Foreword

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 amount and quality of feed and fodder supplies will be crucial in sustaining the growth of animal husbandry sector. 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. 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 and judiciously pursuing the mandate for development of varieties, technique for raising cultivated forage crops and grasses of annual and perennial nature and eco-friendly crop protection technologies and bringing scatters stakeholders and informations at common platform.

I would like to congratulate Project Coordinator and other scientists of AICRP (FC&U) unit who have contributed in the preparation of the Annual Report *Rabi*-2017-18 and helped in achieving the set targets.

14.8.18

(Khem Chand)
Director
ICAR-IGFRI
Jhansi-284003

PREFACE

The Annual Report (2017-18), Part II–*Rabi* 2017-18 embodies the results of 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 Centres. The trials and activities were successfully conducted as per the technical programme fixed for Rabi 2017-18. The report is divided into several chapters, which include Forage Crop Improvement, Forage Crop Production, Forage Crop Protection, Breeder Seed Production, etc. The performance 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 focuses 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 and Berseem. The chapter on Crop Protection deals with different aspects of crop protection in important Rabi forage crops as well as generation of technologies for pest management in the selected crops. The information on breeder seed production of forage species at various centres is also compiles in Breeder Seed Production chapter. Weather data from coordinating and voluntary centers has also been compiled to present an overview of prevalent weather elements during crop growth as well as to correlate the growth and yield of forage crops with weather parameters. Other chapters include details of In-House breeding activities, ther activities of the centers, Fodder technologies demonstrations 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 overall outputs of AICRP on Forage Crops and Utilization is gratefully acknowledged.

I thankfully acknowledge the contribution of colleagues at Project Coordinating unit, Dr. R. K. Agrawal, Principal Scientist (Agronomy), Dr. Nitish R. Bhardwaj, Scientist (Plant Pathology) and technical officers, Shri R. Patel and Shri H. K. Agarwal who provided support in distribution of seed/planting material and analysis and tabulation of data of trials conducted during the season. The efforts of Ms. Priyanka Dixit and Shri Prem kushwaha in computer-based work to final report preparation are sincerely acknowledged.

The administrative support and cooperation received from Dr. Khem Chand, Director, ICAR-IGFRI; Dr.R.V. Kumar and Dr. A.K. Misra, Ex-Directors, IGFRI are thankfully acknowledged. I also record my sincere thanks to colleagues at IGFRI for their kind support.

Meeting 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. A.K. Singh, DDG (CS); Dr. I. S. Solanki, Former ADG (FFC); Dr. R. K. Singh, ADG (CC & FFC) and Dr. D.K.Yadava, ADG (Seed). Support received in various forms from Sri G.R. Deshbandhu, Director (CS), Dr. Dinesh Kumar, Principal Scientist (FFC), ICAR are also gratefully acknowledged. Each and everyone in the team at AICRP on Forage Crops & Utilization gratefully acknowledges their guidance and support.

A. K. Roy
Project Coordinator

CONTENTS

EXECUTIVE SUMMARY

The present report encompasses the results of the coordinated trials conducted on Crop Improvement, Crop Production, Crop Protection as well as the Breeder seed production of the different forage crops during Rabi 2017-18 at different locations/centers in the country placed in five zones *viz*., Hill zone, North West zone, North East zone, Central zone and South zone. Weather data are also reported to correlate the growth and yield of forage crops with weather parameters at different sites during crop period. Results of other activities carried out by staff of AICRP units, in house breeding, tribal sub plan activities, forage technology demonstrations, research guidance, teaching, extension activities etc. were also provided.

A. Forage Crop Improvement

In Rabi 2017-18, Forage crop improvement trials were conducted across the country to identify the suitable entries for different zones and at national level. Various parameters considered included green forage yield, dry matter yield, crude protein yield, crude protein content, ADF, NDF, IVDMD, per day productivity, plant height, leafiness etc. A total of 17 multilocation trials comprising of test entries along with their respective checks were conducted at 32 locations in the country. It included 14 trials under annual and 3 perennial trials. The annual crops include Berseem, Oat (single cut, multicut, dual purpose), Vicia, rye grass, multicut summer bajra whereas under the perennial system, Lucerne, Red Clover and White clover were evaluated. The forage trials on annuals were classified into three groups *viz*., Initial Varietal Trial (IVT), Advanced Varietal Trial Stage –1 (AVT-1) and Advanced Varietal Trial Stage-2 (AVT-2) whereas in perennials, same trial is being evaluated for three consecutive years. A total of 184 trials were allocated out of which data were received from 176 trials making a success rate of 95.65%. A total of 102 entries including 77 annual and 25 perennial along with national and zonal checks were evaluated.

A perusal of the results reported on different cultivated forage species revealed that some entries have recorded their superiority with respect to zonal/national check. These entries have been identified as promising entries and will be placed accordingly for further testing. The summarized results of different cultivated annual and perennial forage evaluation trials are as below:

In Initial Varietal Trial in Berseem (IVTB), six entries along with one national check and three zonal checks in respective zones were evaluated at 17 centres located in four zones (HZ, NWZ, NEZ, CZ). For GFY (q/ha), entries HFB-14-7 (8.4%), PC-91 (8.0%) in Hill zone; entries JHB-17-1 (12.1%), HFB-13-7 (10.4%), HFB-14-7 (7.5%), JHB -17-2 (7.3%), PC-91 (5.2%) in NW zone; entry JHB 17-1 (12.4%) in NE zone showed superiority over the best check. For DMY, HFB-14-7 (14.6%) in Hill zone; entries JHB-17-1 (21.5%), HFB-14-7 (15.3%), JHB-17-2 (10.5%), HFB-13-7 (5.9%) in NW zone; entries JHB-17-1(11.1%), PC-91 (6.1%), HFB-13-7 (4.5%) in NE zone were superior to the best checks. For crude protein yield (q/ha), PC-91 was best performer followed by JHB-17-1. For crude protein percentage, entry PC-91 ranked first. Entries HFB-14-7 for IVDMD % and JB-05-12 for DDM (q/ha) ranked best.

In Advanced Varietal Trial-1 in Berseem (AVTB-1), three entries along with two national checks and two zonal checks were evaluated at ten centres in Central and North East zones. For green forage yield, dry matter yield, crude protein yield (q/ha) and crude protein content (%) the national checks showed superiority. Only marginal superiority of a few entries was observed, the entries performed at par or below par the checks.

In Second Advanced Varietal Trial in Berseem (AVTB-2), two entries along with two national checks and one zonal check were evaluated at five centres in North West zone. For green forage yield, dry matter yield, crude protein yield (q/ha) and crude protein content (%),green and dry forage production potential, other quality parameters checks were best performer and none of the entries showed better performance than the check.

In **Second Advanced Varietal Trial (Seed) [AVTB-2 (SEED)]** in Berseem two entries along with two national checks and one zonal check were evaluated at two centres in North West zone. For seed yield, JB-05-09 was best performer showing 20.6% higher yield than the best check. Other entry PC-82 showed marginal superiority over the best check.

In **Initial Varietal Trial Oat (single cut) IVTO (SC)**, eleven entries along with two national checks and five zonal checks for respective zones were evaluated at 27 locations across the five zones. For GFY, In HZ, NWZ, NEZ the zonal checks were top performers and none of the entries could surpass them in yield. In CZ, entries SKO-240 (9.0%), OL-1896 (7.0%), JO-05-9 (5.8%), HFO-718 (5.5%); in South zone entries HFO-718 (4.8%) and at all India level, OL-1896 (9.4%), HFO-718 (8.5%), HFO-529 (5.5%) performed better than the best check. For DMY, in south zone, 04 entries viz., JO-05-9, HFO-718, NDO-1501, OL-1896 were superior by a margin of more than 5%. At all India level, HFO-718 (8.6%), JO-05-9 (6.7%), OL-1896 (5.8%) performed better than checks. Other entries were either inferior to or showed marginal superiority over best national/zonal check. For quality parameters, entry OL-1896 and HFO-718 ranked joint first for crude protein yield (q/h), entry SKO-240 for IVDMD; and entry JO-05-9 for DDM ranked first.

In **First Advanced Varietal Trial in Oat (single cut), AVTO (SC)-1** eight entries promoted from IVT were evaluated against two national checks and four zonal checks in respective zones at 27 locations in five different zones. For GFY, entries SKO-229 (5.4%) in HZ; HFO-607 (10.1%) in NW zone, HFO-525 (8.9%), HFO-607 (8.1%) in NE zone; entries HFO-607 (10.8%), OL-1861 (10%), OL-1869-1 (9.2%), JO-05-7 (8.8%) in central zone and entry OL-1861 (17.8%) in south zone exhibited superiority over the best check. At national level, OL-1861 and HFO-607 registered 8.6% and 7.7% superiority respectively. For DMY, entries SKO-229 (6.9%) in HZ; HFO-607 (12.8%), HFO-525 (7.7%) in NW zone, entries JO-05-7 (19.2%), HFO-607 (17.3%), HFO-525 (12.8%) in NE zone; entries HFO-607 (11.3%), OL-1861 (10.7%), OL-1862 (5.9%), OL-1869-1 (5.8%), JO-05-7 (4.7%) in central zone; and entry OL-1861 (8.9%) in south zone exhibited superiority over the best check. At national level, HFO-607 and OL-1861 registered 9.4% and 8.1% superiority respectively. For quality parameters, for CPY, OL-1861 ranked first followed by HFO-607. For crude protein content, entry OL-1861 was best performers. For other quality parameters, SKO-229 ranked first for ADF%, NDF%. Kent ranked first for IVDMD%, whereas entry HFO-607 was best for DDM.

In **Second Advanced Varietal Trial in Oat (single cut), [AVTO (SC)-2]** four entries were evaluated against two national checks and two respective zonal checks at 7 locations in two zones (HZ, SZ). For GFY, in South zone, entries HFO-427 (16.7%) and JHO-15-1 (7.8%) showed superiority, combining both zones, only HFO-427 was superior by a margin of 10.2% over the best check. For DMY, in South zone, entries HFO-427 and JHO-15-1 showed superiority by a margin of 21.4% and 7.8% respectively over best check. Combining both zones, only HFO-427 was superior by 12.5% over best check. Entries HFO-427 (6.1) followed by JO-04-22 (5.5) performed better in comparison to best check (4.8) for crude protein yield (q/ha). Entry SKO-227 followed by JO-04-22 were best performers for crude protein content.

In **Second Advanced Varietal Trial in Oat for Seed** [**AVTO (SC)-2 (SEED)]** four entries along with two national checks and respective zonal checks were evaluated at four locations in two zones. Entry SKO-227 ranked first in hill zone whereas entries HFO-227 (9.9%) and JO-04-22 (5.3%) performed better than best check at south zone for seed yield.

In **Initial Varietal Trial in Oat (Multicut)** [**IVTO-MC]** seven entries were evaluated against two national checks (RO-19 and UPO-212) at 18 locations in four zones (HZ, NWZ, NEZ, and CZ). For GFY, entry OL-1874 (2.3%) in HZ; entry OL-1874 (1.9%) in NW zone entry; entries HFO-514 (5.3 %), OL-1874 (1.6 %) in NEZ; entries OL-1874 (4.1%), HFO-514 (2.1 %) in CZ exhibited superiority over the best zonal/national check. At national level, entries HFO-514 (3.1 %), OL-1874 (1.9 %) exhibited superiority. For DMY, entries OL-1874 (8.5%), HFO-514 (5.2%) in HZ; entries JO-05-304 (5.8%), HFO-514 (3.7 %), OL-1874 (2.1 %) in NW zone; entries HFO-514 (5.8 %), OL-1874 (3.9%) in NEZ; entries JO-05-304 (7.4 %), PLP-21 (5.1%), HFO-514 (3.0 %) in CZ exhibited superiority over the best zonal/national check. At national level, HFO-514 (5.1 %), OL-1874 (3.0 %) exhibited superiority. For quality parameters, entry HFO-514 ranked first for CPY. Entry JHO 17-3 and national check RO-19 ranked first for crude protein content (%). For ADF %, NDF % entry JHO 17-3 ranked first. For IVDMD %, entry OL-1874 ranked first.

An **Initial Varietal Trial in Oat (Dual)** [**IVTO (DUAL)]** comprising of seven entries along with two national checks (UPO-212 and JHO-822) was conducted at 14 centres located at three zones. For GFY, entries HFO-611 (9.3 %), entry HFO-608 (5.6%), in NWZ; entries JO-10-506 (19.5%), OL-1906 (7.1%), HFO-608 (7.1%) in NE zone; entries HFO-608 (31.9%), OL-1876-2 (26.8%), HFO-611 (16.6%), JO-10-506 (7.5 %) in CZ and, entries HFO-608 (21.4%), OL-1876-2 (14.3 %), HFO-611 (12.8 %), JO-10-506 (10.0 %) at all India level exhibited superiority. For DMY, entries HFO-611 (14.0 %), OL-1876-2 (9.1%), entry HFO-608 (8.0%) in NWZ; entry JO-10-506 (15.8%) in NE zone; entries HFO-608 (19.9 %), OL-1876-2 (16.2%), HFO-611 (13.2 %) in CZ and at all India level, HFO-608 (15.7 %), HFO-611 (12.6%), OL-1876-2 (12.1%), JO-10-506 (8.0%) exhibited superiority over the best check. For quality parameters, entry HFO-608 for crude protein yield (4.5 q/ha) followed by HFO-611 and OL-1876-2 (4.4q/ha) were superior. Entry JHO-17-4 was best for crude protein content. For IVDMD (%) entries HFO-611 and OL-1876-2 ranked joint first. For seed yield (q/ha), national check JHO-822 was best.

An **Advanced Varietal Trial-1 in Oat (Dual)** [**AVTO-1 (DUAL)]** comprising of four entries along with three national checks was conducted at 9 centres in North East zone and Central zone. For GFY, DMY, crude protein yield, green and dry matter productivity potential, none of the entries could surpass national checks.

Varietal Trial in Lucerne (Perennial) – 2016 [VT Lucerne (P) -2016] was established in 2016 and in second year data of twelve entries including checks were reported by 10 centres in three zones. The entries are coded and will be decoded after completion of trial. For GFY, entry VTLu-13 ranked first followed by VTLu-11 in NWZ; entry VTLu-8 ranked first followed by VTLu-4 in CZ; Entry VTLu-11 ranked first followed by VTLu -3 in south zone. At all India level, VTLu-8 top ranked with average yield of 756.2 q/ha. For DMY, entry VTLu-2 ranked first followed by VTLu -13 in NWZ. Entry VTLu-1 top ranked in CZ followed by VTLu-8. In South zone entry VTLu-3 top ranked. At all India level VTLu-8 top ranked with average yield of 156.6 q/ha. For quality parameters, entry VTLu-4 (34 q/ha) top ranked for CPY (q/ha). For crude protein entry VTLu-2 (20.7%) ranked first. For ADF%, NDF and IVDMD entry VTLu-6 ranked first.

In **First Advanced Trial on Vicia (AVT-1 VICIA)**, five entries were evaluated at four centers. For GFY, JVS-4 (242.8q), JVS-1 (240.5q), JVS-2 (228.3 q) showed superiority over the general mean (216.4q). Similarly for dry matter yield, JVS-1 (56.6q), JVS-3 (56.3q) and JVS-2 (51.7q) showed superiority over the general mean (50.4q). For fodder production (q/ha/day), entry JVS-1 ranked first for both green fodder and dry matter. For crude protein yield (q/ha) entry JVS-4 and for crude protein % entry JVS-5 were superior. For plant height, entry JVS-1 was top ranked. For leafiness entry JVS-4 was top ranked. For NDF, ADF and IVDMD entry JVS-5 top ranked.

In **Advanced Varietal Trial-1 on Lolium (AVT-1 LOLIUM)**, three entries were evaluated along with one check at five centers. For GFY, Palam rye grass-2 (4.6%) followed by Palam rye grass -1 (4.5%) showed superiority over the check. For dry matter entry Palam rye grass-2 (5.9%) Palam rye grass -1 (2.8%) were superior over the checks. For both green and dry fodder production potential (q/ha/day) PBRG-2 ranked first. For CPY (q/ha), CP (%), IVDMD % entry Palam rye grass-1 ranked first.

In **Perennial Trial on Red clover (VT Red Clover 2016)**, 7 entries were evaluated at four locations in Hill zone in 2nd year. The entries are coded and will be decoded after completion of trial. Entry VTRC-1-3 (275.7q) ranked first followed by VTRC-1-7 (243.4 q) for GFY. For DFY, entry VTRC-1-3 (44.6q) ranked first followed by VTRC-1-7 (39.0 q). For crude protein yield, entry VTRC-1-2 and for crude protein (%) entry VTRC-1-4 ranked first.

In **Perennial Trial on Red clover,** (**VT White Clover 2016),** 6 entries were evaluated at four locations in Hill zone in 2nd year. The entries are coded and will be decoded after completion of trial. Entry VTWC-1-6 ranked first for green fodder yield and dry fodder yield showing yield of 100.6 q and 16.7q respectively. For crude protein yield, entries VTWC-1-4 and VTWC-1-5 ranked joint first. For crude protein %, entry VTWC-1-4 (18.7%) ranked first followed by VTWC-1-5 (17.8%).

In **Initial Varietal Trial on Summer Bajra Multicut [IVT Summer Bajra (Multicut)]**, 11 entries were evaluated along with 3 checks at 7 locations in central and south zone. For GFY, MCPMF hybrid 16ADV0061 showed 23.9% and 19.3% superiority over the best check in central zone and both combined zone respectively. For south zone, entry HTBH 4902 (PM0103A X PM0268R) showed 8.9% superiority over the best check. For DMY, entry MCPMF hybrid 16ADV0061 showed 31.3% and 22.1% superiority over the best check in central and combined zones respectively. Entry AFB-37 showed 9.7% and 6.8% superiority over the best check in central and combined zones respectively. For Crude protein Yield (q/ha), entry MCPMF hybrid 16ADV0061 ranked first.

B. Forage Crop Production

The forage crop production programme was executed at 23 locations in five zones. In total 25 experiments were conducted, out of which 12 were in network (10 coordinated and 2 AVT based) and 13 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 hydroponic fodder production, production potential of annual rye grass with berseem in Hill Zone, carbon sequestration potential of perennial grass based cropping and supplementation of forage crops with micronutrients has also been covered. The results of studies on planting geometry of tall fescue grass and white clover in wet temperate conditions, feasibility of oat - *Lathyrus* intercropping system, techniques for enhancing seed productivity of fodder oat and lucerne has also been presented in the chapter.

The results of trials on influence of nature of vegetative propagules on bajra napier hybrids and standardization of seed production techniques in fodder maize etc. has also been. The salient research achievements during Rabi 2017-18 are;

Planting geometry of tall fescue grass and seed rates of white clover in wet temperate conditions: The experiment was started at Palampur and Srinagar to evaluate the productivity, quality and compatibility of tall fescue grass planted at different spacing with variable seed rates of white clover in wet temperate conditions. Tall fescue grass at 30 x 30 cm + white clover @ 3 kg/ha produced higher green, dry forage and crude protein yields. Inclusion of white clover in the system resulted in an improvement in soil nitrogen content.

Production potential feasibility of annual rye grass with berseem in Hill zone: The experiment was initiated at Palampur and Srinagar. ATMA rye grass (ARG) showed best performance in respect of all growth, yield quality as well as economic parameters.

Carbon sequestration in perennial grass based cropping systems: Trial was initiated at Hyderabad, Coimbatore, Vellayani, Ranchi and Jabalpur**.** On locational mean basis, treatment BN hybrid in paired rows (60/120 cm) + Fodder cowpea (Kharif) - Lucerne proved superior for green fodder, dry matter and crude protein yields. Guinea grass in paired rows (60/120 cm) + *Desmanthus* (Perennial) sequestered highest total carbon dioxide.

Productivity and carbon sequestration of silvi pastoral system in hills of north western Himalayas: The experiment was started at Palampur and Srinagar centre to study the system productivity and organic matter input to soil through silvi-pastoral system. The effect of tree species on total green, dry forage and crude protein yields of forage species was not significant. Highest green fodder, dry fodder and crude protein yield, return and B: C ratio was obtained with the planting of Setaria grass.

Productivity of oat - *Lathyrus* intercropping system as influenced by integrated nutrient management: The field experiment was conducted at Kalyani, Bhubaneswar and Ranchi to study the productivity and profitability of *Lathyrus*+ oat intercropping system influenced by integrated nutrient management. Oat + *Lathyrus* (3:2) recorded maximum GFY, CPY and GEFY and monetary return.

Feasibility of Hydroponics fodder production system: The hydroponic study was conducted at Ludhiana and Mandya to study the suitability of maize, sorghum and cowpea for quality fodder production. In maize, plant height increased with advancement of growth and maximum height was observed at 15th day. Total hydroponic green weight (kg/kg of seed) varied from 4.9-5.1 kg and maximum yield was achieved at 13th day. Crude protein content decreased significantly with advancement of growth and maximum level achieved was at 9th day. Seed rate of 200 gm/sq ft recorded highest green fodder, dry matter and crude protein yields.

Enhancing seed productivity of fodder oat in different regions of India under irrigated condition: This experiment was conducted at Raipur, Jabalpur, and Dharwad with the objective to study the effect of crop geometry and nitrogen doses on seed production potential and economics of seed production of oat varieties. At first cut RO-19 was better than JHO 822 as regards to GFY and DFY. JHO-822 exhibited higher harvest index, seed yield, net monetary return and B:C ratio. Sowing of oat at 30 cm row spacing for seed production was better. Application of nitrogen recorded linear improvement in growth and yield parameters up to 120 kg/ha.

Contingent crop plan for fodder oat production in semi arid tropics under irrigated condition: The experiment was initiated at Hyderabad and Dharwad to study the feasibility of oats under varied dates of sowing and seed rates. Crop planted during second fortnight of October to first fortnight of November recorded higher growth and yield parameters both at 45 days after sowing and at second harvest after seed set. JHO -822 recorded significantly higher values in all the parameters. Although fodder yield were satisfactory at 45 DAS, the fodder yield and grain yield were not very satisfactory at the final cut.

Enhancing seed setting in lucerne through foliar spray: A trial was conducted at Coimbatore, Ludhiana, Hyderabad and Bikaner to find out suitable combination of chemical foliar spray, their effect on seed yield, vigour and economics of production of Lucerne. On locational mean basis treatment Brasinolide 1.0 ppm proved superior and it recorded higher number of pods/plant, number of seeds/pod gross returns, net returns and B:C ratio.

Effect of nitrogen levels and seed rate on fodder productivity of rye grass (*Lolium multiflorum*) under rice fallows: The trial was initiated at Jorhat and Bhubaneswar to optimize the seed rate and nitrogen levels for ryegrass. The result indicated that, rye grass seeded at 20 kg/ha was better.

Different models for year round green fodder production under irrigated condition: The trial was initiated during *Kharif* 2015 with objective of identifying the suitable and economical year round fodder production system under irrigated situation. B N hybrid + Lucerne (2:8) recorded higher green fodder, dry matter yield, Net returns and B:C ratio.

Performance of bajra napier hybrids as influenced by nature of vegetative propagules: The experiment was initiated to develop a identify planting material for propagation of bajra napier hybrid varieties. Results revealed that 2 eyed root slips recorded the highest establishment and green fodder yield.

Productivity of oat + pea intercropping system as influenced by integrated nutrient management: The experiment on oat + pea intercropping system under different INM practices was undertaken to study the performance of the cropping system on productivity of both food and forage. Highest GFEY of the system as a whole was found in pea sole. Among intercropping of oat+ pea (3:3 ratio) recorded higher GFEY, CP yield, LER and net return.

Lucerne + oats /sarson fodder production system at variable seed rates of mixed crop under irrigated condition: Field study was carried out at Bikaner to find out optimum seed rate of oats/ sarson mixed cropping for stable green fodder and economics. 100 % Seed rate of oats gave the higher GFY, maximum net return and B:C ratio.

Effect of zinc sulphate and borax on seed production potentiality of oats under lateritic soil of West Bengal: A field experiment was conducted during *rabi* season Sriniketan, West Bengal to study the effect of zinc sulphate and borax on seed production potentiality of oats under lateritic soil. Combined application of $ZnSO_4$ @ 25 kg /ha along with borax @ 10 kg /ha produced the highest seed yield, gross return and net return from seed production of oats

Screening of genotypes of fodder oat under sodic soil: The field experiment was conducted to screen the fodder oat entries for their performance under sodic condition. NDO-951 was superior in all parameters viz., green fodder, dry matter and crude protein yields as well as per day productivity.

Organic nutrient management in sorghum-berseem cropping sequence for sustainable fodder production: The experiment was initiated at Hisar to study the feasibility of organic nutrient management in sorghum-berseem cropping sequence. Highest green fodder and dry

matter yield of sorghum and berseem as well as net returns and B: C ratio was recorded with recommended dose of fertilizers through inorganic source.

Standardization of seed production techniques in fodder maize: The field experiment was initiated with the objective to study the seed production potentiality of fodder maize and economics of seed production under Chhattisgarh conditions. Application of 160kg ha^{-1} nitrogen with the planting geometry of 75 cm X20 cm recorded significantly higher seed yield, gross return, net return and return per rupee.

Evaluation of fodder productivity and quality in dual purpose wheat and berseem (single cut) intercropping system: A field experiment was carried out at Ludhiana to study the effect of wheat + berseem mixture and time of cutting on fodder productivity, feasibility and economics of dual purpose wheat and single cut berseem intercropping system. Wheat + 100% recommended seed rate of berseem recorded significantly higher green fodder, dry matter and crude protein yields

Effect of different nitrogen levels on productivity of perennial grasses under hilly terrace condition: A trial was conducted at Nagaland University, Medziphema to identify the suitable perennial grass for the Nagaland and the effect of nitrogen application on its growth and yield. Setaria recorded highest green fodder and dry matter yield. Highest total green fodder and dry matter yield was recorded with nitrogen dose of 100kg/.

Seed yield maximization in Oat *cv.* RO-19 (Phule Harita): A field trial was conducted at Rahuri with the objectives to study the effect of different levels of silicon dioxide and cutting intervals on lodging and seed yield of oat (RO-19-Phule Harita). The application of silicon dioxide @ 400 kg ha^{-1} recorded significantly higher seed yield, straw yield. The cutting on 45 DAS produced higher seed yield.

Effect of N levels on forage yield of promising entries of oat (AVT-2 SC): In Oat (Single cut), four entries (HFO-427, SKO-227, JHO-15-1 and JO-04-22) along with two national checks, namely; OS-6 and Kent and two zonal checks *viz.*, SKO-90 (HZ) and JHO-2000-4 (SZ) were evaluated at 4 locations across the two zones in the country. In Hill Zone, entry JHO-15-1 proved superior in terms of GFY & DFY. It recorded 5.5% higher GFY and 6.7% higher DFY over best check (Kent-NC). In South Zone also JHO-15-1 remained superior. The growth performance and yields of all the entries improved consistently with increase in level of nitrogen up to 120 kg/ha.

Effect of P levels on forage yield of promising entries of Berseem (AVTB 2-MC): Two berseem entries (JB-05-9 and PC-82) along with two national checks (Wardan and Mescavi) and one zonal check (BB-2) were evaluated at 3 centres located in NWZ zones. Both the testing entries were marginally superior to national checks (Wardan and Mescavi) but inferior to zonal check (BB-3) in terms of GFY, DFY, per day green and dry matter productivity.

C. FORAGE CROP PROTECTION

Survey of pathogens, insect pests and nematodes associated with Berseem, Lucerne and Oats: 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, Rahuri, Palampur, Dharwad, Jhansi and Bhubaneswar.

At Ludhiana, Stem rot on berseem was observed on variety BL-10. Its appearance was first observed in the first week of January, 2018. Disease was progressed at faster rate till 2nd fortnight of March with maximum disease incidence of 55.87 percent due to favourable weather conditions. Leaf blight of oat appeared on OL-10 variety in the 2nd week of January.

Disease development was fast upto end of February and thereafter, it increased at slow rate till first week of April with disease severity of 42.34 percent. Downy mildew of Lucerne was observed on variety LLC 5 in the first fortnight of January, 2018. Disease progressed at faster rate till end of March. Highest disease severity was 39.78 percent. 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 second fortnight of April. The population of *H. armigera* appeared on berseem crop in April with its highest peak during last week of April. *Spodoptera exigua* larvae were also recorded in berseem crop during April, with peak incidence in the last week of April. The insect populations were subsequently reduced owing to rain and windstorm in first week of May. Lucerne var. LLC-5 was infested with lucerne weevil in March. *H. armigera* and *S. exigua* incidence was at its peak in Lucerne during last week of April 2018. Due to heavy rains during January end to mid-February, all aphid population was washed off from oat tillers, hence no incidence was observed. No incidence was observed in March-April.

At Rahuri, the population of pea aphid (*Acyrthosiphon pisum*) was noticed on lucerne during 1stweek of January, 2018 (7.67 aphids/tiller) and increased steadily up to the 3rd week of January, 2018 (10.33 aphids/tiller). Thereafter, the decreasing trend of pea aphid population noticed upto 1st week of February, 2018 (5.33 aphids/tiller). Again the population of pea aphid showed their increasing trend form 2nd week of Feb., 2018 (20.33) and reached at its peak level during 4th week of Feb., 2018 (69.00 aphids/tiller). During the season, population of cowpea aphid and spotted aphid was observed at low to moderate level in the range of 7.00 to 10.33 aphids/tiller from last week of Jan., 2018 to 2nd week of Feb., 2018 and 3.67 to 20.00 aphids/tiller from 1st week of Feb., 2018 to 2nd week of March., 2018, respectively. The *Spodoptrera litura* become a major and regular pest on Lucerne during summer season. Larval population was noticed during 1st week of March, 2018 with 0.50 larva/m^2. Then after, population increased steadily and reached to its peak population (14.67 larvae/m^2) during 2nd week of May, 2018. After that the population of *S. litura* declined and recorded nil during 1st week of June, 2018. The population of *H. armigera* was noticed on lucerne seed crop during 3rd week of March, 2018 (1.67 larvae/m^2) and showed increasing trend upto 2nd week of May, 2018 with highest population of 12.33 larvae/m^2. After that, population declined and showed nil population during last week of May, 2018 when the seed crop was harvested. Periodic abundance of oat aphid (*Rhopalosiphum padi* L.) was observed in oat during the investigation. In berseem crop, aphid *R. maidis* was noticed on crop from 2nd to 3rd week of Dec., 2017. Thereafter, aphid population disappeared from the crop.

At Palampur, oat crop was severely affected by powdery mildew (75% severity), followed by leaf blights (27%), loose smut (3%) and sucking pest (20%). In berseem low incidence of root rot (5 %) and moderate intensity of leaf spot (15%) was observed. Defoliating beetles (20 %) and leaf spot (10 %) was observed on Lucerne.

At Dharwad, Insect and disease incidence taken at 15 days interval in Lucerne revealed that aphid population started building from January months onwards and reached peak during second fortnight of February (102 aphids / stem) and started declining after second fortnight of April and reached nil in May month. Among diseases, rust was the major one and 25% of disease severity was seen during second fortnight of February. Disease intensity was almost nil during May.

At Bhubaneswar, in oat, leaf blight caused by *Helminthosporium* sp. was observed with maximum leaf blight severity of 54.8% and root rot caused by *Sclerotium sp*. with incidence of 22 %. Maximum leaf defoliators were recorded 4.8/ ten plants. In Berseem, leaf spot and blight severity recorded was 44.6%, whereas root rot incidence was 34.2%. Maximum defoliator population recorded was 4.8/ten plants in 3rd meteorological week.

At Jhansi, in Berseem incidence of stem rot (*Sclerotinia trifoliorum*) in sick plot started from third week of January with small lesions and continued to increase up to third week of February with a maximum disease score of 1.88 indicative of moderate level of infection (lesion of 10-20 mm) with each plant showing 50% tissue mortality. Disease development was favoured by low temperature and high humidity. Leaf blight was observed during third week of January at a lower level (5.79%) and it continue to increase upto third week of February with maximum severity of 38.75 %.Weevil infestation was observed in lucerne during first week of February to first week of March with a maximum weevil incidence of 21.33 %. In Oat, leaf blight was the major disease and it appeared during third week of January and maximum severity of 35.33 % was observed during third week of February.

Field screening of *rabi*-breeding materials for resistance to diseases and insect- pests

In Berseem IVTB, At Ludhiana, All the entries showed moderately resistant disease reaction to stem rot of berseem. At Rahuri, all the entries were resistant to aphids. At Palampur, root rot disease pressure was low and all the entries were resistant to disease except JB-05-12 & Wardan, which were moderately resistant. At Bhubaneswar, JB-05-12, BB-3 and HFB-13-7 were resistant to Leaf spot & blight and Leaf defoliators. At Jhansi, all the entries were resistant to moderately resistant to stem rot and leaf blight.

In AVT-1 Berseem, At Rahuri, All the entries were found resistant to aphids as recorded less than 10 aphids per tiller. At Bhubaneswar, entries HFB-13-10, Mescavi and JB-05-10 were resistant to Leaf spot & blight and Leaf defoliators. At Jhansi, all the entries were resistant to moderately resistant to stem rot in sick plot, whereas for leaf blight, HFB-13-10, Wardan & JHB-16-01 were moderately resistant and rests were susceptible. **In Berseem- AVT-2**, At Ludhiana, All entries were moderately resistant to stem rot. **In Berseem-AVT-2 (Seed)**: At Ludhiana, All the entries were moderately resistant to stem rot.

Oats – IVTO SC: At Ludhiana, All the entries were moderately resistant except JHO-17-1 and NDO-1501 which were moderately susceptible. At Palampur, all entries were highly susceptible to susceptible to Powdery mildew except SKO-96 & JO-05-9 which were moderately resistant. At Bhubaneswar, UPO-17-2, UPO-17-2, RO-11-1, UPO-17-3, JHO-17-1, JO-05-9, OL 1893, OL 1896, NDO-1501 and HFO 529 were resistant to Leaf blight, *Sclerotium* root rot and Leaf defoliators. At Jhansi, all the entries were moderately resistant to leaf light except JHO-17-1 &NDO-1501 which were moderately susceptible.

Oats-IVTO MC: At Ludhiana, All entries were moderately resistant except UPO-212 and PLP-21 which were moderately susceptible. At Palampur, all entries were highly susceptible to susceptible to Powdery mildew except HFO-706 which was moderately resistant. At Bhubaneswar, JHO-17-3, OL-1874 and OL-1908, were resistant to Leaf blight, *Sclerotium* root rot and Leaf defoliators. At Jhansi, all the entries were moderately resistant to Leaf blight except UPO-212 & PLP-21 which were moderately susceptible.

Oats – IVTO Dual: At Ludhiana, All entries were moderately resistant except HFO-611, OL-1876-2 and JHO-17-5, which showed moderately susceptible disease reaction to leaf blight. At Bhubaneswar, JHO-17-5, OL-1906 and JO-10-506 were resistant to Leaf blight, *Sclerotium* root rot and Leaf defoliators. At Jhansi, entries HFO-611, OL-1876-2 and JHO-17-5 were moderately susceptible, while rests were moderately resistant to leaf blight.

Oats - AVTOSC-1: At Ludhiana, All entries were moderately resistant to leaf blight except UPO-16-4 and HFO-525, which are moderately susceptible. At Palampur, all entries were highly susceptible to susceptible to Powdery mildew. At Bhubaneswar, Kent, JO-05-7, OL-1869-1, OS-6, OL-1862, UPO-16-4 and HFO-525 were resistant to Leaf blight, *Sclerotium* root rot and Leaf defoliators. At Jhansi, all the entries were moderately resistant to leaf blight except, UPO-16-4 and HFO-525 which were moderately susceptible.

Oats- AVTOSC-2: At Palampur, all the entries were moderately resistant except OS-6, which was susceptible to powdery mildew.

AVTO (SC)-2 (Seed): At Palampur, all the entries were moderately resistant for Powdery mildew except HFO-427 and JO-04-22, which were susceptible. **AVTO -1 (Dual):** At Bhubaneswar, UPO-212, JHO-822, RO-19, OL-1769 and HFO-619 were resistant to Leaf blight, *Sclerotium* root rot and Leaf defoliators. At Jhansi, all the entries were moderately resistant (JO-10-501 and OL-1871) to resistant (UPO-212, JHO-822, RO-19, OL-1769 and HFO-619) against leaf blight.

In VT Lucerne (P) -2016, At Ludhiana, VTL-2016-7, 9, 10, 11 and VTL-2016-12 showed moderately resistant disease reaction to downy mildew in lucerne. All entries showed non-significant variation for Lucerne weevil and *H. armigera* population. At Rahuri, against Aphids VTLu-8 (21.33 aphids/tiller) was found moderately resistant.

VT - Rye grass (VTRG-1): Only slight infection of powdery mildew was observed.

White clover (VTWC): In VTWC, at Palampur, VTWC-1 to 3 were moderately resistant and rest of the entries were susceptible.

Red clover (VTRC): In VTRC, at Palampur, all the entries were susceptible, except, VTRC-6 & 7 which were moderately resistant to powdery mildew.

Pathogenic variability of *Blumeria graminis f. sp. avenae* on oat: At Palampur, Eleven isolates of *Blumeria graminis f.* sp. *avenae* were collected during 2017-18 making the total number of isolates to twenty two and were maintained under controlled conditions. Out of 347 lines evaluated *in vivo* under field conditions, 10 lines were resistant i.e. PLP-1, JPO-40, OL-1847, OL-1689, OS-6, HFO-864, OS-10 and HFO-125. Among these lines PLP-1 was found to be highly resistant. For refinement of differential set, 347 lines of oat were evaluated at Palampur *in vivo* for powdery mildew under natural epiphytotic conditions. From these 347 lines evaluated, 160 lines were selected for *in vitro* screening with different isolates. Till date 80 lines were screened *in vitro* and among which, ADG-124, JPO-36, UPO-102, EC-605831, OATS-17, J0-10, OL-1847, OG-77 and HJ-8 shown differential reaction and were chosen for further screening. Other 80 lines will be evaluated with 3 isolates to make a set of 30 lines for further refinement and these 30 lines will be screened again with more isolates to develop final differential set. The final differential lines will be screened using all the collected isolates. To study the inheritance of powdery mildew resistance, three resistant lines (OL-1847, OG-77 and OL-1689) were selected and crossed with HJ-8 (Susceptible check) in field and F1 seeds were harvested.

Management of soil borne and powdery mildew diseases in Red clover seed crop: At Palampur, it was observed that seed treatment with carbendazim @ 2 g/kg seed followed by three foliar spray of hexaconazole @ 0.1 % gave best management of powdery mildew with 4.2 % disease severity and 92.8 % disease control of powdery mildew and 2.7% disease incidence with 78.7 % disease control of soil borne disease with an overall increase of 46 % in yield as compared to control.

Management of foliar diseases of oat: At Ludhiana, seed treatment with Carbendazim 50WP @2g/kg seed + foliar application of Propiconazole 25 EC @ 1ml/lit after 21 DAS showed minimum disease severity (24.67%) of leaf blight with 38.84 % control of disease and 239.17 q/ha of green fodder and 34.10 q/ha of seed yield followed by seed treatment with *Trichoderma viride* (CFU 10^6/gm of formulation) @ 5g/kg of seed+ foliar application of Propiconazole 25 EC @ 1ml/lit after 21 DAS which showed 29.67 % severity with 26.44 % disease control and 23.23 % increase in green fodder yield as compared to untreated check (40.33%).

At Bhubaneswar also, seed treatment with carbendazim 50WP @ 2g/kg seed + foliar application of Propiconazole 25EC @ 1ml/lt after 21DAS sowed minimum diseases severity of leaf blight in oats (9.33%) with 79.8% disease control and 32.1% increase in yield over check. This treatment was followed by seed treatment with *T. viride* (CFU 10^6/gm of formulation) @ 5g/kg of seed + foliar application of Propiconazole 25 EC @1ml/lt after 21 DAS with 74.0.3% disease control and 26.9% significant increase in yield over check.

Biological management of oat aphid *Rhopalosiphum padi* on oats: At Rahuri and Dharwad, infestation of aphids on oat not seen throughout the crop season, whereas, at Ludhiana, the incidence was negligible owing to heavy rains. Hence, the trial on biological management could not be conducted.

Validation of Management of soil borne diseases in clover seed crop: At Ludhiana, foliar application of Carbendazim @ 1.0 kg/ha (after 1st and 2nd cut) exhibited very less incidence (18.29 %) of stem rot with 48.17 % disease control, 23.95 % increase in green fodder yield and higher seed yield, as compared to control.

Validation of Studies on biological management of *Spodoptera litura* in relation with different time of application on lucerne under field condition : At Rahuri, at 5 and 7 days after spraying, combination of *Sl*NPV @ 1ml and *B. bassiana* @ 5 g/lit of water recorded significantly lowest number of larvae/m^2 (3.77 & 0.95 larvae/m^2, respectively). Combination of *Sl*NPV @ 1ml and *B. bassiana* @ 5 g/lit of water recorded significantly higher GFY (86.02 q/ha). The highest ICBR was recorded in treatment combination of *SlNPV +B. bassiana* (1:2.14).

Validation of Biological control of *Helicoverpa armigera* on lucerne/ berseem seed crop: At Rahuri and Ludhiana, at 5 days and 7 days after spraying, combination of *Ha*NPV @ 1ml and *B. bassiana* @ 5 g/lit of water recorded significantly lowest number of larvae/m^2. and recorded significantly higher seed yield. The highest ICBR was recorded in treatment combination of *HaNPV +B. bassiana* (1:17.83). The number of honeybees per plot before as well as after 12h of treatment varied non-significantly in all the treatments and was in range of 14.33-16.40 honey bees.

Biological management of powdery mildew of oats caused by *Blumeria graminis f. sp. Avenae:* At Palampur, chemical check i.e, three foliar spray of hexaconazole @ 0.1% gave best control of powdery mildew (13.3 % disease severity and 77.1 % disease control) with maximum increase (15.9%) in the seed yield over the control followed by biological management treatments i.e, three foliar sprays of *Trichoderma viride* @ 0.5% and three foliar spray of *Trichoderma harzianum* @ 0.5% giving 48.6 and 45.7 % powdery mildew control with 10.5 and 10.4 % increase in the seed yield respectively over control.

Eco-friendly pest management techniques in berseem ecosystem: At Ludhiana, soil application of *Trichoderma viride* @ 5 g/l + foliar spray of carbendazim @ 2g/l exhibited least disease incidence of stem rot (19.33%) with 47.28 % disease control, but, the number of *H. armigera* larvae/m row length in berseem were high (5.66) as compared to other treatments except control (6.66). But, yield [both GFY (565.96 q/ha) and seed yield (3.11q/ha)] was significantly high in this treatment than other treatments. It was followed by treatment involving recommended 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) which provided 41.82 % stem rot control and number of *H. armigera* larvae/m row length in berseem were also minimum (2.00) in this treatment. It was also found that associated benefits with the use of trap crop & bird perches were not reflected in terms of GFY and seed yield increase. The number of natural enemies per/ row length on Berseem varied from 1.66-3.00 (for coccinellids) and 0.66-1.33 (for spiders) in all the treatments.

D. Forage Crops Breeder Seed Production

The indent for Breeder Seed Production for **Production year Rabi 2017-18 [Indent year Rabi 2018-19]** was received from DAC, GOI for 30 varieties in four forage crops *viz*., Oat (16), Berseem (10), Lucerne (3) and Gobhi Sarson (1). The quantity allocated was 704.66 q which was 43.5% higher than previous year indent of 491.15q. The production target was assigned to thirteen Breeder Seed producing centres of the different SAUs/ NGO/ ICAR institutes. The maximum quantity indented was for Oat (654.6 q) followed by Berseem (45.14 q) and Lucerne (4.90 q) and minimum for Gobhi Sarson (0.02 q). The final Breeder Seed Production Report (BSP-IV) received from different seed producing centres revealed that in Berseem, the overall breeder seed production was more than the allocated quantity. However, there was shortfall in Oat & Lucerne. In Gobhi Sarson, the target was achieved. The overall production was 613.84 q which was 90.82 q (12.89%) less than indented target.

In Berseem, the production was 50.1 q and 3.67 q seed of previous years are also available. It makes a total of 53.77 q which is 8.63 q higher than the allocated quantity of 45.14 q. **In Oat,** the production was 468.8 q and 87.23 q of previous year is also available. It makes a total of 556.03 q against the allocation of 654.6 q making a deficit of 98.57 q. **In Lucerne,** the target of (4.9 q) was allotted out of which 4.02q was produced and there was deficit of 0.88 q. **In Gobhi Sarson,** the production was 0.02 q against the allocation of 0.02 q was achieved. The overall breeder seed production was 522.94 q and considering the previous year seed of 90.9 q thus making a total of 613.84 q against the indent of 704.66 q. There was surplus breeder seed available in many centers of other improved varieties.

A quick analysis indicates that forage crop breeder seed demand is increasing rapidly. The current year indent is 43.47% more than previous year and it is more than double (115% increase over the 2015-16) in last 4 years. Similarly production is also 34.3% more than previous year and it is 137 % higher as compared to 2015-16 (4 years back).

E. Forage Technology Demonstrations

During *Rabi* 2017-18, a total of 448 FTD's were allotted to 21 AICRP centres for Rabi crops. It included 80 FTDs to berseem, 40 to lucerne, 155 to oat (Single cut), 100 to oat (Multicut), 15 to cowpea, 58 to other crops viz., laythrus, rye grass etc,

F. Tribal Sub Plan

Tribal sub-plan activities were carried out in 11 states by different AICRP forage crops centers with the theme Fodder and Livestock based technological modules for upliftment of tribal. The states include Telengana, Madhya Pradesh, West Bengal, Himachal Pradesh, Maharashtra, Jharkhand, Chhattisgarh, Jammu and Kashmir, Uttarakhand, Assam, Manipur. The objectives were Sustainable improvement in existing production system and livelihood of tribals; Developing linkages with development and marketing institutions; Capacity building and skill up gradation of stakeholders. The activities included intervention in Integrated Farming System mode through participatory approach with the natural resource, skill improvement through capacity building programmes, providing inputs for various activities in farming and livestock component.

