table Reference: R-20-AST-4 (a)-d)]

Locations: (4)
CZ: Urulikanchan, Anand, Jabalpur

AVT trial on Forage Pearl millet was conducted at three locationsin Central zone of the country to study the response of nitrogen fertilizer on yield and quality of promising entries of Forage Pearl millet for fodder purpose. In the trial, three entries (BAIF Bajra -6, BAIF Bajra -5 and TSFB-18-1) along with three national checks namely; Giant Bajra, Moti Bajra, Raj Bajra were evaluated for their responsiveness to nitrogen fertilizer. The four nitrogen levels (0, 40, 80 and 120kg/ha N /ha) were imposed on entries to see the response. The nitrogen was applied in two splits i.e., 50% of nitrogen as basal + 50% at 40 DAS as top dressing. The experiment was conducted in Split plot design with three replications.

The results indicated that on locational mean basis all the entries out yielded the national check varieties. In terms of green fodder yield. Among the entries BAIF Bajra -6 recorded maximum green fodder yield (1000.9q/ha) followed by BAIF Bajra -5 (957.8q/ha). It was 21.9 % higher over best check variety Raj Bajra (821.5q/ha). As regards to drymatter and crude protein yields, BAIF Bajra -6 and BAIF Bajra -5 recorded higher yields than all the check varieties. The entries exhibited higher tillering capacity than checkson overall mean basis.

On overall mean basis, significant response to nitrogen application was noted up to 90 kg N/ha which produced (992.4 q green, 187.8 q dry matter and 13.15 q CP yield per hectare). The response equation was worked out to be $y = -0.0044x^2 + 3.1835x + 670.99$ ($R^2 = 1$)

Table R-20-AST-4 (a): Effect of nitrogen levels on green fodder yield and dry matter yield (q/ha) of promising entries of forage pearl millet

Entries	Green fodder yield (q/ha)				Dry Matter Yield (q/ha)			
	Urulikanchan	Anand	Jabalpur	Mean	Urulikanchan	Anand	Jabalpur	Mean
BAIF BAJRA -6	1106.8	1391.0	504.8	1000.9	202.4	261.5	100.5	188.2
BAIF BAJRA -5	997.3	1340.0	536.1	957.8	193.8	241.6	104.1	179.8
TSFB-18-1	856.0	1297.0	457.9	870.3	159.3	230.9	89.0	159.7
GIANT BAJRA (NC)	463.2	789.0	473.4	575.2	86.3	134.6	93.5	104.8
RAJ BAJRA (NC)	814.7	1137.0	512.8	821.5	149.2	266.3	105.2	173.6
MOTI BAJRA (NC)	830.7	1139.0	428.0	799.2	154.2	217.4	82.5	151.4
SEm (±)	15.6		4.6		2.9	2.82	2.7	
CD (0.05)	49.8		12.5		9.4	8.87	6.88	
Nitrogen levels (kg/ha)								
0	653.1	950.0	402.7	668.6	119.0	182.1	75.8	125.6
40	818.0	1125.0	452.6	798.5	151.7	223.0	87.2	154.0
80	914.4	1249.0	508.2	890.5	176.7	234.5	101.6	170.9
120	993.7	1405.0	578.5	992.4	182.8	262.0	118.7	187.8
SEm (±)	9.3	2.2	5.23		1.7	1.1	2.1	
CD (0.05)	26.7	6.4	15.85		4.9	3.2	6.4	
Interaction								
SEm (±)	25.09		4.89		4.68		1.56	
CD (0.05)	75.27		15.74		14.04		3.56	

Table R-20-AST-4 (b): Effect of nitrogen levels on growth and quality parameters of promising entries of forage pearl millet

	Crude Protein Yield (q/ha)			Crude Protein (%)	Plant Height (CM)			Tillers / row meter length
	Urulikanchan	Jabalpur	Mean	Anand	Anand	Urulikanchan	Mean	Anand
Entries								
BAIF BAJRA -6	17.43	8.1	12.77	11.27	139.94	169.00	154.47	35.32
BAIF BAJRA -5	18.70	8.5	13.60	11.41	142.08	182.67	162.38	31.56
TSFB-18-1	14.72	6.8	10.76	11.47	151.65	151.97	151.81	32.22
GIANT BAJRA (NC)	7.69	7.4	7.55	11.54	157.92	155.31	156.62	19.73
RAJ BAJRA (NC)	13.46	8.6	11.03	10.17	161.27	186.81	174.04	34.16
MOTI BAJRA (NC)	14.50	6.2	10.35	11.04	148.91	183.70	166.31	26.62
SEm (±)	0.27	0.85		0.12	0.31			
CD (0.05)	0.86	2.24		0.37	0.99			
Nitrogen levels (kg/ha)								
0	10.45	5.8	8.13	10.98	143.66	170.70	157.18	27.53
40	13.60	6.9	10.25	10.88	148.08	171.91	160.00	29.31
80	16.82	8.2	12.51	11.56	151.58	171.11	161.35	29.92
120	16.79	9.5	13.15	11.17	157.86	172.57	165.22	32.97
SEm (±)	0.27	0.66	8.13	0.08	0.26			0.54
CD (0.05)	0.45	1.85		0.23	0.75			1.54
Interaction								
SEm (±)	0.42	0.52						
CD (0.05)	1.27	2.27						

Table R-20-AST-4 (c): Interaction Effect of nitrogen and entryon GFY and DMY of promising entries of forage pearl milletJabalpur

	GFY (q/ha)					DFY (q/ha)				
	Nitrogen levels (kg/ha)					Nitrogen levels (kg/ha)				
Entries	**0**	**40**	**80**	**120**	**MEAN**	**0**	**40**	**80**	**120**	**MEAN**
BAIF BAJRA -6	421.4	453.6	519.0	625.2	**504.8**	79.7	87.9	102.0	132.3	**100.5**
BAIF BAJRA -5	450.8	505.6	568.1	619.8	**536.1**	84.7	96.4	111.8	123.4	**104.1**
TSFB-18-1	405.9	413.9	483.3	528.7	**457.9**	73.1	78.6	97.9	106.2	**89.0**
GIANT BAJRA (NC)	371.9	452.7	512.0	557.0	**473.4**	70.0	87.4	101.8	114.9	**93.5**
RAJ BAJRA (NC)	424.9	470.4	526.4	629.2	**512.8**	83.5	93.3	111.6	132.5	**105.2**
MOTI BAJRA (NC)	341.4	419.5	440.4	510.8	**428.0**	63.5	79.5	84.6	102.7	**82.5**
Mean	**402.7**	**452.6**	**508.2**	**578.5**		**75.8**	**87.2**	**101.6**	**118.7**	
	V	N	VXN			V	N	VXN		
Sem±	4.56	5.23	4.89			2.66	2.12	1.56		
CD at 5%	12.54	15.85	15.74			6.88	6.36	3.56		

Table R-20-AST-4 (d): Interaction Effect of nitrogen and entry on GFY of promising entries of forage pearl milletAnand

Treatment	**Total Green Fodder yield (q/ha)**					**Total dry matter yield (q/ha)**				
	Nitrogen levels (kg/ha)					**Nitrogen levels (kg/ha)**				
	0	**40**	**80**	**120**	**Mean**	**0**	**40**	**80**	**120**	**Mean**
BAIF BAJRA -6	1120	1343	1463	1639	1391.3	213.9	264.5	278.5	289.31	261.5
BAIF BAJRA -5	1106	1300	1417	1537	1340.0	199.8	237.7	249.6	279.23	241.6
TSFB-18-1	1019	1269	1366	1537	1297.8	177.7	228.4	245.5	272.04	230.9
GIANT BAJRA (NC)	620	713	806	1015	788.5	105.3	129	129.7	174.29	134.6
RAJ BAJRA (NC)	907	1042	1245	1352	1136.5	220.6	263.2	278.2	303.26	266.3
MOTI BAJRA (NC)	926	1083	1199	1347	1138.8	175.4	215.2	225.2	253.88	217.4
Mean	**949.7**	**1125**	**1249**	**1404.5**	**Mean**	182.1	223.0	234.4	262.0	
S.Em±	**5.5**				**S.Em±**	**2.68**				
C.D. at 5%	**15.77**				**C.D. at 5%**	**7.7**				

Table R-20-AST-4 (e): Interaction Effect of nitrogen and entry on GFY of promising entries of forage pearl millet Urulikanchan

Treatment	Total Green Fodder yield (q/ha)					Total dry matter yield (q/ha)				
	Nitrogen levels (kg/ha)					Nitrogen levels (kg/ha)				
	0	**40**	**80**	**120**	**Mean**	**0**	**40**	**80**	**120**	**Mean**
BAIF BAJRA -6	899.9	1132.4	1126.6	1268.4	1106.8	144.4	197.9	226.9	240.5	202.4
BAIF BAJRA -5	398.3	403.2	500.8	550.7	463.2	79.6	76.8	95.5	93.5	86.3
TSFB-18-1	651.6	803.5	888.1	915.5	814.7	106.0	153.4	177.3	159.9	149.2
GIANT BAJRA (NC)	582.5	794.1	927.3	1018.8	830.7	116.5	142.2	164.2	194.1	154.2
RAJ BAJRA (NC)	748.8	938.3	1079.3	1222.6	997.3	146.2	180.4	213.1	235.6	193.8
MOTI BAJRA (NC)	637.3	836.6	964.1	986.1	856.0	121.5	159.3	183.2	173.1	159.3
Mean	653.1	818.0	914.4	993.7		119.0	151.7	176.7	182.8	
S.Em±	**25.09**				**S.Em±**	**4.68**				
C.D. at 5%	**75.27**				**C.D. at 5%**	**14.04**				

Table R-20-AST-4 (f): Interaction Effect of nitrogen and entry on Crude protein yield of promising entries of forage pearl millet Urulikanchan

Treatment	Crude protein yield (q/ha)				
	Nitrogen levels (kg/ha)				
	0	**40**	**80**	**120**	**Mean**
BAIF BAJRA -6	11.89	16.21	22.03	19.6	17.43
BAIF BAJRA -5	7.32	7.29	8.29	7.84	7.69
TSFB-18-1	9.49	12.76	16.08	15.51	13.46
GIANT BAJRA (NC)	10.15	14.04	15.95	17.86	14.5
RAJ BAJRA (NC)	13.21	16.54	21.35	23.7	18.7
MOTI BAJRA (NC)	10.65	14.77	17.24	16.23	14.72
Mean	10.45	13.6	16.82	16.79	
S.Em±	**0.42**				
C.D. at 5%	**1.27**				

CHAPTER-3

FORAGE CROP PROTECTION

FORAGE CROP PROTECTION

PPT-1: Monitoring of diseases and insect pests in Rabi forage crops

Objective: To record the occurrence and abundance of major diseases and insect-pests in Berseem, Lucerne and Oat.

Locations: Ludhiana, Rahuri, Palampur, Jhansi, Bhubaneswar

Plot size: 4x4 m^2 per crop **Replication:** 4 per crop

Observations: Disease/insect-pest progression on rabi forages starting from date of appearance till crop maturity at weekly interval on 10 randomly selected plants/replication/crop using standard rating scale and calculation of disease severity/incidence/insect damage.

Results:

Ludhiana

Stem rot on berseem was observed on variety BL-43. Its appearance was first observed in end of December. Disease progressed at faster rate till first week of April with maximum disease incidence of 63.2 percent. Leaf blight of oat was appeared on OL-11 variety in the 1st week of January. Disease development was fast upto first week of April with highest disease severity of 51.0 percent. Downy mildew of Lucerne on variety LLC 5 was observed in the first fortnight of January, 2021. Disease progressed at faster rate till first week of April. Highest disease severity was 45.2 percent. (Table Ludhiana PPT1a).

Entomological observations:

The population of green semilooper, *T. orichalcea* started appearing on the berseem genotypes in the first week of April with its highest peak observed in the mid April. The population of *H. armigera* appeared on berseem crop in April with its highest peak during second fortnight of April, 2021. *Spodoptera exigua* larvae were also recorded in berseem crop during April, with peak incidence in the last week of April (Table Ludhiana PPT1b). Lucerne var. LLC-5 was infested with lucerne weevil during February end to May with peak during second week of March. *H. armigera* and *S. exigua* incidence was at its peak in Lucerne during second fortnight of April 2021. Incidence of aphids in oat varieties was higher than previous year and it appeared in the second week of February 2021. The peak incidence was during last week of February to first week of March (Table Ludhiana PPT1d).

Table Ludhiana PPT1a: Monitoring of diseases associated with Berseem, Lucerne and Oat ecosystems

Crop	Disease	Percent Disease Incidence / Severity observed in different standard meteorological weeks														
		Standard meteorological weeks														
		52	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Berseem	Stem Rot (*Sclerotinia trifoliorum*)	*4.8	9.0	13.5	19.5	26.5	30.4	37.3	44.7	49.8	55.2	57.3	58.8	61.2	62.3	63.2
Oat	Leaf Blight (*Drechslera avenae*)		*5.5	7.2	9.0	12.2	16.2	22.5	27.5	31.2	36.3	40.7	44.0	46.5	48.7	51.0
Lucerne	Downy Mildew (*Peronospora trifoliorum*)			*3.0	5.3	9.5	13.2	17.2	24.7	29.3	34.7	38.0	41.5	43.0	44.3	45.2

*****DOA: Date of appearance

Table Ludhiana PPT1b: Population dynamics of insect pests associated with *rabi* forages: Incidence of lepidopteran insect pests in different varieties of berseem

Variety	No. of *T. orichalcea* larvae per m row length							Mean
	15	16	17	18	19	20	21	
BL-10	0.66	1.00	1.33	1.00	0.66	0.33	0	**0.71**
BL-42	1.00	1.33	1.00	0.66	0.33	0.00	0	**0.62**
	No. of *H. armigera* larvae per m row length							
BL-10	2.66	2.33	2.00	1.66	1.33	1.33	1.00	**1.76**
BL-42	2.50	2.33	1.84	1.66	1.33	1.00	0.66	**1.62**
	No. of *Spodoptera exigua* larvae per m row length							
BL-10	0.33	0.66	0.83	0.66	0.50	0.50	0	**0.50**
BL-42	0.33	0.50	1.00	0.66	0.50	0.33	0	**0.47**

Table Ludhiana PPT1c: Incidence of insect pests in Shaftal and Lucerne

Variety	No. of lucerne weevils per plant												
	8	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**Mean**
Lucerne LLC-5	0.80	1.33	2.60	2.30	2.00	1.33	1.00	0.66	0.33	0.2	0.2	0.1	-	**1.07**
	No. of *H. armigera* larvae per m row length													
LLC- 5	-	-	-	-	0.20	0.33	0.66	1.00	1.00	1.33	1.0	0.33	-	**0.73**
	No. of *Spodoptera exigua* larvae per m row length													
LLC-5	-	-	-	-	-	-	-	0.33	0.66	0.83	0.5	0.33	-	**0.53**
	No. of black aphids per plant													
Shaftal 69	2.00	4.33	8.4	10.2	1.4	0.33	-	-	-	-	-	-	-	**4.44**

Table Ludhiana PPT1d: Incidence of oat aphid (*Rhopalosiphum padi*) in different varieties of oats

Variety	No. of aphids per tiller									Mean
	5	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	
OL-10	-	0.66	8.66	14.33	13.66	9.00	6.66	2.33	1.00	**7.04**
Kent	-	1.00	9.33	16.00	15.33	8.66	7.00	2.00	0.83	**7.52**

Rahuri

Lucerne

Aphids: The population of pea aphid (*Acyrthosiphon pisum*) noticed on lucerne during 1st week of January (1.00 aphids/tiller) and increased steadily at its peak level up to the 4th week of February (172.20 aphids/tiller). Thereafter the decreasing trend of pea aphid population noticed up to 1st week of March (37.40 aphids/tiller). Then again increased and decreased. Population of cowpea aphid (*Aphis craccivora*) was observed on Lucerne during 2nd week of February (6.00 aphids/tiller) and reached at its peak during 3rd week of March with 135.20 aphids/tiller. There after decreasing trend of aphid population was observed. Simultaneously population of spotted aphid (*Therioaphis maculata*) observed on Lucerne during 1st week of January (1.80 aphids/tiller) and reached at its peak during 2nd week of March with 111.20 aphids/tiller. During the aphid infestation, population of predatory lady bird beetles was observed moderate to high level (1.00 to 3.60 grubs/tiller) (Table Rahuri PPT1a).

Lepidopteran pests: The *Spodoptera litura* become major and regular pests on Lucerne during summer season. Larval population was noticed during 1st week of March with 0.60 larva/m^2. Then after, population increased steadily and reached to its peak population (6.00 larvae/m^2) during 2nd week of April. After that the population of *S. litura* was declined and recorded minimum population (1.00 during 4th week of May). The population of *H. armigera* was noticed on lucerne seed crop during 3rd week of March (0.80 larva/m^2) and showed increasing trend up to 1st week of May with high pest population of 5.60 larvae/m^2. After that population declined and showed minimum population during 4th week of May (3.40 larvae/m^2) (Table Rahuri PPT1a).

Rust: Rust is caused by the fungus *Uromyces striatus* and the severity of rust disease was noticed on lucerne crop during 3rd week of January (1.2%) and showed increasing trend up to 2nd week of May with high disease intensity of 12.7 %. After that intensity declined (Table Rahuri PPT1a).

Oat

Aphid: Periodic abundance of oat aphid (*Rhopalosiphum padi* L.) was observed during the investigation. The data on average number of aphids per tiller recorded from 1st week of January to 1st week March in the range of 1.40 to 42.60 aphids/tiller. Initial population of oat aphid was noticed during 1st week of January (1.40 /tiller). The population increased at faster rate and reached its peak (42.60 aphids/tiller) during the 1st week of February. Then it was started declining and recorded nil aphid population at the end of observations (Table Rahuri PPT1b).

Natural enemies

C. carnea

The population of *Chrysoperla carnea* was observed in the range of 0.30 to 1.42 per tiller throughout the crop period. The maximum population noticed during the sever infestation of aphids on oat.

Coccinellid predators

The initial population of LBB grub was recorded during 2nd week of Januarywith 1.00 grub/tiller. The population of the grubs increased very slowly with its maximum (2.10 grubs/tiller) level during 1st week of February. Thereafter the population of the grubs started decreasing and disappeared from first week of March.

Berseem

Aphids

The population of pea aphid (*Acyrthosiphon pisum*) noticed on berseem during 2nd week of January (1.40 aphids/tiller) and increased steadily at its peak level up to the 4th week of March (97.60 aphids/tiller). Thereafter the decreasing trend of pea aphid population noticed up to 2nd week of April (10.40 aphids/tiller). Population of cowpea aphid (*Aphis craccivora*) observed on berseem during 3rd week of February (8.80 aphids/tiller) and reached at its peak during 4th week of March with 111.0 aphids/tiller. Then after decreasing trend of aphid population was observed. Population of spotted aphid (*Therioaphis maculata*) observed on berseem during 2nd week of January (1.20 aphids/tiller) and reached at its peak during 4th week of March with 147.00 aphids/tiller. During the aphid infestation, population of predatory lady bird beetles was observed low to moderate level (1.00 to 5.20 grubs/tiller) (Table Rahuri PPT1c).

Lepidopteran pests

In berseem crop, lepidopteran pests (*i.e.* Hairy caterpillar, *Spilosoma obliqua*) were observed only on trap crop of Sunflower but on Berseem crop not observed any lepidopteran pests throughout the crop period.

Table Rahuri PPT1a: Population dynamics of insect pests associated with *rabi* forages: Incidence of insect pests in Lucerne

SMW	No. aphids/tiller				Lady bird beetle grubs/tiller	No. of larvae/m^2		*Rust severity (%)*
	Pea aphid (*Acyrthosiphon pisum*)	Cowpea aphid (*Aphis craccivora*)	Spotted aphid (*Therioaphis maculata*)	Total		*S. litura*	*H. armigera*	
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	1.00	0.00	1.80	2.80	0.00	0.00	0.00	0.00
3	1.20	0.00	2.40	3.60	1.40	0.00	0.00	0.00
4	2.20	0.00	12.60	14.80	2.60	0.00	0.00	1.2
5	2.40	0.00	24.20	26.60	2.80	0.00	0.00	1.5
6	0.40	0.00	2.00	2.40	2.00	0.00	0.00	1.8
7	0.80	0.00	6.80	7.60	1.40	0.00	0.00	2.0
8	43.60	0.00	6.60	50.20	2.00	0.00	0.00	2.4
9	114.40	6.00	3.40	123.80	1.40	0.00	0.00	2.6
10	172.20	13.00	5.20	190.40	3.60	0.00	0.00	2.7

11	99.20	0.00	12.00	111.20	1.80	0.60	0.00	3.0
12	37.40	0.00	44.80	82.20	1.60	0.90	0.00	3.4
13	80.00	0.00	111.00	191.00	1.60	1.30	0.00	4.0
14	72.60	135.20	78.60	286.40	2.40	1.40	0.80	4.2
15	65.60	62.00	29.40	157.00	1.60	1.60	0.80	4.5
16	57.00	84.00	23.20	164.20	2.40	3.40	2.20	4.7
17	38.20	101.00	19.80	159.00	1.80	6.00	3.60	5.2
18	27.80	70.00	16.80	114.60	1.40	4.40	4.20	6.3
19	22.00	44.00	8.80	74.80	1.20	4.00	3.80	7.0
20	16.80	20.00	6.40	43.20	1.00	2.60	4.20	8.0
21	15.00	10.40	7.80	33.20	1.00	2.20	5.00	8.6
22	15.20	3.20	6.00	24.40	1.40	1.80	5.60	10.3
23	7.60	2.80	1.60	12.00	1.20	1.40	4.60	12.7
24	4.80	2.40	3.20	10.40	1.00	1.00	3.40	9.5

Table Rahuri PPT1b: Population dynamics of insect pests associated with *rabi* forages: Incidence of insect pests in Oat

Standard meterological week	No. aphids/tiller	Natural enemies/tiller		
		C. carnea	**Lady Bird Beetle grubs**	**Syrphid fly larvae**
1	0.00	0.00	0.00	0.00
2	1.40	0.00	0.00	0.00
3	2.80	0.30	1.00	0.00
4	1.20	0.40	1.20	0.00
5	1.40	0.84	1.46	0.00
6	8.20	1.00	1.66	0.00
7	42.60	1.20	2.10	0.00
8	23.80	1.42	1.34	0.00
9	17.60	1.00	1.00	0.00
10	8.80	0.00	0.00	0.00

Table Rahuri PPT1c: Population dynamics of insect pests associated with *rabi* forages: Incidence of insect pests in Berseem

SMW	No. aphids/tiller				Lady bird beetle grubs/tiller	No. of larvae/m²	
	Pea aphid (*Acyrthosiphon pisum*)	Cowpea aphid (*Aphis craccivora*)	Spotted aphid (*Therioaphis maculata*)	Total		*S. litura*	*H. armigera*
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	1.40	0.00	1.20	2.60	0.00	0.00	0.00
4	0.80	0.00	0.00	0.80	0.00	0.00	0.00
5	0.80	0.00	3.20	4.00	0.00	0.00	0.00
6	1.00	0.00	2.00	3.00	1.00	0.00	0.00
7	0.00	0.00	4.40	4.40	1.20	0.00	0.00
8	1.20	0.00	7.20	8.40	1.40	0.00	0.00
9	1.40	8.80	5.80	16.00	1.80	0.00	0.00
10	8.80	17.60	3.60	30.00	1.60	0.00	0.00
11	24.40	49.00	24.80	98.20	1.40	0.00	0.00
12	44.40	80.00	62.00	186.40	1.80	0.00	0.00
13	84.60	96.40	108. 00	289.00	2.20	0.00	0.00
14	82.60	111.00	147.00	340.60	4.00	0.00	0.00
15	97.60	94.00	116.00	307.60	5.20	0.00	0.00
16	33.60	71.00	99.00	203.60	4.80	0.00	0.00
17	10.40	25.00	99.00	134.40	2.40	0.00	0.00

Palampur: Oat crop was severely affected by powdery mildew (49% severity), followed by leaf blight (15%) and sucking pests (18%). In berseem, low incidence of root rot (5%), moderate intensity of leaf spot (15%) and defoliating beetles (3%) was observed. Defoliating beetles (15%) and leaf spot (10%) was observed on Lucerne (Table Palampur PPT-1).

Bhubaneswar: In oat, maximum leaf blight recorded was 48.4% and maximum root rot incidence was 28.2%. Maximum leaf defoliators were recorded 7.0/10 plants. The Berseem leaf spot and blight severity recorded 40.2% towards 1st week of February, whereas root rot incidence was 30.8% during last week of January 2021. Maximum defoliator recorded was 6.0/10 plants in 4th meteorological week (Table Bhubaneswar PPT-1).

Jhansi: In Berseem, incidence of stem rot started from 4th week of January with small lesions indicative of early infection and continued to increase up to 3rd week of February with a maximum disease incidence of 16.5%. In Oat, leaf blight was the major disease and it appeared during 3rd week of January and maximum severity of 67.8% was observed during 3rd week of March (Table Jhansi PPT-1).

Table Palampur PPT-1: Monitoring of diseases and insect pests associated with berseem, Lucerne and oat ecosystem

Crop	Diseases/ insect-pests	Percent Disease Incidence / Severity observed in different standard meteorological weeks									
		Standard meteorological week									
		9	10	11	12	13	14	15	16	17	Max
Oats	Powdery mildew (*Blumeria graminis* f. sp. *avenae*)	8	15	25	30	40	42	45	47	49	49
	Leaf blight (*Drechslera avenae*)	5	7	7	9	10	15	15	15	15	15
	Aphids & Thrips	5	10	15	18	18	-	-	-	-	18
Berseem	Root rot (*Rhizoctonia solani*)	4	5	-	-	-	-	-	-	-	5
	Leaf spot (*Curvularia trifolii*)	-	5	7	9	15	15	-	-	-	15
	Defoliating beetles	-	-	-	-	2	2	2	3	3	3
Lucerne	Leaf spot (*Pseudopeziza medicaginis*)	5	7	9	9	10	10	10	10	10	10
	Defoliating beetles	-	-	2	3	5	10	15	15	15	15

Table Bhubaneswar PPT-1: Monitoring of diseases and insect pests associated with berseem and oat ecosystem

Crop/insect-pest and disease	Percent Disease Incidence / Severity observed in different standard meteorological weeks									
	Standard meteorological week									
Oat	**48**	**49**	**50**	**51**	**52**	**1**	**2**	**3**	**4**	**5**
Leaf blight (*Drechslera avenae*)	-	-	5.2	10.8	18.6	30.0	36.2	41.8	45.0	48.4
Root rot (*Sclerotium rolfsii*)	-	5.2	7.6	12.4	20.0	24.6	28.2	-	-	-
Leaf defoliators (No./10 Plants)	-	-	2.0	3.4	5.0	5.4	6.0	6.2	7.0	-

Berseem										
Leaf spot & blight (*Curvularia trifolii*)	-	-	4.2	6.6	10.6	15.0	22.2	29.8	36.0	40.2
Root rot (*Rhizoctonia solani*)	-	-	4.8	8.6	12.4	18.6	22.6	24.2	30.8	-
Leaf defoliators (No./10 Plants)	-	-	2.0	2.4	3.6	4.8	5.0	5.4	6.0	-

Table Jhansi PPT-1: Monitoring of diseases and insect pests associated with berseem and oat ecosystem

Crop/insect-pest and disease	**Percent Disease Incidence / Severity observed in different standard meteorological weeks**										
	Standard meteorological week										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Oat											
Leaf blight (*Drechslera avenae*)	0.0	0.0	11.1	26.7	37.8	33.3	35.6	34.4	47.8	64.4	67.8
Berseem											
Stem rot (*Sclerotinia trifoliorum*)	0	0	0	5.5	12.0	14.0	16.5	-	-	-	-

PPT-2: Evaluation of Rabi forage crops breeding materials for prevalent diseases and insect pests under natural conditions

Objective: Screening of various contributed entries along with national and zonal checks for their reaction to diseases and insect pests under natural conditions using standard disease/insect-pest rating scales.
Locations: Ludhiana, Rahuri, Palampur, Bhubaneswar, Jhansi
Crops: Berseem, Oat, Lucerne, white clover, red clover

Results:

BERSEEM

IVTB: Initial Varietal Trial in Berseem

At Ludhiana, All the entries showed moderately resistant disease reaction to stem rot of berseem. **At Rahuri,** all the entries were found moderately susceptible to susceptible to aphids. **At Palampur,** incidence of root rot of berseem was low during the season and all the entries including checks were resistant to root rot. **At Bhubaneswar,** JHB-20-1, BB-3, JHB-20-2, PC-114 were found resistant whereas HFB 17-5 and JB 08-17 expressed moderate resistance reaction to leaf blight.

AVTB-1: First Advanced Varietal Trial in Berseem

At Ludhiana, all the entries showed moderately resistant disease reaction to stem rot. **At Rahuri,** all the entries were found moderately susceptible to susceptible to aphids. **At Palampur,** incidence of root rot of berseem was low during the season and all the entries including checks were resistant to root rot. **At Bhubaneswar,** BB-3, BM-14 and JB-07-15 showed resistant reaction to leaf spot and blight whereas others expressed moderate resistance.

AVTB-2: Second Advanced Varietal Trial in Berseem

At Ludhiana, all the entries showed moderately resistant disease reaction to stem rot. **At Palampur,** incidence of root rot was low during the season and all the entries including checks were resistant to root rot. **At Rahuri,** all the entries were found susceptible to moderately susceptible against aphids.

AVTB-2 (Seed): Second Advanced Varietal Trial in Berseem (Seed)

At Ludhiana, all the entries showed moderately resistant disease reaction to stem rot. **At Palampur,** incidence of root rot of berseem was low during the season and all the entries including checks were resistant to root rot. **At Rahuri,** all the entries were found susceptible to moderately susceptible against aphids.

Table: Disease –pest tolerance in IVT Berseem trial

Entries	Ludhiana			Palampur		Bhubaneswar			Rahuri	
	Stem rot incidence (%)	Reaction	*H. armigera*/ m row length	Root rot (% incidence)	Reaction	Leaf spot & blight	Reaction	Leaf defoliators	Mean no. of aphids/tiller	Reaction
JHB-20-1	27.0	MR	2.33	8	R	5.62	R	2.67	101.37	Susceptible
HFB 17-5	23.7	MR	2.00	5	R	15.67	MR	3.33	62.77	MS
JB- 05-09 (ZC-NWZ)	18.3	MR	2.00							
BL-22 (ZC-HZ)				3	R					
BB-3 (ZC-NEZ)						4.33	R	1.62		
BB-2 (ZC-CZ)									74.20	MS
JHB-20-2	21.0	MR	2.33	3	R	8.87	R	2.54	103.23	Susceptible
PC-114	17.3	MR	2.00	5	R	3.54	R	1.87	59.57	MS
JB 08-17	17.8	MR	2.33	5	R	18.33	MR	4.36	100.67	Susceptible
Wardan (NC)	19.9	MR	2.33	9	R	33.13	MS	6.86	76.80	MS

Table: Disease –pest tolerance in AVT-1 Berseem trial

	Ludhiana			Palampur		Rahuri		Bhubaneswar		
Entry	Stem rot Incidence (%)	Reaction	Larvae of *H. armigera*/ m row length	Root rot (% incidence)	Reaction	Mean No. of aphids/tiller	Reaction	Leaf spot & blight	Reaction	Leaf defoliators
Wardan (NC)	16.25	MR	2.00	7	R	103.53	Susceptible	15.24	MR	3.87
BB-2 (ZC-CZ, NWZ)	16.75	MR	2.33			95.53	MS			
BL-22 (ZC-HZ)				5	R					
BB-3 (ZC-NEZ)								8.54	R	2.62

HFB-16-10	25.5	MR	2.00	7	R	76.80	MS	18.62	MR	3.33
BM-14	15.75	MR	2.00	7	R	71.27	MS	5.87	R	2.42
HFB-16-1	16.50	MR	2.33	7	R	85.07	MS	22.33	MR	3.54
JB-07-15	26	MR	2.33	5	R	101.93	Susceptible	4.67	R	1.86

Table: Disease –pest tolerance in AVT-2 Berseem trial

Entries	Ludhiana			Palampur		Rahuri	
	Stem rot incidence (%)	Reaction	Larvae of *H. armigera*/ m row length	Root rot	Reaction	Mean No. of aphids/tiller	Reaction
JB-06-11	24.0	MR	2.33	9	R	104.27	S
JHB-18-1	14.0	MR	2.00	5	R	89.00	MS
Wardan (NC)	21.3	MR	2.00	4	R	101.73	S
BM-12	16.9	MR	2.66	4	R	80.53	MS
HFB-15-5	24.9	MR	2.00	9	R	71.33	MS
BB-2 (ZC-CZ, NWZ)	27.2	MR	2.33			84.00	MS
BL-22 (ZC-HZ)				5	R		
JHB-18-2	15.9	MR	2.33	3	R	90.93	MS

Table: Disease –pest tolerance in AVT-2 Berseem (Seed) trial

Entries	Ludhiana			Palampur		Rahuri	
	Stem rot incidence (%)	Reaction	Larvae of *H. armigera*/ m row length	Root rot	Reaction	Mean No. of aphids/tiller	Reaction
JB-06-11	25.7	MR	2.33	4	R	132.00	S
JHB-18-1	16.8	MR	2.33	4	R	145.00	S
Wardan (NC)	24.5	MR	2.33	7	R	134.60	S
BM-12	19.5	MR	3.00	5	R	64.00	MS
HFB-15-5	26.8	MR	2.66	5	R	35.67	MS
BB-2 (ZC-CZ, NWZ)	25.3	MR	2.66			109.33	S
BL-22 (ZC-HZ)				5	R		
JHB-18-2	17.0	MR	2.66	5	R	121.00	S

OAT

IVTO (SC): Initial Varietal Trial in Oat (Single Cut)

At Ludhiana, all entries showed moderately resistant disease reaction to leaf blight except OL-1980, UPO-20-1, OL-1974 which were low resistant. **At Rahuri,** entries RO-11-1, JHO-20-1, SKO-244, Kent, OS-6, HFO-1009, HFO-1013, BAUO-101, OL-1974 were moderately susceptible to aphids while other entries were moderately resistant. **At Palampur,** JO-08-37, Kent, OS-6 were moderately resistant while others were susceptible to powdery mildew. **At Bhubaneswar**, OS-403, SKO-244, JO-08-37, HFO-1003, HFO-1013, BAUO-101 expressed high resistant reaction; BAUO-103, JHO-20-1, NDO-1902, OL-1980, OL-1977, HFO-1009, UPO-20-1 showed resistant whereas Kent, OS-6, OL-1974 showed moderate resistant reaction to leaf spot and blight, *Sclerotium* root rot and infestation by leaf defoliator. **At Jhansi,** RO-11-1, JHO-20-1, JO-08-37, Kent, OS-6, OL-1977 were resistant while rest were moderately resistant to low resistant against leaf light.

IVTO-MC: Initial Varietal Trial in Oat (Multi Cut)

At Ludhiana, OL-1944, JO-08-329, JHO-20-3 entries showed resistant disease reaction and other entries were moderately to low resistant. **At Rahuri,** PLP-27, UPO-212 were susceptible to aphids while other entries were moderately resistant. **At Palampur,** RO-19, OL-1944 were moderately resistant while others were susceptible to powdery mildew. **At Bhubaneswar**, RO-19, OL-1949, HFO-915, UPO-20-2, showed high resistance; PLP-27, OL-1944, OL-1942, JO-08-329, HFO-1016 expressed resistant reaction where as JHO-20-3, UPO-212, expressed moderate resistant to leaf blight, *Sclerotium* root rot and infestation by leaf defoliators. **At Jhansi,** all the entries were resistant to moderately resistant to leaf light.

IVTO (DUAL): Initial Varietal Trial in Oat (Dual)

At Ludhiana, All entries were moderately resistant to leaf blight except UPO-20-3, OL-1931, JO-13-513, HFO-1014 which were low resistant. **At Rahuri,** UPO-20-3, JHO-822, OL-1984, HFO-917, HFO-1014, UPO-212 were moderately susceptible to aphids while other entries were moderately resistant. **At Bhubaneswar**, OL-1931, JO-13-513, JHO-20-2 expressed high resistant; HFO-917, HFO-1014 showed resistant reaction; UPO-20-3, JHO-822, OL-1984, UPO-212 expressed moderate resistant where as OL-1992 was found low resistant to leaf blight, root rot and leaf defoliators. **At Jhansi,** entries UPO-20-3, OL-1931, JO-13-513, HFO-1014 were in low resistant category while rest were in mesothetic to low susceptible category to leaf blight.

Table: Disease –pest tolerance in IVT oat (SC) trial:

Entries	Bhubaneswar				Ludhiana			Palampur		Jhansi		Rahuri	
	Leaf blight Severity (%)	Reaction	*Sclerotium* root rot (%)	Leaf defoliators (no./10 plants)	Leaf Blight Severity (%)	Reaction	No. of Aphids/tiller	Powdery mildew severity (%)	Reaction	Leaf Blight Severity (%)	Reaction	No. of Aphids/ tiller	Reaction
OS-403 (ZC-NWZ, NEZ)	3.33	HR	7.03	1.23	24.0	MR	15.00						
SKO-225 (ZC-HZ)								35	S				
RO-11-1 (ZC-CZ)										17.8	R	31.07	MS
BAUO-103	11.67	R	3.33	6.67	26.2	MR	14.66	30	S	31.1	LR	11.20	MR
JHO-20-1	15.23	R		8.87	29.8	MR	14.66	30	S	20.0	R	24.20	MS
NDO-1902	12.42	R		8.11	23.4	MR	15.00	30	S	24.4	MR	7.13	MR
SKO-244	8.67	HR	8.13	4.33	23.5	MR	14.33	35	S	26.7	MR	52.00	MS
OL-1980	10.23	R	4.87	6.03	30.5	LR	14.66	40	S	22.2	MR	11.47	MR
JO-08-37	9.33	HR	4.87	4.67	25.5	MR	14.33	25	MR	11.1	R	14.33	MR
Kent (NC)	20.67	MR	4.67	10.33	29.9	MR	14.66	15	MR	15.6	R	24.33	MS
OS-6 (NC)	22.27	MR	4.78	10.67	23.9	MR	14.66	25	MR	13.3	R	30.13	MS
OL-1977	10.33	R	4.42	5.03	25.8	MR	14.33	29	S	15.6	R	13.93	MR
HFO-1009	14.54	R	4.33	8.33	28.1	MR	14.66	27	S	28.9	MR	22.33	MS
HFO-1003	6.62	HR	4.87	4.16	30.0	MR	15.00	28	S	31.1	LR	17.53 (4.25)	MR
HFO-1013	4.42	HR	6.67	3.14	23.8	MR	15.00	35	S	40.0	LR	93.13	MS
BAUO-101	3.67	HR	6.13	1.33	26.7	MR	15.33	40	S	35.6	LR	71.73	MS
UPO-20-1	18.11	R	8.03	8.87	30.7	LR	15.00	35	S	37.8	LR	13.20	MR
OL-1974	24.03	MR	8.78	11.11	32.3	LR	14.66	37	S	33.3	LR	18.47	MS

Table: Disease –pest tolerance in IVT oat (MC) trial

Entries	Bhubaneswar				Ludhiana			Palampur		Jhansi		Rahuri	
	Leaf blight Severity (%)	Reaction	*Sclerotium* root rot (%)	Leaf defoliators (no./10 plants)	Leaf Blight Severity (%)	Reaction	No. of Aphids/tiller	Powdery mildew severity (%)	Reaction	Leaf blight Severity (%)	Reaction	No. of Aphids/ tiller	Reaction
PLP-27	10.33	R	4.13	4.87	28.7	MR	15.66	30	S	13.3	R	8.47	MR
RO-19 (NC)	4.67	HR	3.42	3.14	31.2	LR	15.00	25	MR	17.8	R	21.00	MS
OL-1944	15.14	R	6.67	5.33	19.0	R	14.66	25	MR	24.4	MR	34.47	MS
OL-1942	14.42	R	5.87	5.64	21.2	MR	14.66	30	S	24.4	MR	33.53	MS
OL-1949	6.54	HR	3.13	3.42	29.1	MR	14.66	40	S	26.7	MR	40.40	MS
JO-08-329	16.33	R	7.24	6.67	18.1	R	14.33	35	S	20.0	MR	36.60	MS
JHO-20-3	20.67	MR	8.87	7.06	16.8	R	15.00	35	S	17.8	R	39.60	MS
HFO-915	1.87	HR	1.67	2.34	33.9	LR	15.33	37	S	24.4	MR	24.00	MS
HFO-1016	11.27	R	5.24	4.11	27.2	MR	14.33	30	S	20.0	MR	20.73	MS
UPO-20-2	3.42	HR	2.11	2.87	26.9	MR	15.00	30	S	15.6	R	44.33	MS
UPO-212 (NC)	22.13	MR	8.34	7.54	30.8	LR	14.66	35	S	26.7	MR	17.60	MR

Table: Disease –pest tolerance in IVT oat (Dual) trial

Entries	Bhubaneswar				Ludhiana			Jhansi		Rahuri	
	Leaf blight Severity (%)	Reaction	*Sclerotium* root rot (%)	Leaf defoliators (no./10 plants)	Leaf Blight Severity (%)	Reaction	No. of Aphids/tiller	Leaf blight Severity (%)	Reaction	No. of Aphids/ tiller	Reaction
UPO-20-3	22.87	MR	7.33	8.67	33.1	LR	14.33	35.6	LR	21.13	MS
OL-1931	6.16	HR	3.26	5.78	30.4	LR	14.33	40.0	LR	16.27	MR
JHO-822 (NC)	25.13	MR	8.42	8.13	25.6	MR	14.66	48.9	M	30.47	MS
OL-1984	24.42	MR	7.87	7.33	27.2	MR	15.00	51.1	LS	21.07	MS
JO-13-513	3.33	HR	3.26	4.42	30.1	LR	14.66	33.3	LR	15.40	MR
HFO-917	10.67	R	4.55	5.67	28.3	MR	14.66	57.8	LS	34.53	MS
HFO-1014	14.54	R	6.03	6.13	39.3	LR	15.33	37.8	LR	41.87	MS
JHO-20-2	2.26	HR	2.42	3.87	27.9	MR	14.66	46.7	M	13.73	MR
OL-1992	31.13	LR	9.76	8.13	23.5	MR	14.33	42.2	M	6.07	MR
UPO-212 (NC)	20.67	MR	6.53	6.33	25.9	MR	14.66	44.4	M	21.07	MS

AVTO (SC)-1: First Advanced Varietal Trial in Oat (Single Cut)

At Ludhiana, all entries were found moderately resistant to leaf blight except Kent, JO-07-28 which were low resistant**. At Rahuri,** HFO-904, HFO-906, RO-11-1, Kent were moderately resistant to aphids, while rest were moderately susceptible to aphids. **At Palampur,** SKO-96, Kent, OS-6 were moderately resistant to powdery mildew and rests were found susceptible. **At Bhubaneswar**, HFO-906, OS-6, JO-07-28 expressed high resistance, HFO-904, Kent showed resistant reaction where as OL-1960, OS-403 expressed moderate resistant to both disease and insect infestation.