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

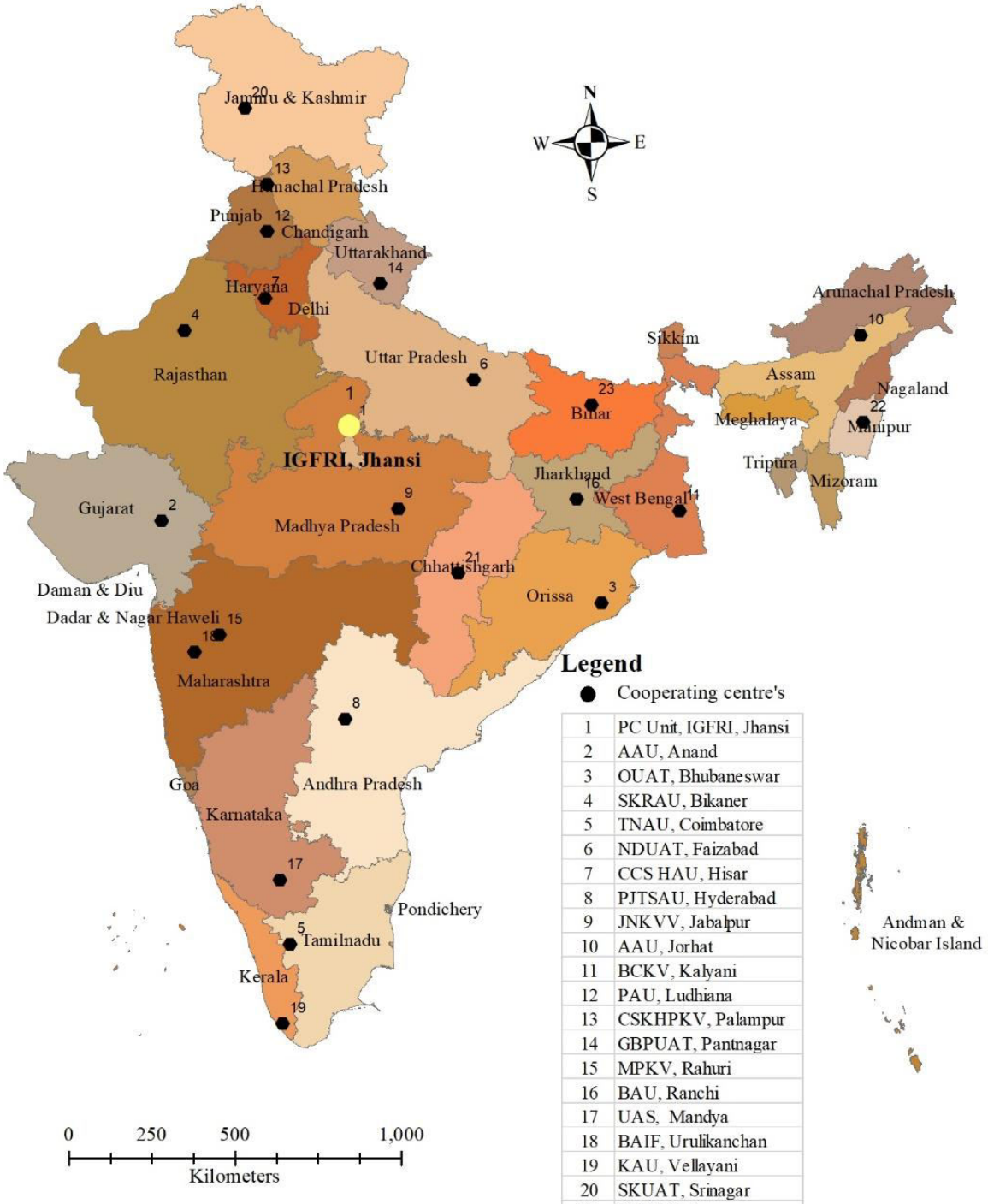
Zone	Coordinated Centers				Testing Locations		
	S. N.	Location	Establishment Year	State	S. N.	Location	State/Union Territory
I. Hill States = 3 Locations = 3	1.	Palampur, CSKHPKV	1970	Himachal Pradesh	1.	Almora, ICAR-VPKAS*	Uttarakhand
					2.	Rajouri, SKUAST-J	Jammu & Kashmir
	2.	Srinagar, SKUAS&T-K	2010	Jammu & Kashmir	3.	Bajoura (Kullu)	Himachal Pradesh
II. North West States = 5 Locations = 13	3.	Ludhiana, PAU	1989	Punjab	4.	Meerut, SVBPUA&T	Uttar Pradesh
					5.	Ballowal Sankhari	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.	DFRS, Arjla, Bhilwara	Rajasthan
					9.	Udaipur, MPUAT	Rajasthan
					10.	Pali-Marwar, ICAR-CAZRI-RRS*	Rajasthan
					11.	Jaisalmer, ICAR-CAZRI-RRS*	Rajasthan
					12.	Fatehpur Shekhawati/ARS Sikar	Rajasthan
					13.	Jalore, SKRAU ARS Keshwana	Rajasthan
III. North East States = 8 Locations = 9	7.	Faizabad, NDUAT	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
	10.	Bhubaneswar,OUAT	1987	Orissa			
	11.	Jorhat, AAU	1970	Assam			
	12.	Imphal, CAU	2010	Manipur			
	13.	Pusa, RPCAU	2015	Bihar			

Zone	Coordinated Centers				Testing Locations		
	S.N.	Location	Establishment Year	State	S. N.	Location	State/Union Territory
IV. Central States = 6 Locations = 10	14.	Anand, AAU	1970	Gujarat	17.	Kanpur, CSAU&T	Uttar Pradesh
	15.	Jabalpur, JNKVV	1970	Madhya Pradesh	18.	Jhansi, ICAR-IGFRI*	Uttar Pradesh
	16.	Rahuri, MPKV	1971	Maharashtra	19.	Dhari,JAU	Gujarat
					20.	Karjat	Maharashtra
	17.	Urulikanchan, BAIF	1982	Maharashtra	21.	Akola, PDKVV	Maharashtra
	18.	Raipur, IGKV	2010	Chhattisgarh	22.	Dapoli & Palghar, DBSKKV	Maharashtra
V. South States = 6 Locations = 7	19.	Mandya, UAS (B)	1986	Karnataka	23.	Dharwad, ICAR-IGFRI-RRS*	Karnataka
	20.	Coimbatore, TNAU	1976	Tamil Nadu	24.	Pudducherry, PJLNCA & RI, Karaikal	Pudducherry
	21.	Vellayani, KAU	1971	Kerala	25.	Tirupati/Guntur, ANGRAU	Andhra Pradesh
	22.	Hyderabad, PJTSAU	1970	Telangana	26.	Raichur, UAS, Raichur	Karnataka
					27.	Mattupetty, KLDB	Kerala

Summary: Zone = 5, States = 24, Coordinating Centers = 22, Testing Locations = 27

*ICAR Institute

AICRP on Forage crops and Utilization

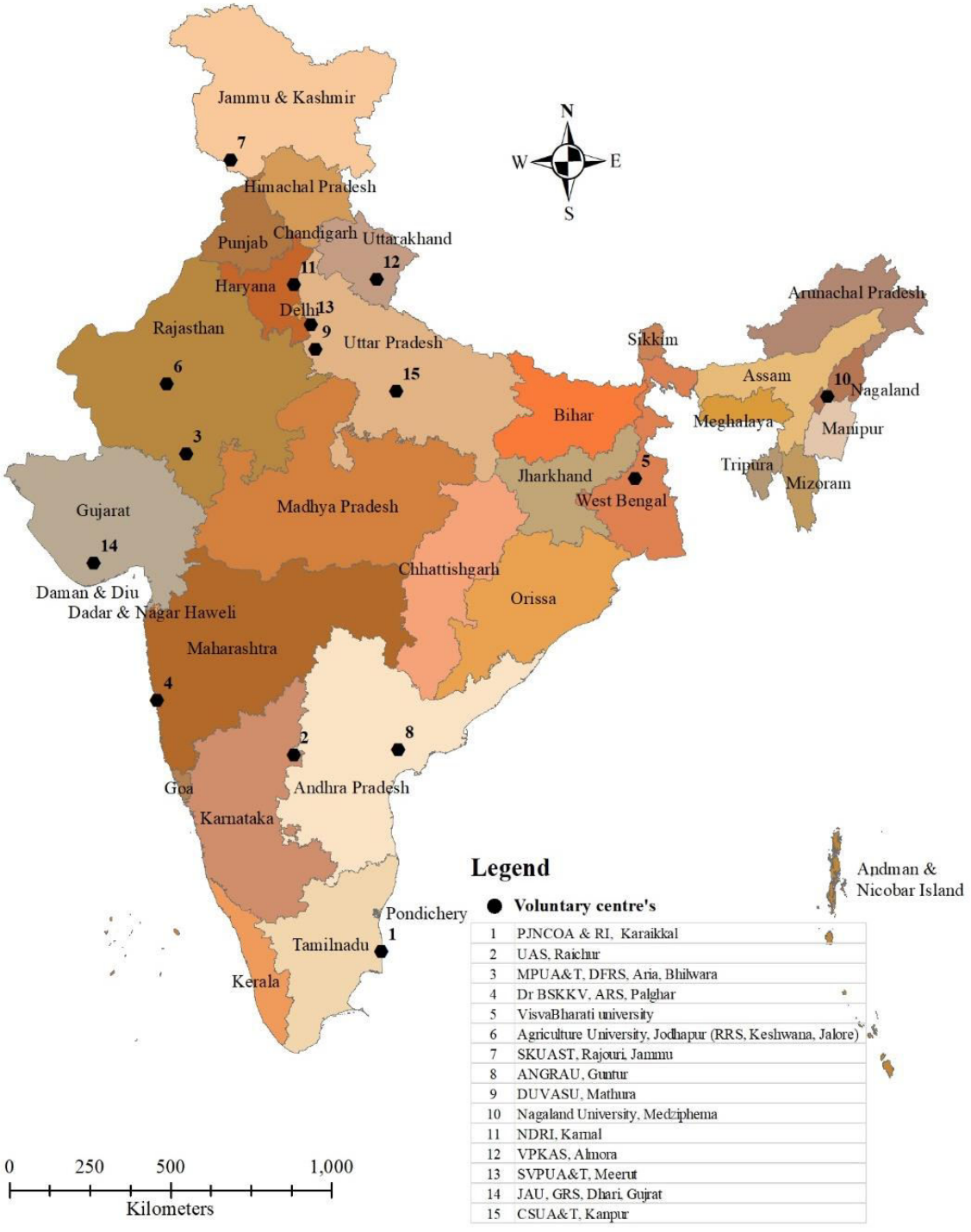


Legend

Cooperating centre's

1	PC Unit, IGFRI, Jhansi
2	AAU, Anand
3	OUAT, Bhubaneswar
4	SKRAU, Bikaner
5	TNAU, Coimbatore
6	NDUAT, Faizabad
7	CCS HAU, Hisar
8	PJTSAU, Hyderabad
9	JNKVV, Jabalpur
10	AAU, Jorhat
11	BCKV, Kalyani
12	PAU, Ludhiana
13	CSKHPKV, Palampur
14	GBPUAT, Pantnagar
15	MPKV, Rahuri
16	BAU, Ranchi
17	UAS, Mandya
18	BAIF, Urulikanchan
19	KAU, Vellayani
20	SKUAT, Srinagar
21	IGKV, Raipur
22	CAU, Imphal
23	RAU, Pusa

AICRP on Forage crops and Utilization



Legend

Voluntary centre's

1	PJNCOA & RI, Karaikkal
2	UAS, Raichur
3	MPUA&T, DFRS, Aria, Bhilwara
4	Dr BSKKV, ARS, Palghar
5	VisvaBharati university
6	Agriculture University, Jodhapur (RRS, Keshwana, Jalore)
7	SKUAST, Rajouri, Jammu
8	ANGRAU, Guntur
9	DUVASU, Mathura
10	Nagaland University, Medziphema
11	NDRI, Karnal
12	VPKAS, Almora
13	SVPUA&T, Meerut
14	JAU, GRS, Dhari, Gujrat
15	CSUA&T, Kanpur

Entries Code for Rabi 2017-18

1. IVTB: Berseem

S. N.	Contributor	Entry name	Code name
1	PAU, Ludhiana	PC-91	IVTB- 1
2	JNKVV, Jabalpur	JB-05-12	IVTB- 2
3	(NC)	Wardan	IVTB- 3
4	(ZC- HZ)	BL-180	IVTB- 4
	(ZC –CZ) (ZC-NWZ)	Bundel Berseem-2	IVTB- 4
	(ZC- NEZ)	Bundel Berseem-3	IVTB- 4
5	IGFRI, Jhansi	JHB-17-1	IVTB- 5
6	CCS HAU, Hisar	HFB-14-7	IVTB- 6
7	CCS HAU, Hisar	HFB-13-7	IVTB- 7
8	IGFRI, Jhansi	JHB-17-2	IVTB- 8

2. AVT-1 Berseem

S. N.	Contributor	Entry name	Code name
1	CCS HAU, Hisar	HFB-13-10	AVT-1B- 1
2	(NC)	Wardan	AVT-1B- 2
3	(NC)	Mescavi	AVT-1B- 3
4	(ZC -NEZ)	Bundel Berseem-3	AVT-1B- 4
	(ZC -CZ)	Bundel Berseem-2	AVT-1B- 4
5	IGFRI, Jhansi	JHB-16-01	AVT-1B- 5
6	JNKVV, Jabalpur	JB-05-10	AVT-1B- 6

3. AVT-2 Berseem

S. N.	Contributor	Entry name	Code name
1	JNKVV, Jabalpur	JB-05-9	AVT-2B- 1
2	(NC)	Wardan	AVT-2B- 2
3	PAU, Ludhiana	PC-82	AVT-2B- 3
4	(NC)	Mescavi	AVT-2B- 4
5	(ZC-NWZ)	Bundel Berseem-2	AVT-2B- 5

4. AVT-2 Berseem (Seed)

S. N.	Contributor	Entries	Code name
1	JNKVV, Jabalpur	JB-05-9	AVT-2B-S- 1
2	(NC)	Wardan	AVT-2B-S- 2
3	PAU, Ludhiana	PC-82	AVT-2B-S- 3
4	(NC)	Mescavi	AVT-2B-S- 4
5	(ZC- NWZ)	Bundel Berseem-2	AVT-2B-S- 5

5. IVTO (SC) Oat

S. N.	Contributor	Entry name	Code name
1	GBPUAT	UPO-17-2	IVTO-SC-1
2	(NC)	Kent	IVTO-SC- 2
3	(ZC- HZ)	SKO-96	IVTO-SC- 3
	(ZC -NWZ)	RO-11-1	IVTO-SC- 3
	(ZC- NEZ)	RO-11-1	IVTO-SC- 3
	(ZC- CZ)	JHO-2009-1	IVTO-SC- 3
	(ZC- SZ)	JHO-2010-1	IVTO-SC- 3
4	GBPUAT, Pantnagar	UPO-17-3	IVTO-SC- 4
5	IGFRI, Jhansi	JHO-17-2	IVTO-SC- 5
6	IGFRI, Jhansi	JHO-17-1	IVTO-SC- 6
7	JNKVV, Jabalpur	JO-05-9	IVTO-SC- 7
8	PAU, Ludhiana	OL 1893	IVTO-SC- 8
9	PAU, Ludhiana	OL 1896	IVTO-SC- 9
10	SKUAST-K, Srinagar	SKO-240	IVTO-SC- 10
11	(NC)	OS-6	IVTO-SC- 11
12	CCS HAU, Hisar	HFO 718	IVTO-SC-12
13	NDUAT, Faizabad	NDO-1501	IVTO-SC-13
14	CCS HAU, Hisar	HFO 529	IVTO-SC- 14

6. AVT Oat (SC-1)

1	(NC)	Kent	AVTO-1-SC- 1
2	JNKVV, Jabalpur	JO-05-7	AVTO-1-SC- 2
3	PAU, Ludhiana	OL-1869-1	AVTO-1-SC- 3
4	(NC)	OS-6	AVTO-1-SC- 4
5	SKUAST-K	SKO-229	AVTO-1-SC- 5
6	CCS HAU, Hisar	HFO-607	AVTO-1-SC- 6
7	PAU, Ludhiana	OL-1862	AVTO-1-SC- 7
8	GBPUAT, Pantnagar	UPO-16-4	AVTO-1-SC- 8
9	CCS HAU, Hisar	HFO-525	AVTO-1-SC- 9
10	(ZC- HZ)	SKO-90	AVTO-1-SC- 10
	(ZC- NWZ)	OL-125	AVTO-1-SC- 10
	(ZC- NEZ)	JHO-99-2	AVTO-1-SC- 10
	(ZC -CZ)	JHO-822	AVTO-1-SC- 10
	(ZC SZ)	JHO-2000-4	AVTO-1-SC- 10
11	PAU, Ludhiana	OL-1861	AVTO-1-SC- 11

7. AVT Oat (SC)-2

S. N.	Contributor	Entry name	Code name
1	CCS HAU, Hisar	HFO-427	AVTO-2-SC- 1
2	SKUAST-K, Srinagar	SKO-227	AVTO-2-SC- 2
3	(NC)	Kent	AVTO-2-SC- 3
4	(ZC- HZ)	SKO-90	AVTO-2-SC- 4
	(ZC- SZ)	JHO-2000-4	AVTO-2-SC- 4
5	(NC)	OS-6	AVTO-2-SC- 5
6	IGFRI, Jhansi	JHO-15-1	AVTO-2-SC- 6
7	JNKVV, Jabalpur	JO-04-22	AVTO-2-SC- 7

8. AVT Oat (SC-2) (Seed)

S. N.	Contributor	Entry name	Code name
1	CCS HAU, Hisar	HFO-427	AVTO-2-SC-S-1
2	SKUAST-K, Srinagar	SKO-227	AVTO-2-SC-S- 2
3	(NC)	Kent	AVTO-2-SC-S- 3
4	(ZC -HZ)	SKO-90	AVTO-2-SC-S- 4
	(ZC- SZ)	JHO-2000-4	AVTO-2-SC-S- 4
5	(NC)	OS-6	AVTO-2-SC-S- 5
6	IGFRI, Jhansi	JHO-15-1	AVTO-2-SC-S- 6
7	JNKVV, Jabalpur	JO-04-22	AVTO-2-SC-S- 7

9. IVTO (MC)

S. N.	Contributor	Entry name	Code name
1	JNKVV, Jabalpur	JO05-304	IVTO-MC- 1
2	(NC)	UPO-212	IVTO-MC- 2
3	(NC)	RO-19	IVTO-MC- 3
4	CCS HAU, Hisar	HFO-514	IVTO-MC- 4
5	CCS HAU, Hisar	HFO-706	IVTO-MC- 5
6	IGFRI, Jhansi	JHO-17-3	IVTO-MC- 6
7	CSKHPKV,Palampur	PLP-21	IVTO-MC- 7
8	PAU, Ludhiana	OL-1874	IVTO-MC- 8
9	PAU, Ludhiana	OL-1908	IVTO-MC- 9

10. IVT Oat (Dual)

S. N.	Contributor	Entry name	Code name
1	(NC)	UPO-212	IVTO-D- 1
2	(NC)	JHO-822	IVTO-D- 2
3	CCS HAU	HFO-611	IVTO-D- 3
4	PAU, Ludhiana	OL-1876-2	IVTO-D- 4
5	IGFRI, Jhansi	JHO-17-5	IVTO-D- 5
6	IGFRI, Jhansi	JHO-17-4	IVTO-D- 6
7	PAU, Ludhiana	OL-1906	IVTO-D- 7
8	JNKVV, Jabalpur	JO-10-506	IVTO-D- 8
9	CCS HAU, Hisar	HFO-608	IVTO-D- 9

11. AVT-1 Oat (Dual)

S. N.	Contributor	Entry name	Code name
1	(NC)	UPO-212	AVTO-1-D- 1
2	(NC)	JHO-822	AVTO-1-D- 2
3	(NC)	RO-19	AVTO-1-D- 3
4	PAU, Ludhiana	OL-1769	AVTO-1-D- 4
5	JNKVV, Jabalpur	JO-10-501	AVTO-1-D- 5
6	PAU, Ludhiana	OL-1871	AVTO-1-D- 6
7	CCS HAU, Hisar	HFO-619	AVTO-1-D- 7

13. AVT-1 Vicia

S. N.	Contributor	Entry name	Code name
1	JNKVV, Jabalpur	JVS-1	AVT-1-VIC- 1
2	JNKVV, Jabalpur	JVS-2	AVT-1-VIC- 2
3	JNKVV, Jabalpur	JVS-3	AVT-1-VIC- 3
4	JNKVV, Jabalpur	JVS-4	AVT-1-VIC- 4
5	JNKVV, Jabalpur	JVS-5	AVT-1-VIC- 5

14. AVT-1 Lolium-2016

S. N.	Contributor	Entry name	Code name
1	CSK HPKV	Palam rye grass-2	AVT-1-RG- 1
2	CSK HPKV	Palam rye grass-1	AVT-1-RG- 2
3	(NC)	PBRG-1	AVT-1-RG- 3
4	PAU	PBRG-2	AVT-1-RG- 4

17. IVT Bajra (Multi cut)

S. N.	Contributor	Entry name	Code name
1	MCPMF hybrid 16ADV0061	ADVANTA	IVTBJ-MC–1
2	TSFMB-17-1	PJTSAU, Hyderabad	IVTBJ-MC- 2
3	JPM-18-1	JNKVV, Jabalpur	IVTBJ-MC-3
4	Giant Bajra	(NC)	IVTBJ-MC–4
5	AFB-38	AAU, Anand	IVTBJ-MC–5
6	Moti Bajra	(NC)	IVTBJ-MC–6
7	Raj Bajra Chari	(NC)	IVTBJ-MC–7
8	AFB-37	AAU, Anand	IVTBJ-MC–8
9	JPM-18-2	JNKVV, Jabalpur	IVTBJ-MC–9
10	TSFMB-17-3	PJTSAU, Hyderabad	IVTBJ-MC-10
11	TSFMB-17-2	PJTSAU, Hyderabad	IVTBJ-MC- 1
12	BAIF Bajra -4	BAIF, Uralikanchan	IVTBJ-MC-12
13	HTBH 4901 (PM022A X PM0267R)	Hytech seed India Pvt ltd, Hyderabad	IVTBJ-MC–13
14	HTBH 4902 (PM0103A X PM0268R)	Hytech seed India Pvt ltd, Hyderabad	IVTBJ-MC–14

Entries Code Agronomy Rabi 2017-18

4A. AVT-2 Berseem (agronomy)

S. N.	Contributor	Entry name	Code name
1	JNKVV, Jabalpur	JB-05-9	AVTB-2-AGRON- 1
2	(NC)	Wardan	AVTB-2-AGRON- 2
3	PAU, Ludhiana	PC-82	AVTB-2-AGRON- 3
4	(NC)	Mescavi	AVTB-2-AGRON- 4
5	(ZC- NWZ)	Bundel Berseem-2	AVTB-2-AGRON- 5

7A. AVT Oat (SC-2) Agronomy

S. N.	Contributor	Entry name	Code name
1	CCS HAU, Hisar	HFO-427	AVTO-2-AGRON- 1
2	SKUAST-K, Srinagar	SKO-227	AVTO-2-AGRON- 2
3	(NC)	Kent	AVTO-2-AGRON- 3
4	(ZC- HZ)	SKO-90	AVTO-2-AGRON- 4
	(ZC -SZ)	JHO-2000-4	AVTO-2-AGRON- 4
5	(NC)	OS-6	AVTO-2-AGRON- 5
6	IGFRI, Jhansi	JHO-15-1	AVTO-2-AGRON- 6
7	JNKVV, Jabalpur	JO-04-22	AVTO-2-AGRON- 7

1. IVTB: INITIAL VARIETAL TRIAL IN BERSEEM
(Reference tables 1.1 to 1.9)

An initial varietal trial in Berseem comprising of six entries along with one national check (Wardan) and three zonal checks in respective zones [BL-180 (HZ), BB-2 (NWZ, CZ) and BB-3 (NEZ)] was conducted at 17 centres located in four different zones (HZ, NWZ, NEZ, CZ) of the country.

For green forage yield (q/ha), entries HFB-14-7 and PC-91 showed 8.4% and 8.0% superiority respectively over the best check in Hill zone. In NW zone, entries JHB-17-1 (12.1%), HFB-13-7 (10.4%), HFB-14-7 (7.5%), JHB -17-2 (7.3%), PC-91 (5.2%) showed superiority over the best check. In NE zone, only one entry JHB 17-1 was superior by a margin of 12.4%. All other entries were below or at par or marginally superior in comparison to best check.

For dry matter yield, HFB-14-7 in Hill zone (14.6%); entries JHB-17-1 (21.5%), HFB-14-7 (15.3%), JHB-17-2 (10.5%), HFB-13-7 (5.9%) in NW zone; entries JHB-17-1(11.1%), PC-91 (6.1%), HFB-13-7 (4.5%) in NE zone were superior to the best checks in their respective zones. Other entries were below par or marginally superior in comparison to the best check.

In central zone and all India level, entries were below par or marginally superior over the best check for both GFY and DMY.

For per day productivity, entry JHB-17-1 ranked first for GFY (q/ha/day), whereas for DMY (q/ha/day) entry HFB-14-7 ranked first. Entry JB-05-12 ranked first for the character plant height. For the character leafiness, entry JHB-17-2 ranked best.

In quality parameters, for crude protein yield (q/ha), PC-91 was best performer followed by JHB-17-1. For crude protein percentage, entry PC-91 ranked first. For other quality parameters, entries HFB-14-7 for IVDMD % and JB-05-12 for DDM (q/ha) ranked best. For ADF % and NDF % zonal check Bundel Berseem -2 ranked first.

2. AVTB-1: FIRST ADVANCED VARIETAL TRIAL IN BERSEEM
(Reference tables 2.1 to 2.9)

An advanced varietal trial in Berseem comprising of three entries along with two national checks (Wardan and Mescavi) and two zonal checks [BB-3 (NE zone), BB-2 (CZ)] was conducted at ten centres located in two zones (Central and North East).

For green forage yield and dry matter yield, in both zones and individually and combined only marginal superiority of a few entries was observed, the entries performed at par or below par the checks.

In green forage production potential (q/ha/day), entry JHB-16-01 ranked first followed by JB-05-10. For dry matter production potential (q/ha/day), entry JB-05-10 ranked first. National checks ranked first for the character plant height and leafiness.

In quality parameters, National check Wardan ranked first for crude protein yield (q/ha) and crude protein content (%). For other quality parameters, HFB-13-10 for ADF%, and NDF% and national check for IVDMD% were best performers.

Table 1.1: IVT Berseem: Initial Varietal Trial in Berseem: Green Forage Yield (q/ha)

Entries	Hill Zone					North West Zone							
	Palam-pur	Rajo-uri	Aver-age	Ra-nk	Superi-ority%	Pant-nagar	His-ar	Ludh-iana	Udai-pur	**Bika-ner	Aver-age	Ra-nk	Superi-ority%
PC-91	441.9	460.8	451.4	2	8.0	756.7	601.1	790.7	950.8	94.8	774.8	5	5.2
JB-05-12	430.8	407.4	419.1	5		708.9	719.1	471.8	951.8	113.1	712.9	7	
JHB-17-1	422.8	443.6	433.2	4		1005.5	676.9	750.9	869.3	127.4	825.6	1	12.1
HFB-14-7	427.7	478.6	453.2	1	8.4	971.1	659.2	704.4	833.0	114.1	791.9	3	7.5
HFB-13-7	416.6	415.2	415.9	7		985.6	643.0	700.3	924.0	95.5	813.2	2	10.4
JHB-17-2	403.6	407.4	405.5	8		786.7	650.0	772.1	952.4	104.6	790.3	4	7.3
Wardan (NC)	341.3	494.8	418.1	6		807.8	651.9	515.1	971.0	110.9	736.4	6	
BL-180 (ZC-HZ)	445.6	446.3	446.0	3									
Bundel Berseem-2 ZC (CZ-NWZ)						780.0	650.6	607.2	907.8	101.0	736.4	6	
Mean	**416.3**	**444.3**	**430.3**			**850.3**	**656.4**	**664.1**	**920.0**	**107.7**	**772.7**		
CD at 5%	NS	0.9				61.7	60.4	47.3	104.8	NS			
CV%	10.3	8.3				7.9	5.4	9.4	6.7	15.3			

Note: ** Not Included in zonal and all India average due to low yield of data

Table 1.1: IVT Berseem: Initial Varietal Trial in Berseem: Green Forage Yield (q/ha)

Entries	North East Zone							
	Kalyani	Ranchi	Faizabad	Pusa	**Bhubaneswar	Average	Rank	Superiority%
PC-91	476.9	352.0	448.5	219.0	72.2	374.1	8	
JB-05-12	576.8	374.5	311.9	263.0	99.3	381.6	7	
JHB-17-1	506.9	537.4	393.5	302.0	75.0	435.0	1	12.4
HFB-14-7	508.1	493.8	280.7	300.0	84.7	395.6	3	
HFB-13-7	493.6	452.0	392.9	230.0	92.4	392.1	5	
JHB-17-2	510.5	448.6	332.8	279.0	88.9	392.7	4	
Wardan (NC)	523.2	433.6	332.8	259.0	79.9	387.1	6	
Bundel Berseem-3 (ZC-NEZ)	551.1	455.4	312.5	308.0	108.8	406.8	2	
Mean	**518.4**	**443.4**	**350.7**	**270.0**	**87.6**	**395.6**		
CD at 5%	15.4	44.8	74.5	19.7	0.6			
CV%	10.2	5.7	12.1	11.2	5.4			

Note: ** Not Included in zonal and all India average due to low yield of data

Table 1.1: IVT Berseem: Initial Varietal Trial in Berseem: Green Forage Yield (q/ha)

Entries	Central Zone							All India		
	Jhansi	Rahuri	Jabalpur	Urulikanchan	Raipur	Average	Rank	Average	Rank	Superiority%
PC-91	1006.5	427.2	986.4	682.0	374.8	695.4	6	598.4	6	
JB-05-12	1102.2	442.2	1041.0	588.4	438.1	722.4	4	588.5	7	
JHB-17-1	986.7	464.5	971.7	557.2	432.2	682.5	7	621.4	1	3.8
HFB-14-7	1085.7	413.4	1014.4	617.9	421.1	710.5	5	613.9	2	2.6
HFB-13-7	985.1	417.3	929.1	632.3	387.4	670.2	8	600.3	4	0.30
JHB-17-2	1108.8	447.9	959.7	698.2	408.9	724.7	3	611.1	3	2.1
Wardan (NC)	1168.2	442.1	949.1	664.7	422.9	729.4	2	598.5	5	
Bundel Berseem-2 ZC (CZ-NWZ)	1136.9	473.3	1194.3	643.9	450.7	779.8	1			
Mean	**1072.5**	**441.0**	**1005.7**	**635.6**	**417.0**	**714.4**		**604.6**		
CD at 5%	158.2	63.6	197.8	66.0	43.7					
CV%	8.4	8.2	11.3	5.9	6.2					

Table 1.2: IVT Berseem: Initial Varietal Trial in Berseem: Dry Matter Yield (q/ha)

Entries	Hill Zone					North West Zone						
	Palam-pur	Rajo-uri	Aver-age	Ra-nk	Superi-ority%	Pant-nagar	His-ar	Ludh-iana	**Bika-ner	Aver-age	Ra-nk	Superi-ority%
PC-91	69.4	73.7	71.6	3		83.1	69.5	119.9	17.2	90.9	6	
JB-05-12	73.1	63.4	68.2	6		86.3	83.2	77.1	22.1	82.2	8	
JHB-17-1	70.0	71.1	70.5	4		129.0	80.8	113.9	22.9	107.9	1	21.5
HFB-14-7	74.0	81.6	77.8	1	14.6	122.3	74.7	110.3	21.4	102.4	2	15.3
HFB-13-7	77.7	63.3	70.5	4		111.9	77.8	92.5	18.2	94.0	4	5.9
JHB-17-2	74.4	64.0	69.2	5		93.5	72.05	128.7	19.7	98.1	3	10.5
Wardan (NC)	57.8	78.0	67.9	7		104.0	77.5	85.0	20.0	88.8	7	
BL-180 (ZC-HZ)	81.8	71.1	76.5	2								
Bundel Berseem-2 ZC (CZ-NWZ)						96.9	75.1	102.2	18.4	91.4	5	
Mean	**72.3**	**70.8**	**71.5**			**103.3**	**76.3**	**103.7**	**20.0**	**94.5**		
CD at 5%	NS	0.2				11.6	9.5	23.5	NS			
CV%	13.4	7.0				6.9	7.3	7.8	17.9			

Note: ** Not Included in zonal and all India average due to low yield of data

Table 1.2: IVT Berseem: Initial Varietal Trial in Berseem: Dry Matter Yield (q/ha)

Entries	North East Zone							
	Kalyani	Ranchi	Faizabad	**Bhubaneswar	**Pusa	Average	Rank	Superiority%
PC-91	91.5	61.6	101.9	15.6	39.4	85.0	2	6.1
JB-05-12	111.3	65.5	71.0	21.4	47.2	82.6	5	
JHB-17-1	99.6	79.7	87.7	15.7	54.3	89.0	1	11.1
HFB-14-7	99.1	74.9	56.7	18.3	53.9	76.9	8	
HFB-13-7	95.4	69.3	86.3	19.8	41.4	83.7	3	4.5
JHB-17-2	99.1	69.5	67.1	19.7	50.1	78.6	7	
Wardan (NC)	103.2	70.1	67.1	18.3	46.6	80.1	6	
Bundel Berseem-3 (ZC-NEZ)	105.7	69.8	74.4	23.4	55.4	83.3	4	
Mean	**100.6**	**70.1**	**76.5**	**19.0**	**48.5**	**82.4**		
CD at 5%	3.7	7.1	15.3	0.2	4.7			
CV%	6.4	5.7	11.4	6.4	10.4			

Note: ** Not Included in zonal and all India average due to low yield of data

Table 1.2: IVT Berseem: Initial Varietal Trial in Berseem: Dry Matter Yield (q/ha)

Entries	Central Zone							All India		
	Jhansi	Rahuri	Jabalpur	Urulikanchan	Raipur	Average	Rank	Average	Rank	Superiority%
PC-91	214.4	98.6	142.0	81.1	55.0	118.2	6	97.1	5	
JB-05-12	245.6	99.7	151.1	73.1	58.4	125.6	2	96.8	6	
JHB-17-1	201.8	106.2	143.4	70.9	58.5	116.1	7	101.0	1	3.2
HFB-14-7	226.6	91.6	148.3	75.2	60.3	120.4	5	99.7	2	1.8
HFB-13-7	196.4	99.6	132.7	75.0	54.5	111.6	8	94.8	7	
JHB-17-2	237.1	97.7	127.4	88.2	54.5	121.0	4	97.9	3	
Wardan (NC)	250.4	92.7	138.7	81.8	59.8	124.7	3	97.4	4	
Bundel Berseem-2 ZC (CZ-NWZ)	251.8	98.9	176.2	81.2	56.9	133.0	1			
Mean	**228.0**	**98.1**	**145.0**	**78.3**	**57.2**	**121.3**		**97.8**		
CD at 5%	30.5	13.9	27.8	8.2	9.1					
CV%	7.6	8.1	10.9	5.9	9.3					

Table 1.3: IVT Berseem: Initial Varietal Trial in Berseem: Green Forage Yield (q/ha/day)

Entries	Rajo-uri	Pant-nagar	His-ar	Ludh-iana	Kal-yani	Ran-chi	Faiza-bad	Rah-uri	Urulikan-chan	Rai-pur	**Bika-ner	**Bhuban-eswar	Aver-age	Ra-nk
PC-91	11.54	4.67	4.14	5.45	3.94	2.59	3.39	2.93	6.50	3.29	0.73	1.50	4.84	4
JB-05-12	10.70	4.37	5.05	3.25	4.77	2.64	2.36	3.03	5.60	3.84	0.87	2.03	4.56	5
JHB-17-1	11.40	6.21	4.74	5.18	4.18	3.72	2.98	3.18	5.31	3.79	0.98	1.63	5.07	1
HFB-14-7	12.41	5.99	4.59	4.96	4.19	3.29	2.12	2.83	5.88	3.69	0.88	1.93	5.00	2
HFB-13-7	10.67	6.08	4.36	4.91	4.08	3.09	2.97	2.86	6.02	3.40	0.73	1.97	4.84	4
JHB-17-2	10.54	4.85	4.46	5.33	4.22	3.17	2.52	3.07	6.65	3.59	0.80	1.93	4.84	4
Wardan (NC)	12.51	4.98	4.40	3.55	4.32	3.12	2.52	3.03	6.33	3.71	0.85	1.82	4.85	3
BL-180 (ZC-HZ)	11.71													
Bundel Berseem-2 ZC (CZ-NWZ)		4.81	4.45	4.19				3.24	6.13	3.95	0.78			
Bundel Berseem-3 (ZC-NEZ)					4.55	3.23	2.36					2.18		
Mean	**11.44**	**5.25**	**4.52**	**4.60**	**4.28**	**3.11**	**2.65**	**3.02**	**6.05**	**3.66**	**0.83**	**1.87**	**4.86**	

Note: ** Not included in all India average due to low yield

Table 1.4: IVT Berseem: Initial Varietal Trial in Berseem: Dry Matter Yield (q/ha/day)

Entries	Rajo-uri	Pant-nagar	His-ar	Ludh-iana	Kal-yani	Ran-chi	Rah-uri	Urulikan-chan	**Rai-pur	**Bika-ner	**Faiza-bad	**Bhuban-eswar	Aver-age	Ra-nk
PC-91	1.77	0.51	0.48	0.83	0.76	0.45	0.68	0.77	0.37	0.13	0.08	0.32	0.78	4
JB-05-12	1.61	0.53	0.58	0.53	0.92	0.46	0.68	0.70	0.38	0.17	0.53	0.44	0.75	6
JHB-17-1	1.75	0.80	0.57	0.79	0.82	0.55	0.73	0.67	0.38	0.18	0.66	0.34	0.83	2
HFB-14-7	2.11	0.75	0.52	0.76	0.81	0.50	0.63	0.72	0.40	0.16	0.42	0.42	0.85	1
HFB-13-7	1.55	0.69	0.52	0.64	0.78	0.47	0.68	0.71	0.36	0.14	0.65	0.42	0.76	5
JHB-17-2	1.59	0.58	0.49	0.89	0.81	0.49	0.67	0.84	0.36	0.15	0.50	0.43	0.80	3
Wardan (NC)	1.87	0.64	0.53	0.59	0.85	0.50	0.64	0.78	0.40	0.15	0.50	0.41	0.80	3
BL-180 (ZC-HZ)	1.79													
Bundel Berseem-2 ZC (CZ-NWZ)		0.60	0.51	0.70			0.68	0.77	0.36	0.14				
Bundel Berseem-3 (ZC-NEZ)					0.87	0.50					0.56	0.47		
Mean	**1.76**	**0.64**	**0.53**	**0.72**	**0.83**	**0.49**	**0.67**	**0.75**	**0.38**	**0.15**	**0.49**	**0.41**	**0.80**	

Note: ** Not included in all India average due to low yield

Table 1.5: IVT Berseem: Initial Varietal Trial in Berseem: Crude Protein Yield (q/ha)

Entries	Palam-pur	His-ar	Ludh-iana	Kal-yani	Faiza-bad	Ran-chi	Rah-uri	Jabal-pur	Urulikan-chan	Rai-pur	**Bika-ner	**Bhuban-eswar	Aver-age	Ra-nk
PC-91	13.2	13.0	19.9	14.2	17.8	9.4	17.0	20.5	13.7	8.9	2.5	2.5	14.8	1
JB-05-12	13.2	15.8	12.7	14.6	12.1	10.0	16.3	21.7	12.7	8.7	3.7	3.3	13.8	5
JHB-17-1	13.8	14.6	18.6	11.6	15.1	10.6	18.5	21.4	12.7	8.4	4.1	2.4	14.5	2
HFB-14-7	14.2	14.6	18.8	13.1	9.5	11.6	16.0	21.0	12.9	9.2	3.3	2.7	14.1	4
HFB-13-7	14.0	14.5	14.7	14.9	14.7	8.3	17.0	18.9	13.0	8.2	3.0	3.0	13.8	5
JHB-17-2	12.8	13.6	21.4	13.2	11.5	11.4	17.1	18.2	15.9	8.1	3.2	2.9	14.3	3
Wardan (NC)	10.3	15.6	14.3	15.1	11.3	11.2	15.8	19.8	13.7	8.7	2.7	2.6	13.6	6
BL-180 (ZC-HZ)	14.5													
Bundel Berseem-2 ZC (CZ-NWZ)		15.9	18.0				15.8	25.3	14.6	7.8	3.0			
Bundel Berseem-3 (ZC-NEZ)				17.7	12.7	9.0						3.6		
Mean	**13.3**	**14.7**	**17.3**	**14.3**	**13.1**	**10.2**	**16.7**	**20.9**	**13.7**	**8.5**	**3.2**	**2.9**	**14.1**	

Note: ** Not included in all India average due to low yield

Table 1.6: IVT Berseem: Initial Varietal Trial in Berseem: Crude Protein (%)

Entries	Palam-pur	His-ar	Ludh-iana	Bika-ner	Kal-yani	Ran-chi	Faiza-bad	Bhuban-eswar	Rah-uri	Jabal-pur	Urulikan-chan	Rai-pur	Aver-age	Ra-nk
PC-91	19.0	18.7	16.6	14.4	15.5	15.3	17.5	16.3	17.3	14.7	16.9	16.2	16.5	1
JB-05-12	18.1	19.2	16.5	16.6	13.2	15.3	17.0	15.3	16.4	14.7	17.4	14.9	16.2	2
JHB-17-1	19.8	18.4	16.3	17.8	11.7	13.3	17.2	15.4	17.4	14.7	18.0	14.4	16.2	2
HFB-14-7	19.3	18.0	17.0	15.5	13.2	15.5	16.8	15.0	17.5	14.5	17.2	15.3	16.2	2
HFB-13-7	18.1	18.5	15.9	16.6	15.7	12.0	17.0	15.0	17.1	14.5	17.4	15.0	16.1	3
JHB-17-2	17.2	18.3	16.6	16.2	13.4	16.4	17.1	14.5	17.5	14.6	18.0	14.9	16.2	2
Wardan (NC)	17.8	18.4	16.8	13.6	14.7	16.0	16.9	14.2	17.1	14.7	16.8	14.5	15.9	4
BL-180 (ZC-HZ)	17.8													
Bundel Berseem-2 ZC (CZ-NWZ)		18.2	17.6	16.5					16.0	14.7	18.0	13.7		
Bundel Berseem-3 (ZC-NEZ)					16.7	12.9	17.1	15.3						
Mean	**18.4**	**18.4**	**16.7**	**15.9**	**14.3**	**14.6**	**17.1**	**15.1**	**17.0**	**14.6**	**17.4**	**14.9**	**16.2**	

Table 1.7: IVT Berseem: Initial Varietal Trial in Berseem: Plant Height (CM)

Entries	Palam-pur	Rajo-uri	Pant-nagar	His-ar	Ludh-iana	Bika-ner	Udai-pur	Kal-yani	Ran-chi	Faiza-bad	Bhuban-eswar	Rah-uri	Jabal-pur	Urulikan-chan	Rai-pur	Aver-age	Ra-nk
PC-91	58.2	35.3	75.0	63.2	47.0	45.5	59.7	74.9	55.3	57.8	60.2	45.0	47.6	49.8	45.0	54.6	7
JB-05-12	69.5	33.4	80.0	74.3	54.0	52.5	65.4	77.8	62.5	56.5	78.2	55.1	52.1	52.9	52.1	61.1	1
JHB-17-1	57.6	32.1	83.0	69.8	47.7	55.5	58.0	77.6	59.5	57.2	61.1	49.3	56.7	48.4	50.3	57.6	3
HFB-14-7	58.5	34.5	82.0	66.1	41.7	47.0	56.8	75.9	60.0	56.7	64.4	49.2	51.9	50.5	41.5	55.8	5
HFB-13-7	56.4	33.1	83.0	64.8	46.3	46.0	61.8	76.8	61.7	55.9	72.4	48.5	47.8	50.6	45.6	56.7	4
JHB-17-2	55.2	32.6	81.0	67.8	51.7	47.0	61.5	80.7	63.1	57.4	69.1	51.1	45.9	32.3	39.3	55.7	6
Wardan (NC)	62.2	36.5	82.0	69.4	50.0	54.0	61.7	78.1	60.1	56.9	67.6	48.8	53.5	53.3	51.3	59.0	2
BL-180 (ZC-HZ)	57.3	34.8															
Bundel Berseem-2 ZC (CZ-NWZ)			85.0	68.8	47.0	62.5	60.2					46.9	60.8	54.7	47.5		
Bundel Berseem-3 (ZC-NEZ)								80.1	63.4	55.8	75.3						
Mean	**59.4**	**34.0**	**81.4**	**68.0**	**48.2**	**51.3**	**60.6**	**77.7**	**60.7**	**56.8**	**68.5**	**49.2**	**52.0**	**49.1**	**46.6**	**57.2**	

Table 1.8: IVT Berseem: Initial Varietal Trial in Berseem: Leaf Stem Ratio

Entries	Palam-pur	His-ar	Ludh-iana	Bika-ner	Kal-yani	Ran-chi	Faiza-bad	Bhuban-eswar	Rah-uri	Jabal-pur	Urulikan-chan	Rai-pur	Aver-age	Ra-nk
PC-91	0.75	0.78	1.23	0.83	0.81	0.72	0.72	0.84	0.78	0.72	0.65	0.40	0.77	7
JB-05-12	0.62	1.04	1.12	0.71	0.84	0.62	0.75	1.19	0.61	0.76	0.62	0.49	0.78	6
JHB-17-1	0.75	1.50	1.25	0.64	0.89	0.65	0.72	0.87	0.60	0.81	0.75	0.60	0.84	4
HFB-14-7	0.65	2.07	1.15	0.77	0.86	0.75	0.71	0.95	0.66	0.73	0.69	0.46	0.87	3
HFB-13-7	0.73	2.23	1.23	0.79	0.85	0.70	0.70	1.11	0.72	0.73	0.71	0.47	0.91	2
JHB-17-2	0.75	2.65	1.27	0.80	0.94	0.60	0.73	1.08	0.66	0.66	0.46	0.56	0.93	1
Wardan (NC)	0.72	1.27	1.00	0.82	1.04	0.67	0.69	0.91	0.62	0.79	0.69	0.56	0.81	5
BL-180 (ZC-HZ)	0.78													
Bundel Berseem-2 ZC (CZ-NWZ)		1.75	0.96	0.74					0.61	0.86	0.72	0.42		
Bundel Berseem-3 (ZC-NEZ)					0.96	0.67	0.68	1.28						
Mean	**0.72**	**1.66**	**1.15**	**0.76**	**0.90**	**0.67**	**0.71**	**1.03**	**0.66**	**0.76**	**0.66**	**0.50**	**0.85**	

Table 1.9: IVT Berseem: Initial Varietal Trial in Berseem: ADF (%), NDF (%), IVDMD (%) & DDM (q/ha)

Entries	ADF (%)		NDF (%)		IVDMD (%)				DDM (q/ha)	
	Ludhiana	Rank	Ludhiana	Rank	Ludhiana	Hisar	Average	Rank	Hisar	Rank
PC-91	34.7	5	43.4	3	62.4	63.6	63.0	7	46.8	7
JB-05-12	34.6	4	44.3	4	64.1	65.2	64.7	3	54.7	1
JHB-17-1	34.4	3	45.4	6	62.4	64.4	63.4	6	48.6	6
HFB-14-7	33.3	2	42.9	2	64.9	65.5	65.2	1	46.6	8
HFB-13-7	36.2	8	45.9	7	61.6	65.3	63.4	6	51.3	4
JHB-17-2	36.1	7	44.3	4	63.9	64.7	64.3	5	48.8	5
Wardan (NC)	35.1	6	44.8	5	63.9	64.9	64.4	4	54.3	2
Bundel Berseem-2 ZC (CZ-NWZ)	32.4	1	41.6	1	65.2	65.1	65.1	2	54.2	3
Mean	**34.6**		**44.1**		**63.6**	**64.8**	**64.2**		**50.7**	

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

Entries	North East Zone							
	Kalyani	Ranchi	Faizabad	Pusa	**Bhubaneswar	Average	Rank	Superiority%
HFB-13-10	411.1	393.8	444.1	290.0	91.3	384.7	5	
JHB-16-01	501.5	434.1	439.4	311.0	87.0	421.5	2	0.02
JB-05-10	484.4	476.3	447.1	292.0	100.7	424.9	1	0.83
Wardan (NC)	424.2	451.0	488.4	322.0	79.7	421.4	3	
Mescavi (NC)	419.1	371.5	431.8	286.0	104.0	377.1	6	
Bundel Berseem-3 ZC (NEZ)	475.7	437.4	454.8	283.0	76.1	412.7	4	
Mean	**452.7**	**427.3**	**450.9**	**297.3**	**89.8**	**407.1**		
CD at 5%	15.2	48.9	105.2	17.4	0.7			
CV%	7.3	6.4	15.5	8.1	5.3			

Note: ** Not included in zonal and all India average due to low yield

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	Average	Rank	Superiority%
HFB-13-10	903.9	456.5	920.4	361.6	330.3	594.5	6	501.3	5	
JHB-16-01	909.9	534.4	993.1	429.3	359.4	645.2	2	545.8	1	1.8
JB-05-10	869.4	489.7	1037.6	364.6	411.3	634.5	3	541.4	2	0.9
Wardan (NC)	899.6	457.0	1002.4	413.3	369.9	628.4	4	536.4	3	
Mescavi (NC)	922.9	424.3	1007.6	375.7	384.0	622.9	5	513.7	4	
Bundel Berseem-2 (ZC-CZ)	912.5	421.8	1173.2	387.6	373.4	653.7	1			
Mean	**903.0**	**464.0**	**1022.4**	**388.7**	**371.4**	**629.9**		**527.7**		
CD at 5%	101.0	46.6	164.3	44.0	56.5					
CV%	7.4	5.5	10.9	7.4	10.3					

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

Entries	North East Zone						
	Kalyani	Ranchi	Faizabad	Pusa	**Bhubaneswar	Average	Rank
HFB-13-10	80.4	59.7	101.7	52.3	18.9	73.5	5
JHB-16-01	96.2	66.6	97.5	55.9	18.5	79.0	3
JB-05-10	94.8	73.8	97.4	52.6	21.9	79.6	2
Wardan (NC)	82.1	69.9	108.8	57.9	17.9	79.7	1
Mescavi (NC)	82.5	53.9	95.6	51.6	23.0	70.9	6
Bundel Berseem-3 ZC (NEZ)	91.6	70.0	100.9	50.9	16.1	78.4	4
Mean	**87.9**	**65.6**	**100.3**	**53.5**	**19.4**	**76.9**	
CD at 5%	1.9	9.9	23.4	4.8	0.2		
CV%	4.7	8.5	15.4	7.6	5.4		

Note: ** Not included in zonal and all India average due to low yield

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

Entries	Central Zone							All India		
	Rahuri	Jabalpur	Urulikanchan	Raipur	*Jhansi	Average	Rank	Average	Rank	Superiority%
HFB-13-10	99.4	129.8	36.2	41.4	186.0	76.7	6	75.1	5	
JHB-16-01	111.9	138.4	48.3	50.4	179.1	87.3	4	83.1	3	
JB-05-10	109.8	150.7	34.7	61.1	196.4	89.1	2	84.4	1	0.72
Wardan (NC)	104.6	150.3	44.3	52.2	206.6	87.8	3	83.8	2	
Mescavi (NC)	94.5	146.5	39.9	56.0	187.5	84.2	5	77.5	4	
Bundel Berseem-2 (ZC-CZ)	91.4	171.3	42.9	53.7	195.3	89.8	1			
Mean	**101.9**	**147.8**	**41.0**	**52.5**	**191.8**	**85.8**		**80.8**		
CD at 5%	10.3	25.4	4.6	10.9	8.2					
CV%	5.6	11.6	7.4	14.1	23.8					

Note: * Not included in zonal & all India average due to CV≥ 20

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

Entries	Kalyani	Ranchi	Faizabad	Bhubaneswar	Rahuri	Urulikanchan	Raipur	Average	Rank
HFB-13-10	3.40	2.87	3.38	1.76	3.26	3.44	3.15	3.04	5
JHB-16-01	4.14	3.11	3.35	1.85	3.82	4.09	3.27	3.38	1
JB-05-10	4.01	3.44	3.41	2.05	3.50	3.47	3.74	3.37	2
Wardan (NC)	3.51	3.17	3.72	1.66	3.26	3.94	3.52	3.25	3
Mescavi (NC)	3.46	2.67	3.29	2.04	3.03	3.58	3.49	3.08	4
Bundel Berseem-3 ZC (NEZ)	3.93	3.07	3.47	1.65					
Bundel Berseem-2 (ZC-CZ)					3.01	3.69	3.39		
Mean	**3.74**	**3.06**	**3.44**	**1.84**	**3.31**	**3.70**	**3.43**	**3.22**	

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

Entries	Kalyani	Ranchi	Faizabad	Bhubaneswar	Rahuri	Urulikanchan	Raipur	Average	Rank
HFB-13-10	0.66	0.43	0.77	0.36	0.71	0.34	0.26	0.51	5
JHB-16-01	0.80	0.48	0.74	0.39	0.80	0.46	0.34	0.57	2
JB-05-10	0.78	0.53	0.74	0.45	0.78	0.33	0.43	0.58	1
Wardan (NC)	0.68	0.49	0.83	0.37	0.75	0.42	0.36	0.56	3
Mescavi (NC)	0.68	0.39	0.73	0.45	0.67	0.38	0.39	0.53	4
Bundel Berseem-3 ZC (NEZ)	0.76	0.49	0.77	0.35					
Bundel Berseem-2 (ZC-CZ)					0.65	0.41	0.37		
Mean	**0.73**	**0.47**	**0.76**	**0.40**	**0.73**	**0.39**	**0.36**	**0.55**	

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

Entries	Kal-yani	Faiza-bad	Ran-chi	Rah-uri	Jabal-pur	Urulikan-chan	Rai-pur	**Bhuban-eswar	Aver-age	Ra-nk
HFB-13-10	12.2	17.1	8.5	16.4	18.9	6.5	6.8	2.9	12.3	4
JHB-16-01	15.5	16.6	8.2	18.6	21.0	8.8	7.2	3.0	13.7	2
JB-05-10	12.4	16.7	9.4	18.8	21.6	6.0	9.2	3.4	13.4	3
Wardan (NC)	11.1	19.1	10.8	18.5	21.1	8.3	7.7	2.7	13.8	1
Mescavi (NC)	10.5	16.1	7.3	14.6	20.5	7.4	7.8	3.8	12.0	5
Bundel Berseem-3 ZC (NEZ)	11.3	17.4	11.5					2.4		
Bundel Berseem-2 (ZC-CZ)				16.4	24.6	8.1	7.1			
Mean	**12.2**	**17.2**	**9.3**	**17.2**	**21.3**	**7.5**	**7.6**	**3.0**	**13.1**	

Note: ** Not included in all India average due to low yield

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

Entries	Kalyani	Ranchi	Faizabad	Bhubaneswar	Rahuri	Jabalpur	Urulikanchan	Raipur	Average	Rank
HFB-13-10	15.2	14.2	16.9	15.2	16.5	14.5	17.9	16.2	15.8	2
JHB-16-01	16.1	12.3	17.0	16.1	16.6	14.6	18.3	14.3	15.7	3
JB-05-10	13.1	12.7	17.1	15.7	17.1	14.6	17.4	15.1	15.3	4
Wardan (NC)	13.5	15.5	17.5	15.0	17.7	14.7	18.7	14.7	15.9	1
Mescavi (NC)	12.7	13.6	16.8	16.4	15.5	14.6	18.4	14.0	15.2	5
Bundel Berseem-3 ZC (NEZ)	12.3	16.4	17.2	14.9						
Bundel Berseem-2 (ZC-CZ)					17.9	14.7	18.9	13.3		
Mean	**13.8**	**14.1**	**17.1**	**15.5**	**16.9**	**14.6**	**18.3**	**14.6**	**15.6**	

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

Entries	Kalyani	Ranchi	Faizabad	Bhubaneswar	Rahuri	Jabalpur	Urulikanchan	Raipur	Average	Rank
HFB-13-10	77.3	70.6	55.8	71.4	49.0	46.8	45.6	45.6	57.8	5
JHB-16-01	81.7	67.6	53.5	68.5	54.2	62.6	49.0	48.2	60.7	3
JB-05-10	78.8	67.1	56.6	77.2	56.9	53.0	51.4	47.3	61.0	2
Wardan (NC)	75.9	71.6	57.9	65.3	56.5	61.9	51.0	50.1	61.3	1
Mescavi (NC)	76.2	68.6	56.5	73.7	52.3	53.7	48.2	46.6	59.5	4
Bundel Berseem-3 ZC (NEZ)	80.8	68.9	55.9	59.1						
Bundel Berseem-2 (ZC-CZ)					53.0	63.4	49.5	49.0		
Mean	**78.5**	**69.0**	**56.0**	**69.2**	**53.6**	**56.9**	**49.1**	**47.8**	**60.0**	

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

Entries	Kal-yani	Ran-chi	Faiza-bad	Bhuban-eswar	Rah-uri	Jabal-pur	Urulikan-chan	Rai-pur	Aver-age	Ra-nk
HFB-13-10	0.92	0.63	0.75	1.11	0.55	0.67	0.75	0.45	0.73	2
JHB-16-01	0.81	0.59	0.71	1.01	0.50	0.82	0.72	0.38	0.69	4
JB-05-10	0.91	0.58	0.68	1.25	0.47	0.78	0.72	0.44	0.73	2
Wardan (NC)	0.88	0.66	0.78	0.94	0.48	0.84	0.72	0.39	0.71	3
Mescavi (NC)	0.98	0.58	0.65	1.31	0.45	0.75	0.77	0.50	0.75	1
Bundel Berseem-3 ZC (NEZ)	0.93	0.63	0.69	0.92						
Bundel Berseem-2 (ZC-CZ)					0.50	0.88	0.78	0.43		
Mean	**0.91**	**0.61**	**0.71**	**1.09**	**0.49**	**0.79**	**0.74**	**0.43**	**0.72**	

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

Entries	ADF (%)				NDF (%)				IVDMD (%)			
	Rah-uri	Ran-chi	Aver-age	Ra-nk	Rah-uri	Ran-chi	Aver-age	Ra-nk	Rah-uri	Ran-chi	Aver-age	Ra-nk
HFB-13-10	30.2	33.5	31.9	1	40.1	41.5	40.8	1	63.0	66.2	64.6	2
JHB-16-01	31.6	34.9	33.3	4	43.7	43.7	43.7	4	62.2	62.5	62.4	5
JB-05-10	31.5	38.1	34.8	5	42.1	46.0	44.1	5	65.4	61.5	63.5	4
Wardan (NC)	32.0	32.3	32.2	2	42.6	39.7	41.2	2	60.0	67.4	63.7	3
Mescavi (NC)	28.5	36.3	32.4	3	38.6	46.5	42.6	3	68.6	62.8	65.7	1
Bundel Berseem-3 ZC (NEZ)		35.1				45.3				65.7		
Bundel Berseem-2 (ZC-CZ)	29.3				38.7				66.4			
Mean	**30.5**	**35.0**	**32.8**		**41.0**	**43.8**	**42.4**		**64.3**	**64.4**	**64.3**	

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

(Reference tables 3.1 to 3.8)

Second advanced varietal trial in Berseem comprising of two entries along with two national checks (Wardan and Mescavi) and one zonal check [BB-2 (NWZ)] was conducted at five centres located in North West zone.

For green forage yield and dry matter yield (q/ha), national check was best performer and none of the entries showed better performance than the check. In green and dry forage production potential (q/ha/day), zonal check Bundel Berseem -2 was best performer. Similarly checks were best performer for the character plant height and leafiness.

In quality parameters, for crude protein yield (q/ha) and crude protein content (%), checks were best performers. For other quality parameters, like ADF %, NDF %, IVDMD % and DDM (q/ha) checks was best performer.

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

(Reference table 4.1)

Second advanced varietal trial (seed) in Berseem comprising of two entries along with two national checks (Wardan and Mescavi) and one zonal check [BB-2 (NWZ] was conducted at two centres located in North West zone.

For seed yield, JB-05-09 was best performer showing 20.6% higher yield than the best check. Other entry PC-82 showed marginal superiority over the best check.

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

Entries	GFY (q/ha)							DMY (q/ha)					
	North West Zone							North West Zone					
	His-ar	Ludh-iana	Pant-nagar	Udai-pur	**Bika-ner	Aver-age	Ra-nk	His-ar	Ludh-iana	Pant-nagar	**Bika-ner	Aver-age	Ra-nk
JB-05-9	548.9	784.0	965.0	911.6	99.5	802.4	4	62.5	119.6	145.3	19.5	109.1	5
PC-82	526.0	755.9	991.7	934.1	128.1	801.9	5	59.5	128.5	162.5	25.2	116.8	3
Wardan (NC)	618.0	577.2	1145.8	899.3	108.2	810.1	3	71.0	84.4	173.8	20.9	109.7	4
Mescavi (NC)	518.4	776.5	1087.5	892.3	119.4	818.7	1	60.6	112.6	183.7	22.1	119.0	1
Bundel Berseem-2 (ZC-NWZ)	600.6	628.9	1149.2	885.5	102.8	816.0	2	68.1	103.0	182.6	19.8	117.9	2
Mean	**562.4**	**704.5**	**1067.8**	**904.6**	**111.6**	**809.8**		**64.3**	**109.6**	**169.6**	**21.5**	**114.5**	
CD at 5%	55.5	39.1	61.7	NS	24.7			8.9	19.2	14.2	5.5		
CV%	7.4	8.2	7.6	6.2	14.7			9.4	7.6	10.2	16.9		

Note: ** Not included in all India average due to low yield

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

Entries	GFY (q/ha/day)						DMY (q/ha/day)					
	His-ar	Ludh-iana	Pant-nagar	**Bika-ner	Aver-age	Ra-nk	His-ar	Ludh-iana	Pant-nagar	**Bika-ner	Aver-age	Ra-nk
JB-05-9	3.78	5.41	5.95	0.77	5.05	4	0.43	0.82	0.90	0.15	0.72	3
PC-82	3.56	5.21	6.12	0.99	4.96	5	0.39	0.89	1.00	0.19	0.76	2
Wardan (NC)	4.27	3.98	7.07	0.83	5.11	3	0.48	0.58	1.07	0.16	0.71	4
Mescavi (NC)	3.46	5.35	6.71	0.92	5.17	2	0.40	0.78	1.13	0.17	0.77	1
Bundel Berseem-2 (ZC-NWZ)	4.13	4.34	7.09	0.79	5.19	1	0.46	0.71	1.13	0.15	0.77	1
Mean	**3.84**	**4.86**	**6.59**	**0.86**	**5.10**		**0.43**	**0.76**	**1.05**	**0.17**	**0.74**	

Note: ** Not included in all India average due to low yield

Table 3.3 AVT-2: Second Advanced Varietal Trial in Berseem: Crude Protein Yield (q/ha) & Crude Protein (%)

Entries	Crude Protein Yield (q/ha)						Crude Protein (%)					
	His-ar	Pant-nagar	Ludh-iana	**Bika-ner	Aver-age	Ra-nk	Bika-ner	His-ar	Ludh-iana	Pant-nagar	Aver-age	Ra-nk
JB-05-9	11.8	24.1	23.2	3.5	19.7	5	17.7	18.8	19.4	16.6	18.1	2
PC-82	10.6	29.1	23.1	4.3	20.9	4	17.0	19.1	18.0	17.9	18.0	3
Wardan (NC)	13.4	34.2	15.4	3.5	21.0	3	16.6	18.9	18.3	19.7	18.4	1
Mescavi (NC)	11.8	34.5	22.7	3.6	23.0	1	16.1	18.6	20.2	18.8	18.4	1
Bundel Berseem-2 (ZC-NWZ)	13.9	35.2	17.4	2.6	22.2	2	13.1	19.2	16.9	19.3	17.1	4
Mean	**12.3**	**31.4**	**20.4**	**3.5**	**21.4**		**16.1**	**18.9**	**18.6**	**18.5**	**18.0**	

Note: ** Not included in all India average due to low yield

Table 3.4 AVT-2: Second Advanced Varietal Trial in Berseem: Plant Height (cm) & Leaf Stem Ratio

Entries	Plant Height (cm)							Leaf Stem Ratio				
	Bika-ner	His-ar	Ludh-iana	Pant-nagar	Udai-pur	Aver-age	Ra-nk	Bika-ner	His-ar	Ludh-iana	Aver-age	Ra-nk
JB-05-9	47.5	72.7	48.3	80.7	65.5	62.9	2	0.77	0.68	1.15	0.87	2
PC-82	54.0	63.1	50.5	77.9	59.1	60.9	4	0.79	0.71	1.10	0.87	2
Wardan (NC)	49.5	71.4	47.3	77.4	63.4	61.8	3	0.80	0.66	0.95	0.80	4
Mescavi (NC)	48.0	65.9	46.0	79.6	61.1	60.1	5	0.74	0.73	1.18	0.88	1
Bundel Berseem-2 (ZC-NWZ)	57.5	69.6	51.3	80.3	60.2	63.8	1	0.60	0.73	1.25	0.86	3
Mean	**51.3**	**68.5**	**48.7**	**79.2**	**61.9**	**61.9**		**0.74**	**0.70**	**1.13**	**0.86**	

Table 3.5 AVT-2: Second Advanced Varietal Trial in Berseem: ADF (%), NDF (%) & IVDMD (%) & DDM (q/ha)

Entries	ADF (%)				NDF (%)				IVDMD (%)				DDM (q/ha)	
	Ludh-iana	Pant-nagar	Aver-age	Ra-nk	Ludh-iana	Pant-nagar	Aver-age	Ra-nk	Ludh-iana	His-ar	Aver-age	Ra-nk	His-ar	Ra-nk
JB-05-9	32.9	52.2	42.6	2	43.2	62.3	52.8	4	65.3	64.9	65.1	2	39.9	4
PC-82	33.6	52.5	43.1	3	42.6	60.7	51.7	1	64.0	64.0	64.0	3	35.2	5
Wardan (NC)	34.1	53.3	43.7	4	41.9	61.4	51.7	1	64.2	58.4	61.3	5	40.4	3
Mescavi (NC)	31.4	52.6	42.0	1	41.3	62.7	52.0	2	67.2	66.2	66.7	1	41.1	2
Bundel Berseem-2 (ZC-NWZ)	35.6	52.4	44.0	5	43.9	61.4	52.7	3	62.2	64.4	63.3	4	46.4	1
Mean	**33.5**	**52.6**	**43.1**		**42.6**	**61.7**	**52.1**		**64.6**	**63.6**	**64.1**		**40.6**	

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

Entries	North West Zone				
	Hisar	Ludhiana	Average	Rank	Superiority%
JB-05-9	4.77	3.90	4.34	1	20.6
PC-82	3.56	3.65	3.61	2	0.28
Wardan (NC)	3.85	2.60	3.23	5	
Mescavi (NC)	3.65	3.55	3.60	3	
Bundel Berseem-2 (ZC-NWZ)	2.90	3.75	3.33	4	
Mean	**3.75**	**3.49**	**3.62**		
CD at 5%	0.69	1.17			
CV%	12.66	8.17			

5. IVTO (SC): INITIAL VARIETAL TRIAL IN OAT (SINGLE CUT) (Reference tables 5.1 to 5.9)

In Oat (single cut), eleven entries along with two national checks namely OS-6 and Kent and five zonal checks *viz.*, SKO-96 (HZ), RO-11-1 (NWZ, NEZ), JHO-99-2 (NEZ), JHO-2009-1 (CZ) and JHO-2010-1 (SZ) for respective zones were evaluated in initial varietal trial at 27 locations across the five zones in the country.

For green forage yield (q/ha), In HZ, NWZ, NEZ the zonal checks were top performers and none of the entries could surpass them in yield. In CZ, entries SKO-240 (9.0%), OL-1896 (7.0%), JO-05-9 (5.8%), and HFO-718 (5.5%) performed better than the best check. Other entries showed marginal superiority over below par performance in comparison to best check. In South zone entries HFO-718 (4.8%) and JHO-17-1 (4.2%) were superior to the best checks. At all India level, OL-1896 (9.4%), HFO-718 (8.5%), HFO-529 (5.5%) performed better. Other entries were either inferior to or showed marginal superiority over best national/zonal check.

For dry matter yield (q/ha), In HZ only UPO-17-3 and in Central zone, entry JO-05-9 performed marginally better than checks. In NWZ, NEZ the zonal checks were top performers and none of the entries could surpass them in yield. In south zone, 04 entries viz., JO-05-9, HFO-718, NDO-1501, OL-1896 were superior by a margin of more than 5%. At all India level, HFO-718 (8.6%), JO-05-9 (6.7%), OL-1896 (5.8%) performed better than checks. Other entries were either inferior to or showed marginal superiority over best national/zonal check.

For fodder production potential (q/ha/day), HFO-718 followed by OL-1896 for green and HFO 529 followed by JO-05-9 and OL-1893 for dry forage yield were top performers. For plant height, HFO-718 followed by HFO-529 was best performers. For the character leafiness (L/S ratio), entry UPO-17-2 and JHO-17-1 ranked joint first.

For quality parameters, entry OL-1896 and HFO-718 ranked joint first for crude protein yield (q/h), whereas check ranked first for crude protein (%). For other quality parameters, entry OL-1896 showed superiority for NDF, ADF; whereas, entry SKO-240 ranked first for IVDMD; and entry JO-05-9 for DDM ranked first.

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

Entries	Hill Zone					North West Zone						
	Palam-pur	Sri-nagar	Raj-ouri	Aver-age	Ra-nk	Bika-ner	His-ar	Ludh-iana	Pant-nagar	Udai-pur	Aver-age	Ra-nk
UPO-17-2	149.6	337.2	188.5	225.1	10	255.8	341.5	575.6	611.1	558.4	468.5	13
UPO-17-3	165.6	351.3	201.9	239.6	3	202.0	294.8	578.5	577.8	572.2	445.0	14
JHO-17-2	166.4	337.3	176.3	226.7	6	334.5	333.0	678.0	600.5	673.6	523.9	5
JHO-17-1	164.8	325.6	170.7	220.4	14	325.6	217.0	676.5	644.5	661.1	504.9	8
JO-05-9	218.4	324.5	179.6	240.8	2	345.7	371.5	653.1	711.3	537.5	523.8	6
OL-1893	164.0	333.3	182.2	226.5	7	298.3	349.3	649.4	562.3	605.5	492.9	12
OL-1896	156.8	330.2	174.4	220.5	13	361.7	383.3	690.4	716.6	766.6	583.7	2
SKO-240	196.8	316.5	187.4	233.6	5	407.1	222.2	687.6	755.7	633.3	541.2	4
HFO-718	172.0	350.3	184.1	235.5	4	407.9	352.2	675.2	588.4	555.5	515.8	7
NDO-1501	142.4	333.6	194.4	223.5	11	268.4	389.6	563.3	666.5	615.4	500.7	9
HFO-529	154.4	354.7	167.0	225.4	9	327.6	401.1	657.2	577.8	822.2	557.2	3
Kent (NC)	153.6	318.4	191.9	221.3	12	254.0	352.6	578.5	594.4	695.8	495.1	11
OS-6 (NC)	146.4	335.1	197.4	226.3	8	304.7	315.9	585.9	677.6	611.1	499.0	10
SKO-96 (ZC-HZ)	175.2	362.7	186.3	241.4	1							
RO-11-1 (ZC-NWZ)						354.6	383.0	702.6	866.7	752.8	611.9	1
Mean	**166.2**	**336.5**	**184.4**	**229.0**		**317.7**	**336.2**	**639.4**	**653.7**	**647.2**	**518.8**	
CD at 5%	35.4	23.8	1.8			103.9	63.4	82.1	112.5	138.9		
CV%	12.7	10.4	6.5			19.2	11.1	8.9	9.7	13.4		

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	Faiza-bad	Imp-hal	Aver-age	Ra-nk
UPO-17-2	251.3	487.5	309.9	596.4	366.0	426.7	307.3	392.2	5
UPO-17-3	265.4	511.1	235.3	558.2	369.0	421.3	352.2	387.5	6
JHO-17-2	277.5	487.4	174.6	563.6	326.0	469.3	406.5	386.4	7
JHO-17-1	239.5	486.7	347.9	604.0	313.0	411.4	268.3	381.5	8
JO-05-9	254.4	496.4	214.6	569.3	286.0	392.0	394.7	372.5	10
OL-1893	242.3	513.7	281.3	497.8	353.0	361.7	353.1	371.8	11
OL-1896	215.6	526.2	363.2	611.1	349.0	402.7	410.4	411.2	4
SKO-240	208.5	513.3	200.6	528.9	393.0	360.0	363.4	366.8	13
HFO-718	297.5	541.2	338.6	575.1	326.0	541.3	417.8	433.9	2
NDO-1501	214.4	503.1	259.9	468.0	339.0	456.0	411.1	378.8	9
HFO-529	208.2	501.2	382.8	515.1	366.0	528.0	433.7	419.3	3
Kent (NC)	229.3	517.7	245.3	530.7	353.0	413.3	308.6	371.1	12
OS-6 (NC)	225.8	505.3	171.3	406.2	397.0	440.0	374.8	360.1	14
RO-11-1 (ZC-NEZ)	313.6	564.8	397.9	625.8	371.0	536.0	445.1	464.9	1
Mean	**246.0**	**511.1**	**280.2**	**546.4**	**350.5**	**440.0**	**374.8**	**392.7**	
CD at 5%	4.4	12.7	1.8	60.6	29.2	83.4	17.3		
CV%	4.5	9.8	5.0	6.6	8.7	11.3	3.9		

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

Entries	Central Zone									
	Rah-uri	Urulikan-chan	Ana-nd	Jabal-pur	Rai-pur	Jha-nsi	Pal-ghar	Aver-age	Ra-nk	Superi-ority%
UPO-17-2	380.5	585.6	553.0	465.2	255.2	530.8	378.2	449.8	11	
UPO-17-3	440.3	538.1	586.0	482.5	290.0	524.6	216.1	439.7	12	
JHO-17-2	444.4	554.6	743.0	567.8	332.2	514.7	230.5	483.9	6	0.3
JHO-17-1	435.6	752.0	561.0	571.8	318.1	462.9	239.5	477.3	9	
JO-05-9	408.2	695.4	578.0	699.8	318.9	580.1	292.2	510.4	3	5.8
OL-1893	435.0	769.6	684.0	462.5	375.8	475.2	244.5	492.4	5	2.1
OL-1896	505.4	585.0	762.0	593.1	308.9	592.5	266.3	516.2	2	7.0
SKO-240	292.8	906.6	753.0	447.8	303.7	656.7	285.3	520.8	1	9.0
HFO-718	415.0	781.3	719.0	533.2	235.2	598.7	279.0	508.7	4	5.5
NDO-1501	393.4	566.9	562.0	470.5	318.9	629.5	207.3	449.8	11	
HFO-529	426.9	637.8	590.0	389.2	379.6	598.7	226.1	464.0	10	
Kent (NC)	395.3	535.4	561.0	451.8	177.4	506.1	318.4	420.8	13	
OS-6 (NC)	340.1	718.9	639.0	554.5	312.6	555.5	255.3	482.3	7	
JHO-2009-1 (ZC-CZ)	422.2	608.0	675.0	642.5	218.5	530.8	258.4	479.3	8	
Mean	**409.6**	**659.7**	**640.4**	**523.7**	**296.1**	**554.0**	**264.1**	**478.2**		
CD at 5%	32.0	89.3	114.1	103.5	67.9	16.3	87.0			
CV%	4.7	8.0	10.6	11.8	13.5	9.7	19.5			

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

Entries	South Zone								All India		
	Hydera-bad	Man-dya	Coimba-tore	**Tiru-pati	**Mattu-petty	Aver-age	Ra-nk	Superi-ority%	Aver-age	Ra-nk	Superi-ority%
UPO-17-2	588.8	222.2	348.1	53.1	121.0	386.4	9		402.8	10	
UPO-17-3	533.3	214.3	405.6	35.1	84.0	384.4	11		395.5	12	
JHO-17-2	592.5	199.3	409.3	50.5	149.0	400.3	5		423.7	5	3.1
JHO-17-1	551.8	270.7	431.5	36.5	106.0	418.0	2	4.2	418.1	7	1.7
JO-05-9	596.2	170.6	389.6	54.3	236.0	385.5	10		427.1	4	3.9
OL-1893	599.9	197.4	416.3	59.3	117.0	404.5	3	0.8	416.3	8	1.3
OL-1896	570.3	208.0	394.1	41.3	316.0	390.8	7		449.8	1	9.4
SKO-240	285.2	207.0	360.0	43.2	172.0	284.1	14		418.9	6	1.9
HFO-718	596.2	271.3	394.1	58.2	223.0	420.5	1	4.8	445.8	2	8.5
NDO-1501	474.0	221.0	370.4	55.1	259.0	355.1	12		401.6	11	
HFO-529	574.0	243.4	372.6	51.8	142.0	396.7	6		433.4	3	5.5
Kent (NC)	588.8	212.1	370.4	52.6	110.0	390.4	8		394.2	12	
OS-6 (NC)	570.3	203.6	430.0	48.4	87.0	401.3	4		411.0	9	
JHO-2010-1 (ZC-SZ)	481.4	181.1	400.0	56.2	119.0	354.2	13				
Mean	**543.1**	**215.8**	**392.3**	**49.7**	**160.1**	**383.7**			**418.3**		
CD at 5%	48.3	22.8	2.7	7.8	7.4						
CV%	5.3	9.2	7.8	8.9	2.7						

Note: ** Not included in all India average due to low yield

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	Rajo-uri	Aver-age	Ra-nk	Superi-ority%	Bika-ner	His-ar	Ludh-iana	Pant-nagar	Aver-age	Ra-nk
UPO-17-2	28.7	72.8	45.6	49.0	4		50.4	72.6	122.6	132.4	94.5	11
UPO-17-3	29.0	75.9	50.0	51.6	1	3.6	41.1	65.1	125.0	91.4	80.7	14
JHO-17-2	28.3	72.8	37.8	46.3	9		64.5	65.6	153.2	106.1	97.3	9
JHO-17-1	27.3	70.4	36.3	44.7	11		59.5	46.9	157.6	96.4	90.1	13
JO-05-9	41.5	70.1	40.7	50.8	3		66.3	86.7	146.3	105.4	101.2	7
OL-1893	29.3	72.0	39.3	46.9	7		72.1	76.7	138.3	138.3	106.3	2
OL-1896	28.4	71.3	36.7	45.5	10		74.8	84.5	158.1	98.5	104.0	4
SKO-240	33.2	68.4	42.6	48.1	5		72.6	47.7	156.1	132.6	102.3	6
HFO-718	31.0	75.7	40.4	49.0	4		83.6	73.7	149.2	115.3	105.4	3
NDO-1501	25.9	72.0	44.4	47.4	6		67.1	86.9	125.1	119.2	99.6	8
HFO-529	28.6	76.6	35.2	46.8	8		71.6	89.8	143.3	108.5	103.3	5
Kent (NC)	28.5	68.8	43.3	46.9	7		59.4	82.3	131.9	111.0	96.2	10
OS-6 (NC)	24.4	72.4	43.7	46.8	8		70.0	69.4	130.1	105.1	93.6	12
SKO-96 (ZC-HZ)	33.7	78.4	42.2	51.4	2							
RO-11-1 (ZC-NWZ)							67.5	77.9	153.9	127.1	106.6	1
Mean	**29.8**	**72.7**	**41.3**	**47.9**			**65.8**	**73.3**	**142.2**	**113.4**	**98.6**	
CD at 5%	NS	5.5	0.3				20.6	18.0	42.2	26.3		
CV%	16.7	8.8	5.4				18.4	14.4	11.2	12.6		

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

Entries	North East Zone								
	Jorhat	**Kalyani**	**Bhubaneswar**	**Ranchi**	**Pusa**	**Faizabad**	**Imphal**	**Average**	**Rank**
UPO-17-2	50.2	72.7	69.9	144.1	73.1	103.5	84.3	85.4	7
UPO-17-3	51.0	77.7	51.7	157.2	74.0	92.6	101.5	86.5	5
JHO-17-2	53.3	71.7	36.9	163.4	65.1	102.2	106.3	85.6	6
JHO-17-1	45.1	70.8	75.2	129.9	62.1	89.8	82.7	79.3	11
JO-05-9	48.3	72.3	47.0	145.2	57.2	89.0	106.4	80.8	9
OL-1893	47.0	76.9	62.2	126.9	70.5	79.0	96.7	79.9	10
OL-1896	37.4	76.3	74.5	145.6	69.9	92.5	131.8	89.7	4
SKO-240	40.3	74.1	44.7	103.1	78.8	77.6	101.4	74.3	13
HFO-718	56.2	79.3	71.9	146.7	64.9	130.9	125.0	96.4	2
NDO-1501	40.2	76.1	56.5	127.1	67.9	101.1	101.4	81.5	8
HFO-529	37.0	73.1	82.1	134.8	73.2	126.7	113.0	91.4	3
Kent (NC)	43.8	74.9	52.5	147.7	70.5	9.0	70.4	67.0	14
OS-6 (NC)	34.8	73.1	38.2	111.0	79.2	98.1	102.5	76.7	12
RO-11-1 (ZC-NEZ)	56.4	84.1	84.4	166.9	74.1	116.2	135.4	102.5	1
Mean	**45.8**	**75.2**	**60.5**	**139.3**	**70.0**	**93.4**	**104.2**	**84.1**	
CD at 5%	3.0	2.0	0.4	19.0	6.1	18.6	15.8		
CV%	7.0	6.4	5.0	8.1	9.4	11.1	12.8		

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

Entries	Central Zone									
	Rahuri	**Urulikanchan**	**Anand**	**Jabalpur**	**Raipur**	**Jhansi**	***Palghar**	**Average**	**Rank**	**Superiority%**
UPO-17-2	83.7	120.2	89.5	104.1	52.7	132.7	62.5	97.1	13	
UPO-17-3	85.4	117.7	79.1	108.2	57.7	148.5	38.5	99.4	12	
JHO-17-2	93.2	132.6	105.5	132.9	69.9	126.3	39.5	110.1	4	
JHO-17-1	88.1	160.4	80.2	134.0	60.8	104.4	47.9	104.6	11	
JO-05-9	81.3	149.7	84.4	165.5	73.8	162.6	48.7	119.5	1	4.5
OL-1893	79.6	163.2	100.5	103.3	85.9	117.4	45.5	108.3	6	
OL-1896	113.9	126.7	103.7	139.7	58.1	108.6	43.7	108.5	5	
SKO-240	65.5	222.0	99.3	97.5	44.5	99.6	39.5	104.7	10	
HFO-718	100.9	140.7	102.1	120.2	41.1	133.5	42.2	106.4	8	
NDO-1501	85.7	118.0	80.4	105.7	78.0	171.6	25.7	106.6	7	
HFO-529	90.3	137.1	85.0	82.3	84.0	151.6	34.8	105.0	9	
Kent (NC)	86.8	107.8	80.2	101.0	37.8	126.2	49.4	90.0	14	
OS-6 (NC)	82.4	150.3	98.4	125.7	77.5	151.5	47.4	114.3	2	
JHO-2009-1 (ZC-CZ)	86.1	130.8	105.3	151.5	55.2	154.8	44.2	113.9	3	
Mean	**87.3**	**141.2**	**92.4**	**119.4**	**63.4**	**134.9**	**43.5**	**106.3**		
CD at 5%	6.7	18.9	17.3	28.7	17.1	17.5	16.3			
CV%	4.6	7.9	11.1	14.5	16.0	10.4	22.1			

Note: * Not included in zonal and all India average due to CV≥ 20

Table 5.2 IVT Oat (SC): Initial 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%
UPO-17-2	106.4	42.7	82.2	29.8	65.3	12		81.9	11	
UPO-17-3	124.6	50.5	98.0	20.7	73.4	10		82.2	10	
JHO-17-2	130.3	45.3	100.3	37.3	78.3	5	3.6	87.5	5	3.3
JHO-17-1	101.4	63.7	106.4	26.5	74.5	8		82.3	9	
JO-05-9	133.7	40.3	97.4	58.1	82.4	1	9.0	90.4	2	6.7
OL-1893	125.4	46.3	103.8	29.3	76.2	6	0.8	86.7	6	2.4
OL-1896	112.7	41.9	87.2	77.9	79.9	4	5.7	89.6	3	5.8
SKO-240	60.3	44.7	71.2	43.1	54.8	13		80.0	12	
HFO-718	103.4	64.0	101.8	56.1	81.3	2	7.5	92.0	1	8.6
NDO-1501	117.3	53.0	89.7	64.8	81.2	3	7.4	86.5	7	2.1
HFO-529	118.6	57.4	86.7	35.5	74.5	8		88.4	4	4.4
Kent (NC)	142.6	45.5	86.8	27.6	75.6	7		76.5	13	
OS-6 (NC)	121.2	45.6	106.5	22.3	73.9	9		84.7	8	
JHO-2010-1 (ZC-SZ)	115.6	41.5	97.9	30.2	71.3	11				
Mean	**115.3**	**48.8**	**94.0**	**39.9**	**74.5**			**85.3**		
CD at 5%	33.0	6.5	1.2	2.3						
CV%	16.9	11.7	3.3	3.5						

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

Entries	Palam-pur	Sri-nagar	Rajo-uri	Bika-ner	His-ar	Ludh-iana	Pant-nagar	Jor-hat	Kal-yani	Bhuban-eswar	Ran-chi	Pu-sa	Faiza-bad
UPO-17-2	1.27	2.30	1.23	2.69	3.02	4.76	5.93	2.86	5.81	4.37	6.41	3.89	3.74
UPO-17-3	1.46	2.39	1.32	2.13	2.66	4.78	5.61	3.02	6.10	3.41	6.16	4.01	3.69
JHO-17-2	1.56	2.29	1.15	3.52	2.97	5.60	6.25	3.15	5.80	2.39	6.31	3.54	4.12
JHO-17-1	1.40	2.22	1.12	3.43	1.89	5.59	6.25	2.99	5.79	5.12	6.36	3.40	3.61
JO-05-9	2.05	2.21	1.17	3.64	3.26	5.40	6.90	2.92	5.91	3.20	6.72	3.04	3.43
OL-1893	1.41	2.27	1.19	3.14	3.12	5.37	5.56	2.78	6.11	4.02	5.31	3.79	3.18
OL-1896	1.32	2.25	1.14	3.81	3.33	5.71	6.39	1.96	6.26	5.26	6.52	3.79	3.53
SKO-240	1.60	2.15	1.22	3.60	1.90	5.68	7.63	1.75	6.11	2.67	5.10	4.18	3.16
HFO-718	1.46	2.38	1.20	4.29	3.01	5.58	5.88	3.42	6.44	4.84	6.61	3.51	4.75
NDO-1501	1.36	2.27	1.27	2.83	3.54	4.66	5.95	2.13	5.98	3.56	5.68	3.61	4.00
HFO-529	1.36	2.44	1.09	3.45	3.65	5.43	5.72	2.26	5.96	5.17	5.83	3.89	4.63
Kent (NC)	1.38	2.17	1.25	2.67	3.21	4.78	6.32	2.87	6.20	3.66	5.94	3.84	3.62
OS-6 (NC)	1.39	2.28	1.29	3.21	2.82	4.84	5.55	2.60	6.02	2.31	4.82	4.22	3.86
SKO-96 (ZC-HZ)	1.41	2.47	1.22										
RO-11-1 (ZC-NWZ)				3.73	3.33	5.81	7.73						
RO-11-1 (ZC-NEZ)								3.56	6.72	5.38	6.56	4.03	4.70
Mean	**1.46**	**2.29**	**1.20**	**3.30**	**2.98**	**5.29**	**6.26**	**2.73**	**6.09**	**3.95**	**6.02**	**3.77**	**3.86**

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

Entries	Rah-uri	Urulikan-chan	Ana-nd	Rai-pur	Jha-nsi	Pal-ghar	Hydera-bad	Man-dya	Coimb-atore	Mattu-petty	Aver-age	Ra-nk
UPO-17-2	4.34	7.32	6.28	2.93	5.53	5.73	7.39	3.19	4.77	1.34	4.22	8
UPO-17-3	4.98	6.56	7.06	3.33	5.46	3.32	6.95	2.98	5.48	0.93	4.08	11
JHO-17-2	5.11	6.30	8.26	3.69	5.59	3.60	7.53	2.72	5.38	1.65	4.28	6
JHO-17-1	5.03	9.17	7.29	3.53	4.87	3.63	7.00	3.68	5.53	1.18	4.35	5
JO-05-9	4.84	8.80	6.57	3.80	6.24	4.57	7.64	2.26	5.27	2.63	4.46	3
OL-1893	5.02	9.38	8.05	5.51	4.90	3.88	7.83	2.48	5.55	1.30	4.40	4
OL-1896	5.30	6.43	8.19	3.84	6.73	4.03	7.01	2.68	5.05	3.51	4.52	2
SKO-240	2.89	8.98	7.61	3.04	7.82	4.53	3.14	3.04	4.62	1.92	4.10	10
HFO-718	4.32	8.68	7.99	2.35	6.37	4.10	7.26	3.93	5.05	2.48	4.60	1
NDO-1501	5.15	6.91	6.94	4.09	6.49	3.24	6.35	3.28	4.87	2.88	4.22	8
HFO-529	5.10	7.78	6.94	4.52	6.24	3.43	7.50	3.65	5.04	1.58	4.46	3
Kent (NC)	4.96	6.69	7.10	2.11	5.82	4.90	7.76	3.14	5.14	1.22	4.21	9
OS-6 (NC)	4.66	9.10	7.70	3.59	6.38	3.99	7.64	3.21	5.73	0.97	4.27	7
JHO-2009-1 (ZC-CZ)	5.01	7.41	7.67	2.60	5.47	3.97						
JHO-2010-1 (ZC-SZ)							6.23	2.65	5.41	1.32		
Mean	**4.77**	**7.82**	**7.40**	**3.50**	**5.99**	**4.07**	**6.95**	**3.06**	**5.21**	**1.78**	**4.32**	

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

Entries	Sri-nagar	Rajo-uri	Bika-ner	His-ar	Ludh-iana	Pant-nagar	Jor-hat	Kal-yani	Bhuban-eswar	Ran-chi	Pu-sa	Faiza-bad
UPO-17-2	0.52	0.30	0.53	0.64	1.01	1.28	0.57	0.87	0.98	1.55	0.78	0.91
UPO-17-3	0.51	0.33	0.43	0.59	1.03	0.88	0.58	0.93	0.75	1.73	0.80	0.81
JHO-17-2	0.50	0.25	0.68	0.59	1.27	1.10	0.61	0.85	0.51	1.83	0.71	0.89
JHO-17-1	0.47	0.24	0.63	0.41	1.30	0.93	0.56	0.84	1.11	1.37	0.68	0.78
JO-05-9	0.46	0.25	0.70	0.76	1.21	1.02	0.56	0.86	0.70	1.71	0.61	0.78
OL-1893	0.51	0.26	0.76	0.69	1.14	1.36	0.54	0.91	0.89	1.36	0.76	0.69
OL-1896	0.49	0.24	0.79	0.74	1.31	0.88	0.41	0.91	1.08	1.55	0.76	0.81
SKO-240	0.45	0.28	0.64	0.41	1.29	1.33	0.42	0.88	0.60	0.99	0.84	0.68
HFO-718	0.52	0.26	0.88	0.63	1.23	1.15	0.65	0.94	1.03	1.69	0.70	1.15
NDO-1501	0.48	0.29	0.71	0.79	1.03	1.06	0.50	0.90	0.77	1.54	0.72	0.88
HFO-529	0.55	0.23	0.75	0.82	1.18	1.07	0.42	0.87	1.11	1.53	0.78	1.11
Kent (NC)	0.46	0.28	0.63	0.75	1.09	1.18	0.55	0.89	0.78	1.65	0.77	0.79
OS-6 (NC)	0.48	0.29	0.74	0.62	1.08	0.86	0.40	0.87	0.52	1.32	0.84	0.86
SKO-96 (ZC-HZ)	0.52	0.28										
RO-11-1 (ZC-NWZ)			0.71	0.68	1.27	1.13						
RO-11-1 (ZC-NEZ)							0.64	1.01	1.14	1.75	0.80	1.02
Mean	**0.49**	**0.27**	**0.68**	**0.65**	**1.17**	**1.09**	**0.53**	**0.90**	**0.86**	**1.54**	**0.75**	**0.87**

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

Entries	Rahuri	Urulikanchan	Anand	Raipur	Jhansi	Palghar	Hyderabad	Coimbatore	Average	Rank
UPO-17-2	0.96	1.50	1.02	0.57	1.38	0.95	1.33	1.13	0.94	6
UPO-17-3	0.97	1.44	0.95	0.62	1.55	0.59	1.63	1.32	0.92	8
JHO-17-2	1.07	1.51	1.17	0.75	1.37	0.62	1.66	1.32	0.96	4
JHO-17-1	1.02	1.96	1.04	0.62	1.10	0.73	1.28	1.36	0.92	8
JO-05-9	0.96	1.89	0.96	0.87	1.75	0.76	1.71	1.32	0.99	2
OL-1893	0.92	1.99	1.18	0.93	1.21	0.72	1.64	1.38	0.99	2
OL-1896	1.20	1.39	1.12	0.61	1.23	0.66	1.38	1.12	0.93	7
SKO-240	0.65	2.20	1.00	0.35	1.19	0.63	0.67	0.91	0.82	9
HFO-718	1.05	1.56	1.13	0.36	1.42	0.62	1.27	1.31	0.98	3
NDO-1501	1.12	1.44	0.99	1.01	1.77	0.40	1.57	1.18	0.96	4
HFO-529	1.08	1.67	1.00	0.94	1.58	0.53	1.55	1.17	1.00	1
Kent (NC)	1.09	1.35	1.02	0.43	1.45	0.76	1.88	1.21	0.95	5
OS-6 (NC)	1.13	1.90	1.19	0.90	1.74	0.74	1.63	1.42	0.98	3
JHO-2009-1 (ZC-CZ)	1.02	1.60	1.20	0.67	1.60	0.68				
JHO-2010-1 (ZC-SZ)							1.50	1.32		
Mean	**1.02**	**1.67**	**1.07**	**0.69**	**1.45**	**0.67**	**1.48**	**1.25**	**0.95**	

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

Entries	Palampur	Hisar	Ludhiana	Bikaner	Jorhat	Kalyani	Bhubaneswar	Faizabad	Imphal
UPO-17-2	2.7	10.7	9.6	6.8	4.8	5.3	5.5	8.3	5.7
UPO-17-3	3.1	8.1	8.0	4.3	4.6	7.1	4.2	7.5	5.7
JHO-17-2	2.7	8.6	10.1	8.2	5.4	5.9	3.1	8.6	5.1
JHO-17-1	2.5	6.7	11.2	5.7	4.6	7.2	6.2	7.5	5.2
JO-05-9	3.6	13.0	9.9	9.5	5.0	5.3	3.8	7.2	5.8
OL-1893	2.8	10.5	9.7	10.1	4.4	7.3	5.0	6.6	7.3
OL-1896	2.7	10.8	14.4	8.9	3.8	6.5	6.5	7.9	8.4
SKO-240	3.2	6.4	14.5	8.9	3.4	6.0	3.6	6.4	5.4
HFO-718	3.0	11.2	11.6	6.1	5.6	6.4	6.0	11.3	6.8
NDO-1501	2.7	11.8	10.3	5.9	4.0	8.8	4.6	8.1	7.6
HFO-529	2.6	13.3	10.5	5.8	3.7	6.9	6.8	10.6	7.2
Kent (NC)	2.2	11.8	8.0	8.3	4.6	6.6	4.4	7.1	5.1
OS-6 (NC)	2.6	11.2	11.6	6.9	3.4	6.8	3.1	8.1	4.8
SKO-96 (ZC-HZ)	3.1								
RO-11-1 (ZC-NWZ)		11.5	11.5	9.2					
RO-11-1 (ZC-NEZ)					5.3	7.2	7.1	9.5	9.9
Mean	**2.8**	**10.4**	**10.8**	**7.5**	**4.5**	**6.7**	**5.0**	**8.2**	**6.4**

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

Entries	Rahuri	Urulikanchan	Anand	Jabalpur	Raipur	Mandya	Coimbatore	Hyderabad	Average	Rank
UPO-17-2	6.2	11.2	8.2	8.4	4.0	3.0	9.7	6.6	6.9	9
UPO-17-3	6.9	10.2	8.5	8.8	3.6	4.9	10.7	7.6	6.7	10
JHO-17-2	6.1	12.0	10.8	10.9	5.0	3.2	11.4	10.2	7.5	5
JHO-17-1	6.0	14.6	8.5	11.1	4.3	5.6	11.6	4.9	7.3	7
JO-05-9	5.8	13.9	8.9	13.7	4.5	3.5	9.4	5.8	7.6	4
OL-1893	5.9	15.0	8.8	8.3	6.2	3.2	6.3	7.7	7.4	6
OL-1896	7.4	10.6	9.3	11.6	3.1	3.8	11.4	7.9	7.9	1
SKO-240	4.7	20.7	8.5	7.9	2.4	3.9	7.5	3.9	6.9	9
HFO-718	6.3	13.0	14.5	9.7	2.5	4.5	9.8	6.2	7.9	1
NDO-1501	5.6	10.6	7.7	8.5	4.9	4.6	9.8	5.6	7.1	8
HFO-529	6.8	12.4	8.3	6.5	5.3	5.5	11.4	8.3	7.8	2
Kent (NC)	6.3	9.2	8.8	8.3	2.7	4.4	9.5	7.5	6.7	10
OS-6 (NC)	5.4	13.9	10.1	10.3	4.9	4.2	15.3	8.4	7.7	3
JHO-2009-1 (ZC-CZ)	6.2	11.4	9.9	12.5	3.4					
JHO-2010-1 (ZC-SZ)						3.7	9.4	5.5		
Mean	**6.1**	**12.8**	**9.3**	**9.7**	**4.0**	**4.1**	**10.2**	**6.9**	**7.3**	

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

Entries	Palampur	Bikaner	Hisar	Ludhiana	Jorhat	Kalyani	Bhubaneswar	Ranchi	Faizabad	Imphal
UPO-17-2	9.3	13.4	15.0	7.8	9.6	7.3	7.9	7.2	8.0	6.7
UPO-17-3	10.8	10.4	13.3	6.4	9.2	9.1	8.1	7.9	8.1	5.5
JHO-17-2	9.6	12.7	13.6	6.6	10.3	8.3	8.4	6.8	8.4	4.8
JHO-17-1	9.3	9.6	13.7	7.1	10.1	10.1	8.3	7.0	8.3	6.3
JO-05-9	8.8	14.4	14.2	6.8	10.4	7.3	8.1	6.3	8.1	5.5
OL-1893	9.6	14.0	13.1	7.0	9.4	9.5	8.1	6.8	8.4	7.6
OL-1896	9.6	11.9	13.2	9.1	10.2	8.6	8.7	6.6	8.5	6.4
SKO-240	9.6	12.2	13.3	9.3	8.5	8.1	8.0	5.5	8.2	5.3
HFO-718	9.6	7.3	14.6	7.8	10.0	8.1	8.4	6.3	8.6	5.5
NDO-1501	10.5	8.8	14.3	8.2	10.2	11.6	8.2	8.1	8.0	7.4
HFO-529	9.3	8.1	14.2	7.3	10.2	9.5	8.3	6.6	8.4	6.4
Kent (NC)	7.9	13.9	14.9	6.1	10.5	8.8	8.3	7.4	7.9	7.3
OS-6 (NC)	10.5	9.8	13.6	8.9	9.9	9.3	8.0	7.2	8.3	4.7
SKO-96 (ZC-HZ)	9.3									
RO-11-1 (ZC-NWZ)		13.6	14.2	7.5						
RO-11-1 (ZC-NEZ)					9.5	8.6	8.4	7.2	8.2	7.3
Mean	**9.6**	**11.4**	**13.9**	**7.6**	**9.9**	**8.9**	**8.2**	**6.9**	**8.2**	**6.2**

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

Entries	Rahuri	Urulikanchan	Anand	Jabalpur	Raipur	Mandya	Hyderabad	Average	Rank
UPO-17-2	7.4	9.3	9.2	8.2	7.6	7.0	6.1	8.7	2
UPO-17-3	8.1	8.7	10.8	8.2	7.2	9.6	6.1	8.6	3
JHO-17-2	6.6	9.1	10.2	8.3	7.2	7.0	7.9	8.6	3
JHO-17-1	6.8	9.1	10.6	8.3	7.1	8.7	4.8	8.5	4
JO-05-9	7.2	9.3	10.5	8.4	6.1	8.7	4.4	8.5	4
OL-1893	7.4	9.2	8.8	8.1	7.2	7.0	6.1	8.7	2
OL-1896	6.5	8.4	8.9	8.3	5.3	9.2	7.0	8.6	3
SKO-240	7.2	9.3	8.6	8.1	5.4	8.7	6.6	8.3	6
HFO-718	6.3	9.2	14.2	8.2	6.1	7.0	6.1	8.4	5
NDO-1501	6.6	9.0	9.6	8.1	6.3	8.7	4.8	8.7	2
HFO-529	7.6	9.0	9.8	8.0	6.3	9.6	7.0	8.6	3
Kent (NC)	7.2	8.5	10.9	8.2	7.1	9.6	5.3	8.8	1
OS-6 (NC)	6.6	9.2	10.2	8.2	6.3	9.2	7.0	8.6	3
JHO-2009-1 (ZC-CZ)	7.2	8.7	9.4	8.3	6.2				
JHO-2010-1 (ZC-SZ)						8.7	4.8		
Mean	**7.0**	**9.0**	**10.1**	**8.2**	**6.5**	**8.5**	**6.0**	**8.6**	