AVTO (SC)-2: Second Advanced Varietal Trial in Oat (Single Cut)

At Rahuri, OL-1874-1, Kent, JO-06-23, RO-11-1 were moderately resistant to aphids, while rest were moderately susceptible to aphids. **At Palampur,** SKO-241 was moderately resistant to powdery mildew and rests were found susceptible. **At Jhansi,** Kent was in low resistant category while rest were in mesothetic to low susceptible category against leaf blight.

AVTO (SC)-2 (Seed): Second Advanced Varietal Trial in Oat (Single Cut) for seed

At Rahuri, OL-1876-1, RO-11-1-3, JO-06-23 were moderately resistant to aphids, while rest were moderately susceptible to aphids. **At Palampur,** HFO-806 was moderately resistant to powdery mildew and rests were found susceptible.

Table: Disease –pest tolerance in AVT-1 oat (SC) trial

Entries	Bhubaneswar				Ludhiana			Palampur		Rahuri	
	Leaf blight Severity (%)	Reaction	*Sclerotium* root rot (%)	Leaf defoliators (no./10 plants)	Leaf Blight Severity (%)	Reaction	No. of Aphids/tiller	Powdery mildew severity (%)	Reaction	No. of Aphids/ tiller	Reaction
HFO-904	12.42	R	5.11	4.64	28.0	MR	15.00	45	S	10.67	MR
HFO-906	5.23	HR	4.67	3.16	25.7	MR	14.66	45	S	14.20	MR
OL-1960	26.67	MR	7.23	6.67	23.3	MR	15.00	35	S	32.13	MS
OS-403 (ZC-NWZ, NEZ)	22.62	MR	6.87	6.12	25.6	MR	14.66				
SKO-96 (ZC-HZ)								25	MR		
RO-11-1 (ZC-CZ)										15.00	MR
Kent (NC)	17.33	R	6.13	5.42	31.0	LR	15.00	18	MR	14.93	MR
OS-6 (NC)	8.27	HR	5.03	3.87	20.7	MR	14.66	25	MR	27.53	MS
JO-07-28	3.67	HR	3.33	1.33	31.0	LR	15.00	27	S	21.87	MS

Table: Disease–pest tolerance in AVT-2 oat (SC) trial

Entries	Palampur		Jhansi		Rahuri	
	Powdery mildew severity (%)	Reaction	Leaf Blight Severity (%)	Reaction	No. of Aphids/ tiller	Reaction
OL-1874-1	37	S	51.1	LS	14.73	MR
Kent (NC)	39	S	37.8	LR	13.00	MR
OL-1876-1	41	S	53.3	LS	63.33	MS
RO-11-1-3	29	S	57.8	LS	39.80	MS
JO-06-23	27	S	42.2	M	11.87	MR
SKO-241	24	MR	48.9	M	37.20	MS
SKO-96 (ZC-HZ)	26	S				
RO-11-1 (ZC-CZ)			46.7	M	19.27	MR
OS-6 (NC)	29	S	51.1	LS	38.87	MS
RO-11-1-2	33	S	44.4	M	25.47	MS
HFO-806	32	S	55.6	LS	20.27	MS

Table: Disease –pest tolerance in AVTO (SC)-2 (Seed) trial

Entries	Palampur		Rahuri	
	Powdery mildew severity (%)	Reaction	No. of Aphids/ tiller	Reaction
OL-1874-1	39	S	53.87	MS
Kent (NC)	28	S	29.07	MS
OL-1876-1	29	S	13.67	MR
RO-11-1-3	36	S	14.87	MR
JO-06-23	32	S	14.20	MR
SKO-241	34	S	45.73	MS
SKO-96 (ZC-HZ)	37	S		
RO-11-1 (ZC-CZ)			67.53	MS
OS-6 (NC)	27	S	68.13	MS
RO-11-1-2	29	S	67.73	MS
HFO-806	24	MR	60.47	MS

AVTO (MC)-1: First Advanced Varietal Trial in Oat (Multi Cut)

At Palampur, all the entries were found susceptible to powdery mildew. **At Rahuri,** HFO-921, RO-19, JO-07-310, HFO-918, PLP-24 were moderately resistant to aphids, while rest were moderately susceptible to aphids. **At Jhansi,** all the entries were resistant to moderately resistant against leaf blight except OL-1924, OL- 1919 which were in low resistant category.

AVTO (MC)-2: Second Advanced Varietal Trial in Oat (Multi Cut)

At Ludhiana, All entries showed moderately resistant disease reaction to leaf blight except RO-19.

AVTO (MC)-2 Seed: Second Advanced Varietal Trial in Oat (Multi Cut) Seed

At Ludhiana, OL-1882, UPO-212 entries showed moderately resistant disease reaction to leaf blight. HFO-707, RO-19 showed low resistant reaction.

Table: Disease –pest tolerance in AVTO-1 (MC) trial

Entries	Palampur		Jhansi		Rahuri	
	Powdery mildew severity (%)	Reaction	Leaf blight Severity (%)	Reaction	No. of Aphids/ tiller	Reaction
HFO-921	30	S	28.9	MR	18.20	MR
RO-19 (NC)	35	S	20.0	R	13.20	MR
JO-07-310	34	S	22.2	MR	13.07	MR
OL-1924	37	S	31.1	LR	38.33	MS
OL- 1919	27	S	33.3	LR	24.07	MS
HFO-918	39	S	26.7	MR	9.93	MR
PLP-24	31	S	24.4	MR	31.47	MR
UPO-212 (NC)	30	S	28.9	MR	33.07	MS

Table: Disease –pest tolerance in AVTO-2 (MC) trial

Entries	Ludhiana		
	Leaf Blight Severity (%)	Reaction	No. of Aphids/tiller
HFO-707	29.75	MR	15.66
RO-19 (NC)	30.75	LR	15.33
OL-1882	26.0	MR	15.33
UPO-212 (NC)	20.5	MR	15.66

Table: Disease –pest tolerance in AVTO-2 (MC) Seed trial

Entries	Ludhiana		
	Leaf Blight Severity (%)	**Reaction**	**No. of Aphids/tiller**
HFO-707	31.25	LR	15.66
RO-19 (NC)	33.5	LR	15.33
OL-1882	23.87	MR	15.66
UPO-212 (NC)	20.52	MR	16.00

IVT Lucerne: Initial Varietal Trial in Lucerne

At Ludhiana, LLC-7, RL-88, BAIF Lucerne-5 showed moderately resistant disease reaction to downy mildew. Rest of the entries were moderately susceptible. **At Rahuri,** all the seven entries were moderately susceptible to susceptible to aphids. All the seven entries were resistant to rust.

Table: Disease –pest reaction in IVT Lucerne trial

Entry	Ludhiana				Rahuri			
	Downy mildew severity (%)	Disease Reaction	Lucerne weevil/ plant	*H. armigera*/ metre row length	Mean No. of aphids/ tiller	Reaction	Rust severity	Reaction
LLC-7	19.75	MR	3.33	2.33	131.60	S	17.08	Resistant
RL-88 (NC)	14.75	MR	3.66	2.33	99.60	MS	20.04	Resistant
BAIF Lucerne-5	18.87	MR	3.66	2.33	60.40	MS	22.88	Resistant
AWCL-2	30.5	MS	3.83	2.66	124.60	S	13.12	Resistant
Anand-2 (NC)	26.25	MS	3.33	2.33	246.40	S	19.08	Resistant

AVT-Lucerne: Advanced Varietal Trial in Lucerne

At Ludhiana, all entries showed moderately resistant disease reaction to downy mildew.

S. No.	Entries	Downy mildew Severity (%)	Disease Reaction	Lucerne weevil/ plant	*H. armigera*/metre row length
1	RL-88 (NC)	18.2	MR	3.00	2.00
2	LLC-6	19.2	MR	3.33	2.33
3	AL-66	19.4	MR	3.66	2.00
4	Anand-2 (NC)	17.4	MR	3.33	2.33

IVT Summer Bajra: At Rahuri, no diseases and insect-pests were observed.
AVT-1 Summer Bajra: At Rahuri, no diseases and insect-pests were observed.
AVT-2 Summer Bajra: At Rahuri, no diseases and insect-pests were observed.

PPT-17: To study the pathogenic variability of *Blumeria graminis* f. sp. *avenae* on oat

Location: Palampur

Results:

Pathogenic Variability: The virulence pattern of the 24 isolates of *B. graminis* f. sp. *avenae* was studied on developed differential set comprising of 11 lines *viz.*, ADG-96, HFO-102, IG-03-213, JPO-40, OL-1847, OG-77, PLP-1, JO-11, OL-1867, UPO-212 and a susceptible check HJ-8 using seedling evaluation method. The data on infection type and reaction type were recorded after 10 days of inoculation. Only two disease reaction categories *viz.,* resistant (R) and susceptible (S) were used to designate the pathotypes. Different isolates produced variable infection type (0, 1, 2, 3 and 4) on the developed set of differential lines, however, HJ-8 gave susceptible reaction type (4) to all isolates. These 24 isolates were grouped into 14 pathotypes on the basis of their reaction to the set of 11 differential lines and data is presented in Table PPT 17.1.

Table PPT 17.1: Grouping of 24 isolates of oat powdery mildew into pathotypes

Designation of pathotype	No. of isolates	Isolate Name
OMP-1	3	BGA-1 (Palampur), BGA-2 (Aima) and BGA-12 (KVK Bara)
OMP-2	3	BGA-4 (Bir), BGA-9 (Shanan) and BGA-10 (Lad-Bharol)
OMP-3	2	BGA-5 (Manderh) and BGA-16 (Bagianda)
OMP-4	2	BGA-6 (KVK Kangra) and BGA-7 (53 Mile)
OMP-5	2	BGA-11 (Barogala) and BGA-19 (Largi)
OMP-6	3	BGA-21 (Jahalman), BGA-22 (Kukumseri) and BGA-23 (Udaipur)
OMP-7	2	BGA-3 (Utarala) and BGA15 (Salmoha)
OMP-8	1	BGA-8 (Tikkan)
OMP-9	1	BGA-13 (Bhager)
OMP-10	1	BGA-17 (Bajaura)
OMP-11	1	BGA-14 (Samoh)
OMP-12	1	BGA-18 (Shuru)
OMP-13	1	BGA-20 (Keylong)
OMP-14	1	BGA-24 (Trilokinath)

OMP= Oat Powdery mildew Pathotype

Of the 24 isolates, three isolates each were placed in pathotype OMP-1, OMP-2 and OMP-6, two isolates each in OMP-3, OMP-4, OMP-5 & OMP-7 and one isolate each in pathotype OMP-8, OMP-9, OMP-10, OMP-11, OMP-12, OMP-13 and OMP-14.

The OMP-1 contained isolates collected from Palampur (BGA-1), Aima (BGA-2) & KVK Bara (BGA-12), OMP-2 had isolates from Bir (BGA-4), Shanan (BGA-9) & Lad Bharol (BGA-10), OMP-3 had isolates BGA-5 (Manderh) & BGA-16 (Bagianda) and the pathotype OMP-4 had isolates collected from KVK Kangra (BGA-6) and 53 mile (BGA-7). The pathotype OMP-5 had isolates BGA-11 (Barogala) & BGA-19 (Larji), OMP-6 had isolates BGA-21 (Jahalman), BGA-22 (Kukumseri) & BGA-23 (Udaipur) and OMP-7 had isolate collected from Utarala (BGA-3) & Salmoha (BGA-15). The pathotype OMP-8, OMP-9, OMP-10, OMP-11, OMP-12, OMP-13 and OMP-14 had single isolate *i.e.*Tikkan (BGA-8), Bhager (BGA-13), Bajaura (BGA-17), BGA-14 (Samoh), BGA-18 (Shuru), BGA-20 (Keylong) and BGA-24 (Trilokinath), respectively. It was also observed that isolates grouped in a particular pathotype also showed relation with distribution of isolates to a particular geographic region. The isolates grouped in one pathotype (OMP-1 to OMP-7) belonged to nearby areas of a region. The remaining pathotypes (OMP-7 to OMP-14) had single isolate and gave different reaction from the OMP-1 to OMP-7 pathotypes on the differential set. Hence, it can be concluded that same pathotype of *B. graminis* f. sp. *avenae* is prevalent over a large area of particular geographical region.

Studies on inheritance of powdery mildew resistance: In present study 75, 60 & 55 F_1 generation and 774, 695 & 636 (Total 2105) plants of F_2 population from three crosses *viz.*, OL-1847× HJ-8, OG-77 × HJ-8 and OL-1689 ×HJ-8, respectively were evaluated to study the inheritance of powdery mildew resistance in resistance donors *i.e.*Ol-1847, OG-77 and OL-1689 under field conditions. These plants were selfed to get F_2 seeds. The F_2 generation segregated into 456 resistant and exhibited goodness of fit to the expected Mendelian ratio of three resistant and one susceptible plant with χ^2 value of below the tabulated indicating that the resistance to powdery mildew in this cross was controlled by single dominant gene.

Table PPT 17.2: Disease reaction of F_1 and F_2 generations of crosses between resistant and susceptible genotypes to powdery mildew

Cross	Total Plants	R	S	Ratio Fit	Chi Value	P Value	Table Value
F1							
OL-1847 × HJ-8	75	75	-	-	-	-	-
OG-77 × HJ-8	60	60	-	-	-	-	-
OL-1689 ×HJ-8	55	55	-	-	-	-	-
F2							
OL-1847 × HJ-8	774	569	205	3:1	0.91	0.34	3.841
OG-77 × HJ-8	695	500	195	3:1	3.47	0.06	3.841
OL-1689 ×HJ-8	636	456	180	3:1	3.70	0.05	3.841

R- Resistant; S- Susceptible

PPT-26: Validation of best treatment of trial entitled "Biological management of oat aphid *Rhopalosiphum padi* on oat"

Location: Rahuri, Ludhiana

Crop: Oat **Variety:** Kent **Plot size:** 10 x 10 m^2
Replication: 7 **Design:** Paired Plot Design

Treatments:
T1- Foliar application of *L. lecanii* @ 1×10^8 CFU/g (7.5 g/lit)
T2- Foliar application of *M. anisopliae* @ 1×10^8 CFU/g (7.5 g/lit)
T3- Untreated control

Results:
At Rahuri, Precount of aphids and coccinellids were non-significant. At 5 DAS, *L. lecanii* @ 7.5 g/lit recorded significantly lower number of survived aphids per tiller (25.41). However, it was at par with *M. anisopilae* @ 7.5 g/lit (34.85). Similar trend of result was also noticed at 7 DAS. Trend of aphid population in promising treatments at 7 DAS of *L. lecanii* @ 7.5g/lit. were (12.75) and it was at par with *M. anisopilae* @ 7.5g/lit (14.2). Among the treatments there were non-significant differences of coccinellid predators. Biopesticides did not affected the activities of coccinellid predators at 5 and 7 days after spray. Green Forage yield of *L. lecanii* @ 7.5 g/lit (387.76 q/ha) was recorded at par with *M. anisopilae* @ 7.5 g/lit (380.13 q/ha). B:C ratio was high (1:1.80) in T1 compared to T2 (1:1.76) (Table PPT-26a).
At Ludhiana, Pre-count was non-significant. Least incidence of oat aphid at 5 and 7 days after treatment was recorded in foliar application of *L. lecanii* @ $1X10^8$ CFU/g (7.5 g/lit) followed by application of *M. anisopliae* @ $1X10^8$ CFU/g (7.5 g/lit). Green fodder yield in both the treatments was at par with each other and significantly higher than untreated control. Biopesticides did not affect the activities of natural enemies after spray. B:C ratio was high (1:1.79) in T1 compared to T2 (1:1.55) (Table PPT-26b).

Table PPT-26a: Validation of best treatment of trial entitled "Biological management of oat aphid *Rhopalosiphum padi* on oat" at Rahuri

Sr. No.	Treatments	Dose	Precount	Av. No. of aphids/tiller days after 1st spray		Av. No. of LBB grubs/tiller			GFY (Q/ha)	B:C ratio
				5 DAS	7 DAS	Pre count	5 DAS	7 DAS		
1	*L. lecanii* 1.5 % WP	7.5 gm/lit.	32.34 **(6.02)**	25.41 **(5.08)**	12.25 **(3.33)**	1.49 **(1.32)**	1.63 **(1.37)**	1.78 **(1.42)**	387.76[a]	1:1.80
2	*Metarrhizium anisopilae* 1.5 % WP	7.5 gm/lit.	45.24 **(6.51)**	34.25 **(5.51)**	14.2 **(3.87)**	1.51 **(1.33)**	1.61 **(1.36)**	1.71 **(1.40)**	380.13[ab]	1:1.76
3	Untreated control	--	32.51 **(5.91)**	46.24 **(6.68)**	47.24 **(7.16)**	1.56 **(1.34)**	1.58 **(1.35)**	1.82 **(1.44)**	341.41[c]	
	SE ±	--	0.22	0.19	0.23	0.03	0.05	0.03	2.71	
	CD at 5%	--	NS	0.60	0.71	NS	NS	NS	8.54	
	CV%	--	8.80	8.11	11.53	6.05	9.41	6.00	7.80	

*Values in parenthesis are square root transformed **DAS:** Days after spray **LBB:** Lady bird beetle

Table PPT-26b Validation of best treatment of trial entitled "Biological management of oat aphid *Rhopalosiphum padi* on oat" at Ludhiana

Ludhiana									
Sr. No.	**Treatment**	**Dose**	**Av. No. of aphids/tiller days after 1st spray**			**Av. No. of LBB grubs/tiller**		**Green fodder yield (q/ha)**	**B:C ratio**
			Pre count	**5 DAS**	**7 DAS**	**Pre count**	**7 DAS**		
1	Foliar application of *L. Lecanii* @ $1X10^8$ CFU/g	7.5 g/litre	18.30[a]	11.43[a]	5.00[a]	3.00[a]	2.86[a]	332.7[a]	1:1.79
2	Foliar application of *M. anisopliae* @ $1X10^8$ CFU/g	7.5 g/litre	18.14[a]	12.14[a]	5.71[a]	2.86[a]	2.71[a]	330.0[a]	1:1.55
3	Untreated control	--	18.43[a]	19.14[b]	18.71[b]	3.00[a]	3.00[a]	300.6[b]	
	SE ± (m)		0.34	0.39	0.27	0.23	0.22	5.7	
	CD (5%)		NS	1.09	0.85	NS	NS	17.6	
	CV		4.92	6.52	10.38	20.0	21.1	4.66	

PPT-30: Validation of best treatment of trial entitled "Biological management of powdery mildew of oats caused by *Blumeria graminis* f. sp. *avenae*"

Location: Palampur **Treatments:** 3 **Replications:** 7
Design: Paired plot design **Plot size:** 10x10 m^2 **Variety:** Kent

Treatments:
T1: Three foliar sprays of *Trichoderma viride* @ 0.5%
T2: Three foliar sprays of Vitex @ 0.1%
T3: Control
Note: Foliar sprays will be given at 10 days interval starting from disease onset.
Observations:

- Powdery mildew severity (%)
- Green fodder yield (q/ha)
- Economics

Results: The experiment was conducted to manage the powdery mildew through biological management in oat crop. It was observed that three foliar spray of *Trichoderma viride* @ 0.5% gave best control of powdery mildew (26.7% disease severity and 49.7% disease control) with maximum increase (10.8 %) in the fodder yield over the check. B:C ratio of the same treatment was also found to be higher (1:2.57) compared to three foliar sprays of Vitex @ 0.1% (1:2.14).

Table PPT-30: Validation of best treatment of trial entitled "Biological management of powdery mildew of oats caused by *Blumeria graminis* f. sp. *avenae*"

Treatment	Powdery mildew		GFY		B:C ratio
	% Severity	% control	Q/ha	% increase	
T_1= Three foliar sprays of *Trichoderma viride* @ 0.5%	26.7 (31.1)[a]	49.7	349[a]	10.8	1: 2.57
T2 = Three foliar sprays of Vitex @ 0.1%	32.3 (34.6)[b]	39.0	347[a]	10.2	1: 2.14
T3 =Control	53.0 (46.7)[c]	-	315[b]	-	
CD (5%)	1.85		6.79		
CV	4.19		1.71		
SE (M)±	0.59		2.18		

*Values in parenthesis are arc sine transformed values

PPT-31: Eco-friendly pest management techniques in berseem ecosystem

Location: Ludhiana and Rahuri

Design: RBD **Replication:** 3 **Plot size:** 5x5 m^2

Treatments:

T1: Seed treatment with *Trichoderma viride* @ 5 g/kg + foliar spray of NSKE @ 5%
T2: Soil application of *Trichoderma viride* @ 1kg/25kg FYM/acre + foliar spray of NKSE @ 5%
T3: T1+ Chickpea as trap crop on border row + Bird perches
T4: T2 + Chickpea as trap crop on border row + Bird perches
T5: T1+ Sunflower as trap crop on border row + Bird perches
T6: T2+ Sunflower as trap crop on border row + Bird perches
T7: Farmer's Practice (Spray of Bavistin on fodder as well as seed crop + Malathion on fodder crop and Chlorantraniliprole 18.5 SC on seed crop)
T8: Control

Results:

Ludhiana: The experiment was conducted for the evaluation of eco-friendly disease and pest management techniques in berseem. The results presented in table PPT 31 showed that T4 (Soil application of *Trichoderma viride* @ 1kg/25kg FYM/acre + foliar spray of NSKE @ 5% + Chickpea as trap crop on border row + Bird perches) exhibited least disease incidence of stem rot (20.0%) with 58.82% disease control as compared to control (48.12%) and 16.2% increase in green fodder yield. Likewise, treatments T2 and T6 also provided 51.82 and 50.86% disease control with more than 12.7 and 11.2% increase in green fodder yield respectively as compared to untreated control. The number of *H. armigera* larvae per metre row length were minimum in T7 (Farmers practice i.e. Spray of Bavistin on fodder as well as seed crop + Malathion on fodder crop and Chlorantraniliprole 18.5 SC on seed crop) followed by T6 (Soil application of *Trichoderma viride* @ 1kg/25kg FYM/acre + foliar spray of NSKE @ 5% + Sunflower as trap crop on border row + Bird perches) and T4 (Soil application of *Trichoderma viride* @ 1kg/25kg FYM/acre + foliar spray of NSE @ 5% + chickpea as trap crop on border row + Bird perches). More number of *H. armigera* larvae and natural enemies were observed on sunflower plants as compared to chickpea.

Rahuri: *H. armigera* or other lepidopteran larvae were not observed throughout the crop growth period and hence treatments were not imposed. Among different treatments, highest green fodder yield (249.13 q/ha) was obtained in T2 (soil application of *Trichoderma viride* @ 1kg/ 25kg FYM/acre + foliar spray of NSKE @ 5%) followed by T1 (seed treatment of *Trichoderma viride* @ 5g/Kg + foliar spray of NSKE @ 5%).

Table PPT-31: Evaluation of eco-friendly disease and pest management techniques in berseem

	Ludhiana									Rahuri
Treatment	**Stem rot incidence (%)**	**Disease Control (%)**	***H. armigera* larvae/ m row length in berseem**	***H. armigera* larvae/ plant on trap crop**	**Natural enemies per metre row length on berseem**		**Green fodder yield (q/ha)**	**% increase over control**	**Seed Yield (q/ha)**	**Green fodder yield (q/ha)**
					Coccinellids	**Spiders**				
T_1	29.23[d]	39.81	2.66[cd]	-	1.66[b]	0.83[bc]	549[cd]	8.2	3.06	246.25[ab]
T_2	23.40[f]	51.82	3.00[d]	-	2.00[b]	1.00[abc]	571[b]	12.7	3.23	249.13[a]
T_3	32.53[c]	33.02	2.66[cd]	1.33[a]	3.00[a]	1.00[abc]	549[cd]	8.2	2.81	230.37[cf]
T_4	20.00[g]	58.82	1.83[bc]	1.33[a]	3.00[a]	1.00[abc]	589[a]	16.2	3.41	229.33[cg]
T_5	36.07[b]	25.74	2.33[bcd]	1.66[a]	3.33[a]	1.33[ab]	538[d]	6.1	2.72	230.90[ce]
T_6	23.87[ef]	50.86	1.50[b]	1.66[a]	3.33[a]	1.33[ab]	564[bc]	11.2	3.10	231.14[cd]
T_7	25.20[e]	48.12	0.50[a]	-	1.66[b]	0.66[c]	558[bc]	10.1	3.07	232.20[c]
T_8	48.57[a]		5.33[e]	-	3.33[a]	1.50[a]	507[e]		2.48	228.94[ch]
CD (P=0.05)	1.656		0.92	NS	0.97	NS	10.028		NS	2.20
SE ±(m)	0.541		0.30	0.19	0.32	0.21	3.274		0.23	6.68
CV	3.137		21.04	22.22	20.66	23.04	1.025		13.67	5.62

PPT-34: Integrated disease management in berseem

Location: Jhansi, Ludhiana, Bhubaneswar, Palampur

Design: RBD **Replication:** 3 **Plot size:** 3x2 m^2

Treatments:

T1: Seed treatment with Chitosan @ 0.05%
T2: Seed treatment with *Trichoderma* @ 0.5%
T3: Seed treatment with carbendazim @ 0.2%
T4: Seed treatment with Chitosan @ 0.05% + *Trichoderma* @ 0.5%
T5: Seed treatment with Chitosan @ 0.05 % + carbendazim @ 0.1%
T6: T1 + foliar spray of Chitosan @ 0.05%
T7: T2+ foliar spray of Chitosan @ 0.05 %
T8: T3 +foliar spray of Chitosan @ 0.05 %
T9: T3 + foliar spray of carbendazim @ 0.1%
T10: Control

Results:

At Ludhiana, for stem rot management, best treatments were T6 (Seed treatment with Chitosan @ 0.05 % + foliar spray of Chitosan @ 0.05%) followed by T8 (Seed treatment with carbendazim @ 0.2 % + foliar spray of Chitosan @ 0.05%) with 21.0% and 21.27% incidence. Highest green fodder and seed yield was obtained in T6 (616.0 q/ha and 5.36 q/ha respectively) followed by T8 (603.0 q/ha and 5.05 q/ha respectively) (Table PPT-34).

At Jhansi, for stem rot management, best treatment was T7 (Seed treatment with *Trichoderma* @ 0.5%
+ foliar spray of Chitosan @ 0.05%) followed by T6 (Seed treatment with Chitosan @ 0.05% + foliar spray of Chitosan @ 0.05%) and T9 (Seed treatment with carbendazim @ 0.2% + foliar spray of carbendazim @ 0.1 %) with 7.85, 10.18 and 10.37% incidence respectively. Highest green fodder and seed yield was obtained in T7 (688.9 q/ha and 4.39 q/ha respectively) (Table PPT-34).

At Palampur, for root rot management, best treatment was T9 (Seed treatment with carbendazim @ 0.2% + foliar spray with carbendazim @ 0.1%) with 0.8 % incidence. For leaf blight management, best treatment was T9 (2.3% severity). Highest green fodder yield was obtained in T9 (344.0 q/ha) (Table PPT-34).

At Bhubaneswar, for root rot management, best treatment was T5 (Seed treatment with Chitosan @ 0.05% + carbendazim @ 0.1%) with 4.7% incidence. For leaf blight management, best treatment was T9 (Seed treatment with carbendazim @ 0.2% + foliar spray with carbendazim @ 0.1%) having 7.30% severity. Highest green fodder yield was obtained in T9 (435.7 q/ha) followed by T8 (407.5 q/ha) (Table PPT-34).

Table PPT-34: Integrated disease management in berseem

Treatments	Jhansi			Ludhiana			Palampur			Bhubaneswar		
	Stem rot Incidence (%)	**Green Fodder Yield (q/ha)**	**Seed Yield (q/ha)**	**Stem rot Incidence (%)**	**Green Fodder Yield (q/ha)**	**Seed Yield (q/ha)**	**Root rot incidence (%)**	**Leaf blight severity (%)**	**Green Fodder Yield (q/ha)**	**Leaf spot & blight severity (%)**	**Root rot and wilt (%)**	**Green Fodder Yield (q/ha)**
T_1	11.55^{bc}	550.0^{ed}	3.28^{d}	30.33^{d}	547^{ef}	3.78	2.3 (8.8)^{bc}	8.7 (17.1)^{c}	335.3^{bc}	35.4^{g}	13.50^{c}	353.7^{b}
T_2	11.23^{bc}	544.4^{ed}	3.17^{de}	36.47^{bc}	537^{f}	3.26	4.3 (12.0)^{d}	9.7 (18.1)^{c}	331.7^{c}	39.9^{h}	17.3^{d}	354.4^{b}
T_3	12.67^{b}	538.9^{ed}	3.39^{cd}	38.17^{b}	536^{f}	3.39	1.0 (5.7)^{ab}	7.7 (16.1)^{c}	337.7^{b}	28.6^{f}	10.1^{b}	365.4^{bc}
T_4	12.52^{b}	533.3^{ed}	3.67^{bcd}	31.00^{d}	564de	4.03	2.7 (9.4)^{c}	8.3 (16.8)^{c}	334.0^{bc}	32.6^{fg}	8.4^{b}	394.5^{de}
T_5	10.63^{c}	583.3^{bcd}	3.89^{abc}	34.53^{c}	544^{ef}	3.88	1.7 (7.4)^{b}	6.3 (14.6)^{bc}	342.0^{ab}	27.5^{e}	4.7^{a}	400.6^{de}
T_6	10.18^{c}	561.1^{cde}	3.61^{bcd}	21.00^{g}	616^{a}	5.36	2.0 (8.1)^{bc}	3.7 (11.0)^{ab}	335.7^{bc}	17.3^{c}	15.60^{d}	384.9^{cde}
T_7	7.85^{d}	688.9^{a}	4.39^{a}	26.10^{f}	587^{bc}	4.84	3.3 (10.5)^{cd}	4.7 (12.5)^{b}	335.0^{bc}	21.5^{d}	13.3^{c}	377.3^{bcd}
T_8	10.37^{c}	600.00^{bc}	4.06^{ab}	21.27^{g}	603^{ab}	5.05	1.3 (6.6)^{ab}	2.7 (9.4)^{a}	339.3^{ab}	12.5^{b}	10.6^{b}	407.5^{e}
T_9	8.13^{d}	616.7^{b}	3.94^{abc}	28.17^{e}	573^{cd}	4.82	0.8 (5.2)^{a}	2.3 (8.8)^{a}	344.0^{a}	7.30^{a}	8.5^{b}	435.7^{f}
T_{10}	19.66^{a}	475.8^{f}	2.67^{e}	49.23^{a}	496^{g}	3.08	7.0 (15.3)^{e}	13.7 (21.7)^{d}	328.3^{c}	46.2^{h}	21.0^{e}	325.5^{a}
CD (P=0.05)	1.51	44.93	0.55	1.997	13.154	0.86	1.80	2.55	5.58	7.76	1.52	24.56
SE ±(m)	0.51	15.12	0.18	0.667	4.393	0.28	0.60	0.85	1.86	2.61	0.51	8.27
CV	7.65	4.60	8.97	3.652	1.358	12.01	11.70	10.13	0.96	16.84	7.22	3.77

*At Palampur, values in parenthesis are arc sine transformed

PPT-35: Non chemical management of stem rot of berseem caused by *Sclerotinia trifoliorum*

Location: Ludhiana **Duration:** 4 years

Botanicals to be tested:

Ocimum tenuiflorum, Ricinus communis, Curcuma longa, Nicotiana tabacum, Murraya koenigii, Melia azedarach, Azadirachta indica, Calotropis gigantean, Aegle marmelos, Cymbopogan citrates and Datura stramonium

Organic inputs to be tested:

Panchgavya, compost tea, NSKE

Methodology:

- Collection, isolation, identification and maintenance of stem rot pathogen (*Sclerotinia trifoliorum*)
- Collection, preservation and preparation of aqueous extracts of botanicals and organic inputs
- Screening of plant extracts and organic inputs against stem rot pathogen under in vitro conditions
- Evaluation of antifungal extracts and organic inputs against test pathogens in pot experiments
- Field evaluation of most effective antagonistic plant extracts and organic inputs against stem rot disease

1. Collection, isolation, identification and maintenance of stem rot pathogen (*Sclerotinia trifoliorum*)

Berseem plants showing symptoms of stem rot were collected from the fields and pathogen was isolated by following standard isolation protocol. The pathogen was identified and maintained for further studies.

2. Collection, preservation and preparation of aqueous extracts of botanicals and organic inputs

Eleven plants namely *Ocimum tenuiflorum, Ricinus communis, Curcuma longa, Nicotiana tabacum, Murraya koenigii, Melia azedarach, Azadirachta indica, Calotropis gigantean, Aegle marmelos, Cymbopogan citrates* and *Datura stramonium* were collected and air dried. The fine dry powder was prepared by grounding plant material in a blender. The aqueous extracts were prepared from overnight soaked fine powder, filtered and stored in flasks at 28±2°C for further use. Organic inputs were procured from School of Organic Farming, PAU.

3. **Screening of plant extracts and organic inputs against stem rot pathogen under *in vitro* conditions**

The effect of plant extracts and organic inputs on *S. trifoliorum* under *in vitro* conditions is presented in Table PPT 35a & b. Results presented in Table PPT 35a showed that highest percent mycelial inhibition of *S. trifoliorum* was provided by *Curcuma longa* (91.67%), *Murraya koenigii* (91.48%), *Aegle marmelos* (92.41%) and *Cymbopogan citrates* (92.96%). Among five organic inputs tested under *in vitro* conditions, Panchgavya provided complete inhibition of mycelial growth of stem rot pathogen and Organic formulation 2 & 1 showed 84.44 and 81.67% inhibition respectively at 10 % concentration.

Table PPT 35a: Efficacy of plant extracts against stem rot pathogen

Name of Plants	Concentration of plant extracts (% w/v)									
	2.0		4.0		6.0		8.0		10.0	
	A	B*	A	B	A	B	A	B	A	B
Ocimum tenuiflorum	39.17^{b}	56.48	37.67^{b}	58.15	34.33^{b}	61.85	32.50^{ab}	63.89	23.83^{b}	73.52
Ricinus communis	53.50^{a}	40.56	43.50^{a}	51.67	36.67^{a}	59.26	34.33^{a}	61.85	24.83^{b}	72.41
Curcuma longa	15.00^{e}	83.33	11.67^{fg}	87.04	10.67^{f}	88.15	9.83^{fg}	89.07	7.50^{e}	91.67
Nicotiana tabacum	21.00^{d}	76.67	17.83^{e}	80.19	14.67^{e}	83.70	13.17^{e}	85.37	10.00^{d}	88.89
Murraya koenigii	13.33^{e}	85.19	11.17^{fg}	87.59	9.83^{fg}	89.07	8.33^{gh}	90.74	7.67^{e}	91.48
Melia azedarach	39.33^{b}	56.30	37.00^{b}	58.89	34.17^{b}	62.04	32.17^{b}	64.26	29.17^{a}	67.59
Azadirachta indica	34.67^{c}	61.48	27.50^{d}	69.44	24.50^{d}	72.78	22.50^{d}	75.00	19.67^{c}	78.15
Calotropis gigantean	41.33^{b}	54.07	34.67^{c}	61.48	29.67^{c}	67.04	26.67^{c}	70.37	23.17^{b}	74.26
Aegle marmelos	14.17^{e}	84.26	9.33^{g}	88.89	8.67^{g}	90.37	7.83^{h}	91.30	6.83^{e}	92.41
Cymbopogan citrates	35.83^{c}	60.19	9.67^{g}	89.26	8.33^{g}	90.74	7.50^{h}	91.67	6.33^{e}	92.96
Datura stramonium	19.17^{d}	78.70	12.67^{f}	85.93	11.00^{f}	87.78	10.67^{f}	88.15	9.50^{d}	89.44
CD (P=0.05)	2.321		1.376		1.020		1.183		1.028	
SE ± (m)	0.817		0.484		0.359		0.416		0.362	
CV	6.741		5.149		4.346		5.457		5.783	

A - Mycelial growth (mm), B - Percent Mycelial Inhibition

*Mycelial growth in control plate - 90 mm

Table PPT35b: Effect of organic inputs against stem rot pathogen

Organic inputs	Concentration of organic inputs (% w/v)									
	2.0		4.0		6.0		8.0		10.0	
	A	B	A	B	A	B	A	B	A	B
Compost Tea	37.17[c]	58.70	29.00[c]	67.78	23.67[c]	73.70	20.67[c]	77.04	17.83[c]	80.19
Poultry manure	42.33[b]	52.96	33.33[b]	62.96	26.00[b]	71.11	21.83[b]	75.74	20.17[b]	77.59
Panchgavya	12.83[f]	85.74	9.17[e]	89.81	4.50[f]	95.0	0.00[f]	100.0	0.00[f]	100.0
Organic formulation 1	34.00[d]	62.22	26.00[d]	71.11	20.67[d]	77.04	18.33[d]	79.63	16.50[d]	81.67
Organic formulation 2	29.17[e]	67.59	24.50[d]	72.78	18.17[e]	79.81	16.67[e]	81.48	14.00[e]	84.44
Control	90.0[a]		90.0[a]		90.0[a]		90.0[a]		90.0[a]	
CD (P=0.05)	0.963		1.362		0.991		0.643		0.723	
SE ± (m)	0.332		0.469		0.342		0.222		0.249	
CV	1.987		3.254		2.743		1.944		2.310	

A - Mycelial growth (mm), B –Percent Mycelial Inhibition

PPT-36: Assessment of yield losses due to insect-pests and diseases in Lucerne

Target Diseases: Crown rot, Rust, Downy mildew

Target insect-pest: Aphids, Weevil (*Hypera postica*), *Spodoptera litura*, *Helicoverpa armigera*

Location: Rahuri, Jhansi, Ludhiana

Treatments: 10 **Replications:** 3 **Design:** RBD

Duration: 2 years **Plot size:** 4x3 m^2 **Variety:** RL-88

Treatments Details

T1: Seed treatment with thiram @ 1g/kg of seed

T2: T1+ spray at 30, 55, 85, 115, 145 days after emergence (DAE)

T3: T1+ spray at 55, 85, 115, 145 DAE

T4: T1+ spray at 30, 85, 115, 145 DAE

T5: T1+ spray at 30, 55, 115, 145 DAE

T6: T1+ spray at 30, 55, 85, 145 DAE

T7: T1+ spray at 30, 55, 85, 115 DAE

T8: T1+ spray at 30, 55, 85 DAE

T9: Spray at 30, 55, 85, 115, 145 DAE

T10: Control

Treatment information:

- Seed treatment with thiram @1gm/kg seed for management of crown rot
- Spray at 30 DAE of imidacloprid 17.8 SL @ 0.3ml/lit of water for management of aphids
- Spray at 55 DAE of Propiconazole @ 1g /lit of water + Ridomil MZ @ 2.5 g/lit of water for management of rust and downy mildew

- Spray at 85 DAE of Quinalphos 25 EC @ 2 ml /lit of water for management of weevil
- Spray at 115 DAE of SlNPV 500 LE, 1000 million POBs/ml @1 ml / lit. of water for management of *Spodoptera litura*
- Spray at 145 DAE of HaNPV 500 LE, 1000 million POBs/ml @1 ml / lit. of water for management of *Helicoverpa armigera*

Observations:

- **Crown rot:** Disease incidence in 10 randomly selected plants/replication at weekly interval.
- **Aphids:** No. of aphids per tiller on 10 randomly selected tillers starting from pest emergence till pest presence on weekly interval.
- **Weevil:** No. of grubs and adult weevils per tiller on 10 randomly selected tillers starting from pest emergence till pest presence on weekly interval.
- **Diseases (Rust and downy mildew):** Disease severity in 10 randomly selected plants/replication at weekly interval starting from disease appearance till its presence.
- **Defoliators (*Helicoverpa armigera, Spodoptera litura*):** No. of larvae per tiller on 10 randomly selected tillers starting from pest emergence till pest presence on weekly interval.
- Green fodder yield (q/ha) in different treatments.
- Percent Yield loss in different treatments due to different diseases and insect-pests.

Results:

Rahuri

Aphids, rust, *Spodoptera litura* and *Helicoverpa armigera* were the major insect-pests and diseases diseases (Table Rahuri PPT-36a; 36b; 36c; 36d; 36e).

Aphids started appearing after the first cut (25-January) and were observed to be present upto 6th cut (7-May). Aphid population ranged from 14.27 to 85.58 aphids/tiller. Cumulative average yield loss due to aphid was 9.92 %.

Rust started appearing after the second cut (15-February) and was observed to be present upto 5th cut (12-April). Rust severity ranged from 1.35 to 15.35%. Cumulative average yield loss recorded due to rust was 20.86%.

Spodoptera litura started appearing after the 5th cut (20-April) and was observed to be present upto 7th cut (27-May). *Spodoptera litura* population ranged from 0.51 to 3.86 larvae/tiller. Cumulative average yield loss due to *Spodoptera litura* recorded was 24.23%.

Helicoverpa armigera started appearing after the 6th cut (13-May) and was observed to be present upto 7th cut (27-May). *Helicoverpa armigera* population ranged from 0.57 to 4.88 larvae/tiller. Cumulative average yield loss due to *Helicoverpa armigera* recorded was 14.08%.

Cumulative average yield losses due to defoliators (both *S. litura* and *H. armigera*) were 20.85%. Overall average yield losses due to insect-pest and diseases in control were 36.57%.

Ludhiana

Downy mildew and weevil were the major insect-pests and diseases (Table Ludhiana PPT-36a; 36b; 36c; 36d).

Downy mildew started appearing early (12-January) and was observed to be present upto 3-April. Downy mildew severity ranged from 3.5 to 39.33%. Cumulative average yield loss recorded due to downy mildew was 10.4%.

Weevil started appearing after the first cut (17-February) and was observed to be present upto 7-April. Weevil population ranged from 0 to 2.33 larvae/tiller. Cumulative average yield loss recorded due to weevil was 6.6%.

Overall average yield losses due to insect-pest and diseases were 15.5%.

Jhansi

Aphid, weevil and *Helicoverpa armigera* were the major insect-pests (Table Jhansi PPT-36a; 36b; 36c).

Aphid started appearing early (30-December) and was observed to be present upto first cut (27-January). Aphid population ranged from 0.2 to17.00 aphids/tiller. Aphid presence do not have any significant effect on yield.

Weevil started appearing after the first cut (8-February) and was observed to be present upto 4th cut (19 April). Weevil population ranged from 0.1 to 6.1 larvae/tiller. Weevil do not have significant impact on yiels during 2nd and 4th cut. During 3rd cut, yield loss recorded due to weevil was 20.8%.

Helicoverpa armigera started appearing before 4th cut (19-April) and was observed to be present upto 5th cut (17-May). *Helicoverpa armigera* population ranged from 0 to 1.1 larvae/tiller. *Helicoverpa armigera* presence do not have any significant effect on yield.

Yield losses due to weevil in control were 21.9 %.

Table Rahuri PPT-36a: Mean no. of aphids/tiller during different observation periods in Lucerne

Treatment	25-Jan	01-Feb	08-Feb	15-Feb	22-Feb	01-Mar	08-Mar	15-Mar	22-Mar	30-Mar	05-Apr	12-Apr	20-Apr	28-Apr	07-May
T1	39.67^{e} (6.34)	48.98^{d} (7.01)	53.74^{d} (7.35)	36.78^{c} (6.07)	67.22^{cd} (8.22)	87.03^{cd} (9.35)	63.94^{ef} (8.00)	68.70^{ef} (8.31)	70.94^{cd} (8.44)	45.43^{ab} (6.68)	52.62^{c} (7.23)	75.56^{c} (8.69)	62.22^{ab} (7.90)	72.10^{c} (8.50)	86.43^{cd} (9.31)
T2	19.40^{c} (4.46)	26.89^{ab} (5.23)	31.68^{ab} (5.67)	27.91^{ab} (5.32)	57.96^{ab} (7.64)	77.93^{ab} (8.85)	41.65^{ab} (6.47)	49.39^{ab} (7.05)	57.62^{ab} (7.60)	38.89^{ab} (6.25)	45.36^{ab} (6.75)	66.23^{ab} (8.16)	48.87^{ab} (7.01)	58.83^{a} (7.69)	70.83^{a} (8.44)
T3	43.20^{ef} (6.60)	52.59^{de} (7.28)	57.57^{de} (7.62)	37.58^{cd} (6.17)	64.26^{c} (8.05)	80.78^{ab} (9.01)	47.59^{cd} (6.91)	55.16^{cd} (7.45)	65.51^{ab} (8.09)	35.27^{a} (5.97)	42.48^{ab} (6.55)	66.94^{ab} (8.19)	55.38^{a} (7.47)	65.35^{ab} (8.11)	80.69^{ab} (9.01)
T4	23.13^{cd} (4.86)	32.20^{c} (5.71)	37.08^{c} (6.13)	29.20^{ab} (5.44)	65.85^{cd} (8.14)	82.60^{c} (9.10)	48.85^{cd} (7.00)	56.49^{cd} (7.53)	65.97^{c} (8.12)	37.01^{ab} (6.07)	43.56^{ab} (6.60)	69.00^{ab} (8.33)	57.21^{ab} (7.57)	67.23^{ab} (8.22)	82.42^{ab} (9.09)
T5	14.80^{ab} (3.90)	23.34^{a} (4.86)	28.24^{a} (5.35)	23.51^{ab} (4.89)	53.63^{ab} (7.35)	73.92^{ab} (8.62)	56.65^{e} (7.53)	65.01^{e} (8.07)	71.65^{cd} (8.47)	49.76^{c} (7.07)	56.54^{cd} (7.54)	79.72^{cd} (8.95)	66.52^{ab} (8.16)	73.11^{cd} (8.53)	87.78^{cd} (9.36)
T6	16.33^{ab} (4.10)	24.57^{ab} (5.00)	29.68^{ab} (5.49)	24.61^{ab} (5.01)	54.80^{ab} (7.44)	74.79^{ab} (8.68)	38.24^{a} (6.20)	44.25^{a} (6.68)	54.76^{a} (7.38)	39.24^{ab} (6.27)	45.70^{ab} (6.77)	69.27^{ab} (8.34)	59.27^{ab} (7.71)	69.20^{ab} (8.34)	84.53^{cd} (9.21)
T7	14.27^{a} (3.82)	23.34^{ab} (4.87)	28.03^{ab} (5.33)	22.67^{a} (4.80)	52.46^{a} (7.27)	72.81^{a} (8.56)	43.93^{ab} (6.62)	51.22^{ab} (7.16)	59.65^{ab} (7.69)	33.93^{ab} (5.81)	41.44^{a} (6.43)	64.11^{a} (8.01)	57.20^{ab} (7.58)	67.09^{ab} (8.20)	82.56^{c} (9.11)
T8	21.40^{cd} (4.67)	27.04^{ab} (5.22)	32.43^{ab} (5.72)	29.38^{ab} (5.46)	59.45^{ab} (7.74)	79.58^{ab} (8.95)	45.27^{ab} (6.76)	51.84^{ab} (7.23)	61.15^{ab} (7.81)	35.27^{ab} (5.97)	42.25^{ab} (6.51)	65.25^{ab} (8.10)	51.69^{ab} (7.19)	61.40^{ab} (7.84)	76.07^{ab} (8.73)
T9	23.13^{cd} (4.86)	29.97^{ab} (5.52)	35.24^{ab} (5.98)	29.52^{ab} (5.48)	59.68^{ab} (7.76)	79.73^{ab} (8.96)	47.03^{c} (6.87)	53.96^{c} (7.36)	63.40^{ab} (7.96)	36.37^{ab} (6.04)	42.28^{ab} (6.53)	65.43^{ab} (8.12)	59.70^{ab} (7.75)	69.99^{ab} (8.39)	84.99^{cd} (9.24)
T10	47.47^{g} (6.92)	56.01^{de} (7.51)	60.7^{de} (7.82)	39.02^{cd} (6.27)	68.65^{cd} (8.29)	85.58^{cd} (9.27)	65.08^{ef} (8.09)	71.44^{ef} (8.46)	76.14^{cd} (8.72)	53.94^{cd} (7.35)	60.67^{cd} (7.79)	83.90^{cd} (9.17)	70.71^{c} (8.43)	80.68^{cd} (9.00)	94.68^{cd} (9.75)
SE±	0.16	0.24	0.23	0.25	0.18	0.17	0.21	0.20	0.25	0.29	0.26	0.21	0.23	0.24	0.22
CD	0.47	0.72	0.67	0.74	0.55	0.52	0.63	0.59	0.73	0.86	0.77	0.63	0.69	0.71	0.65
CV	5.44	7.25	7.56	7.89	5.10	6.36	5.23	4.60	5.31	7.94	6.53	4.36	5.26	5.02	4.16

Table Rahuri PPT-36b: Rust severity (%) during different observation periods in Lucerne

Treatment	15-Feb	22-Feb	01-Mar	08-Mar	15-Mar	22-Mar	30-Mar	05-Apr	12-Apr
T1	7.44[c]	6.90[c]	10.57	6.24[c]	8.90[ab]	14.57[c]	6.57[a]	11.24[a]	14.24[a]
T2	2.02[ab]	2.97[ab]	4.80[ab]	3.23[ab]	6.13[ab]	8.67[ab]	4.23[a]	8.57[a]	11.23[a]
T3	1.72[ab]	2.88[ab]	4.55[ab]	3.38[ab]	6.38[ab]	9.05[ab]	4.71[a]	9.38[a]	11.71[a]
T4	7.81[cd]	7.49[cd]	10.82	6.45[cd]	10.12[c]	14.79[cd]	6.79[a]	10.12[a]	14.79[a]
T5	2.58[ab]	3.13[ab]	5.30[ab]	3.47[ab]	6.55[ab]	9.13[ab]	5.80[a]	8.80[a]	11.47[a]
T6	1.35[a]	2.53[a]	4.20[a]	3.67[ab]	6.80[ab]	9.47[ab]	5.33[a]	9.00[a]	10.67[a]
T7	1.69[ab]	2.70[ab]	4.37[ab]	3.21[ab]	6.07[ab]	8.57[ab]	5.21[a]	8.55[a]	11.88[a]
T8	2.43[ab]	3.23[ab]	4.90[ab]	3.07[a]	6.00[a]	8.55[a]	5.07[a]	9.40[a]	11.40[a]
T9	1.90[ab]	2.90[ab]	4.57[ab]	3.80[ab]	6.90[ab]	9.73[ab]	5.80[a]	8.80[a]	10.80[a]
T10	8.12[cd]	8.02[cd]	8.02	6.68[cd]	11.02[cd]	15.35[cd]	7.02[a]	10.68[a]	14.68[a]
SE±	0.75	0.92	0.99	0.89	1.11	1.39	0.93	1.19	1.48
CD	2.24	2.73	2.94	2.65	3.30	4.14	*NS	NS	NS
CV	14.80	7.19	9.60	10.46	12.71	15.36	28.56	21.74	20.80

*NS- Not significant

Table Rahuri PPT-36c: Mean no. of larvae/m^2 of *Spodoptera litura* and *Helicoverpa armigera* during different observation periods in Lucerne

Treatment	*Spodoptera litura*						*Helicoverpa armigera*		
	20-Apr	**28-Apr**	**07-May**	**13-May**	**20-May**	**27-May**	**13-May**	**20-May**	**27-May**
T1	2.01^{ab} (1.57)	2.05^{c} (1.59)	2.61^{cd} (1.75)	2.76^{cd} (1.79)	3.09^{cd} (1.89)	3.61^{cd} (2.01)	3.98^{a} (2.11)	4.53^{cd} (2.24)	4.59^{cd} (2.25)
T2	1.51^{a} (1.39)	1.26^{a} (1.32)	1.10^{a} (1.23)	0.84^{a} (1.15)	0.65^{a} (1.07)	0.51^{a} (1.00)	3.36^{a} (1.96)	2.79^{ab} (1.78)	0.89^{ab} (1.17)
T3	1.67^{ab} (1.46)	1.32^{ab} (1.35)	1.17^{ab} (1.28)	0.93^{ab} (1.18)	0.80^{ab} (1.12)	0.61^{ab} (1.05)	2.85^{a} (1.81)	2.15^{a} (1.60)	0.57^{a} (1.02)
T4	1.80^{ab} (1.51)	1.41^{ab} (1.38)	1.28^{ab} (1.32)	1.08^{ab} (1.25)	0.88^{ab} (1.17)	0.82^{ab} (1.14)	3.02^{a} (1.87)	2.44^{ab} (1.66)	0.69^{ab} (1.07)
T5	1.77^{ab} (1.51)	1.37^{ab} (1.36)	1.24^{ab} (1.27)	1.03^{ab} (1.22)	0.90^{ab} (1.17)	0.73^{ab} (1.10)	3.29^{a} (1.93)	2.73^{ab} (1.78)	0.80^{ab} (1.13)
T6	2.06^{ab} (1.59)	2.10^{cd} (1.60)	2.28^{c} (1.66)	2.61^{c} (1.75)	2.95^{c} (1.85)	2.78^{c} (1.81)	3.14^{a} (1.90)	2.70^{ab} (1.78)	0.74^{ab} (1.10)
T7	1.62^{ab} (1.45)	1.30^{ab} (1.34)	1.15^{ab} (1.27)	0.88^{ab} (1.17)	0.71^{ab} (1.09)	0.55^{ab} (1.02)	3.86^{a} (2.08)	4.45^{cd} (2.20)	4.44^{cd} (2.18)
T8	2.19^{c} (1.64)	2.27^{cd} (1.66)	2.65^{cd} (1.76)	2.98^{cd} (1.86)	3.31^{cd} (1.95)	3.65^{cd} (2.03)	3.56^{a} (1.99)	4.31^{c} (2.15)	4.40^{c} (2.19)
T9	1.71^{ab} (1.48)	1.35^{ab} (1.35)	1.20^{ab} (1.30)	0.97^{ab} (1.19)	0.84^{ab} (1.13)	0.69^{ab} (1.08)	2.92^{a} (1.83)	2.24^{ab} (1.63)	0.63^{ab} (1.03)
T10	2.28^{cd} (1.67)	2.41^{cd} (1.70)	2.86^{cd} (1.83)	3.20^{cd} (1.92)	3.53^{cd} (2.00)	3.86^{cd} (2.08)	4.02^{a} (2.11)	4.56^{cd} (2.22)	4.88^{cd} (2.32)
SE±	0.08	0.09	0.10	0.13	0.12	0.11	0.16	0.13	0.16
CD	0.22	0.26	0.29	0.39	0.35	0.31	*NS	0.36	0.49
CV	12.88	10.15	12.82	15.56	14.21	12.82	14.49	12.33	14.53

*NS- Not significant

Table Rahuri PPT-36d: Green fodder yield (q/ha) and associated yield loss compared to best treatment in different cuts in Lucerne

Treatments	Green fodder yield (q/ha) and associated yield loss compared to best treatment in each cut												
	1st cut	2nd cut	Yield loss (%)	3rd cut	Yield loss (%)	4th cut	Yield loss (%)	5th cut	Yield loss (%)	6th cut	Yield loss (%)	7th cut	Yield loss (%)
T1	42.61[a]	43.50[e]	28.69	50.64[fg]	25.32	46.92[i]	34.93	49.69[fg]	33.65	45.61[h]	40.33	57.00[ef]	26.51
T2	49.83[a]	55.03[cd]	1.74	63.42[d]	2.99	63.47[e]	1.43	66.25[e]	11.54	65.08[bc]	-	73.42[cd]	5.34
T3	42.22[a]	42.22[ef]	30.79	51.42[f]	1.03	57.61[f]	7.97	68.72[cd]	7.68	66.78[bc]	2.13	72.33[cd]	-
T4	42.50[a]	60.11[ab]	9.79	58.69[e]	24.17	50.36[g]	30.16	58.69[f]	8.24	57.61[d]	6.03	74.28[c]	6.74
T5	39.00[a]	59.56[ab]	0.77	67.11[ab]	13.45	48.78[gh]	32.35	51.56[f]	31.15	53.22[e]	5.38	57.11[ef]	9.18
T6	39.56[a]	60.53[ab]	1.46	67.81[a]	-	72.11[a]	-	74.89[a]	21.63	47.75[fg]	37.53	76.56[ab]	10.93
T7	43.28[a]	56.17[c]	-	65.78[c]	0.66	66.36[cd]	6.20	69.14[cd]	-	66.92[b]	0.65	58.58[e]	14.08
T8	41.19[a]	61.00[a]	2.36	66.14[ab]	6.47	71.08[ab]	11.98	73.86[ab]	1.38	48.31[f]	36.80	57.19[ef]	25.08
T9	46.92[a]	59.94[ab]	7.92	67.36[ab]	2.46	67.64[c]	20.11	70.42[c]	5.97	69.22[a]	4.09	77.56[a]	4.23
T10	36.94[a]	41.22[g]	32.43	42.89[h]	36.75	42.89[j]	40.52	45.67[h]	39.02	42.89[i]	43.89	56.78[ef]	26.79
SE±	0.35	0.47		0.64		0.78		0.71		0.67		0.68	
CD @5%	*NS	1.39		1.91		2.32		2.10		2.00		2.03	
CV%	11.81	12.60		15.24		17.90		16.25		17.22		14.93	

*NS- Not significant

Table Rahuri PPT-36e: Average cumulative yield loss due to different insect-pests and diseases in Lucerne at Rahuri

Insect-pests and disease	Average Yield loss (%)
Aphids	9.92
Rust	20.86
Spodoptera litura	24.23
Helicoverpa armigera	14.08
Spodoptera litura + Helicoverpa armigera	20.85
Control	36.57

Table Ludhiana PPT-36a: Downy mildew severity (%) during different observation periods in Lucerne

Treatment	12.1.21	19.1.21	26.1.21	2.2.21	15.2.21	22.2.21	2.3.21	15.3.21	22.3.21	03.4.21
T1	3.57	13.07^{c}	27.80^{c}	31.67^{b}	17.07^{b}	26.20^{b}	28.03^{c}	7.83^{d}	14.57	16.57^{c}
T2	3.5	10.73^{d}	22.00^{d}	24.57^{c}	12.37^{de}	19.17^{c}	22.27^{d}	10.17^{bc}	16.33	13.80^{d}
T3	3.63	10.83^{d}	21.63^{de}	24.17^{c}	11.90^{de}	20.33^{c}	21.30^{def}	9.17^{bcd}	14	13.33^{d}
T4	3.67	13.83^{bc}	30.73^{b}	33.40^{b}	18.27^{b}	26.67^{b}	30.73^{b}	10.50^{b}	16.17	18.73^{b}
T5	3.67	13.50^{bc}	19.10^{f}	25.33^{c}	12.83^{cde}	20.57^{c}	20.27^{ef}	8.33^{cd}	13	13.50^{d}
T6	3.87	15.00^{ab}	21.67^{de}	23.47^{c}	12.93^{cd}	20.00^{c}	21.50^{de}	10.00^{bc}	12.83	13.33^{d}
T7	3.5	12.87^{c}	21.47^{de}	23.87^{c}	12.50^{cde}	20.37^{c}	21.67^{de}	9.17^{bcd}	13.83	14.33^{d}
T8	3.93	13.80^{bc}	20.27^{ef}	23.47^{c}	11.47^{e}	19.33^{c}	19.67^{f}	8.50^{cd}	11.17	13.23^{d}
T9	4.03	13.53^{bc}	21.10^{de}	24.17^{c}	13.83^{c}	21.37^{c}	21.07^{def}	8.67^{bcd}	12.33	14.27^{d}
T10	4.4	15.63^{a}	35.57^{a}	39.33^{a}	23.93^{a}	33.00^{a}	35.80^{a}	12.83^{a}	15.63	22.60^{a}
CD (P=0.05)	*NS	1.511	1.723	2.116	1.394	2.250	1.803	1.937	NS	1.756
SE±(d)	0.441	0.719	0.820	1.007	0.664	1.071	0.858	0.922	1.948	0.836
CV	14.29	6.63	4.16	5.53	5.53	5.78	4.34	11.87	17.06	6.66

*NS- Not significant

Table Ludhiana PPT-36b: Weevil larvae/tiller during different observation periods in Lucerne

Treatment	17/2/21	24/2/21	3/3/2021	10/3/2021	17/3/21	24/3/21	31/3/21	7/4/2021
T1	0.8[a]	0.93[b]	2.33[c]	0.86[b]	1.50[b]	1.23[c]	1.00[c]	0.70[b]
T2	0.8[a]	0.17[a]	0[a]	0[a]	0.16[a]	0.13[a]	0.10[a]	0[a]
T3	0.8[a]	0.15[a]	0[a]	0[a]	0.26[a]	0.20[a]	0.13[a]	0.07[a]
T4	0.86[a]	0.20[a]	0[a]	0[a]	0.26[a]	0.16[a]	0.08[a]	0[a]
T5	0.93[a]	1.66[d]	1.66[b]	0.83[b]	1.43[b]	0.76[b]	0.70[b]	0.66[b]
T6	0.93[a]	0.23[a]	0[a]	0[a]	0.10[a]	0.07[a]	0[a]	0[a]
T7	0.80[a]	0.21[a]	0[a]	0[a]	0.33[a]	0.16[a]	0.13[a]	0.07[a]
T8	0.86[a]	0.27[a]	0[a]	0[a]	0.13[a]	0.10[a]	0.08[a]	0[a]
T9	0.90[a]	0.20[a]	0[a]	0[a]	0.07[a]	0.08[a]	0[a]	0[a]
T10	0.86[a]	1.33[c]	2.33[c]	1.00b	1.77[b]	1.37[c]	1.00[c]	0.50[b]
CD (P=0.05)	*NS	0.22	0.57	0.22	0.51	0.27	0.18	0.20
SE±(d)	0.10	0.08	0.19	0.07	0.17	0.09	0.06	0.07
CV	19.6	22.5	21.7	27.1	29.5	27.0	23.8	19.39

*NS- Not significant

Table Ludhiana PPT-36c: Green fodder yield (q/ha) and associated yield loss compared to best treatment in different cuts in Lucerne

Treatment	**Green fodder yield (q/ha) and associated yield loss compared to best treatment in each cut**							
	1st cut	**Yield loss (%)**	**2nd cut**	**Yield loss (%)**	**3rd cut**	**Yield loss (%)**	**4th cut**	**Yield loss (%)**
T1	139.00^{e}	7.9	147.00^{e}	11.3	159.00^{d}	6.7	132.00^{e}	28.0
T2	150.00^{ab}	0.7	163.33^{b}	1.4	168.33^{ab}	1.2	146.00^{c}	20.4
T3	148.33^{bc}	1.8	162.33^{b}	2.0	167.33^{ab}	1.8	144.33^{cd}	21.3
T4	132.67^{f}	12.1	144.67^{f}	12.7	159.33^{d}	6.5	148.00^{c}	19.3
T5	147.00^{cd}	2.6	157.00^{d}	5.2	164.00^{c}	3.7	163.33^{b}	10.9
T6	145.67^{d}	3.5	156.00^{d}	5.8	160.33^{d}	5.9	183.33^{a}	0.0
T7	148.00^{bcd}	2.0	159.67^{c}	3.6	165.33^{bc}	2.9	182.67^{a}	0.4
T8	151.00^{a}	0.0	165.67^{a}	0.0	170.33^{a}	0.0	158.33^{b}	13.6
T9	147.67^{bcd}	2.2	159.33^{c}	3.8	164.00^{c}	3.7	163.33^{b}	10.9
T10	131.67^{f}	12.8	143.33^{f}	13.5	150.33^{e}	11.7	139.67^{d}	23.8
CD (P=0.05)	2.636		2.229		3.031		5.682	
SE±(d)	1.255		1.061		1.443		2.684	
CV	1.07		0.83		1.09		2.106	

Table Ludhiana PPT-36d: Average cumulative yield loss due to different insect-pests and diseases in Lucerne at Ludhiana

Insect-pests and disease	**Average Yield loss (%)**
Downy mildew	10.4
Weevil	6.6
Control	15.5

Table Jhansi PPT-36a: Mean no. of aphids/tiller during different observation periods in Lucerne

Treatment	Aphids/tiller					Weevil larvae/tiller									*Helicoverpa* larvae/tiller			
	30-Dec	6-Jan	13-Jan	20-Jan	27-Jan	8-Feb	15-Feb	22-Feb	8-Mar	15-Mar	22-Mar	5-Apr	12-Apr	19-Apr	19-Apr	3-May	10-May	17-May
T1	3.4	3.1	3.4^{a}	5.7^{a}	16.9^{a}	0.1	0.2	0.4	0.8	3.2^{a}	5.4^{b}	0.7	0.7	0.5	0.0	0.1	0.3	1.1^{a}
T2	4.5	4.5	0.6^{bc}	2.4^{c}	4.9^{c}	0.2	0.2	0.4	1.1	1.1^{b}	2.6^{c}	0.7	0.8	0.5	0.1	0.1	0.2	0.2^{c}
T3	3.6	4.6	3.3^{a}	5.3^{b}	16.7^{a}	0.2	0.2	0.4	1.1	1.4^{b}	2.5^{c}	0.8	0.6	0.4	0.0	0.1	0.2	0.3^{c}
T4	3.5	3.3	0.5^{bc}	2.4^{c}	5.5^{bc}	0.2	0.3	0.3	1.6	1.2^{b}	2.3^{c}	0.6	0.7	0.6	0.2	0.1	0.2	0.3^{c}
T5	2.5	4.2	0.3^{bc}	2.6^{c}	5.5^{bc}	0.2	0.2	0.3	1.7	3.2^{a}	5.6^{ab}	0.7	0.6	0.5	0.1	0.1	0.2	0.3^{c}
T6	3.7	4.6	0.7^{b}	2.3^{c}	5.7^{bc}	0.2	0.2	0.3	2.0	1.4^{b}	2.6^{c}	0.7	0.8	0.4	0.1	0.1	0.2	0.2^{c}
T7	2.8	4.8	0.5^{bc}	2.4^{c}	5.9^{bc}	0.1	0.2	0.3	1.2	1.0^{b}	2.6^{c}	0.6	0.6	0.6	0.1	0.1	0.2	0.9^{b}
T8	2.6	4.7	0.5^{bc}	2.2^{c}	6.0^{b}	0.2	0.2	0.3	1.0	0.8^{b}	2.3^{c}	0.6	0.6	0.4	0.0	0.1	0.2	1.0^{ab}
T9	2.0	3.9	0.2^{c}	2.5^{c}	6.1^{b}	0.2	0.2	0.4	1.3	0.9^{b}	2.3^{c}	0.7	0.6	0.6	0.1	0.1	0.2	0.3^{c}
T10	2.3	4.2	3.6^{a}	6.0^{a}	17.0^{a}	0.3	0.2	0.3	1.1	3.3^{a}	6.1^{a}	0.6	0.7	0.5	0.1	0.1	0.2	1.1^{a}
CD	*NS	NS	0.4	0.4	1.0	NS	NS	NS	NS	0.32	0.16	NS	NS	NS	NS	NS	NS	0.78
CV				7.3	6.6					12.82	9.9							15.3
SE±				0.1	0.4					0.10	0.54							0.26

*NS- Not significant

Table Jhansi PPT-36b: Green fodder yield (q/ha) and associated yield loss compared to best treatment in different cuts in Lucerne

Treatment	*Green fodder yield (q/ha) and associated yield loss compared to best treatment in each cut					
	1st Cut	2nd cut	3rd cut	Yield loss (%)	4th cut	5th cut
T1	31.94	70.0	62.50[a]	20.5	63.61	62.50
T2	34.89	71.7	78.61[b]	0.0	67.78	67.78
T3	31.81	72.2	77.50[b]	1.4	66.67	66.39
T4	34.44	70.8	78.06[b]	0.7	62.50	66.67
T5	34.72	70.8	62.22[a]	20.8	61.67	66.94
T6	34.17	73.6	77.78[b]	1.1	68.06	66.67
T7	34.33	74.2	78.33[b]	0.4	65.28	61.94
T8	34.58	73.3	76.11[b]	3.2	62.78	61.67
T9	34.22	68.3	76.39[b]	2.8	64.44	66.11
T10	31.75	66.9	61.39[a]	21.9	61.11	60.56
CD (P=0.05)	*NS	NS	9.10		NS	NS
CV			7.28			
SE±			0.58			

*NS- Not significant

Table Jhansi PPT-36c: Average cumulative yield loss due to different insect-pests and diseases in Lucerne at Jhansi

Insect-pests and disease	Average Yield loss (%)
Aphids	Not significant
Weevil	20.8
Helicoverpa armigera	Not significant
Control	21.9

CHAPTER-4

BREEDER SEED PRODUCTION

Forage Crops Breeder Seed Production

[Indent year Rabi 2021-22]
[Production year Rabi 2020-21]
(Table Reference: Tables BSP 1, 2, 3, 4)

The indent for Breeder Seed Production was received from DAC, GOI for 35 varieties in four forage crops *viz*., Oat (22), Berseem (8), Lucerne (4) and rye grass (1). The total quantity allocated was 444.58q. The production target was assigned to different Breeder Seed producing centers of the SAUs/ NGO/ ICAR institutes. Among quantity indented for different forage crops, the maximum was for Oat (373.80q) followed by Berseem (33.16 q) and Lucerne (4.32q) and rye grass (0.55q).

The final Breeder Seed Production Report (BSP-IV) received from different seed producing centres revealed that in two crops Oat & Lucerne the overall breeder seed production was more than the allocated quantity. The overall breeder seed production was 562.22q against the indent of 411.83q (Table BSP 1 & 2) which is 150.39q surplus or 36.52% higher.

In Oat, the production was 526.70q against the allocation of 373.80q making a surplus of 152.90q. The total indent was for 22 varieties. In four varieties viz., NDO-2, OL-11, OL-1861, OS-403 the production targets were not fulfilled and hence there was deficit in production. In all other cases (18 varieties) there was surplus or equal production. The indent was allocated to 9 centers in 07 states / UT and only one institution viz., ANDUAT, Ayodhya could not meet the target and was net deficit producer. All other centers produced surplus or equal seeds, although some varietal mismatch was observed. There is also surplus seed produced in six varieties of oat to the tune of 13.00 q which were not indented. (table 3).

In Berseem, the total production was 33.00q against the indent of 33.16q making a deficit of 0.16q. There was indent of 8 varieties and were allocated to 3 centers located in 3 different states. In only one variety *viz.,* BL-43, the production was less than the indent. In other seven varieties there was surplus or equal production. Center wise scenario indicates that IGFRI, Jhansi, JNKVV Jabalpur were net surplus breeder seed producers whereas PAU, Ludhiana was net deficit producer in Berseem.

In Lucerne, the target of (4.32 q) was allotted to four centers in four states. The total production was 1.52q which was 2.80q less than the indent. MPKV Rahuri was net surplus producer whereas AAU, Anand; SKRAU, Bikaner and TNAU, Coimbatore failed to meet the target. Out of 4 varieties, in RL-88 there was surplus production of 0.20q. In other 3 varieties, the target was not met.

In rye grass, there was indent of one variety, PBRG-2 for 0.55q. It was allocated to PAU, Ludhiana and the production was 1.00q which was 0.45q higher than the indented quantity.

Table BSP 1: State wise/ Centre wise Breeder Seed Production (q) during *Rabi 2020-21*

[Indent Rabi 2021-22]

[Production year Rabi 2020-21]

Oat

SN	Producing centre	Variety	DAC indent	Allocation BSP-I	Production	Surplus/ Deficit	Indenter organization
1.	**Punjab**						
	PAU, Ludhiana	OL-10	6.00	6.00	6.00	0.00	1.00 (DADH); 3.00 (NAFED); 1.00 (PB) ; 1.00 (SAI)
		OL-11	8.00	8.00	7.00	(-) 1.00	8.00 (NDDB)
		OL-12 (OL 1802-1)	4.00	4.00	10.00	6.00	0.50 (PB), 2.50 (GJ), 1.00 (DADH)
		Ol-13	8.00	8.00	10.00	2.00	6.00 (DADH); 2.00 (NDDB)
		OL-1769-1	2.00	2.00	2.00	0.00	2.00 (UP)
		OL-1861	10.00	10.00	4.00	(-) 6.00	10.00 (NDDB)
		Total	**38.00**	**38.00**	**39.00**	**1.00**	
2.	**Maharashtra**						
	BAIF, Uralikanchan	Kent	100.40	25.00	27.00	2.00	10.00 (JK), 1.00 (NAFED), 15.00 (NDDB), 50.00 (NSC), 0.10 (PB), 4.30 (SAI);20.00 (UP)
		Total		**25.00**	**27.00**	**2.00**	
	MPKV, Rahuri	RO-11-1 (P. Surabhi)	3.00	3.00	5.00	2.00	3.00 (RJ)
		RO-19 (P. Haritha)	0.00	0.00	3.00	3.00	-
		Kent		25.00	24.00	(-)1.00	10.00 (JK), 1.00 (NAFED), 15.00 (NDDB), 50.00 (NSC), 0.10 (PB), 4.30 (SAI);20.00 (UP)
		Total	**103.40**	**28.00**	**32.00**	**4.00**	
3.	**Gujarat**						
	AAU, Anand	Kent	-	15.00	15.00	-	10.00 (JK), 1.00 (NAFED), 15.00 (NDDB), 50.00 (NSC), 0.10 (PB), 4.30 (SAI);20.00 (UP)
		Total	**-**	**15.00**	**15.00**	**-**	
4.	**Uttarakhand**						
	GBPUAT, Pantnagar	UPO-212	72.50	72.50	100.00	27.50	52.50 (NDDB),20.00 (NSC)
		Total	**72.50**	**72.50**	**100.00**	**27.50**	
5.	**Uttar Pradesh**						
	IGFRI, Jhansi	Kent	-	35.40	80.00	44.60	10.00 (JK), 1.00 (NAFED), 15.00 (NDDB), 50.00 (NSC), 0.10 (PB), 4.30 (SAI);20.00 (UP)
		JHO-2015-1	0.50	0.50	5.00	4.50	0.50 (HP)
		BJ-20122 (JHO 2012-2)	1.00	1.00	3.00	2.00	1.00 (DADH)
		JHO-2009-1	3.00	3.00	10.00	7.00	3.00 (UP)
		JHO-99-2	5.00	5.00	5.00	0.00	5.00 (UP)
		JHO-822	47.00	47.00	70.00	23.00	37.00 (NDDB); 10.00 (UP)
		JHO 2000-4	0.00	0.00	3.00	3.00	-
		JHO 99-1	0.00	0.00	2.00	2.00	-
		JHO 851	0.00	0.00	1.00	1.00	-
		JHO 2010-1	0.00	0.00	2.00	2.00	-
		Total	**56.50**	**91.90**	**181.00**	**124.50**	
	ANDUAT, Aodhya	NDO-2	0.50	0.50	0	-0.50	0.50 (NDDB)
		Total	**0.50**	**0.50**	**0**	**-0.50**	
6.	**Haryana**						
	CCS HAU, Hisar	OS-403	20.00	20.00	13.90	(-) 6.10	10.00 (JK), 5.00 (NDDB), 2.00 (NSC); 3.00 (RJ)
		OS-405	2.00	2.00	20.30	18.30	2.00 (DADH)
		0S-346	2.50	2.50	15.50	13.00	2.50 (NDDB)
		OS-377	6.00	6.00	8.75	2.75	6.00 (NDDB)
		HJ-8	0.40	0.40	2.25	1.85	0.40 (SAI)
		Total	**30.90**	**30.90**	**60.70**	**29.80**	

7.	UT of J&K						
	SKUAST, Srinagar	SKO-20	70.00	70.00	70.00	0.00	50.00 (HP), 20.00 (JK)
		SABZAAR	2.00	2.00	2.00	0.00	2.00 (SAI)
		Total	**72.00**	**72.00**	**72.00**	**0.00**	
Grand Total			**373.80**	**373.80**	**526.70**	**152.90**	

Table BSP 1: State wise/ Centre wise Breeder Seed Production (q) during *Rabi 2020-21— Contd...*

Berseem

SN	Producing centre	Variety	Allocation as per DAC	Allocation BSP-I	Production	Surplus/ Deficit	Indenter organization
1.	**Punjab**						
	PAU, Ludhiana	BL-43	8.68	8.68	7.00	(-) 1.68	4.00 (NSC) 4.20 (NDDB), 0.48 (PB),
		BL-42	2.98	2.98	3.00	0.02	0.50 (JK), 2.00 (NSC), 0.48 (PB)
		BL-10	3.40	3.40	3.50	0.10	2.00 (NDDB), 0.40 (PB), 1.00 (NSC)
		Total	**15.06**	**15.06**	**13.50**	(-) **1.56**	
2.	**Uttar Pradesh**						
	IGFRI, Jhansi	JBSC-1	1.30	1.30	2.00	0.70	1.30 (NDDB)
		BB-3	3.00	3.00	3.00	0.00	3.00 (NDDB)
		BB-2	5.15	5.15	5.15	0.00	3.00 (JH); 0.15 (RJ) ; 2.00 (UP)
		Wardan	8.50	8.50	8.50	0.00	3.00 (UP); 5.00 (NSC); 0.50 (NAFED) * LAST 2 INDENT IS FOR Mascavi added to Wardan.
		Total	**17.95**	**17.95**	**18.65**	**0.70**	
3.	**Madhya Pradesh**						
	JNKVV, Jabalpur	JB 05-09	0.15	0.15	0.85	0.70	0.15 (RJ)
		Total	0.15	0.15	0.85	0.70	
Grand Total			**33.16**	**33.16**	**33.00**	(-) **0.16**	

Table BSP 1: State wise/ Centre wise Breeder Seed Production (q) during *Rabi 2020-21 — Contd...*

Lucerne

SN	Producing centre	Variety	Allocation as per DAC	Allocation BSP-I	Production	Surplus/ Deficit	Indenter organization
1.	**Maharashtra**						
	MPKV, Rahuri	RL- 88	0.32	0.32	0.52	0.20	0.02 (NDDB) ; 0.30 (NSAI)
		Total	0.32	0.32	**0.52**	**0.20**	
2.	**Gujarat**						
	AAU, Anand	Anand-2	2.50	2.50	0.00	(-) 2.50	2.50 (NDDB)
		Total	**2.50**	**2.50**	**0.00**	(-) **2.50**	
3.	**Rajasthan**						
	SKRAU, Bikaner	RBB 07-01 (Krishna)	0.75	0.75	**0.50**	(-) **0.25**	0.25 (NDDB) ; 0.50 (NSAI)
		Total	0.75	0.75	**0.50**	(-) **0.25**	
	Tamil Nadu						
4.	TNAU, Coimbatore	Lucerne Co 3	0.75	0.75	0.50	(-) 0.25	0.20 (DADH) ; 0.55 (NSAI)
		Total	0.75	0.75	**0.50**	(-) **0.25**	
Grand Total			**4.32**	**4.32**	**1.52**	(-) **2.80**	

Table BSP 1: State wise/ Centre wise Breeder Seed Production (q) during *Rabi 2020-21 Contd...*

Rye Grass

SN	Producing centre	Variety	DAC indent	Allocation BSP-I	Production	Surplus/ Deficit	Indenter organization
1.	**Punjab**						
	PAU, Ludhiana	PBRG-2	0.55	0.55	1.00	(+) 0.45	0.55 (NDDB)
		Total	**0.55**	**0.55**	**1.00**	(+) 0.45	

Table BSP 2: Variety wise breeder seed production (q) during Rabi 2020-21

[Indent Rabi 2021-22]
[Production year Rabi 2020-21]

Crop: Forage Oat

S N	Variety	Produced by	Notification Year	Allocation as per DAC	Allocation BSP-1	Production	Surplus (+) / Deficit (-)
1	OL-10	PAU, Ludhiana		6.00	6.00	6.00	0.00
2	OL-11			8.00	8.00	7.00	-1.00
3	OL-12 (OL 1802-1)			4.00	4.00	10.00	6.00
4	Ol-13			8.00	8.00	10.00	2.00
5	OL-1769-1			2.00	2.00	2.00	0.00
6	OL-1861			10.00	10.00	4.00	-6.00
7	Kent	BAIF, Uralikanchan		100.40	25.00	27.00	2.00
		AAU, Anand			15.00	15.00	0.00
		MPKV, Rahuri			25.00	24.00	-1.00
		IGFRI, Jhansi			35.40	80.00	44.60
		Total			**100.40**	**146.00**	**45.60**
8	RO 11-1 (P. Surabhi)	MPKV, Rahuri		3.00	3.00	5.00	2.00
9	RO-19 (P. Haritha)	MPKV, Rahuri		0.00	0.00	3.00	3.00
10	UPO- 212	GBPUAT, Pantnagar		72.50	72.50	100.00	27.50
11	JHO 2015-1	IGFRI, Jhansi		0.50	0.50	5.00	4.50
12	BJ- 20122	IGFRI, Jhansi		1.00	1.00	3.00	2.00
13	JHO- 2009-1	IGFRI, Jhansi		3.00	3.00	10.00	7.00
14	JHO 99-2	IGFRI, Jhansi		5.00	5.00	5.00	0.00
15	JHO- 822	IGFRI, Jhansi		47.00	47.00	70.00	23.00
16	JHO 2000-4	ICAR- IGFRI, Jhansi		0.00	0.00	3.00	3.00
17	JHO 99-1	ICAR- IGFRI, Jhansi		0.00	0.00	2.00	2.00
18	JHO 851	ICAR- IGFRI, Jhansi		0.00	0.00	1.00	1.00
19	JHO 2010-1	ICAR- IGFRI, Jhansi		0.00	0.00	2.00	2.00
20	OS - 403	CCS HAU, Hisar		20.00	20.00	13.90	-6.10
21	OS- 377	CCS HAU, Hisar		6.00	6.00	8.75	2.75
22	HJ- 8	CCS HAU, Hisar		0.40	0.40	2.25	1.85
23	OS-405	CCS HAU, Hisar		2.00	2.00	20.30	18.30
24	0S-346	CCS HAU, Hisar		2.50	2.50	15.50	13.00
25	NDO-2	ANDUAT, Ayodhya		0.50	0.50		-0.50
26	SKO- 20	SKUAST, Srinagar		70.00	70.00	70.00	0.00
27	SABZAAR			2.00	2.00	2.00	0.00
		Grand Total		**373.80**	**373.80**	**526.70**	**152.90**

Table BSP 2: Variety wise breeder seed production (q) during Rabi 2020-21……Contd.