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

Entries	Palam-pur	Sri-nagar	Raj-ouri	Bika-ner	His-ar	Ludh-iana	Pant-nagar	Udai-pur	Jor-hat	Bhuban-eswar	Ran-chi	Faiza-bad	Imp-hal	Kal-yani
UPO-17-2	100.7	109.2	138.2	95.0	115.8	135.2	170.6	172.0	124.1	134.2	125.4	101.5	133.4	169.4
UPO-17-3	98.0	114.3	118.0	90.0	118.8	132.3	149.5	168.1	129.9	115.4	116.6	99.5	128.2	156.6
JHO-17-2	112.3	113.0	110.3	115.0	115.4	140.1	156.4	164.1	132.1	104.1	117.8	107.0	156.8	165.1
JHO-17-1	86.7	95.9	99.7	100.0	99.0	139.4	129.5	138.7	104.2	139.3	112.2	96.5	108.2	164.8
JO-05-9	102.0	102.7	115.7	110.0	120.7	132.4	161.3	149.6	124.1	108.1	124.5	94.4	149.2	161.1
OL-1893	97.7	105.5	117.3	105.0	119.9	142.6	164.7	151.7	126.1	129.9	119.5	97.5	146.1	153.9
OL-1896	97.7	115.7	125.0	96.0	124.6	130.1	188.4	160.0	150.9	149.9	121.0	120.0	166.6	165.5
SKO-240	65.0	113.8	119.0	115.0	101.1	128.4	172.4	161.3	138.1	109.5	126.8	81.5	127.3	167.7
HFO-718	99.7	119.4	117.0	124.0	123.1	142.3	151.3	167.1	134.5	145.6	119.0	122.5	174.4	169.3
NDO-1501	107.7	108.0	97.7	110.0	114.7	122.5	188.6	139.1	123.7	124.1	116.3	107.2	142.8	167.1
HFO-529	115.7	121.6	117.0	125.0	126.4	146.4	158.5	168.2	123.3	154.5	121.8	148.0	165.4	167.5
Kent (NC)	98.7	100.0	137.2	95.0	121.4	110.4	165.5	161.2	121.7	119.1	125.2	98.5	139.0	154.4
OS-6 (NC)	107.0	107.7	131.7	110.0	127.3	130.4	119.7	160.1	126.4	98.7	119.3	138.0	147.6	168.2
SKO-96 (ZC-HZ)	53.7	111.6	123.0											
RO-11-1 (ZC-NWZ)				120.0	122.8	145.6	192.9	168.9						
RO-11-1 (ZC-NEZ)									139.0	157.3	131.2	110.2	179.4	169.8
Mean	**95.9**	**109.9**	**119.1**	**107.9**	**117.9**	**134.2**	**162.1**	**159.3**	**128.4**	**127.8**	**121.2**	**108.7**	**147.5**	**164.3**

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

Entries	Rah-uri	Urulikan-chan	Ana-nd	Jabal-pur	Rai-pur	Jha-nsi	Pal-ghar	Hydera-bad	Man-dya	Coimb-atore	Tiru-pati	Mattu-petty	Aver-age	Ra-nk
UPO-17-2	114.3	120.3	136.3	120.0	121.9	154.7	93.3	112.0	100.7	144.3	46.3	122.0	123.5	7
UPO-17-3	116.6	109.3	135.7	135.6	129.9	147.9	92.3	100.4	85.7	141.3	56.7	100.0	118.7	12
JHO-17-2	127.7	126.0	151.3	133.6	119.6	163.2	118.3	111.5	86.9	155.7	61.4	145.0	127.3	4
JHO-17-1	110.0	120.9	124.2	133.5	112.9	162.6	95.7	74.8	96.6	145.7	56.0	97.0	113.2	13
JO-05-9	110.1	116.6	133.3	149.8	122.7	154.4	110.0	84.5	98.1	152.7	64.3	127.0	122.3	8
OL-1893	123.3	127.3	161.4	122.6	131.1	147.8	125.0	118.1	99.9	154.3	47.2	124.0	125.4	6
OL-1896	131.2	124.2	155.5	138.9	136.0	134.8	131.7	115.8	95.5	139.7	58.0	142.0	131.3	3
SKO-240	102.7	110.3	150.4	133.5	120.0	157.3	106.7	79.8	88.9	148.0	34.2	139.0	119.1	10
HFO-718	137.4	135.8	152.7	121.2	135.1	160.8	121.7	121.4	113.7	134.3	56.5	158.0	133.0	1
NDO-1501	102.8	102.1	126.5	114.3	139.0	129.1	115.0	96.3	96.5	146.3	54.9	142.0	120.5	9
HFO-529	120.9	129.8	161.1	106.9	138.8	146.0	111.7	140.6	106.3	133.3	53.4	123.0	132.0	2
Kent (NC)	104.1	109.4	132.7	124.6	129.2	145.9	105.0	101.0	91.8	139.7	43.5	117.0	118.9	11
OS-6 (NC)	112.2	124.9	143.3	134.3	138.4	164.4	138.3	121.3	102.7	148.3	61.0	118.0	126.9	5
JHO-2009-1 (ZC-CZ)	108.3	108.6	159.9	143.6	122.2	157.1	91.7							
JHO-2010-1 (ZC-SZ)								100.8	89.3	146.0	41.4	120.0		
Mean	**115.8**	**119.0**	**144.6**	**129.5**	**128.3**	**151.9**	**111.2**	**105.6**	**96.6**	**145.0**	**52.5**	**126.7**	**124.0**	

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

Entries	Palampur	Srinagar	Bikaner	Hisar	Ludhiana	Pantnagar	Jorhat	Kalyani	Ranchi	Faizabad
UPO-17-2	0.43	0.50	0.81	0.94	0.60	0.46	1.01	0.88	0.34	0.72
UPO-17-3	0.38	0.52	0.62	0.59	0.50	0.31	0.84	0.88	0.30	0.68
JHO-17-2	0.40	0.50	0.68	0.59	0.85	0.38	0.89	0.97	0.29	0.70
JHO-17-1	0.62	0.56	0.64	0.96	0.75	0.42	1.02	0.95	0.36	0.67
JO-05-9	0.53	0.53	0.71	0.54	0.70	0.41	0.98	0.89	0.30	0.71
OL-1893	0.55	0.45	0.76	0.63	0.80	0.55	0.81	0.87	0.31	0.65
OL-1896	0.57	0.47	0.70	0.64	0.92	0.29	0.68	0.97	0.35	0.68
SKO-240	0.62	0.48	0.85	0.91	0.80	0.34	0.68	0.97	0.41	0.69
HFO-718	0.47	0.49	0.53	0.44	0.82	0.38	1.34	0.98	0.32	0.72
NDO-1501	0.53	0.50	0.45	0.43	0.64	0.28	1.45	0.91	0.33	0.70
HFO-529	0.57	0.51	0.43	0.47	0.78	0.33	1.06	0.96	0.30	0.71
Kent (NC)	0.44	0.52	0.63	0.52	0.72	0.33	1.47	0.95	0.29	0.69
OS-6 (NC)	0.60	0.45	0.45	0.35	0.73	0.43	0.84	0.95	0.23	0.63
SKO-96 (ZC-HZ)	0.48	0.55								
RO-11-1 (ZC-NWZ)			0.86	0.49	0.80	0.38				
RO-11-1 (ZC-NEZ)							1.42	0.85	0.32	0.71
Mean	**0.51**	**0.50**	**0.65**	**0.61**	**0.74**	**0.38**	**1.03**	**0.93**	**0.32**	**0.69**

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

Entries	Rah-uri	Urulikan-chan	Ana-nd	Jabal-pur	Pal-ghar	Man-dya	**Bhuban-eswar	** Imp-hal	**Rai-pur	**Hydera-bad	**Coimb-atore	Aver-age	Ra-nk
UPO-17-2	0.54	0.48	1.50	0.72	0.59	0.54	1.14	0.21	0.37	0.27	0.25	0.69	1
UPO-17-3	0.56	0.42	0.92	0.71	0.82	0.62	0.87	0.22	0.33	0.23	0.34	0.60	6
JHO-17-2	0.56	0.35	0.75	0.81	0.86	0.64	0.77	0.19	0.45	0.22	0.27	0.64	4
JHO-17-1	0.61	0.38	1.08	0.79	0.85	0.44	1.24	0.23	0.35	0.62	0.28	0.69	1
JO-05-9	0.56	0.41	0.79	0.89	0.65	0.62	0.84	0.24	0.38	0.34	0.25	0.64	4
OL-1893	0.64	0.46	0.82	0.69	0.86	0.63	1.05	0.22	0.41	0.32	0.28	0.65	3
OL-1896	0.47	0.50	0.69	0.80	0.85	0.70	1.29	0.16	0.30	0.35	0.36	0.64	4
SKO-240	0.42	0.35	0.79	0.57	0.88	0.74	0.81	0.23	0.37	0.37	0.32	0.66	2
HFO-718	0.36	0.38	1.00	0.72	0.92	0.52	1.18	0.15	0.38	0.29	0.30	0.65	3
NDO-1501	0.49	0.48	1.17	0.51	0.67	0.55	0.97	0.29	0.35	0.22	0.38	0.63	5
HFO-529	0.43	0.53	1.08	0.50	0.83	0.76	1.37	0.23	0.40	0.25	0.29	0.64	4
Kent (NC)	0.36	0.54	0.75	0.64	0.60	0.66	0.94	0.31	0.30	0.62	0.20	0.63	5
OS-6 (NC)	0.36	0.48	0.69	0.74	0.86	0.52	0.73	0.21	0.33	0.20	0.26	0.58	7
RO-11-1 (ZC-NEZ)							1.41	0.16					
JHO-2009-1 (ZC-CZ)	0.58	0.55	0.79	0.85	0.81				0.43				
JHO-2010-1 (ZC-SZ)						0.64				0.26	0.29		
Mean	**0.50**	**0.45**	**0.92**	**0.71**	**0.79**	**0.61**	**1.04**	**0.22**	**0.37**	**0.33**	**0.29**	**0.64**	

Note: ** Not included in all India average due to low yield

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

Entries	NDF (%)		ADF (%)		IVDMD (%)				DDM (q/ha)	
	Ludhiana	Rank	Ludhiana	Rank	Ludhiana	Hisar	Average	Rank	Hisar	Rank
UPO-17-2	62.4	6	41.2	7	55.7	69.9	62.8	4	49.4	10
UPO-17-3	61.4	5	42.4	10	54.5	67.7	61.1	9	41.5	12
JHO-17-2	67.4	13	43.2	12	53.9	66.6	60.3	11	42.1	11
JHO-17-1	62.6	7	42.4	10	55.4	68.8	62.1	6	33.4	13
JO-05-9	66.3	12	42.6	11	56.2	66.9	61.6	7	61.1	1
OL-1893	63.9	9	41.7	8	54.9	64.8	59.9	12	52.1	8
OL-1896	59.6	1	38.4	1	60.8	65.5	63.2	2	54.4	5
SKO-240	60.2	2	38.8	2	59.4	67.4	63.4	1	32.4	14
HFO-718	62.4	6	40.2	5	56.4	66.4	61.4	8	51.2	9
NDO-1501	60.6	3	39.6	4	58.3	63.5	60.9	10	52.2	7
HFO-529	63.4	8	42.3	9	55.2	63.6	59.4	14	59.8	2
Kent (NC)	64.6	10	43.4	13	53.2	65.9	59.6	13	52.4	6
OS-6 (NC)	61.3	4	39.4	3	57.3	68.4	62.9	3	56.5	3
RO-11-1 (ZC-NWZ)	65.3	11	40.3	6	56.2	68.5	62.4	5	55.2	4
Mean	**63.0**		**41.1**		**56.2**	**66.7**	**61.5**		**49.5**	

6. AVTO (SC)-1: FIRST ADVANCED VARIETAL TRIAL IN OAT (SINGLE CUT)

(Reference tables 6.1 to 6.9)

In Oat (single cut), eight entries promoted from IVT were evaluated against two national checks (Kent and OS-6) and four zonal checks in respective zones [(SKO-90 (HZ), OL-125 (NWZ), JHO-99-2 (NEZ), JHO 822 (CZ) and JHO 2000-4 (SZ)] at 27 locations in five different zones of the country.

For green forage yield (q/ha), entries SKO-229 (5.4%) in HZ; HFO-607 (10.1%) in NW zone, HFO-525 (8.9%), HFO-607 (8.1%) in NE zone; entries HFO-607 (10.8%), OL-1861 (10%), OL-1869-1 (9.2%), JO-05-7 (8.8%) in central zone and entry OL-1861 (17.8%) in south zone exhibited superiority over the best check. At national level, OL-1861 and HFO-607 registered 8.6% and 7.7% superiority respectively for GFY (Q/ha). Other entries were either inferior or marginally superior over the best check in zonal and national level.

Similarly for dry matter yield (q/ha), entries SKO-229 (6.9%) in HZ; HFO-607 (12.8%), HFO-525 (7.7%) in NW zone, entries JO-05-7 (19.2%), HFO-607 (17.3%), HFO-525 (12.8%) in NE zone; entries HFO-607 (11.3%), OL-1861 (10.7%), OL-1862 (5.9%), OL-1869-1 (5.8%), JO-05-7 (4.7%) in central zone; and entry OL-1861 (8.9%) in south zone exhibited superiority over the best check. At national level, HFO-607 and OL-1861 registered 9.4% and 8.1% superiority respectively for DMY (Q/ha). Other entries were either inferior or marginally superior over the best check in zonal and national level.

In green forage production potential (q/ha/day), entry OL-1861 followed by OL-1869-1 performed best, whereas for dry matter production potential (q/ha/day), HFO-525 was the best. For plant height (cm), entry HFO-607 (130.7 cm) ranked first, whereas for the character leafiness, SKO-229 was adjudged best performers.

For quality parameters, for crude protein yield, OL-1861 ranked first followed by HFO-607. For crude protein content, entry OL-1861 followed by check OS-6 were best performers. For other quality parameters, SKO-229 ranked first for ADF%, NDF%. Kent ranked first for IVDMD%, whereas entry HFO-607 was best for DDM.

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	Superi-ority%	Bika-ner	His-ar	Ludh-iana	Pant-nagar	Udai-pur	Aver-age	Ra-nk	Superi-ority%
JO-05-7	172.6	381.0	202.5	252.0	3	1.1	325.5	368.9	639.4	620.8	691.6	529.2	7	
OL-1869-1	144.0	398.9	186.7	243.2	9		328.8	400.3	726.1	668.8	745.8	574.0	5	
SKO-229	148.0	430.6	209.2	262.6	1	5.4	231.9	306.7	693.3	570.8	666.6	493.9	11	
HFO-607	138.4	414.3	198.3	250.3	5	0.4	308.2	423.1	756.4	751.3	741.6	596.1	1	10.1
OL-1862	141.6	405.2	185.8	244.2	8		431.4	285.0	654.4	583.2	672.2	525.2	8	
UPO-16-4	153.6	401.0	195.8	250.1	6	0.8	315.1	319.2	685.0	606.7	656.9	516.6	9	
HFO-525	131.2	409.0	212.8	251.0	4	0.7	488.3	380.6	690.8	588.3	734.7	576.5	4	
OL-1861	144.0	416.6	207.8	256.1	2	2.8	355.5	352.5	782.8	696.3	719.4	581.3	3	
Kent (NC)	168.0	375.5	204.2	249.2	7		336.8	386.1	686.1	566.7	730.5	541.2	6	
OS-6 (NC)	132.0	376.8	194.2	234.3	11		303.7	321.7	629.4	593.9	730.5	515.8	10	
SKO-90 (ZC-HZ)	124.8	405.3	189.4	239.8	10									
OL-125 (ZC-NWZ)							417.5	383.1	734.7	571.7	808.3	583.1	2	
Mean	**145.3**	**401.3**	**198.8**	**248.5**			**349.3**	**357.0**	**698.0**	**619.9**	**718.0**	**548.4**		
CD at 5%	26.7	32.8	2.1				88.0	52.1	62.8	124.6	81.6			
CV%	10.8	10.6	5.1				14.8	8.6	6.1	11.6	7.1			

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	Faiza-bad	Imp-hal	Aver-age	Ra-nk	Superi-ority%
JO-05-7	290.8	371.9	369.7	501.7	322.0	453.3	411.6	388.7	3	0.07
OL-1869-1	289.4	426.7	245.0	450.3	355.0	369.5	393.6	361.4	9	
SKO-229	317.5	382.5	310.5	396.7	322.0	360.0	269.9	337.0	11	
HFO-607	342.4	401.1	214.5	464.7	377.0	497.1	454.8	393.1	2	8.1
OL-1862	280.7	390.8	264.5	577.3	344.0	394.3	369.1	374.4	7	
UPO-16-4	315.4	385.2	383.2	459.0	344.0	405.7	389.7	383.2	5	
HFO-525	370.2	397.5	402.0	495.3	299.0	400.0	407.9	396.0	1	8.9
OL-1861	333.1	422.7	354.0	499.3	311.0	318.1	435.1	381.9	6	
Kent (NC)	254.0	383.3	289.0	519.3	388.0	356.1	356.4	363.7	8	
OS-6 (NC)	309.9	373.1	211.0	477.0	311.0	415.2	332.6	347.1	10	
JHO-99-2 (ZC-NEZ)	360.9	409.4	332.0	489.3	322.0	358.1	417.6	384.2	4	
Mean	**314.9**	**394.9**	**306.9**	**484.5**	**335.9**	**393.4**	**385.3**	**373.7**		
CD at 5%	3.2	15.7	3.3	49.8	34.4	84.8	16.9			
CV%	3.2	3.6	6.3	5.8	10.8	12.7	3.6			

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

Entries	Central Zone									
	Jha-nsi	Rah-uri	Urulikan-chan	Ana-nd	Jabal-pur	Rai-pur	Pal-ghar	Aver-age	Ra-nk	Superi-ority%
JO-05-7	745.4	442.1	561.2	519.0	656.0	317.2	251.7	498.9	4	8.8
OL-1869-1	819.5	413.7	564.6	533.0	454.0	333.8	386.1	500.7	3	9.2
SKO-229	796.4	345.0	598.2	419.0	532.0	328.2	234.0	464.7	7	1.3
HFO-607	796.4	549.7	563.9	484.0	561.0	278.8	324.5	508.3	1	10.8
OL-1862	754.7	452.2	553.6	476.0	435.0	342.1	313.0	475.2	5	3.6
UPO-16-4	824.1	404.1	512.8	442.0	432.0	236.4	410.5	466.0	6	1.6
HFO-525	787.1	426.9	494.2	408.0	350.0	297.1	320.9	440.6	9	
OL-1861	777.8	508.7	554.0	505.0	629.0	364.6	193.8	504.7	2	10.0
Kent (NC)	699.1	399.9	526.5	499.0	486.0	356.5	243.5	458.7	8	
OS-6 (NC)	708.4	359.9	606.6	374.0	323.0	246.9	349.1	424.0	11	
JHO-822 (ZC-CZ)	717.7	428.5	435.9	497.0	402.0	269.6	259.0	429.9	10	
Mean	**766.1**	**430.1**	**542.9**	**468.7**	**478.2**	**306.5**	**298.7**	**470.2**		
CD at 5%	20.3	34.1	51.2	59.1	99.7	69.1	64.5			
CV%	12.2	4.7	5.5	7.4	12.3	13.2	12.6			

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		
	Hydera-bad	Tiru-pati	Man-dya	Coimb-atore	Mattu-petty	Aver-age	Ra-nk	Superi-ority%	Aver-age	Ra-nk	Superi-ority%
JO-05-7	305.4	128.6	317.5	328.6	316.0	279.2	5		407.9	3	3.7
OL-1869-1	313.8	150.3	265.3	410.8	226.0	273.2	6		407.4	4	3.5
SKO-229	83.3	121.6	182.0	410.3	277.0	214.8	11		368.3	10	
HFO-607	308.2	143.6	321.4	326.1	300.0	279.9	4		423.7	2	7.7
OL-1862	349.9	118.7	300.0	323.6	338.0	286.0	2	1.2	397.6	6	1.0
UPO-16-4	377.6	90.7	305.8	305.6	194.0	254.7	10		390.8	8	
HFO-525	316.5	130.3	311.3	340.6	182.0	256.1	9		399.0	5	1.4
OL-1861	410.9	121.5	348.2	382.8	402.0	333.1	1	17.8	427.6	1	8.6
Kent (NC)	330.4	156.8	285.7	380.6	260.0	282.7	3		393.5	7	
OS-6 (NC)	330.4	113.9	347.2	366.1	147.0	260.9	7		369.8	9	
JHO-2000-4 (ZC-SZ)	352.6	82.7	276.9	326.4	243.0	256.3	8				
Mean	**316.3**	**123.5**	**296.5**	**354.7**	**262.3**	**270.6**			**398.6**		
CD at 5%	25.3	23.3	49.2	1.7	14.4						
CV%	4.7	9.2	9.7	4.8	3.3						

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						
	Palam-pur	Sri-nagar	Rajo-uri	Aver-age	Ra-nk	Superi-ority%	Bika-ner	His-ar	Ludh-iana	Pant-nagar	Aver-age	Ra-nk	Superi-ority%
JO-05-7	32.6	78.9	54.7	55.4	5	1.1	57.1	80.9	139.4	105.5	95.7	8	
OL-1869-1	27.8	82.6	48.6	53.0	9		57.8	89.3	164.8	100.3	103.1	5	
SKO-229	27.1	90.1	58.6	58.6	1	6.9	44.3	66.5	144.9	105.6	90.3	11	
HFO-607	23.3	85.8	53.9	54.3	7		57.6	102.0	167.9	144.7	118.1	1	12.8
OL-1862	25.6	83.9	51.1	53.5	8		75.4	62.0	146.6	91.4	93.9	10	
UPO-16-4	30.3	84.0	53.3	55.9	4	2.0	59.0	71.1	156.2	99.1	96.3	7	
HFO-525	24.0	84.7	59.4	56.0	3	2.2	100.7	86.6	152.0	111.8	112.8	2	7.7
OL-1861	27.2	86.2	55.8	56.4	2	2.9	54.3	77.9	170.6	125.3	107.0	3	2.2
Kent (NC)	31.3	75.7	57.5	54.8	6		65.2	84.1	153.7	115.9	104.7	4	
OS-6 (NC)	22.7	78.0	51.4	50.7	11		68.0	66.4	137.2	106.9	94.6	9	
SKO-90 (ZC-HZ)	23.1	82.6	46.7	50.8	10								
OL-125 (ZC-NWZ)							60.9	82.0	156.5	104.8	101.1	6	
Mean	**26.8**	**83.0**	**53.7**	**54.5**			**63.7**	**79.0**	**153.6**	**110.1**	**101.6**		
CD at 5%	NS	6.5	0.6				19.3	17.1	24.2	24.6			
CV%	15.1	9.6	5.0				17.8	12.7	6.5	13.2			

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	Faizabad	Imphal	Average	Rank	Superiority%
JO-05-7	53.0	53.7	83.2	113.7	64.5	114.2	131.6	87.7	1	19.2
OL-1869-1	54.9	64.5	53.6	90.8	71.0	83.8	117.7	76.6	8	
SKO-229	60.5	54.2	66.6	93.2	64.3	83.8	84.4	72.4	11	
HFO-607	61.0	59.5	47.5	88.3	75.2	126.6	146.1	86.3	2	17.3
OL-1862	55.9	56.7	59.0	99.1	68.9	94.1	115.4	78.4	7	
UPO-16-4	60.2	54.8	79.2	90.3	68.7	90.9	112.9	79.6	6	
HFO-525	70.3	57.2	85.6	107.3	59.8	83.8	116.8	83.0	3	12.8
OL-1861	65.9	65.7	76.5	100.7	62.3	73.7	122.0	81.0	5	
Kent (NC)	50.9	57.6	62.2	90.0	77.5	85.8	89.5	73.4	10	
OS-6 (NC)	57.7	54.8	43.0	102.6	62.1	103.8	91.3	73.6	9	
JHO-99-2 (ZC-NEZ)	68.5	60.8	71.9	102.8	64.4	81.6	120.3	81.5	4	
Mean	**59.9**	**58.1**	**66.2**	**98.1**	**67.2**	**92.9**	**113.5**	**79.4**		
CD at 5%	3.6	3.3	0.7	12.1	5.7	20.3	12.8			
CV%	8.3	6.2	6.1	6.9	8.4	12.8	9.4			

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	Anand	Jabalpur	Raipur	**Palghar	Average	Rank	Superiority%
JO-05-7	197.1	89.4	117.1	77.2	152.2	75.5	35.8	118.1	5	4.7
OL-1869-1	260.9	80.2	117.5	80.6	101.7	75.2	61.5	119.3	4	5.8
SKO-229	199.0	72.4	135.4	60.6	119.1	78.8	33.3	110.9	7	
HFO-607	228.7	130.6	125.6	80.8	129.4	58.6	51.2	125.6	1	11.3
OL-1862	263.4	85.3	121.2	64.4	96.5	85.9	48.5	119.5	3	5.9
UPO-16-4	225.0	89.7	100.0	74.2	95.8	48.3	64.9	105.5	9	
HFO-525	254.4	98.5	104.0	59.7	75.9	65.2	51.6	109.6	8	
OL-1861	218.9	118.5	113.7	85.3	145.7	67.5	27.0	124.9	2	10.7
Kent (NC)	207.2	86.5	113.3	71.1	110.1	88.8	35.5	112.8	6	
OS-6 (NC)	205.5	81.6	131.8	58.1	68.5	65.4	55.5	101.8	11	
JHO-822 (ZC-CZ)	202.6	100.3	87.9	70.3	89.0	63.1	39.6	102.2	10	
Mean	**223.9**	**93.9**	**115.2**	**71.1**	**107.6**	**70.2**	**45.8**	**113.7**		
CD at 5%	11.6	7.5	11.1	9.0	22.1	13.2	10.4			
CV%	7.0	4.7	5.6	7.4	12.0	11.0	13.2			

Note: ** Not Included in zonal and all India average due to low yield of data

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	Tirupati	Mandya	Coimbatore	Mattupetty	Average	Rank	Superiority%	Average	Rank	Superiority%
JO-05-7	68.2	49.6	71.1	71.4	59.9	64.0	7		87.7	3	3.1
OL-1869-1	70.0	57.0	57.8	87.0	56.4	65.6	5		86.1	6	1.2
SKO-229	13.9	46.9	41.5	88.8	69.3	52.1	10		78.8	10	
HFO-607	57.7	54.4	64.3	80.9	76.9	66.8	3		93.1	1	9.4
OL-1862	74.7	43.8	71.7	78.2	85.5	70.8	2		86.2	5	1.3
UPO-16-4	74.1	35.5	71.7	76.2	48.5	61.2	8		82.0	8	
HFO-525	75.7	49.4	73.8	84.6	46.8	66.0	4		87.5	4	2.8
OL-1861	76.6	47.5	82.5	77.2	101.8	77.1	1	8.9	92.0	2	8.1
Kent (NC)	77.5	58.3	62.1	90.4	65.8	70.8	2		85.1	7	
OS-6 (NC)	76.4	42.5	81.4	89.7	35.6	65.1	6		79.3	9	
JHO-2000-4 (ZC-SZ)	73.1	29.0	47.2	78.8	61.7	57.9	9				
Mean	**67.1**	**46.7**	**65.9**	**82.1**	**64.4**	**65.2**			**85.8**		
CD at 5%	19.3	8.9	9.9	0.9	3.6						
CV%	16.7	8.8	8.8	2.7	3.3						

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

Entries	Palam-pur	Sri-nagar	Rajo-uri	Bika-ner	His-ar	Ludh-iana	Pant-nagar	Jor-hat	Kal-yani	Bhuban-eswar	Ran-chi	Pu-sa	Faiza-bad
JO-05-7	1.47	2.61	1.35	3.10	3.29	5.56	6.14	3.20	4.83	5.36	5.32	3.46	3.94
OL-1869-1	1.21	2.70	1.24	3.13	3.54	6.31	6.55	3.18	5.54	3.31	4.95	3.82	3.21
SKO-229	1.19	2.91	1.39	1.84	2.56	6.03	4.67	3.71	4.97	4.09	3.66	3.43	3.13
HFO-607	1.17	2.81	1.32	2.94	3.65	6.58	6.76	3.76	5.21	3.02	5.03	3.68	4.32
OL-1862	1.25	2.74	1.24	4.11	2.50	5.69	5.71	3.28	5.07	3.62	6.74	3.62	3.43
UPO-16-4	1.44	2.72	1.31	3.00	2.82	5.96	5.94	3.67	5.01	5.11	5.53	3.62	3.52
HFO-525	1.22	2.84	1.42	4.65	3.46	6.01	5.94	4.36	5.16	5.91	6.07	3.18	3.48
OL-1861	1.23	2.82	1.39	3.39	3.15	6.81	6.82	3.66	5.48	5.06	5.39	3.34	2.76
Kent (NC)	1.54	2.58	1.36	3.21	3.48	5.97	6.09	2.79	4.98	3.91	6.16	4.08	3.09
OS-6 (NC)	1.23	2.55	1.29	2.89	2.92	5.47	6.38	3.60	4.85	2.89	5.94	3.34	3.61
SKO-90 (ZC-HZ)	1.00	2.75	1.26										
OL-125 (ZC-NWZ)				3.98	3.48	6.39	5.60						
JHO-99-2 (ZC-NEZ)								4.20	5.31	4.61	5.69	3.46	3.11
Mean	**1.27**	**2.73**	**1.32**	**3.29**	**3.17**	**6.07**	**6.05**	**3.58**	**5.13**	**4.26**	**5.50**	**3.55**	**3.42**

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

Entries	Jhansi	Rahuri	Urulikanchan	Anand	Palghar	Raipur	Hyderabad	Mandya	Coimbatore	Mattupetty	Average	Rank
JO-05-7	7.45	5.10	6.76	5.70	4.00	3.96	3.76	4.62	4.38	2.64	4.26	7
OL-1869-1	8.91	5.42	6.89	6.83	5.85	4.17	4.06	3.66	5.48	2.51	4.46	2
SKO-229	8.21	2.88	5.92	5.05	3.71	4.21	0.92	2.59	5.00	3.08	3.70	9
HFO-607	8.30	5.91	6.63	5.15	5.15	3.48	3.76	4.00	3.84	3.33	4.34	4
OL-1862	6.92	5.36	6.67	6.35	4.89	4.12	4.47	3.82	4.26	3.75	4.33	5
UPO-16-4	8.58	4.72	6.11	5.33	6.52	2.85	4.85	4.23	4.19	2.16	4.31	6
HFO-525	8.37	5.14	5.49	5.10	4.94	3.81	4.13	3.93	4.73	2.02	4.41	3
OL-1861	8.10	5.65	6.37	5.43	3.08	4.56	4.99	4.73	5.04	4.46	4.51	1
Kent (NC)	7.13	4.96	6.42	5.87	3.93	4.69	4.41	4.12	5.44	2.88	4.31	6
OS-6 (NC)	5.90	4.71	7.40	4.68	5.29	3.16	4.41	4.61	4.69	1.64	4.06	8
JHO-822 (ZC-CZ)	7.63	5.16	4.79	6.21	4.18	3.37						
JHO-2000-4 (ZC-SZ)							4.75	4.22	4.35	2.70		
	7.77	**5.00**	**6.31**	**5.61**	**4.69**	**3.85**	**4.05**	**4.05**	**4.67**	**2.83**	**4.27**	

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

Entries	Srinagar	Rajouri	Bikaner	Hisar	Ludhiana	Pantnagar	Jorhat	Kalyani	Bhubaneswar	Ranchi	Pusa	Faizabad
JO-05-7	0.57	0.36	0.54	0.72	1.21	1.04	0.58	0.69	1.21	1.21	0.69	0.99
OL-1869-1	0.56	0.32	0.55	0.79	1.43	0.98	0.60	0.84	0.72	1.00	0.76	0.73
SKO-229	0.62	0.39	0.35	0.55	1.26	0.86	0.71	0.70	0.88	0.86	0.68	0.73
HFO-607	0.59	0.36	0.55	0.88	1.46	1.30	0.67	0.77	0.67	0.96	0.79	1.10
OL-1862	0.54	0.34	0.72	0.54	1.27	0.89	0.65	0.74	0.81	1.16	0.73	0.82
UPO-16-4	0.56	0.36	0.56	0.63	1.36	0.97	0.70	0.71	1.06	1.09	0.72	0.79
HFO-525	0.59	0.40	0.96	0.79	1.32	1.12	0.83	0.74	1.26	1.31	0.64	0.73
OL-1861	0.59	0.37	0.52	0.70	1.48	1.22	0.72	0.85	1.09	1.09	0.67	0.64
Kent (NC)	0.53	0.38	0.62	0.76	1.34	1.23	0.56	0.75	0.84	1.07	0.82	0.75
OS-6 (NC)	0.52	0.34	0.65	0.60	1.19	1.14	0.67	0.71	0.59	1.28	0.67	0.90
SKO-90 (ZC-HZ)	0.54	0.31										
OL-125 (ZC-NWZ)			0.58	0.75	1.36	1.02						
JHO-99-2 (ZC-NEZ)							0.80	0.78	1.00	1.19	0.69	0.71
Mean	**0.56**	**0.36**	**0.60**	**0.70**	**1.33**	**1.07**	**0.68**	**0.75**	**0.92**	**1.11**	**0.71**	**0.81**

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

Entries	Jhansi	Rahuri	Urulikanchan	Anand	Palghar	Raipur	Hyderabad	Coimbatore	Average	Rank
JO-05-7	1.97	1.03	1.41	0.85	0.57	1.11	0.84	0.95	0.93	6
OL-1869-1	2.84	1.05	1.43	1.03	0.93	0.94	0.91	1.16	0.98	2
SKO-229	2.05	0.60	1.34	0.73	0.53	1.16	0.15	1.08	0.81	8
HFO-607	2.38	1.40	1.48	0.86	0.81	0.73	0.70	0.95	0.97	3
OL-1862	2.42	1.01	1.46	0.86	0.76	1.26	0.95	1.03	0.95	4
UPO-16-4	2.34	1.05	1.19	0.89	1.03	0.79	0.95	1.04	0.94	5
HFO-525	2.71	1.19	1.16	0.75	0.79	1.07	0.99	1.17	1.03	1
OL-1861	2.28	1.32	1.31	0.92	0.43	0.84	0.93	1.02	0.95	4
Kent (NC)	2.11	1.07	1.38	0.84	0.57	1.11	1.03	1.29	0.95	4
OS-6 (NC)	1.71	1.07	1.61	0.73	0.84	1.07	1.02	1.15	0.92	7
JHO-822 (ZC-CZ)	2.16	1.21	0.97	0.88	0.64	0.79				
JHO-2000-4 (ZC-SZ)							0.99	1.05		
Mean	**2.27**	**1.09**	**1.34**	**0.85**	**0.72**	**0.99**	**0.86**	**1.08**	**0.94**	

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

Entries	Palampur	Hisar	Ludhiana	Bikaner	Pantnagar	Jorhat	Kalyani	Bhubaneswar	Faizabad	Imphal	Ranchi
JO-05-7	3.1	8.4	9.5	4.6	8.3	5.8	5.0	6.8	9.4	8.3	8.0
OL-1869-1	2.4	10.2	12.7	4.8	7.0	5.9	5.5	4.5	6.5	8.4	6.5
SKO-229	2.9	7.5	11.6	4.0	9.3	6.4	5.3	5.7	6.5	5.4	5.1
HFO-607	2.2	10.8	12.9	3.9	12.7	6.0	4.7	3.9	10.5	7.9	6.0
OL-1862	2.3	7.1	11.3	4.2	9.6	5.8	5.4	4.4	7.5	8.5	6.2
UPO-16-4	2.7	6.7	10.9	5.0	9.5	6.0	5.2	7.0	7.2	6.9	7.0
HFO-525	2.5	10.6	10.3	10.3	8.8	7.1	4.3	7.4	6.4	7.2	7.5
OL-1861	2.5	7.4	10.2	6.6	12.0	6.7	5.7	6.5	5.7	7.9	6.3
Kent (NC)	3.1	9.1	11.5	3.6	9.2	5.2	5.4	5.3	6.8	5.5	7.1
OS-6 (NC)	1.8	6.2	9.7	5.2	10.3	5.9	5.3	4.0	8.4	6.6	7.2
SKO-90 (ZC-HZ)	2.2										
OL-125 (ZC-NWZ)		8.1	10.0	6.2	10.1						
JHO-99-2 (ZC-NEZ)						6.8	5.9	6.1	6.0	7.9	7.0
Mean	**2.5**	**8.4**	**11.0**	**5.3**	**9.7**	**6.2**	**5.3**	**5.6**	**7.3**	**7.3**	**6.7**

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

Entries	Rahuri	Urulikanchan	Anand	Jabalpur	Raipur	Mandya	Coimbatore	Hyderabad	Average	Rank
JO-05-7	6.1	9.5	7.5	12.6	6.2	3.6	6.3	4.8	7.0	3
OL-1869-1	4.9	10.8	7.2	8.2	6.6	2.5	10.3	4.6	6.8	5
SKO-229	4.9	13.6	5.8	9.7	6.1	2.2	9.0	0.7	6.4	8
HFO-607	7.1	11.7	6.4	10.6	3.9	3.1	9.5	4.5	7.3	2
OL-1862	5.6	11.4	5.8	7.8	5.2	4.1	8.9	4.9	6.6	6
UPO-16-4	6.7	9.1	7.2	7.8	3.4	4.0	7.0	4.9	6.5	7
HFO-525	6.1	8.3	5.8	6.0	5.2	3.9	6.7	5.7	6.9	4
OL-1861	7.2	10.7	8.3	12.0	5.5	4.4	11.1	5.6	7.5	1
Kent (NC)	5.4	9.9	7.2	9.0	6.7	3.5	11.8	3.4	6.8	5
OS-6 (NC)	5.0	11.5	6.9	5.2	5.8	4.0	13.7	6.1	6.8	5
JHO-822 (ZC-CZ)	6.6	8.2	6.4	7.1	4.3					
JHO-2000-4 (ZC-SZ)						2.6	8.3	3.5		
Mean	**6.0**	**10.4**	**6.8**	**8.7**	**5.4**	**3.4**	**9.3**	**4.4**	**6.9**	

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

Entries	Palampur	Bikaner	Hisar	Ludhiana	Pantnagar	Jorhat	Kalyani	Bhubaneswar	Ranchi	Faizabad	Imphal
JO-05-7	9.3	8.1	10.4	6.8	7.9	11.2	9.2	8.1	7.0	8.2	6.3
OL-1869-1	8.5	8.3	11.5	7.7	7.0	10.9	8.6	8.4	7.2	7.8	7.1
SKO-229	10.5	9.0	10.7	8.0	8.8	10.6	9.8	8.5	5.5	7.7	6.4
HFO-607	9.6	6.7	10.1	7.7	8.8	9.9	7.9	8.2	6.8	8.3	5.4
OL-1862	9.0	5.6	11.7	7.7	10.5	10.5	9.6	7.5	6.3	8.0	7.3
UPO-16-4	8.8	8.4	10.2	7.0	9.6	10.1	9.4	8.8	7.7	7.9	6.1
HFO-525	10.5	10.2	12.2	6.8	7.9	10.3	7.6	8.6	7.0	7.6	6.2
OL-1861	9.3	12.2	10.6	6.0	9.6	10.2	8.7	8.5	6.3	7.7	6.5
Kent (NC)	9.9	5.5	11.5	7.5	7.9	10.3	9.4	8.5	7.9	7.9	6.2
OS-6 (NC)	7.9	7.6	10.1	7.1	9.6	10.3	9.7	9.2	7.0	8.1	7.2
SKO-90 (ZC-HZ)	9.6										
OL-125 (ZC-NWZ)		10.1	10.6	6.4	9.6						
JHO-99-2 (ZC-NEZ)						10.1	9.7	8.4	6.8	7.4	6.6
Mean	**9.4**	**8.3**	**10.9**	**7.2**	**8.8**	**10.4**	**9.1**	**8.4**	**6.9**	**7.9**	**6.5**

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

Entries	Rahuri	Urulikanchan	Anand	Jabalpur	Raipur	Mandya	Hyderabad	Coimbatore	Muttupetty	Average	Rank
JO-05-7	6.8	8.1	9.5	8.3	8.2	5.1	7.0	8.8	10.9	8.3	3
OL-1869-1	6.1	9.2	8.9	8.2	8.8	4.2	6.6	11.8	7.4	8.2	4
SKO-229	6.7	10.0	9.7	8.2	7.7	5.2	5.3	10.1	5.7	8.2	4
HFO-607	5.5	9.3	7.8	8.3	6.7	4.8	7.9	11.7	7.0	7.9	5
OL-1862	6.6	9.4	9.1	8.1	6.1	5.7	6.6	11.4	7.0	8.2	4
UPO-16-4	7.4	9.1	9.5	8.1	7.0	5.5	6.6	9.2	8.7	8.3	3
HFO-525	6.2	8.0	9.9	8.0	8.1	5.3	7.4	7.9	8.3	8.2	4
OL-1861	6.1	9.4	9.6	8.3	8.2	5.4	7.4	14.4	7.4	8.6	1
Kent (NC)	6.3	8.7	10.4	8.2	7.5	5.7	4.4	13.1	7.0	8.2	4
OS-6 (NC)	6.1	8.7	11.6	7.7	8.8	4.9	7.9	15.3	5.3	8.5	2
JHO-822 (ZC-CZ)	6.6	9.3	9.0	8.1	6.9						
JHO-2000-4 (ZC-SZ)						5.6	4.8	10.5	6.6		
Mean	**6.4**	**9.0**	**9.5**	**8.1**	**7.6**	**5.2**	**6.5**	**11.3**	**7.4**	**8.3**	

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

Entries	Palam-pur	Sri-nagar	Rajo-uri	Bika-ner	His-ar	Ludh-iana	Pant-nagar	Udai-pur	Jor-hat	Kal-yani	Bhuban-eswar	Ran-chi	Faiza-bad	Imp-hal
JO-05-7	99.3	102.6	121.7	95.0	127.9	117.6	148.5	161.8	118.1	141.2	154.7	134.9	87.2	133.9
OL-1869-1	86.3	110.8	142.3	105.0	117.9	130.2	153.7	160.2	120.8	177.7	127.5	134.7	90.4	140.4
SKO-229	84.3	117.9	116.3	90.0	112.2	112.8	111.8	168.0	116.3	139.7	142.6	121.3	88.6	85.8
HFO-607	88.7	124.7	94.3	101.0	120.1	128.5	194.3	166.9	141.3	163.1	125.4	134.8	122.5	165.3
OL-1862	98.0	113.2	123.3	110.0	121.2	111.8	151.4	167.3	121.2	169.9	129.7	122.5	106.0	142.3
UPO-16-4	90.3	105.8	130.7	93.0	113.0	130.7	185.5	160.1	123.9	167.6	161.3	119.7	115.2	134.4
HFO-525	103.3	104.1	123.0	97.0	136.9	126.5	185.8	169.4	121.3	168.3	163.9	144.8	117.4	142.7
OL-1861	96.0	114.2	129.3	86.0	120.6	133.4	178.5	170.9	124.6	190.1	151.2	138.3	116.5	152.2
Kent (NC)	101.0	106.4	149.3	120.0	125.9	122.8	151.4	149.4	118.4	161.1	135.2	140.6	82.5	143.4
OS-6 (NC)	110.0	111.2	120.7	140.0	122.9	113.4	162.7	166.0	125.0	168.1	122.6	136.3	112.0	137.3
SKO-90 (ZC-HZ)	55.3	110.5	124.0											
OL-125 (ZC-NWZ)				105.0	141.1	130.6	171.3	171.3						
JHO-99-2 (ZC-NEZ)									134.3	166.4	146.5	140.4	118.2	137.9
Mean	**92.0**	**111.0**	**125.0**	**103.8**	**123.6**	**123.5**	**163.2**	**164.7**	**124.1**	**164.8**	**141.9**	**133.5**	**105.1**	**137.8**

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	Ana-nd	Jabal-pur	Rai-pur	Pal-ghar	Hydera-bad	Tiru-pati	Man-dya	Coimb-atore	Mattu-petty	Aver-age	Ra-nk
JO-05-7	160.8	109.7	111.2	135.7	147.9	126.4	103.3	72.0	33.0	81.6	135.0	153.0	119.8	9
OL-1869-1	181.7	117.4	115.7	130.8	119.3	133.6	101.7	74.3	59.2	80.8	156.7	153.0	123.9	5
SKO-229	155.0	117.5	97.6	128.9	125.4	131.2	98.3	65.8	38.1	78.6	117.3	143.0	111.7	10
HFO-607	172.7	129.4	128.8	143.2	130.1	136.3	140.0	99.8	59.1	95.3	105.0	187.0	130.7	1
OL-1862	173.4	110.4	117.3	139.7	115.7	128.8	126.7	71.5	46.7	86.0	134.0	160.0	123.0	7
UPO-16-4	173.3	109.0	114.7	138.7	112.3	120.3	146.7	78.5	42.9	84.2	118.3	145.0	123.7	6
HFO-525	175.6	127.1	112.9	127.3	109.0	143.6	140.0	85.2	59.9	92.5	111.7	163.0	128.9	3
OL-1861	181.4	124.3	108.6	138.3	138.0	133.6	92.3	89.4	59.3	108.3	134.7	183.0	130.5	2
Kent (NC)	169.0	109.1	105.9	132.7	121.9	142.1	116.7	68.9	56.7	82.3	117.0	160.0	122.7	8
OS-6 (NC)	173.2	113.9	103.9	130.2	94.7	148.9	125.0	81.4	57.7	80.3	152.0	163.0	125.9	4
JHO-822 (ZC-CZ)	170.9	115.3	112.0	128.6	113.5	128.8	112.3							
JHO-2000-4 (ZC-SZ)								73.5	37.9	94.9	132.3	157.0		
Mean	**171.5**	**116.6**	**111.7**	**134.0**	**120.7**	**134.0**	**118.5**	**78.2**	**50.0**	**87.7**	**128.5**	**160.6**	**124.1**	

Table 6.7 AVT Oat (SC-1): First Advanced Varietal Trial in Oat (Single Cut): Leaf Stem Ratio

Entries	Palampur	Srinagar	Bikaner	Hisar	Ludhiana	Pantnagar	Kalyani	Bhubaneswar	Ranchi	Faizabad	Imphal	Jorhat
JO-05-7	0.43	0.56	0.76	0.60	0.63	0.44	0.91	1.28	0.48	0.74	0.17	0.73
OL-1869-1	0.44	0.49	0.80	0.56	0.85	0.37	0.87	0.92	0.55	0.69	0.14	0.65
SKO-229	0.61	0.56	0.77	0.96	0.70	0.41	0.99	1.09	0.41	0.70	0.53	0.75
HFO-607	0.55	0.54	0.54	0.64	0.83	0.33	1.00	0.85	0.46	0.75	0.14	0.66
OL-1862	0.51	0.48	0.48	0.76	0.55	0.52	0.88	0.97	0.45	0.71	0.16	0.69
UPO-16-4	0.37	0.52	0.64	0.47	0.83	0.36	1.00	1.35	0.39	0.68	0.21	1.47
HFO-525	0.52	0.56	0.67	0.46	0.80	0.37	0.95	1.42	0.34	0.67	0.29	0.85
OL-1861	0.51	0.49	0.59	0.61	0.80	0.42	1.01	1.24	0.34	0.70	0.19	1.16
Kent (NC)	0.59	0.50	0.49	0.61	0.67	0.31	0.87	1.05	0.49	0.68	0.25	0.87
OS-6 (NC)	0.68	0.50	0.39	0.38	0.53	0.34	0.97	0.82	0.40	0.72	0.14	0.84
SKO-90 (ZC-HZ)	0.55	0.53										
OL-125 (ZC-NWZ)			0.44	0.50	0.85	0.32						
JHO-99-2 (ZC-NEZ)							0.88	1.21	0.33	0.79	0.17	0.77
Mean	**0.52**	**0.52**	**0.60**	**0.60**	**0.73**	**0.38**	**0.94**	**1.11**	**0.42**	**0.71**	**0.22**	**0.86**

Table 6.7 AVT Oat (SC-1): First Advanced Varietal Trial in Oat (Single Cut): Leaf Stem Ratio

Entries	Rahuri	Urulikanchan	Anand	Jabalpur	Raipur	Palghar	Hyderabad	Mandya	Coimbatore	Average	Rank
JO-05-7	0.40	0.44	1.44	0.81	0.39	0.72	0.55	0.42	0.38	0.63	2
OL-1869-1	0.58	0.37	1.04	0.71	0.33	0.73	0.45	0.26	0.33	0.58	5
SKO-229	0.69	0.32	0.75	0.76	0.34	0.64	0.70	0.64	0.44	0.66	1
HFO-607	0.50	0.50	0.72	0.79	0.38	0.76	0.36	0.29	0.40	0.57	6
OL-1862	0.43	0.51	1.17	0.65	0.33	0.75	0.46	0.59	0.36	0.59	4
UPO-16-4	0.31	0.48	1.22	0.66	0.31	0.89	0.36	0.39	0.32	0.63	2
HFO-525	0.35	0.46	1.22	0.57	0.26	0.58	0.35	0.29	0.36	0.59	4
OL-1861	0.38	0.53	0.82	0.76	0.34	0.76	0.45	0.42	0.43	0.62	3
Kent (NC)	0.58	0.59	1.63	0.72	0.31	0.75	0.43	0.28	0.39	0.62	3
OS-6 (NC)	0.74	0.48	1.50	0.51	0.25	0.70	0.41	0.39	0.37	0.57	6
JHO-822 (ZC-CZ)	0.34	0.66	1.27	0.55	0.47	0.70					
JHO-2000-4 (ZC-SZ)							0.53	0.49	0.46		
Mean	**0.48**	**0.49**	**1.16**	**0.68**	**0.34**	**0.73**	**0.46**	**0.41**	**0.39**	**0.61**	

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

Entries	ADF (%)							NDF (%)						
	Palam-pur	Ludh-iana	Rah-uri	Pant-nagar	Ran-chi	Aver-age	Ra-nk	Palam-pur	Ludh-iana	Rah-uri	Pant-nagar	Ran-chi	Aver-age	Ra-nk
JO-05-7	57.8	44.1	47.4	58.6	37.9	49.2	9	65.4	64.9	64.7	66.0	55.4	63.3	5
OL-1869-1	54.6	41.9	41.0	56.2	41.4	47.0	3	64.2	62.1	63.7	65.8	62.3	63.6	6
SKO-229	58.8	41.8	34.9	55.4	38.6	45.9	1	65.0	61.4	53.3	64.0	58.8	60.5	1
HFO-607	57.4	42.3	39.1	57.2	43.3	47.9	5	65.8	62.3	61.7	64.2	64.5	63.7	7
OL-1862	56.2	44.2	45.6	56.2	40.1	48.5	7	64.2	63.2	64.0	65.0	59.7	63.2	4
UPO-16-4	55.8	43.9	40.2	55.2	40.7	47.2	4	65.0	63.4	60.5	64.4	57.1	62.1	3
HFO-525	57.6	43.8	42.3	53.4	44.6	48.3	6	66.6	65.1	61.2	63.4	65.2	64.3	9
OL-1861	55.8	44.9	45.8	57.8	39.5	48.8	8	65.0	64.8	63.6	65.2	60.5	63.8	8
Kent (NC)	57.4	43.1	36.1	58.0	38.1	46.5	2	66.2	62.7	56.3	65.4	58.6	61.8	2
OS-6 (NC)	54.4	43.4	44.2	55.2	42.1	47.9	5	66.6	64.3	64.5	67.0	62.7	65.0	10
SKO-90 (ZC-HZ)	58.6							65.4						
OL-125 (ZC-NWZ)		44.2		54.6					65.3		66.2			
JHO-99-2 (ZC-NEZ)					42.8							61.8		
JHO-822 (ZC-CZ)			40.7							61.1				
Mean	**56.8**	**43.4**	**41.6**	**56.2**	**40.8**	**47.7**		**65.4**	**63.6**	**61.3**	**65.1**	**60.6**	**63.1**	

Table 6.9 AVT Oat (SC-1): First Advanced Varietal Trial in Oat (Single Cut): IVDMD (%) & DDM (q/ha)

Entries	IVDMD (%)						DDM (q/ha)	
	Ludh-iana	Rah-uri	His-ar	Ran-chi	Aver-age	Ra-nk	Hisar	Rank
JO-05-7	51.6	53.6	61.0	62.5	57.2	9	49.1	6
OL-1869-1	55.8	54.7	64.8	57.6	58.2	8	57.6	2
SKO-229	56.3	62.6	63.0	59.7	60.4	2	43.8	9
HFO-607	55.2	56.9	66.1	54.9	58.3	7	70.4	1
OL-1862	55.6	54.2	68.5	57.3	58.9	5	41.3	11
UPO-16-4	54.1	56.2	69.0	59.6	59.7	3	45.1	8
HFO-525	52.3	54.2	61.1	54.7	55.6	10	53.3	4
OL-1861	52.4	54.8	69.7	61.1	59.5	4	48.9	7
Kent (NC)	54.9	60.0	69.2	60.7	61.2	1	54.4	3
OS-6 (NC)	52.6	55.8	67.8	58.3	58.6	6	41.7	10
OL-125 (ZC-NWZ)	51.3		64.1				49.2	5
JHO-99-2 (ZC-NEZ)				57.5				
JHO-822 (ZC-CZ)		57.8						
Mean	**53.8**	**56.4**	**65.8**	**58.5**	**58.8**		**50.4**	

7. AVTO (SC)-2: SECOND ADVANCED VARIETAL TRIAL IN OAT (SINGLE CUT)

(Reference tables 7.1 to 7.9)

In Oat (single cut), four entries were evaluated against two national checks Kent and OS-6 and two respective zonal checks SKO-90 (HZ), JHO-2004 (SZ) at 7 locations in two different zones (HZ, SZ).

For green forage yield (q/ha), in South zone, entries HFO-427 and JHO-15-1 showed superiority by a margin of 16.7% and 7.8% respectively over the best check. Combining both zones, only HFO-427 was superior by a margin of 10.2% over the best check. Other entries were either inferior or showed marginal superiority over the best check. None of the entries could surpass check in Hill zone.

Similarly for dry matter yield (q/ha), none of the entries could surpass check in Hill zone. In South zone, entries HFO-427 and JHO-15-1 showed superiority by a margin of 21.4% and 7.8% respectively over the best check. Combining both zones, only HFO-427 was superior by a margin of 12.5% over the best check. Other entries were either inferior or showed marginal superiority over the best check.

For forage production potential (q/ha/day), entries HFO-427 followed by JHO-15-1 for both green and dry matter production potential were adjudged superior performers. For plant height, entry JHO-15-1 (124.9 cm) ranked first. For the character leafiness, entry SKO-227 was superior.

In quality parameters, entries HFO-427 (6.1) followed by JO-04-22 (5.5) performed better in comparison to best check (4.8) for crude protein yield (q/ha). Similarly entry SKO-227 followed by JO-04-22 were best performers for crude protein content. For other quality parameters, JHO-15-1 for ADF (%), SKO-227 for NDF (%) ranked first.

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

(Reference table 8.1)

Results of the advanced varietal trial in Oat for seed with four entries along with two national checks, Kent and OS-6 and respective zonal checks conducted at four locations in two zones revealed that for seed yield (q/ha), entry SKO-227 ranked first in hill zone whereas entries HFO-227 (9.9%) and JO-04-22 (5.3%) performed better than the best check at south zone.

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

Entries	Hill Zone					South Zone							Combined 2 zones		
	Palam-pur	Sri-nagar	Rajo-uri	Aver-age	Ra-nk	Hydera-bad	Man-dya	Coimba-tore	Mattu-petty	Aver-age	Ra-nk	Superi-ority%	Aver-age	Ra-nk	Superi-ority%
HFO-427	181.3	343.3	267.2	263.9	2	513.7	331.9	308.1	365.6	379.8	1	16.7	330.2	1	10.2
SKO-227	136.5	327.5	265.3	243.1	5	91.6	252.8	380.6	347.8	268.2	7		257.4	6	
JHO-15-1	176.0	346.2	224.4	248.9	4	455.4	293.1	293.9	361.4	350.9	2	7.8	307.2	2	2.5
JO-04-22	169.6	348.2	234.7	250.8	3	410.9	303.2	302.5	324.7	335.3	3	3.0	299.1	4	
Kent (NC)	147.2	375.7	272.2	265.0	1	399.8	310.9	279.7	311.4	325.5	4		299.6	3	
OS-6 (NC)	115.2	307.3	252.2	224.9	7	333.2	262.6	300.8	289.2	296.5	6		265.8	5	
SKO-90 (ZC-HZ)	122.7	315.6	245.0	227.8	6										
JHO-2000-4 (ZC-SZ)						355.4	295.9	382.5	229.4	315.8	5				
Mean	**149.8**	**337.7**	**251.6**	**246.3**		**365.7**	**292.9**	**321.1**	**318.5**	**324.6**			**293.2**		
CD at 5%	27.8	28.6	3.3			59.3	41.1	6.8	8.7						
CV%	10.4	12.6	6.2			9.0	7.9	1.2	1.5						

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

Entries	Hill Zone					South Zone							Combined 2 zones		
	Palam-pur	Sri-nagar	Rajo-uri	Aver-age	Ra-nk	Hydera-bad	Man-dya	Coimb-atore	Mattu-petty	Aver-age	Ra-nk	Superi-ority%	Aver-age	Ra-nk	Super-iority%
HFO-427	35.3	71.5	71.1	59.3	2	96.3	80.0	70.0	91.4	84.4	1	21.4	73.7	1	12.5
SKO-227	23.8	68.2	72.5	54.8	5	12.2	57.5	87.8	86.9	61.1	6		58.4	5	
JHO-15-1	30.2	74.5	60.6	55.1	4	81.4	66.3	61.4	90.4	74.9	2	7.8	66.4	2	1.4
JO-04-22	33.7	73.9	69.2	58.9	3	61.5	69.9	61.8	81.4	68.6	4		64.5	4	
Kent (NC)	26.5	79.3	74.4	60.1	1	60.6	74.1	65.9	77.5	69.5	3		65.5	3	
OS-6 (NC)	21.4	64.0	64.7	50.0	7	56.5	60.5	67.7	73.3	64.5	5		58.3	6	
SKO-90 (ZC-HZ)	22.4	65.7	65.8	51.3	6										
JHO-2000-4 (ZC-SZ)						54.5	62.5	69.7	57.4	61.0	7				
Mean	**27.6**	**71.0**	**68.3**	**55.7**		**60.4**	**67.3**	**69.2**	**79.7**	**69.2**			**64.5**		
CD at 5%	9.2	3.7	0.4			15.6	8.0	3.0	2.9						
CV%	18.8	9.0	2.9			14.3	6.7	2.5	2.0						

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

Entries	Palampur	Srinagar	Rajouri	Hyderabad	Mandya	Coimbatore	Mattupetty	Average	Rank
HFO-427	1.52	2.34	1.84	6.40	4.21	3.95	4.06	3.47	1
SKO-227	1.08	2.23	1.83	1.00	2.72	4.53	3.86	2.46	6
JHO-15-1	1.47	2.39	1.55	6.15	3.82	3.92	4.02	3.33	2
JO-04-22	1.41	2.37	1.62	5.12	3.94	4.03	3.61	3.16	4
Kent (NC)	1.24	2.55	1.88	5.40	4.25	3.68	3.46	3.21	3
OS-6 (NC)	0.96	2.09	1.74	4.73	4.00	3.96	3.21	2.96	5
SKO-90 (ZC-HZ)	0.97	2.15	1.69						
JHO-2000-4 (ZC-SZ)				4.91	4.08	5.10	2.55		
Mean	**1.24**	**2.30**	**1.74**	**4.82**	**3.86**	**4.17**	**3.54**	**3.10**	

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

Entries	Srinagar	Rajouri	Hyderabad	Coimbatore	Average	Rank
HFO-427	0.48	0.49	1.20	0.90	0.77	1
SKO-227	0.46	0.50	0.13	1.05	0.53	6
JHO-15-1	0.49	0.42	1.10	0.82	0.71	2
JO-04-22	0.52	0.48	0.77	0.82	0.65	4
Kent (NC)	0.55	0.51	0.82	0.87	0.69	3
OS-6 (NC)	0.43	0.45	0.80	0.89	0.64	5
SKO-90 (ZC-HZ)	0.44	0.45				
JHO-2000-4 (ZC-SZ)			0.77	0.93		
Mean	**0.48**	**0.47**	**0.80**	**0.90**	**0.66**	

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

Entries	Crude Protein Yield (q/ha)							Crude Protein (%)						
	Palam-pur	Man-dya	Coimb-atore	Hydera-bad	Mattu-petty	Aver-age	Ra-nk	Palam-pur	Man-dya	Coimb-atore	Hydera-bad	Mattu-petty	Aver-age	Ra-nk
HFO-427	3.7	7.0	5.2	8.4	6.0	6.1	1	10.5	8.7	7.4	8.8	6.6	8.4	4
SKO-227	2.4	4.3	11.5	0.9	7.6	5.3	3	10.3	7.4	13.1	7.0	8.8	9.3	1
JHO-15-1	3.1	6.1	4.3	7.5	4.8	5.2	4	10.2	9.2	7.0	9.2	5.3	8.2	6
JO-04-22	3.2	5.5	7.6	5.4	6.0	5.5	2	9.6	7.9	12.3	8.8	7.4	9.2	2
Kent (NC)	2.3	4.9	6.9	5.3	4.7	4.8	5	8.5	7.9	10.5	8.8	6.1	8.3	5
OS-6 (NC)	1.9	5.3	6.2	5.4	5.1	4.8	5	8.8	8.8	9.2	9.6	7.0	8.7	3
SKO-90 (ZC-HZ)	2.1							9.3						
JHO-2000-4 (ZC-SZ)		5.8	7.6	4.5	4.5				7.9	10.9	8.3	7.9		
Mean	**2.7**	**5.6**	**7.0**	**5.3**	**5.5**	**5.2**		**9.6**	**8.2**	**10.1**	**8.6**	**7.0**	**8.7**	

Table 7.6: AVT Oat (SC)-2: Second Advanced Varietal Trial in Oats (Single Cut): Plant Height (cm)

Entries	Palampur	Srinagar	Rajouri	Hyderabad	Mandya	Coimbatore	Mattupetty	Average	Rank
HFO-427	95.3	110.6	114.9	98.6	120.7	121.0	173.0	119.2	4
SKO-227	37.3	93.8	144.1	56.2	87.9	81.3	143.0	92.0	6
JHO-15-1	91.3	113.0	150.4	94.5	127.1	130.7	167.0	124.9	1
JO-04-22	73.3	115.0	156.3	88.7	118.3	136.7	164.0	121.7	3
Kent (NC)	89.0	109.7	104.7	79.2	130.4	131.3	170.0	116.3	5
OS-6 (NC)	89.0	115.7	144.0	94.3	96.7	142.0	178.0	122.8	2
SKO-90 (ZC-HZ)	46.7	104.8	148.3						
JHO-2000-4 (ZC-SZ)				94.6	111.9	151.0	167.0		
Mean	**74.6**	**108.9**	**137.5**	**86.6**	**113.3**	**127.7**	**166.0**	**116.1**	

Table 7.7: AVT Oat (SC)-2: Second Advanced Varietal Trial in Oats (Single Cut): Leaf Stem Ratio

Entries	Palampur	Srinagar	Hyderabad	Mandya	Coimbatore	Average	Rank
HFO-427	0.59	0.51	0.54	0.62	0.40	0.53	2
SKO-227	1.49	0.48	0.96	0.58	0.41	0.78	1
JHO-15-1	0.37	0.49	0.63	0.56	0.32	0.47	4
JO-04-22	0.47	0.53	0.48	0.57	0.34	0.48	3
Kent (NC)	0.33	0.59	0.66	0.40	0.34	0.46	5
OS-6 (NC)	0.30	0.49	0.49	0.33	0.33	0.39	6
SKO-90 (ZC-HZ)	1.10	0.56					
JHO-2000-4 (ZC-SZ)			0.62	0.52	0.49		
Mean	**0.66**	**0.52**	**0.63**	**0.51**	**0.38**	**0.52**	

Table 7.8: AVT Oat (SC)-2: Second Advanced Varietal Trial in Oats (Single Cut): ADF (%) & NDF (%)

Entries	ADF (%)		NDF (%)	
	Palampur	Rank	Palampur	Rank
HFO-427	54.6	4	64.6	3
SKO-227	50.2	2	63.6	1
JHO-15-1	50.0	1	64.0	2
JO-04-22	55.0	5	65.4	4
Kent (NC)	53.4	3	65.6	5
OS-6 (NC)	55.4	6	65.4	4
SKO-90 (ZC-HZ)	54.6	4	66.6	6
Mean	**53.3**		**65.0**	

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

Entries	Hill Zone					South Zone					Combined 2 zones	
	Palam-pur	Sri-nagar	Aver-age	Ra-nk	Super-iority%	Hydera-bad	Man-dya	Aver-age	Ra-nk	Superi-ority%	Aver-age	Ra-nk
HFO-427	12.11	17.70	14.91	5		12.50	8.31	10.41	1	9.9	12.66	4
SKO-227	15.16	21.50	18.33	1	2.9	0.80	7.33	4.07	7		11.20	5
JHO-15-1	14.88	19.10	16.99	3		10.30	8.39	9.35	4		13.17	3
JO-04-22	14.92	18.50	16.71	4		11.90	8.03	9.97	2	5.3	13.34	2
Kent (NC)	12.11	23.50	17.81	2		8.90	10.03	9.47	3		13.64	1
OS-6 (NC)	5.44	17.10	11.27	7		5.60	9.95	7.78	6		9.52	6
SKO-90 (ZC-HZ)	5.55	20.40	12.98	6								
JHO-2000-4 (ZC-SZ)						10.60	7.33	8.97	5			
Mean	**11.45**	**19.69**	**15.57**			**8.66**	**8.48**	**8.57**			**12.07**	
CD at 5%	1.30	1.23				2.10	1.78					
CV%	6.39	8.52				13.60	11.79					

9. IVTO-MC: INITIAL VARIETAL TRIAL IN OAT (MULTI CUT) (Reference tables 9.1 to 9.9)

In initial varietal trial in oat (multicut), seven entries were evaluated against two national checks (RO-19 and UPO-212) at 18 locations in four zones (HZ, NWZ, NEZ, and CZ).

For green fodder yield (q/ha), entry OL-1874 (2.3%) in HZ; entry OL-1874 (1.9%) in NW zone entry; entries HFO-514 (5.3 %), OL-1874 (1.6 %) in NEZ; entries OL-1874 (4.1%), HFO-514 (2.1 %) in CZ exhibited superiority over the best zonal/national check. At national level, entries HFO-514 (3.1 %), OL-1874 (1.9 %) exhibited superiority. Other entries were inferior to the checks.

For dry matter yield (q/ha), entries OL-1874 (8.5%), HFO-514 (5.2%) in HZ; entries JO-05-304 (5.8%), HFO-514 (3.7 %), OL-1874 (2.1 %) in NW zone; entries HFO-514 (5.8 %), OL-1874 (3.9%) in NEZ; entries JO-05-304 (7.4 %), PLP-21 (5.1%), HFO-514 (3.0 %) in CZ exhibited superiority over the best zonal/national check. At national level, HFO-514 (5.1 %), OL-1874 (3.0 %) exhibited superiority. Other entries were inferior to the checks.

For fodder production potential (q/ha/day), entry HFO-514 ranked first followed by OL-1874 for both GFY and DMY. For plant height entry OL-1874 ranked first whereas for leafiness entry JO-05-304 ranked first.

For quality parameters, entry HFO-514 ranked first for crude protein yield (q/ha). Entry JHO 17-3 and national check RO-19 ranked first for crude protein content (%). For ADF %, NDF % entry JHO 17-3 ranked first. For IVDMD %, entry OL-1874 ranked first. For DDM (q/ha), HFO-514 ranked first.

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	Rajo-uri	Aver-age	Ra-nk	Superi-ority%	His-ar	Ludh-iana	Pant-nagar	Aver-age	Ra-nk	Superi-ority%
JO-05-304	142.4	310.6	191.3	246.3	222.7	9		471.9	586.9	702.2	587.0	5	
HFO-514	149.6	344.7	203.0	297.4	248.7	3		533.7	613.0	650.0	598.9	3	
HFO-706	166.4	296.9	200.1	275.2	234.6	4		452.7	618.9	575.6	549.1	7	
JHO-17-3	115.2	307.9	189.8	289.2	225.5	8		404.8	487.8	568.9	487.2	9	
PLP-21	142.4	300.3	204.4	272.2	229.8	6		463.9	573.9	587.8	541.9	8	
OL-1874	148.8	344.0	223.6	309.3	256.4	1	2.3	494.6	590.0	777.8	620.8	1	1.9
OL-1908	136.0	325.0	162.3	306.7	232.5	5		441.3	564.1	788.9	598.1	4	
UPO-212 (NC)	186.4	334.2	206.9	275.2	250.7	2		521.3	597.0	617.8	578.7	6	
RO-19 (NC)	137.6	305.6	212.8	252.6	227.2	7		512.1	593.3	722.2	609.2	2	
Mean	**147.2**	**318.8**	**199.4**	**280.5**	**236.5**			**477.4**	**580.5**	**665.7**	**574.5**		
CD at 5%	NS	23.9	45.4	1.9				36.4	108.1	134.6			
CV%	16.2	10.9	13.2	6.2				9.0	9.9	12.3			

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

Entries	North East Zone									Central Zone								All India		
	Faiza-bad	Jor-hat	Bhuban-eswar	Imp-hal	Pu-sa	Ran-chi	Aver-age	Ra-nk	Superi-ority%	Jha-nsi	Ana-nd	Jabal-pur	Rah-uri	Urulikan-chan	Aver-age	Ra-nk	Superi-ority%	Aver-age	Ra-nk	Superi-ority%
JO-05-304	397.8	500.2	252.6	434.7	334.0	430.2	391.6	8		201.9	753.0	747.8	628.9	653.8	597.1	5		443.7	6	
HFO-514	565.3	478.6	314.6	505.5	361.0	508.4	455.6	1	5.3	218.8	803.0	587.8	742.1	779.7	626.3	2	2.1	480.9	1	3.1
HFO-706	450.7	470.0	282.6	513.8	354.0	450.7	420.3	5		177.7	893.0	633.2	563.2	570.6	567.6	8		441.4	8	
JHO-17-3	477.3	425.3	363.6	393.7	377.0	438.2	412.5	6		170.8	859.0	581.1	506.8	643.7	552.3	9		422.2	9	
PLP-21	376.0	439.0	273.3	421.4	323.0	408.4	373.5	9		206.3	952.0	567.8	549.5	915.1	638.2	1	4.1	443.2	7	
OL-1874	464.0	496.7	383.9	497.4	329.0	465.3	439.4	2	1.6	223.0	873.0	506.5	703.5	724.2	606.0	4		475.3	2	1.9
OL-1908	368.0	461.8	358.7	450.1	318.0	415.1	395.3	7		169.4	844.0	667.8	585.4	693.3	592.0	6		447.5	5	
UPO-212 (NC)	418.1	490.8	330.6	467.8	346.0	471.6	420.8	4		203.3	817.0	585.1	621.6	628.2	571.0	7		451.0	4	
RO-19 (NC)	442.7	452.4	298.6	568.3	339.0	493.8	432.5	3		238.8	935.0	595.9	645.5	650.6	613.2	3		466.5	3	
Mean	**440.0**	**468.3**	**317.6**	**472.5**	**342.3**	**453.5**	**415.7**			**201.1**	**858.8**	**608.1**	**616.3**	**695.5**	**596.0**			**452.4**		
CD at 5%	65.0	7.1	2.8	29.8	31.7	52.9				13.4	120.1	117.9	41.0	126.7						
CV%	8.5	6.3	6.8	3.5	9.8	6.6				7.7	8.1	11.2	3.9	10.4						

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	Rajo-uri	Aver-age	Ra-nk	Superi-ority%	His-ar	Ludh-iana	Pant-nagar	Aver-age	Ra-nk	Superi-ority%
JO-05-304	28.2	61.7	51.7	60.8	50.6	8		85.7	143.8	103.0	110.8	1	5.8
HFO-514	31.2	67.5	50.0	78.9	56.9	2	5.2	97.7	145.9	82.3	108.6	2	3.7
HFO-706	31.4	59.4	48.8	69.7	52.3	5		81.5	149.2	73.9	101.5	7	
JHO-17-3	21.5	60.2	46.2	77.8	51.4	7		71.2	115.6	76.8	87.9	9	
PLP-21	28.0	60.5	49.2	70.0	51.9	6		76.4	137.7	66.6	93.6	8	
OL-1874	29.6	67.3	55.6	82.2	58.7	1	8.5	83.9	144.6	92.0	106.9	3	2.1
OL-1908	27.2	63.6	42.0	78.2	52.8	4		74.1	139.3	99.9	104.5	5	
UPO-212 (NC)	37.5	64.7	49.7	64.4	54.1	3		93.4	140.3	80.3	104.7	4	
RO-19 (NC)	26.3	61.0	49.0	62.2	49.6	9		87.6	143.6	79.4	103.5	6	
Mean	**29.0**	**62.9**	**49.1**	**71.6**	**53.1**			**83.5**	**140.0**	**83.8**	**102.4**		
CD at 5%	NS	3.7	13.3	0.4				9.1	32.7	7.9			
CV%	16.2	8.4	15.6	5.6				12.9	11.1	4.4			

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

Entries	North East Zone									Central Zone								All India		
	Faiza-bad	Jor-hat	Bhuban-eswar	Imp-hal	Pu-sa	Ran-chi	Aver-age	Ra-nk	Super-iority%	Jha-nsi	Ana-nd	Jabal-pur	Rah-uri	Urulikan-chan	Aver-age	Ra-nk	Superi-ority%	Aver-age	Ra-nk	Superi-ority%
JO-05-304	85.3	95.0	50.1	91.4	66.4	94.6	80.5	9		56.5	99.1	167.5	152.8	121.9	119.6	1	7.4	89.7	3	
HFO-514	132.8	83.2	65.7	111.8	72.1	104.2	95.0	1	5.8	54.9	100.0	131.9	154.3	132.4	114.7	3	3.0	94.3	1	5.1
HFO-706	100.3	92.4	57.3	104.5	70.4	113.4	89.7	4		45.8	113.4	137.6	138.7	105.5	108.2	8		88.5	5	
JHO-17-3	110.6	84.1	74.1	81.2	74.8	94.2	86.5	6		50.6	101.0	128.3	124.0	108.4	102.5	9		83.4	8	
PLP-21	81.9	85.5	55.9	106.5	64.5	96.0	81.7	8		58.7	98.6	125.0	135.7	167.4	117.1	2	5.1	86.9	7	
OL-1874	101.9	94.8	79.1	113.6	65.3	104.7	93.3	2	3.9	51.6	100.0	106.6	166.2	124.9	109.8	6		92.4	2	3.0
OL-1908	83.0	84.8	72.7	102.7	63.1	109.3	85.9	7		44.6	86.2	149.0	144.0	124.9	109.7	7		88.3	6	
UPO-212 (NC)	92.6	88.1	67.0	96.1	69.0	114.7	87.9	5		56.7	100.4	132.6	147.7	119.4	111.4	4		89.7	3	
RO-19 (NC)	99.0	88.1	61.3	115.9	67.7	107.0	89.8	3		57.3	99.0	130.5	148.4	119.1	110.9	5		89.0	4	
Mean	**98.6**	**88.4**	**64.8**	**102.6**	**68.1**	**104.2**	**87.8**			**53.0**	**99.7**	**134.3**	**145.7**	**124.9**	**111.5**			**89.1**		
CD at 5%	14.9	4.8	0.6	13.6	7.3	17.3				5.0	13.9	27.1	9.8	23.0						
CV%	8.7	10.0	6.7	7.4	11.4	9.3				2.9	8.0	11.6	3.9	10.5						

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

Entries	Rajo-uri	His-ar	Ludh-iana	Pant-nagar	Faiza-bad	Bhuban-eswar	Pu-sa	Ran-chi	Ana-nd	Rah-uri	Urulikan-chan	Aver-age	Ra-nk
JO-05-304	1.59	3.60	4.45	5.75	3.48	3.11	3.60	4.23	6.22	5.70	6.11	4.35	9
HFO-514	1.88	4.10	4.64	5.32	5.07	3.79	3.90	5.19	6.69	6.57	7.29	4.95	1
HFO-706	1.76	3.39	4.69	5.18	4.33	3.38	3.80	4.69	7.70	5.43	5.33	4.52	7
JHO-17-3	1.89	3.07	3.70	4.62	4.33	4.55	4.00	4.61	7.47	4.51	6.02	4.43	8
PLP-21	1.75	3.44	4.35	5.34	3.41	3.42	3.50	4.25	7.74	4.71	8.55	4.59	6
OL-1874	1.94	3.68	4.47	6.37	4.10	4.68	3.60	4.78	7.21	6.32	6.77	4.90	2
OL-1908	1.84	3.27	4.27	6.41	3.50	4.62	3.40	4.58	6.86	5.61	6.48	4.62	5
UPO-212 (NC)	1.77	3.96	4.52	5.61	4.05	4.03	3.80	5.00	7.04	5.88	5.87	4.68	4
RO-19 (NC)	1.74	3.91	4.49	5.87	3.98	3.78	3.70	4.84	7.79	5.76	6.08	4.72	3
Mean	**1.80**	**3.60**	**4.40**	**5.61**	**4.03**	**3.93**	**3.70**	**4.69**	**7.19**	**5.61**	**6.50**	**4.64**	

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

Entries	Rajo-uri	His-ar	Ludh-iana	Pant-nagar	Faiza-bad	Bhuban-eswar	Pu-sa	Ran-chi	Ana-nd	Rah-uri	Urulikan-chan	Aver-age	Ra-nk
JO-05-304	0.37	0.70	1.09	0.84	0.74	0.62	0.71	0.93	0.82	1.39	1.14	0.85	7
HFO-514	0.50	0.80	1.11	0.67	1.18	0.79	0.78	1.06	0.83	1.37	1.24	0.94	1
HFO-706	0.40	0.65	1.13	0.67	0.96	0.68	0.75	1.18	0.98	1.34	0.99	0.88	5
JHO-17-3	0.48	0.58	0.88	0.62	1.00	0.93	0.80	0.99	0.88	1.10	1.01	0.84	8
PLP-21	0.44	0.61	1.04	0.61	0.74	0.70	0.70	1.00	0.80	1.16	1.56	0.85	7
OL-1874	0.51	0.67	1.10	0.75	0.90	0.97	0.71	1.08	0.83	1.49	1.17	0.92	2
OL-1908	0.46	0.59	1.06	0.81	0.79	0.94	0.67	1.21	0.70	1.38	1.17	0.89	4
UPO-212 (NC)	0.38	0.77	1.06	0.73	0.89	0.82	0.75	1.22	0.87	1.40	1.12	0.91	3
RO-19 (NC)	0.42	0.72	1.09	0.64	0.89	0.78	0.74	1.05	0.83	1.32	1.11	0.87	6
Mean	**0.44**	**0.68**	**1.06**	**0.70**	**0.90**	**0.80**	**0.73**	**1.08**	**0.84**	**1.33**	**1.17**	**0.88**	

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

Entries	Palam-pur	His-ar	Ludh-iana	Faiza-bad	Jor-hat	Bhuban-eswar	Imp-hal	Ran-chi	Ana-nd	Jabal-pur	Rah-uri	Urulikan-chan	Aver-age	Ra-nk
JO-05-304	2.7	12.8	15.5	6.8	5.0	4.2	7.2	6.6	14.7	13.7	10.4	11.2	9.2	4
HFO-514	3.4	15.3	15.6	11.8	4.0	5.2	8.4	6.9	13.5	10.6	11.8	12.1	9.9	1
HFO-706	2.8	10.7	18.3	8.3	4.4	4.6	7.6	6.7	15.6	11.0	8.9	9.3	9.0	5
JHO-17-3	1.9	11.6	17.2	9.2	4.6	6.0	7.4	5.0	13.7	10.4	7.1	9.8	8.7	7
PLP-21	2.6	11.5	13.9	7.0	4.2	4.5	7.2	5.5	15.1	10.0	7.6	14.4	8.6	8
OL-1874	2.8	12.7	18.4	8.6	5.0	6.3	7.6	8.1	12.7	8.2	10.1	11.7	9.3	3
OL-1908	2.6	11.1	15.6	6.9	4.4	5.8	7.0	6.7	12.2	12.1	11.3	11.1	8.9	6
UPO-212 (NC)	3.3	13.9	15.9	7.5	4.0	5.6	7.7	8.5	13.7	10.8	8.4	11.2	9.2	4
RO-19 (NC)	2.7	14.6	16.9	7.6	4.6	5.0	9.3	8.2	13.8	10.5	10.4	10.7	9.5	2
Mean	**2.7**	**12.7**	**16.4**	**8.2**	**4.5**	**5.3**	**7.7**	**6.9**	**13.9**	**10.8**	**9.6**	**11.3**	**9.2**	

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

Entries	Palam-pur	His-ar	Ludh-iana	Faiza-bad	Jor-hat	Bhuban-eswar	Imp-hal	Ran-chi	Ana-nd	Jabal-pur	Rah-uri	Urulikan-chan	Aver-age	Ra-nk
JO-05-304	9.6	15.4	10.8	8.0	10.6	8.4	8.2	7.0	14.1	8.2	6.8	9.2	9.7	2
HFO-514	10.8	15.8	10.7	8.9	9.8	7.9	7.8	6.6	13.0	8.2	7.7	9.2	9.7	2
HFO-706	9.0	15.0	12.3	8.2	9.6	8.1	7.6	5.9	13.6	8.2	6.4	8.8	9.4	4
JHO-17-3	9.0	15.8	14.9	8.7	11.1	8.1	9.0	5.3	13.5	8.2	5.8	9.0	9.9	1
PLP-21	9.3	16.2	10.1	8.6	10.0	8.1	7.3	5.7	14.8	8.2	5.6	8.6	9.4	4
OL-1874	9.3	15.9	12.7	8.4	10.6	8.0	7.1	7.7	12.5	8.0	6.1	9.4	9.6	3
OL-1908	9.3	15.4	11.2	8.3	10.6	8.0	7.1	6.1	14.0	8.2	7.9	8.9	9.6	3
UPO-212 (NC)	8.8	15.0	11.3	8.1	9.2	8.4	8.3	7.4	13.5	8.2	5.7	9.4	9.4	4
RO-19 (NC)	10.2	16.3	11.8	8.4	10.6	8.1	8.3	7.7	13.2	8.2	7.0	9.0	9.9	1
Mean	**9.5**	**15.6**	**11.8**	**8.4**	**10.2**	**8.1**	**7.9**	**6.6**	**13.6**	**8.2**	**6.5**	**9.0**	**9.6**	

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

Entries	Palampur	Srinagar	Rajouri	Hisar	Ludhiana	Pantnagar	Faizabad	Jorhat	Bhubaneswar
JO-05-304	54.7	95.9	79.3	97.1	100.5	141.3	105.0	105.1	84.7
HFO-514	60.0	109.9	75.7	102.6	117.2	158.8	112.2	111.9	100.2
HFO-706	58.0	99.7	73.7	95.6	132.9	116.7	115.3	109.7	94.3
JHO-17-3	50.0	96.3	83.3	96.9	102.5	119.2	80.1	87.5	120.9
PLP-21	55.2	99.1	86.3	97.1	110.4	118.3	104.1	107.9	90.2
OL-1874	56.3	108.3	83.7	101.1	122.7	166.8	103.1	121.3	124.5
OL-1908	57.7	102.8	77.3	89.9	112.3	164.9	97.3	117.4	116.3
UPO-212 (NC)	57.0	114.0	77.7	94.1	102.0	121.5	125.2	115.6	109.3
RO-19 (NC)	60.8	93.6	78.3	101.2	103.5	145.2	112.7	112.2	97.6
Mean	**56.6**	**102.2**	**79.5**	**97.3**	**111.6**	**139.2**	**106.1**	**109.8**	**104.2**

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

Entries	Imphal	Ranchi	Jhansi	Anand	Jabalpur	Rahuri	Urulikanchan	Average	Rank
JO-05-304	77.5	112.8	141.7	125.5	83.8	78.2	72.4	97.2	8
HFO-514	77.7	121.8	141.3	129.8	77.5	81.3	75.1	103.3	2
HFO-706	88.7	111.9	145.1	134.5	70.7	82.0	72.5	100.1	5
JHO-17-3	61.5	83.0	142.3	115.1	73.4	70.4	64.2	90.4	9
PLP-21	83.5	100.6	140.8	132.1	78.7	72.3	82.4	97.4	7
OL-1874	87.5	122.9	144.9	130.0	78.7	83.3	83.9	107.4	1
OL-1908	77.6	112.7	148.8	130.1	82.3	89.6	72.6	103.1	3
UPO-212 (NC)	82.3	105.4	138.6	131.0	81.4	75.6	69.2	100.0	6
RO-19 (NC)	85.9	118.3	142.0	133.6	67.0	90.5	80.1	101.4	4
Mean	**80.2**	**109.9**	**142.8**	**129.1**	**77.1**	**80.4**	**74.7**	**100.0**	

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	Faiza-bad	Jor-hat	Bhuban-eswar	Imp-hal	Ran-chi	Ana-nd	Jabal-pur	Rah-uri	Urulikan-chan	Aver-age	Ra-nk
JO-05-304	0.84	0.45	0.87	2.00	0.52	0.71	1.34	0.78	2.04	0.45	1.13	0.88	0.78	0.77	0.97	1
HFO-514	0.67	0.40	0.99	1.80	0.44	0.77	1.00	0.98	2.41	0.32	1.08	0.80	0.64	0.93	0.94	2
HFO-706	0.74	0.42	0.81	1.10	0.66	0.73	1.13	0.89	0.99	0.30	0.89	0.71	0.72	0.86	0.78	8
JHO-17-3	0.78	0.40	1.12	1.00	0.64	0.76	1.39	1.12	2.28	0.34	0.72	0.74	0.76	0.72	0.91	3
PLP-21	0.73	0.37	1.24	1.00	0.61	0.69	1.49	0.83	1.87	0.34	1.17	0.76	0.69	0.76	0.90	4
OL-1874	0.83	0.37	1.09	1.20	0.51	0.68	1.07	1.19	1.05	0.30	1.04	0.64	0.62	0.82	0.81	7
OL-1908	0.67	0.43	0.89	0.80	0.41	0.70	1.60	1.09	2.16	0.28	0.92	0.85	0.79	0.76	0.88	6
UPO-212 (NC)	0.80	0.37	1.11	1.50	0.60	0.69	1.31	1.05	1.47	0.30	1.00	0.81	0.69	0.81	0.89	5
RO-19 (NC)	0.65	0.41	0.95	1.60	0.58	0.72	1.16	0.94	0.90	0.31	0.82	0.66	0.49	0.75	0.78	8
Mean	**0.75**	**0.40**	**1.01**	**1.33**	**0.55**	**0.72**	**1.28**	**0.99**	**1.68**	**0.33**	**0.97**	**0.76**	**0.68**	**0.80**	**0.87**	

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

Entries	ADF (%)		NDF (%)		IVDMD (%)				DDM (q/ha)	
	Ludhiana	Rank	Ludhiana	Rank	Ludhiana	Hisar	Average	Rank	Hisar	Rank
JO-05-304	33.4	7	47.2	6	64.1	64.7	64.4	6	53.8	5
HFO-514	32.9	6	47.9	7	61.3	62.3	61.8	8	64.9	1
HFO-706	31.4	3	45.3	2	67.1	65.7	66.4	4	47.2	7
JHO-17-3	30.2	1	44.6	1	69.2	65.9	67.6	3	47.7	6
PLP-21	33.8	8	48.1	8	62.4	67.4	64.9	5	46.7	8
OL-1874	30.7	2	45.7	3	68.1	68.6	68.4	1	55.8	4
OL-1908	32.3	5	46.9	5	64.1	63.8	63.9	7	45.7	9
UPO-212 (NC)	32.9	6	46.3	4	64.9	67.8	66.4	4	62.2	2
RO-19 (NC)	31.8	4	47.2	6	66.2	69.2	67.7	2	61.1	3
Mean	**32.2**		**46.6**		**65.3**	**66.1**	**65.7**		**53.9**	

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

(Reference tables 10.1 to 10.10)

An initial varietal trial in Oat (Dual) comprising of seven entries along with two national checks (UPO-212 and JHO-822) was conducted at 14 centres located at three zones of the country. Results obtained from different centres revealed that for green forage yield (q/ha), entries HFO-611 (9.3 %), entry HFO-608 (5.6%), JO-10-506 (1.2%) in NWZ; entries JO-10-506 (19.5%), OL-1906 (7.1%), HFO-608 (7.1%), JHO-17-5 (3.5%) in NE zone; entries HFO-608 (31.9 %), OL-1876-2 (26.8%), HFO-611 (16.6%), JO-10-506 (7.5 %) exhibited superiority over the best check. At all India level, HFO-608 (21.4 %), OL-1876-2 (14.3 %), HFO-611 (12.8 %), JO-10-506 (10.0 %) exhibited superiority over the best check;

For dry matter yield, entries HFO-611 (14.0 %), OL-1876-2 (9.1%), entry HFO-608 (8.0 %), JO-10-506 (1.0%) in NWZ; entries JO-10-506 (15.8%), HFO-608 (2.2%) in NE zone; entries HFO-608 (19.9 %), OL-1876-2 (16.2 %), HFO-611 (13.2 %), JO-10-506 (2.6 %) exhibited superiority over the best check. At all India level, HFO-608 (15.7 %), HFO-611 (12.6 %), OL-1876-2 (12.1 %), JO-10-506 (8.0 %) exhibited superiority over the best check; Other entries were inferior over the best national check for both green and dry fodder yield.

For the character green fodder production potential (q/ha/day), entries HFO-608 followed by OL-1876-2 were superior to best check. For dry matter production potential, entry OL-1876-2 was best followed by HFO-608. Entry HFO-608 ranked first for the character plant height. For the character leafiness, entry JHO 17-4 performed best.

For quality parameters, entry HFO-608 for crude protein yield (4.5 q/ha) followed by HFO-611 and OL-1876-2 (4.4q/ha) were superior to best check. Entry JHO-17-4 was best for crude protein content. Entry JHO 17-4 ranked first for ADF (%), NDF (%). For IVDMD (%) entries HFO-611 and OL-1876-2 ranked joint first. For DDM (q/ha), entry HFO-611 was best.

For seed yield (q/ha), national check JHO-822 was best.

11. AVTO-1 (DUAL): FIRST ADVANCED VARIETAL TRIAL IN OAT (DUAL)

(Reference tables 11.1 to 11.10)

An Advanced varietal trial -1 in Oat (Dual) comprising of four entries along with three national checks (UPO-212, RO-19 and JHO-822) was conducted at 9 centres located in North East zone and Central zone. Results obtained from different centres revealed that for green forage yield (q/ha), dry matter yield (q/ha), green and dry matter productivity potential (GFY/q/ha/day), none of the entries could surpass national checks. Only OL-1769 showed nominal superiority over the best check for GFY and DMY in NE zone. Entry OL-1769 ranked first for the character plant height whereas national check was best for leafiness.

For crude protein yield, national check was best. For crude protein content (%), entry OL-1769 (9.4%) was better than best check (9.1%). National check ranked first for ADF (%), NDF (%), and IVDMD (%). For seed yield (q/ha), national check was best.

Table 10.1 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Green Forage Yield (q/ha)

Entries	North West Zone								North East Zone					
	Ludh-iana	His-ar	Bika-ner	Pant-nagar	Udai-pur	Aver-age	Ra-nk	Superi-ority%	Jor-hat	Bhuban-eswar	Faiza-bad	Aver-age	Ra-nk	Superi-ority%
HFO-611	199.3	232.4	156.6	270.0	125.6	196.8	1	9.3	256.4	201.3	136.0	197.9	6	
OL-1876-2	214.8	197.2	134.7	231.1	93.1	174.2	5		272.8	196.6	122.6	197.3	7	
JHO-17-5	132.8	201.9	150.9	158.9	137.6	156.4	8		242.6	261.9	120.0	208.2	4	3.5
JHO-17-4	84.8	140.0	87.7	117.8	139.3	113.9	9		228.5	183.3	109.3	173.7	9	
OL-1906	185.7	220.4	129.6	155.6	114.5	161.1	7		251.3	285.9	109.3	215.5	2	7.1
JO-10-506	200.4	235.9	160.7	185.6	128.1	182.1	3	1.2	287.3	300.6	133.3	240.4	1	19.5
HFO-608	211.5	272.2	206.9	173.3	86.7	190.1	2	5.6	274.4	246.6	125.3	215.4	3	7.1
UPO-212 (NC)	161.3	209.0	138.8	160.0	177.0	169.2	6		261.9	224.6	117.3	201.2	5	
JHO-822 (NC)	165.7	227.8	162.9	232.2	111.5	180.0	4		238.3	189.3	133.3	187.0	8	
Mean	**172.9**	**215.2**	**147.6**	**187.2**	**123.7**	**169.3**			**257.1**	**232.2**	**122.9**	**204.1**		
CD at 5%	78.4	47.2	42.4	42.6	23.0				4.0	1.8	25.4			
CV%	10.6	12.9	16.7	13.8	11.1				4.8	6.0	7.7			

Table 10.1 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Green Forage Yield (q/ha)

Entries	Central Zone									All India		
	Jha-nsi	Rah-uri	Urulikan-chan	Ana-nd	Jabal-pur	Rai-pur	Aver-age	Ra-nk	Superi-ority	Aver-age	Ra-nk	Superi-ority
HFO-611	123.7	282.1	582.9	278.0	219.9	310.2	299.5	3	16.6	241.0	3	12.8
OL-1876-2	127.8	352.4	630.4	369.0	106.6	368.5	325.8	2	26.8	244.1	2	14.3
JHO-17-5	118.5	272.6	497.0	174.0	146.6	287.4	249.4	6		207.3	6	
JHO-17-4	114.8	132.2	355.2	181.0	73.3	140.4	166.1	9		149.1	9	
OL-1906	114.1	281.0	467.2	249.0	81.3	228.9	236.9	8		205.3	8	
JO-10-506	111.5	314.7	549.3	259.0	122.6	300.0	276.2	4	7.5	234.9	4	10.0
HFO-608	121.8	356.3	573.8	308.0	294.5	379.3	338.9	1	31.9	259.3	1	21.4
UPO-212 (NC)	125.5	286.5	564.2	270.0	92.0	203.0	256.9	5		213.6	5	
JHO-822 (NC)	117.4	285.8	453.3	226.0	98.6	256.3	239.6	7		207.0	7	
Mean	**119.5**	**284.9**	**519.3**	**257.1**	**137.3**	**274.9**	**265.5**			**218.0**		
CD at 5%	7.8	36.4	143.5	47.1	30.3	59.8						
CV%	4.5	7.4	15.8	10.6	12.8	12.8						

Table 10.2 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Dry Matter Yield (q/ha)

Entries	North West Zone							North East Zone					
	Ludh-iana	His-ar	Bika-ner	Pant-nagar	Aver-age	Ra-nk	Superi-ority%	Jor-hat	Bhuban-eswar	Faiza-bad	Aver-age	Ra-nk	Superi-ority%
HFO-611	43.6	25.5	27.9	33.3	32.6	1	14.0	50.3	43.1	31.8	41.7	3	
OL-1876-2	50.3	19.7	23.5	31.2	31.2	2	9.1	50.7	41.6	27.7	40.0	6	
JHO-17-5	31.3	20.3	23.7	21.5	24.2	8		43.6	53.5	27.5	41.6	4	
JHO-17-4	19.8	13.9	17.8	16.5	17.0	9		35.6	40.7	23.8	33.4	8	
OL-1906	43.1	22.8	21.6	19.7	26.8	6		41.8	55.5	25.3	40.8	5	
JO-10-506	42.9	22.8	25.3	24.7	28.9	4	1.0	47.4	65.3	32.2	48.3	1	15.8
HFO-608	44.6	25.9	30.6	22.5	30.9	3	8.0	49.8	48.3	29.6	42.6	2	2.2
UPO-212 (NC)	36.1	22.3	25.4	18.7	25.6	7		51.3	46.6	27.0	41.7	3	
JHO-822 (NC)	37.4	23.7	24.9	28.3	28.6	5		41.5	40.6	32.3	38.1	7	
Mean	**38.8**	**21.9**	**24.5**	**24.0**	**27.3**			**45.8**	**48.4**	**28.6**	**40.9**		
CD at 5%	22.5	6.4	6.8	3.1				2.3	0.4	5.8			
CV%	9.2	17.2	16.2	7.3				6.6	7.0	11.9			

Table 10.2 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Dry Matter Yield (q/ha)

Entries	Central Zone									All India		
	Jha-nsi	Rah-uri	Urulikan-chan	Ana-nd	Jabal-pur	Rai-pur	Aver-age	Ra-nk	Superi-ority%	Aver-age	Ra-nk	Superi-ority
HFO-611	22.8	66.4	92.1	34.8	40.1	58.2	52.4	3	13.2	43.8	2	12.6
OL-1876-2	20.1	74.9	101.5	40.6	19.2	66.3	53.8	2	16.2	43.6	3	12.1
JHO-17-5	25.5	61.0	77.3	23.3	26.7	48.7	43.8	7		37.2	8	
JHO-17-4	27.3	34.4	51.6	21.2	13.2	27.3	29.2	9		26.4	9	
OL-1906	26.3	64.3	78.5	31.9	14.5	42.6	43.0	8		37.5	7	
JO-10-506	25.6	71.8	76.9	31.4	22.1	56.9	47.5	4	2.6	42.0	4	8.0
HFO-608	16.8	76.1	79.3	37.9	53.9	69.2	55.5	1	19.9	45.0	1	15.7
UPO-212 (NC)	26.3	64.1	101.7	31.5	16.5	37.8	46.3	5		38.9	5	
JHO-822 (NC)	29.0	60.7	85.3	26.7	17.7	48.1	44.6	6		38.2	6	
Mean	**24.4**	**63.8**	**82.7**	**31.0**	**24.9**	**50.1**	**46.2**			**39.2**		
CD at 5%	2.9	8.0	23.4	5.7	5.4	12.6						
CV%	1.7	7.3	16.2	10.6	12.6	13.0						

Table 10.3 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	Faiza-bad	Rah-uri	Urulikan-chan	Ana-nd	Rai-pur	Aver-age	Ra-nk
HFO-611	2.66	2.87	1.98	4.50	3.94	3.66	2.19	4.55	10.6	4.1	4.85	4.17	4
OL-1876-2	2.86	2.43	1.70	3.85	4.20	3.58	1.97	5.68	11.5	5.4	5.76	4.45	2
JHO-17-5	1.77	2.49	1.91	2.65	3.73	4.76	1.93	4.40	9.0	2.6	4.49	3.61	8
JHO-17-4	1.13	1.73	1.11	1.96	3.52	3.33	1.76	2.13	6.5	2.7	2.19	2.54	9
OL-1906	2.48	2.72	1.64	2.59	3.87	5.20	1.76	4.53	8.5	3.7	3.58	3.68	6
JO-10-506	2.67	2.91	2.03	3.09	4.42	5.47	2.15	5.08	10.0	3.8	4.69	4.21	3
HFO-608	2.82	3.36	2.62	2.89	4.22	4.48	2.00	5.75	10.4	4.5	5.93	4.46	1
UPO-212 (NC)	2.15	2.58	1.76	2.67	4.03	4.08	1.89	4.62	10.3	4.0	3.17	3.74	5
JHO-822 (NC)	2.21	2.81	2.06	3.87	3.67	3.44	2.15	4.61	8.2	3.3	4.00	3.67	7
Mean	**2.31**	**2.66**	**1.87**	**3.12**	**3.95**	**4.22**	**1.98**	**4.59**	**9.44**	**3.78**	**4.30**	**3.84**	