Crop: Berseem

SN	Variety	Produced by	Notification Year	Allocation as per DAC	Allocation BSP-1	Production	Surplus (+) / Deficit (-)
1	BL- 43	PAU, Ludhiana		8.68	8.68	7.00	-1.68
2	BL- 42	PAU, Ludhiana		2.98	2.98	3.00	0.02
3	BL-10	PAU, Ludhiana		3.40	3.40	3.50	0.10
4	JBSC - 1	IGFRI, Jhansi		1.30	1.30	2.00	0.70
5	BB- 3	IGFRI, Jhansi		3.00	3.00	3.00	0.00
6	BB- 2	IGFRI, Jhansi		5.15	5.15	5.15	0.00
7	Wardan	IGFRI, Jhansi		8.50	8.50	8.50	0.00
8	JB 05-09	JNKVV, Jabalpur		0.15	0.15	0.85	0.70
Grand Total				**33.16**	**33.16**	**33.00**	**-0.16**

Table BSP 2: Variety wise breeder seed production (q) during Rabi 2020-21 ……Contd.

Crop: Lucerne

SN	Variety	Produced by	Notification Year	Allocation as per DAC	Allocation BSP-1	Production	Surplus / Deficit
1	RL-88	MPKV, Rahuri	1996	0.32	0.32	0.52	0.20
2	Lucerne Co-3	TNAU, Coimbatore		0.75	0.75	0.50	-0.25
3	Anand - 2	AAU, Anand		2.50	2.50	0.00	-2.50
4	RBB 07-01 (Krishna)	SKRAU, Bikaner		0.75	0.75	0.50	-0.25
5							
Total				**4.32**	**4.32**	**1.52**	**-2.80**

Table BSP 2: Variety wise Breeder Seed Production (q) during *Rabi 2020-21* *Contd...*

Rye Grass

SN	Variety	Produced by	Notification Year	Allocation as per DAC	Allocation BSP-1	Production	Surplus / Deficit
1	PBRG-2	PAU, Ludhiana		0.55	0.55	1.00	(+) 0.45
Total				0.55	0.55	1.00	(+) 0.45

Table: BSP 3 Surplus seed produced of varieties not indented.

CROP: OAT

SN	Variety	Produced by	Notification Year	Allocation as per DAC	Allocation BSP-1	Production	Surplus / Deficit
1	RO-19 (P. Haritha)	MPKV, Rahuri		0.00	0.00	3.00	3.00
2	JHO 2000-4	IGFRI, Jhansi		0.00	0.00	3.00	3.00
3	JHO 99-1	IGFRI, Jhansi		0.00	0.00	2.00	2.00
4	JHO 851	IGFRI, Jhansi		0.00	0.00	1.00	1.00
5	JHO 2010-1	IGFRI, Jhansi		0.00	0.00	2.00	2.00
Total				0.00	0.00	**11.00**	**11.00**

Table 4: Summary of indent and production of breeder seed in 2020-21 rabi.

(Rabi Forages)	Allocation as per DAC	Allocation BSP-I	Production	Surplus/Deficit
Grand Total	**411.83**	**411.83**	**562.22**	**150.39**

FORAGE TECHNOLOGY DEMONSTRATION

To popularize the forage production technologies and make the farmers aware about various new fodder crop varieties. A total of 660 FTD's were allotted to 22 AICRP centres for Rabi crops. It included 80 FTDs to berseem, 45 to lucerne, 310 to oat (Single cut), 110 to oat (Multi cut), 10 to Lytharus, 95 to other crops viz., lathyrus, rye grass, cowpea, bajra napier hybrid etc.

Crop-wise FTDs to be conducted during Rabi 2020-21

S N	Centre	Berseem	Lucerne	Oat (SC)	Oat (MC)	Other crops	Total
1.	AAU, Jorhat			20			20
2.	OUAT, Bhubaneswar			15			15
3.	BCKV, Kalyani	05		10		Lathyrus: 10	25
4.	BAU, Ranchi	10		20			30
5	NDUAT, Ayodhya			10		BxN Hybrid: 10	20
6.	JNKVV, Jabalpur	15		10			25
7.	AAU, Anand		10	10			20
8.	BAIF, Urulikanchan	10		10		Fodder summer bajra:5	25
9.	MPKV, Rahuri						nil
10.	SKRAU, Bikaner		10	15			25
11.	PAU, Ludhiana				160		160
12.	CCS HAU, Hisar	10		15	05		30
13.	GBPUAT, Pantnagar	20		20		Maize+cowpea=20	40
14.	TNAU, Coimbatore		05			Forage cowpea 05	10
15.	PJTSAU, Hyderabad		10	05		Hedge lucerne: 10	35
16.	ZRS, UAS (B), Mandya		10	10			20
17.	CSK HPKV, Palampur				20	Rye Grass:10	30
18.	KAU, Vellayani					Forage Cowpea 5, BN Hybrid: 20	25
19.	IGKV, Raipur	10		10	5	Moringa: 5; Perennial Sorghum: 5	30
20.	CAU, Imphal			10			10
21.	SKUA& T, Srinagar			30			30
22.	RPCAU, Pusa			10			10
Total		**80**	**45**	**310**	**110**	**115**	**660**

IN-HOUSE BREEDING ACTIVITIES - RABI 2020-21

AICRP on FC&U, NDUAT, Ayodhya

Germplasm collection, evaluation & maintenance

S.N.	Crop	New collections 2020-21	Total collections
1.	Oat	04	170
2.	Berseem	02	24

Breeding Programme in oat - Twelve new crosses were made during Rabi 2020-21

S.N.	Cross combinations	S.N.	Cross combinations
1	NDO 10 x NDO 1902	7	Kent x NDO 1902
2	NDO 10 x NDO 1501	8	Kent x NDO 1501
3	NDO 1807 x NDO 1102	9	Kent x NDO 1102
4	NDO 711 x NDO 1902	10	OS6 x NDO 952
5	NDO 711 x NDO 1501	11	OS6 x NDO 1802
6	NDO 711 x NDO 1102	12	OS6 x NDO 1101

Segregating generations & progenies

Generations	Progenies	Generations	Progenies	Generations	Progenies
F_1	11	**F_2**	13	**F_3**	12
F_4	08	**F_5**	06	**F_6**	04

Advance lines - 09

Station trial: One station trial viz.; VT Station on Forage oat was conducted with fourteen promising lines and tested against two checks viz., NDO-1 and NDO-2 will be continued during rabi 2021-22.

Breeder Seed Production: Rabi 2020-21 Production - oat variety NDO-2=0.15q

New promising entries: NDO-1807, NDO-1802, NDO-1902, NDO-1904, NDO-1908

AICRP on FC&U, (RPCAU, Pusa)

- A total of 275 genotypes of different fodder crops were collected and are being maintained.
- Two stations trials and one maintenance trials have been conducted on Fodder Oat.
- Extensive crosses were made in Oat breeding programme and F_2's of crosses have been generated to be planted in next season.

AICRP on FC&U, BAU, RANCHI

Maintenance of germplasm lines: A total 102 germplasm lines of oat, 24 of Lathyrus and 13 of Berseem were maintained following standard breeding procedures.

Station Trial of Oat (SC): Out of eleven entries tested, the entry BAU O-102 (338.5 q/ha) was found significantly superior against both the national checks UPO-212 and Kent followed by BAUO-104 (318.6 q/ha) and BAUO-105 (314 q/ha).

Station Trial of Oat (MC): The entry RSO-60 (327 q/ha) was found significantly superior against both the national check i.e UPO-212 and Kent followed by BAUO-105 (322.7 q/ha) and BAUO-104 (319.7 q/ha).

Station Trial of Lathyrus: Twelve entries were tested, the varietal differences were found significant. The entry BL-1 and BL-3 showed high GFY comparable with national checks i.e Maheteora, Nirmal and Prateak.

Crossing programme of Oat: Six new crosses made for higher GFY, higher tillering & Multicut type

- **Segregating material advanced: $\mathbf{F_2}$** – 2 ; **$\mathbf{F_3}$** – 10 ; **$\mathbf{F_4}$** – 4 ; **$\mathbf{F_6}$** – 3
- **Advance breeding lines** : 4

AICRP on FC&U, AAU, Jorhat

Collection of germplasm: germplasm collected in rabi 2020-21

Ricebean : 2	Area: Tinsukia, Jorhat Assam
Cowpea : 3	Area : Karbi Anglong, Assam

Lathyrus

- **Evaluation of germplasm**: Ten selected lines from *Lathyrus* germplasm were evaluated.
- **Hybridization programme**: A diallel cross was made in *rabi* 2016-17 among four selected local Lathyrus germplasm lines and the test entries Nirmal, Prateek, Ratan and Madhuri without reciprocal to develop a forage lathyrus variety with high biomass yield, quality, disease resistance and low BOAA content. In *rabi* 2020-21 F_3 progenies were evaluated.
- **Mutation breeding programme**: M_6 progenies were evaluated.

Ricebean

- **Evaluation of Ricebean germplasm for rabi season:** Suitable entries selected for *rabi* season were evaluated for their fodder yield and quality.

AICRP on FC&U, MPKV, RAHURI

Germplasm Maintenance

SN	Crop	Nos	SN	Crop	Nos
1	Oat	40	**8**	Napier (*Pennisetum purpureum* L)	33
2	Lucerne	16	**9**	Guinea grass (*Panicum maximum* L)	11
3	Marvel (*Dichanthium spp.)*	48	**10**	Madras Anjan (*Cenchrus spp.)*	44
4	Dongari *(Chrysopogon fulvus)*	13	**11**	Rhodes grass (*Chloris gayana*)	7
5	Gokarn/Butterfly pea	25	**12**	Dinanath (*Pennisetum pedicellatum*)	5
6	Moshi (*Iseilema wighttii*)	3	**13**	Ber *(Ischaemum aristatum)*	3
7	Stylo (*Stylosanthes* spp.) *S. seabrana* : 35; . *S. scabra:5; S. viscosa-1;* *S.seca:1 ; S. hamata:2*	44			
				Total	**292**

Development of Dual Purpose Fodder Oat: F_3 progenies of following crosses were sown during *rabi* 2020-21. Superior individual plants from these progenies were selected and harvest separately. These F_3 progenies will be grown and evaluated as F_4 progenies during *rabi* 2021-22 for green forage yield and seed potential.

S.N.	Name of Cross (F_3)	S.N.	Name of Cross (F_3)
1	RO- 11 - 1- 3 x P. Surabhi	11	RO- 11 - 1- 6 x Kent
2	RO- 11 - 1- 4 x P. Surabhi	12	RO- 11 - 2- 2 x RSO-8
3	RO- 11 - 1- 6 x P. Surabhi	13	RO- 11 - 2- 8 x RSO-8
4	RO- 11 - 1- 8 x P. Surabhi	14	RO- 11 - 1- 13 x P. Surabhi
5	RO- 11 - 1- 12 x P. Surabhi	15	RO- 11 - 2- 2 x P. Surabhi
6	RO- 11 - 1- 3 x P. Harita	16	RO- 11 - 2- 8 x P. Surabhi
7	RO- 11 - 1- 4 x P. Harita	17	RO- 11 - 2- 11 x P. Surabhi
8	RO- 11 - 1- 12 x P. Harita	18	RO- 11 - 1- 13 x P. Harita
9	RO- 11 - 1- 3 x Kent	19	RO- 11 - 2- 2 x P. Harita
10	RO- 11 - 1- 4 x Kent	20	RO- 11 - 2- 8 x P. Harita

AICRP on FC&U, OUAT, Bhubaneswar

Rice bean: Four best performing pure lines identified as suitable for August-September sowing and January-February sowing because of better plant height and foliage growth was sown for seed multiplication during Pre Rabi 2020-21.

AICRP on FC&U, BCKV, Kalyani

Germplasm maintained

Name of the crop	Total number of lines
Rice bean	250
Lathyrus	9

- Five (5) germplasm lines of lathyrus were evaluated against one check; Prateek as Large Scale Trial (LST) on production of green forage cum seed production as dual purpose.

SN	Crop/ Variety	Nucleus Seed	Breeder seed	TFL seed
1	Rice bean (Bidhan Rice bean 1)	6 kg	60 kg	25 kg
2	Rice bean (Bidhan Rice bean 2)	5 kg	20 kg	10 kg
3	Rice bean (Bidhan Rice bean 3)	3 kg	5 kg	-
4	Coix (Bidha Coix 1)	4 kg	12 kg	5 kg
5	Oat (cv. Kent)	-	-	20 kg
6	Lathyrus (cv. Prateek)	-	-	20 kg

Management of BN hybrid during *rabi*, 2020-2021
BN hybrid (CO-3) : 9000 cuttings (Approx.) [Nos.]
BN hybrid (CO-4) : 8000 cuttings (Approx.) [Nos.]
BN hybrid (CO-5) : 10000 cuttings (Approx.) [Nos.]

Study on gamma ray induced mutagenesis in Bidhan Rice Bean 1
Rationales: To find out any morphological mutants in regards to forage quality (high protein or fibre), photo insensitivity, early flowering, bushy types (without the trailing habit) *etc* or any other agro-economic traits. Variants serving dual purpose character (seed + green forage) could be a good finding which may be of two types- (i) Green forage yielder after proper harvesting of seeds: in that case early flowering mutants will be selected; (ii) Green forage yielder before the harvesting of the seeds, here late flowering may be selected.
M1, M2 & M3 generation is over. The selected plants from the M3 generation is be evaluated in the M4 generations for confirmed selection of desired mutants.

M3 generation: M3 Mutant- L1P6, L13P5, L1P1, L3P4, L6P1, L4P5, L7P1, L3P2, L4P3 and Control eg. L4P5- dual purpose (higher GFY + seed yield), L6P1 and L13P5 are promising lines for higher GFY and CPY.

AICRP on FC&U, CAU Imphal

Germplasm maintained

Sl. No.	Crop	No. of accessions
1	Rice bean	43
2	Maize	27
3	Cowpea	19
4	Bajra x Napier hybrid	4
5	Seteria	1
6	Signal	1

AICRP on FC&U, GBPUAT Pantnagar

Evaluation and maintenance of oat germplasm: 270 germplasm lines of oats were evaluated and maintained having different characters and used for oat improvement.

Crossing block of oat: 56 advance lines along with 41 exotic lines were planted for crossing and maintenance.

Evaluation of different filial generation of oat

SN	Generation	No. of lines	SN	Generation	No. of lines
1	F1	13	**5**	F7	147
2	F2	123	**6**	F8	128
3	F5	128	**7**	F9	27
4	F6	152	**8**	F10	9

Multiplication of advance lines/released varieties of oat: Advance lines = 24

SN	Advance lines	SN	Advance lines	SN	Advance lines	SN	Advance lines
1	UPO-10-1	**7**	UPO-16-2	**13**	UPO-18-2-2	**19**	UPO-18-5
2	UPO-10-3	**8**	UPO-16-3	**14**	UPO-18-3	**20**	UPO-19-1
3	UPO-11-1	**9**	UPO-18-2-1	**15**	UPO-18-4-1	**21**	UPO-19-2
4	UPO-12-2	**10**	UPO-20-1	**16**	UPO-18-4-2	**22**	UPO-19-3
5	UPO-16-1	**11**	UPO-20-2	**17**	UPO-18-4-3	**23**	UPO-20-4
6	UPO-16-1	**12**	UPO-20-3	**18**	UPO-18-4-4	**24**	UPO-20-5

Released varieties

- **UPO 10-2 -** Released named as Pant Forage Oat 4 through SVRC meeting held on 19-05-2020 at Dehradun
- **UPO-16-4 -** Identified named as Pant Forage Oat 5 through SVRC meeting held in September 2020 at Dehradun

New crosses in oat = 16: The following 16 new crosses have been made in crossing blocks on the basis of foliage character, plant height and disease resistance.

SN	Crosses	SN	Crosses
1	OGP-6 x UPO-10-2	**9**	OGP-1 x UPO-18-4-3
2	OGP-5 x UPO-10-2	**10**	OGP-27 x UPO-18-4-3
3	OGP-4 x UPO-10-2	**11**	OGP- 28 x UPO-18-4-3
4	OGP-1 x UPO-10-2	**12**	OGP- 29 x UPO-18-4-3
5	OGP-8 x UPO-16-4	**13**	OGP- 32 x UPO-18-1-3
6	OGP- 31 x UPO-18-1-3	**14**	OGP- 33 x UPO-18-1-3
7	OGP- 30 x Kent	**15**	OGP- 117 x UPO-16-4
8	OGP- 103 x UPO-16-4-3	**16**	OGP- 59 x UPO-20-1

Breeder seed production

SN	Crop	Variety	Target	Actual production
1	Forage oat	UPO-212	72.5q	100 q

State varietal trial: One State varietal trial of oat was conducted during Rabi 2019-20 and data submitted.

AICRP on FC&U, TNAU, Coimbatore

Development of high water use efficient BN hybrids

Raising of crossing block with identified parents -Screening of all the available Napier grass for water use efficiency was taken up and among the Napier germplasm lines, the accessions *viz.*, FD 482, FD 474, FD 434, FD 443 were identified as WUE Napier genotypes. Crossing block was raised during Rabi 2020-21 by using these Napier accessions as male parents and 25 elite pearl millet accessions from ICRISAT as female parents. The details of crossing block raised in line and testers fashion are as follows

Bajra accessions						Napier grass accessions	
SN	**Accessions**	**SN**	**Accessions**	**SN**	**Accessions**	**SN**	**Accessions**
1.	GP 15069	**10.**	TNFB 9901	**18.**	IP 20338	**1.**	FD 482
2.	GP 15072	**11.**	TNFB 9902	**19.**	PT 5091	**2.**	FD 474
3.	GP 15073	**12.**	GP 16023	**20.**	PT 5365	**3.**	FD 434
4.	GP 15074	**13.**	GP 16026	**21.**	PT 5581	**4.**	FD 443
5.	GP 15076	**14.**	GP 16271	**22.**	PT 5588	**5.**	FD 465
6.	GP 15953	**15.**	GP 18219	**23.**	PT 5652	**6.**	FD 464
7.	GP 15958	**16.**	IP 11354	**24.**	PT 5682	**7.**	FD 432
8.	GP 15988	**17.**	IP 20273	**25.**	PT 5701/1		
9.	GP 16016						

Hybridization between identified fodder bajra and napier grass parents - Hybridization was made between 25 bajra (lines) and 5 napier (testers) genotypes. Of hybridization attempted in the genotypes, seed set was successful in following 32 cross combinations.

SN	Crosses	SN	Crosses	SN	Crosses
1.	GP 15074 x FD 482	**12.**	GP 15958 x FD 482	**23.**	TNFB 9902 x FD 432
2.	GP 15074 x FD 464	**13.**	GP 15958 x FD 464	**24.**	GP 15069 x FD 474
3.	GP 15074 x FD 465	**14.**	GP 15958 x FD 465	**25.**	PT 5682 x FD 474
4.	GP 15074 x FD 432	**15.**	GP 15988 x FD 482	**26.**	GP 18219 x FD 474
5.	GP 16016 x FD 482	**16.**	GP 15988 x FD 464	**27.**	GP 15074 x FD 474
6.	GP 16016 x FD 464	**17.**	GP 15988 x FD 465	**28.**	PT 5588 x FD 474
7.	GP 16016 x FD 465	**18.**	GP 16023 x FD 482	**29.**	PT 5588 x FD 434
8.	GP 16016 x FD 432	**19.**	GP 16023 x FD 432	**30.**	GP 18219 x FD 434
9.	GP 15073 x FD 482	**20.**	PT 5091 x FD 482	**31.**	TNFB 9902 x FD 434
10.	GP 15073 x FD 464	**21.**	PT 5091 x FD 432	**32.**	GP 15074 x FD 434
11.	GP 15073 x FD 465	**22.**	TNFB 9902 x FD 482		

Hybrid seeds of 32 crosses were collected and F_1 generation was raised in field for evaluation. By observing the phenotypes of the hybrids, true hybrids are being identified at present.

Development of bajra napier hybrid grass for high green fodder yield

Clonal Nursery Evaluation: A total of 28 F_1 hybrids along with the check hybrids CO (BN) 5 and CO 6 were planted in clonal nursery on 15.10.2020. Two harvests have been completed. Clone (CO 8 x FD 453/1) recorded highest GFY (60.16 t/cut) followed by CO 7 x FD 483 (50 t/cut/ha).

Performance of F_1 hybrids in clonal nursery

SN	F_1 hybrids	GFY (kg/plot)			t/cut/ha	Dry Matter (%)	Leaf Stem Ratio
		I cut	II cut	Mean			
1.	CO 7 x FD 434	8	10	9.0	14.06	21.30	0.31
2.	**CO 7 x FD 483**	**25**	**39**	**32.0**	**50.00**	21.47	0.24
3.	CO 8 x FD 483	12	33	22.5	35.16	21.95	0.31
4.	**CO 8 x FD 453/1**	**52**	**25**	**38.5**	**60.16**	22.44	0.25
5.	RFBJ 1 x FD 483/1	25	25	25.0	39.06	21.83	0.34
6.	CO 9 x FD 453/1	15	24	19.5	30.47	21.32	0.27

7.	IP 20350 x FD 483	17	9	13.0	20.31	20.96	0.24
8.	IP 20350 x FD 453/1	15	24	19.5	30.47	20.04	0.28
9.	IP 20350 X FD 434	20	22	21.0	32.81	21.57	0.29
10.	PT 5382 X FD 426	13	27	20.0	31.25	20.61	0.20
11.	PT 5382 X FD 448	15	19	17.0	26.56	20.48	0.34
12.	PT 5382 X FD 434	21	25	23.0	35.94	20.24	0.34
13.	GP 16021 X FD 434	10	20	15.0	23.44	21.33	0.26
14.	GP 16021 X FD 432	12	14	13.0	20.31	21.02	0.36
15.	IP 20350 X FD 471	11	20	15.5	24.22	20.88	0.24
16.	IP 20350 X FD 458	22	25	23.5	36.72	20.82	0.40
17.	IP 20350 X FD 438/1	19	26	22.5	35.16	22.04	0.26
18.	IP 20350 X FD 451	20	24	22.0	34.38	21.88	0.28
19.	GP 16021 X FD 434	13	31	22.0	34.38	21.85	0.32
20.	IP 2269 X FD 434	5	2	3.5	5.47	20.46	0.32
21.	IP 20840 X FD432	27	25	26.0	40.63	20.83	0.33
22.	IP 22269 X FD 462	34	24	29.0	45.31	21.50	0.35
23.	DSRB 4 X FD 473	20	25	22.5	35.16	22.74	0.29
24.	DSRB 4 X FD 474	20	21	20.5	32.03	22.43	0.28
25.	DSRB 4 X FD 450	23	20	21.5	33.59	20.36	0.36
26.	CO 8 X FD 465	12	15	13.5	21.09	22.37	0.31
27.	CO (BN) 5	21	27.5	24.3	37.89	20.5	0.33
28.	CO 6	27	26	26.5	41.41	20.8	0.32

Multi Location Trial in Bajra Napier hybrid grass

Performance of the bajra –Napier hybrid clones during 2019-20 under MLT- Multi Location Trials (MLTs) were conducted at five locations of Tamil Nadu during 2019-20 to evaluate the performance of promising clones and checks *viz*., TNCN 1901, TNCN 1902 and TNCN 1903. Of the three entries, TNCN 1901 had recorded highest GFY of 35.16 t/ha/cut while the TNCN 1902 and TNCN 1903 have recorded a GFY of 34.31 and 31.15 and t/ha/cut respectively.

S. No.	Location	Green fodder yield (t/ha/cut)		
		TNCN 1901	TNCN 1902	TNCN 1903
1.	Dept. of Forage Crops, Coimbatore	52.20	49.60	48.20
2.	RRS, Vridhachalam	30.60	29.40	24.75
3.	AC&RI, Killikulam	28.30	30.62	25.63
4.	ARS, Kovilpatti	23.18	22.21	20.76
5.	ARS, Bhavanisagar	41.50	39.70	36.39
	Overall mean	**35.16**	**34.31**	**31.15**

Performance of the Bajra Napier hybrid clones during 2020-21 - During 2020-21, MLTs have been organized at eleven locations of Tamil Nadu to evaluate the performance of two promising clones along with the check CO (BN) 5 which where coded as TNCN 1901, TNCN 1902 and TNCN1903. Out of the three entries, TNCN 1902 had recorded highest green fodder yield of 38.56 t/ha/cut followed by TNCN 1901 and TNCN 1903 with the green fodder yield of 35.45 and 33.66 t/ha/cut. The pooled analysis of data and decoding of genotypes will be done during 2021-22 to ascertain the yield performance of the nominated cultures for consecutive three years over the check CO (BN) 5. The details of the green fodder yield recorded by the bajra napier genotypes in MLT organized during 2020-21 are furnished below. The superior performing genotypes over three years will be considered for the promotion into state on-farm trials during 2022-23.

Results of MLTs on Bajra Napier hybrids (2020-21)

S. No.	Location	Green fodder yield (t/ha/cut)		
		TNCN 1901	**TNCN 1902**	**TNCN 1903**
1.	DFC, Coimbatore	45.60	47.40	42.80
2.	AC&RI, Killikulam	36.85	35.50	33.64
3.	RRS, Virudhachalam	28.60	30.80	22.95
4.	ARS, Bhavanisagar	40.97	57.42	44.92
5.	FC & RI, Mettupalayam	25.07	23.21	22.98
6.	TCRS, Yethapur	39.69	43.23	37.34
7.	ARS, Paramakudi	36.96	38.71	34.46
8.	SRS, Melalathur	29.83	32.17	30.17
9.	RRS, Ambasamudram	Crop is at establishment stage		
10.	KVK, Pongalur			
11.	RRS, Aruppukopttai			
	Overall mean	**35.45**	**38.56**	**33.66**

Lucerne

Poly cross breeding programme: Eight parents namely Anand-2, Krishna, RL-88, CO 1, BAL 08-1, Anand-3, CO 4 and Kutchi were sown on 05.03.2021 in heptagon design. One green fodder cut was given to enable the genotypes to put forth multiple tillers. The crop is at late vegetative stage.

Fodder Cowpea

Seed multiplication of superior performing cowpea cultures: During *rabi* 2020-21, a promising fodder cowpea culture TNFC 1910 seed was multiplied and nominated for evaluation under IVT *kharif* 2021, AICRP on FC & U. A quantity of 2.5 kg of the seed was dispatched to the Project Co-ordinating unit, IGFRI, Jhansi for inclusion in the Kharif 2021 initial varietal Trial.

***Stylosanthes* spp.**

Collection of different *Stylosanthes* spp. and accessions: Different species of Stylosanthes *viz.*, *S. scabra*, *S. hamata*, and *S. guinensis* were collected from KLDB, Dhoni farm, Kerala. Of the three species raised in the field, only two species *viz.*, *S. scabra* and *S. hamata* have established well at TNAU, Coimbatore.

Characterization of entries for fodder yield and quality: The observations on plant height, number of branches, total green fodder yield/plant were recorded for *S. scabra* and *S. hamata.* The observations revealed that the biomass production observed at TNAU was quite less when compared to KLDB, Kerala. The details of characterization under taken in the *S. scabra* and *S. hamata* for fodder yield and quality are furnished below.

S. No.	Plant characters	*Stylosanthes scabra*	*Stylosanthes hamata*
1.	Plant height (cm)	55	30
2.	Number of branches	10	16
3.	Leaf size	Small	Medium
4.	Leaf colour	Light green	Light green
5.	Leaf surface	Non sticky	Non sticky
6.	Leaf pubescence	Glabrous	Glabrous
7.	Stem colour	Pale green	Pale green
8.	Stem hairiness	Hairy	Hairy
9.	Stem surface	Smooth	Smooth
10.	Green fodder yield (g/per plant)	83.2	73.5
11.	Crude protein (%)	17.85	17.17
12.	Flower colour	Yellow	Yellow
13.	Seed colour	Yellow	Yellow

AICRP on FC&U, UAS (B) ZARS Mandya

Fodder Maize

➢ **Yellow seeded: Yellow seeded inbreds F_6generation DOS: 28-1-2021**

Cross	Number of Populations/Lines
A. Tall x Sujay-121-1	F_6 Generation (2 Populations)
A. Tall x Sujay-267-2	F_6 Generation (1 Population)
A. Tall x Sujay-267-1	F_6Generation (7 Populations)

➢ **Selected promising inbreds in Yellow seeded**

SN	Populations	SN	Populations	SN	Populations
1	MFM-20-1	5	MFM-20-5	9	MFM-20-9
2	MFM-20-2	6	MFM-20-6	10	MFM-20-10
3	MFM-20-3	7	MFM-20-7		
4	MFM-20-4	8	MFM-20-8		

➢ **Orange seeded: Multiplication of Orange seeded stabilized inbreds F_9 DOS: 28-1-2021**

Inbreds derived from the cross- A. Tall x Sujay-267-1 - F_9 Generation (16 Populations)

SN	Inbreds	SN	Inbreds	SN	Inbreds	SN	Inbreds
1	MFMI-1	5	MFMI-5	9	MFMI-9	13	MFMI-13
2	MFMI-2	6	MFMI-6	10	MFMI-10	14	MFMI-14
3	MFMI-3	7	MFMI-7	11	MFMI-11	15	MFMI-15
4	MFMI-4	8	MFMI-8	12	MFMI-12	16	MFMI-16

Inbreds derived from the cross - A. Tall x Sujay-267-2 F_9 Generation (10 Populations)

SN	Inbreds	SN	Inbreds	SN	Inbreds	SN	Inbreds
1	MFMI-17	4	MFMI-20	7	MFMI-23	10	MFMI-26
2	MFMI-18	5	MFMI-21	8	MFMI-24		
3	MFMI-19	6	MFMI-22	9	MFMI-25		

Inbreds derived from the cross - A. Tall x Sujay-121 - F_9 Generation (8 Populations)

SN	Inbreds	SN	Inbreds	SN	Inbreds	SN	Inbreds
1	MFMI-27	3	MFMI-29	5	MFMI-31	7	MFMI-33
2	MFMI-28	4	MFMI-30	6	MFMI-32	8	MFMI-34

➢ **Forwarding of selected F_5 generation of forage Maize populations for yield and quality – 20 progenies selected for fodder traits**

SN	Cross	SN	Cross	SN	Cross	SN	Cross
1	MFM-18-1	**6**	MFM-18-2	**11**	MFM-18-1	**16**	MFM-18-2
2	MFM-18-2	**7**	MFM-18-3	**12**	MFM-18-2	**17**	MFM-18-3
3	MFM-18-3	**8**	MFM-18-4	**13**	MFM-18-3	**18**	MFM-18-4
4	MFM-18-4	**9**	MFM-18-1	**14**	MFM-18-4	**19**	MFM-18-1
5	MFM-18-1	**10**	MFM-18-2	**15**	MFM-18-1	**20**	MFM-18-2

➢ **Generation of new crosses for forage and multiple disease resistance traits**
DOS: 28-1-2021 - Source AICRP on Maize, ZARS, Mandya

SN	Varieties	SN	Varieties	SN	Varieties	SN	Varieties
1	MAI-2	**7**	MAI-764	**13.**	24848	**19.**	52167
2	MAI-3	**8**	V-490-7	**14.**	40203	**20.**	CAL-1518
3	MAI-142	**9**	V-931-6	**15.**	40283	**21.**	1926009
4	MAI-267	**10**	V-938-56	**16.**	52336	**22**	MAI-105
5	MAI-298	**11**	VL-191000	**17.**	52347	**23.**	MAI-137
6	MAI-712	**12**	VL-19999	**18.**	52349		

II. Fodder Cowpea

Evaluation of stabilized Forage Cowpea advanced generations (F_7) - DOS: 25-1-2021

SN	Generations	SN	Generations	SN	Generations	SN	Generations
1	MFC-20-1	**7**	MFC-20-7	**13.**	MFC-20-13	**19.**	MFC-20-19
2	MFC-20-2	**8**	MFC-20-8	**14.**	MFC-20-14	**20.**	MFC-20-20
3	MFC-20-3	**9**	MFC-20-9	**15.**	MFC-20-15	**21.**	MFC-20-21
4	MFC-20-4	**10**	MFC-20-10	**16.**	MFC-20-16	**22**	MFC-20-22
5	MFC-20-5	**11**	MFC-20-11	**17.**	MFC-20-17	**23.**	MFC-20-23
6	MFC-20-6	**12**	MFC-20-12	**18.**	MFC-20-18	**24.**	MFC-20-24

AICRP on FC&U, BAIF, Urulikanchan

Lucerne

Mutation Breeding: The M2 seeds were collected from 200 M1 plants and were sown in nursery under polyhouse conditions. Well established seedlings of 100 M2 families were transplanted into field to evaluate for high biomass. The data on forage yield contributing characters and other morphological characters was collected for M2 plants.

Polycross Programme: New cycle of polycross nursery was established with following eight parental lines contributed by five participating centres.

Code	Parental line	Contributing center	Code	Parental line	Contributing center
A	Anand -2 (GAUL-2)	AAU, Anand	**E**	BAL-08-01	BAIF, Urulikanchan
B	Krishna	SKRAU, Bikaner	**F**	AL-3	AAU, Anand
C	RL-88	MPKV, Rahuri	**G**	Co-4	TNAU, Coimbatore
D	Co-1	TNAU, Coimbatore	**H**	Kutchhi (selection)	AAU, Anand

Seed sowing of parental lines was done as per the uniform layout decided by all the participating centers. After first cut, the mother plants were left for crossing under nets and manual tripping was done daily.

Germplasm Evaluation: Three accessions collected from Lucerne dominated areas of Gujarat are grown for evaluation along with checks RL-88 and Krishna. All the lines will be evaluated for forage yield and quality traits.

Forage Maize

Crossing programme: A crossing programme was initiated using six genotypes and five crosses attempted were BAIF 235 x BAIF 102, BAIF 242 x BAIF 102, BAIF 245 x BAIF 102, BAIF 297 x BAIF 102 and Pratap Makka-6 x BAIF 102. Crossed seed of all the five crosses were obtained and will be used for further evaluation.

Maize x Teosinte cross: Progenies of seven IPS from F_5 generation were advanced to F_6 generation and elite individual plants were selected for further study.

AICRP on FC&U, PAU, Ludhiana

Varieties released at Central or State level (in last 5 years): (21)

Year	Crop	Varieties developed	Features
2015-16	Oats	OL 1804/ CVRC	It is a single cut variety of oats recommended for North East Zone comprising of states viz; West Bengal, Odhisha, Jharkhand, Bihar, Eastern Uttar Pradesh, Manipur and Assam. Its average green fodder yield is 155q/acre.
		OL 1802/ CVRC	It is a multicut variety of oats recommended for Central Zone comprising of states viz; Central Uttar Pradesh, Maharashtra, Gujarat, Chhattisgarh and Madhya Pradesh. Its average green fodder yield is 225q/acre.
	Bajra Napier Hybrid	PBN 346/ SVRC	It is a Bajra Napier hybrid recommended for irrigated areas of Punjab state. Its plants have long, smooth, non-hairy and broad leaves. The fodder yield and silage quality of this variety is better than PBN 233. It yields 715 quintal of green fodder per acre.
2016-17	Oats	OL 11/ SVRC	It is a single cut variety recommended for irrigated areas of Punjab state. Its fodder quality is superior to OL 9 and Kent. On an average, it yields about 245 quintals of green fodder and 8.5 quintals of seed per acre.
		OL 1760	It is a single cut variety of oats recommended for South Zone comprising of states viz; Tamil Naidu, Telengana, Andhra Pradesh and Karnataka. On an average, it yields about 145 quintals of green fodder per acre. Its fodder quality is better than the checks OS 6 and Kent.
		OL 1769-1/CVRC	It is a single cut variety of oats recommended for Central Zone comprising of states viz; Uttar Pradesh, Maharashtra, Gujarat, Chhattisgarh and Madhya Pradesh. On an average, it yields about 200 quintals of green fodder per acre.
		OL 1802-1/CVRC	It is a single cut variety of oats recommended for North West Zone comprising of states viz; Punjab, Haryana, Rajasthan, Uttarakhand and Western Uttar Pradesh. Its average green fodder yield is 215q/acre.
	Bajra Napier Hybrid	PBN 342/ SVRC, CVRC	It is a Bajra Napier hybrid recommended for NWZ, NEZ and SZ comprising of states viz; Punjab, Haryana, Rajasthan, Odhisha, Assam, Tamil Naidu and Karnataka. The fodder yield quality of this variety is better than national checks viz; PBN 233 and CO 3. Its average green fodder yield is 430q/acre.
2017-18	Oats	OL 12/ SVRC	It is a single cut variety recommended for irrigated areas of Punjab state. Its fodder quality is superior to OL 9, OL 11 and Kent. On an average, it yields about 255 quintals of green fodder and 9.0 quintals of seed per acre.
	Berseem	BL 43/ SVRC	It is a quick growing and tall variety of Berseem with more number of tillers recommended for irrigated areas of Punjab state. It supplies superior quality green fodder of 390 quintals per acre up to first week of June and gave good seed yield.
2018-19	Bajra Napier Hybrid	PBN 351	It is a Bajra Napier hybrid recommended for CZ Uttar Pradesh, Maharashtra, Gujarat, Chhattisgarh and Madhya Pradesh. The fodder yield quality of this variety is better than national checks viz; CO (BN)5, NB 21 and CO 3. Its average green fodder yield is 520 q/acre.
2019-20	Oats	OL 1861	It is a single cut variety recommended for All India except HZ. It gave 9.2% and 15.1% more green fodder yield than the national checks Kent and OS 6 respectively at National level. It is also moderately resistant to leaf blight.
		OL 1869-1	It is a single cut variety recommended for NWZ and CZ. It gave 6.0% and 11.7% more green fodder yield than the national checks Kent and OS 6 respectively at National level. It is also moderately resistant to leaf blight.

2020-21	Oats	OL 13	It is a single cut variety and its mean GFY is 305.0 q/acre. Its plants are tall with long and broad leaves, high tillering ability.
		OL 14	It is a multicut variety and its mean GFY is 307.0 q/acre. Its plants are tall with long and broad leaves, high tillering ability.
		OL 1896	It is a single cut variety and its mean GFY is 650 q/ha. Its plants are tall with long and broad leaves, high tillering ability, moderately resistant to leaf blight, quality better than the national checks. Its recommended for NWZ.
		OL 1874	It is a single cut variety and its mean GFY is 640.0 q/ha. Its plants are tall with long and broad leaves, high tillering ability, moderately resistant to leaf blight, quality better than the national checks. It is recommended for NWZ.
		OL 1876-2	A dual variety and its mean GFY is 225.0 q/acre. It has high tillering ability, moderately resistant to leaf blight, quality better than the national checks. It is recommended for NEZ.
	Rye grass	PBRG 2	mean GFY 325.0 q/acre. Its quality is better than PBRG 1, tolerant to diseases and insect pests
	Maize	J 1007	mean GFY 280.0 q/acre. Moderately resistance to *maydis* leaf blight and brown stripe downy mildew diseases. Grains are white
	Bajra	PCB 165	mean GFY 265.0 q/acre. Dual purpose composite variety & resistant to downy mildew.

Oats

Conduct of station and Multi location Trials - A total of seven evaluation trials (5 station and 2 multi location) were conducted. Promising entries identified on yield basis is given below:

SN	Description of the Trial	Promising entries
1.	MLT in oats-multicut	OL 1942, OL 1919, OL 1964, OL 1882, OL 1924
2.	MLT in oats —Single Cut	OL 1971, OL 1876-1, OL 1964, OL 1967
3.	Station trial in Oats – Single Cut/Dual	OL 1992, OL 1984, OL 1931
4.	Station trial in Oats – Multi cut	OL 1967, OL 1977, OL 1983, OL 1975, OL 1931
5.	Station trial in Oats-1-Single Cut	OL 1988, OL 1985, OL 1980, OL 1974, OL 1977,

Germplasm Collection, Maintenance and Evaluation

- A total of 315 new oat accessions were acquired from NBPGR, New Delhi
- A total of 720 germplasm lines were maintained following standard breeding procedures.

Hybridization

A total of fifty crosses have been attempted involving promising genotypes and exotic germplasm accessions.

Breeding material handled

Breeding material as per details given below was handled following standard breeding methods and procedures:

Generation	Number	Generation	Number	Generation	Number
F_1 crosses	65	F_3 generation	250	F_5 generation	300
F_2 generation	150	F_4 generation	350	F_6 generation	40

Berseem

- Two evaluation trials (1 station and 1 multilocation) comprising of 12 genotypes were conducted.
- Polycrosses were made involving nine promising genotypes. Promising polycross progenies will be advanced. Promising polycross progenies will be evaluated against the check variety for fodder yield, fodder quality and in sect pest and diseases.

Lucerne

- One multilocation trial of Lucerne varieties involving three test genotypes against one check was conducted.
- One station trial in of Lucerne varieties involving seven genotypes was conducted.

- Polycrosses were made involving 5 promising genotypes. Promising polycross progenies will be advanced. Promising polycross progenies will be evaluated against the check variety for fodder yield, fodder quality and in sect pest and diseases.

Ryegrass

- One station trial in of Ryegrass varieties involving six genotypes was conducted
- Promising polycross progenies will be advanced. Promising polycross progenies will be evaluated against the check variety for fodder yield, fodder quality and in sect pest and diseases.

Germplasm maintained/ handled (921)

Oats – 720 ; Berseem – 130 ; Ryegrass - 31; Lucerne- 40

Nucleus seed production

Crop: Oat

Variety	Tentative seed production (q)	Variety	Tentative seed production (q)	Variety	Tentative seed production (q)
Kent	0.25	**OL 14**	1.00	**OL 1869-1**	1.00
OL 9	0.20	**OL 1802**	0.20	**OL 1874-1**	0.15
OL 10	1.04	**OL 1804**	0.20	**OL 1876-2**	0.10
OL 11	0.80	**OL 1760**	0.20	**OL 1896**	1.50
OL 12	1.06	**OL 1769-1**	0.20	**OL 1906**	0.20
OL 13	0.60	**OL 1802-1**	0.15		
Crop:	**Berseem**				
BL 10	0.50	**BL 43**	0.50	**BL 22**	0.05
BL 42	0.50	**BL 1**	0.05	**BL 180**	0.10

Besides the recommended varieties, seed of advanced lines and selected elite material was also produced in Oat, Berseem and Lucerne.

AICRP on FC&U, IGKV, Raipur

Maintenance of germplasm lines: Total 42 selected germplasm of oat, 34 of Lathyrus, 31 of cowpea were grown in 2020-21.

Generation of F_1 from elite Oat crosses: F_1 seed of UPO-212 x OS-409, UPO-94 x JHO-822, JHO-822 x JHO-99-1, UPO-212 x OL-10, UPO-94 x JHO-99-1 were obtained by attempted new crosses.

Generation of F_1 from elite Lathyrus crosses: F_1 seed of diallel crossed between Mahateora, RLK-1950, Pusa-24, Nirmal, Ratan and BK-05 were obtained by attempted new crosses.

Generation of F_4 from F_3 seed of elite Oat crosses: F_3 seed of OS-409 x RO-19, ROS-8 x OS-6, OL-10 x RO-19 were sown at 08-12-2020 for advancing generation.

Seed Multiplication of promising lines of Cowpea: RCC-48 was sown at 08-12-2020 for seed multiplication.

Generation of F_7 from F_6 seed of elite (Low ODAP, Late duration, Broad leaf) **Lathyrus crosses:** F_6 seed of Mahateora x RLK-1950, Pusa24 x RLK-1950, Mahateora x PUSA-24, Mahateora x BK-05, Mahateora x Nirmal, Pusa-24 X Prateek, Pusa-24 X BK-05 were sown at 06-11-2020 for advancing generation.

Induction of Polyploidy in Berseem, Lathyrus using colchicine: Collected seeds in 6 polyploid plants from 9 confirmed polyploids of Berseem variety Mescavi

AICRP on FC&U, CSKHPKV, Palampur

Germplasm Holding

Crop	No. of collections
Tall Fescue Grass (*Festuca arundinacea)*	58
Rye Grass (*Lolium perenne)*	8
Red Clover (*Trifolium pratense)*	9
White Clover (*Trifolium repens)*	58
Oat (*Avena* spp.)	337

Oat

Germplasm evaluation

- Estimation of protein content assay revealed that wild species HFO-505 (*A. strigosa*-11.33%), followed by HFO-508 (*A. sterilis*-11.28%) and HFO-58 (*A. barbata*-11.21%) possessed higher protein content than cultivated oat (7.34%-10.03%).
- Evaluation of oat germplasm under organic & inorganic conditions revealed that genotypes JPO-73, JPO-5 & EC-605837, KRR-AK-36 & EC-528890 showed superiority for green fodder yield along with resistance against powdery mildew.

Generation of breeding material

- Forty-four new cross combinations developed involving 11 lines and 4 testers.
- In order to develop mapping population for identification of QTLs for quality traits (specifically beta- glucan), crosses between identified diverse parents IG-03-205 (5.52 %) and JPO-18 (2.50%) were attempted based on their phenotypic estimation.
- To introgress powdery mildew resistance, progeniesof crossesHJ-8(S) X JPO-46(R) and Kent(S) X PLP-1(R) were evaluated for powdery mildew resistance and further backcrossed to generate (40 seeds) BC_2F_1 generation.
- Oat material evaluated in segregating generations derived from different crosses and about 300 promising progenies have been selected.
- In M_3 generation, treatment of 200Gy & 300 Gy, and combined doses of 400Gy + 0.6% EMS & 400Gy + 0.9% EMS were found effective for generating putative mutants for plant height (tallness) and powdery mildew resistance respectively in variety Kent, whereas high number of tillers and powdery mildew resistant mutants in varietyHJ-8 were recorded in combined treatment of 400Gy + 0.3% EMS and 200 Gy+ 0.3% EMS, respectively.
- BC_2F_1 progenies of crosses *A. longiglumis* × *A. sativa, A. strigosa* × *A. sativa* and *A. sativa* × *A. byzantina* exhibited superiority for spikelets per panicle, tillers per plant, leaves per plant and grain yield per plant.

Tall Fescue Grass

- Polycross progenies derived from different diverse genotypes revealed that Hima-3, EC-178182, EC-178184, Hima-15, Hima-1, Hima-4, Sel-63 and Sel-71exhibited significant higher values for different traits *viz*., plant height, leaf length, leaf width, tillers per plant, leaf area, green forage yield per plant, ADF, NDF, crude protein contents& crude protein yield per plant and physiological traits like root length, shoot length, root weight, shoot weight, relative water content, drought susceptibility index, total chlorophyll & proline content were good general combiners and can be used for the constitution of new synthetic populations.

White clover

- Restricted Recurrent Phenotypic Selection has been taken up for developing superior populations**.**

Red clover

- Restricted Recurrent Phenotypic Selection has been taken up for developing superior populations and populations are under evaluation.

AICRP on FC&U, JNKVV, Jabalpur

Germplasm holding: Oat - 110 ; Berseem - 96

Berseem

- To create variability, poly cross nursery programme has been started taking five diverse parents viz., Wardan, BL42, Mescavi, UPB110, and JB1.Tripping has been done is to ensure cross pollination in all possible combination. Selections shall be made in all for fodder traits in coming generation.
- Variety JB5 has been treated with different doses (five) of gamma rays. Single plant selection and row bulks were done, treatment wise to raise the M_5 generation.
- In Wardan, four superior bulks were selected from mutated population.

Oat

- Under National crossing programme crosses have been attempted (LxT cross) with lines and broad based tester.
- 47 advanced lines were evaluated for different fodder traits.
- No. of crosses made - 24
- Segregating material advanced/ handled - 31 (F_2 onwards)
- Advance breeding lines - 37

AICRP on FC&U, PJTSAU, Hyderabad

Forage maize:

- 28 F_1s developed through diallel mating design without reciprocals were evaluated along with eight parental lines during Rabi 2020-21.

SN	Parental lines	SN	Parental lines
1.	IC- 335185 x IC- 335188	**15**	IC- 338984 X IC -334966
2.	IC- 335185 x IC- 338984	**16**	IC- 338984 X IC-335194
3.	IC- 335185 x IC-334969	**17**	IC- 338984 X IC - 334973
4.	IC- 335185 x IC -334966	**18**	IC- 338984 X IC- 334965
5.	IC- 335185 x IC-335194	**19**	IC-334969 X IC -334966
6	IC- 335185 x IC - 334973	**20**	IC-334969 X IC-335194
7	IC- 335185 x IC- 334965	**21**	IC-334969 X IC - 334973
8	IC- 335188 x IC- 338984	**22**	IC-334969 X IC- 334965
9	IC- 335188 x IC-334969	**23**	IC -334966 X IC-335194
10	IC- 335188 x IC-334966	**24**	IC -334966 X IC - 334973
11	IC- 335188 x IC-335194	**25**	IC -334966 X IC- 334965
12	IC- 335188 x IC-334973	**26**	IC-335194 X IC - 334973
13	IC- 335188 x IC 334965	**27**	IC-335194 X IC- 334965
14	IC- 338984 x IC-334969	**28**	IC – 334973 X IC- 334965

Forage cowpea

- Multiplication of elite culture TSFB 18 -16 was taken up during Rabi 2020.

Bajra Napier hybrids

- 5 Napier lines established

AICRP on FC&U, SKUAST, Srinagar

Multi-location testing and multiplication of advanced pipeline entries: Six single cut advanced fodder oats materials were evaluated during 2020-21 across locations (advanced evaluation trial) to confirm the fodder yield potential of these entries and will help in identifying entries to be evaluated in AICRP trials (IVT-SC) and OFT programmes.

Station trials: 10 families were promoted to Station preliminary evaluation trial during *rabi* 2020-21 and best performing entries will be promoted to multi-location testing.

Advanced lines: 10 F_6 families of three crosses were put for seed multiplication in order to evaluated them in IVT during 2021-22

Progeny detail:

- F5 families of below mentioned crosses were evaluated and selections made among families for further evaluation.

SN	Cross Combination	SN	Cross Combination
1	SKO-208 X SKO-204	6	SKO-212 X SKO-209
2	SKO-211 X SKO-205	7	SKO-207 X SKO-205
3	SKO-211 X SKO-204	8	SKO-212 X SKO-204
4	SKO-211 X SKO-210	9	SKO-210 X SKO-207
5	SKO-207 X Sabzar	10	SKO-205 X SKO-204

No. of Germplasm

SN	Crop	Germplasm holdings	IC number obtained
1.	Oats	145	6
2.	Alfalfa	55	Nil
3.	Barley	25	Nil
4.	Red Clover	6	Nil
5.	White Clover	4	Nil
6.	Perennial Rye grass	4	Nil

Seed Production : Crop: Oats

SN	Variety	Anticipated production (q)	
		Nucleus seed	Breeder seed
1	Shalimar Fodder Oats-1 (SKO-20)	1.0	55.0
2	Shalimar Fodder Oats-2 (SKO-90)	1.0	6.0
3	Shalimar Fodder Oats-3 (SKO-96)	1.0	5.0
4	Shalimar Fodder Oats-4 (SKO-108)	1.0	2.5
5	Shalimar Fodder Oats-6 (SKO-225)	1.0	5.0
6	Sabzar	1.0	5.0

Forage Technology Demonstration – Oats - 05

AICRP on FC&U, KAU, CoA, Vellayani

Induced mutagenesis for developing dual purpose genotypes in fodder cowpea: Forage cowpea (*Vigna unguiculata*) variety Aishwarya seeds were treated using chemical mutagen EMS. The final target was to develop a dual purpose cowpea with forage characters as well as good seeding behaviour. The M_1 generation was harvested and the segregating M_2 population was raised. Seeds from the selected plants in the M_2 generation were harvested separately and will be used to raise M_3 generation.

Development of core collection of fodder cowpea genotypes: 139 accessions of forage cowpea *(Vigna unguiculata)* collected from NBPGR, New Delhi were raised in summer 2021 season. Many of the accessions are showing promising forage characteristics. These will be further raised in the coming seasons and depending on the genetic distance among the accessions based on D^2 statistics, crosses will be attempted to generate variability.

Identification of *Stylosanthes* species for yield and quality suited for cultivation in Kerala: To identify the best *Stylosanthes* species from among *S. scabra, S. hamata, S. seabrana and S. guianensis* suited for the climatic conditions of Kerala, thirteen accessions are collected from different parts of the country and are being evaluated for forage yield and quality and the best suited species for the climatic condition of Kerala will be identified.

New programs

Construction of population structure in Stylo [*Stylosanthes* sp.] using SSR markers: Genomic DNA of accessions of *Stylosanthes* genotypes from among *S. scabra, S.seabrana, S.hamata* and *S. guianensis* will be isolated from the leaf samples and will be screened using SSR markers. Phenotypic data of same genotypes will be utilized for interpretation of molecular data and construction of population structure of the genotypes will be attempted.

Variability studies in fodder bajra (*Pennisetum glaucum* (L.) R. Br.) for yield and quality: Thirty genotypes of Fodder Bajra will be raised in Summer 2022 and evaluated for yield and its correlated characteristics along with the nutritional profiling including antioxidant analysis.

Suitability of a potential underutilized legume *Vigna stipulacea* for fodder purpose: Accessions of *Vigna stipulacea* collected from NBPGR, New Delhi will be raised in Rabi 2021 and evaluated for fodder and seed yield along with nutritional quality.

AICRP on FC&U, AAU, Anand

Lucerne:

- **Germplasm maintenance: 290 Lines**
- **Contribution of entry in AICRP trial:** AL-66 in AVT -1 Lucerne – Annual (NWZ & SZ)
- **Composite programme & Maintenance:**

(I) ALC-1

- Kutchhi-1
- TNCO-3 (TN)
- AL-3 (AND)
- TSLU-14-3 (Hyd)

(II) ALC-2

- BAIF-1
- Krishna
- AL-3
- Anand-2

Crossing programme (Lucerne) – Polycross programme

Contributing center	entry	Code	Contributing center	entry	Code
AAU, Anand	Anand-2	A	BAIF, Urulikanchan	BAL 08-1	E
SKRAU, Bikaner	Krishna	B	AAU, Anand	Anand-3	F
MPKV, Rahuri	RL-88	C	TNAU, Coimbatore	CO-4	G
TNAU, Coimbatore	CO-1	D	AAU, Anand	Kutchi	H

Note: *Rabi* season 2020-21 crossing programme i.e. Polycross of lucerne failed due to strong cyclone 'Tauktae' and heavy rain during 18th &19th May 2021.

Segregating materials: (Lucerne)

Generation	RABI 2020-21				
	Sown	SELECTION (IPS/BULK)	Generation	Sown	SELECTION (IPS/BULK)
F_1	24	24	F_5	34	50
F_2	12	60	F_6	61	63
F_3 (Polycross)	110 (Poly.)	116			
F_3	55	51	**TOTAL**	**296**	**364**

Crossing programme (Forage Maize) - Summer

- **New crosses:** 14 with objective Higher GFY, Tall type

➢

SN	Name of cross	SN	Name of cross
1.	IC-130882 X ORIGIN MEXICO-6354	**8.**	IC-130913 X MEXICAN ACCESSION-4207
2.	IC-130882 X ORIGIN MEXICO-6357	**9.**	IC-130913 X NP96K-2415
3.	IC-130882 X ORIGIN MEXICO-6377	**10.**	IC-130913 X ORIGIN MEXICO-6345
4.	IC-130882 X GDRFG-1644	**11.**	IC-130913 X ORIGIN MEXICO-6354
5.	IC-130913 X IC-130976	**12.**	IC-130913 X ORIGIN MEXICO-6357
6.	IC-130913 X IC-130987	**13.**	IC-130913 X ORIGIN MEXICO-6377
7.	IC-130913 X IC-131016	**14.**	IC-130913 X GDRFG-1644

Varieties released/endorsed at State/National Level (in last 3 years)

Forage Bajra: Gujarat Anand Forage Bajra 4 (GAFB 4)

This variety was recommended by 14th Combined Joint AGRESCO Meeting of SAUs held during April 3-5, 2018 at Junagadh Agricultural University, Junagadh and accepted for the release.

Breeder Seed Production: Rabi 2020-21 in kg

SN	Crop	Nucleus Seed	ICAR		STATE		Total Production
			Indent	Production	Indent	Production	
1.	Oats *var.* Kent	300	1500	1500	800	850	2650
2.	Lucerne *var.* Anand-2	10	250	0	25	0	0*
3.	Lucerne *var.* Anand-3	09	0	0	105	0	0*

Note: * *Rabi* season 2020-21 breeder seed production programme of lucerne var. Anand 2 at Anand and var. AL 3 at Vadodara centre have been failed due to strong cyclone 'Tauktae' and heavy rain during 18th &19th May 2021.

Bio-chemical analysis *DURING* RABI 2020-21 & SUMMER-2021

Discipline	Total No. of Expts.	No. of samples analyzed for			
		DM%	CP%	NDF & ADF	HCN
Plant Breeding	18	1106	1096	826	0
Agronomy	3	321	321	438	0
PG Study	1	0	24	0	0
Bikaner Centre	8	0	62	0	0
TOTAL	**30**	**1427**	**1503**	**1264**	**0**

OTHER ACTIVITIES RABI 2020-21

AICRP on FC&U, BAIF, Urulikanchan

Papers in research journals

Singh VK, Kale RV, Takawale PK. 2020. Response of phosphorus on different cowpea varieties for seed yield production in Sambalpur district of Odisha. *Forage Res.*, 46 (1): pp. 95-97

Kelkar Nandini, Kakade Bharat, Kote Ravi, Takawale Pramod Kumar and Nighut Sandip. 2020. Impact of 'Integrated Crop Management Approach' on Crop Yield and Economics in Amaravati and Yavatmal District (M.S.), *India Int. J. Curr. Microbiol. App. Sci.*, 9(6): 185-193

Important persons visited to AICRPFC centre:

- Mr Sunil Kedar, Hon. Minister, Animal Husbandry and Dairy, Govt. of Maharashtra

FTDs conducted: 33 Fodder Technology Demonstrations of Oat var. Kent (22) and Berseem var. Wardan (11) were organised at farmer's field in four blocks of Pune district

TSP activities: Tribal Sub Plan activities were implemented in five villages namely Jalakh, Nanderkhada, Ozarda, Navagaon & Shrimpur of Nandurbar district of Maharashtra. The major objectives of were training and capacity building of the tribal farmers, promotion of new fodder crops and their varieties, establish the nurseries of newly released BN hybrid for quality planting material, demonstrate benefits of improved farm implements at village level. It was need based and participatory programme. Inputs such as seed and planting material, fertilizers, silage bags etc., agricultural equipments, chaffcutter, and micro-irrigation systems with water tank were provided to the participating farmers. Few activities were implemented at group level. The salient achievements of the programme are as under.

- Established 70 nursery units (0.05 ha area each) of newly released B N Hybrid i.e. **BNH-11** with drip irrigation at Tribal Farmers field.
- Good quality planting material is available to the farmers in the area and generated the income from sale of planting material.
- Fifty Tribal farmers have developed the skills of silage making from hybrid napier fodder through training and demonstration

Total farmers benefited out of this programme during the year were 100 from five villages distributed in five groups.

HRD for the AICRP-FC staff:

- Mr. P. S. Takawale, attended online course on "Pre-breeding and Pre-breeding Project Management" developed by FAO.
- Attended several webinars related on Biodiversity and Agriculture, sustainable agriculture, soil and climate to update the knowledge.

Details of seed/ planting material sold: 2.18 lakh stem cuttings of BAIF Napier Hybrid-10 **(BNH-10)** and BAIF Napier Hybrid-11 **(BNH-11), a**bout 35 q seed of oat, berseem, bajra and cowpea seed was supplied to farmers and different institutions.

AICRP on FC&U, GBPUAT, Pantnagar

Papers in research journals

Bahuguna A and Pal MS. 2020. Effect of establishment method and nutrient management on growth and yield of baby corn (*Zea mays* L.) in Tarai region of Uttarakhand. P*antnagar Journal of Research* 18 (2): 12-16.

Bahuguna A and Pal MS. 2021. Effect of crop establishment methods and nutrient management options on productivity and economics of baby corn (*Zea mays* L.). *Pantnagar Journal of Research* (accepted).

Lecture delivered

Pal MS. 2019. Crop-livestock interaction under conservation agriculture. CAFT Training on Tactical Response Farming fro Climate Resilience' from Nov. 20 to Dec. 1, 2019 at Department of Agronomy, Pantnagar**.**

Book published - 02

Pal MS. 2021. Basic Mathematics and Aptitude. NIPA Publishing House, New Delhi. 952p. (ISBN: 978938990725).

Prasad Birendra. 2021. All in one objectives in Seed Science and Technology. Jaya Publishing House (11 April 2021) New Delhi. ASIN: .p340 .VL25W0928B

Popular articles-03

Pal MS. 2021. Earn more from sunflower cultivation. *Kisan Bharti* 52 (06): 4-7**.**

Prasad Birendra, Ojha OP and Kumar Amarjeet 2020. Seed production: a key factor for enhancing productivity of farm. Indian farmer digest. pp.29-32.

Prasad Birendra, Ojha OP and Kumar Amarjeet 2020. Rabi Faslon M Beej Utpadan Tacnik

TSP-Forage Crops: 123 fodder demonstrations on Oat, berseem and berseem+Oat mixed cropping system

- Total scheduled tribes dominated 07 villages : Dhusra, Kanpura, Dyori and Matiha (Sitarganj Block) and Sethwala (Gadarpur Block) in U S Nagar District and Halduchur (Lalkuan block) and Pitampura (Haldwani Block) in Nainital Districts (Uttarakhand) were selected under TSP program during *Rabi* season 2020-21.
- 860 rooted slips of B N hybrids were distributed. Inputs like seed, fertilizers and pesticides were also distributed free of cost to farmers, and Important literature related to recent production technology was given to farmers. Other information related to organic production and dairy farming, mushroom production was also provided to interested farmers.

FTD conducted	**: 20** (10 Oat and 10 Berseem)
Farmers' Meetings	**: 011 (**431 beneficiaries**)**
Group discussions	**: 20 (**185 beneficiaries**)**
Radio Talks	**: 04 (**MS Pal – 3, B Prasad – 1)

Participation in Conference/Workshop (Webinars) = 06 (MS Pal – 2 national and 1 international, B Prasad – 3 national)

Online lecture delivered: 01 on topic 'Precision Nutrient Management for Sustainable Fodder Production' in 21 days training on 'Modern Practices of Plant and Animal Nutrition for Sustainable Agriculture Production and Intensive Livestock Development' organized by ICAR-IGFRI, Southern Regional Research Station, Dharwad (Karnataka) from Feb. 02 to 22, 2021.

Review of Research Papers: 02
PG & Ph D thesis evaluation: 03
Research Guidance (PG & Ph D) =07 - (Mahendra Singh Pal – 2, B Prasad – 5)
Submission of theses research work = 01 M.Sc. (Ag) : Oat Breeding (Dr B Prasad)
Teaching courses=06 (MS Pal – 3, B Prasad – 3)

Course	Course title	Credit hours	Semester	Degree
APA 318	Rainfed Agriculture & Watershed Management	02	II	UG
APA522	Agronomy of Rabi Crops	04	II	PG
APA 614	Soil conservation and Watershed Agrostology & Agroforestry	03	II	PG
AGP 313	Principles of Seed Technology	03	II	UG
AGP 530	Breeding field crop -II	02	II	PG
AST 705	Advances in Seed Science and Technology	01	II	PG

Income generated

SN	Crop	Variety	Quantity	Rate of Breeder seed/q	Amount (Rs.)
1	Oat	UPO-212	100.0 q	7250	725000.00
2	BN Hybrid	Pant Sel-1			2000.00
	Total				727000.00

Additional Duties

- Dr Mahendra Singh Pal - Vice President, Alumni Almamater Advancement Association (4A), Pantnagar, Hostel Warden
- Dr B Prasad: Dy Coordinator, RAWE, College of Agriculture

AICRP on FC&U, NDUAT, Ayodhya

Papers in research journals

Singh AP, Yadav RS, Singh RP, Singh A and Singh V. 2020. Influence of weed management practice on weeds, weed control efficiency nitrogen uptake by weeds and the crop, quality and yield of fodder oat (*Avena sativa* L.). *Int. J. Curr. Microbiol. App. Sci.(*Special Issues)-10:168-172

Singh A, Yadav RS, Kumar A, Kumar Abhay, Patel VK, Singh AP and Singh RP. 2020. Effect of wed management practices on yield and economics in Indian mustard. *International Journal of Chemical Studies* 8 (2):1064-1067

Participation in Seminar/Symposia/Workshop: 2

Courses taught

- Agron 221(V) -(B.Sc.Ag.)- Crop production technology (Rabi crops)
- Agron 624- (Ph. D.) –Management of saline and alkali soils

Ph.D. student Guidance

- Mr. Shrimannarayan Dubey Id.No.-A7522/13//18
- Mr. Avinash Kumar Singh Id.No.-A10103/17

FTD conducted: 20 (Forage oat-NDO-1 -10; BN Hybrid - 10)
Radio Talks: 2

AICRP on FC & U, TNAU, Coimbatore

Papers in research journals

Iyanar K, Kalamani A, Babu C, Sudhagar R, Sivakumar SD, Premnath A, Ezhilarasi T, Ganesamurthy K and Geetha S. 2021. A high biomass yielding legume fodder variety Desmanthus CO 2 suited for all states of India. EJPB., 12(1):137-141.

Babu C, Sudhagar R, Iyanar K, Sivakumar SD, Ezhilarasi T, Ganesamurthy K and Geetha S. 2021. A high green fodder yielding Cumbu Napier hybrid grass CO 6 suited for the states of Central and North Western Zones. EJPB., 12(1):17-21

Important persons visited to AICRP FC centre

- Golden Jubilee Forage Garden (AICRP on FC & U) and Solar Dryer was inaugurated by Prof. Dr. N. Kumar, Vice Chancellor, TNAU on 24.09.2020.
- Dr. C. Balachandran, Vice-Chancellor of TANUVAS, Chennai on 09.10.2020.
- Biodiversity Heritage Site Committee members *viz*., Dr. D. Narisimhan and Dr. C.P. Rajkumar on 28.10.2020.
- Prof. Dr. N. Kumar, Vice Chancellor, TNAU visited Cumbu Napier Hybrid grass clonal nursery on 20.11.2020.
- Mr. C. Ponnaiyan, Vice – Chairman of State Development Policy Council on 11.01.2021 to review the progress of TANII Scheme (2020-21).
- Dr. Praveen Rao Velchala, Vice Chancellor, PJTSAU on 05.02.2021.
- Dr. G.R. Chintala, Chairman of NABARD on 10.02.2021
- Mr. Sam Joseph, General Manager, and his team from HATSUN Agro Product Ltd., on 03.03.2021 to review the progress of HATSUN Chair Assistant Professor Chair Scheme.

Student(s) guided:

- Ph.D. in Plant Breeding and Genetics – 4; M.Sc. (Agri.) in PBG – 1;
- M.Sc. (Agri.) in Agronomy -1
- M.Sc. (Agri.) in Entomology – 1.

FTDs conducted: 20

Externally funded project: 3

SN	Title of the project	Sponsors	Duration	Outlay	PI
1.	HATSUN chair Assistant Professor scheme in PB&G for forage Crop research	HATSUN Agro Product. Ltd. (HAPL)	2018-23	Rs. 64.74 Lakhs	Professor and Head AICRP (FC&U) i/c
2.	Pelletization of Forage Crops for enhancing livestock productivity	TANII, GoTN	2019-21	Rs 210.00 lakhs	Dr. S.D. Sivakumar & Dr. K.N. Ganesan
3.	Expansion of Activities of Biotech-KISAN Hub in Two Aspirational districts (Virudhunagar and Ramanathapuram)	DBT, New Delhi	2019-21	Rs 76.00 lakhs	Dr. S.D. Sivakumar Dr. K.N. Ganesan
Total				**350.74**	

Training conducted for farmers/ NGO/ Govt. officials: 7 through KVKs of TNAU,

S. No.	Title of training	No. of trainees	Date	Districts
1.	Pelletization of Forage Crops	25	29.01.2021	Salem
2.	Pelletization of Forage Crops	25	02.02.2021	Villupuram
3.	Pelletization of Forage Crops	25	03.02.2021	Cuddalore

4.	Pelletization of Forage Crops	25	04.02.2021	Vellore
5.	Pelletization of Forage Crops	40	09.02.2021	Tiruppur
6.	Pelletization of Forage Crops	30	18.02.2021	Madurai
7.	Pelletization of Forage Crops	25	19.02.2021	Kanyakumari
	Funding Agency	GoTN - TANII		
	Budget	Rs.2.8 lakhs		

Details of seed/ planting material sold (2021-22)

S. No.	Crop/ variety	Class of seeds	Quantity produced	Quantity supplied	Balance	Expected production (2021-22)	Total quantity
I	**SEEDS (kg)**						
1.	Multicut Fodder sorghum CO (FS) 29	BS	167.00	167.00	-	100.00	100.00
		TFL	-	-	-	100.00	100.00
2.	Fodder sorghum CO 31	BS	456	456		112.00	400.00
		TFL	517.65	60.65	457.00	1000.00	1,012.25
3.	Fodder Cowpea TNFC 0926	BS	50.00	50.00	-	250.00	250.00
4.	Maize African tall	TFL	13.00	3.10	9.90	100.00	502.15
5.	*Desmanthus* CO 1	TFL	36.30	28.25	8.05	500.00	1,317.85
6.	Desmanthus CO 2	BS	2.00	2.00	-	12.00	12.00
7.	Lucerne CO 3	BS	-	-	-	75.00	75.00
		TFL	0.20	-	0.20	100.00	103.15
8.	Agathi	TFL	0.60	0.30	0.30	500.00	501.30
Total			**1242.75**	**767.30**	**475.45**	**2849**	**4,373.7**
II	**PLANTING MATERIAL (Nos.)**						
1.	BN hybrid CO (BN) 5 stem cuttings		10,000	8250	1750	10,00,000	10,01,750
2.	Guinea grass CO (GG) 3 rooted slips		100	50	50	1,000	1,050
Total			**10,100**	**8,300**	**1,800**	**10,01,000**	**10,02,800**

AICRP on FC&U, PJTSAU, Hyderabad

Book chapter

Shashikala T. 2020. Pachimetha -Pasugrasa Pantalu . In: Skil Oriented Training Programme For Young Farmers Training Manual . 2020. (Ramanjaneyulu, A V., Saritha A and Jagan Mohan Rao P. Eds). pp 60 – 71 . Organised by PJTSAU with Cornell Sathguru Foundation for Development and Aurobindo Pharma Foundation At ARS, Tornala. (Publication No.: 11/TM/PJTSAU/2020)

Student's guidance	:	3 as Major adviser, 1 as minor adviser
Guest lecturers	:	3
Workshops/ symposia	:	2
21 days training programme	:	2
TV Programme	:	2 phone in live programmes for DD Yadagiri
Radio programme	:	1
Popular articles	:	1
FTDs	:	25

AICRP on FC&U, UAS (B) ZARS, Mandya

Awards: Certificate of Appreciation for Development of Production technologies in forage crops form, ICAR-IGFRI, Jhansi

- Agase Intercropping with BN Hybrid or perennial fodder sorghum
- Perennial grass based cropping system involving Bajra Napier Hybrid grass with *Sesbania grandiflora*

Papers in research journals

Shekara BG, Mahadevu P, Chikkarugi NM and Manasa N. 2020. Enhancing productivity and quality of fodder through organic source of nutrients in fodder Cowpea - Maize Cropping System. *Int. J. Curr. Microbiol. App. Sci* (2020) Special Issue-11: 914-930.

Extension folder in Kannada: 01

- Leaf folder in local language entitled "Improved production technologies for higher green forage yield" released during NGM Kharif-2021

External examiner/ thesis evaluation- Served as external examiner for Ph.D thesis correction

Administration/ Farm Management/Coordination

Served as member of the Committee for uplifment of Jaggery Park at V C Farm, Mandya.

- Served as a member of the committee for selection of farmers for district best farmers award of Mysore district.

Important persons visited to AICRP-FC centre

- Shri. B C Patil, Hon'ble Minister of Agriculture, Govt of Karnataka.
- Boards Members of UAS, GKVK, Bengaluru.
- Vice chancellor. UAS, GKVK, Bengaluru.
- Director of Research, UAS, GKVK, Bengaluru.

Teaching activities - Courses handled

- Crop production Technology-2 AGR 221 (1+1) oil seeds, commercial crops & fiber crops COA, Chamarajanagara – UG Course
- Principles and Practices of weed Management AGR 503 (1+1) (CoA, Mandya) – PG course
- Breeding Cereals, Forages and Sugarcane GPB 511 (2+0) – PG course

Student(s) guided:

- **M.Sc.** (Agri.) in GPB – 2
- **M. Sc.** (Agri.) in Agronomy- 1
- **Ph.D.** (Agri.) in Agronomy- 1

No. of FTDs conducted: 20

Seminars/Conferences/ Symposia/ workshops attended

Sl. No	Title	Date	Events held at	Scientist Participated
1	Current Scenario and Path Forward for GM Crops in India	28th January, 2021	UAS, GKVK, Bangalore	Dr. B G Shekara Mr. Nagesh Chikkarugi
2	ESI Young Entomologist Award Lectures	9th January, 2021	Entomological Society of India, New Delhi -110012	Mr. Nagesh Chikkarugi
3	Technical Meet of Agronomist	16th to 18th February 2021	UAS, GKVK, Bangalore	Dr. B G Shekara

4	Environmental Ethics & Ecological restoration: Issues and Strategies	05/06/2021	MPUAT, Udaipur (Rajasthan)	Dr. Nagesh Chikkarugi
5	Public Private Partnership for Sustainable Irrigation	07/06/2021	DDG- Agricultural Education-ICAR-New Delhi	Dr. B G Shekara
6	Increasing farmers Income: Way Forward	18/06/2021	UAS, Bangalore	Dr. Nagesh Chikkarugi
7	Business opportunities in exporting of fruits and vegetables-Alumni Association, UAS, Bangalore	20/06/2021	UAS, Bangalore	Dr. B G Shekara

Training/Desi Programme attended as rescores person-RSK visit

SN	Title	Date	Place	Scientist
1	Oilseed production technology	12-02-2021	KVK, Mandya	Dr. B G Shekara
2	Cotton and Jowar production technology	26-02-2021	KVK, Mandya	Dr. B G Shekara
3	Pulse production technologies	18/03/2021	DATC, Nagenahalli	Dr. B G Shekara
4	Forage Crop Production	08/06/2021	EEU, Nagenahalli	Dr. B G Shekara

TV talk:01

Details of seed/ planting material sold

S. No.	Crops	Root Slips Sold (In Lakhs)
1.	Napier Bajra Hybrid (Co-3)	0.15
	Napier Bajra Hybrid (BNH-10)	0.10
2	Guinea grass (JHGG-08-1)	0.05
3	Rhodes grass (Selection)	0.02
4	Signal grass(Selection)	0.02

Quality seed production for the year 2020-21

SN	Crop	Variety/ Hybrids Parental line	Class of seed	Quantity Produced (q)
1	Forage Cowpea	MFC-09-1	NS	0.1
2	Forage Cowpea	MFC-08-14	NS	0.1
3	Fodder Cowpea	MFC-09-3	NS	0.05
4	Fodder Cowpea	MFC-08-14	BS	2.0
5	Fodder Cowpea	MFC-08-14	BS	2.0

Externally funded projects: 01

- Accelerating green fodder production through establishment of model demonstration and multiplication units in southern Karnataka with budget outlay of 25 lakhs. (Dept of animal husbandry and veterinary services, GOK)

AICRP on FC&U, PAU, Ludhiana

Papers in research journals

Amandeep, Kapoor Rahul and Singh Gurpreet. 2021 Genetic variability and association study from exotic germplasm accessions in fodder oats (*Avena sativa* L.) *Forage Res.*, 46 (4): 332-336.

Kaur Gagandeep, Kapoor Rahul, Sharma Priti and Srivastava Puja. 2021. Molecular characterization of oats (*Avena sativa* L.) germplasm with microsatellite markers. *Indian J. Genet. and Pl. Breed.*81(1): 144-147

Kaur Maninder and Oberoi Harpreet Kaur. 2021. Evaluation of fodder productivity, grain yield and economics of dual-purpose wheat and single cut Egyptian clover intercropping system. *Agriculture Research Journal*. Accepted

KaurManinder, Oberoi Harpreet Kaur and Ashlesha. 2021. Interactive effects of fertility levels and genotypes on production potential, quality estimation and disease incidence of forage sorghum. *Forage Research*. Accepted

Oberoi HK, Singh J, Tiwana US and Goyal M 2021 Interactive effect of irrigation regimes and sowing dates on morphophysiological response, fodder yield and quality and antinutrient HCN of multi-cut sorghum in the semi-arid region. *Maydica* 66 (1):1-20

Kumari A, Goyal M and Kumar R 2021 Nutritional evaluation of sorghum genotypes with varying resistance to shoot fly, *Atherigonasoccata* (Rondani) infestation. *Range Management & Agroforestry* (Accepted)

AshleshaAtri, Cheema, H.K. & Singh, N. 2021. Ecofriendly management of stem rot of berseem caused by *Sclerotiniatrifoliorum*. *European Journal of Plant Pathology*.160: 649-662. https://doi.org/10.1007/s10658-021-02273-0

AshleshaAtri and ManinderKaur 2021. Influence of nitrogen levels and non-chemical management strategies on sheath rot (*Sclerotiumrolfsii*) of napier hybrid. *Journal of Plant Diseases and Protection*.128: 725–734 https://doi.org/10.1007/s41348-021-00426-1

Bhardwaj NR, Atri Ashlesha, Rani Upasana and Roy AK 2021. A logistic regression model for predicting *Sclerotinia* stem rot in Egyptian clover (*Trifoliorum alexandrinum* L.). *Legume Research*. 10.18805/LR-4492.

Bhardwaj NR, Atri Ashlesha, Rani Upasana and Roy AK 2021. Prediction model for gray leaf spot disease of fodder sorghum. *Indian Phytopathology*, 74(1): 61-67. https://doi.org/10.1007/s42360-020-00278-z.

Papers presented in Symposia/Workshops:

Kaur Maninder and Oberoi Harpreet Kaur. 2021. Heat unit requirement, fodder yield and quality of pearl millet varieties under different sowing windows in Central Punjab. Extended summary published in National Conference on “Strategic Reorientation for Climate Smart Agriculture” held during March 17-19, 2019 at PAU, Ludhiana.

Kaur Maninder, Oberoi Harpreet Kaur, Gangaiah B and Satpal. 2021. Foliar sprays of growth regulators and nutrients to alleviate drought impacts on forage sorghum. Poster presented in International Plant Physiology Virtual Symposium on “Physiological Interventions for Climate Smart Agriculture (IPPVS 2021)” held during 11-12 March, 2021, at ICAR-Sugarcane Breeding Institute, Coimbatore, Tamil Nadu, in collaboration with Indian Society of Plant Physiology (ISPP), New Delhi, India.

Kaur Aanchaldeep and Goyal Meenakshi 2021 Weather parameters alteration with staggered planting influence nutritional quality and nitrate-N content in forage oat (oral presentation)Virtual National conference on “Stretegic orientation for climate smart Agriculture” held on 17-19 March, 2021 (Poster)

Extension publications

Singh Devinder pal, Sohu RS and Kaur Maninder 2021. Berseem de beejutpadansambandhizaroorinukte. *Bahumantvi Kheti* 4(10): 10. (January 2021).

Singh Devinder pal, Meenakshi and Kaur Maninder 2021. Garmiyanvich hare chariyan di kasat de sudhredhange. *Bahumantvi Kheti* 4(11): 11-13. (April 2021).

Kaur Maninder and Oberoi Harpreet Kaur 2021. Guna nal bharpur ate sakhatjan chara – bajra. *Vigiyanak Pashu Palan* 15(9): 7-8. (May 2021).

Kaur Maninder, Oberoi Harpreet Kaur and Singh Devinder Pal 2021. Year-round production of green fodder. *The Tribune*, pp-2. (May 2021).

Singh Devinder Pal, Garg Tosh and Goyal Meenakshi 2021. J1007- A new forage maize variety.Progressive Farming, 57 (3): 11.

Cheema Harpreet Kaur and Ashlesha 2021. Sauni de charediyaphaslan de much kide ate bimariyan. VigyanikPashuPalan 15(8): 9-11

Oberoi Harpreet K, Kaur Maninder and Kapoor R 2021 DudharuPashuaan nu sarasaalharachaaradeo. Chardikala, April, 21.4.2021

Students guided: M. Sc. :6 ; Ph.D. :1
FTDs conducted: Oats = 120 (OL 12 = 40, OL 13/OL 1869-1 = 40, OL 14/OL 1874 = 40)

Details of seed/Planting material sold to farmers during Rabi 2020-21:

Crop	Variety	TL (q)	C/S (q)	F/S (q)	B/S (q)
Berseem	BL 1	-	-	-	1.25
	BL 10	5.60	40.00	3.50	3.50
	BL 42	30.00	4.66	-	5.49
	BL 43	2.00	-	-	3.30
	BL 180	-	-	-	-
Oats	OL 9	-	-	-	4.50
	OL 10	80.00	14.00	5.00	24.50
	Kent	--	16.95	2.90	6.50
	OL 11	6.50	-	-	4.00
	OL 12	2.20	-	-	3.50
	1769-1	-	-	-	6.00
	1802	-	-	-	5.50
	OL 13	22.50	-	-	-
	OL 14	40.00	-	-	-
Rye grass	PBRG 1	11.70	-	-	-
	Total	**200.50**	**75.61**	**10.40**	**68.04**

External funded Projects: (2)

Name of the Project/Scheme	Funding Agency	Amount of the Project	Name of PI/Co-PI
Breeding for development of baby corn hybrids	ICAR-Indian Institute of Maize Research, Ludhiana	1,09,59,000	Dr. Meenakshi Goyal
Development of low lignin mutants sugarcane through mutagenesis and genome editing approach	IIMR-CSIR	33,00,000	Dr. Meenakshi Goyal

AICRP on FC&U, BAU, Ranchi

Award : Award received from IGFRI, Jhansi during kharif 2020 to team of BAU, Ranchi for Contribution Towards Development of Technology **"Intercropping of Oat+*Lathyrus* in split rows for higher fodder production"** identified during 2019.

Extension Bulletin

Prasad, Yogendra and Kumar, Birendra (2020). Dinanath gash ki Buwai kar pasuwo ke liye hara chara utpadan kare.

Abstracts in Seminar/Symposium

Mahto Ajay Kumar; Kumar, Kamleshwar; Prasad, Krishna; Kumar, Ravi; Ekka, Savita; Mahto, Chandra Shekhar and Prasad, Yogendra (2020). Evaluation of Chickpea (*Cicer arietinum* L.) Genotypes under different Growing Environments. Published in National Seminar on Ranchi Chapter (Indian Society of Genetics & Plant Breeding, New Delhi) on Crop Breeding for Wider Adaptation held on 12th & 13th December, 2020 at BAU, Ranchi. Pp 84-85.

Mahto Ajay Kumar; Kumar, Kamleshwar; Prasad, Krishna; Kumar, Ravi; Ekka, Savita; Mahto, Chandra Shekhar and Prasad, Yogendra (2020). To Study the Genetic Variability, Correlation and Path Analysis of Chickpea (*Cicer arietinum* L.) Genotypes under different Growing Environments. Published in National Seminar on Ranchi Chapter (Indian Society of Genetics & Plant Breeding, New Delhi) on Crop Breeding for Wider Adaptation held on 12th & 13th December, 2020 at BAU, Ranchi. Pp 88-89.