Table 10.4 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	Faiza-bad	Bhuban-eswar	Rah-uri	Urulikan-chan	Ana-nd	Rai-pur	Aver-age	Ra-nk
HFO-611	0.58	0.31	0.35	0.56	0.77	0.51	0.78	1.07	1.67	0.51	0.62	0.70	3
OL-1876-2	0.67	0.24	0.30	0.52	0.78	0.45	0.76	1.21	1.85	0.60	0.69	0.73	1
JHO-17-5	0.42	0.25	0.30	0.35	0.67	0.44	0.97	0.98	1.41	0.34	0.49	0.60	6
JHO-17-4	0.26	0.17	0.23	0.28	0.55	0.38	0.74	0.55	0.94	0.31	0.29	0.43	7
OL-1906	0.57	0.28	0.27	0.32	0.64	0.41	1.01	1.04	1.43	0.47	0.45	0.63	5
JO-10-506	0.57	0.28	0.32	0.41	0.73	0.52	1.19	1.16	1.40	0.46	0.61	0.70	3
HFO-608	0.59	0.32	0.39	0.38	0.77	0.48	0.88	1.23	1.44	0.56	0.73	0.71	2
UPO-212 (NC)	0.48	0.28	0.32	0.31	0.79	0.43	0.85	1.03	1.85	0.46	0.40	0.65	4
JHO-822 (NC)	0.50	0.29	0.32	0.47	0.64	0.52	0.74	0.98	1.55	0.39	0.51	0.63	5
Mean	**0.52**	**0.27**	**0.31**	**0.40**	**0.70**	**0.46**	**0.88**	**1.03**	**1.50**	**0.46**	**0.53**	**0.64**	

Table 10.5 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Crude Protein Yield (q/ha)

Entries	Ludh-iana	His-ar	Bika-ner	Jor-hat	Bhuban-eswar	Faiza-bad	Rah-uri	Urulikan-chan	Ana-nd	Jabal-pur	Rai-pur	Aver-age	Ra-nk
HFO-611	5.3	3.0	4.0	5.2	3.5	2.6	4.6	8.6	5.0	3.3	2.8	4.4	2
OL-1876-2	6.3	2.5	3.7	4.8	3.4	2.2	5.7	9.8	5.5	1.5	3.0	4.4	2
JHO-17-5	4.5	1.8	4.0	3.8	4.6	2.2	4.7	7.1	3.4	2.1	2.5	3.7	4
JHO-17-4	3.0	1.3	3.4	3.4	3.0	1.9	3.0	4.8	3.8	1.1	1.4	2.7	6
OL-1906	4.2	2.5	2.8	4.1	4.6	2.1	4.2	7.4	4.5	1.1	2.3	3.6	5
JO-10-506	5.0	1.3	3.4	4.4	5.2	2.3	4.1	6.3	5.4	1.9	3.1	3.8	3
HFO-608	5.4	2.9	3.8	5.1	4.3	2.4	5.2	7.3	5.1	4.4	3.5	4.5	1
UPO-212 (NC)	4.1	3.1	4.3	4.8	3.9	2.2	3.6	9.2	4.8	1.3	2.0	3.9	3
JHO-822 (NC)	3.9	2.7	5.0	4.0	3.3	2.6	3.7	7.4	4.1	1.5	2.5	3.7	4
Mean	**4.6**	**2.3**	**3.8**	**4.4**	**4.0**	**2.3**	**4.3**	**7.5**	**4.6**	**2.0**	**2.6**	**3.9**	

Table 10.6 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Crude Protein (%)

Entries	Ludh-iana	His-ar	Bika-ner	Jor-hat	Bhuban-eswar	Faiza-bad	Rah-uri	Urulikan-chan	Ana-nd	Jabal-pur	Rai-pur	Aver-age	Ra-nk
HFO-611	12.1	11.2	14.2	10.5	8.1	8.3	7.0	9.3	14.4	8.3	4.8	9.8	4
OL-1876-2	12.6	12.2	15.7	9.6	8.3	7.8	7.6	9.7	13.5	8.3	4.5	10.0	3
JHO-17-5	14.3	10.6	16.9	8.7	8.5	8.0	7.7	9.2	14.7	8.3	5.1	10.2	2
JHO-17-4	15.1	11.2	19.1	9.8	7.3	8.1	8.8	9.4	17.7	8.2	5.1	10.9	1
OL-1906	9.8	12.7	12.9	9.9	8.3	8.2	6.6	9.5	14.0	8.2	5.4	9.6	6
JO-10-506	11.6	6.4	13.4	9.4	8.0	8.4	5.7	8.2	17.3	8.3	5.4	9.3	7
HFO-608	12.0	12.4	12.5	10.4	8.8	8.0	6.8	9.2	13.4	8.4	5.1	9.7	5
UPO-212 (NC)	11.3	12.8	16.8	9.5	8.4	8.2	5.7	9.0	15.1	8.3	5.3	10.0	3
JHO-822 (NC)	10.4	12.4	20.0	9.7	8.1	8.5	6.1	8.7	15.4	8.3	5.2	10.2	2
Mean	**12.1**	**11.3**	**15.7**	**9.7**	**8.2**	**8.2**	**6.9**	**9.1**	**15.1**	**8.3**	**5.1**	**10.0**	

Table 10.7 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Plant Height (cm)

Entries	Ludh-iana	His-ar	Bika-ner	Pant-nagar	Udai-pur	Jor-hat	Bhuban-eswar	Faiza-bad	Jha-nsi	Rah-uri	Urulikan-chan	Ana-nd	Rai-pur	Aver-age	Ra-nk
HFO-611	110.4	91.7	92.0	40.0	145.7	91.7	105.4	98.5	149.8	48.1	56.7	103.1	93.4	94.4	2
OL-1876-2	118.5	75.8	75.0	43.0	137.2	101.5	95.7	89.5	154.3	60.3	64.6	107.5	98.9	94.0	4
JHO-17-5	72.6	80.1	60.0	30.0	123.2	82.7	119.2	94.3	151.7	60.5	58.7	92.4	82.7	85.2	7
JHO-17-4	65.1	55.2	32.0	20.0	114.0	72.3	97.2	78.5	137.9	28.8	40.9	84.8	48.6	67.3	8
OL-1906	82.4	82.1	69.0	30.0	143.0	88.4	123.5	105.3	158.7	61.8	53.3	96.7	98.4	91.7	5
JO-10-506	115.4	74.2	67.0	39.0	131.1	97.2	127.7	116.0	135.8	69.7	68.4	99.6	82.4	94.1	3
HFO-608	120.7	85.6	94.0	36.0	131.8	101.6	116.9	89.5	144.0	69.0	64.8	103.6	99.1	96.7	1
UPO-212 (NC)	93.1	92.2	70.0	40.0	147.4	95.2	109.6	103.5	155.0	44.9	57.2	100.9	83.3	91.7	5
JHO-822 (NC)	92.6	82.6	94.0	39.0	117.3	88.8	93.7	118.5	132.2	51.1	51.8	95.8	83.4	87.8	6
Mean	**96.8**	**79.9**	**72.6**	**35.2**	**132.3**	**91.1**	**109.9**	**99.3**	**146.6**	**54.9**	**57.4**	**98.3**	**85.6**	**89.2**	

Table 10.8 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Leaf Stem Ratio

Entries	Ludh-iana	His-ar	Bika-ner	Pant-nagar	Jor-hat	Bhuban-eswar	Faiza-bad	Rah-uri	Urulikan-chan	Ana-nd	Rai-pur	Aver-age	Ra-nk
HFO-611	2.40	1.41	1.20	1.39	1.07	0.91	0.71	1.30	1.11	1.17	0.81	1.23	2
OL-1876-2	2.80	1.34	1.08	1.37	1.00	0.84	0.72	0.96	0.83	1.08	0.65	1.15	5
JHO-17-5	2.60	1.76	1.44	1.25	0.94	1.16	0.70	0.92	0.99	1.00	0.68	1.22	3
JHO-17-4	2.90	2.10	1.50	1.33	1.56	0.72	0.71	2.33	1.85	1.22	1.42	1.60	1
OL-1906	2.80	1.73	1.38	1.13	0.64	1.21	0.69	1.00	1.08	0.82	0.69	1.20	4
JO-10-506	2.50	1.46	1.35	1.40	1.59	1.27	0.76	0.72	0.76	1.13	0.60	1.23	2
HFO-608	2.70	1.48	0.84	1.29	0.62	1.06	0.73	0.85	0.87	0.67	0.75	1.08	8
UPO-212 (NC)	2.10	1.34	1.05	1.50	0.56	0.98	0.69	1.30	0.98	1.00	0.89	1.13	7
JHO-822 (NC)	2.20	1.51	0.90	1.55	1.18	0.79	0.75	1.00	1.11	0.82	0.74	1.14	6
Mean	**2.56**	**1.57**	**1.19**	**1.36**	**1.02**	**0.99**	**0.72**	**1.15**	**1.06**	**0.99**	**0.80**	**1.22**	

Table 10.9 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): ADF (%), NDF (%) & IVDMD (%)

Entries	ADF (%)		NDF (%)		IVDMD (%)				DDM (q/ha)	
	Ludhiana	Rank	Ludhiana	Rank	Ludhiana	Hisar	Average	Rank	Hisar	Rank
HFO-611	31.4	3	44.6	2	66.2	66.0	66.1	1	17.3	1
OL-1876-2	32.2	5	45.0	5	67.9	64.2	66.1	1	13.0	6
JHO-17-5	30.5	2	44.8	3	68.1	62.6	65.4	3	10.3	8
JHO-17-4	29.3	1	43.9	1	70.3	59.4	64.9	5	6.8	9
OL-1906	34.9	9	48.9	8	62.1	64.6	63.4	6	12.6	7
JO-10-506	32.9	6	46.2	6	66.4	64.6	65.5	2	13.1	5
HFO-608	31.8	4	44.9	4	66.9	63.0	65.0	4	15.0	2
UPO-212 (NC)	33.1	7	47.1	7	64.6	59.4	62.0	7	14.3	3
JHO-822 (NC)	34.1	8	46.2	6	62.9	60.4	61.7	8	13.3	4
Mean	**32.2**		**45.7**		**66.2**	**62.7**	**64.4**		**12.9**	

Table 10.10 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Seed Yield (q/ha)

Entries	Ludh-iana	His-ar	Bika-ner	Pant-nagar	Udai-pur	Jor-hat	Faiza-bad	Jha-nsi	Rah-uri	Urulikan-chan	Jabal-pur	Rai-pur	**Bhuban-eswar	**Ana-nd	Aver-age	Ra-nk
HFO-611	20.2	20.6	8.6	28.9	36.1	14.3	19.7	12.8	14.8	23.5	27.1	12.9	6.9	2.3	20.0	6
OL-1876-2	15.4	15.3	12.6	11.1	21.1	14.1	17.2	14.4	16.7	19.7	35.6	16.4	7.7	0.6	17.5	8
JHO-17-5	18.3	16.2	16.1	14.4	20.1	13.4	16.0	9.8	12.8	17.6	39.9	16.4	8.7	0.5	17.6	7
JHO-17-4	31.6	21.1	20.9	22.2	35.7	14.1	16.8	11.9	23.8	40.5	23.4	21.2	8.3	7.9	23.6	2
OL-1906	22.1	17.9	10.4	28.9	28.2	14.4	14.7	15.0	21.6	35.2	33.2	19.8	9.9	1.1	21.8	3
JO-10-506	25.7	12.0	14.3	32.2	29.5	12.6	12.5	13.7	18.8	26.1	31.7	15.9	9.5	3.7	20.4	5
HFO-608	17.2	13.3	5.4	11.1	12.9	9.2	14.7	14.8	18.3	18.7	36.7	12.4	9.2	0.9	15.4	9
UPO-212 (NC)	24.4	22.6	16.4	33.3	34.0	11.9	17.7	13.9	19.5	21.3	28.6	15.3	7.4	1.9	21.6	4
JHO-822 (NC)	27.3	21.3	25.1	23.3	39.4	14.3	18.0	18.5	20.2	29.9	33.0	20.2	8.1	1.0	24.2	1
Mean	**22.5**	**17.8**	**14.4**	**22.8**	**28.6**	**13.1**	**16.4**	**13.9**	**18.5**	**25.8**	**32.1**	**16.7**	**8.4**	**2.2**	**20.2**	
CD at 5%		5.1	4.0	4.9	4.4	1.1	2.1	6.1	3.0	2.8	6.7	2.7	0.1	0.6		
CV%		16.9	16.1	12.8	9.1	6.0	7.2	3.5	9.4	6.1	12.0	9.5	4.5	15.1		

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

Table 11.1 AVT-1 Oat (Dual): Advanced Varietal Trial in Oat (Dual): Green Forage Yield (q/ha)

Entries	North East Zone						Central Zone								All India	
	Jor-hat	Bhuban-eswar	Faiza-bad	Aver-age	Ra-nk	Superi-ority%	Jha-nsi	Rah-uri	Urulikan-chan	Ana-nd	Rai-pur	**Jabal-pur	Aver-age	Ra-nk	Aver-age	Ra-nk
OL-1769	220.7	290.3	140.6	217.2	1	0.46	218.5	216.8	480.4	434.0	193.8	94.0	308.7	2	274.4	2
JO-10-501	205.4	184.5	125.7	171.9	7		207.4	203.4	533.8	293.0	109.1	298.0	269.3	6	232.8	6
OL-1871	201.9	221.0	112.4	178.4	6		181.5	187.1	474.4	378.0	158.8	86.0	275.9	5	239.4	5
HFO-619	213.8	243.0	102.9	186.5	5		190.7	187.5	416.8	351.0	120.2	61.0	253.3	7	228.2	7
UPO-212 (NC)	219.0	209.0	156.3	194.7	3		200.0	208.4	511.3	353.0	134.5	106.0	281.4	4	248.9	4
JHO-822 (NC)	193.5	264.2	118.1	191.9	4		251.8	192.5	413.8	408.0	178.5	232.3	288.9	3	252.5	3
RO-19 (NC)	229.4	280.0	139.1	216.2	2		266.6	294.5	487.3	564.0	285.4	156.0	379.6	1	318.3	1
Mean	**212.0**	**241.7**	**127.8**	**193.8**			**216.6**	**212.9**	**474.0**	**397.3**	**168.6**	**147.6**	**293.9**		**256.4**	
CD at 5%	2.8	2.4	20.4				6.6	14.3	85.0	103.3	34.1	30.1				
CV%	4.1	5.5	9.0				3.7	3.8	7.1	14.6	11.8	11.1				

Note: ** Not Included in zonal and all India average due to low yield of data

Table 11.2 AVT-1 Oat (Dual): Advanced Varietal Trial in Oat (Dual): Dry Matter Yield (q/ha)

Entries	North East Zone						Central Zone								All India	
	Jor-hat	Bhuban-eswar	Faiza-bad	Aver-age	Ra-nk	Superi-ority%	Jha-nsi	Rah-uri	Urulikan-chan	Ana-nd	Jabal-pur	Rai-pur	Aver-age	Ra-nk	Aver-age	Ra-nk
OL-1769	41.8	60.4	34.6	45.6	1	0.88	20.6	45.6	79.6	52.6	16.8	24.6	40.0	4	41.8	2
JO-10-501	38.3	41.5	28.5	36.1	7		26.0	43.8	77.7	35.4	54.3	15.1	42.1	2	40.1	4
OL-1871	38.4	46.3	27.1	37.3	6		27.8	40.5	74.3	38.9	20.9	21.0	37.2	6	37.3	6
HFO-619	38.1	51.3	23.6	37.6	5		26.8	39.5	53.6	35.8	10.5	13.6	30.0	7	32.5	7
UPO-212 (NC)	43.4	42.9	39.3	41.9	3		26.8	47.3	76.6	40.9	19.1	17.8	38.1	5	39.3	5
JHO-822 (NC)	38.8	54.3	27.4	40.2	4		29.5	41.7	65.6	42.5	42.3	20.6	40.4	3	40.3	3
RO-19 (NC)	41.8	59.9	34.1	45.2	2		23.3	63.2	76.9	63.2	28.3	33.2	48.0	1	47.1	1
Mean	**40.1**	**50.9**	**30.6**	**40.6**			**25.8**	**45.9**	**72.1**	**44.2**	**27.5**	**20.9**	**39.4**		**39.8**	
CD at 5%	2.3	0.6	4.9				2.8	3.1	13.4	11.2	5.4	4.3				
CV%	7.7	6.7	9.1				1.6	3.8	7.4	14.3	11.0	12.1				

Table 11.3 AVT-1 Oat (Dual): Advanced Varietal Trial in Oat (Dual): Green Forage Yield (q/ha/day)

Entries	Jorhat	Bhubaneswar	Faizabad	Jhansi	Rahuri	Urulikanchan	Anand	Raipur	Average	Rank
OL-1769	4.01	5.28	2.30	3.58	3.50	8.74	6.20	3.18	4.60	2
JO-10-501	3.73	3.36	2.06	3.46	3.28	9.71	4.19	1.79	3.95	5
OL-1871	3.67	4.02	1.84	2.79	3.02	8.62	5.40	2.60	3.99	4
HFO-619	3.89	4.42	1.69	3.08	3.02	7.58	5.01	1.97	3.83	6
UPO-212 (NC)	3.98	3.80	2.56	3.08	3.36	9.30	5.04	2.21	4.17	3
JHO-822 (NC)	3.52	4.80	1.93	3.76	3.10	7.52	5.83	2.93	4.17	3
RO-19 (NC)	4.17	5.09	2.28	4.04	4.75	8.86	8.06	4.68	5.24	1
Mean	**3.85**	**4.39**	**2.09**	**3.40**	**3.43**	**8.62**	**5.68**	**2.77**	**4.28**	

Table 11.4 AVT-1 Oat (Dual): Advanced Varietal Trial in Oat (Dual): Dry Matter Yield (q/ha/day)

Entries	Jorhat	Bhubaneswar	Faizabad	Jhansi	Rahuri	Urulikanchan	Anand	**Raipur	Average	Rank
OL-1769	0.76	1.10	0.57	0.34	0.74	1.45	0.75	0.40	0.81	2
JO-10-501	0.70	0.75	0.47	0.43	0.71	1.41	0.51	0.22	0.71	5
OL-1871	0.70	0.84	0.44	0.43	0.65	1.35	0.56	0.26	0.71	5
HFO-619	0.69	0.93	0.38	0.43	0.64	0.98	0.51	0.20	0.65	6
UPO-212 (NC)	0.79	0.78	0.64	0.41	0.76	1.39	0.58	0.22	0.76	3
JHO-822 (NC)	0.71	0.99	0.45	0.44	0.67	1.19	0.61	0.30	0.72	4
RO-19 (NC)	0.76	1.09	0.56	0.35	1.02	1.40	0.90	0.42	0.87	1
Mean	**0.73**	**0.93**	**0.50**	**0.41**	**0.74**	**1.31**	**0.63**	**0.29**	**0.75**	

Table 11.5 AVT-1 Oat (Dual): Advanced Varietal Trial in Oat (Dual): Crude Protein Yield (q/ha)

Entries	Jorhat	Bhubaneswar	Faizabad	Rahuri	Urulikanchan	Anand	Jabalpur	Raipur	Average	Rank
OL-1769	4.3	5.4	2.8	3.8	7.2	7.1	1.3	2.2	4.3	2
JO-10-501	3.8	3.2	2.4	2.6	7.1	5.4	4.4	1.1	3.7	4
OL-1871	3.9	4.1	2.3	3.4	6.2	5.9	1.6	1.5	3.6	5
HFO-619	4.0	4.5	1.9	3.0	4.6	5.3	0.7	0.9	3.1	6
UPO-212 (NC)	4.3	3.9	3.3	2.9	7.0	5.4	1.5	1.4	3.7	4
JHO-822 (NC)	4.0	4.9	2.3	2.7	5.4	5.8	3.4	1.7	3.8	3
RO-19 (NC)	4.2	5.2	2.8	4.0	6.3	8.1	2.3	3.0	4.5	1
Mean	**4.1**	**4.4**	**2.5**	**3.2**	**6.2**	**6.2**	**2.2**	**1.7**	**3.8**	

Table 11.6 AVT-1 Oat (Dual): Advanced Varietal Trial in Oat (Dual): Crude Protein (%)

Entries	Jorhat	Bhubaneswar	Faizabad	Rahuri	Urulikanchan	Anand	Jabalpur	Raipur	Average	Rank
OL-1769	10.3	8.9	8.1	8.3	9.1	13.6	8.1	8.8	9.4	1
JO-10-501	10.1	7.8	8.3	5.9	9.1	15.3	8.2	7.5	9.0	4
OL-1871	10.2	8.8	8.6	8.4	8.4	15.2	8.1	7.0	9.3	2
HFO-619	10.6	8.8	8.0	7.7	8.5	14.9	7.7	6.3	9.0	4
UPO-212 (NC)	9.9	9.0	8.5	6.1	9.1	13.1	8.2	7.7	9.0	4
JHO-822 (NC)	10.5	9.0	8.4	6.6	8.2	13.7	8.2	8.1	9.1	3
RO-19 (NC)	10.1	8.6	8.2	6.3	8.2	12.8	8.2	8.9	8.9	5
Mean	**10.2**	**8.7**	**8.3**	**7.0**	**8.6**	**14.1**	**8.1**	**7.8**	**9.1**	

Table 11.7 AVT-1 Oat (Dual): Advanced Varietal Trial in Oat (Dual): Plant Height (cm)

Entries	Jorhat	Bhubaneswar	Faizabad	Jhansi	Rahuri	Urulikanchan	Anand	Raipur	Average	Rank
OL-1769	95.7	131.5	103.5	118.0	57.4	68.0	124.8	71.7	96.3	1
JO-10-501	83.9	93.8	112.5	144.3	50.5	46.7	108.9	47.5	86.0	4
OL-1871	83.3	98.2	106.5	126.7	44.3	51.9	111.8	56.1	84.8	5
HFO-619	84.0	100.3	99.5	115.0	52.7	57.9	100.0	50.5	82.5	7
UPO-212 (NC)	90.2	95.6	115.5	144.7	40.3	51.7	113.3	56.0	88.4	3
JHO-822 (NC)	80.7	104.1	114.3	100.0	47.4	53.6	104.3	64.2	83.6	6
RO-19 (NC)	96.7	129.6	110.2	108.0	52.8	65.3	118.3	60.8	92.7	2
Mean	**87.8**	**107.6**	**108.9**	**122.4**	**49.3**	**56.4**	**111.6**	**58.1**	**87.8**	

Table 11.8 AVT-1 Oat (Dual): Advanced Varietal Trial in Oat (Dual): Leaf Stem Ratio

Entries	Jorhat	Bhubaneswar	Faizabad	Rahuri	Urulikanchan	Anand	**Raipur	Average	Rank
OL-1769	0.65	1.30	0.68	0.92	1.07	0.67	0.25	0.88	4
JO-10-501	0.84	0.91	0.70	1.08	1.16	1.22	0.34	0.99	2
OL-1871	0.75	0.97	0.72	0.78	1.04	1.00	0.38	0.88	4
HFO-619	0.66	1.09	0.71	1.27	1.13	1.00	0.33	0.98	3
UPO-212 (NC)	1.16	0.94	0.76	1.27	0.96	1.00	0.31	1.02	1
JHO-822 (NC)	0.87	1.14	0.77	1.22	1.04	0.82	0.39	0.98	3
RO-19 (NC)	0.73	1.21	0.75	0.92	0.79	0.67	0.33	0.84	5
Mean	**0.81**	**1.08**	**0.73**	**1.07**	**1.03**	**0.91**	**0.33**	**0.94**	

Note: ** Not Included in zonal and all India average due to low yield of data

Table 11.9 AVT-1 Oat (Dual): Advanced Varietal Trial in Oat (Dual): ADF (%), NDF (%) & IVDMD (%)

Entries	ADF (%)		NDF (%)		IVDMD (%)	
	Rahuri	Rank	Rahuri	Rank	Rahuri	Rank
OL-1769	38.8	6	58.8	3	57.3	6
JO-10-501	42.1	7	65.1	7	57.1	7
OL-1871	37.6	5	60.9	5	60.5	3
HFO-619	36.5	4	60.4	4	58.6	5
UPO-212 (NC)	36.0	3	56.8	2	58.8	4
JHO-822 (NC)	35.7	2	56.8	2	60.9	2
RO-19 (NC)	35.0	1	56.1	1	62.4	1
Mean	**37.4**		**59.3**		**59.4**	

Table 11.10 AVT-1 Oat (Dual): Advanced Varietal Trial in Oat (Dual): Seed Yield (q/ha)

Entries	Jorhat	Faizabad	Jhansi	Rahuri	Urulikanchan	Jabalpur	Raipur	**Bhubaneswar	**Anand	Average	Rank
OL-1769	11.9	14.7	13.9	14.5	18.3	34.2	30.4	8.1	1.5	19.7	4
JO-10-501	9.2	12.9	17.8	14.6	21.0	33.7	25.5	6.8	2.7	19.2	5
OL-1871	10.9	13.4	16.7	8.8	18.3	33.2	21.9	7.3	1.8	17.6	7
HFO-619	11.9	13.4	16.7	16.0	23.6	43.5	37.1	7.7	4.4	23.2	2
UPO-212 (NC)	13.4	13.9	13.9	17.4	24.4	40.5	27.5	6.5	4.3	21.6	3
JHO-822 (NC)	13.9	14.7	19.4	18.2	26.3	34.7	41.7	7.9	2.9	24.1	1
RO-19 (NC)	14.4	12.4	13.1	13.6	14.5	36.9	28.8	8.5	1.7	19.1	6
Mean	**12.2**	**13.6**	**15.9**	**14.7**	**20.9**	**36.7**	**30.4**	**7.5**	**2.7**	**20.6**	
CD at 5%	0.9	1.9	2.9	2.3	9.2	8.0	5.6	0.1	0.7		
CV%	5.7	7.7	1.6	8.8	17.6	12.3	10.7	5.6	14.2		

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

12. VT Lucerne (P) -2016: VARIETAL TRIAL IN LUCERNE (Perennial) - 2016 – 2ND YEAR

(Reference tables 12.1 to 12.8)

The trial was established in 2016 and in second year data of twelve entries including checks were reported by 10 centres in three zones (North West, Central and South zone). The entries are coded and will be decoded after completion of trial.

For green fodder production (q/ha), entry VTLu-13 ranked first followed by VTLu-11 in NWZ; entry VTLu-8 ranked first followed by VTLu-4 in CZ; Entry VTLu-11 ranked first followed by VTLu -3 in south zone. At all India level, VTLu-8 top ranked with average yield of 756.2 q/ha.

Similarly for dry matter yield (q/ha), entry VTLu-2 ranked first followed by VTLu -13 in NWZ. Entry VTLu-1 top ranked in CZ followed by VTLu-8. In South zone entry VTLu-3 top ranked. At all India level VTLu-8 top ranked with average yield of 156.6 q/ha.

For fodder production potential, VTLu-8 for green fodder and dry matter production potential (q/ha/day) was top ranker. For growth parameters, VTLu-8 ranked first for plant height while for leaf stem ratio, entry VTLu-11 was superior.

For quality parameters, entry VTLu-4 (34 q/ha) top ranked for CPY (q/ha). For crude protein entry VTLu-2 (20.7%) ranked first. For ADF%, NDF and IVDMD entry VTLu-6 ranked first.

13. AVT-1 VICIA: FIRST ADVANCED TRIAL IN VICIA

(Reference tables 13.1 to 13.5)

In first advanced trial on Vicia, five entries were evaluated at four centers. For green fodder yield, JVS-4 (242.8q), JVS-1 (240.5q), JVS-2 (228.3 q) showed superiority over the general mean (216.4q). Similarly for dry matter yield, JVS-1 (56.6q), JVS-3 (56.3q) and JVS-2 (51.7q) showed superiority over the general mean (50.4q). For fodder production (q/ha/day), entry JVS-1 ranked first for both green fodder and dry matter. For crude protein yield (q/ha) entry JVS-4 and for crude protein % entry JVS-5 were superior. For plant height, entry JVS-1 was top ranked. For leafiness entry JVS-4 was top ranked. For NDF, ADF and IVDMD entry JVS-5 top ranked.

Table 12.1 VT Lucerne (P)-2016: Varietal Trial in Lucerne (Perennial)-2nd Year: Green Forage Yield (q/ha)

Entries	North West Zone			Central Zone				
	**Bikaner	Ludhiana	Rank	Rahuri	Urulikanchan	Anand	Average	Rank
VTLu-1	58.8	614.2	4	883.1	1375.0	277.0	845.0	3
VTLu-2	96.7	450.0	9	510.8	1057.2	240.0	602.7	8
VTLu-3	159.0	566.7	6	477.2	1322.7	248.0	682.7	5
VTLu-4	127.8	502.5	7	739.5	1668.7	230.0	879.4	2
VTLu-6	194.2			122.5	1055.6	59.0	412.4	11
VTLu-7	81.1	466.7	8	407.3	1270.0	117.0	598.1	9
VTLu-8	138.5	681.7	3	980.6	1435.1	223.0	879.6	1
VTLu-9	124.4	397.5	10	548.3	1375.8	144.0	689.4	4
VTLu-10	73.6			59.6	558.8	23.0	213.8	12
VTLu-11	184.3	695.8	2	571.6	1203.4	196.0	657.0	6
VTLu-12	117.3	593.3	5	243.4	1262.3	94.0	533.2	10
VTLu-13	106.2	697.5	1	596.2	1117.7	136.0	616.6	7
Mean	**121.8**	**566.6**		**511.7**	**1225.2**	**165.6**	**634.2**	
CD at 5%	34.8	37.7		93.0	165.8	46.0		
CV%	16.9	9.7		10.7	7.7	16.4		

Note: ** Not included in zonal and all India average due to low yield

Table 12.1 VT Lucerne (P)-2016: Varietal Trial in Lucerne (Perennial)- 2nd Year: Green Forage Yield (q/ha)

Entries	South Zone							All India	
	Hyderabad	Coimbatore	Mandya	Dharwad	**Tirupati	Average	Rank	Average	Rank
VTLu-1	219.4	1153.7	606.8	613.9	29.0	648.4	11	717.9	3
VTLu-2	233.2	1265.5	710.8	586.1	25.4	698.9	6	631.7	9
VTLu-3	244.3	1489.1	605.3	632.8	36.0	742.9	2	698.3	5
VTLu-4	222.1	1204.5	686.1	573.3	27.6	671.5	9	728.4	2
VTLu-6	230.5	1120.8	589.6	547.2	41.9	622.0	12	532.2	11
VTLu-7	238.8	1215.5	776.6	569.7	25.8	700.2	5	632.7	8
VTLu-8	236.0	1293.0	611.7	588.9	23.5	682.4	8	756.2	1
VTLu-9	258.2	1384.9	696.7	571.1	45.4	727.7	3	672.1	6
VTLu-10	263.8	1314.1	453.5	602.5	24.7	658.5	10	467.9	12
VTLu-11	269.3	1448.3	676.2	598.9	43.5	748.2	1	707.4	4
VTLu-12	277.7	1232.7	700.4	604.2	24.8	703.8	4	626.0	10
VTLu-13	266.6	1190.8	650.2	642.8	33.9	687.6	7	662.2	7
Mean	**246.7**	**1276.1**	**647.0**	**594.3**	**31.8**	**691.0**		**652.7**	
CD at 5%	30.1	13.1	99.9	32.7	12.4				
CV%	7.2	0.6	7.4	3.3	0.1				

Note: ** Not included in zonal and all India average due to low yield

Table 12.2 VT Lucerne (P)-2016: Varietal Trial in Lucerne (Perennial) - 2nd Year: Dry Matter Yield (q/ha)

Entries	North West Zone			Central Zone				
	**Bikaner	Ludhiana	Rank	Rahuri	Urulikanchan	Anand	Average	Rank
VTLu-1	19.0	131.4	4	283.2	149.5	67.0	166.6	1
VTLu-2	31.2	154.3	1	164.8	114.8	56.5	112.0	6
VTLu-3	47.1	119.7	6	148.1	133.7	61.8	114.6	5
VTLu-4	39.5	96.5	10	249.0	160.5	56.5	155.4	3
VTLu-6	60.9			34.6	98.4	15.7	49.6	10
VTLu-7	26.3	99.1	9	126.8	125.7	29.5	94.0	8
VTLu-8	43.1	135.9	3	291.3	144.5	54.4	163.4	2
VTLu-9	38.3	116.9	7	170.6	145.3	36.5	117.5	4
VTLu-10	22.2			15.0	72.1	5.7	30.9	11
VTLu-11	54.0	127.8	5	182.0	123.0	47.5	117.5	4
VTLu-12	34.6	111.7	8	78.4	164.0	24.3	88.9	9
VTLu-13	34.0	138.5	2	186.0	99.6	35.1	106.9	7
Mean	**37.5**	**123.2**		**160.8**	**127.6**	**40.9**	**109.8**	
CD at 5%	10.4	24.9		29.7	16.8	11.1		
CV%	16.4	7.1		10.9	8.6	16.1		

Table 12.2 VT Lucerne (P)-2016: Varietal Trial in Lucerne (Perennial) - 2nd Year: Dry Matter Yield (q/ha)

Entries	South Zone							All India	
	Hyderabad	Coimbatore	Mandya	Dharwad	**Tirupati	Average	Rank	Average	Rank
VTLu-1	41.7	267.1	141.0	170.4	9.1	155.0	10	156.4	2
VTLu-2	47.5	289.7	157.4	160.0	8.8	163.6	6	143.1	7
VTLu-3	49.5	371.5	142.5	174.8	13.0	184.6	1	150.2	3
VTLu-4	43.7	281.1	153.6	157.8	9.2	159.0	7	149.8	4
VTLu-6	46.9	262.8	126.2	152.7	15.3	147.1	12	105.3	11
VTLu-7	46.4	280.6	177.6	166.3	8.1	167.7	3	131.5	9
VTLu-8	47.9	299.5	114.1	164.8	7.7	156.6	9	156.6	1
VTLu-9	51.6	334.0	149.9	158.3	14.8	173.4	2	145.4	5
VTLu-10	51.0	304.1	100.2	155.4	7.5	152.7	11	100.5	12
VTLu-11	54.9	354.2	122.5	138.7	14.1	167.6	4	143.8	6
VTLu-12	55.5	281.9	156.4	167.4	9.1	165.3	5	129.9	10
VTLu-13	53.3	271.3	142.7	165.4	11.6	158.2	8	136.5	8
Mean	**49.2**	**299.8**	**140.3**	**161.0**	**10.7**	**162.6**		**137.4**	
CD at 5%	6.9	2.9	25.3	13.7	2.6				
CV%	8.3	0.6	8.7	5.0	0.1				

Table 12.3 VT Lucerne (P)-2016: Varietal Trial in Lucerne (Perennial) - 2nd Year: Green Forage Yield (q/ha/day)

Entries	Ludhiana	Bikaner	Rahuri	Dharwad	**Anand	Average	Rank
VTLu-1	3.40	1.20	2.65	2.05	0.83	2.33	5
VTLu-2	2.50	1.97	1.53	1.95	0.72	1.99	9
VTLu-3	3.10	3.24	1.43	2.11	0.74	2.47	3
VTLu-4	2.70	2.61	2.22	1.91	0.69	2.36	4
VTLu-6		3.96	0.37	1.82	0.18	2.05	8
VTLu-7	2.60	1.66	1.22	1.90	0.35	1.84	10
VTLu-8	3.70	2.83	2.94	1.96	0.67	2.86	1
VTLu-9	2.20	2.54	1.65	1.90	0.43	2.07	7
VTLu-10		1.50	0.18	2.01	0.07	1.23	11
VTLu-11	3.80	3.76	1.72	2.00	0.59	2.82	2
VTLu-12	3.20	2.39	0.73	2.01	0.28	2.08	6
VTLu-13	3.80	2.17	1.79	2.14	0.41	2.47	3
Mean	**3.10**	**2.49**	**1.54**	**1.98**	**0.50**	**2.21**	

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

Table 12.4 VT Lucerne (P)-2016: Varietal Trial in Lucerne (Perennial) - 2nd Year: Dry Matter Yield (q/ha/day)

Entries	Ludhiana	Bikaner	Rahuri	Dharwad	**Anand	Average	Rank
VTLu-1	0.40	0.39	0.85	0.57	0.20	0.55	5
VTLu-2	0.40	0.64	0.49	0.53	0.17	0.52	7
VTLu-3	0.30	0.96	0.44	0.58	0.19	0.57	4
VTLu-4	0.30	0.81	0.75	0.53	0.17	0.60	
VTLu-6		1.24	0.10	0.51	0.05	0.62	2
VTLu-7	0.30	0.54	0.38	0.55	0.09	0.44	9
VTLu-8	0.40	0.88	0.87	0.55	0.16	0.68	1
VTLu-9	0.30	0.78	0.51	0.53	0.11	0.53	6
VTLu-10		0.45	0.05	0.52	0.02	0.34	10
VTLu-11	0.30	1.10	0.55	0.46	0.14	0.60	3
VTLu-12	0.30	0.71	0.24	0.56	0.07	0.45	8
VTLu-13	0.40	0.69	0.56	0.55	0.11	0.55	5
Mean	**0.34**	**0.77**	**0.48**	**0.54**	**0.12**	**0.54**	

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

Table 12.5 VT Lucerne (P)-2016: Varietal Trial in Lucerne (Perennial) - 2nd Year: Crude Protein Yield (q/ha)

Entries	Ludhiana	Rahuri	Urulikanchan	Coimbatore	Mandya	Dharwad	**Bikaner	**Anand	Average	Rank
VTLu-1	18.8	53.9	26.6	29.2	20.4	45.5	2.7	16.8	32.4	2
VTLu-2	12.3	31.0	20.1	32.6	25.5	42.7	5.6	13.3	27.4	4
VTLu-3	11.9	27.2	24.1	44.5	22.5	34.4	8.1	15.0	27.4	4
VTLu-4		40.8	28.9	34.6	25.7	40.1	6.1	13.2	34.0	1
VTLu-6		5.8	17.3	29.8	18.8	39.4	11.5	3.8	22.2	10
VTLu-7	12.4	19.7	21.9	30.9	23.3	44.4	4.3	6.8	25.4	7
VTLu-8	11.6	51.0	26.3	31.7	16.5	43.3	7.1	13.0	30.1	3
VTLu-9	11.6	25.7	25.7	38.0	19.0	38.2	5.4	8.6	26.4	5
VTLu-10		2.5	13.7	37.2	15.8	33.3	3.8	1.4	20.5	11
VTLu-11	10.7	28.1	21.3	42.8	21.0	29.1	7.7	11.6	25.5	6
VTLu-12	14.0	12.7	28.3	33.2	23.3	34.5	5.7	5.8	24.3	8
VTLu-13	13.8	27.7	17.5	34.6	15.7	28.9	5.6	8.1	23.0	9
Mean	**13.0**	**27.2**	**22.6**	**34.9**	**20.6**	**37.8**	**6.1**	**9.8**	**26.6**	

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

Table 12.6 VT Lucerne (P)-2016: Varietal Trial in Lucerne (Perennial) - 2nd Year: Crude Protein (%)

Entries	Ludhiana	Bikaner	Rahuri	Urulikanchan	Anand	Mandya	Coimbatore	Dharwad	Average	Rank
VTLu-1	19.1	14.1	19.0	17.8	25.2	14.4	19.2	26.7	19.4	6
VTLu-2	24.3	17.9	18.8	17.5	24.3	16.2	19.7	26.7	20.7	1
VTLu-3	20.5	17.3	18.4	18.0	24.6	15.8	20.3	19.7	19.3	7
VTLu-4	24.7	15.4	16.4	18.0	24.5	16.6	21.3	25.4	20.3	2
VTLu-6		18.9	16.8	17.6	25.6	14.9	19.7	25.8	19.9	3
VTLu-7	24.9	16.2	15.5	17.4	23.9	13.1	19.3	26.7	19.6	4
VTLu-8	17.0	16.4	17.5	18.2	24.7	14.8	18.3	26.3	19.1	8
VTLu-9	19.8	14.1	15.1	17.7	25.2	12.7	19.3	24.1	18.5	9
VTLu-10		16.9	16.6	19.0	25.1	15.8	20.7	21.4	19.4	6
VTLu-11	16.8	14.2	15.5	17.3	25.1	17.1	20.3	21.0	18.4	10
VTLu-12	25.1	16.4	16.3	17.2	25.2	14.9	20.2	20.6	19.5	5
VTLu-13	19.9	16.5	14.9	17.5	24.8	10.9	21.3	17.5	17.9	11
Mean	**21.2**	**16.2**	**16.7**	**17.8**	**24.9**	**14.8**	**20.0**	**23.5**	**19.3**	

Table 12.7 VT Lucerne (P)-2016: Varietal Trial in Lucerne (Perennial) - 2nd Year: Plant Height (cm)

Entries	Ludhiana	Bikaner	Rahuri	Urulikanchan	Anand	Mandya	Tirupati	Average	Rank
VTLu-1	57.2	47.8	58.5	86.1	70.8	66.5	46.5	61.9	7
VTLu-2	58.8	41.9	50.4	81.6	68.2	69.9	45.7	59.5	9
VTLu-3	57.4	63.4	52.2	79.4	60.1	63.9	44.2	60.1	8
VTLu-4	59.4	55.6	56.0	86.8	70.3	68.1	42.2	62.6	5
VTLu-6		55.6	43.4	74.7	42.9	67.9	50.1	55.8	11
VTLu-7	57.2	43.9	52.5	77.5	65.0	78.8	61.4	62.3	6
VTLu-8	55.2	53.6	64.4	89.2	66.9	68.1	59.4	65.3	1
VTLu-9	60.8	48.8	59.4	80.3	61.7	66.6	64.3	63.1	4
VTLu-10		42.9	52.9	71.4	37.3	62.3	44.0	51.8	12
VTLu-11	63.2	60.5	63.3	80.2	57.3	68.6	58.0	64.4	3
VTLu-12	60.2	42.9	57.3	75.7	59.0	70.5	34.0	57.1	10
VTLu-13	64.0	49.7	67.8	78.2	65.2	69.8	60.1	65.0	2
Mean	**59.3**	**50.5**	**56.5**	**80.1**	**60.4**	**68.4**	**50.8**	**60.7**	

Table 12.8 VT Lucerne (P)-2016: Varietal Trial in Lucerne (Perennial) - 2nd Year: Leaf Stem Ratio

Entries	Ludhiana	Bikaner	Rahuri	Urulikanchan	Mandya	Average	Rank
VTLu-1	1.18	1.76	1.25	0.79	0.55	1.10	2
VTLu-2	0.89	1.56	1.08	0.97	0.55	1.01	4
VTLu-3	1.25	1.27	1.30	0.90	0.44	1.03	3
VTLu-4	0.88	1.29	1.18	0.94	0.40	0.94	6
VTLu-6		1.22	1.46	0.88	0.55	1.03	3
VTLu-7	1.15	1.34	1.20	0.89	0.57	1.03	3
VTLu-8	1.25	1.19	1.01	0.68	0.70	0.97	5
VTLu-9	1.13	1.46	1.00	0.93	0.51	1.01	4
VTLu-10		1.44	0.39	0.89	0.40	0.78	7
VTLu-11	1.12	1.76	1.23	0.97	0.57	1.13	1
VTLu-12	1.05	1.48	1.20	0.88	0.55	1.03	3
VTLu-13	1.23	1.27	1.08	0.83	0.43	0.97	5
Mean	**1.11**	**1.42**	**1.11**	**0.88**	**0.52**	**1.00**	

Table 12.9 VT Lucerne (P)-2016: Varietal Trial in Lucerne (Perennial) - 2nd Year: ADF (%), NDF (%) & IVDMD (%)

Entries	ADF (%)				NDF (%)				IVDMD (%)			
	Ludhiana	Rahuri	Average	Rank	Ludhiana	Rahuri	Average	Rank	Ludhiana	Rahuri	Average	Rank
VTLu-1	28.0	35.8	31.9	10	40.8	46.5	43.7	8	62.2	58.5	60.4	8
VTLu-2	25.9	37.1	31.5	8	40.1	46.3	43.2	7	65.6	59.2	62.4	7
VTLu-3	27.2	24.1	25.7	2	41.4	34.7	38.1	2	63.4	68.4	65.9	3
VTLu-4	26.1	30.8	28.5	5	39.2	40.0	39.6	4	66.1	65.2	65.7	4
VTLu-6		25.3	25.3	1		35.4	35.4	1		66.7	66.7	1
VTLu-7	25.7	27.5	26.6	4	40.3	37.1	38.7	3	66.2	65.3	65.7	4
VTLu-8	28.4	29.6	29.0	6	44.6	39.1	41.9	6	61.7	66.7	64.2	5
VTLu-9	26.8	37.4	32.1	11	42.3	46.7	44.5	10	64.1	60.6	62.4	7
VTLu-10		37.7	37.7	12		49.2	49.2	11		60.2	60.2	9
VTLu-11	27.9	31.0	29.5	7	43.3	39.0	41.2	5	61.7	63.1	62.4	7
VTLu-12	25.9	37.3	31.6	9	39.2	49.1	44.1	9	66.8	60.5	63.7	6
VTLu-13	28.3	23.4	25.9	3	43.6	33.8	38.7	3	63.4	69.1	66.2	2
Mean	**27.0**	**31.4**	**29.6**		**41.5**	**41.4**	**41.5**		**64.1**	**63.6**	**63.8**	

Table 13.1 AVT-1 Vicia: Advanced Varietal Trial in Vicia: Green Forage Yield & Dry Matter Yield (q/ha)

Entries	GFY (q/ha)						DMY (q/ha)					
	Jabalpur	Rahuri	Raipur	Jhansi	Average	Rank	Jabalpur	Rahuri	Raipur	Jhansi	Average	Rank
JVS-1	316.4	140.5	145.8	359.4	240.5	2	60.5	46.8	40.0	79.1	56.6	1
JVS-2	296.6	118.6	185.8	312.2	228.3	3	57.3	37.5	43.3	68.7	51.7	3
JVS-3	182.1	132.3	140.6	290.6	186.4	4	35.1	46.0	33.5	63.9	44.6	4
JVS-4	325.8	146.9	206.4	292.2	242.8	1	63.0	48.2	49.8	64.3	56.3	2
JVS-5	278.9	126.3	141.1	189.4	183.9	5	53.6	42.9	32.5	41.7	42.7	5
Mean	**280.0**	**132.9**	**163.9**	**288.8**	**216.4**		**53.9**	**44.3**	**39.8**	**63.5**	**50.4**	
CD at 5%	46.6	22.0	18.5	10.8			9.0	7.2	7.1	2.3		
CV%	11.2	10.7	7.6	26.8			11.3	10.6	12.0	26.8		

Table 13.2 AVT-1 Vicia: Advanced Varietal Trial in Vicia: GFY (q/ha/day) & DMY (q/ha/day)

Entries	GFY (q/ha/day)					DMY (q/ha/day)				
	Rahuri	Raipur	Jhansi	Average	Rank	Rahuri	Raipur	Jhansi	Average	Rank
JVS-1	1.48	1.84	5.99	3.10	1	0.49	0.51	1.32	0.77	1
JVS-2	1.28	2.35	4.88	2.84	3	0.40	0.55	1.07	0.67	4
JVS-3	1.41	1.78	5.14	2.78	4	0.49	0.42	1.13	0.68	3
JVS-4	1.55	2.61	5.08	3.08	2	0.51	0.63	1.12	0.75	2
JVS-5	1.34	1.79	3.38	2.17	5	0.46	0.41	0.75	0.54	5
Mean	**1.41**	**2.07**	**4.89**	**2.79**		**0.47**	**0.50**	**1.08**	**0.68**	

Table 13.3 AVT-1 Vicia: Advanced Varietal Trial in Vicia : Crude Protein Yield (q/ha) & Crude Protein (%)

Entries	Crude Protein Yield (q/ha)						Crude Protein (%)					
	Rahuri	Raipur	Jabalpur	Jhansi	Average	Rank	Rahuri	Raipur	Jabalpur	Jhansi	Average	Rank
JVS-1	7.5	6.2	9.0	12.7	8.8	2	16.0	15.5	15.1	16.0	15.6	5
JVS-2	7.0	6.9	8.6	10.9	8.4	3	18.8	15.9	15.1	15.9	16.4	4
JVS-3	9.4	5.1	5.0	10.5	7.5	4	20.3	15.1	14.3	16.4	16.5	3
JVS-4	9.7	7.8	9.4	11.4	9.6	1	20.1	15.6	15.2	17.8	17.2	2
JVS-5	9.7	4.9	8.1	7.1	7.5	4	22.7	15.1	15.1	17.1	17.5	1
Mean	**8.7**	**6.2**	**8.0**	**10.5**	**8.3**		**19.6**	**15.4**	**15.0**	**16.6**	**16.7**	

Table 13.4 AVT-1 Vicia: Advanced Varietal Trial in Vicia: Plant Height (CM) & Leaf Stem Ratio

Entries	Plant Height (cm)						Leaf Stem Ratio					
	Jabalpur	Rahuri	Raipur	Jhansi	Average	Rank	Jabalpur	Rahuri	Raipur	Jhansi	Average	Rank
JVS-1	107.9	58.2	79.9	92.7	84.7	1	0.91	0.84	0.72	0.61	0.77	5
JVS-2	100.3	64.6	67.9	102.8	83.9	2	0.94	1.06	0.61	0.50	0.78	4
JVS-3	87.6	63.8	67.6	106.8	81.4	3	0.86	1.16	0.61	0.58	0.80	3
JVS-4	111.1	48.8	61.5	80.3	75.4	5	0.98	1.20	0.79	0.56	0.88	1
JVS-5	105.6	49.4	70.3	91.9	79.3	4	0.92	1.09	0.75	0.57	0.83	2
Mean	**102.5**	**57.0**	**69.5**	**94.9**	**80.9**		**0.9**	**1.1**	**0.7**	**0.6**	**0.8**	

Table 13.5 AVT-1 Vicia: Advanced Varietal Trial in Vicia: ADF (%), NDF (%) & IVDMD (%)

Entries	ADF (%)				NDF (%)				IVDMD (%)	
	Rahuri	Jhansi	Average	Rank	Rahuri	Jhansi	Average	Rank	Rahuri	Rank
JVS-1	33.5	38.6	36.1	4	44.2	53.2	48.7	2	64.1	4
JVS-2	31.9	38.6	35.2	2	47.1	56.4	51.8	4	65.0	3
JVS-3	32.5	39.3	35.9	3	46.6	54.2	50.4	3	65.2	2
JVS-4	34.9	38.8	36.9	5	48.4	52.5	50.4	3	60.9	5
JVS-5	28.7	36.9	32.8	1	43.5	53.7	48.6	1	67.6	1
Mean	**32.3**	**38.4**	**35.4**		**46.0**	**54.0**	**50.0**		**64.6**	

14. AVT-1 LOLIUM: VARIETAL TRIAL IN RYE GRASS (ANNUAL)

(Reference tables 14.1 to 14.5)

In Advanced Varietal Trial-1 on Lolium, three entries were evaluated along with one check at five centers. For green fodder yield, Palam rye grass-2 (4.6%) followed by Palam rye grass -1 (4.5%) showed superiority over the check. For dry matter entry Palam rye grass-2 (5.9%) Palam rye grass -1 (2.8%) were superior over the checks. Other entries showed only marginal superiority over the checks. For both green and dry fodder production potential (q/ha/day) PBRG-2 ranked first.