Prasad Yogendra; Kumar, Sunil; Kumar, Kamleshwar; Singh, D. N. and Kumar, Ravi (2020). Genetic Diversity Study in Forage Oat (*Avena sativa* L.). Published in National Seminar on Ranchi Chapter (ISGPB, New Delhi) on Crop Breeding for Wider Adaptation held on 12th & 13th December, 2020 at BAU, Ranchi. Pp 86-87.

Rani Varsha; Prakash, Surya; Surin, Supriya; Kumar, Arun; Verma Nutan; Kumar, Kamleshwar ; Prasad, Yogendra and Singh, D. N. (2020). Effect of Electro-Smog on Plant Grow and Development. Published in National Seminar on Ranchi Chapter (ISGPB, New Delhi) on Crop Breeding for Wider Adaptation held on 12th & 13th December, 2020 at BAU, Ranchi. Pp 85-86.

Student Guided: Ph.D-1 in PBG, M.Sc-1 in Agronomy

Participation in Seminar/Conference

- National Webinar on Breeding of Oilseeds: A Challenge for self-Sufficiency organised by BAU, Sabour, Bhagalpur on 29th July 2020.
- National Webinar on Plant Biological Interventions for Climate Smart Agriculture organised by BAU, Sabour, Bhagalpur on 30th July 2020.
- National Web conference on Enhancing Livestock Productivity for Food Security through Advance Genetics and Reproductive Techniques organised by BAU, Sabour, Bhagalpur on September, 30th 2020.
- Three days International Webinar on "Omics in Agriculture" organised by RPCAU, Pusa (Samastipur) on September, 7th - 09th October 2020.
- Two days Webinar on CROP BREEDING FOR WIDER ADAPTATION" Jointly Organised by ISGPB, New Delhi and BAU, Ranchi on 12 & 13 December, 2020.

AICRP on FC&U, CAU, Imphal

Extension Activities

- Resource person : 3
- Interaction programme : 4

FTDs conducted – 25 (Oat variety Kent- 10, Oat variety JHO-822 – 15)

TSP activity:

- 441 families from different villages under the district of Kangpokpi, Imphal west, Churachandpur and Chandel, Manipur were benefited **– inputs in the form of** Napier hybrid cutting, fodder seeds (rice bean, Cowpea Maize, oats, etc.), fertilizers, Fish fingerling, Poultry chicks and duckling etc were provided to the farmers

M.Sc / Ph.D students guided

- Ph. D. (Agri.) as Co-guide - 01
- M. Sc. (Agri.) as Co- Guide- 01

Courses taught - Fodder crops and Dryland agriculture.- 35 topics
Publications - Research paper -1 Bulletins - 1
Revenue generated - Selling of Napier cutting- Rupees 30,000
Inputs supplied

- Fodder maize seed, Hybrid Napier cutting, rice bean seed, oats seed, chemical fertilizers, plant protection chemicals etc were supply to FTDs beneficiaries.
- Any type of fodder seed (seasonal, perennial, perennial cutting etc) are made available at the AICRP on Forage Crops & Utilization, CAU, Imphal Centre.

University Assigned Activities

- Assigned as Co-PI in the Project Sustainable Livelihood Development of Farmers under Farmers FIRST Programme component.
- Assigned as Co-PI in the Project ICAR-IGFRI NEH Component Project.
- Assigned as Co-PI in the Project Identification of Climate resilient food crops, traditional rice varieties of Manipur and their production enhancement through Scientific manipulation having least impact to climate Change.
- Assigned as committee chairman and members in many programme and initiated by CAU, Imphal

*Scientist and staff of AICRP on Forage crops of CAU Imphal centre are also actively involved in many activities in the CAU Head Quarter and Directorate of Research office of CAU, Imphal

AICRP on FC&U, BCKV, Kalyani

Papers in research journals

Atta K, Pal AK and Jana K 2020. Effects of salinity, drought and heavy metal stress during seed germination stage of ricebean [*Vigna umbellate* (Thunb.) Ohwi and Ohashi]. *Springer Plant Physiol. Rep*

Atta K., Karmakar S, Dutta D, Pal AK and Jana K 2019. Comparative physiology of salinity, drought and heavy metal stress during seed germination of ricebean [*Vigna umbellate* (Thunb.)].*Journal of crop and Weed*, 15 (3): 145-149.

Banerjee S, Jana K, Mondal R, Mondal K and Mondal A 2020. Effect of seed priming on growth and yield of hybrid maize-lathyrus sequence under rainfed situation. *Current Journal Applied Science and Technology* 39 (1): 126-136.

Banerjee S, Jana K, Mondal R, Mondal K and Mondal A. 2020.Yield attributes and yield of hybrid maize *(Zea mays* L.) and (*Lathyrus sativus* L.) in sequence as influenced by seed priming under rainfed situation. *International Journal of Environment and Climate Change* 10(12): 550-560.

Biswas S, Jana K, Agrawal RK and Puste AM 2020. Effect of integrated nutrient management on green forage, dry matter and crude protein yield of oat in oat – lathyrus intercropping system. *Journal of Crop and Weed* 16 (2): 233-238.

Biswas S, Jana K, Agrawal RK, Puste AM 2020. Impact of integrated nutrient management on performance of oat-grasspea cropping systems, competition indices and residual soil fertility. *International Research Journal of Pure & Applied Chemistry.* 21 (24): 358-371.

Goswami S, Mondal R, Puste AM, Sarkar S, Banerjee H, Jana K 2020. Influence of irrigation and tillage management on growth, yield and water-use efficiency of wheat (*Triticum aestivum*) in Gangetic plains in West Bengal. *Indian Journal of Agronomy,* 65 (1): 47-52.

Jana K, Mondal R and Mallick GK 2020. Growth, productivity and nutrient uptake of aerobic rice (*Oryza sativa* L.) as influenced by different nutrient management practices. *Oryza* 57: 49- 56.

Khan R, Biswas S, Kundu CK, Jana K 2020. Effect on conservation tillage on yield and economics of fodder crops. *International Journal of Environment and Climate Change* 10(12):529-539.

Mondal K, Mallick GC, Jana K, Banerjee M 2020. Performance of herbicides on weed growth and productivity of dry season transplanted rice. *Journal of Crop and Weed* 16 (3): 91-96.

Mondal R, Goswami SB, Jana K 2020. Effect of different nutrient management practices on growth, grain yield, production economics, soil nutrient availability of transplanted *kharif* rice (*Oryza sativa L.*) and correlation studies. *Journal of Crop and Weed* 16(1): 172-179.

Mukherjee B, Ghosh M, Banerjee S, Jana K 2020. Response of rice hybrids to irrigation levels for yield, quality and water use during boro season in lower Gangetic plains of West Bengal. *Oryza* 57(4):310-314.

Sana M, Jana K, Mondal R, Mondal K and Banerjee H 2020. Integration of chemical fertilizer with biological products on growth and production of rice during wet season. *Oryza* 57 (3): 211-218.

Popular articles: 3 (in bengali)
Student(s) guided: M. Sc. (Ag.) in Agronomy – 1, Ph. D. in Agronomy- 3

Courses taught: AGR-554: Agronomy of fodder and forage crops and other courses

FTDs conducted: 40 units (*Rabi*, 2020-2021) - Berseem (cv. Mescavi) - 10 units, Oat (SC) (cv. Kent) – 10 units and Lathyrus (cv. Prateek) – 20 units, respectively

TSP activities: 170 tribal farmers of Pingla, Narayangarh, Debrea block of Paschim Medinipur district, Binpur –II block of Jhargram and Raipur block of Bankura district (Red & laterite zone i.e. western part) were benefitted by different field activities organized under TSP Programme of AICRP on FC & U, BCKV, Kalyani centre. TSP interventions were implemented at Bankura, Jhargram and Paschim Medinipur district. Forage Maize (cv. J 1006), *Moringa* seeds, Rice bean (cv. Bidhan Ricebean-1, Bidhan rice bean-2 & Bidhan Rice bean-3), Hybrid maize (cv. Disha), Coix (cv. Bidhan Coix-1), forage mungbean (cv. Meha), Mustard (cv. Punjab Keshari), forage Blackgram (cv. Sulata), planting materials (cuttings) of Bajra-Napier Hybrid (CO 3, CO 4 & CO 5), Lathyrus (cv. Prateek) and forage groundnut (cv. TG 25) along with r*hizobium* culture, insecticides, herbicides, fungicides, Knap sack sprayer, plastic bucket were distributed among selected tribal farmers.

Farmers' Meeting: 4 (Four)

Externally Funded Project: 2 (Private Company)

Establishment and management of Forage Garden at CRF, BCKV, Gayeshpur, Nadia.

Reviewer of research papers in ORYZA International Journal, Cuttack, Odisha & another in Journal of Crop and Weed, BCKV, Mohanpur, Nadia, West Bengal-741252.

Monitoring the AICRP on FC & U-BAU, Ranchi Centre, Jharkhand and CAU, Imphal during rabi-2020-2021 through online platform.

Participated in seminar/farmers' meeting etc

- Farmers' Meet on forage production technology with tribal families/farmers at Pingla block (Vill-Sangar Batitaki & Vill- Jamna), Narayangarh (Vill- Ganga-Jamuna & Vill- Bakhrabad) of Paschim Medinipur district of West Bengal (western part) under TSP.
- Participated as resource person and delivered lecture on "Modern Agronomic Technology & Management Practices in Crop Production" in Training Programme organized by AICRP on Forage Crops, BCKV, Kalyani at Belti of Narayangarh block under FTDs programme with maintaining COVID-19 protocol.
- Participated as resource person and delivered lecture on Forage Crops Production Technology at Jamna village of Pingla block of Paschim Medinipur district.

Awareness development on 'seed production' of forage crops: Seed production of lathyrus (cv. Prateek/Ratan) and Oats (cv. Kent) by farmers for their own uses as seed for the next year.

Transfer of technology

- Distributed the seeds of berseem (cv. Mescavi) and lathyrus (cv. Prateek/Ratan) to the resource poor farmers for popularizing as an under canopy legume crop in nutrient enrichment and fodder production in the litchi, mango, banana and guava orchards.
- Introduced oats as dual purpose *i.e* green forage cum seed production and grasspea as '*paira'* crop (dual purpose) in Pingla, Narayangarh block area in Paschim Medinipur district and Raipur block of Bankura district under western zone of West Bengal.
- Given online trainings to the farmers' club, Women SHGs of different districts (Bankura, Nadia, Purulia, Paschim Medinipur, North-24 Parganas).
- Distributions of leaflets on forage crops among the farmers.
- Distributed the planting material (cuttings) of BN hybrid (Variety: CO 3, CO 4 & CO 5) and rooted slips of guinea grass to the resource poor farmers in Bankura, Jhargram, Paschim Medinipur, Nadia and North-24 PGS districts etc.
- Provided the seeds of oats, lathyrus and berseem to the scientists of UBKV, Cooch behar, and College of Agriculture, Agartala, Tripura for research purposes.
- Provided lathyrus (cv. Prateek/Ratan) seeds for research purpose to different Institutes.
- Distributed hybrid maize seed (cv. Disha) to the resource poor tribal farmers for popularizing as baby corn cum green forage/ green cob cum green forage as well as grain cum stover production.

AICRP on FC&U, KAU CoA, Vellayani

Papers in research journals

Mubeena P and Thomas Usha C. 2021. Fodder for climate resilient agriculture: A review. *Forage Res.* 46 (4): 295-301

Popular articles

Thomas Usha C. 2021. Fodder trees. Karshakasree (June 2021). pp78-79

Mubeena P and Thomas Usha C 2021. Fodder maize cuitivation. Karshakan (July 2021) p.54-55

Navya MV, Deepthi C, Mubeena P and Thomas Usha C. 2021. Humic substances-an elixir to plant growth. Biotica Research Today 3(6):435-436

Deepthi C. Navya MV, , Mubeena P and Thomas Usha C . 2021. Coconut based fodder production in Kerala. Biotica Research Today 3(6):443-444

Navya MV, Deepthi C, Mubeena P and Thomas Usha C. 2021. Beneficial microbes as plant biostimulants. Agri-biotech E.Newsletter1(2):18-19.

Webinars for dairy farmers

- Three webinars were organized for dairy farmers in Trivandrum district on 19.5.2021, 22.05.2021 and 26.05.2021.Topics ‘Scientific fodder cultivation and preservation methods’ and ‘Balanced animal nutrition’. Total number of participants- 182.
- An online training was conducted on 26.06.2021 for TSP beneficiaries in Wayanad district-on the topic- Scientific backyard poultry rearing. Number of participants- 60

Tribal sub plan programme (TSP)

- In March 2021, distribution of layer hen to Tribal women in Wayanad district. KAU-KVK, Wayanad in collaboration with Kudumbashree Mission, Government of Kerala, has launched their Tribal Smart Village Adoption Programme 2020-2021, in Tirunellypanchayath of Mananthavady Block. We are also collaborating with KVKs for above said programme, in Tirunellypanchayath of Mananthavady Block for implementation of TSP programme.
- The official inauguration of the programme was conducted on 18.06.2021 in online mode. Hon. MLA of Mananthavady, Wayanad inaugurated the programme. Hon.Vice chancellor of KAU, Director of Research, Director of Extension and Associate directors participated in the programme (online).The programme is being implemented through Kudumbashree mission of Government of Kerala. Beneficiaries were identified by Kudumbasree mission from this area and we could give 400 layer hens to the beneficiaries. The hens were reared in KVK, Wayanad and the breed is suitable for backyard rearing in Kerala. The hen will be reared by the Tribal society in a group farming model in participatory mode and profit will be shared among the beneficiaries.

Farmer help Desk- Dr.Usha C Thomas is a member of the farmers help desk, formulated by RARS(SZ), Vellayani and answered queries of farmers related to Fodder cultivation.

<u>Student(s) guidance</u>

PhD in Agronomy- 2
M.Sc. (Agri.) in Agronomy-3
M.Sc. (Agri.) in Plant Breeding and Genetics-4
M.Sc. –Integrated Biotechnology-1

Teaching- Courses

Dr.Usha C Thomas-

- Agro1101- Introductory Agrometeorology& Climate change(1+1)-
- Agron 605- Irrigation management(2+1)
- DOF1101- Introductory Agriculture (1+0)
- Elcp 4207 (0+10)

Dr.Gayathri G

- Pbgn 3205 – Intellectual Property Rights (1+0)
- Pbgn 2204 Crop Improvement-2 (1+1)
- Pbgn 1102- Principles of Genetics and Cytogenetics (Old Scheme) (2+1)
- GP520- Genetics (Remedial course for M.Sc.(Ag.Stat.)(2+0)
- GP518- Breeding of Tropical Crops(1+1)
- GP605- Advanced Plant Breeding Systems (2+0)

EAPs

Dr.Usha C Thomas is the PI

- Revolving Fund scheme on 'Planting material production in fodder crops', funded by KAU
- Kerala State plan project 2020-21 on 'Performance Evaluation of Promising Fodder Varieties in Different AEUs in Kerala'

Dr.Gayathri G is the PI

- Kerala State plan project 2020-21 on 'Identification of *Stylosanthes* species for yield and quality suited for cultivation in Kerala'

Awards/Appreciation

- Received two letters of appreciation for the two fodder production technology developed during 2020 from ICAR during the National Group Meet Kharif 2021 of AICRP on Forage Crops and Utilization on June 1-2,2021.

Additional Duty

- Usha C Thomas as Assistant Warden, UG Ladies Hostel, College of Agriculture, Vellayani
- Gayathri G Assisting Academic Officer (UG) in day-to-academic matters of Undergraduate students and nodal officer for KSHEC Higher Education Survey 2018-19

HRD- Participation in Trainings

Dr. Usha C Thomas attended IFFCO online webinar on Nanourea on 3.06.2021

Dr. Gayathri G.

- Attended a webinar entitled 'Biomimicry Innovation Inspired by Nature" on 12/05 conducted by IITM Bioincubator, IIT Madras
- Attended webinar on International Biodiversity Day 2021 on 22/05 conducted by Kerala State Biodiversity Board
- Attended webinar on Molecular techniques in crop improvement- Plantation crops and Spices on 29/05 conducted by the RARS(SZ), Vellayani
- Attended webinar entitled 'Taxonomy and its role in management of Plant Genetic Resources" on 19/06 conducted by Dept of Plant Breeding and Genetics, College of Agriculture, Vellanikkara as part of Monthly Webinar Series 21-22 Crop Improvement: Genetic Resources to Omics

- Attended webinar entitled ‘Translating genomcs for next generation crop improvement" on 10/06 conducted by TIGS (Tata Institute for Genetics and Society)
- Completed a MOOC on Theoretical Foundations of Educational Technology conducted by NAARM from 01/06 to 30/06

AICRP on FC&U, MPKV, Rahuri

Papers in research journals

Lagad PM, Pathan SH, Damame SV and Sinare BT. 2020. Effect of foliar nutrient management on growth, yield and quality of summer forage sorghum. *Forage Res* 46 (3) 271-273.

Gaikwad SA, Kulkarni SR, Landge SA and Wasu RS. 2021. Effectiveness of biopesticides against oat aphid, *Rhopalosiphum padi* L. International Journal of Chemical Studies 9(1): 2629-2633

Vanjare DC, Shinde GC, Shinde SD and Pawar VS. 2021. Genetic variability, heritability and genetic advance studies for green forage yield and associated traits in forage oat (*Avena sativa* L). International Journal of current microbiology and applied sciences 10(03) :488-493

Vanjare D, Shinde GC, Shinde SD and Pawar VS. 2021. Genetic diversity studies in forage oat (*Avena sativa* L) genotypes. International Journal of current microbiology and applied sciences 10(03) :494-501

Popular articles

Badhe Promod, Landge Sandip and Damame Shivaji. 2021. “Apatkalin Paristhitith Chara Pikanche Niyojan” ‘Shetkari-2021’ March, Page No. 12

Badhe Promod, Landge Sandip and Wanjare Devendra. 2021. “Unhali Hangamatil Chara Pikanchi Lagwad” ‘Shri Sugi Unhali-2021’, Page No. 21-31

Surana Prasanna, Landge Sandip. 2021. “Rahurit Vaishishtpurn Chara Vananchi Vividhata” ‘Sakal; Agrowon-12th May 2021’, Page No. 9

Surana Prasanna and Shinde Vijay. 2021. “Management of different Forages crops in *Kharif* Season” ‘Shri Sugi Kharif-2021’, Page No.46-48.

Visits of important persons to AICRP FC, MPKV, Rahuri centre

- Dr. SR Gadakh, Director of Research, MPKV, Rahuri on 8.02.2021 & 17.02.2021
- Dr. AS Jadhav, Head, Department of Botany, MPKV, Rahuri on 8.02.2021 & 17.02.2021.
- Shri. Narayan Shisode, Director, Soil and Water conservation, State Agril. Department on 17.02.2021
- Shri. Mohan Wagh, Registrar, MPKV, Rahuri on 17.02.2021.

Research Guidance

Plant Breeding	Dr. P.L.Badhe	: 01 M. Sc. (Agri.) student
Agronomy	Dr. N.J.Danawale	: 01 M.Sc (Agri.) student
Biochemistry	Dr. S. V. Damame	: 01 M. Sc. (Agri.) student
Entomology	Dr. S. A. Landge	: 01 M. Sc. (Agri.) student

HRD for the AICRP-FC / Training participation of staff:

- Dr. S. A. Landge attended 21 days online training on “Climate Smart Organic Farming” jointly organized by the Centre for Advanced Agricultural Science and Technology (CAAST) for Climate Smart Agriculture and Water Management (CSAWM) and Organic Farming Research and Training Centre, MPKV, Rahuri during February 15 to March 07, 2021.
- Shri. D. C. Vanjare attended 21 days online training on ”Modern Practices of Plant and Animal Nutrition for Sustainable Agriculture Production and Intensive Livestock Development” jointly organized by ICAR-IGFRI RRS, Dharwad and UAS Raichur and National Agricultural Development Cooperation Ltd. Baramulla (UT of J &K) during February 02 to 22, 2021.

- Dr. S. V. Damame attended 12 days online training on "Journey of Pearl millet" organized by Division of Biochemistry-ICAR-IARI, New Delhi during 1st to 12th March, 2021
- National Webinar on Fodder Management for Sustainable Livestock Production in Arid Zone (July 24, 2021) sponsored by SKRAU, Bikaner.

TV/Radio talk: Radio talk :01

Lectures to farmers in training programme: 03

Breeder Seed Production (*Rabi*-20-21)

S.N.	Crop	Variety	Quantity Seed Produced (qt.)
1	Oat	Phule Surabhi (RO-11-1)	10.00
2	Oat	Phule Harita (RO-19)	7.20
3	Oat	Kent	17.25

Visits of farmers and Govt. Staff of Agril. Department of Maharashtra State

- No. of Farmers visited to farm during *Rabi* 2020-21 : 160
- No. of Govt. officers/staff visited to farm during *Rabi* 2019-20 : 09
- Dr. P. S. Takawale, and Dr. R. V. Kale BAIF, Urulikanchan, Pune monitored the Rabi Forage trial on 8.02.2021.
- Dr. P. L. Badhe, and Dr. S.A.Landge visited the Rabi Forage crops trials at BAIF, Urulikanchan, Pune on 1.02.2021.

Important Meeting attended

- Attended Research Review Committee meeting of Product Testing on 16.03.2014 and Revolving fund meeting on 17.03.2021 and Entomology on 24/03/2021 and plant pathology as on 25/3/2021, Basic sciences on 26.3.2021, held at MPKV, Rahuri by online mode.
- Attended RRC Meeting of Agril. Botany as on 19 and 20 April. 2021
- Attended Research Finding Release Committee Meeting of Agronomy on 20.05.202021 and Agril. Entomology on 21.05.2021 and Agril. Botany 20-21.05.2021 held at MPKV, Rahuri by online mode
- Attended Research Planning Meeting of Agril Botany as on 02 to 03 June 2021, Agronomy on 7 to 8th June, biochemistry 9th June and Agril. Entomology, 10th June 2021

Farmer rally/ Shivarferi:

- Rabi day and Farmers shivarferi organized at AICRP on Forage crops, MPKV, Rahuri as on 17.02.2021
- Celebrated Vanmohotsav Programme (Krishidin) as on 7th July, 2021 on fields of AICRP on Forage Crops by planting 150 bamboo plants along the boundaries of fields.
- Presented the last year activities of forage project in Mogova Programme as on 01/04/2021
- Dr. S. A. Landge delivered lecture on Facebook Live on topic "Increase Farmers Income through Beekeeping" organized by Krishi Vidnyan Kendra, Dahigaon, Shevgaon, Ahmednagar, Krishi Vidnyan Kendra, Badnapur, Jalna on 20th May 2021 in occasion of "World Honey Bee Day".
- Dr. S. A. Landge delivered lecture on Facebook Live on topic "Increase Farmers Income through Beekeeping" organized by Krishi Vidnyan Kendra, Badnapur, Jalna on 20th May 2021 in occasion of "World Honey Bee Day".
- Tribal Sub Plan (TSP) was implemented on 22.01.2021 at Village Raipur, Tal- Navapur, Dist- Nandurbar by distribuing cycle hoe, Oat seed and delivered lecture by Dr, S.V. Damame, Dr. S. A. Landge, Shri. K.P.Pawar and Shri. M. D. Deshmukh on forage crop technology and crop protection technology.
- Lecture given by Dr. S. A. Landge on different types of Forage crops and their cultivation to the farmers group visited from Paithan, Dist- Aurangabad to Forage Project on 05/02/2021.

Laboratory testing of forage quality **Product testing**

SN	Company	Particulars	Testing fee (Rs.)
1	M/s Ajeet Seeds PVT. Ltd., Aurangabad	Fodder quality testing of sorghum & maize hybrids	Rs. 20000/-
2	M/s Crystal Crop Protection, Ltd. Aurangabad	Forage quality testing of sorghum hybrids	Rs. 12500/-

AICRP on FC&U, AAU, ANAND

Papers in research journals

Chaudhary JG, Shah SN, Patel HK and Shroff JC 2020. Effect of nitrogen and potash levels on green pod yield, quality and postharvest soil nutrient status of okra *(Abelmoschus esculentus* L. Moench) during kharif Season under Middle Gujarat Conditions. *Int.J.Curr.Microbiol.App.Sci.*, 9(5): 1619-1626.

Chaudhary NN, Patel RA and Patel HK. 2020. Effect of nitrogen, phosphorus and sulphur on growth and yield of Rajma (L.), *Green farming*, 11(2&3): 156-161.

Lakum YC, Patel HK, Patel GG, Makwana CF and Patel PD 2020. Yield and Yield attributes of maize as influenced by organic manures and inorganic fertilizers under Maize-Chickpea cropping Sequence. *Int. J. Curr. Microbiol. App. Sci*. 9(7): 994-1003.

Lakum YC, Patel HK, Patel GG, Patel PD and Patel DK. 2020. Residual effect of manure and fertilizer on growth, yield of chickpea and soil nutrient status under Maize-Chickpea cropping system. *International Journal of Chemical Studies* 9(4): 2940-2945.

Lakum YC, Patel HK, Patel KC, Patel GG and Patel PD 2020. Effect of organic manures and inorganic fertilizers on maize yield, chemical composition and seed quality under maize: Chickpea cropping sequence. *International Journal of Chemical Studies* 2020; 8(4): 145-146.

Patel GG, Patel HK, Lakum YC and Shah SN. 2020. Effect of organic and inorganic fertilizers in comparison with humic acid on wheat quality, nutrient content and soil nutrient status after harvest. *Green farming*, 11(2&3):195-198.

Shah SN, Patel HK, and Patel AP 2020. Effect of Spacing and Topping on Yield of Summer Sesame (*Sesamum indicum* L.). *Int. J. Curr. Microbiol. App.Sci.*, 9(5): 2312-2319.

Shiyal VN, Patel HK, Raval CH, Rathwa MK, Patel PS and Patel HK. 2020. Fodder yield and economics as influenced by integrated nutrient management on fodder dual purpose oat (*Avena sativa*). *Int. J. Curr. Microbiol. App. Sci.* 9(11): 3752-3758.

Sidapara Mayank P, Gohil DP, Patel Oarthik U and Sharma Deepak D. 2021. Heterosis studies for yield and yield components in okra [*Abelmoschus esculentus* (L.) Moench]. *Journal of Pharmacognosy and Phtochemistry* 10(1):1268-1275.

Vaghela GM, Mevada KD, Ninama SD and Patel HK. 2020. Influence of intercropping system and integrated nitrogen management in maize (popcorn) (*Zea mays everta* L.) - chickpea (*Cicer arietinum* L.) intercropping under middle Gujarat conditions. *International Journal of Chemical Studies*. 8(5): 1769-1774.

Vasava RL, Shah SN, Patel HK and Shroff JC. 2020. Effect of nutrient management through organic sources on quality, post-harvest soil nutrient and economics fenugreek (*Trigonella foenum-graecum* L.). *International Journal of Chemical Studies* 2020; 8(3): 277-279.

Training/Seminar /Conference attended/participated

- **Patel HK** has participated 21 Days National Training course on "Technology Interventions Towards Transformation of Agriculture, Sericulture, Animal Husbandry and allied sectors into sustainable Enterprises for Atmanirbhar Bharat" from 11th October to 31st October-2020 by Online mode.
- **Patel HK** has participated in **o**nline seminar on Advance in micro irrigation and fertigation for improving water use efficiency and crop productivity on 18th December-2020.
- **Patel HK** has participated in state level webinar on *rabi* crops fertilizer management by jointly organized by Indian Society of Soil Science, Anand chapter and Central for Agricultural marketing intelligence, NAHEP-CAAST, Anand Agricultural University, Anand on 09th November-2020.
- **Patel HK** and **Raiyani AM** has participated in state level webinar on Sajeev Khetima Pak Sanraksan was jointly organized by Plant Protection Association of Gujarat (PPAG) and Anand Agricultural University, Anand on 27th October-2020.
- **Patel HK** has participated in state level webinar on *Kharif* Pakoma Pak Sanrakasan Na Pravartman Prashno and Nirakarn was jointly organized by Plant Protection Association of Gujarat (PPAG) and Anand Agricultural University, Anand on 20th august -2020.
- **Patel H.K.** and **Raiyani A.M.** has participated in state level webinar on Shiyalu Shakbhajina pakoma pak Sanrakshan was jointly organized by Plant Protection Association of Gujarat (PPAG) and Anand Agricultural University, Anand on 6th October-2020.
- **Patel H.K.** has participated in online seminar on protection cultivation for enhanching resources use efficiency and productivity of horticulture crops was jointly organized by College of Agriculture, Vaso and and Central for Agricultural marketing intelligence, NAHEP-CAAST, Anand Agricultural University, Anand on 22nd December-2020.
- **Patel HK** has participated in World Soil Day Celebration-2020 state levels seminar on જીવત જમીન-સ્વસ્થ જમીન jointly organized by Indian Society of Soil Science, Anand chapter and Central for Agricultural marketing intelligence, NAHEP-CAAST, Anand Agricultural University, Anand on 05th December -2020.
- **Patel HK** has participated in the "National Webinar on कृ ष शक्षा के नयेआयाम एवंअवसर" organized by Directorate of Research, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan on 3 rd December 2020 under IDP-NAHEP (ICAR), New Delhi.
- **Patel HK** has participated in National Webinar on "Integrated Farming System and Farmers' Income" organized by Department of Agronomy, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan on 05th November, 2020 under Institutional Development Plan, National Agricultural Higher Education Project (NAHEP) of Indian Council of Agricultural Research (ICAR), New Delhi.
- **Patel HK** and **Raiyani AM** participated in state level webinar on *Kapas naa pako maa pak sharakshan* was jointly organized by Plant Protection Association of Gujarat (PPAG) and Anand Agricultural University, Anand on 20th august -2020.
- **Raiyani AM** has participated in online seminar on *cost effective and innovative green energy initiatives for futuristic agriculture* jointly organized by college of agricultural engineering and technology, AAU, Godhara and Central for Agricultural marketing intelligence, NAHEP-CAAST, Anand Agricultural University, Anand on 11th November-2020.
- **Raiyani AM** has participated in "National Webinar on *Management of Biotic and Abiotic Stresses in Protected Agriculture* organized by center of Advanced Agricultural Sciences & Technology on Protected Agriculture and Natural Farming CSKHPKV Palampur under the aegis of World Bank & Indian Council of Agricultural Research (ICAR), New Delhi jointly funded NAHEP Project on 22-24th September-2020.
- **Raiyani AM** has participated in Webinar on *Technical writing* organized by NAHEP-CAAST and center for Agricultural Market Intelligence, Anand Agricultural University, Anand on 16 and 17th October-2020.
- **Raiyani AM** has participated in Webinar on *Market Dynamics in Poultry Sector : Perspectives and Challenges* organized by NAHEP-CAAST and center for Agricultural Market Intelligence, Anand Agricultural University, Anand on 17 and 18th September-2020.
- **Raiyani AM** has participated in Workshop on *Trade in F & V Products and Commodities* organized by NAHEP-CAAST and center for Agricultural Market Intelligence, Anand Agricultural University, Anand on 15th September-2020.

- **Raiyani AM** has participated in Virtual Webinar on *Biotechnological Approaches for Crop Improvement* arranged to commemorate Late Dr. Diwakar R. Patel twelfth Memorial lecture, organized by BACA Alumni Association, Anand Agricultural University, Anand on 10th September-2020.
- **Raiyani AM** has participated in the National Webinar on *Contemplative Perspectives on Seed: Conservation, Quality Assurance and Supply Systems* Organized by ICAR-Indian Institute of Seed Science, Mau held on 10th September, 2020.
- **Raiyani AM** has participated in the National Webinar on *Recent Advances in underutilized Fruits* Organized by Department of Fruit Science, College of Horticulture, Sardarkrushinagar Dantiwada agricultural University, Jagudan, Mehsana held on 5th September, 2020.
- **Raiyani AM** has attended the Webinar on *Devlopment of Viral Vaccine and Other Preventative Measures in Pandemic* Organized by Department of Microbiology and Biotechnology University School of Sciences, Gujarat University, Ahmedabad, Gujarat held on 17th May, 2020.

Book Chapter published:

Patel HK, Rathod PH and Padheriya DR. Lila Ghaschara Tareeke Kathol Vargna Pakonu Mahatv (In Gujrati) In Book Kathol Pako published by Directorate of Extension Education, AAU, Anand.

Popular articles (Gujarati / English)

Patel HK, Rathod PH and Padheriya DR. 2020. Hybrid Napier (Gajraj Ghash): Best option for green fodder. *Krushi Govidhya*, Directorate of Extension Education, Anand Agricultural University, April-July-2020:, PP: 38-41.

Patel HK, Gohil DP, Padheriya DR and Raiyani AM 2020. *Pasu aahar mate no uttam kathod* pak: *Rajko* (2020). *Krushi Govidhya*, Directorate of Extension Education, Anand Agricultural University, November-2020:, PP: 10-12.

Patel HK, Rathod PH, Padheriya DR and Raiyani AM. 2020. Hybrid Napier (Gajraj Ghash): Best option for green fodder. *Krushi Jivan*, Gujarat State Fertilizer and Chemical Limited, -2020:, PP: 12-15.

Rathod PH, Patel HK and Bumbadiya Naresh 2021. ક્ષારીય જમીન અને તેની સુધારણા. Krushi Govidhya, Directorate of Extension Education, Anand Agricultural University, February issue. pp. 14-25.

P.G. Teaching during 2020-21:

Name	Course No.	Title of the course	Credit
Dr. D. P. Gohil	GP 511	Breeding for cereals, forage and sugarcane	2 + 1
Dr. H. K. Patel	AGRON 511	Agronomy of Forage Crops	2 + 1
	AGRON 601	Current trend in Agronomy	3+0
	PGS-506	Disaster Management	1 + 0
	ABM-519	Fertilizer Technology and management	2 + 0
	e-Course	Usefulness of disaster management in Agriculture, Distance Education at IDEA, AAU, Anand	1+0
Dr. Paresh H. Rathod	NRHM 4.7	Soil, Water and Plant Analysis B. Sc. (Hons.) Horticulture, 4th Semester College of Horticulture, AAU, Anand	1 + 1

Research Guidance

Name of Teacher	Name of Student	Degree	Present position
Dr. D. P. Gohil	Parmar Sumitkumar Virabhai	M. Sc. (Agri.)	Continue 3rd sem.
	Borkhatariya Tejaskumar Hardasbhai	M. Sc. (Agri.)	Continue 1st sem.
Dr. H. K. Patel	Shiyal Vikram Kumar	M. Sc. (Agri.)	Completed
	Patel Harsh K.	M. Sc. (Agri.)	Continue 3rd sem.
	Nagar Kuldeep	M. Sc. (Agri.)	Continue 1st sem.
	Badi Aehamadraza	M. Sc. (Agri.)	Continue 1st sem.

FTD conducted: Twenty -Lucerne crop *var*. Anand 2: 10 & Oat crop *var*. Kent: 10

Externally funded project:

- A project entitled "Quality Seed Production in Fodder Crops" under Fodder Development Programme funded by Govt. of Gujarat, Gandhinagar. **B.H. 18457-28**
- Evaluation of performance of chicklet variety funded by Foragen Seeds Pvt. Ltd., Hyderabad. **B.H. 18558-71**

Extension activities:

- Delivered lectures on "Ghaschara Pakonu Gunvatta Sabhar Beej Utpadan" in the course "Diploma in Agricultural Extension Services for Input Dealers (DAESI)" organized by Institute of Distance Education (IDEA), AAU, Anand on Date: 01.01.2021.
- Resolved some FAQ by farmer regarding Forage and Fodder crops

AGRONOMY

Region specific technology generated: Following recommendations for the farmers communities have been made in the SAUs Joint Combined AGRESCO meetings.

- **Effect of cutting management and fertility status levels on growth and seed yields of multicut forage sorghum [Sorghum bicolor (L.) Moench] var. CoFS-29:** The farmers of middle Gujarat agro-climatic zone growing multicut forage sorghum variety CoFS-29 for seed production purpose are recommended to apply 40 kg N/ha and 40 kg P_2O_5 /ha as basal and 120 kg N/ha in three equal splits at 30 days after sowing, after first cut (50 DAS) and at 30 days after first cut for obtaining higher seed yield and net return. (2018-19)

AICRP on FC&U, AAU, Jorhat

Papers in research journals

Teron R, Neog SB, Barua NS, Das K and Phukan SN. 2020. Evaluation of S1 line of Maize (*Zea mays L*) for fodder related attributes. *International journal of Agricultural Sciences* 12(7): 9678-9682.

Bora SS, Sharmah KK, Borah K and Saud R. 2020. Opportunities and challenges of forage cultivation in Assam- A review. *Forage Res*. 45 (04): 251-257.

Sarma A, Saud RK, Sharma KK and Bora SS. 2020. Nitrogen management in rye grass (*Lolium multiflorum*) *Forage Res*. 45 (04): 295-297.

Bora SS, Sharmah KK, Borah K, Saud R and Borgohain L. 2020. Effect of Nitrogen levels and seed rate on quality of Rye grass (*Lolium multiflorum*) in Assam *Forage Res*. 46 (01): 54-57

Extension Leaflet

- Xitkalin Ghahar Kheti (Assamese)
- Mahajtiya xaxyar kheti (Assamese)

Research Guidance: Msc. (Agri) -1

Course taught: UG: 1 MSc: 1

Extension activities

- Establishment of Fodder Seed Village at Baksa District under TSP.
- Establishment of custom hiring centre at Parbatia Gaon, Jorhat District and Charaimari gaon Baksa district.
- Facilitated formation of 10 fodder-based Farmers Self Help groups.
- Farm implements distributed among 13 numbers of Dairy cooperative society.

FTD conducted: 25

TSP activities: Adopted five villages in Baksa district, Assam

Details of seed/ planting material sold

- Hybrid Napier CO3, CO4, CO5 - 1.62 lakh planting material – rooted slips
- Setaria : Kazungula, PSS-1 - 1.1 lakh planting material – rooted slips
- Congosignal grass - 1.3 lakh planting material – rooted slips
- Lathyrus var Madhuri – 25 kg Foundation seed, 200 kg TFL seed

AICRP on FC&U, CSK HPKV Palampur

Papers in research journals

Arora A, Sood VK, Chaudhary HK, Banyal DK, Kumar S, Kumari A, Khushbu, Priyanka, Sabita, Yograj. 2021. Genetic diversity analysis of oat (*Avena sativa* L.) germplasm revealed by agro-morphological and SSR markers. *Range Management and Agroforestry* (accepted).

Banyal DK, Chatak S, Malannavar AB, Thakur A and Singh A 2020. Evaluation of bioefficacy of pydiflumetofen 7.5% +difenoconazole 12.5% w/v (200 SC) against early blight of potato. *Pl. Dis. Res. 35 (1)*: 67-69

Bhardwaj NR, Banyal DK and Roy AK. 2021. Prediction model for assessing powdery mildew disease in common Oat (*Avena sativa* L.) Crop Protection 146 (2021) 105677

Brar MS and Kumar Naveen 2020. Production potential of multicut sorghum and pearl millet hybrids under intercropping systems- A review. *Forage Research* 46 (3):215-222

Chahal A, Sharma GD, Kumar N, Sankhyan NK , Katoch R, Rana MC and Chandel RC. 2020. Impact of different nutrient sources on forage yield, nutritive value and economics of sorghum sudan grass hybrid-Oat cropping system. *Journal of Plant Nutrition.* 44 (9) 1223-40.

Katoch R and Tripathi A. 2020. Effect of altitude on nutritional profile of white clover (*Trifolium repens* L.). *Range Management and Agroforestry.* 41(1): 173-177.

Katoch R and Tripathi A. 2020. Study on lignin biosynthetic genes from tall fescue (*Festuca arundinacea Schreb*.). *Indian Journal of Agricultural Biochemistry*.33(2):133-139.

Katoch R, Apoorva, Tripathi A, Manoj NV 2021. Effect of pre-treatments on quality of maize (*Zea mays* L.) Stover. *Forage research* 46(4): 356-362.

Katoch R, Apoorva, Tripathi A, Manoj NV 2021. Effect of pre-treatments on quality of maize (*Zea mays*) Stover. *Forage research* 46(4): 356-362.

Katoch R, Sood V K and Tripathi A. 2020. Influence of chemical treatments on the nutritional attributes of maize (*Zea mays* L.) stover. *Indian J Agric Biochemistry.* 33(2): 167-175.

Naveen Kumar, SR Kantwa, GD Sharma, Sukhchain Singh and Priyanka Kumari 2020. Effect of biofertilizers and inorganic nutrients management on the productivity and soil properties of setaria (*Setaria anceps* Stapf.) – white clover (*Trifolium repens* L.) system under sub-temperate climatic conditions. *Journal of Pharmacognosy and Phytochemistry* 9(5): 2450-2453

Sharma S, Katoch V and Banyal DK. 2021. Review on harnessing biotechnological tools for the development of stable bacterial wilt resistant solanaceous vegetable crops. *Scientia Horticulturae* 285 (2021) 110158

Shiney Chatak and Banyal DK 2020 Evaluation of IDM components for the management of urdbean anthracnose caused by *Colletotrichum truncatum* (Schwein) Andrus and Moore. *Himachal Journal of Agricultural Research. 46 (2): 156-161*

Book Chapters

Banyal D K, Thakur Ashima, Sinha Diksha and Singh Amar.2021.Management of Plant Diseases under Protected Cultivation - 413-434. Editors: N K Bharat and H R Gautam. Technology mastrides in plant health management. pp 1-506

Kumar N, Katoch R, Banyal DK and Sood VK. 2020. An approach for improving forage and livestock productivity in Himachal Pradesh through Tribal Sub-Plan. In: Glimpses of Tribal Sub Plan activities of All India Coordinated Research Project on Forage Crops and Utilization. (Eds: Roy A K., Agrawal, R.K. Bhardwaj, N. R. and Chand S). Classic Enterprises (ISBN: 978-81-948917-3-4). Pp 41-47

Technical bulletin

Bhardwaj NR, Banyal DK, Atri A, Dhal A, Langde S, Tambe A, Behra P, Mawar R, Bhaskar RB, Chand S, Agrawal R K, Roy AK 2020. Technological Advances in Forage Crop Protection. AICRP on Forage Crops and Utilization, ICAR-IGFRI, Jhansi. **Tech. Pub. Number- 8/2020** pp 1-29

Participation in symposiums and conferences

- Online Training on Introduction to Plant Biosecurity and Plant Quarantine organised by National Institute of Plant Health Management Hyderabad from 4 to 8 January, 2021.
- INSOP workshop on 4.05.2021 online
- Webinar on “Nano urea: Importance and Use” organized by Indian Farmers Fertilizers Cooperative Limited, Himachal Pradesh Unit on 7.6.2021
- ISWS Webinar on "Aquatic weeds: Problems and their management for improving water productivity" on 29.5. 2021

Courses Taught

Course No.	Course Title	Cr. Hr.
LPM	Livestock production and Management	4+2=6
Agron-510	Agroforestry and Agrostology	2+1=3
ORT 111	Orientation	1+0=1
Agron 3613	Agrochemicals	2+1=3
Pl Path 505	Detection and Diagnosis of Plant Diseases	0+2=2
Pl Path 511	Chemicals in Plant Disease Management	2+1=3
Pl Path 518	Epidemiology and Forecasting of Plant Diseases	2+1=3
GP-232	Fundamentals of Plant Breeding	2+1=3
GP-591	Master’s Seminar	1+0=1
GP-604	Molecular and Chromosomal Manipulations for Crop Improvement	2+0=2
Biochem.501	Basic Biochemistry	3+1=4
Biochem.502	Plant Biochemistry	3+0=3
PB-121	Plant Biochemistry	1+0=1

Recognitions & Awards

- **Dr. Naveen Kumar-** Reviewer Excellence Award – ARCC Journals
- **Dr. D K Banyal- Award of certificate of reviewing for 2018-19 by Indian Phytopathology**

Offices held

Dr. Naveen Kumar

- **Member Editorial Board, Section Editor: Resource Management**; The Society for Advancement of Wheat and Barley Research (SAWBAR), Karnal. *J. of Cereal Research*
- **Councilor-** Range Management Society of India, IGFRI Jhansi
- **Councilor-** Haryana Agronomist Association (Haryana J. Agronomy), Hisar

Dr. Naveen Kumar **Lead lecture: In- National Webinar on "***Dairy Vavsaya Hetu Hara Chara Utpadhan evm Sarakshan*/ डेरी व्यवसाय हेतु हरा चारा उत्पादन एवं सरक्षण" **held on 22th June, 2021 organised by ICAR-National Dairy Research Institute Karnal (Haryana)** **Dr. D K Banyal** • Diseases and their integrated management under protected cultivation, in Nation Webinar on Management of Biotic and Abiotic stresses in Protected Agriculture on 23.09.2020 under CAAST Project (22-24.09.2020) • Management of Plant Diseases under Protected Cultivation on 05.05.2021 in conference organised by Himalayan Phytopathological Society UHF Solan

Other activities

Students guidance	:	M Sc. –6 , Ph. D. 10 (as major advisor)
Forage technology consultations	:	9
Consultancy	:	– Jersey Breeding Farm, Department of Animal Husbandry (HP)- Development of 3 ha lantana infested land into productive pasture
Linkage with other programmes and institutes:	:	– AICRP (IFS) – AICRP (Agroforestry)
Association in Adhoc Projects	:	– Scientists are associated in 7 *Ad hoc* projects as PI and Co-PIs

AICRP on FC&U, IGKV, Raipur

Variety Identified

Forage Cowpea entry RFC-2 (RCC-48): It was identified for release in the state of West Bengal, Jharkhand, Bihar, Eastern UP, Imphal, Assam and Odisha. It gives 245-265 q/ha green fodder yield. Seed yield is 25-30 q/ha. Maturity in 100-110 days. Crude protein is 23.12%. It is resistance / moderately resistance against yellow mosaic and fertilizer responsive.

Papers in research journals

Jha SK, Dewangan YK and Jha Deepti 2020. Effect of weed management practices and seed rates on economics and energetics on direct seeded rice production system Journal of Pharmacognosy and Phytochemistry 2020; 9(5): 677-681

Sahoo Abinita, Kalyani Gudadhe R, Verma Sunil K, Saxena Ritu R, Verulkar Satish B and Mishra Ambika Prasad 2020 Identification of QTLs and Markers Linked to Root Traits in Rice (Oryza sativa L.) International Journal of Current Microbiology and Applied Sciences 9(11): 94-100

Shesh Jayesh, Jha SK and porte Chanchal 2020. Effect of de - topping and nitrogen doses on yield and yield characters of two maize (*Zea mays* L.) varieties under Chhattisgarh condition Journal of Pharmacognosy and Phytochemistry 2020; 9(1): 1484-1487

Shesh Jayesh, Jha SK, Kumar Ritesh and Kunjam Swati 2020. Effect of de-topping and nitrogen levels on yield and nutrients uptake of maize (*Zea mays* L.) Internatonal Journal of Research in Agronomy 2020;3(1): 45-48

Singh Uma, Verma AK and Jha SK 2020 Effect of nitrogen levels, cutting management and splitting of nitrogen dose on growth, yield an.d quality of fodder oat (*Avena sativa* L.) *International Journal of Chemical Studies* 2020, 8(2) : 1488-1490

Singh Uma, Verma AK, Jha SK, Verma Neha and Porte Dipendre Pankaj 2020 Quality of oat fodder (*Avena sativa* L.) As influenced by different doses of nitrogen, cutting management and splitting of nitrogen Journal of Pharmacognosy and Phytochemistry 2020; 9(4): 3003-3006

Thakur Supriya, Jha SK, Sunil Kumar and Shesh Jayesh 2020. Effect of crop geometry and nitrogen levels on growth, productivity of baby corn (*Zea mays* L.) International Journal of Chemical Studies 2024; 9(1): 632-634

Thomas Helan Baby, Verulkar Satish, Saxena Ritu Ratan and Verma Sunil Kumar 2020. Genetic Mapping of QTLs for Physiological Traits in Rice (*Oryza sativa* L.)by using Danteswari/ DaggadDeshi RIL Population. Int. J. Curr. Microbiol. App. Sci; 9(7): 3804-3812.

Leaflets/Folders -1 in Hindi

Popular Article

- Jha SK, Sahu RP and Verma Sunil "*Hydroponic taknik se chara utpadan"*, Kheti (Hindi) May 2021 4-6, ICAR, New Delhi

Book Chapter

Jha SK, Verma Sunil Kumar and Jha Deepti (2021). Tribal welfare programme through AICRP-FC&U, IGKV, Raipurunder Tribal Sub Plan in Chhattisgarh Glimpses of Tribal Sub Plan Activities of All India Coordinated Research Project on Forage Crops and Utilization. AICRP on Forage Crops and Utilization, ICAR-IGFRI, Jhansi, India. pp 56 to 67 (ISBN No 978-81-948917-3-4).

Linkage with other programmes and institutes – AICRP (Dry Land), CARS, Jagdalpur, Bastar (Chhattisgarh), AICRP(IFS). KVK's of Chhattisgarh

Externally Funded Projects

SN	project/ study	Funding agency	Duration	Budget	PI/Co PI
1.	Demonstration, Training and Production of silage to accelerate milk production in Chhattisgarh	RKVY	1 Year	50 Lakh	S. K. Jha / SK Verma
2.	Evaluation of bio-efficacy and phytotoxicity of BAS 625 04 H against grassy weed in transplanted rice and its residual effect on succeeding crop"	PPP (BASF India Limited)	2 Year	6.0 Lakh	S.K.Jha
3.	Study the effect of improved corn hybrids on the quality of silage"	PPP (Bayer Crop Science Ltd)	2 Year	3.0 Lakh	S. K. Jha / SK Verma
4.	Effficacy of Carfentrazone ethyl 40DF against sedges and broad leafed weed in	PPP (DSR FMC India Ltd).	2 Year	4 Lakh	S. K. Jha
5.	Tribal Sub Plan AICRP-Forage Crops	ICAR	1 Year	4.5 Lakh	S. K. Jha
6.	Accelerated Genetic gain in Rice (AGGRi Alliance) Marginal Environment (ME)	IRRI	5 years	15 Lakh	SK Verma
7	Identification of genetically superior species/varieties Morphological and DNA marker based identification of Bamboo in C.G.	RNBM	4 Years	5 Lakh	SK Verma
8.	Global Rice Array: India partnership to strengthen global phenomics networks	IRRI	3 Years	5 Lakh	SK Verma
9.	Mainstreaming rice landraces diversity in varietal development through genome wide association studies: A model for large-scale utilization of gene bank collection of rice	DBT	5 years	96 lakh	SK Verma
10.	Development of superior haplotype based near isogenic lines (Haplo-NILs) for enhanced genetic gain in rice	DBT	5 years	110 lakh	SK Verma

Teaching 2020-21

S. No.	Level	COURSES	SUBJECT
Dr S. K. Jha			
1.	PG	AGRON -501	Modern Concept in crop production
2.	UG	AGRO5121	Agricultural Water Management
Dr. Sunil Kumar Verma			
1	UG	ABT-5211	Food Safety and Standards
2	UG	ABT-5121	Fundamentals of Plant Biochemistry and Biotechnology
3	PG	MBB-551	Principles of Genetics
4	PG	MBBD-506	Genetics and Plant Breeding
5	PhD	MBB-601	Advances in Plant Molecular Biology
6	PG	MBBD-521	Molecular Breeding
7	PG	MBBD-528	Molecular breeding ,genomics & proteomics

Research Guidance

Subject	No of student registered
Agronomy (Dr S.K. Jha)	PG: Major advisor- 2, Co-advisor -6 Ph. D.: Major advisor- 2
Plant Breading (Dr. Sunil Kumar Verma)	PG: Major advisor- 7 , Co-advisor -7 Ph. D Major advisor- 1 , Co-advisor -2

Training Courses and Conference/Seminar/Workshop papers attended

S.N.	Title of Programme	Duration	Organized by
Dr S.K. Jha			
1	All India Fodder Production Officers: Kharif	June 23-26,2020 (Five Day)	Online Training ICAR-IGFRI Jhansi (U.P.)
2	Specialized International training on “Introduction to selection tools in tropical forage”	15/12/2020	Alliance Bioversity-CIAT and ICAR-IGFRI Jhansi (U.P.)
3	Project Formulation and Funding opportunities for young researchers	June 16. 2020	HAU, Hisar
4	Farmers educational cum awareness programme on Fall Army Worm on Maize	11/09/2020	IGKV, Raipur
Dr S.K. Verma			
5	E-agriculture for climate resilience “	04^{th} - 06^{th} March, 2020	IRRI South Asia regional Centre, Varanasi
6	Biodiversity Quiz 2020	08/06/2020	KendriyaVidyalaya B.S.F. Camp, Chhawla
7	All India Fodder Production Officers: Kharif	June 23-26,2020	Online Training ICAR-IGFRI Jhansi
8.	Integrated Assessment Importing countries and Domestic Regulations requirements	18 & 19 July 2020	Online Training NABL, Gurugram
9	Recent Advances in Proteomics Technology	21 & 22 July 2020	Heredity Life Sciences Pvt. Ltd. KIIT-TBI, Bhubaneswar, Odisha
10	Plant genome engineering for Agriculture, Food & Nutrition	04 August 2020	Shri Vaishnavvidyapeeth Vishwavidyalaya, Indore MP
11	Innovative approaches in seed quality maintenance for successful entrepreneurship	7 August 2020	University of Agricultural Sciences, Dharwad& NAHEP, ICAR, New Delhi
12	Techniques in Molecular Biology: A virtual Laboratory insight	12 August 2020	University college for Women, Koti, Hyderabad
13	National Online Quiz on Microbiology Agriculture	16-17 August 2020	Mandsaur University
14	Artificial Intelligence using Python	14-19 Sep 2020	Brainovision Solutions India Pvt Ltd.
15	B4R	21 Oct 2020	IRRI, Philippines
16	Introduction to selection tools in Tropical forages	15/12/2020	Online Alliance Bioversity-CIAT in collaboration with ICAR-IGFRI

Extension packages

- Generated *package of practices of fodder crops production under Chhattisgarh Condition* and published for Extension workers. Published package of practices of fodder crops production in ***KrishiYugPanchang*** *in* 2020 and 2021. Demonstrated the fodder *production technology in* ***Agriculture Museum*** at IGKV, Raipur

New Seed production Farm

- New fodder seed production farm imitated at CARS, Bhatapara , KVK Mahasamund and KVK Durg with the help of local administration and RKVY.

Important visitor

- Visit of Hon'ble V.C. IGKV, Raipur along with Directors, Deans, PC, SMS and scientist.

Training conducted under RKVY Silage Production

- One day Master's Training Programme On Demonstration, Training and Production of Silage to Accelerate Milk Production in Chhattisgarh, under RKVY Project Dated 23/12/2020
- Hands on training on silage production organized under RKVY, Project. Total 600 participants from Raipur, Koriya, Durg, Jagdalpur, Saja and Kanker participated.

Forage Garden

- Rabi – 74 varieties of Berseem, Lucerne, Rye grass, Oat and Lathyrus
- Kharif – 44 varieties of Cowpea, Maize, Guar, Rice bean, Pearl millet, Sorghum, BN Hybrid, Dinanath grass, Guinea grass, Dhaman grass, Anjan grass
- Fodder tree and shrub of Munga, Albizia, Leucena, Desmenthus, Clitoria,

AICRP on FC&U, OUAT, Bhubaneswar

Papers in research journals

Sen A, Dhal A and Niranjan C. 2020. Assessment of various nutritional media, temperature and colour on growth behaviour of Blue Oyster mushroom in Odisha, India. International Journal of Current Microbiology & Applied Science 9 (3): 842-847

Dhal P, Sahu GS, Mohanty S and Dhal A. 2020. Effect of priming on seed characters, disease incidence and yield in French bean (*Phaseolus vulgaris* L.) Journal of Pharmacogony and Phytochemistry 9 (1) 1028-1032

Dhal P, Sahu GS, Mohanty S, Dash SK, Tripathy P and Dhal A. 2020. Effect of priming on growth behaviours of French bean (*Phaseolus vulgaris* L.) International Journal of Chemical Studies 8 (1) 1366-1369

Dhal P, Sahu GS, Mohanty S, Dhal A and Dash SK. 2020. Efficacy of seed priming on yield and yield attributing characters in French bean (*Phaseolus vulgaris* L.) International Journal of Current Microbiology & Applied Science 9 (2): 915-922

Teaching Activities

- Fundamentals of Plant Pathology PPT-121 (2+1) Practical
- Diseases of Field & Horticultural Crops-I PPT-313 (2+1) Theory
- Diseases of Field & Horticultural Crops-II PPT-324 (2+1) Theory
- Seed Certification and Production PPT-605 (1+0), Theory

Research Guidance: MSc Ag in Plant Pathology – 3nos.

- Studies on root rot wilt in rice bean by N.N. Nanda, PG thesis – completed 2020.
- Management of root rot and wilt in forage cowpea by K.M.Bhawani - Continuing

TSP Activities:

The following TSP activities were carried out in 14 tribal villages under six blocks of three districts namely Kondhamal, Rayagada and Koraput districts of the state.

	Activities	**Achievements**	**Number of Beneficiaries**
1	**Training programme** conducted (No.)	20	604
2	**Demonstrations** (FLDs/ OFTs) conducted (No.)	114	114
3	**Inputs supplied**		
	Root slips of Perennial Fodders (Nos.)	1,72,000	114
	Fertilizers (Kg)	840	114
	Barbed Wire for Fencing purpose (Kg)	132	66
	Other (Distribution of small tool kits) (No.) (Improved Sickle, Sprayer, Spade, Hoe)	114	114

AICRP on FC&U, SKRAU, Bikaner

Papers in research journals

Sunder Anchra, R.C.Bairwa, S.P.Singh and Shri Rakesh (2020). Effect of Nitrogen and phosphorus on growth and yield of fodder pearl millet (*Pennisetum glaucum* L.) varieties. *Res. Jr. of Agril. Sci*. 11(4):966-968.

Course taught

- Dr. A. S. Godara & Dr. R.C. Bairwa taught a Ph.D. course “AGRON 611-Advances of Crop Growth & Productivity”

FTDs conducted: Total 22 fodder demonstrations were conducted under AICRP on Forage Crops and Utilization during Rabi-2020-21, which were 15 of oat, 7 of Lucerne.

Training conducted for farmers/NGO/Govt. Officials

- Farmers were given training of green fodder production during rabi season at the time of distribution of demonstrations under AICRP on FCU.
- Dr. A. S. Godara & Dr. R.C. Bairwa attended two webinar during the rabi season 2020-21.

Works in other projects / assignments

- Dr. A.S. Godara conducted two station trials on wheat and fenugreek varieties.
- Dr. R. C. Bairwa conducted one station trial on mustard crop
- Dr. A. S. Godara: Farm Incharge, Member of physical verification committee, ARS, Bikaner; Sell and Purchase committee member of ARS, Bikaner and NSP Bikaner
- Dr. R. C. Bairwa: PG Hostel warden

AICRP on FC&U, RPCAU, Pusa

Quality Seed production

- Oat variety Kent – 8.5 q
- Under university funded project on “Fodder seed production programme”, we have initiated the work for development of Fodder Hub cum Pasture in the Dhab area with cooperation of Scientists from IGFRI, Jhansi.
- Propagules of Napier and guinea grass sold nearly Rs. 15000/-

Golden Jubilee Fodder Garden was established and inaugurated.

Technical guidance

- Providing technical guidance to NavGanga Food Private Limited, Begusarai for production of Maize silage on commercial scale as per the MoU signed with our University.

Research Guidance

- Dr. Nilanjaya - two M.Sc. and one Ph.D. student on Forage Cowpea. One M.Sc. student has completed research work on fodder Oat.
- Dr. Gangadhar Nanda, Agronomist has guided one M. Sc. student on fodder Oat.

Teaching

- Dr. Nilanjaya is having online course load of nearly 20 credit hours per semester along with additional assignment of Officer-In- Charge (Academic) of Deptt. of Plant Breeding and Genetics as well as Co-ordinator, Academic society, PG College of Agriculture (PGCA).
- Dr. Gangadhar Nanda is having online course load of nearly 12 credit hours per semester along with additional assignment of Officer-In- Charge, Fodder production at APRI, RPCAU, Pusa.

AICRP on FC&U, JNKVV, Jabalpur

Papers in research journals

Gupta kavita and Mehta AK 2020. Genetic Variability Studies of Advanced Generation Mutant Oat (*Avena sativa* L.) Lines for Yield, Fodder Traits and Proline Content. *Range management & Agroforestry* **41 (1) : 52-59**

Important Persons visited

- Board Members of Vishwa Vidyalaya.
- Dr. Ashutosh Sarkar International Scientist, ICARDA New Delhi.
- Scientists Dr. Santosh Jha and Dr .Verma of IGKVV Raipur(CG) (On line)
- Director, weed science. Jabalpur
- Shri Kamal Patel, State Agriculture minister of M.P government

Students guided: M. Sc. - 1

FTDs conducted: Berseem JB1, JB5 = 10; Oat JO1, JO 5 = 5

TSP activity: 34 demonstrations of different fodder crops at tribal block of Dindori (M.P.) and forage crop related literature were distributed to farmers.

TV/Radio talks: Radio talks = 1

WEATHER REPORT RABI 2020-21

The weather report of the AICRP-FCU Coordinating centers, Voluntary centers across the different zones and Headquarter during *Rabi* 2020-21 have been presented in this section. The weather parameters prevalent during 40th Standard Meteorological Week (SMW) (October 01-07, 2020) to 21st SMW (May 21-27, 2021) were taken into consideration, which covers the *Rabi* season, 2020-21 for all the testing/ experimenting locations of trial conduction (Tables M1 to M12). During the reporting period, weather variations are clearly visible in maximum and minimum temperature, relative humidity, rainfall, rainy days and sunshine hours in different agro-climatic zones, which had varied impact on establishment, growth, yield and quality of different annual and perennial forage crops and their varieties and also having close correlation with the incidence and magnitude of insect-pest and diseases of forage crops.

Temperature

In Hill zone, Srinagar was the coolest location recording -7.1^{0}C during 3rd SMW. Maximum temperature was recorded at Almora (31.5^{0}C) during 40th SMW. The mean T_{Min} over the season was recorded the lowest at Srinagar (2.5^{0}C). Whereas, the highest mean T_{max} was recorded at Almora (25.1^{0}C). In North-East zone, Ranchi centre recorded the lowest minimum temperature (3.6^{0}C) during 51st SMW. The highest T_{max} was recorded at Bhubaneswar (39.9^{0}C) during 17th SMW. The higher mean T_{Max} was recorded at Bhubaneswar (33.6^{0}C) and the lowest mean T_{min} was recorded at Ranchi (12.5^{0}C). In North-West zone, Bikaner recorded the lowest minimum temperature (2.7^{0}C) during 2nd SMW, as well as maximum temperature (41.6^{0}C) during 21st SMW. The higher mean T_{max} was noted at Bikaner (31.8^{0}C); whereas, the lowest mean T_{min} was noted at Pantnagar (12.8^{0}C). In Central zone, Jhansi recorded the lowest minimum temperature (5.2) during 52nd SMW, whereas the maximum temperature was recorded at Jhansi (42.1^{0}C) during 18thSMW. The higher mean T_{max} and lower mean T_{min} was were recorded at Raipur and Jhansi (33.4 and 13.4^{0}C, respectively). In South zone, the lowest minimum and maximum temperature was recorded at Hyderabad (10.9^{0}C during 52ndSMW and 37.7^{0}C during 13th SMW, respectively). The higher mean T_{max} and lower mean T_{min} was also recorded at Vellayani and Hyderabad (32.6 and 17.7^{0}C, respectively).

Rainfall

The average annual rainfall of India is about 1192 mm and 80-90 percent rainfall in the country is mostly contributed through South-West Monsoon. During winter season some of the states received substantial amount of rainfall especially Kerala, Assam and West Bengal as evident from the rainfall data presented in tables (M1 to M12).

In Hill zone, Palampur received higher rainfall (395.7 mm) as compared to other centres in the zone. In North-East zone, Imphal centre received highest rainfall (473.7 mm in 60 rainy days) followed by Bhubaneswar(468.2 mm) and the lowest being at Ayodhya (9.2 mm). In North-West zone, Pantnagar received highest rainfall (210.2 mm). Bikaner centre received the lowest rainfall (14.6 mm) in 2 rainy days. In Central zone, maximum rainfall and maximum number of rainy days (380.5 mm, 22 days) was recorded at Urulikanchan followed by Rahuri (231.8 mm in 17 rainy days) and lowest being at Jhansi (39.2 mm in 5 rainy days). In South zone, Vellayani received maximum rainfall (1348.1 mm) in 65rainy days followed by Hyderabad (497.2mm).

Relative Humidity

In the tables RH1 and RH2 refers to morning and afternoon RH respectively. In Hill zone, higher average RH during morning hours was recorded at Almora (90.5%). In afternoon hours Srinagar centre recorded higher RH2 (56.9%) followed by Palampur. In North-East zone, maximum average RH of 95.4 % during morning hours was recorded at Jorhat followed by Kalyani (90.5%). The average minimum RH during afternoon hours was recorded at Imphal (46.1%). In North-West zone, higher average RH of the season during morning hours was recorded at Hisar (85.7 %) and Pantnagar (85.0 %) and in afternoon, higher RH was recorded at Pantnagar (44.6%). The lowest RH during morning as well as evening hours was recorded at Bikaner (60.7&27.6%, respectively). In Central zone, maximum RH in morning hours was recorded at Jhansi (80.9%) and Anand (79.2%). The mean afternoon RH varied in limited range of 31.1 to 50% at all the centers in the zone. In South zone, maximum average RH of the season in morning and evening hours (91.4 and 77.1%) was recorded at Vellayani. The lowest average RH (88.6&46.6%) in morning and evening hours, respectively, was recorded at Hyderabad.

Sunshine hours

In Hill zone, maximum average sunshine hours were recorded at Almora (7.3 hours/ day) and Palampur (7.1) followed by Srinagar (4.4). This indicates that the weather was fairly clear during the period. In North-West zone, higher average sunshine hours were recorded at Bikaner (8.3). The lowest average sunshine hours were recorded at Hisar (6.2) in the zone. In North-East zone, maximum average sunshine hours were recorded at Ranchi (8.1) followed by Imphal (7.1) and the lowest at Jorhat (5.5). In Central zone, maximum average sunshine hours were recorded at Anand (8.7) followed by Rahuri (8.2). InSouth zone, maximum average sunshine hours were recorded at Hyderabad (7.5) and the lowest at Vellayani (6.4).

Std. Week No.	Period	Std. Week No.	Period
40	01-07 Oct, 2020	05	29-04 Feb, 2021
41	08-14 Oct, 2020	06	05-11 Feb, 2021
42	15-21 Oct, 2020	07	12-18 Feb, 2021
43	22-28 Oct, 2020	08	19-25 Feb, 2021
44	29-04 Nov, 2020	09	26-04 March, 2021
45	05-11 Nov, 2020	10	05-11 March, 2021
46	12-18 Nov, 2020	11	12-18 March, 2021
47	19-25 Nov, 2020	12	19-25 March, 2021
48	26-02 Dec, 2020	13	26-01 April, 2021
49	03-09 Dec, 2020	14	02-08 April, 2021
50	10-16 Dec, 2020	15	09-15 April,2021
51	17-23 Dec, 2020	16	16-22 April,2021
52	24-31 Dec, 2020	17	23-29 April,2021
01	01-06 Jan, 2021	18	30-06 May, 2021
02	07-14 Jan, 2021	19	07-13 May, 2021
03	15-21 Jan, 2021	20	14-20 May, 2021
04	22-28 Jan, 2021	21	21-27 May, 2021

Table M1: Meteorological data in Hill zone during crop growth period of Rabi 2020-21

Std. Week no.	PALAMPUR						ALMORA						
	Temperature (C)		Humidity (%)		Rainfall (mm)	Sunshine hrs	Temperature (C)		Humidity (%)		Rainfal (mm)	No. of Rainy days	Sunshine hrs
	Max.	Min.	RH1	RH2			Max.	Min.	RH1	RH2			
40							13.2	31.9	94	40	0.0	-	8.2
41							11.1	31.3	95	39	0.0	-	8.8
42							9.4	30.7	92	27	0.0	-	8.8
43							5.1	27.7	92	28	0.0	-	8.7
44	24.3	8.9	66	46	0.0	9.1	5.5	27.0	85	42	0.0	-	8.4
45	23.3	7.2	62	38	0.0	8.5	2.2	26.0	92	28	0.0	-	8.3
46	19.5	6.2	76	59	15.0	4.8	1.9	24.8	97	27	0.0	-	8.0
47	17.3	4.7	67	59	0.4	5.8	1.1	21.6	92	35	0.0	-	5.4
48	19.2	5.7	70	49	8.6	5.9	0.2	22.8	94	43	0.0	-	6.7
49	20.8	7.1	71	52	0.0	6.6	-0.3	23.1	99	34	0.0	-	6.4
50	17.3	3.3	79	52	24.8	5.9	-1.5	22.1	100	31	0.0	-	6.8
51	17.1	0.8	62	44	0.0	9.0	-3.5	21.2	100	30	0.0	-	6.7
52	14.9	1.8	77	47	16.0	7.3	-3.7	20.7	100	41	0.0	-	6.1
1	15.8	5.5	78	65	34.6	2.8	1.4	16.2	100	64	36.0	3	3.0
2	17.9	3.5	68	48	0.0	9.1	1.2	21.8	98	38	0.0	-	7.6
3	17.2	4.1	76	43	0.0	8.6	1.2	20.1	100	47	0.0	-	7.5
4	16.1	3.5	75	49	3.6	6.3	-1.7	21.1	100	40	0.0	-	8.1
5	16.6	3.2	73	46	14.8	8.7	-2.1	20.9	95	30	10.0	1	7.5
6	17.3	4.9	76	46	0.0	8.0	1.6	22.3	95	36	0.0	-	8.2
7	20.3	7.1	74	45	0.1	7.1	2.6	22.9	97	34	0.0	-	7.0
8	21.7	9.6	67	42	0.3	6.5	3.7	24.9	94	32	0.0	-	7.4
9	22.1	8.9	59	33	3.8	7.4	2.6	25.3	84	30	0.0	-	9.0
10	23.6	10.6	57	30	0.6	7.4	4.2	25.5	91	30	3.5	1	7.1
11	23.6	10.9	55	32	0.0	5.7	5.8	26.6	80	25	0.0	-	8.3
12	23.3	11.2	62	44	17.4	4.6	6.1	27.4	80	30	2.0	1	7.8
13	26.2	12.9	48	31	0.0	8.9	7.3	28.4	82	35	0.0	-	7.9
14	24.1	11.8	64	38	30.0	6.9	5.4	28.0	73	31	0.0	-	9.8
15	27.3	13.8	69	26	0.0	9.3	5.9	30.1	74	29	0.0	-	7.9
16	24.0	11.6	74	54	68.6	4.2	8.3	27.4	78	39	36.0	5	5.7
17	25.4	13.6	50	35	55.2	9.0	9.6	28.4	84	56	15.0	2	6.8
18	28.9	15.9	60	55	39.8	6.2	12.6	25.6	78	43	17.5	3	6.1
19	26.2	15.1	68	66	28.4	5.9	12.1	28.6	81	49	5.5	3	5.5
20	26.4	15.7	61	51	25.2	7.5	14.0	20.0	100	100	102.0	2	4.3
21	28.1	16.2	57	38	8.4	9.1	13.8	29.8	85	42	0.0	-	9.5
Mean/ Total	**21.5**	**8.5**	**66.7**	**45.4**	**395.7**	**7.1**	**4.6**	**25.1**	**90.5**	**38.4**	**227.5**	**21**	**7.3**

Table M2: Meteorological data in Hill zone during crop growth period of Rabi 2020-21

Std. Week No.	SRINAGAR					
	Temperature (C)		Humidity (%)		Rainfall (mm)	Sunhine hrs
	Max.	Min.	RH1	RH2		
40	27.2	6.3	66	39	0.0	8.5
41	26.4	4.8	69	44	0.0	7.6
42	25.4	4.6	72	55	0.0	7.8
43	22.0	1.8	73	49	0.0	5.9
44	20.1	1.5	77	53	0.0	5.5
45	19.1	-0.5	73	59	0.0	4.8
46	12.4	1.8	81	69	0.8	1.8
47	8.3	0.3	85	72	1.9	1.1
48	12.9	-0.3	90	71	0.2	2.3
49	9.9	1.6	88	76	2.7	0.0
50	9.6	-0.5	82	66	3.8	3.1
51	9.1	-5.6	85	57	0.0	5.0
52	8.7	-2.8	88	63	0.5	2.8
1	5.4	-2.5	92	78	16.9	1.2
2	5.6	-3.5	88	70	1.3	3.0
3	8.4	-7.1	93	60	0.0	5.2
4	5.1	-3.9	89	74	3.3	2.5
5	3.3	-4.5	94	78	0.7	1.6
6	11.4	-1.0	87	50	0.0	5.3
7	16.1	-0.5	85	34	0.0	8.0
8	16.7	4.1	76	43	0.4	5.1
9	14.6	3.5	82	54	2.6	5.5
10	12.8	5.3	79	65	3.1	2.7
11	13.8	4.9	87	59	5.3	3.0
12	14.4	5.8	81	62	10.3	3.0
13	19.9	7.5	79	43	1.1	4.4
14	18.1	5.9	57	44	3.6	4.7
15	17.8	7.3	72	56	1.6	2.9
16	15.0	8.1	81	66	7.4	0.8
17	23.7	7.6	62	32	5.4	9.3
18	23.3	10.8	63	50	3.2	5.4
19	25.3	10.5	66	44	0.9	8.2
20	23.0	10.2	64	45	0.5	5.6
Mean/ Total	**15.3**	**2.5**	**79.0**	**56.9**	**77.5**	**4.4**

Table M3: Meteorological data in North West zone during crop growth period of Rabi 2020-21

Std. Week No.	HISAR							BIKANER						Sunshine hrs
	Temperature (C)		Humidity (%)		No. of Rainy	Rainfall (mm)	Sunshine hrs	Temperature (C)		Humidity (%)		No. of Rainy days	Rainfall (mm)	
	Max.	Min.	RH1	RH2				Max.	Min.	RH1	RH2			
40	36.6	18.2	79	29	0	0	8.2	38.7	19.6	56	20	0	0.0	9.7
41	35.6	16.3	86	28	0	0	7.9	38.0	17.9	53	21	0	0.0	9.7
42	34.2	13.7	76	22	0	0	7.1	36.1	17.9	54	22	0	0.0	8.4
43	33.0	12.8	80	26	0	0	6.5	29.6	13.8	56	17	0	0.0	9.6
44	30.4	9.8	85	24	0	0	5.6	32.9	11.3	53	16	0	0.0	9.2
45	29.7	10.5	91	33	0	0	3.2	32.6	12.5	54	23	0	0.0	9.2
46	25.6	12.6	89	50	1	18.2	2.7	26.6	8.5	69	52	0	0.0	6.4
47	23.1	7.7	88	43	0	0	6.5	25.6	8.4	62	44	0	0.0	8.7
48	23.3	8.4	92	42	0	1.7	6.6	27.0	6.9	73	34	0	1.2	8.1
49	25.5	9.1	90	53	0	0	5.9	30.1	8.1	73	38	0	0.0	8.2
50	20.8	5.0	96	63	0	0	5.3	20.5	6.4	80	48	0	0.0	6.6
51	19.7	3.0	92	42	0	0	6.2	23.0	3.3	69	32	0	0.0	8.1
52	19.5	2.6	96	51	0	0	5.8	25.0	4.3	69	29	0	0.0	8.4
1	17.5	9.6	96	82	2	8.9	1.8	20.3	5.9	82	55	0	0.0	3.0
2	15.8	4.6	98	72	0	0	2.7	21.6	2.7	77	36	0	0.0	8.0
3	16.4	6.7	99	74	0	0	2.7	22.5	4.4	82	41	0	0.0	6.2
4	18.8	4.9	96	59	0	0	5.2	23.3	5.6	78	26	0	0.0	8.3
5	22.6	5.2	94	46	1	8.7	7.5	27.0	7.1	69	20	0	0.0	9.6
6	22.6	5.5	98	53	0	0	6.7	27.9	7.6	72	20	0	0.0	9.1
7	25.2	8.4	100	52	0	0	5.6	31.0	10.5	70	21	0	0.0	9.4
8	27.6	9.1	97	43	0	0	7.1	33.3	13.5	61	25	0	0.0	10.2
9	29.3	9.7	94	34	0	0	8.4	33.2	13.9	62	25	0	0.0	9.9
10	30.7	14.1	91	43	0	0	6.8	35.1	16.6	56	30	0	0.0	8.3
11	30.7	13.9	89	40	0	1.2	6	34.3	16.3	62	28	0	0.0	7.4
12	31.4	14.5	88	37	1	4.4	5.9	34.1	17.8	62	22	1	2.6	5.1
13	33.5	14.3	75	26	0	0	7.7	38.9	17.6	53	20	0	0.0	7.4
14	35.0	13.3	69	18	0	0	8.2	38.0	18.6	36	14	0	0.0	9.0
15	37.2	16.0	54	15	0	0	8.8	40.0	20.6	25	10	0	0.0	9.3
16	35.6	17.2	67	26	0	0.5	7.7	36.3	19.4	57	27	0	1.6	9.6
17	37.0	17.9	58	23	0	0	9.7	39.6	23.0	40	17	0	0.0	9.6
18	40.1	23.1	54	30	0	1.5	7.6	39.3	25.4	39	24	1	7.6	8.2
19	38.1	23.0	64	37	1	5.9	7.8	40.9	24.3	43	23	0	0.0	8.6
20	34.7	22.9	71	44	0	0	5.5	37.4	24.4	57	32	0	0.0	6.8
21	36.3	21.1	72	34	2	20.8	9.2	41.6	25.6	60	25	0	1.6	10.1
Mean/ Total	**28.6**	**11.9**	**84.2**	**41.0**	**8**	**71.8**	**6.4**	**31.8**	**13.5**	**60.7**	**27.6**	**2**	**14.6**	**8.3**

Table M4: Meteorological data in North West zone during crop growth period of Rabi 2020-21

Std. Week No.	LUDHIANA							PANTNAGAR						
	Temperature (C)		Humidity (%)		No. of Rainy Days	Rainfall (mm)	Sunshine hrs	Temperature (C)		Humidity (%)		No. of Rainy Days	Rainfall (mm)	Sunshine hrs
	Max.	Min.	RH1	RH2				Max.	Min.	RH1	RH2			
40	33.9	18.8	90	33	0	0.0	9.8	34.2	21.3	91	62	0	0.0	8.9
41	34.1	18.3	91	34	0	0.0	8.7	34.0	19.2	89	53	0	0.0	3.1
42	33.1	14.9	85	22	0	0.0	9.3	33.0	17.4	83	48	0	0.0	3.9
43	31.1	13.3	85	23	0	0.0	6.2	31.0	13.1	88	47	0	0.0	3.7
44	29.1	11.2	88	23	0	0.0	6.0	30.4	12.4	85	40	0	0.0	1.6
45	28.5	10.2	92	26	0	0.0	6.0	28.5	12.3	92	37	0	0.0	4.5
46	24.8	10.9	88	43	1	14.6	4.4	28.5	11.3	89	37	0	0.0	6.7
47	21.5	7.9	89	39	1	1.0	5.2	25.1	8.7	92	36	0	0.0	7.1
48	24.2	8.8	93	34	0	0.0	8.3	25.0	8.6	93	43	0	0.0	6.7
49	24.6	11.4	89	47	0	0.0	4.6	25.7	10.1	94	42	0	0.0	9.2
50	17.4	9.3	90	64	1	4.2	3.8	20.8	9.7	94	50	1	2.5	7.6
51	18.6	3.5	91	39	0	0.0	7.0	16.0	4.1	93	67	0	0.0	7.0
52	15.8	4.2	96	63	1	1.8	4.1	20.8	4.1	95	65	0	0.0	8.0
1	17.6	10.0	91	75	2	11.0	0.5	20.3	9.2	96	55	3	18.6	3.1
2	14.0	6.8	93	71	0	0.0	1.8	18.7	8.7	94	62	0	0.0	3.9
3	16.6	6.9	96	70	0	0.0	3.0	18.2	7.5	97	72	0	0.0	3.7
4	17.9	6.4	93	55	0	0.0	4.6	16.6	8.8	96	69	0	0.0	1.6
5	20.6	6.3	89	39	2	17.0	6.5	18.8	6.1	96	75	0	0.0	4.5
6	21.3	7.3	95	58	0	0.0	7.4	23.7	7.8	96	61	1	4.6	6.7
7	22.5	10.8	96	69	0	0.0	5.4	25.7	9.0	94	53	0	0.0	7.1
8	26.8	11.6	96	47	0	0.0	7.8	26.9	9.9	91	45	0	0.0	6.7
9	27.8	11.9	90	38	0	0.0	9.8	29.3	11.2	89	48	0	0.0	9.2
10	29.7	15.3	50	42	0	0.0	7.5	29.6	14.2	90	37	0	0.0	7.6
11	28.6	15.2	81	39	0	0.0	4.2	30.3	13.6	83	46	0	0.0	7.0
12	29.1	15.2	84	35	2	5.0	6.1	32.6	14.1	86	36	0	0.0	8.0
13	32.2	15.6	73	25	0	0.0	9.7	33.4	14.6	82	27	0	0.0	7.9
14	32.2	14.6	55	16	1	3.0	8.1	34.4	13.9	84	23	0	0.0	6.5
15	36.1	17.5	49	11	0	0.0	9.5	37.5	14.1	59	14	0	0.0	10.0
16	32.0	17.9	64	31	2	6.6	5.7	36.8	17.8	59	11	0	0.7	8.4
17	36.2	18.0	67	23	2	4.7	9.9	36.7	17.1	57	17	0	0.0	10.3
18	37.5	23.0	53	27	1	3.4	5.5	36.3	21.9	52	16	1	3.4	6.8
19	34.1	22.0	64	45	3	5.5	6.3	34.9	19.9	61	30	2	36.4	8.5
20	35.3	21.5	57	33	1	13.8	7.8	32.4	21.1	73	41	1	80.4	5.1
21	39.9	21.3	49	23	0	0.0	10.8	32.7	22.0	76	50	1	63.6	9.4
Mean/ Total	**27.2**	**12.9**	**80.9**	**40.1**	**20**	**91.6**	**6.5**	**28.2**	**12.8**	**85.0**	**44.6**	**10**	**210.2**	**6.5**

Table M5: Meteorological data in Central zone during crop growth period of Rabi 2020-21