For CPY (q/ha) and CP (%), entry Palam rye grass-1 ranked first, whereas for ADF %, NDF%, Palam rye grass -2 ranked first. Entry Palam rye grass -1 ranked first for IVDMD %. For plant height and for leafiness Palam rye grass-1 ranked first.

15. VT Red Clover 2016: VARIETAL TRIAL IN RED CLOVER (Perennial) - 2016 – 2ND YEAR

(Reference tables 15.1 to 15.4)

In perennial trial on Red clover, 7 entries were evaluated at four locations in Hill zone of the country. The entries are coded and will be decoded after completion of trial. Entry VTRC-1-3 (275.7q) ranked first followed by VTRC-1-7 (243.4 q) for green fodder yield. Similarly for dry fodder yield, entry VTRC-1-3 (44.6q) ranked first followed by VTRC-1-7 (39.0 q). For crude protein yield, entry VTRC-1-2 and for crude protein (%) entry VTRC-1-4 ranked first. For plant height and leaf stem ratio entry VTRC-1-3 ranked first. For ADF % entry VTRC-1-5 and for NDF% entry VTRC-1-1 ranked first.

16. VT White Clover 2016: VARIETAL TRIAL IN WHITE CLOVER (Perennial) - 2016 – 2ND YEAR

(Reference tables 16.1 to 16.3)

In perennial trial on Red clover, 6 entries were evaluated at four locations in Hill zone of the country. The entries are coded and will be decoded after completion of trial. Entry VTWC-1-6 ranked first for green fodder yield and dry fodder yield showing yield of 100.6 q and 16.7q respectively. For crude protein yield, entries VTWC-1-4 and VTWC-1-5 ranked joint first. For crude protein %, entry VTWC-1-4 (18.7%) ranked first followed by VTWC-1-5 (17.8%). For plant height and leaf stem ratio, first rank was obtained by VTWC-1-2. For NDF and ADF, entry VTWC-1-5 ranked first.

Table 14.1 AVT-1 Lolium-2016: Varietal Trial in Rye grass (Annual): Green Forage Yield (q/ha) & Dry Matter Yield (q/ha)

Entries	GFY (q/ha)								DMY (q/ha)							
	Palam-pur	Sri-nagar	Alm-ora	Baja-ura	Ludh-iana	Aver-age	Ra-nk	Superi-ority%	Palam-pur	Sri-nagar	Alm-ora	Baja-ura	Ludh-iana	Aver-age	Ra-nk	Superi-ority%
Palam rye grass-2	478.0	306.4	136.3	311.7	1050.4	456.6	1	4.6	95.2	57.1	22.8	60.1	126.2	72.3	1	5.9
Palam rye grass-1	454.0	316.9	114.5	335.3	1060.2	456.2	2	4.5	84.0	59.0	20.8	65.4	122.0	70.2	2	2.8
PBRG-2	427.7	298.1	97.9	253.9	1106.7	436.8	3	0.1	82.6	55.5	16.0	53.1	132.8	68.0	4	
PBRG-1 (NC)	436.0	290.5	111.7	263.8	1080.2	436.4	4		82.7	55.9	18.7	54.9	129.5	68.3	3	
Mean	**448.9**	**303.0**	**115.1**	**291.2**	**1074.4**	**446.5**			**86.1**	**56.9**	**19.6**	**58.4**	**127.6**	**69.7**		
CD at 5%	NS	21.5	21.3	23.3	12.3				NS	1.2	3.5	4.3	3.6			
CV%	11.3	8.6	13.3	5.8	7.03				10.4	5.4	12.7	5.4	7.1			

Table 14.2 AVT-1 Lolium-2016: Varietal Trial in Rye grass (Annual): GFY (q/ha/day) & DMY (q/ha/day)

Entries	GFY (q/ha/day)		DMY (q/ha/day)	
	Ludhiana	Rank	Ludhiana	Rank
Palam rye grass-2	5.61	4	0.67	3
Palam rye grass-1	5.67	3	0.65	4
PBRG-2	5.92	1	0.71	1
PBRG-1 (NC)	5.77	2	0.69	2
Mean	**5.74**		**0.68**	

Table 14.3 AVT-1 Lolium-2016: Varietal Trial in Rye grass (Annual): Crude Protein Yield (q/ha) & Crude Protein (%)

Entries	Crude Protein Yield (q/ha)				Crude Protein (%)			
	Palampur	Ludhiana	Average	Rank	Palampur	Ludhiana	Average	Rank
Palam rye grass-2	10.7	18.2	14.4	2	11.2	15.1	13.2	2
Palam rye grass-1	10.1	19.6	14.9	1	12.1	15.4	13.7	1
PBRG-2	9.0	18.7	13.8	3	10.9	14.1	12.5	4
PBRG-1 (NC)	9.5	17.4	13.5	4	11.6	14.0	12.8	3
Mean	**9.8**	**18.5**	**14.2**		**11.4**	**14.7**	**13.0**	

Table 14.4 AVT-1 Lolium-2016: Varietal Trial in Rye grass (Annual): Plant Height (cm) & Leaf Stem Ratio

Entries	Plant Height (cm)						Leaf Stem Ratio				
	Palampur	Srinagar	Bajaura	Ludhiana	Average	Rank	Palampur	Srinagar	Ludhiana	Average	Rank
Palam rye grass-2	72.8	83.7	68.8	39.0	66.1	2	0.62	1.56	2.22	1.47	3
Palam rye grass-1	72.4	84.9	70.8	41.8	67.5	1	0.62	1.61	2.44	1.56	1
PBRG-2	72.8	72.8	68.8	44.0	64.6	4	0.62	1.53	2.33	1.49	2
PBRG-1 (NC)	76.8	75.5	69.8	40.8	65.7	3	0.61	1.50	2.27	1.46	4
Mean	**73.7**	**79.2**	**69.6**	**41.4**	**66.0**		**0.62**	**1.55**	**2.32**	**1.49**	

Table 14.5 AVT-1 Lolium-2016: Varietal Trial in Rye grass (Annual): ADF (%), NDF (%) & IVDMD (%)

Entries	ADF (%)				NDF (%)				IVDMD (%)	
	Ludhiana	Palampur	Average	Rank	Ludhiana	Palampur	Average	Rank	Ludhiana	Rank
Palam rye grass-2	21.0	47.7	34.3	1	36.8	54.2	45.5	1	67.2	2
Palam rye grass-1	21.5	49.2	35.4	3	36.4	54.8	45.6	2	67.4	1
PBRG-2	22.9	48.6	35.8	4	39.2	52.6	45.9	4	65.2	4
PBRG-1 (NC)	22.5	47.8	35.2	2	37.5	53.8	45.7	3	66.4	3
Mean	**22.0**	**48.3**	**35.1**		**37.5**	**53.9**	**45.7**		**66.6**	

Table 15.1 VT Red Clover-2016: Varietal Trial in Red Clover (Perennial) -2nd Year: Green Forage Yield & Dry Matter Yield (q/ha)

Entries	GFY (q/ha)						DMY (q/ha)					
	Palampur	Srinagar	Bajaura	**Almora	Average	Rank	Palampur	Srinagar	Bajaura	**Almora	Average	Rank
VTRC-1-1	88.1	172.4	356.6	36.0	205.7	7	14.5	28.1	58.8	7.2	33.8	7
VTRC-1-2	94.6	193.0	360.6	42.7	216.0	6	16.9	31.6	55.4	6.3	34.6	6
VTRC-1-3	87.4	214.3	525.4	28.8	275.7	1	15.4	34.3	84.0	4.6	44.6	1
VTRC-1-4	92.2	205.3	395.5	45.4	231.0	5	16.7	32.4	63.5	8.2	37.5	3
VTRC-1-5	92.2	171.0	444.6	45.8	235.9	3	15.1	27.3	69.9	7.3	37.4	4
VTRC-1-6	97.6	185.3	418.2	44.0	233.7	4	16.1	29.1	65.6	7.9	36.9	5
VTRC-1-7	95.8		391.1	53.3	243.4	2	16.0		61.9	9.6	39.0	2
Mean	**92.6**	**190.2**	**413.1**	**42.3**	**234.5**		**15.8**	**30.5**	**65.6**	**7.3**	**37.7**	
CD at 5%	NS	12.6	33.7	10.9			NS	1.8	4.8	1.9		
CV%	8.1	9.5	5.6	14.3			11.3	5.3	5.1	14.5		

Note: ** Not included in average due to low yield

Table 15.2 VT Red Clover-2016: Varietal Trial in Red Clover (Perennial) -2nd Year: Crude Protein Yield (q/ha) & Crude Protein (%)

Entries	Crude Protein Yield (q/ha)		Crude Protein (%)	
	Palampur	Rank	Palampur	Rank
VTRC-1-1	2.4	4	16.3	5
VTRC-1-2	3.0	1	17.8	2
VTRC-1-3	2.4	4	16.3	5
VTRC-1-4	3.0	1	18.7	1
VTRC-1-5	2.3	5	16.0	6
VTRC-1-6	2.5	3	16.6	4
VTRC-1-7	2.9	2	17.5	3
Mean	**2.6**		**17.0**	

Table 15.3 VT Red Clover-2016: Varietal Trial in Red Clover (Perennial) -2nd Year: Plant Height (CM) & Leaf Stem Ratio

Entries	Plant Height (CM)					Leaf Stem Ratio			
	Palampur	Srinagar	Bajaura	Average	Rank	Palampur	Srinagar	Average	Rank
VTRC-1-1	47.3	38.8	49.0	45.0	7	0.78	1.53	1.16	5
VTRC-1-2	47.3	43.2	50.4	47.0	3	0.77	1.69	1.23	2
VTRC-1-3	53.5	51.1	53.2	52.6	1	0.80	1.74	1.27	1
VTRC-1-4	44.5	47.1	49.1	46.9	4	0.69	1.77	1.23	2
VTRC-1-5	49.3	37.0	52.3	46.2	5	0.82	1.60	1.21	3
VTRC-1-6	45.3	41.6	48.9	45.3	6	0.75	1.62	1.19	4
VTRC-1-7	48.8		48.7	48.7	2	0.71		0.71	6
Mean	**48.0**	**43.1**	**50.2**	**47.4**		**0.76**	**1.66**	**1.14**	

Table 15.4 VT Red Clover-2016: Varietal Trial in Red Clover (Perennial) -2nd Year: ADF (%) & NDF (%)

Entries	ADF (%)		NDF (%)	
	Palampur	Rank	Palampur	Rank
VTRC-1-1	44.8	7	48.6	1
VTRC-1-2	43.8	4	53.8	5
VTRC-1-3	44.6	6	50.6	2
VTRC-1-4	43.6	3	51.8	3
VTRC-1-5	41.8	1	52.2	4
VTRC-1-6	44.0	5	51.8	3
VTRC-1-7	43.4	2	50.6	2
Mean	**43.7**		**51.3**	

Table 16.1 VT White Clover-2016: Varietal Trial in White Clover (Perennial) -2nd Year: GFY & DMY (q/ha)

Entries	Green Forage Yield (q/ha)						Dry Matter Yield (q/ha)					
	Palampur	Srinagar	Almora	Bajaura	Average	Rank	Palampur	Srinagar	Almora	Bajaura	Average	Rank
VTWC-1-1	62.9	162.5	69.0	103.2	99.4	2	10.8	26.8	15.2	12.9	16.4	3
VTWC-1-2	58.3	187.2	61.0	82.4	97.2	4	10.3	31.4	14.3	10.3	16.6	2
VTWC-1-3	63.5	155.8	53.8	72.1	86.3	6	11.3	26.8	10.8	9.7	14.6	6
VTWC-1-4	60.4	174.0	39.9	104.7	94.7	5	10.6	28.4	8.4	13.2	15.1	5
VTWC-1-5	65.1	167.0	59.9	100.2	98.0	3	10.7	28.4	13.2	12.6	16.2	4
VTWC-1-6	58.3	180.9	62.9	100.3	100.6	1	9.9	30.3	13.9	12.6	16.7	1
Mean	**61.4**	**171.2**	**57.8**	**93.8**	**96.0**		**10.6**	**28.7**	**12.6**	**11.9**	**15.9**	
CD at 5%	NS	15.8	12.9	22.0			NS	1.6	3.1	NS		
CV%	9.1	10.6	15.4	12.9			13.7	6.7	16.1	12.9		

Table 16.2 VT White Clover-2016: Varietal Trial in White Clover (Perennial) -2nd Year: CPY (q/ha), CP (%) Plant Height (CM) & Leaf Stem Ratio

Entries	Crude Protein Yield (q/ha)		Crude Protein (%)		Plant Height (CM)					Leaf Stem Ratio	
	Palampur	Rank	Palampur	Rank	Palampur	Srinagar	Bajaura	Average	Rank	Srinagar	Rank
VTWC-1-1	1.8	2	16.0	5	13.8	28.7	30.5	24.3	5	1.56	4
VTWC-1-2	1.6	4	16.3	4	15.5	39.4	30.7	28.5	1	1.70	1
VTWC-1-3	1.7	3	16.0	5	18.5	25.8	27.1	23.8	6	1.46	6
VTWC-1-4	2.0	1	18.7	1	15.5	32.1	31.8	26.5	3	1.66	2
VTWC-1-5	2.0	1	17.8	2	15.8	30.1	31.1	25.7	4	1.52	5
VTWC-1-6	1.7	3	17.5	3	15.0	34.8	30.2	26.7	2	1.62	3
Mean	**1.8**		**17.1**		**15.7**	**31.8**	**30.2**	**25.9**		**1.59**	

Table 16.3 VT White Clover-2016: Varietal Trial in White Clover (Perennial) -2nd Year: ADF (%) & NDF (%)

Entries	ADF (%)		NDF (%)	
	Palampur	Rank	Palampur	Rank
VTWC-1-1	45.8	6	50.6	3
VTWC-1-2	43.8	2	51.8	5
VTWC-1-3	45.0	5	51.0	4
VTWC-1-4	44.2	3	52.2	6
VTWC-1-5	43.4	1	49.6	1
VTWC-1-6	44.6	4	50.4	2
Mean	**44.5**		**50.9**	

17. **IVT BAJRA (MULTICUT): INITIAL VARIETAL TRIAL IN FODDER BAJRA (MULTICUT) IN SUMMER**

(Reference tables 17.1 to 17.5)

In Initial varietal Trial on summer Bajra multicut, 11 entries were evaluated along with 3 checks (Giant Bajra, Moti Bajra, Raj Bajra Chari) at 07 locations in central and south zone.

For green forage yield (q/ha), MCPMF hybrid 16ADV0061 showed 23.9% and 19.3% superiority over the best check in central zone and both combined zone respectively. For south zone, entry HTBH 4902 (PM0103A X PM0268R) showed 8.9% superiority over the best check. For dry matter yield (q/ha), entry MCPMF hybrid 16ADV0061 showed 31.3% and 22.1% superiority over the best check in central and combined zones respectively. Entry AFB-37 showed 9.7% and 6.8% superiority over the best check in central and combined zones respectively.

For fodder production potential, both GFY and DMY, entry MCPMF hybrid 16ADV0061 ranked first. For Crude protein Yield (q/ha), entry MCPMF hybrid 16ADV0061 ranked first whereas for crude protein %, check Moti Bajra was best. For Plant height, entry TSFMB-17-1 and for leafiness entry JPM-18-1 was best.

Table 17.1 IVT Bajra (Multicut): Initial Varietal Trial in fodder bajra (multicut) in summer: Green Forage Yield (q/ha)

Entries	Central Zone						
	Rahuri	Urulikanchan	Anand	Jabalpur	Average	Rank	Superiority%
MCPMF hybrid 16ADV0061	864.8	888.9	1862.0	760.3	1094.0	1	23.9
TSFMB-17-1	548.3	592.3	951.0	666.5	689.5	12	
JPM-18-1	612.5	611.9	1313.0	591.5	782.2	6	
AFB-38	739.7	643.0	1273.0	552.0	801.9	4	
AFB-37	723.3	679.7	1565.0	514.5	870.6	3	
JPM-18-2	605.3	670.8	1091.0	364.5	682.9	13	
TSFMB-17-3	592.4	810.5	1029.0	487.4	729.8	11	
TSFMB-17-2	726.6	794.1	1095.0	491.5	776.8	7	
BAIF Bajra-4	605.3	503.3	750.0	520.0	594.6	14	
HTBH 4901 (PM022A X PM0267R)	751.2	558.8	1207.0	585.3	775.6	8	
HTBH 4902 (PM0103A X PM0268R)	695.9	585.0	1225.0	531.1	759.2	9	
Giant Bajra (NC)	720.4	732.9	1110.0	570.7	783.5	5	
Moti Bajra (NC)	725.0	882.4	1413.0	510.3	882.7	2	
Raj Bajra Chari (NC)	677.9	649.5	1188.0	500.0	753.8	10	
Mean	**684.9**	**685.9**	**1219.4**	**546.1**	**784.1**		
CD at 5%	97.0	132.4	170.9	105.6			
CV%	8.4	11.4	8.4	11.5			

Table 17.1 IVT Bajra (Multicut): Initial Varietal Trial in fodder bajra (multicut) in summer: Green Forage Yield (q/ha)

Entries	South Zone						Combined 2 zones		
	Hydera-bad	Man-dya	Vella-yani	Aver-age	Ra-nk	Superi-ority%	Aver-age	Ra-nk	Superi-ority%
MCPMF hybrid 16ADV0061	226.7	616.2	250.1	364.3	9		781.3	1	19.3
TSFMB-17-1	388.6	473.0	292.1	384.6	7		558.8	12	
JPM-18-1	439.5	531.6	324.2	431.8	3		632.0	5	
AFB-38	434.9	545.0	204.1	394.7	4		627.4	6	
AFB-37	231.3	454.8	296.8	327.6	13		637.9	4	
JPM-18-2	194.3	448.6	222.3	288.4	14		513.8	13	
TSFMB-17-3	397.9	458.6	315.2	390.6	5		584.4	11	
TSFMB-17-2	231.3	528.2	250.2	336.6	12		588.1	10	
BAIF Bajra-4	388.6	474.1	287.7	383.5	8		504.1	14	
HTBH 4901 (PM022A X PM0267R)	249.8	602.0	314.7	388.8	6		609.8	8	
HTBH 4902 (PM0103A X PM0268R)	573.7	605.7	250.3	476.6	1	8.9	638.1	3	
Giant Bajra (NC)	360.9	466.8	257.1	361.6	10		602.7	9	
Moti Bajra (NC)	231.3	550.0	273.5	351.6	11		655.1	2	
Raj Bajra Chari (NC)	439.5	535.5	338.2	437.7	2		618.4	7	
Mean	**342.0**	**520.7**	**276.9**	**379.9**			**610.9**		
CD at 5%	57.8	67.7	8.4						
CV%	10.0	11.3	1.8						

Table 17.2 IVT Bajra (Multicut): Initial Varietal Trial in fodder bajra (multicut) in summer: Dry Matter Yield (q/ha)

Entries	Central Zone						
	Rahuri	Urulikanchan	Anand	Jabalpur	Average	Rank	Superiority%
MCPMF hybrid 16ADV0061	197.4	172.3	325.8	163.7	214.8	1	31.3
TSFMB-17-1	141.1	121.1	176.1	143.5	145.4	9	
JPM-18-1	129.1	112.9	177.4	127.2	136.6	11	
AFB-38	190.5	125.4	207.3	118.1	160.3	4	
AFB-37	173.3	141.8	293.2	109.7	179.5	2	9.7
JPM-18-2	137.7	115.2	164.4	76.0	123.3	13	
TSFMB-17-3	153.8	163.8	168.5	103.5	147.4	7	
TSFMB-17-2	151.4	135.0	147.9	103.1	134.3	12	
BAIF Bajra-4	132.8	81.1	101.1	111.0	106.5	14	
HTBH 4901 (PM022A X PM0267R)	173.9	106.1	186.3	125.4	147.9	6	
HTBH 4902 (PM0103A X PM0268R)	164.9	116.6	187.2	113.5	145.6	8	
Giant Bajra (NC)	158.5	141.9	148.0	122.2	142.6	10	
Moti Bajra (NC)	154.4	179.9	211.5	108.7	163.6	3	
Raj Bajra Chari (NC)	176.3	128.0	199.5	106.2	152.5	5	
Mean	**159.6**	**131.5**	**192.4**	**116.6**	**150.0**		
CD at 5%	23.1	25.5	30.9	21.2			
CV%	8.6	11.5	9.6	10.8			

Table 17.2 IVT Bajra (Multicut): Initial Varietal Trial in fodder bajra (multicut) in summer: Dry Matter Yield (q/ha)

Entries	South Zone				Combined 2 zones		
	Hyderabad	Vellayani	Average	Rank	Average	Rank	Superiority%
MCPMF hybrid 16ADV0061	43.7	61.7	52.7	13	160.8	1	22.1
TSFMB-17-1	76.8	73.1	75.0	6	121.9	8	
JPM-18-1	94.1	81.0	87.6	3	120.3	10	
AFB-38	97.1	50.9	74.0	7	131.6	4	
AFB-37	52.1	73.9	63.0	10	140.7	2	6.8
JPM-18-2	42.5	55.6	49.1	14	98.6	13	
TSFMB-17-3	87.1	78.5	82.8	4	125.9	7	
TSFMB-17-2	48.3	63.0	55.6	12	108.1	12	
BAIF Bajra-4	86.6	72.7	79.6	5	97.6	14	
HTBH 4901 (PM022A X PM0267R)	50.8	79.7	65.2	9	120.4	9	
HTBH 4902 (PM0103A X PM0268R)	114.6	63.1	88.9	2	126.7	6	
Giant Bajra (NC)	78.7	64.0	71.4	8	118.9	11	
Moti Bajra (NC)	50.7	68.5	59.6	11	128.9	5	
Raj Bajra Chari (NC)	95.7	84.7	90.2	1	131.7	3	
Mean	**72.8**	**69.3**	**71.0**		**123.7**		
CD at 5%	13.6	2.6					
CV%	11.1	2.2					

Table 17.3 IVT Bajra (Multicut): Initial Varietal Trial in fodder bajra (multicut) in summer: Green Forage Yield (q/ha/day) & Dry Matter Yield (q/ha/day)

Entries	GFY (q/ha/day)						DMY (q/ha/day)				
	Rah-uri	Ana-nd	Hydera-bad	Vella-yani	Aver-age	Ra-nk	Rah-uri	Ana-nd	Hydera-bad	Aver-age	Ra-nk
MCPMF hybrid 16ADV0061	7.39	12.75	1.92	2.51	6.14	1	1.69	2.23	0.37	1.43	1
TSFMB-17-1	4.69	6.51	3.29	2.84	4.33	12	1.21	1.21	0.65	1.02	8
JPM-18-1	5.24	8.99	3.72	3.21	5.29	4	1.10	1.22	0.80	1.04	7
AFB-38	6.32	8.72	3.69	2.00	5.18	6	1.63	1.42	0.82	1.29	3
AFB-37	6.18	10.72	1.96	2.88	5.44	2	1.48	2.01	0.44	1.31	2
JPM-18-2	5.17	7.47	1.65	2.27	4.14	13	1.18	1.13	0.36	0.89	11
TSFMB-17-3	5.06	7.05	3.37	3.12	4.65	10	1.31	1.15	0.74	1.07	6
TSFMB-17-2	6.21	7.50	1.96	2.49	4.54	11	1.29	1.01	0.41	0.90	10
BAIF Bajra-4	5.17	5.14	3.29	2.79	4.10	14	1.14	0.69	0.73	0.85	12
HTBH 4901 (PM022A X PM0267R)	6.42	8.27	2.12	3.03	4.96	8	1.49	1.28	0.43	1.07	6
HTBH 4902 (PM0103A X PM0268R)	5.95	8.39	4.86	2.51	5.43	3	1.41	1.28	0.97	1.22	5
Giant Bajra (NC)	6.16	7.60	3.06	2.62	4.86	9	1.35	1.01	0.67	1.01	9
Moti Bajra (NC)	6.20	9.68	1.96	2.73	5.14	7	1.32	1.45	0.43	1.07	6
Raj Bajra Chari (NC)	5.79	8.14	3.72	3.17	5.21	5	1.51	1.37	0.81	1.23	4
Mean	**5.85**	**8.35**	**2.90**	**2.73**	**4.96**		**1.36**	**1.32**	**0.62**	**1.10**	

Table 17.4 IVT Bajra (Multicut): Initial Varietal Trial in fodder bajra (multicut) in summer: Crude Protein Yield (q/ha) & Crude Protein (%)

Entries	CPY (q/ha)						CP (%)					
	Rah-uri	Urulikan-chan	Ana-nd	Jabal-pur	Aver-age	Ra-nk	Rah-uri	Urulikan-chan	Ana-nd	Jabal-pur	Aver-age	Ra-nk
MCPMF hybrid 16ADV0061	15.1	15.9	33.7	13.3	19.5	1	7.7	9.2	10.9	8.1	9.0	6
TSFMB-17-1	10.8	10.6	19.2	11.6	13.0	10	7.7	8.7	10.9	8.1	8.8	7
JPM-18-1	11.6	9.3	18.9	10.2	12.5	11	9.0	8.3	11.0	8.0	9.1	5
AFB-38	13.8	11.3	21.7	9.5	14.1	5	7.2	9.0	10.4	8.0	8.7	8
AFB-37	12.1	13.4	28.9	8.7	15.8	3	7.0	9.4	10.2	7.9	8.7	8
JPM-18-2	10.5	11.1	17.0	5.8	11.1	13	7.7	9.7	11.0	7.6	9.0	6
TSFMB-17-3	13.8	14.0	19.8	8.3	14.0	6	9.0	8.5	12.3	8.0	9.5	3
TSFMB-17-2	12.2	12.4	20.1	8.3	13.3	9	8.1	9.2	13.3	8.1	9.7	2
BAIF Bajra-4	10.5	7.6	13.5	8.9	10.1	14	7.9	9.3	13.8	8.0	9.8	1
HTBH 4901 (PM022A X PM0267R)	16.4	9.0	21.2	10.2	14.2	4	9.4	8.5	11.9	8.1	9.5	3
HTBH 4902 (PM0103A X PM0268R)	13.0	10.1	23.1	9.3	13.9	7	7.9	8.7	12.5	8.2	9.3	4
Giant Bajra (NC)	12.1	12.2	15.2	9.8	12.3	12	7.7	8.6	11.5	8.0	9.0	6
Moti Bajra (NC)	15.9	15.5	26.0	8.7	16.5	2	10.3	8.6	12.1	8.0	9.8	1
Raj Bajra Chari (NC)	13.1	11.1	22.0	8.5	13.7	8	7.4	8.7	11.3	8.0	8.8	7
Mean	**12.9**	**11.7**	**21.4**	**9.4**	**13.9**		**8.1**	**8.9**	**11.6**	**8.0**	**9.2**	

Table 17.5 IVT Bajra (Multicut): Initial Varietal Trial in fodder bajra (multicut) in summer: Plant Height (cm) & Leaf Stem Ratio

Entries	Plant Height (cm)						Leaf Stem Ratio						
	Rah-uri	Ana-nd	Jabal-pur	Vella-yani	Aver-age	Ra-nk	Rah-uri	Urulikan-chan	Ana-nd	Jabal-pur	Vella-yani	Aver-age	Ra-nk
MCPMF hybrid 16ADV0061	110.9	187.0	171.1	117.0	146.5	4	0.58	1.08	0.97	0.87	1.17	0.93	7
TSFMB-17-1	131.6	195.5	158.9	138.0	156.0	1	0.55	1.06	0.76	0.79	0.98	0.83	11
JPM-18-1	99.8	153.6	156.0	120.0	132.3	9	1.48	0.92	1.51	0.80	1.19	1.18	1
AFB-38	115.6	197.9	146.6	129.0	147.3	3	0.47	1.9	1.00	0.82	1.07	1.05	3
AFB-37	127.5	195.4	137.8	135.0	148.9	2	0.55	1.05	0.99	0.72	1.29	0.92	8
JPM-18-2	81.1	154.2	88.4	111.0	108.7	14	1.12	1.1	1.22	0.62	0.96	1.00	5
TSFMB-17-3	128.2	157.5	106.0	133.0	131.2	10	0.56	1.09	1.02	0.83	1.00	0.90	9
TSFMB-17-2	105.5	54.0	118.6	195.0	118.3	13	0.70	1.45	1.13	0.86	1.14	1.06	2
BAIF Bajra-4	100.0	148.9	128.5	124.0	125.4	12	0.71	1.06	0.92	0.68	0.93	0.86	10
HTBH 4901 (PM022A X PM0267R)	97.6	163.4	149.4	136.0	136.6	8	0.77	1.45	0.88	0.76	1.25	1.02	4
HTBH 4902 (PM0103A X PM0268R)	116.8	167.7	136.0	104.0	131.1	11	0.59	1.08	0.94	0.74	1.26	0.92	8
Giant Bajra (NC)	130.5	175.2	155.3	121.0	145.5	5	0.55	0.68	0.76	0.76	0.91	0.73	12
Moti Bajra (NC)	126.4	173.6	136.7	132.0	142.2	6	0.98	0.98	0.75	0.77	1.18	0.93	7
Raj Bajra Chari (NC)	128.4	188.5	118.3	122.0	139.3	7	0.38	1.55	0.85	0.81	1.10	0.94	6
Mean	**114.3**	**165.2**	**136.3**	**129.8**	**136.4**		**0.71**	**1.18**	**0.98**	**0.77**	**1.10**	**0.95**	

Forage Crop Production

The forage crop production programme was executed at 23 locations in five zones. In total 25 experiments were conducted, out of which 12 were in network (10 coordinated and 2 AVT based) and 13 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 hydroponic fodder production, production potential of annual rye grass with berseem in Hill Zone, carbon sequestration potential of perennial grass based cropping and supplementation of forage crops with micronutrients has also been covered. The results of studies on planting geometry of tall fescue grass and white clover in wet temperate conditions, feasibility of oat - *Lathyrus* intercropping system, techniques for enhancing seed productivity of fodder oat and lucerne has also been presented in the chapter. The results of trials on influence of nature of vegetative propagules on bajra napier hybrids and standardization of seed production techniques in fodder maize etc. has also been compiled in the chapter. The salient research achievements of the forage crop production trials during Rabi 2017-18 are as follows:

A. ON GOING COORDINATED TRIALS

PS-14-AST-4: **Studies on planting geometry of tall fescue grass and seed rates of white clover in wet temperate conditions** **[Table Reference: PS-14-AST-4 (a)-(c)]**

Locations: Palampur and Srinagar

The experiment was started during *Rabi* 2014-15 at Palampur and Srinagar centre in coordinated mode to evaluate the productivity, quality and compatibility of tall fescue grass planted at different spacing with variable seed rates of white clover in wet temperate conditions. All possible combinations of three spacing of fescue grass (20cm x 30cm; 30 cm x 0 cm and 40 cm x 40 cm) and three seed rate of white clover (1.0, 2.0 and 3.0 kg/ha) with sole stand of tall fescue grass (30cm x 30 cm) and white clover (6 kg/ha sown by broadcast) were evaluated in randomised block design. In the treatments comprising of tall fescue grass + white clover, the legume was over sown by broadcast in tall fescue after transplanting of this grass. The treatments are as under;

Code	Treatments	Code	Treatments
T_1	TFG 20x30 cm + WC 1.0 Kg/ha	T_7	TFG 40x40 cm + WC 1.0 Kg/ha
T_2	TFG 20x30 cm + WC 2.0 Kg/ha	T_8	TFG 40x40 cm + WC 2.0 Kg/ha
T_3	TFG 20x30 cm + WC 3.0 Kg/ha	T_9	TFG 40x40 cm + WC 3.0 Kg/ha
T_4	TFG 30x30 cm + WC 1.0 Kg/ha	T_{10}	Sole TFG 30 x 30 cm
T_5	TFG 30x30 cm + WC 2.0 Kg/ha	T_{11}	Sole WC 6.0 kg/ha
T_6	TFG 30x30 cm + WC 3.0 Kg/ha		
TFG- Tall fescue grass		WC- White clover	

The results indicated that, the performance of crops in terms of growth and herbage yield was better at Srinagar than Palampur. The response of treatments was similar at both the locations. T_6- tall fescue grass at 30 x 30 cm + white clover @ 3 kg/ha produced higher green, dry forage and crude protein yields and was closely followed by T_5-planting of tall fescue grass at 30 x 30 cm + white clover @ 2 kg/ha. T_6 produced 27.18 % and 30.06 % more green forage over sole tall fescue grass and white clover, respectively. The respective increase in dry forage yield was 21.67 %, 68.65 %. In terms of crude protein yield T_6 was followed by T_5, T_8, T_{11} and T_4.At Palampur higher net returns and B: C ratio was observed in T_9. Inclusion of white clover in the system resulted in an improvement in soil nitrogen content.

Table PS-14-AST-4 (a): Effect on on yield, quality and economics of system

Treatment	Yield (q/ha)									Crude protein content (%)			Net returns (Rs./ha)	B:C ratio
	Green fodder			Dry fodder			Crude protein							
	Palam-pur	Sri-nagar	Mean	Palam-pur	Sri-nagar	Mean	Palam-pur	Sri-nagar	Mean	Palam-pur	Sri-nagar	Mean	Palam-pur	
T_1	308.2	345.6	326.9	82.74	84.5	83.62	11.83	10.05	10.94	14.3	11.9	13.1	59136	3.30
T_2	310.5	351.2	330.8	74.51	81.6	78.06	11.77	9.95	10.86	15.8	12.2	14.00	58679	3.10
T_3	318.7	355.4	337.1	70.12	83.0	76.56	11.15	10.70	10.93	15.9	12.9	14.4	60794	3.22
T_4	298.5	348.7	323.6	74.62	87.9	81.26	11.79	10.54	11.17	15.8	12.0	13.9	55686	2.94
T_5	314.6	364.8	339.7	78.53	88.8	83.67	12.72	11.01	11.87	16.2	12.4	14.3	59208	3.05
T_6	324.6	375.4	350.0	77.90	97.6	87.75	12.62	12.68	12.65	16.2	13.0	14.6	61742	3.18
T_7	280.1	340.2	310.2	67.23	80.4	73.82	10.69	9.65	10.17	15.9	12.0	13.95	52313	2.95
T_8	308.5	345.8	327.1	70.95	82.5	76.73	11.85	11.55	11.70	16.7	14.0	15.35	58225	3.08
T_9	324.6	347.2	335.9	64.92	83.9	74.41	11.10	11.07	11.09	17.1	13.2	15.15	62243	3.29
T_{10}	224.8	325.6	275.2	58.44	85.8	72.12	5.61	10.12	7.87	9.6	11.8	10.7	40611	2.61
T_{11}	252.5	285.7	269.1	45.45	58.6	52.03	8.73	14.58	11.66	19.2	17.0	18.1	47246	2.98
SE(m) ±	5.98	5.27	-	2.41	1.52	-	0.36	0.35	-	0.3	0.3	-	-	-
C.D. (P=0.05)	17.58	15.30	-	7.08	4.42	-	1.06	1.02	-	0.9	0.8	-	-	-

TFG- Tall fescue grass, WC- White clover

Table PS-14-AST-4 (b): Effect on planting on growth of species

Treatment	Plant height (cm)						L:S Ratio (Palampur)		% proportion of species (Palampur)	
	Tall fescue grass			White clover						
	Palampur	Srinagar	Mean	Palampur	Srinagar	Mean	TFG	WC	TFG	WC
T_1	58.9	84.3	71.6	25.8	43.5	34.7	1.48	1.68	64.8	35.2
T_2	58.1	75.6	66.85	26.8	48.2	37.5	1.71	1.71	58.6	41.4
T_3	55.4	86.8	71.1	26.7	47.0	36.9	1.91	1.78	57.6	42.4
T_4	56.4	77.5	66.95	26.7	50.3	38.5	1.58	1.64	60.2	39.8
T_5	57.8	79.2	68.5	25.8	50.2	38.0	1.81	1.62	56.7	43.3
T_6	61.8	83.6	72.7	26.7	51.8	39.3	1.98	1.74	55.4	44.6
T_7	56.7	81.8	69.25	28.4	48.6	38.5	1.54	1.74	58.2	41.8
T_8	56.8	75.3	66.05	28.4	48.7	38.6	1.41	1.81	54.6	45.4
T_9	56.3	77.3	66.8	27.6	50.1	38.9	1.71	1.69	51.8	48.2
T_{10}	52.2	70.5	61.35	-	-	-	1.69	-	100	0
T_{11}	-	-	-	25.8	53.4	39.6	1.48	1.78	0	100
SE(m) ±	1.8	1.35	-	1.4	0.9	-	0.06	0.07	5.2	2.1
C.D. (P=0.05)	5.5	3.96	-	4.1	2.6	-	0.18	0.19	15.3	6.2

TFG- Tall fescue grass, WC- White clover

Table PS-14-AST-4 (c): Effect on soil properties (Palampur)

Treatment	N (kg/ha)	P (kg/ha)	K (kg/ha)	pH	Total soil organic carbon (t carbon/ha)
T_1	232	20	268	5.6	7.56
T_2	239	19	256	5.6	7.62
T_3	245	18	268	5.6	7.57
T_4	238	21	273	5.6	7.64
T_5	244	19	269	5.7	7.58
T_6	254	20	268	5.5	7.61
T_7	229	19	264	5.5	7.78
T_8	248	21	269	5.7	7.78
T_9	262	21	268	5.5	7.482
T_{10}	216	19	269	5.6	7.64
T_{11}	262	19	267	5.6	7.12
Initial value	212	17	242	5.7	7.34

R-14-AST-1-: Studies on the Production Potential Feasibility of annual rye grass with berseem in Hill Zone. **[Table Reference: R-14-AST-1 (a)-(c)]**

Locations: Palampur and Srinagar

The experiment was initiated at two locations *viz*. Palampur and Srinagar during *Rabi* season of 2014-15 under coordinated mode to study the production potential feasibility of rye grass with berseem in hill zone. The experiment consisted of thirteen treatments including three rye grass genotypes (Punjab Rye Grass- PRG, Kashmir collection-KRG and ATMA (HP) rye grass- ARG) and four different ratios of rye grass: berseem (100:0, 75:25, 50:50 & 25:75) plus sole stand of berseem. Trial was conducted in randomized block design with three replications.

The results revealed that among the three genotypes tested, ARG showed best performance over other two genotypes in respect of all growth, yield as well as quality parameters. Mean data indicated better plant height and leaf stem ratio on ARG and followed by PRG. The per cent proportion of species was in agreement with the proportion of seed used in each treatment. Mean data indicated that T_9-ATMA rye grass (pure stand) produced higher green fodder yield (565.33 q/ha) and was followed by T_{10} i.e. ATMA rye grass + berseem with seed rate in 75:25 ratio (538.38 q/ha). Treatments T_9 – sole ATMA rye grass also produced higher dry fodder yield (123.65 q/ha) and was followed by T_{10} i.e. ATMA rye grass + berseem with seed rate in 75:25 ratio (104.42 q/h). Crude protein yield in all the genotypes increased with increasing proportion of berseem. Higher yield of crude protein was observed in T_{10} i.e. ATMA rye grass + berseem with seed rate in 75:25 ratio and closely followed by ATMA rye grass + berseem (50:50). At Palampur sole stand of ATMA rye grass gave maximum net returns of Rs89011/- ha and next best treatments were ATMA rye grass + berseem sown in 75:25 ratio (Rs. 83442/- ha) and sole Punjab rye grass (Rs. 80768/- ha). Better B:C ratio of 1.96 was observed in T_9 – sole ATMA rye grass with next treatment T_{10}- ATMA rye grass + berseem with seed rate in 75:25 ratio (1.86) and T2 Punjab ryegrass-1 + berseem sown in 75:25 ratio(1.85). No appreciable effect of treatment on soil N, P and K contents was observed.

Table R-14-AST-1(a): Effect of rye grass and berseem seed ratios on yield, quality and economics of production

Treatment	Yield (q/ha)									Net returns (Rs/ha)	B:C ratio	LER
	Green fodder			Dry fodder yield			Crude protein					
	Palam-pur	Sri-nagar	Mean	Palam-pur	Sri-nagar	Mean	Palam-pur	Sri-nagar	Mean	Palam-pur	Palam-pur	Palam-pur
T_1- PRG : B (100:0)	606.6	416.3	511.4	136.57	105.23	120.90	15.83	7.26	11.55	76469	1.70	1.00
T_2- PRG : B (75:25)	626.2	435.8	531.0	121.74	100.06	110.90	16.33	8.70	12.52	80768	1.85	1.11
T_3- PRG : B (50:50)	586.1	378.3	482.2	113.08	79.38	96.23	17.19	9.04	13.12	74355	1.80	1.11
T_4- PRG : B (25:75)	509.5	342.6	426.1	95.10	68.42	81.76	17.47	10.94	14.21	61368	1.51	1.02
T_5- KRG:B (100:0)	522.4	384.5	453.5	116.90	88.92	102.91	14.01	5.70	9.86	65420	1.68	1.00
T_6- KRG:B (75:25)	470.0	405.7	437.8	105.30	97.20	101.25	13.78	9.23	11.51	56164	1.48	0.96
T_7- KRG:B (50:50)	437.1	368.2	402.7	94.28	80.96	87.62	13.47	8.82	11.15	50340	1.36	0.91
T_8- KRG:B (25:75)	438.6	334.6	386.6	84.65	66.80	75.73	14.44	10.75	12.60	50664	1.37	0.93
T_9- ARG:B (100:0)	672.1	458.6	565.3	144.34	123.65	134.0	19.80	9.40	14.60	89011	1.96	1.00
T_{10}- ARG:B (75:25)	640.9	435.8	538.4	143.06	104.42	123.74	21.26	11.23	16.24	83442	1.86	1.05
T_{11}- ARG:B (50:50)	625.0	412.6	518.8	120.69	86.25	103.47	20.34	12.22	16.28	80087	1.78	1.08
T_{12}- ARG:B (25:75)	524.5	368.9	446.7	96.83	73.60	85.22	17.75	12.25	15.0	63423	1.53	0.99
T_{13}- Sole berseem	423.0	278.5	350.7	76.93	51.20	64.07	15.28	9.83	12.56	47135	1.26	1.00
SE(m) ±	9.25	5.02	-	1.96	1.07	-	0.37	0.35	-	1025	0.03	0.02
C.D. (P=0.05)	27.01	14.56	-	5.73	3.12	-	1.09	1.06	-	2992	0.08	0.06

PRG- Punjab Rye grass; KRG – Kashmir Rye grass ARG- ATMA (HP) Rye grass

Table R-14-AST-1(b): Effect of rye grass and berseem seed ratios on growth parameters

Treatment	Mean Plant height rye grass (cm)			Mean Plant height berseem (cm)	Per cent proportion of species (Palampur)		L:S ratio			
							Rye grass			Berseem (Palampur)
	Palam-pur	Sri-nagar	Mean	Palam-pur	Rye grass	Berseem	Palam-pur	Sri-nagar	Mean	
T_{1}. PRG : B (100:0)	55.2	98.5	76.85	-	100.0	0	1.872	1.02	1.45	-
T_{2}. PRG : B (75:25)	55.5	102.6	79.05	42.1	82.89	19.12	2.009	0.86	1.43	0.609
T_{3}. PRG : B (50:50)	54.1	100.8	77.45	40.5	66.46	34.34	1.972	0.72	1.35	0.633
T_{4}. PRG : B (25:75)	54.7	94.3	74.50	37.1	55.15	49.10	2.005	0.65	1.33	0.669
T_{5}. KRG:B (100:0)	54.0	89.3	71.65	-	100.0	0	0.698	0.98	0.84	-
T_{6}. KRG:B (75:25)	53.2	93.6	73.40	40.7	74.19	26.13	0.790	0.76	0.78	0.635
T_{7}. KRG:B (50:50)	49.7	92.8	71.25	40.1	63.78	36.16	0.945	0.62	0.78	0.658
T_{8}. KRG:B (25:75)	52.0	92.0	72.0	39.2	52.96	46.39	0.937	0.60	0.77	0.681
T_{9}. ARG:B (100:0)	57.0	102.6	79.80	-	100.0	0	1.848	1.12	1.48	-
T_{10}. ARG:B (75:25)	54.7	108.5	81.60	40.3	84.13	16.11	1.855	0.92	1.39	0.628
T_{11}. ARG:B (50:50)	55.0	110.4	82.70	38.3	74.09	26.26	1.835	0.84	1.34	0.623
T_{12}. ARG:B (25:75)	55.1	109.8	82.45	39.0	55.33	44.36	1.878	0.76	1.32	0.643
T_{13}. Sole berseem	-	58.9	59.90	40.5	-	100	-	-	-	0.706
SE(m) ±	0.88	1.70	-	0.70	0.46	0.92	0.040	0.04	-	0.012
C.D. (P=0.05)	NS	4.93	--	2.05	1.34	2.68	0.118	0.12	-	NS

PRG- Punjab Rye grass; KRG – Kashmir Rye grass ARG- ATMA (HP) Rye grass

Table R-14-AST-1 (c): Effect on different rye grass and berseem seed ratios on soil properties at Palampur

Treatment	N (kg/ha)	P (kg/ha)	K (kg/ha)	pH	Total soil organic carbon (%)
T_{1}. PRG : B (100:0)	221	14	248	5.6	0.70
T_{2}. PRG : B (75:25)	231	14	240	5.6	0.69
T_{3}. PRG : B (50:50)	240	13	243	5.7	0.71
T_{4}. PRG : B (25:75)	245	14	244	5.8	0.67
T_{5}. KRG:B (100:0)	221	14	244	5.6	0.72
T_{6}. KRG:B (75:25)	223	13	239	5.6	0.69
T_{7}. KRG:B (50:50)	228	13	242	5.7	0.68
T_{8}. KRG:B (25:75)	234	14	241	5.7	0.71
T_{9}. ARG:B (100:0)	227	13	244	5.6	0.70
T_{10}. ARG:B (75:25)	230	14	242	5.7	0.69
T_{11}. ARG:B (50:50)	232	11	241	5.6	0.69
T_{12}. ARG:B (25:75)	240	13	242	5.6	0.71
T_{13}. Sole berseem	249	13	245	5.7	0.69
Initial value	217	12	236	5.5	0.68

K-15-AST-11 C: Studies on carbon sequestration in perennial grass based cropping systems [Table Reference: K-15-AST-11 C (a)-(e)]

Locations: Hyderabad, Coimbatore, Vellayani, Ranchi, Jabalpur and Anand

A trial was initiated at six centres with the objective to study the effect of cropping system on Fodder yield, quality, economics and carbon sequestration potential. The treatments included T_1 -BN hybrid at recommended spacing, T_2- Guinea grass at recommended spacing, T_3- BN hybrid in paired rows (60/120 cm) + Fodder cowpea (*Kharif*) - Lucerne (Rabi), T_4 -BN hybrid in paired rows (60/120 cm) + *Desmanthus* (Perennial), T_5- BN hybrid in paired rows (60/120 cm) + *Sesbania grandiflora,* T_6 -Guinea grass in paired rows (60/120 cm) + Fodder cowpea (Kharif) - Lucerne (Rabi), T_7 -Guinea grass in paired rows (60/120 cm) + *Desmanthus* (Perennial), T_8 - Guinea grass in paired rows (60/120 cm) + *Sesbania grandiflora.* Cowpea was included instead of lucerne in treatment T_2 and T_6 at Kerala (Vellayani). Treatments were replicated thrice in randomised block design.

The second year results indicated that on locational mean basis, treatment T_3 BN hybrid in paired rows (60/120 cm) + Fodder cowpea (Kharif) - Lucerne (1958.7 q green and 540.42 q dry matter/ha) and T_5 BN hybrid in paired rows (60/120 cm) + *Sesbania grandiflora* (1945.1q green and 530.75 q dry matter/ha) and T_4 -BN hybrid in paired rows (60/120 cm) + *Desmanthus* (Perennial) (1899.8q green and 531.4 q dry matter/ha) remained on par with each other but significantly superior to other treatments. The treatment T_2- Guinea grass at recommended spacing recorded lowest yield (1264.3 q green and 398.20 q dry matter/ha). However, as regards to crude protein yields, T_5 BN hybrid in paired rows (60/120 cm) + *Sesbania grandiflora* and T_1 -BN hybrid at recommended spacing proved superior to T_3 BN hybrid in paired rows (60/120 cm) + Fodder cowpea (Kharif) - Lucerne as well as other treatments. Among the centres, higher biomass and crude protein yields were recorded at Coimbatore. The treatment T_3 BN hybrid in paired rows (60/120 cm) + Fodder cowpea (Kharif) – Lucerne and T_5 BN hybrid in paired rows (60/120 cm) + *Sesbania grandiflora also recorded higher* gross monetary returns. However, T_5 BN hybrid in paired rows (60/120 cm) + *Sesbania grandiflora* recorded significantly higher BC ratio over rest of the treatment.