Std. Week No.	URULIKANCHAN						JHANSI					
	Temperature (C)		Humidity (%)		No. of Rainy days	Rainfall (mm)	Temperature (C)		Humidity (%)		No. of Rainy days	Rainfall (mm)
	Max.	Min.	RH1	RH2			Max.	Min.	RH1	RH2		
40	31.9	21.9	98	56	2	14.7	35.9	20.7	86	56	0	0.0
41	31.4	21.5	99	64	5	165.9	35.3	19.3	86	48	0	0.0
42	30.2	21.0	99	69	3	70.7	35.3	19.7	87	44	0	0.0
43	32.5	20.7	100	55	0	0.0	35.4	15.5	86	44	0	0.0
44	32.9	16.8	100	43	0	0.0	32.0	11.5	85	44	0	0.0
45	31.1	11.8	100	42	0	0.0	31.0	10.6	88	42	0	0.0
46	31.9	15.6	100	56	0	0.7	29.0	13.2	85	45	0	0.0
47	32.0	17.0	98	56	0	0.5	25.7	9.7	85	47	0	2.0
48	27.4	16.7	96	56	0	0.0	25.8	9.1	86	50	0	0.0
49	30.8	10.6	100	44	0	0.9	27.6	9.6	87	56	0	0.0
50	30.7	17.5	97	55	0	1.4	26.7	10.5	87	55	0	0.0
51	29.1	9.9	100	45	0	0.0	23.5	5.4	86	51	0	0.0
52	31.0	11.9	100	48	0	0.0	22.5	5.2	85	57	0	0.0
1	29.8	16.8	99	60	1	5.0	22.7	10.3	87	65	0	0.0
2	30.4	17.1	100	49	1	7.4	21.3	9.4	90	60	0	0.0
3	32.8	15.9	99	47	0	0.0	22.2	6.3	88	56	0	0.0
4	32.3	12.2	99	41	0	0.0	21.0	5.7	88	59	0	0.0
5	31.0	11.1	97	40	0	0.0	24.7	6.3	89	48	0	0.0
6	31.4	9.4	96	33	0	0.0	24.2	9.1	86	4.6	0	1.0
7	32.5	13.3	96	40	2	19.4	27.5	10.9	88	43	0	3.8
8	30.5	14.1	97	47	0	0.2	28.8	12.1	79	42	0	0.0
9	33.9	14.7	88	29	0	0.0	32.1	14.2	85	46	0	0.0
10	34.1	14.4	85	28	0	0.0	33.7	14.3	81	43	1	0.0
11	34.3	15.9	85	30	0	0.0	31.6	14.5	86	39	1	4.6
12	34.3	17.6	87	38	1	6.4	34.8	16.6	81	37	1	4.2
13	34.6	15.6	80	27	0	0.0	37.0	16.8	78	33	0	0.0
14	34.1	18.3	84	28	0	0.7	38.7	17.3	72	33	0	0.0
15	34.4	20.4	90	37	1	7.6	38.4	18.8	64	36	0	0.0
16	34.4	19.6	83	30	0	0.2	39.1	19.0	60	36	0	0.0
17	34.5	20.2	80	29	0	1.7	38.7	18.5	64	33	0	0.0
18	34.5	20.9	87	39	0	3.2	42.1	19.7	58	32	0	0.0
19	34.3	23.6	84	45	0	0.5	38.1	21.1	56	38	0	0.6
20	31.8	22.8	92	63	4	39.0	35.6	21.3	71	44	2	23.0
21	32.6	23.1	90	54	2	34.4						
Mean/ Total	**32.2**	**16.8**	**94**	**45**	**22**	**380.5**	**30.8**	**13.4**	**80.9**	**44.4**	**5**	**39.2**

Table M6: Meteorological data in Central zone during crop growth period of Rabi 2020-21

Std. Week No.	ANAND						RAHURI						Sunshine hrs
	Temperature (C)		Humidity (%)		Rainfall (mm)	Sunshine hrs	Temperature (C)		Humidity (%)		No. of Rainy days	Rainfall (mm)	
	Max.	Min.	RH1	RH2			Max.	Min.	RH1	RH2			
40	33.9	24.9	87	52	13.2	8.8	31.7	23.5	90	56	2	9.4	8.0
41	35.9	23.0	77	39	0.0	8.0	31.5	23.7	85	47	2	10.6	4.5
42	35.1	26.9	88	57	10.4	7.0	29.8	23.1	89	54	4	114.6	4.8
43	35.3	20.3	80	30	0.0	9.5	30.1	21.5	92	63	1	21.4	6.7
44	34.0	17.6	80	31	0.0	9.1	30.9	18.0	90	55	-	0.0	8.9
45	33.4	15.8	80	30	0.0	9.3	29.1	13.9	87	37	-	0.0	9.1
46	32.6	19.1	79	40	0.0	8.5	29.9	18.4	84	33	-	0.0	9.2
47	30.4	15.2	81	39	0.0	8.7	30.6	19.0	83	41	1	4.2	7.8
48	30.4	17.6	77	42	0.0	8.4	28.2	17.5	89	44	-	0.0	8.2
49	32.7	15.1	88	36	0.0	9.5	29.5	12.8	82	44	-	0.0	9.6
50	27.4	17.9	94	62	16.4	4.8	27.7	18.0	84	28	-	0.0	4.1
51	26.6	12.6	82	44	0.0	8.8	28.1	12.3	84	47	-	0.0	8.0
52	26.8	12.3	74	37	0.0	9.2	27.9	13.2	84	36	-	0.0	8.4
1	25.7	14.9	77	48	0.0	4.1	27.7	17.7	85	44	-	0.0	4.8
2	27.5	16.1	89	59	0.0	5.6	28.2	18.3	91	44	1	20.6	6.1
3	29.2	13.6	91	44	0.0	8.6	30.1	17.0	84	37	-	0.0	8.0
4	26.9	11.1	81	38	0.0	9.4	30.2	14.2	86	34	-	0.0	8.8
5	28.9	10.9	83	31	0.0	9.8	28.5	12.6	81	34	-	0.0	8.3
6	29.6	11.0	80	23	0.0	9.7	28.3	11.1	80	27	-	0.0	9.6
7	31.8	14.7	82	34	0.0	9.2	30.4	15.3	79	31	-	0.0	8.6
8	32.7	15.6	74	27	0.0	9.8	29.2	15.0	85	34	1	7.2	8.9
9	34.4	15.2	84	27	0.0	10.2	33.1	16.4	75	21	-	0.0	9.8
10	35.8	16.6	85	29	0.0	9.7	35.0	15.6	71	20	-	0.0	9.2
11	36.4	18.1	75	30	0.0	8.8	35.9	17.3	70	21	-	0.0	8.7
12	36.5	20.0	77	36	0.0	8.8	33.7	19.4	77	31	3	23.4	7.4
13	38.1	19.8	74	27	0.0	9.6	37.4	18.5	70	14	-	0.0	9.5
14	38.3	22.3	83	29	0.0	9.6	37.8	21.2	68	15	-	0.0	9.5
15	39.4	21.9	73	25	0.0	9.5	37.0	23.8	60	19	-	0.0	7.8
16	38.5	23.8	69	31	0.0	10.0	37.7	23.5	57	16	-	0.0	9.7
17	39.3	24.0	73	38	0.0	9.5	38.4	25.0	50	17	-	0.0	9.4
18	39.4	26.1	69	31	0.0	9.0	36.8	25.3	60	25	-	2.0	7.0
19	39.6	26.3	71	33	0.0	10.4	38.5	26.2	63	24	-	0.0	9.0
20	35.6	25.8	77	54	130.0	4.8	35.5	26.2	71	25	-	2.6	5.2
21							37.1	25.4	70	28	-	0.0	7.9
Mean/ Total	**33.3**	**18.4**	**79.8**	**37.3**	**170.0**	**8.7**	**32.1**	**18.8**	**78.2**	**33.7**	**15**	**216.0**	**8.0**

Table M7: Meteorological data in Central zone during crop growth period of Rabi 2020-21

Std. Week No.	JABALPUR							RAIPUR						
	Temperature (C)		Humidity (%)		No. of Rainy	Rainfall (mm)	Sunshine hrs	Temperature (C)		Humidity (%)		No. of Rainy days	Rainfall (mm)	Sunshine hrs
	Max.	Min.	RH1	RH2				Max.	Min.	RH1	RH2			
40	32.1	20.9	85	52	0	0.0	7.4	31.8	25.0	90	63	1	12.8	4.0
41	32.3	22.8	91	58	0	0.0	5.7	32.5	25.3	90	66	0	0.0	5.0
42	33.0	21.2	89	49	0	0.0	8.2	31.9	24.4	90	60	1	7.0	6.5
43	32.7	16.7	85	33	0	0.0	8.7	32.6	20.1	87	35	0	0.0	8.0
44	30.8	12.7	80	25	0	0.0	8.3	31.8	17.4	82	30	0	0.0	7.6
45	29.6	8.3	81	22	0	0.0	7.9	30.3	12.5	87	28	0	0.0	8.5
46	31.2	15.5	86	41	1	5.2	8.2	32.7	18.9	87	37	0	0.0	8.5
47	28.0	10.7	82	37	0	1.4	6.9	31.0	15.9	88	35	0	0.4	7.4
48	27.6	9.1	83	33	0	0.0	8.1	28.6	14.7	81	35	0	0.0	6.2
49	29.3	9.1	81	29	0	0.0	9.4	30.7	11.9	89	33	0	0.0	7.3
50	26.4	14.7	88	57	0	2.3	3.2	30.2	15.8	86	37	0	0.0	3.7
51	23.2	5.5	74	31	0	0.0	7.4	27.7	10.3	87	27	0	0.0	5.0
52	23.8	7.2	83	43	0	0.0	6.2	28.4	10.3	87	28	0	0.0	4.8
1	26.5	12.4	87	50	0	0.5	4.5	29.7	13.8	85	32	0	0.0	3.2
2	25.0	11.8	86	49	0	0.4	5.7	31.2	16.3	78	30	0	0.0	3.9
3	25.4	8.0	75	31	0	0.0	8.2	30.0	11.7	83	24	0	0.0	6.1
4	24.6	8.6	86	49	0	0.0	7.4	31.0	14.2	80	36	0	0.0	3.3
5	21.4	4.8	73	31	0	0.0	6.0	28.2	10.3	81	23	1	4.6	6.8
6	26.4	8.9	72	34	0	0.0	9.1	30.1	10.6	78	20	0	0.0	9.5
7	27.7	11.8	83	42	1	12.6	7.7	31.4	14.9	80	41	0	1.0	3.6
8	28.6	10.6	79	28	0	0.0	9.3	30.9	14.5	81	30	0	1.4	7.4
9	32.7	12.4	74	25	0	0.0	9.8	35.8	15.7	69	16	0	0.0	9.5
10	34.8	13.0	74	20	0	0.0	8.9	36.3	17.3	64	21	0	0.0	8.3
11	32.3	15.3	78	29	1	6.2	7.0	34.7	19.4	76	27	1	6.2	5.9
12	33.9	16.7	67	27	0	0.0	5.0	35.1	20.1	65	28	0	1.4	5.0
13	36.8	16.7	57	13	0	0.0	8.5	39.7	20.6	51	13	0	0.0	8.3
14	38.3	14.8	64	11	0	0.0	8.6	40.4	21.4	57	18	0	0.0	7.4
15	37.7	18.6	61	22	0	0.6	8.0	38.5	23.8	53	22	0	0.0	5.7
16	37.0	18.0	53	19	0	0.0	7.2	38.8	23.2	55	23	0	1.0	6.7
17	38.2	17.5	52	13	0	0.0	9.9	40.2	22.9	48	15	0	0.0	8.6
18	38.8	23.2	47	24	1	2.6	7.8	39.9	25.2	54	27	0	0.0	7.9
19	38.0	23.3	71	35	2	39.0	9.6	36.2	23.9	73	48	3	68.6	7.8
20								38.9	27.4	67	38	0	0.6	10.5
21								38.9	27.2	50	22	0	0.0	6.5
Mean/ Total	**30.8**	**13.8**	**75.8**	**33.2**	**6**	**70.8**	**7.6**	**33.4**	**18.1**	**75.3**	**31.4**	**7**	**105.0**	**6.6**

Table M8: Meteorological data in North East zone during crop growth period of Rabi 2020-21

Std. Week No.	RANCHI							JORHAT						
	Temperature (C)		Humidity (%)		No. of Rainy days	Rainfall (mm)	Sunshine hrs	Temperature (C)		Humidity (%)		Rainfall (mm)	No. of Rainy days	Sunshine hrs
	Max.	Min.	RH1	RH2				Max.	Min.	RH1	RH2			
40	31.1	21.7	86	69	0	2	3.8	32.0	24.7	96	81	63.0	3	3.2
41	31.1	22.3	84	69	2	2.2	7.1	32.9	24.3	96	70	10.0	1	6.6
42	30.7	21.2	87	69	0	3.3	9.1	33.2	23.8	96	69	6.7	2	6.3
43	28.8	17.9	83	68	0	0.7	8.8	28.9	21.5	97	79	101.1	3	3.0
44	30.0	18.7	86	70	0	1.7	9.1	31.2	21.7	95	67	14.7	2	5.3
45	28.6	13.7	85	69	0	0.5	8.8	29.0	16.8	97	63	0.0	0	6.3
46	30.7	19.4	86	68	0	5.1	8.5	29.7	15.1	96	60	4.6	1	7.2
47	27.6	16.1	86	68	0	2.5	7	25.5	14.1	99	61	0.0	0	5.9
48	25.4	7.2	86	69	0	3.3	6.1	26.6	12.1	98	54	0.0	0	7.8
49	26.1	6.7	85	68	0	3.6	9.4	25.0	12.7	98	61	4.0	1	6.7
50	27	7.9	84	68	0	5.6	4.9	25.2	11.9	98	65	0.0	0	5.9
51	20.8	3.6	85	68	0	5.9	7.2	23.9	9.4	99	61	0.0	0	5.4
52	20.3	4.1	86	69	1	8.9	9.3	24.3	8.2	99	58	0.0	0	7.0
1	25.1	9.1	86	68	0	7.5	8.4	25.0	8.1	100	50	0.0	0	7.1
2	27.3	12.3	86	69	0	5.4	7.9	23.2	12.7	99	72	0.0	0	1.7
3	23.4	4.2	85	70	0	7.2	9.1	21.0	11.5	100	77	11.9	2	0.9
4	24.6	5.2	87	68	0	4.2	9.5	23.6	9.4	100	58	0.0	0	6.4
5	22.6	4.0	85	68	2	5.1	8.2	25.3	9.6	99	50	2.4	0	7.8
6	26.6	6.2	87	69	0	6.5	9.1	27.0	9.6	99	42	0.8	0	8.8
7	26.7	9.6	86	69	0	6.9	8.1	27.5	11.7	96	44	0.0	0	6.2
8	27.3	11.9	87	69	0	3.9	7.4	29.3	12.4	97	43	0.0	0	5.5
9	34	13.8	86	69		2	9.2	26.5	15.6	95	61	2.5	0	3.0
10	35.6	15.5	88	69		2.2	9.1	26.0	14.8	97	67	43.6	4	2.9
11	32.4	14	85	70		3.3	6.7	29.9	17.0	95	52	3.6	0	6.1
12	34.6	17.5	86	69		0.7	8.2	32.1	17.4	91	47	0.0	0	5.0
13	35.6	16.8	87	70		1.7	9.6	30.1	16.6	95	58	20.6	2	3.8
14	36.7	17.7	83	69		0.5	9.3	31.4	17.0	89	47	0.8	0	6.5
15								31.1	18.5	88	52	0.0	0	4.3
16								29.6	19.3	88	62	26.0	1	5.1
17								35.2	19.6	82	40	0.0	0	9.1
18								32.5	20.7	87	63	7.4	2	1.5
19								29.5	20.1	94	69	36.3	4	3.6
20								27.5	20.9	98	86	55.3	5	1.0
21								33.1	24.2	91	68	49.3	4	5.3
Mean/ Total	**28.5**	**12.5**	**85.7**	**68.8**	**5**	**102.4**	**8.1**	**28.3**	**16.0**	**95.4**	**60.5**	**465**	**37**	**5.2**

Table M9: Meteorological data in North East zone during crop growth period of Rabi 2020-21

Std. Week No.	IMPHAL							KALYANI						
	Temperature (C)		Humidity (%)		Rainfall (mm)	No. of Rainy days	Sunshine hrs	Temperature (C)		Humidity (%)		No. of Rainy days	Rainfall (mm)	Sunshine hrs
	Max.	Min.	RH1	RH2				Max.	Min.	RH1	RH2			
40	30.0	22.6	91	67	23.0	3	4.3	31.9	25.5	95	82	7	20.6	5.0
41	29.0	22.3	94	70	40.4	5	4.1	34.0	25.9	94	72	4	13.4	7.2
42	31.8	21.1	89	59	2.1	2	8.0	33.0	26.2	90	62		0.0	8.0
43	28.8	20.8	93	70	47.3	4	3.8	30.3	23.5	95	74	2	2.1	5.3
44	27.9	19.6	96	69	8.9	3	6.0	32.1	22.5	91	63		0.0	7.9
45	27.8	19.1	97	68	115.1	4	5.3	31.0	16.9	89	42		0.0	8.9
46	27.8	13.2	93	47	0.0	0	10.0	31.9	25.5	95	82	7	20.6	5.0
47	26.2	12.0	94	46	0.0	0	9.4	34.0	25.9	94	72	4	13.4	7.2
48	24.3	10.0	92	49	0.0	0	6.7	33.0	26.2	90	62		0.0	8.0
49	25.5	9.6	95	44	0.0	0	8.7	30.3	23.5	95	74	2	2.1	5.3
50	23.0	8.0	96	47	0.0	0	9.2	32.1	22.5	91	63		0.0	7.9
51	23.0	7.5	95	48	0.0	0	9.4	31.0	16.9	89	42		0.0	8.9
52	22.3	5.1	96	52	0.0	0	9.0	31.7	17.9	87	45		0.0	9.5
1	24.7	5.8	97	38	0.0	0	6.5	28.7	17.5	88	53	1	0.0	5.2
2	23.1	6.4	94	42	0.0	0	8.0	27.7	14.5	89	55		0.0	6.1
3	21.7	7.9	96	47	6.6	1	6.2	28.5	14.5	90	53		0.0	4.6
4	23.4	5.9	97	37	0.0	0	8.9	24.9	14.6	97	65		0.0	2.4
5	24.0	6.7	94	36	0.0	0	8.6	23.9	11.2	91	45		0.0	5.7
6	25.5	7.4	94	31	4.3	1	9.3	24.9	9.1	89	44		0.0	7.0
7	26.5	6.7	92	29	0.0	0	9.2	25.7	9.8	90	44		0.0	7.8
8	26.9	9.9	88	35	0.0	0	6.8	28.4	15.2	89	50		0.0	5.5
9	27.2	13.2	85	32	3.2	1	5.5	22.9	11.3	92	56		0.0	0.2
10	26.9	13.3	85	40	11.5	6	6.8	24.3	13.4	94	56		0.0	3.6
11	30.0	11.9	80	30	0.0	0	9.1	23.3	8.6	89	41		0.0	6.3
12	30.3	12.8	72	25	0.0	0	6.9	27.1	11.1	88	39	2	0.2	7.7
13	28.8	13.4	78	36	54.6	3	5.8	29.6	14.0	90	41		0.0	7.1
14	29.5	14.0	83	35	6.8	1	6.0	29.5	15.1	90	44		0.0	4.7
15	30.7	16.4	75	36	6.6	4	7.4	35.0	19.1	90	29		0.0	8.2
16	28.9	15.9	77	45	30.9	2	6.2	34.4	19.2	88	36		0.0	7.0
17	32.6	15.0	66	31	0.0	0	8.8	33.2	20.8	91	47		0.0	5.0
18	30.3	17.2	82	47	21.4	5	5.8	37.2	20.3	85	28		0.0	7.8
19	28.7	17.7	78	53	22.1	6	6.5	37.5	22.7	86	32		0.0	6.8
20	27.8	19.6	88	66	38.3	5	2.6	37.5	22.7	86	32		0.0	6.8
21	32.0	21.0	79	60	30.6	4	7.0	36.5	23.8	89	37	1	1.5	8.0
Mean/Total	**27.3**	**13.2**	**88.3**	**46.1**	**473.7**	**60**	**7.1**	**30.5**	**18.5**	**90.5**	**51.8**	**30**	**73.9**	**6.4**

Table M10: Meteorological data in North East zone during crop growth period of Rabi 2020-21

Std. Week No.	BHUBANESWAR							AYODHYA						
	Temperature (C)		Humidity (%)		Rainy days	Rainfall (mm)	Sunshine hrs	Temperature (C)		Humidity (%)		Rainy days	Rainfall (mm)	Sunshine hrs
	Max.	Min.	RH1	RH2				Max.	Min.	RH1	RH2			
40	30.6	25.3	97	86	5	116.5	1.5	34.4	23.0	94	531	1	3.0	6.6
41	32.8	25.7	95	76	2	77.7	5.3	34.3	21.4	90	50	0	0.0	7.8
42	32.2	25.2	96	74	4	36.4	5.1	34.2	21.1	92	44	0	0.0	7.0
43	31.8	23	95	71	2	17	4.9	32.9	16.4	91	36	0	0.0	7.6
44	32.9	22.1	89	66	0	0	8.5	31.3	13.5	90	32	0	0.0	7.7
45	31.4	18.7	91	57	0	0	7.2	30.0	11.7	92	33	0	0.0	5.1
46	32.0	20.5	90	50	1	2.8	6.7	28.1	14.8	93	50	1	6.2	6.7
47	31.6	19.4	90	50	0	0.8	6.4	25.9	10.2	92	36	0	0.0	7.1
48	29.4	16.1	88	40	0	2	5.5	26.8	8.8	92	37	0	0.0	7.4
49	31.6	15.2	95	41	0	0	7.6	27.3	10.2	94	47	0	0.0	5.2
50	31.0	17	96	43	0	0	5.9	22.7	11.0	91	58	2	0.0	1.8
51	28.3	13.4	91	42	0	0	6.2	20.5	5.1	92	45	0	0.0	6.0
52	28.1	11.9	95	41	0	0	5.6	23.0	5.1	92	42	0	0.0	7.0
1	29.4	13.5	92	36	0	0	6.2	24.4	9.5	87	45	2	0.0	4.9
2	32.8	17.9	90	40	0	0	5.4	21.3	8.8	89	59	1	0.0	5.8
3	29.8	16.9	93	45	0	0	2.7	18.5	7.4	96	64	2	0.0	2.8
4	30.6	16.8	94	35	0	0	3.4	16.8	7.0	97	72	0	0.0	3.7
5	29.1	13.6	94	36	0	0	4.8	21.1	5.5	94	49	0	0.0	4.5
6	31	13.2	92	29	0	0	8.1	25.5	9.0	89	46	0	0.0	6.3
7	33.6	16.7	92	29	0	0	6.4	27.2	9.5	93	43	0	0.0	6.8
8	33.4	16.9	89	28	0	0	5.8	28.2	11.7	89	44	0	0.0	7.6
9	38.1	20.2	95	25	0	0	7.8	30.2	13.2	75	42	0	0.0	7.0
10	37.1	22.3	95	36	0	0	6.5	31.8	14.2	77	51	0	0.0	6.6
11	36.3	22.7	92	33	0	0	7.1	32.3	15.2	85	47	0	0.0	6.2
12	38.5	23.5	92	30	0	0	4.1	34.6	16.5	76	38	0	0.0	6.8
13	39.7	24.6	93	35	1	7.5	6.3	35.6	16.4	77	36	0	0.0	7.5
14	37.6	25.5	92	46	1	3.5	6.8	37.5	17.0	64	24	0	0.0	6.7
15	37	24.8	89	50	1	3.7	4.6	33.3	18.8	47	22	0	0.0	6.2
16	38.8	26.0	90	42	0	0	8.0	37.9	20.1	56	35	0	0.0	7.5
17	39.9	26.6	89	37	0	0	7.3	38.5	17.7	79	38	0	0.0	7.5
18	37.3	25.0	87	47	2	5.6	7.6	36.3	24.1	64.9	38.4	0	0.0	6.9
19	37.4	25.5	85	60	4	58.2	8.1	34.6	25.6	73.1	44.4	1	30.2	6.9
20	37.1	27.3	91	51	1	31.2	8.9	34.5	24.1	82.0	61.3	1	4.4	4.7
21	34.9	25.6	89	67	4	105.3	4.7	34.2	24.4	79.4	50.0	1	16.2	6.7
Mean/ Total	**33.6**	**20.5**	**91.8**	**46.3**	**28**	**468.2**	**6.1**	**29.2**	**13.0**	**85.5**	**59.9**	**12**	**60.0**	**6.2**

Table M11: Meteorological data in North East zone during crop growth period of Rabi 2020-21

Std. Week No.	Pusa						
	Temperature (C)		Humidity (%)		Rainy days	Rainfall (mm)	Sunshine hrs
	Max.	Min.	RH1	RH2			
40	32.8	26.5	89	80	0	0.0	4.4
41	33.8	25.8	86	77	0	0.0	7.3
42	34.0	25.0	88	69	0	0.0	7.0
43	32.0	22.2	91	66	0	0.0	8.1
44	31.3	18.9	85	47	0	0.0	8.5
45	29.9	15.5	85	55	0	0.0	8.3
46	30.0	18.6	82	51	0	0.0	8.8
47	26.6	14.4	86	62	0	0.0	6.8
48	26.8	13.0	92	59	0	0.0	6.5
49	23.1	12.1	96	79	0	0.0	0.0
50	22.7	12.0	94	72	0	0.0	0.9
51	19.8	8.4	95	71	0	0.0	3.8
52	22.9	8.0	95	65	0	0.0	6.8
1	24.4	11.2	94	66	0	0.0	6.4
2	21.6	10.9	95	68	0	0.0	4.9
3	15.6	8.2	94	77	0	0.0	0.1
4	16.9	8.2	95	82	0	0.0	2.0
5	19.4	7.2	94	74	0	0.0	3.2
6	24.6	10.6	90	63	0	0.0	7.4
7	26.0	12.2	93	71	0	0.0	6.1
8	28.0	13.9	90	58	0	0.0	9.0
9	29.2	15.5	84	55	0	0.0	9.6
10	30.3	16.9	93	64	0	0.0	8.8
11	30.1	17.6	89	57	0	0.0	7.2
12	33.9	19.0	82	42	0	0.0	7.7
13	34.3	17.2	87	45	0	0.0	8.3
14	35.6	17.8	79	38	0	0.0	9.0
15	36.5	20.4	81	42	0	0.0	6.3
16	34.3	20.5	75	45	0	0.8	7.9
17	37.1	19.5	83	33	0	0.0	9.4
18	32.9	21.6	77	53	0	2.0	7.8
19	30.3	21.1	87	69	2	27.3	5.5
20	33.8	23.5	89	59	1	52.2	6.6
21	32.9	23.5	82	66	4	63.6	3.7
Mean/ Total	**28.6**	**16.4**	**88.2**	**61.2**	**7**	**145.9**	**6.3**

Table M12: Meteorological data in South zone during crop growth period of Rabi 2020-21

Std. Week No.	HYDERABAD							VELLAYANI						
	Temperature (C)		Humidity (%)		No. of Rainy Days	Rainfall (mm)	Sunshine hrs	Temperature (C)		Humidity (%)		No. of Rainy days	Rainfall (mm)	Sunshine hrs
	Max.	Min.	RH1	RH2				Max.	Min.	RH1	RH2			
40	31.1	22.0	93	60	1	8.0	5.6	31.8	25.1	92	78	1	3.6	7.4
41	29.1	21.9	94	80	2	48.6	2.9	30.7	24.0	96	86	5	118.2	3.9
42	28.8	20.7	98	77	4	271.0	4.7	30.7	24.8	94	81	3	26.7	5.5
43	30.6	18.8	96	67	1	25.0	6.0	31.9	25.3	90	83	2	0.8	8.3
44	30.8	17.1	93	50	0	0.0	8.0	32.4	25.2	88	75	0	0.0	8.1
45	30.2	14.9	88	39	0	0.0	8.2	33.2	25.8	92	76	2	2.4	7.0
46	29.5	17.6	87	49	0	0.0	7.8	30.6	24.5	95	86	5	71.0	3.2
47	30.6	17.1	87	40	0	0.0	8.3	32.6	24.9	92	75	0	0.0	6.1
48	26.4	17.1	90	61	3	15.2	4.7	32.9	25.1	89	78	1	11.7	7.4
49	28.9	12.8	96	38	0	0.0	8.4	31.3	24.3	93	82	1	8.7	2.8
50	29.5	12.9	92	35	0	0.0	9.6	32.8	24.4	93	75	1	0.4	7.2
51	27.9	12.4	93	46	0	0.0	8.5	32.2	23.9	94	83	3	9.5	3.3
52	27.8	10.9	93	46	0	0.0	8.1	33.2	23.6	90	75	0	0.0	7.2
1	27.1	15.4	96	54	1	3.6	5.9	32.0	23.6	95	84	4	32.2	3.9
2	29.1	16.2	94	45	0	0.6	6.0	30.3	23.9	94	88	6	45.0	0.9
3	29.5	14.0	94	41	0	0.0	8.2	32.0	24.2	93	77	1	1.4	4.8
4	31.6	15.4	95	43	0	0.0	8.4	32.6	22.2	92	72	0	0.0	8.5
5	29.5	14.4	92	40	0	0.0	6.4	33.0	23.7	91	69	0	0.0	8.7
6	29.7	11.2	90	36	0	0.0	9.2	33.0	21.4	92	72	0	0.0	9.1
7	31.7	13.7	84	42	0	0.0	9.4	33.0	20.4	89	71	0	0.0	9.1
8	30.1	15.9	88	46	0	0.4	7.6	33.3	23.4	91	72	0	0.0	8.3
9	35.1	16.4	85	40	0	0.0	8.6	33.4	22.5	88	68	0	0.0	8.6
10	35.4	14.9	82	27	0	0.0	9.1	34.0	20.4	90	66	0	0.0	8.1
11	35.4	15.0	83	20	0	0.0	8.9	34.3	23.0	88	65	0	0.0	8.8
12	35.4	18.6	76	35	0	0.0	6.9	34.1	25.4	89	68	0	0.0	6.8
13	37.7	19.4	78	34	0	0.0	7.3	34.1	25.8	90	72	2	70.5	7.7
14	38.3	19.8	73	38	0	0.0	8.4	34.3	26.4	88	76	0	0.0	8.9
15	36.9	22.1	81	50	1	12.2	6.2	33.5	25.6	91	79	5	64.3	6.6
16	36.4	22.0	86	51	0	0.0	7.9	33.4	25.4	87	79	2	1.5	6.6
17	37.6	24.4	85	49	0	0.0	7.9	34.2	26.1	88	77	0	0.0	8.2
18	36.9	23.4	82	46	1	14.2	7.8	33.6	26.0	89	77	3	58.6	6.9
19	36.9	25.1	85	51	0	1.6	8.9	33.5	25.5	93	80	4	216.0	5.5
20	36.1	24.4	92	54	4	74.6	8.4	31.1	24.1	96	87	7	326.7	2.8
21	36.0	25.1	93	52	1	22.2	7.9	30.5	24.1	95	88	7	278.9	2.9
Mean/ Total	**32.2**	**17.7**	**88.6**	**46.6**	**19**	**497.2**	**7.5**	**32.6**	**24.2**	**91.4**	**77.1**	**65**	**1348.1**	**6.4**

APPENDICES

APPENDIX-I: FORAGE CROPS BREEDING TRIALS AT A GLANCE: (RABI-2020-21) Cont...

Rabi 2020-21		Tr.-1	Tr.-2	Tr.-3	Tr.-4	Tr.-5	Tr.-6	Tr.-7	Tr.-8	Tr.-9	Tr.-10	Tr.-11	Tr. -12
Zone	Location	IVTB	AVTB-1	AVTB-2	AVT-2 B (Seed)	IVTO (SC)	AVTO (SC-1)	AVTO (SC-2)	AVTO (SC-2) (Seed)	IVTO (MC)	AVTO-1 (MC)	AVTO-2 (MC)	AVT-2 (MC) (Seed)
1 (HZ)	Palampur	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR		
2	Srinagar	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR		
3	Almora	DR	DR							DR	DR		
4	Rajouri	DR	DR	DR		DR	DR	DR					
5 (NWZ)	Bikaner	DR	DR	DR		DR	DR						
6	Jalore			DR						DR		DR	
7	Hisar	DR	DR	DR	DR	DR	DR			DR		DR	DR
8	Ludhiana	DR	DR	DR	DR	DR	DR			DR		DR	DR
9	Pantnagar	DR	DR	DR	DR	DR	DR			DR		DR	DR
10	Udaipur	DR	DR	DR		DNR	DR						
11	Meerut	DR	DR	DR		DR	DR						
12 (NEZ)	Jorhat					DR	DR			DR			
13	Kalyani	DR	DR			DR	DR						
14	Bhubaneswar	DR	DR			DR	DR			DR			
15	Ranchi	DR	DR			DR	DR			DR			
16	Pusa	DR	DR			DR	DR			DR			
17	Ayodhya	DR	DR			DR	DR			DR			
18	CAU Imphal					DR	DR			DR			
19(CZ)	Jhansi	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR		
20	Rahuri	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR		
21	Urulikanchan	DR	DR	DR		DR	DR	DR		DR	DR		
22	Anand					DR	DR	DR	DR	DR	DR		
23	Jabalpur	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR		
24	Raipur	DR	DR	DR	DR	DR	DR	DR	DR				
25	Karjat					DR	DR	DR					
26	Dhari					DR	DR						
27 (SZ)	Hyderabad					DR	DR	DR	DR				
28	Mandya					DR	DR	DR	DR				
29	Coimbatore					DR	DR	DR	DR				
30	Vellayani/Mattupetty					DR	DR	DR					
31	Tirupti/Guntur					DR	DNR	DNR					
32	Dharwad												
Total Location		20/20	20/20	15/15	9/9	29/28	29/28	15/14	10/10	18/18	8/8	4/4	3/3

APPENDIX-I: FORAGE CROPS BREEDING TRIALS AT A GLANCE: (RABI-2020-21)

Rabi 2020-21		Tr. 13	Tr.-14	Tr.-15	Tr.-16	Tr.-17	Tr.-18	Tr.-19	Total
Zone	Location	IVTO (Dual)	VT Lucerne (New)	AVT Lucerne-1 (Annual)	IVT Summer Bajra (New)	AVT-1 Summer Bajra	AVT-2 Summer Bajra	AVT-2 Summer Bajra (Seed)	
1 (HZ)	Palampur								10/10
2	Srinagar								10/10
3	Almora								4/4
4	Rajouri								6/6
5 (NWZ)	Bikaner	DR	DR	DR					8/8
6	Jalore		DR	DR					5/5
7	Hisar	DR							10/10
8	Ludhiana	DR	DR	DR					12/12
9	Pantnagar	DR							10/10
10	Udaipur		DNR	DNR					7/4
11	Meerut								5/5
12 (NEZ)	Jorhat	DR							4/4
13	KalDRani								4/4
14	Bhubaneswar	DR							6/6
15	Ranchi	DR							6/6
16	Pusa	DR							6/6
17	ADRodhDRa	DR							6/6
18	CAU Imphal								3/3
19 (CZ)	Jhansi	DR							11/11
20	Rahuri	DR	DR		DR	DR	DR	DR	16/16
21	Urulikanchan		DR		DR	DR	DR	DR	13/13
22	Anand	DR			DR	DR	DR	DR	11/11
23	Jabalpur	DR			DR	DR	DR	DR	15/15
24	Raipur	DR							9/9
25	Karjat								3/3
26	Dhari								2/2
27 (SZ)	HDRderabad		DR	DR	DR	DR			8/8
28	MandDRa		DR	DR	DR	DR			8/8
29	Coimbatore		DR	DR					6/6
30	Vellayani/Mattupatty				DR	DR			5/5
31	Tirupti/Guntur		DNR						4/1
32	Dharwad		DR	DR					2/2
Total Location		14/14	11/9	8/7	7/7	7/7	4/4	4/4	235/229

Abbreviations: DR = Data Reported; **DNR** =Data not reported; **Data Reporting= (%) = 97.4 (%)**

APPENDIX-II: FORAGE CROP PRODUCTION TRIALS AT A GLANCE: (RABI-2020-21)

Location	R-18-AST-4	R-19-AST-5	K-19-AST-1	R-19-AST-1	K-19-AST-2	R-19-AST-2	R-19-AST-3	K-20-AST-1c	K-20-AST-6	K-16-AST-6	R-16-AST-4	K-18-AST-4	R-18-AST-7	R-19-AST-5	K-20-AST-4b	K-20-AST-4c	R-20-AST-1	R-20-AST-2	R-20-AST-3	R-20-AST-4	Total
Hill Zone																					
Palampur															DR		DR	DR			3/3
Srinagar								DR									DR	DR			3/3
North West zone																					
Hisar								DR		DR							DR		DR		4/4
Pantnagar		DR		DR													DR		DR		4/4
Bikaner													DR								1/1
Ludhiana																	DR		DR		2/2
North East zone																					
Ayodhya	DR			DR												DR					3/3
Ranchi		DR		DR	DR			DR													4/4
Kalyani	DR				DR																2/2
Jorhat	DR				DR																2/2
Imphal	DR				DR						DR										3/3
Pusa					DR			DR													2/2
Central Zone																					
Jabalpur	DR																			DR	2/2
Urulikanchan								DR										DR		DR	3/3
Anand	DR			DR		DR		DR										DR		DR	6/6
Raipur																		DR			1/1
South Zone																					
Hyderabad			DR			DR						DR									3/3
Coimbatore			DR																		1/1
Mandya			DR				DR		DR												3/3
Vellayani			DR											DR							2/2
Dharwad							DR		DR												2/2
Total (DR & TC)	6/6	2/2	4/4	4/4	5/5	2/2	2/2	6/6	2/2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	5/5	5/5	3/3	3/3	56/56

DR- Data reported; **DNR-**Data not reported**; Success Index (%) =** (100) %

APPENDIX –III: FORAGE CROP PROTECTION TRIALS AT A GLANCE (RABI- 2020-21)

Locations/Trials	PPT-1	PPT-2	PPT-17	PPT-26	PPT-30	PPT-31	PPT-34	PPT-35	PPT-36	Total
(HZ)										
Palampur	DR	DR	DR		DR		DR			**5/5**
(NWZ)										
Ludhiana	DR	DR		DR		DR	DR	DR	DR	**7/7**
(NEZ)										
Bhubaneswar	DR	DR					DR			**3/3**
(CZ)										
Rahuri	DR	DR		DR		DR			DR	**5/5**
Jhansi	DR	DR					DR		DR	**4/4**
Total	**5/5**	**5/5**	**1/1**	**2/2**	**1/1**	**2/2**	**4/4**	**1/1**	**3/3**	**24/24**

Abbreviations: DR = Data Reported; **DNR** =Data not reported; **Data Reporting (%) =100 %**

APPENDIX- IV

Rating Scales used in Forage Crop Protection trials

Oat

Leaf Blight

Select 10 plants/treatment and calculate the disease severity index (%).

Disease rating scale	Per cent leaf area affected	Disease reaction
0	0%	Immune (I)
1	1-10%	Highly resistant (HR)
2	10.01-20.00%	Resistant (R)
3	20.01-30.00%	Moderately resistant (MR)
4	30.01-40.00%	Low resistant (LR)
5	40.01-50.00%	Mesothetic (M)
6	50.01-60.00%	Low susceptible (LS)
7	60.01-70.00%	Moderately susceptible (MS)
8	70.01-80.00%	Susecptible (S)
9	80.01-100.00 %	Highly susceptible (HS)

Powdery mildew

Select 10 plants/treatment and calculate the disease severity index (%).

Disease rating	Description	Disease severity (%)	Reaction
0	No symptom on the leaf	No disease	No disease **(ND)**
1	Small pecks of whitish gray dots covering 1% or less of the leaf area	<1	Highly Resistant **HR)**
3	White powdery patches covering 1-10% of the leaf area	1-10	Resistant **(R)**
5	Powdery patches big, covering 11-25% of the leaf area	11-25	Moderately resistant **(MR)**
7	Powdery patches big, coalescing, covering 26-50% of the leaf area	26--50	Susceptible (**S)**
9	Powdery patches big, coalescing to cover 51% or more of the leaf area.	>50	Highly susceptible (**HS)**

Aphids

Rating scale	Number of aphids	Appearance	Reaction
0	0	no infestation	Immune
1	1-4	a few individual aphids	Resistant
3	5-20	a few isolated colonies	Moderately resistant
5	21-100	several small colonies	Moderately susceptible
7	101-500	large isolated colonies	susceptible
9	>500	large continuous colonies	Highly suscetible

Berseem

Stem rot

Select 10 plants/treatment and calculate the disease incidence (%).

Rating scale	Symptom	Rating score	Disease incidence	Reaction
0	no visible infection			
1	early infection indicated by a small lesion (< 10 mm)	equal to or less than 1.50	(≤15 % incidence)	Resistant
2	moderate infection (10-20 mm),	1.51 to 3.00	(>15-30 % incidence)	Moderately resistant
3	Severe infection characterized by a large, water-soaked lesion (> 20 mm) or collapse of the stem	more than 3.00	(>30 % incidence)	Susceptible

Root rot/ wilt:

Select 10 plants/treatment and calculate the disease incidence (%).

Rating scale	Description (Infected plants)	Reaction
1	0	Immune
2	0-5 %	Resistant
3	5-10 %	
4	11-20 %	Moderately resistant
5	21-40 %	Moderately susceptible
6	41-60 %	Susceptible
7	61-80 %	Highly suscetible
8	81-90 %	
9	91-100 %	

Lucerne

Rust

Select 10 plants/treatment and calculate the disease severity index (%).

Score	Severity Level	Disease signs and intensity
1	No disease infection	No visible infection and sign of disease on leaflet
2	Resistant	Flecks and closed pustules, 0–25% affected foliage
3	Moderately resistant	Some flecks closed and open pustules, 25–50% foliage affected
4	Susceptible	Several small open pustules, 50–75% foliage affected
5	Highly susceptible	Several large open pustules, 75–100% foliage get infected

Downy mildew

Select 10 plants/treatment and calculate the disease incidence (%).

Disease incidence	Reaction
≤10 %	Resistant
>10-20 %	Moderately resistant
>20-40 %	Moderately susceptible
>40-60 %	susceptible
>60 %	Highly susceptible

Weevil, *Helicoverpa*, aphids and *Spodoptera*

For all these pests, select 10 plants/replication and count the number of larvae/nymphs as given in Lucerne trial in proceedings rabi 2020-21.

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