In terms of total carbon dioxide sequestered by different systems, T_4 was significantly superior to other treatments. Guinea grass in paired rows (60/120 cm) + *Desmanthus* (Perennial) recorded the highest value (400.4 t/ha in six cuts), which was at par with T_4, T_5 and T_1.

Table K-15-AST-11 C (a): Total biomass yields of perennial grass based cropping systems

Treatments	Total green fodder yield during the year (q/ha)							Total Dry matter yield during the year (q/ha)						
	Coimb-atore	Hydera-bad	Ran-chi	Vella-yani	Jabal-Pur	Ana-nd	Mean	Coimb-atore	Hydera-bad	Ran-chi	Vella-yani	Jabal-Pur	Ana-nd	Mean
T_1-BN hybrid	5281.3	1411.67	1099	1529.0	1651.1	622.8	1932.5	1330.0	336.92	348	382.6	613.8	152.55	527.31
T_2- Guinea grass	3259.4	728.33	837	1335.6	957.8	467.5	1264.3	916.2	238.93	265	337.8	498.1	133.20	398.20
*T_3- BN hybrid+ Lucerne	5153.6	1216.92	1558	1734.6	1592.2	497.1	1958.7	1296.5	272.73	530	427.5	590.5	125.23	540.42
T_4- BN hybrid+Desmanthus	5204.5	1166.83	1353	1651.3	1474.4	548.7	1899.8	1307.6	279.00	454	409.7	600.8	135.78	531.14
T_5-BN hybrid+Sesbania (Agati)	5161.9	1,599.64	1249	1562.4	1537.8	559.6	1945.1	1304.6	359.93	411	389.0	585.1	134.68	530.73
*T_6-Guinea grass+ Lucerne	3541.1	616.41	1177	1602.5	1112.2	422.3	1411.9	925.5	169.41	371	398.7	516.2	121.67	417.08
T_7- Guinea grass+Desmanthus	3590.5	642.5	1046	1500.1	1048.9	443.6	1378.6	922.9	184.26	343	374.8	483.4	127.37	405.96
T_8 -Guinea grass + Sesbania (Agati)	3546.8	1016.39	943	1512.6	1031.1	538.0	1431.3	938.1	267.37	300	378.0	502.2	121.36	417.84
SE(m) ±	184.8	78.96	15.62	15.0	103.30	66.6		49.9	40.35	14.82	3.2	28.41	17.15	527.31
C.D. (P=0.05)	372.6	25.78	47.86	30.0	412.03	NS		102.3	13.17	45.40	6.3	87.99	NS	
CV (%)			2.32		14.63	22.5				6.78		16.93	22.60	

Table K-15-AST-11 C (b): Total crude protein yield of perennial grass based cropping systems

Treatments	Total Crude Protein Yield (q/ha)					
	Coimb-atore	Hydera-bad	Jabal-pur	Vella-yani	Anand	Mean
T_1-BN hybrid	187.7	26.10	54.0	38.603	11.48	63.58
T_2- Guinea grass	79.8	15.45	38.6	34.050	8.39	35.26
*T_3- BN hybrid+ Lucerne	183.8	18.88	51.3	25.596	9.42	57.80
T_4- BN hybrid+Desmanthus	185.8	21.18	52.5	23.746	10.73	58.79
T_5-BN hybrid+Sesbania(Agati)	185.1	30.82	51.2	31.863	10.35	61.87
*T_6-Guinea grass+ Lucerne	80.9	10.38	40.3	26.140	8.28	33.20
T_7- Guinea grass+Desmanthus	83.7	13.65	39.4	23.033	8.74	33.70
T_8 -Guinea grass + Sesbania (Agati)	86.3	24.79	43.9	21.963	7.53	36.90
SE(m) ±	5.78	3.312	1.07	0.324	1.28	
C.D. (P=0.05)	12.01	1.081	3.28	0.649	NS	
CV (%)			15.23		23.62	

Table K-15-AST-11 C (c): Growth parameters in perennial grass based cropping systems

Treatments	Plant height (cm)				No. of tillers/ m^2				Leaf stem ratio			
	Hydera-bad	Coimb-atore	Vella-yani	Mean	Hydera-bad	Coimb-atore	Vella-yani	Mean	Hydera-bad	Coimb-atore	Vella-yani	Mean
T_1-BN hybrid	71.46	216	147.58	145.01	45.33	56.9	4.83	35.69	0.54	1.03	2.36	1.31
T_2- Guinea grass	95.7	173.9	132.25	133.95	42.33	44.7	73.08	53.37	0.47	0.86	2.873	1.40
*T_3- BN hybrid+ Lucerne	84.83	207	165.83	152.55	44.0	36.8	40.50	40.43	0.56	1.00	2.633	1.40
T_4- BN hybrid+ Desmanthus	94.98	202.7	161.08	152.92	44.66	36.1	46.08	42.28	0.56	0.98	2.846	1.46
T_5-BN hybrid+ Sesbania (Agati)	82.13	201.9	168	150.68	47.33	36.4	40.00	41.24	0.6	0.97	2.313	1.29
*T_6-Guinea grass+ Lucerne	80.16	171.8	142.92	131.63	39.0	57.4	87.25	61.22	0.46	0.84	2.5	1.27
T_7- Guinea grass+ Desmanthus	94.13	166.2	138.67	133.00	38.0	50.2	85.92	58.04	0.45	0.85	2.56	1.29
T_8 -Guinea grass + Sesbania (Agati)	95.16	172.4	143.25	136.94	41.33	51.5	75.83	56.22	0.5	0.84	3.506	1.62
SE(m) ±	5.55	8.36	2.0		2.63	2.17	1.23		0.03	0.041	0.258	
C.D. (P=0.05)	NS	17.07	4.0		NS	4.47	2.47		0.10	0.084	0.517	

Table K-15-AST-11 C (d): Cost of cultivation and gross monitory returns of perennial grass based cropping systems

Treatments	Cost of cultivation				GMR				
	Hydera-bad	Vella-yani	Coimb-atore	Mean	Vella-yani	Coimb-atore	Hydera-bad	Ran-chi	Mean
T_1 -BN hybrid	63,400	315000	203046	1,93,815	458700	792195	1,97,083	109963	3,66,414
T_2- Guinea grass	45,300	305000	175795	1,75,365	400500	528910	1,04,258	83781	2,38,983
*T_3- BN hybrid+ Lucerne	59,333	274000	209561	1,80,965	520200	773040	1,85,650	169755	3,76,148
T_4- BN hybrid + Desmanthus	58,050	260000	206940	1,74,997	495300	780675	1,86,741	147456	3,71,624
T_5 -BN hybrid+ Sesbania (Agati)	66,166	258000	205464	1,76,543	468600	774285	2,78,366	136082	3,96,244
*T_6 -Guinea grass+ Lucerne	44,416	270000	179840	1,64,752	480600	531165	96,016	128294	2,51,825
T_7- Guinea grass+ Desmanthus	44,640	250000	177766	1,57,469	450000	538575	1,03,133	114027	2,51,912
T_8 -Guinea grass + Sesbania (Agati)	52,116	240000	179538	1,57,218	453600	532020	1,87,533	102869	2,74,141
SE(m) ±	467						3075	1691	
C.D. (P=0.05)	1433						9418	5181	

Table K-15-AST-11 C (e): gross monitory returns and B: C ratio in perennial grass based cropping systems

Treatments	NMR					B: C ratio				
	Vella-yani	Coimb-atore	Hydera-bad	Ran-chi	Mean	Vella-yani	Coimb-atore	Hydera-bad	Ran-chi	Mean
T_1 -BN hybrid	143700	589149	1,33,683	87963	238624	1.45	3.90	3.11	3.99	3.11
T_2- Guinea grass	95500	333115	58,958	61781	137339	1.31	2.88	2.3	2.8	2.32
*T_3- BN hybrid+ Lucerne	246200	563479	1,26,316	145255	270313	1.9	3.69	3.12	5.92	3.66
T_4- BN hybrid + Desmanthus	235300	573735	1,28,691	122956	265171	1.91	3.77	3.21	5.01	3.48
T_5 -BN hybrid+ Sesbania (Agati)	210600	568821	2,12,200	111582	275801	1.82	3.77	4.21	4.55	3.59
*T_6 -Guinea grass+ Lucerne	210600	351325	51,600	103794	179330	1.78	2.95	2.16	4.23	2.78
T_7- Guinea grass+ Desmanthus	200000	360809	58,493	89527	177207	1.8	3.03	2.31	3.65	2.70
T_8 -Guinea grass + Sesbania (Agati)	213600	352482	1,35,416	78369	194967	1.89	2.96	3.59	3.19	2.91
SE(m) ±			2844	1691				0.06	0.07	
C.D. (P=0.05)			8711	5181				0.19	0.21	

Table K-15-AST-11 C (f): Total carbon sequestered by crops (7 cuts) during the year (t/ha)

Treatments	BN hybrid	Inter crop (legume component)	Lucerne (q/ha/yr)	Total C sequestered		Mean
	Coimbatore	Coimbatore	Coimbatore	Coimbatore	Vellayani	
T_1	600.7	0.0	0.0	600.7	160.7	380.7
T_2	427.9	0.0	0.0	427.9	141.9	284.9
T_3	586.0	7.7	14.1	607.8	171.6	389.7
T_4	589.2	39.7	0.0	628.8	172.0	400.4
T_5	588.8	26.9	0.0	615.7	163.4	389.5
T_6	418.1	8.4	16.6	443.1	167.5	305.3
T_7	416.1	39.9	0.0	456.0	157.4	306.7
T_8	423.6	28.3	0.0	451.9	158.8	305.35
SE(m) ±	17.31			18.97	1.3	
C.D. (P=0.05)	35.24			38.46	2.6	

Table K-15-AST-11 C (g): Effects of treatments on Soil OC and Soil pH, Soil EC and Soil total N (after 20th cut) at Anand

Treatments	Soil OC%	Soil pH	Soil EC (dS/m; 1:2.5 water: soil ratio)	Soil Total N%
T_1	0.347	8.16	0.102	0.03
T_2	0.347	8.14	0.097	0.03
T_3	0.386	8.33	0.116	0.03
T_4	0.495	8.00	0.116	0.04
T_5	0.287	8.23	0.105	0.02
T_6	0.392	8.14	0.115	0.03
T_7	0.312	8.23	0.089	0.03
T_8	0.332	8.21	0.102	0.03
SE(m) ±	0.06	0.12	0.01	0.01
C.D. (P=0.05)	NS	NS	NS	NS
C.V. %	30.63	2.44	10.06	30.63

K-15-AST-12C:-Studies on the productivity and carbon sequestration of silvi pastoral system in hills of north western Himalayas

[Table Reference: K-15-AST-12 C (a)-(b)]

Locations: Palampur and Srinagar

The experiment was started during *Kharif* -2015 at Palampur and Srinagar centre in coordinated mode to study the system productivity and organic matter input to soil through silvi-pastoral system. two tree species {*Grewia* (at Palampur) and Salix (at Srinagar) and Mulberry} in main plot and four range species treatments (Setaria grass var. PSS-1, tall fescue grass var. Hima-14, white clover var. PLP composite, tall fescue grass+ white clover, local species) in sub plots were evaluated in split plot design. The data was recorded of complete crop year 2017-18.
Data for the second year revealed that the effect of tree species on total green, dry forage and crude protein yields of forage species was not significant at both the locations. Among range species highest green fodder and dry fodder yield was obtained with the planting of Setaria grass at both the locations. This was followed by tall fescue grass+ white clover. Minimum herbage yield was obtained in white Clover. Similar effect on crude protein yield was observed except in local species where minimum crude protein yield was obtained.

Tree species had no significant effect on either net returns or B: C ratio. Setaria grass resulted in highest return and B: C ratio at both the locations. At Palampur Setaria grass planting realised higher returns of Rs. 87666, 109768, 67101 and 108390 over tall fescue grass, white clover, tall fescue grass + white clover and local species, respectively. No appreciable effect of treatments on total organic carbon was observed

Table K-15-AST-12C (a): Effect of tree and range species on green, dry and crude protein yields (q/ha)

Treatment	Green fodder			Dry fodder			Crude protein		
	Palampur	Srinagar	Mean	Palampur	Srinagar	Mean	Palampur	Srinagar	Mean
A. Tree species									
Grewia/ Salix*	250.49	255.10	252.79	55.84	54.30	55.07	7.03	7.40	7.21
Mulberry	262.92	268.32	265.62	58.49	56.35	57.42	7.95	7.90	7.92
S Em±	2.86	2.92	-	1.84	2.05	-	1.54	1.48	-
CD (0.05)	NS	NS	-	NS	NS	-	NS	NS	-
B. Range species									
Setaria grass	563.53	472.30	517.91	129.61	102.60	116.10	15.18	12.66	13.92
Tall fescue grass	210.46	260.65	235.55	48.41	53.04	50.72	6.88	7.52	7.20
White clover	102.85	127.36	115.10	24.68	22.05	23.36	1.61	4.10	2.85
Tall fescue grass + white clover	292.72	322.20	307.46	61.47	68.90	65.18	9.74	11.88	10.81
Local scecies	113.97	126.10	120.03	21.65	30.24	25.94	4.05	2.13	3.10
SE(m) ±	6.12	6.21	-	5.76	4.20	-	6.02	5.60	-
C.D. (P=0.05)	18.42	18.53	-	17.10	12.27	-	18.45	16.24	-
C. Interaction: Tree X range spp.	NS	NS	-	NS	NS	-	NS	NS	-

*Palampur- Grewia; Srinagar- Salix

Table K-15-AST-12C (b): Effect of tree and range species on economics and soil organic carbon

Treatment	Net Returns (Rs/ha)			B:C ratio			Total soil organic carbon (t carbon/ha)		
	Palampur	Srinagar	Mean	Palampur	Srinagar	Mean	Palampur	Srinagar	Mean
A. Tree species									
Grewia/ Salix*	57542	52520	55031	11.06	8.75	9.90	6.34	6.98	6.65
Mulberry	60650	54296	57473	11.66	9.70	10.68	6.38	6.80	6.60
SEm±	386	287	-	0.14	0.12	-	-	-	-
CD (0.05)	NS	NS	-	NS	NS	-	-	-	-
B. Range species									
Setaria grass	133681	103260	118470	18.57	13.32	15.95	6.55	6.82	6.68
Tall fescue grass	46015	52390	49202	6.97	7.12	7.05	6.26	7.18	6.72
White clover	23913	24840	24376	13.28	9.30	11.30	6.37	6.60	6.48
Tall fescue grass + white clover	66580	61550	64065	10.09	10.20	10.14	6.42	7.12	6.77
Local scecies	25291	24995	25143	7.90	6.20	7.05	6.23	6.68	6.45
SE(m) ±	713	520	-	0.19	0.32	-	-	-	-
C.D. (P=0.05)	2153	1508	-	0.59	0.92	-	-	-	-
C. Interaction: tree X range spp.	NS	NS	-	NS	NS	-	NS	NS	NS

*Palampur- Grewia/, Srinagar- Salix

R-15-AST-1: **Productivity of oat - *Lathyrus* intercropping system as influenced by integrated nutrient management [Table Reference: R-15-AST-1 (a)-(h)]**

Locations: Kalyani, Ranchi & Bhubaneswar

The field experiment was initiated at Kalyani, Bhubaneswar and Ranchi from Rabi 2015-16 to study the productivity and profitability of food (*Lathyrus*) + forage (oat) intercropping system influenced by **integrated nutrient management**. The experiment was laid out in split plot design with three replications. The treatments consisted of crops in the main plot: T_1-sole oat, T_2- sole *Lathyrus*, T_3- oat + *Lathyrus* (3:2) and T_4- oat + *Lathyrus* (3:3). **Integrated nutrient management** was assigned in the sub plot: F_1- RDF (inorganic), F_2- 50% N (RDF) + 50% N (FYM) and F_3- 50% N (RDF) + 50% N (vermicompost). Oat cv. OS-6 and *Lathyrus* Cv. Nirmal were used for the study.

The mean over the location indicated that, T_3 – oat + *Lathyrus* (3:2) recorded maximum GFY, CPY and GEFY (238.0, 9.05 and 340.9q/ha). However, in with respect to DFY (83.01q), and CPY (6.023 q) T_1 – Sole oat recorded significant superiority over other treatments. Among three cropping system, T_3 proved most remunerative recording net monetary returns of Rs.30585/ha and B: C ratio of 1.60 on locational mean basis. Among the centres, maximum green and dry matter productivity was recorded at Ranchi. Recommended dose of fertilizers i.e.80, 40 and 40 kg ha N, P_2O_5 and K_2O per hectare, respectively were applied for the study and part of it was supplied by other sources in different treatments. On location mean basis, F_3-50% N (RDF) + 50% N (vermicompost) recorded significantly higher GFY (356.8 q), DFY (85.49 q), CPY (8.50 q), and GFEY (327.0q/ha).In case of DFY, F_3 and F_1remained at par with each other. However in monetary parameters, F_1- RDF (inorganic) proved better, recording higher net monetary returns (Rs. 25798 and B: C ratio1.52).

Table R-15-AST-1 (a): Green Fodder yield of oat and lathyrus as influenced by intercropping systems and integrated nutrient management

Intercropping system	GFY (q/ha)						
	Kalyani			Ranchi			Mean GFY of locations
	Oat	Lathyrus	Total	Oat	Lathyrus	Total	
T_1 – Sole oat	271.6	--	271.6	337.0	0.0	337.0	304.3
T_2 – Sloe Lathyrus	--	107.2	107.2	0.0	134.8	134.8	121.0
T_3 – oat + Lathyrus (3:2)	270.5	50.8	321.3	282.9	71.9	354.8	338.0
T_4 – oat + Lathyrus (3:3)	189.5	63.4	252.9	209.3	90.6	299.9	276.4
S Em (±)	1.2	2.2	--	6.5	1.0		
CD (0.05)	3.5	6.5	--	25.2	3.8		
Integrated nutrient management							
F_1	233.9	72.2	306.1	292.1	100.0	392.1	349.1
F_2	247.8	65.1	312.9	262.8	93.0	355.8	334.3
F_3	251.1	84.2	335.3	274.3	104.0	378.3	356.8
SE(m) ±	1.7	1.8	--	5.7	2.1		
C.D. (P=0.05)	4.9	5.4	--	17.6	6.6		
CV (%)				7.1	7.5		

Table R-15-AST-1 (b): Dry matter yield of oat and lathyrus as influenced by intercropping systems and integrated nutrient management

Intercropping system	DMY (q/ha)						
	Kalyani			Ranchi			
	Oat	Lathyrus	Total	Oat	Lathyrus	Total	Mean
T_1 – Sole oat	51.8		51.8	114.22		114.22	83.01
T_2 – Sole Lathyrus		16.8	16.8		29.44	29.44	23.12
T_3 – oat + Lathyrus (3:2)	48.7	7.6	56.3	90.44	16.51	106.95	81.62
T_4 – oat + Lathyrus (3:3)	33.9	8.7	42.6	62.67	21.37	84.04	63.32
SEm (±)	0.62	0.37		2.78	0.15		
CD (0.05)	1.82	1.1		10.84	0.62		
Integrated nutrient management							
F_1	42.1	10.9	53.0	94.44	22.6	117.04	85.02
F_2	45.6	8.71	54.3	85.44	21.45	106.89	80.59
F_3	46.7	13.5	60.2	87.44	23.34	110.78	85.49
SE(m) ±	0.65	0.34		1.72	0.58		
C.D. (P=0.05)	1.91	0.99		5.32	1.81		
CV (%)				6.7	9.03		
Interaction				NS	NS		

Table R-15-AST-1 (c): Crude protein content and yield of oat and lathyrus

Intercropping system	Crude Protein (%)					Crude Protein Yield (q/ha)				
	Kalyani			Ranchi	Overall mean	Kalyani			Ranchi	Overall mean
	Oat	Lathyrus	Mean	Mean		Oat	Lathyrus	Total	Mean	
T_1 – Sole oat	10.5		10.5	10.06	10.28	5.44		5.44	10.34	7.89
T_2 – Sole Lathyrus		18.7	18.7	14.82	16.76		3.14	3.14	3.93	3.53
T_3 – oat + Lathyrus (3:2)	9.8	16.5	26.3	12.55	19.42	4.77	1.25	6.02	12.09	9.05
T_4 – oat + Lathyrus (3:3)	8.4	13.8	22.2	13.18	17.69	2.85	1.2	4.05	9.73	6.89
SEm (±)	0.21	0.32	--	0.009		0.19	0.29	--	0.23	
CD (0.05)	0.62	0.94	--	0.03		0.56	0.85	--	0.79	
Integrated nutrient management										
F_1	8.5	13.5	22	12.5	17.25	3.58	1.47	5.05	9.41	7.23
F_2	8.9	16.3	25.2	12.64	18.92	4.06	1.42	5.48	8.71	7.09
F_3	11.3	19.2	30.5	12.82	21.66	5.28	2.6	7.88	9.13	8.50
SE(m) ±	0.18	0.43	--	0.26		0.28	0.25	--	0.26	
C.D. (P=0.05)	0.53	1.26	--	0.83		0.82	0.73	--	0.8	
Interaction										
CV (%)				7.37					9.96	

Table R-15-AST-1 (d): Growth parameters of oat and lathyrus

Intercropping system	Plant height (cm) at harvest		L:S ratio		Plant population (tillers/m)	
	Kalyani		Kalyani		Ranchi	
	Oat	Lathyrus	Oat	Lathyrus	Oat	Lathyrus
T_1 – Sole oat	141.1		0.82		33.34	
T_2 – Sloe Lathyrus		105.3		1.53	----	17.58
T_3 – oat + Lathyrus (3:2)	142.9	82.6	0.85	1.50	35.00	17.34
T_4 – oat + Lathyrus (3:3)	137.6	93.8	0.79	1.48	34.20	16.59
SE(m) ±	0.72	2.52			0.80	0.15
C.D. (P=0.05)	2.11	7.40			NS	NS
Integrated nutrient management						
F_1	139.9	89.2	0.80	1.49	36.82	12.22
F_2	136.6	95.8	0.75	1.48	35.95	17.08
F_3	142.1	96.7	0.91	1.54	35.65	17.08
SE(m) ±	0.75	0.75			0.68	0.22
C.D. (P=0.05)	2.2	2.2			NS	NS
Interaction					NS	NS

Table R-15-AST-1 (e): Grain, Stover yield and harvest Index of oat and lathyrus

Intercropping system (T)	Seed yield (q/ha)			Stover yield (q/ha)			Harvest Index	
	Kalyani			Kalyani			Kalyani	
	Oat	Lathyrus	Total	Oat	Lathyrus	Total	Oat	Lathyrus
T_1	14.8		14.8	31.8		31.8	31.8	
T_2		8.62	8.62		14.6	14.6		37.1
T_3	9.7	3.86	13.56	20.7	6.4	27.1	31.9	37.6
T_4	8.5	4.72	13.22	19.4	8.5	27.9	30.5	35.7
SE(m) ±	0.11	0.16		0.42	0.12			
C.D. (P=0.05)	0.32	0.47		1.23	0.35			
CV (%)	4.63	6.54		3.53	5.23			
Integrated nutrient management (F)								
F_1	8.6	4.85	13.45	15.2	8.2	23.4	36.1	37.2
F_2	11.7	5.74	17.44	26.4	9.4	35.8	30.7	37.9
F_3	12.7	6.61	19.31	30.3	10.8	41.1	29.5	37.9
SEm (±)	0.12	0.13		0.64	0.15			
CD (P=0.05)	0.35	0.38		1.88	0.44			
CV (%)	6.78	6.24		8.45	3.85			

Table R-15-AST-1 (f): Land equivalent ratio and green fodder equivalent yield of oat and lathyrus intercropping system

Intercropping system (T)	LER		GFEY (q/ha)			
	Kalyani	Ranchi	Kalyani	Ranchi	Bhubaneswar	Mean
T_1	1.00	1.00	271.6	337.00	313.37	307.3
T_2	1.00	1.00	160.8	156.12	253.60	190.2
T_3	1.10	1.35	346.7	363.39	312.53	340.9
T_4	1.12	1.27	284.6	311.21	302.90	299.6
SE(m) ±		0.31		7.82	2.34	
C.D. (P=0.05)		NS		26.99	7.39	
Integrated nutrient management (F)						
F_1	1.14	1.28	342.2	303.46	278.21	308.0
F_2	1.45	1.25	345.5	278.65	298.53	307.6
F_3	1.61	1.41	377.4	293.68	310.06	327.0
SE(m) ±		0.04		5.36	3.28	
C.D. (P=0.05)		0.12		16.59	9.41	
CV (%)		10.76		6.36	5.49	

Table R-15-AST-1 (g): Economics of oat and lathyrus intercropping system

Intercropping system (T)	GMR (Rs./ha)				NMR (Rs./ha)				B:C ratio			
	Kal-yani	Bhuba-neswar	Ran-chi	Mean	Kal-yani	Bhuban-eswar	Ran-chi	Mean	Kal-yani	Bhuban-eswar	Ran-chi	Mean
T_1	56870	32217	67400	52162	30370	16547	33898	26938	2.14	1.06	1.05	1.42
T_2	42950	26490	33422	34287	21550	11820	3888	12419	2.01	0.82	0.13	0.99
T_3	58800	31560	72677	54346	34600	16393	40763	30585	2.42	1.09	1.30	1.60
T_4	57700	30583	62241	50175	32900	15350	31890	26713	2.32	1.02	1.05	1.46
SE(m) ±		224.66	1744			224.66	1744			0.015	0.05	
C.D. (P=0.05)		707.77	6020			707.77	6020			0.047	0.19	
Integrated nutrient management (F)												
F_1	52750	28410	61205	47455	29550	15235	32608	25798	2.27	1.16	1.13	1.52
F_2	56550	30013	55729	47431	34050	13853	25586	24496	2.51	0.86	0.84	1.40
F_3	59780	32215	59871	50622	35180	15995	24635	25270	2.43	0.98	0.69	1.37
SE(m) ±		265.55	561			265.55	561			0.017	0.02	
C.D. (P=0.05)		762.25	1684			762.25	1684			0.049	0.07	
SE(m) ±		650.47				650.47				0.042		
Interaction												
C.D. (P=0.05)		1867.12	NS			1867.12	NS			0.121	NS	
CV (%)		5.15	3.30			10.36	7.04			10.44	9.43	

Table R-15-AST-1(h): Effect of oat+lathyrus intercropping system and integrated nutrient management on soil fertility parameters after harvest (BCKV, Kalyani)

Treatments		Soil parameters			Available nutrient in soil (kg/ha)		
		pH	EC (dsm^{-1})	OC (%)	N	P	K
T_1	F_1	6.75	0.14	0.47	170.5	23.1	158.1
	F_2	6.60	0.15	0.48	172.3	25.2	171.2
	F_3	6.55	0.13	0.49	170.1	25.7	175.5
T_2	F_1	6.81	0.14	0.50	175.2	26.7	168.2
	F_2	6.64	0.14	0.51	180.4	27.5	169.4
	F_3	6.63	0.13	0.52	181.5	25.2	184.5
T_3	F_1	6.52	0.15	0.53	178.4	26.7	178.1
	F_2	6.71	0.16	0.52	179.2	27.2	179.2
	F_3	6.67	0.15	0.57	178.1	28.4	185.7
T_4	F_1	6.53	0.13	0.56	175.2	25.5	187.2
	F_2	6.75	0.16	0.56	180.1	28.1	179.5
	F_3	6.67	0.15	0.57	181.2	30.2	187.2
Initial		**6.58**	**0.14**	**0.49**	**198.2**	**42.5**	**211.4**

K-16-AST-1: Feasibility of Hydroponics fodder production system-A Quantitative and Qualitative study. [Table Reference: K-16-AST-1 (a)-(e)]

Location: Mandya, Ludhiana

The hydroponic study was conducted at Ludhiana and Mandya to study the suitability of maize, sorghum and cowpea for fodder quality fodder production under. At Vellayani and Hyderabad it will be conducted during Kharif season. The treatments include three fodder crops (maize, sorghum and cowpea), three seed densities (200,300 and 400g per square feet) and four harvest stages (9, 11, 13, 15 days) replicated thrice. The trial was harvested at different stages in Feb-April and the laboratory temperature varied from 17-25^{o}C.

In maize, plant height increased with advancement of growth and maximum height was observed at 15th day of growth which was at par with 13th day of growth at Ludhiana. Total hydroponic green weight (kg/kg of seed) varied from 4.9-5.1 kg and maximum yield was achieved at 13th day of growth. Highest dry matter was achieved at 9th day. Nutritional quality of hydroponically grown maize crop varied with age of plant. At Ludhiana, crude protein content decreased significantly with advancement of growth and maximum level achieved was at 9th day. Both ADF and NDF contents significantly increased with delayed harvest and maximum level was at 15th day at all seed rates at Ludhiana; whereas, reverse trend was observed at Mandya.

As regards to density of seeds, seed rate of 200 gm / sq ft recorded highest green fodder, dry matter and crude protein yields. The difference in CP content at varying seed density was not significant. ADF and ash content were higher at higher densities.

In cowpea crop, plant height increased with the age of the plant and plant density. Both green fodder yield and dry matter were highest at 9th day. Crude protein content varied from 35.04-37.03% and maximum level was achieved at 11th day stage. ADF, NDF and ash content increased with advancement of growth and maximum level was found at 15th day. Cowpea also exhibited similar trend as that of maize in terms of green fodder, dry matter and crude protein yields. No significant variation was noticed in quality parameters at different seed densities.

In Sorghum, GFY content was low and anti-nutritional component HCN was very high (143.9-172.4 ppm). Hence, sorghum crop is not advisable to be used in hydroponic system.

Table K-16-AST-1 (a): Yield and quality of fodder maize grown under hydroponic production system

Treatments	Green fodder (kg GFY per kg seed)			Dry matter yield (kg DMY per kg seed)			DM (%)	Crude protein Yield (kg CP per kg seed)			Crude protein content (%)		
	Man-dya	Ludh-iana	Mean	Man-dya	Ludh-iana	Mean	Ludh-iana	Man-dya	Ludh-iana	Mean	Man-dya	Ludh-iana	Mean
Harvest stage													
9th day	4.05	5.33	4.7	0.46	0.5	0.48	9.37	0.052	0.073	0.063	11.11	14.7	12.9
11th day	4.60	5.27	4.9	0.65	0.45	0.55	8.63	0.06	0.061	0.06	12.19	13.7	12.94
13th day	5.27	5.00	5.1	0.52	0.41	0.47	8.13	0.078	0.057	0.068	14.85	13.6	14.22
15th day	5.38	4.47	4.9	0.53	0.33	0.43	7.4	0.079	0.033	0.056	15.20	10.1	12.6
SE(m) ±	0.10			0.01				0.002			0.08		
C.D. (P=0.05)	0.37			0.04				0.007			0.32		
Seed rate (gm / sq ft)													
200	5.60	5.18	5.4	0.58	0.46	0.52	8.93	0.078	0.06	0.069	13.28	13	13.14
300	4.76	5.18	5.0	0.50	0.45	0.48	8.6	0.066	0.06	0.063	13.32	13.05	13.14
400	4.12	4.7	4.4	0.43	0.36	0.40	7.63	0.057	0.05	0.054	13.42	13.43	13.18
SE(m) ±	0.08	0.15		0.01			0.10	0.002			0.07	0.08	
C.D. (P=0.05)	0.32	0.60		0.04			0.4	0.006			NS	0.32	
Interaction													
SE(m) ±	0.17	0.024		0.02				0.003			0.14	0.31	
C.D. (P=0.05)	0.65	0.10		0.08			NS	NS			NS	1.21	

Table K-16-AST-1 (b): Growth and quality parameters of fodder maize grown under hydroponic production system

Treatments	Crude Fiber content (%)	ADF (%)	NDF (%)	Ash content (%)	Plant Height (cm)	Leaf Stem ratio
	Mandya	Ludhiana	Ludhiana	Mandya	Ludhiana	Mandya
Time of Harvest						
9th day	11.11	17.00	38.63	0.16	28.33	0.42
11th day	12.19	24.93	50.60	0.18	31.60	0.44
13th day	14.85	30.20	53.97	0.24	33.33	0.45
15th day	15.20	31.60	54.60	0.25	33.40	0.46
SE(m) ±	0.06	1.38	1.66	0.01	0.025	0.001
C.D. (P=0.05)	0.23	5.29	6.35	NS	0.10	0.006
Seed rate (gm / sq ft)						
200	13.28	26.2	48.95	0.17	30.78	0.41
300	13.32	25.9	50.68	0.21	31.70	0.45
400	13.42	25.3	48.73	0.25	32.53	0.47
SE(m) ±	0.05	0.655	0.82	0.01	0.08	0.001
C.D. (P=0.05)	NS	2.51	4.22	NS	0.30	0.005
Interaction						
SE(m) ±	0.10	0.92		0.02		0.003
C.D. (P=0.05)	0.40	3.53	5.8	NS	NS	0.010

Table K-16-AST-1 (c): Yield and quality of fodder cowpea grown under hydroponic production system

Treatments	Green fodder (kg GFY per kg seed)			Crude protein content (%)			Dry matter yield (kg DMY/ kg seed)			DM (%)	Crude protein Yield (kg CP/kg seed)		
	Man-dya	Ludh-iana	Mean	Man-dya	Ludh-iana	Mean	Man-dya	Ludh-iana	Mean	Ludh-iana	Man-dya	Ludh-iana	Mean
Time of Harvest													
9th day	3.74	4.33	4.04	24.98	45.6	35.29	0.60	0.40	0.50	9.13	0.14	0.18	0.16
11th day	4.40	4.2	4.30	26.32	47.73	37.03	0.64	0.36	0.5	8.8	0.17	0.17	0.17
13th day	5.59	3.97	4.78	28.67	44.87	36.77	0.67	0.33	0.50	8.37	0.19	0.14	0.17
15th day	5.72	3.53	4.63	29.18	40.9	35.04	0.68	0.27	0.50	7.87	0.19	0.11	0.15
SE(m) ±	0.13			0.09			0.02				0.01		
C.D. (P=0.05)	0.49			0.34			0.08				0.02		
Seed rate (gm / sq ft)													
200	5.14	4.18	4.66	27.18	44.53	35.86	0.68	0.46	0.57	8.88	0.24	0.20	0.22
300	4.90	4.08	4.49	27.31	44.48	35.90	0.67	0.41	0.54	8.50	0.18	0.18	0.20
400	4.36	3.78	4.07	27.37	45.33	36.35	0.58	0.35	0.46	8.25	0.15	0.16	0.20
SE(m) ±	0.11			0.08			0.02				0.01		
C.D. (P=0.05)	0.43	NS		NS	0.58		0.07			0.19	0.02		
Interaction													
SE(m) ±	0.22			0.15			0.04						
C.D. (P=0.05)	0.85	NS		NS			0.14				0.02		
CV (%)					1.87					0.11	0.05		

Table K-16-AST-1 (d): Growth and quality parameters of fodder cowpea grown under hydroponic production system

Time of Harvest	Mandya			Ludhiana		
	Crude Fiber content (%)	Ash content (%)	Leaf Stem ratio	ADF (%)	NDF (%)	Plant Height (cm)
9th day	9.60	2.59	0.28	18.07	31.30	27.07
11th day	10.14	2.68	0.29	22.80	42.33	27.87
13th day	11.47	3.16	0.31	27.30	44.10	30.23
15th day	12.73	3.51	0.33	27.27	44.33	30.33
SE(m) ±	0.04	0.01	0.001			
C.D. (P=0.05)	0.17	0.06	0.006	1.78	3.21	NS
Seed rate (gm / sq ft)						
200	10.97	2.97	0.29	24.65	39.75	27.55
300	10.99	2.99	0.30	23.75	41.08	28.9
400	11.00	3.00	0.32	23.18	40.73	30.2
SE(m) ±	0.04	0.01	0.001			
C.D. (P=0.05)	NS	NS	0.005	2.89	1.52	0.21
Interaction						
SE(m) ±	0.07	0.025	0.003			
C.D. (P=0.05)	NS	NS	0.010	3.21	1.21	NS

Table K-16-AST-1(e): Effect of harvest stage and seed rate on green fodder yield (GFY) and HCN content (ppm) in hydroponically grown sorghum at Ludhiana

Harvest stage (Days)	GFY(kg/kg seed)			HCN (ppm)		
	200 g/sqft	300 g/sqft	400 g/sqft	200 g/sqft	300 g/sqft	400 g/sqft
9th day	3.8	2.1	1.8	145.0	158.4	143.9
11th day	4.1	2.8	1.6	167.4	165.8	152.2
13th day	4.2	3.1	1.7	160.4	172.4	158.4
15th day	3.2	1.9	1.4	164.3	154.8	149.4
C.D. (P=0.05)						
Seed rate			0.41			0.19
Harvest stage			0.32			0.42
Interaction			0.23			NS

R-16-AST-1: Enhancing seed productivity of fodder oat in different regions of India under irrigated condition [Table Reference: R-16-AST-1 (a)-(f)]

Location: Raipur, Jabalpur, Dharwad

This experiment was initiated at three centres during Rabi 2016-17 with the objective to study the effect of crop geometry and nitrogen doses on seed production potential and economics of seed production of oat varieties. The treatments included two varieties i.e., JHO -822 and RO – 19, two row spacing i.e., 30 and 45 cms and three Nitrogen doses i.e., 80, 100 and 120 kg/ha. The treatments were replicated thrice in factorial Randomised block design. 1st cut was taken after 45 DAS then crop was left for seed production. The nitrogen was applied 50% at basal + 50 % after 1st cut.

The results indicated that as regards to GFY and DFY, at first cut variety RO 19 was better than JHO-822 at on mean locational basis. However, JHO822 exhibited higher harvest index, seed yield, net monetary return (Rs.61075/ha) and B: C ratio (2.59). The sowing of oat at 30 cm row spacing for seed production proved better over row spacing of 45 cm. It recorded higher GFY (163.09q/ha), DFY (34.53q/ha), seed yield (20.10q/ha), net returns (Rs.54153/ha) and B: C ratio (2.49). The application of nitrogen recorded linear improvement in growth and yield parameters up to 120 kg/ha. Application of 120kg N/ha recorded 7.9, 8.2 and 8.3% higher GFY, DFY and seed yield respectively over 80kg N/ha. It (120 kg N/ha) also resulted in higher net return (Rs.56591/ha) and B: C ratio (2.56) on locational mean basis.

Table R-16-AST-1(a): Productivity (q/ha) of fodder oat in different regions

Varieties	GFY 1st cut (45 DAS)			Mean	DMY 1st cut (45 DAS)			Mean	Seed Yield (q/ha)			Mean
	Raipur	Jabalpur	Dharwad		Raipur	Jabalpur	Dharwad		Raipur	Jabalpur	Dharwad	
V1-JHO-822	53	85.8	303.3	147.37	7.4	14.7	71.3	31.13	32.5	33	83	24.60
V2-RO-19	82.3	56.5	352.9	163.90	11.2	10.9	82.9	35.00	17	25.5	91.4	17.21
SE(m) ±	1.564	2.12	6.9		0.22	0.25	1.6		0.377	0.4	1.3	
C.D. (P=0.05)	4.587	6.36	42.1		0.647	0.75	9.9		1.106	1.221	8	
Crop Geometry												
S_1.30 cm	71.8	75.3	341.9	163.00	9.9	13.4	80.3	34.53	25.3	25.8	92.1	20.10
S_2.45 cm	63.5	67	314.3	148.27	8.7	12.2	73.9	31.60	24.2	24.7	82.2	19.04
SE(m) ±	1.564	1.12	4.1		0.22	0.35	1		0.377	0.45	0.7	
C.D. (P=0.05)	4.587	3.36	16.3		0.647	1.05	3.8		1.016	1.371	2.6	
Nitrogen doses												
N_1. 80 kg/ha	61.2	64.7	308.1	144.67	8.4	11.9	72.4	30.90	23.5	24	82.3	18.58
N_2.100 kg/ha	68	71.5	325.6	155.03	9.2	12.7	76.5	32.80	24.4	24.9	85.5	19.28
N_3. 120 kg/ha	73.8	77.3	350.5	167.20	10.3	13.8	82.4	35.50	26.4	26.9	93.8	20.89
SE(m) ±	1.915	1.83	7.6		0.27	0.38	1.8		0.462	0.389	1.3	
C.D. (P=0.05)	5.618	5.51	22.9		0.792	1.14	5.4		1.35	1.16	4	
CV (%)			8.05				8.05				5.3	

Table R-16-AST-1(b): Straw yield and yield attributes of fodder oat in different regions

Treatments	Straw Yield (q/ha)				Harvest Index (%)				Plant Height at 1st cut (45 DAS)			
	Raipur	Jabalpur	Dharwad	Mean	Raipur	Jabalpur	Dharwad	Mean	Raipur	Jabalpur	Dharwad	Mean
Varieties												
V1-JHO-822	90.1	90.6	30.29	70.33	26.5	27	27.46	26.99	42.3	49.1	1.14	30.85
V2-RO-19	109.8	110.3	33.71	84.60	13.4	13.9	27.07	18.12	45.6	45.8	1.32	30.91
SE(m) ±	0.942	0.89	0.55		0.334	0.4	0.29		0.487	0.5	0.01	
C.D. (P=0.05)	2.765	2.685	3.33		0.979	1.212	NS		1.43	1.51	0.07	
Crop Geometry												
S_1.30 cm	99	99.5	33.74	77.41	20.4	20.9	27.35	22.88	42.4	45.9	1.18	29.83
S_2.45 cm	100.9	101.4	30.27	77.52	19.5	20	27.18	22.23	45.5	49	1.28	31.93
SE(m) ±	NS	NS	0.32		NS	NS	0.13		0.487	1.12	0.02	
C.D. (P=0.05)			1.25				NS		1.43	3.37	0.06	
Nitrogen doses												
N_1- 80 kg/ha	96.7	97.2	31.16	75.02	19.7	20.2	26.44	22.11	42.8	46.3	1.16	30.09
N_2-100 kg/ha	100.1	100.6	31.34	77.35	19.7	20.2	27.32	22.41	43.7	47.2	1.25	30.72
N_3- 120 kg/ha	103.1	103.6	33.51	80.07	20.5	21	28.04	23.18	45.4	48.9	1.28	31.86
SE(m) ±	1.154	1.135	0.68		0.409	0.502	0.4		0.462	0.55	0.03	
C.D. (P=0.05)	3.386	3.4	2.05		1.06	1.5	1.19		1.35	1.66	0.1	
CV (%)			8.24				5.06				8.99	

Table R-16-AST-1(c): Economics of fodder oat in different regions

Varieties	Gross Return (Rs./ha)				Net Return (Rs./ha)				Cost of cultivation (Rs./ha)			B: C Ratio		
	Rai-pur	Jabal-pur	Dhar-wad	Mean	Rai-pur	Jabl-pur	Dhar-wad	Mean	Rai-pur	Jabal-pur	Mean	Dhar-wad	Rai-pur	Mean
V1-JHO-822	91057	92057	84421	89178	63652	64652	54921	61075	27405	28405	27905	1.86	3.32	2.59
V2-RO-19	56204	57204	96000	69803	29199	30199	66500	41966	27005	28005	27505	2.25	2.08	2.17
SE(m) ±	918	91	425		918	91	425					0.01	0.034	
C.D. (P=0.05)	2693	2893	2585		2693	2697	2585					0.09	0.099	
Crop Geometry														
S_1.30 cm	75403	76403	94564	82123	48198	49198	65064	54153	27205	28205		2.2	2.77	2.49
S_2.45 cm	71858	72858	85857	76858	44653	45653	56357	48888	27205	28205		1.91	2.64	2.28
SE(m) ±	918	918	886		918	859	886					0.03	0.034	
C.D. (P=0.05)	2693	2693	3477		2693	2693	3477					0.12	0.099	
Nitrogen doses														
N_1. 80 kg/ha	69639	70639	85479	75252	42638	43638	56179	47485	27001	28001	27501	1.92	2.57	2.25
N_2.100 kg/ha	72723	73723	89022	78489	45467	46467	59522	50485	27256	28256	27756	2.02	2.66	2.34
N_3. 120 kg/ha	78529	79529	96131	84730	51171	52171	66431	56591	27358	28358	27858	2.24	2.87	2.56
SE(m) ±	1124	1236	1459		1124	1124	1459					0.05	0.041	
C.D. (P=0.05)	3298	3365	4374		3298	3397	4374					0.15	0.121	
CV (%)			5.6				8.32					8.32		

Table R-16-AST-1(d): Growth and yield parameters of fodder oat at harvest

Varieties	Plant Height (cm)				No of Tillers				No of Panicle m^{-1} row length		
	Raipur	Jabalpur	Dharwad	Mean	Raipur	Jabalpur	Dharwad	Mean	Raipur	Jabalpur	Mean
V1-JHO-822	122.5	154.24	64.28	113.67	93.4	101.2	48.33	80.98	87.9	83.2	85.55
V2-RO-19	152.2	124.3	69.5	115.33	99.4	95.2	39.44	78.01	81.4	89.7	85.55
SE(m) ±	0.64	0.56	0.83		1.7	1.65	0.98		1.36	1.45	
C.D. (P=0.05)	1.89	1.68	5.06		5.01	4.95	5.98		4.01	4.35	
Crop Geometry											
S_1-30 cm	136.3	138.1	65.94	113.45	90.5	92.3	44.44	75.75	81.6	83.4	82.50
S_2-45 cm	138.3	140.1	67.83	115.41	102.3	104.1	43.33	83.24	87.8	89.6	88.70
SE(m) ±	0.64	0.69	1.74		1.70	1.71	1.34		1.36	1.46	
C.D. (P=0.05)	1.89	2.07	NS		5.01	5.13	NS		4.01	4.38	
Nitrogen doses											
N_1- 80 kg/ha	132.9	132.9	64.25	110.02	86	86	40	70.67	75.7	75.7	75.70
N_2-100 kg/ha	137.7	137.7	66.67	114.02	96.5	96.5	44.67	79.22	83.2	83.2	83.20
N_3- 120 kg/ha	141.4	141.4	69.75	117.52	106.6	106.6	47	86.73	95.1	95.1	95.10
SE(m) ±	0.79	0.81	1.05		2.09	1.80	0.66		1.67	1.71	
C.D. (P=0.05)	2.32	2.43	3.15		6.14	5.40	1.98		4.91	5.13	

Table R-16-AST-1(e): Yield attributes of fodder oat at harvest in different regions

Varieties	Panicle length (cm)			Panicle weight (g)			Filled Grains per panicle (No)		
	Raipur	Jabalpur	Mean	Raipur	Jabalpur	Mean	Raipur	Jabalpur	Mean
V1-JHO-822	31.6	35.9	33.75	3.78	5.44	4.61	77.4	63.2	70.3
V2-RO-19	34.1	33.4	33.75	3.64	5.58	4.61	61.4	79.2	70.3
SE(m) ±	0.28	0.28		0.04	0.4		1.52	1.49	
C.D. (P=0.05)	0.84	0.84		0.118	1.2		4.47	4.74	
Crop Geometry									
S_1-30 cm	32.2	34	33.1	3.59	5.39	4.49	67.8	69.6	68.7
S_2-45 cm	33.5	35.3	34.4	3.83	5.63	4.73	71	72.8	71.9
SE(m) ±	0.28	0.32		0.04	0.5		NS	NS	
C.D. (P=0.05)	0.84	0.96		0.118	1.5				
Nitrogen doses									
N_1- 80 kg/ha	32	32	32	3.48	3.48	3.48	63.1	63.1	63.1
N_2-100 kg/ha	32.8	32.8	32.8	3.7	3.7	3.7	69.1	69.1	69.1
N_3- 120 kg/ha	33.8	33.8	33.8	3.97	3.97	3.97	76	76	76.0
SEm±	0.35	0.46		0.049	0.55		1.86	2.01	
CD (P=0.05)	1.02	1.38		0.144	1.65		5.47	6.03	
CV (%)									

Table R-16-AST-1(f): Growth and Yield attributes of fodder oat at harvest in different regions

Varieties	Unfilled Grains per panicle (No)			1000- grain weight			Tillers/m Row 45 DAS
	Raipur	Jabalpur	Mean	Raipur	Jabalpur	Mean	Dharwad
V1-JHO-822	6.5	17.4	11.95	42.7	30.4	36.55	98.44
V2-RO-19	15.6	8.3	11.95	37.6	32.5	35.05	93.94
SE(m) ±	0.71	0.7		0.64	0.55		0.56
C.D. (P=0.05)	2.08	2.1		1.89	1.65		3.39
Crop Geometry							
S_1.30 cm	9.5	11.3	10.4	39.7	31.5	35.6	93.50
S_2.45 cm	12.6	14.4	13.5	40.6	32.4	36.5	98.89
SE(m) ±	0.71	0.72		NS	NS		0.91
C.D. (P=0.05)	2.08	2.16					3.56
Nitrogen doses							
N_1- 80 kg/ha	9.3	9.3	9.3	38.6	30.6	34.6	92.25
N_2-100 kg/ha	9.7	9.7	9.7	41.1	31.1	36.1	96.33
N_3- 120 kg/ha	14.2	14.2	14.2	40.8	31.8	36.3	100.00
SE(m) ±	0.86	0.69		NS	NS		1.96
C.D. (P=0.05)	2.45	2.07					5.89

R-16-AST-1 (b): Contingent crop plan for fodder oat production in semi arid tropics under irrigated condition [Table Reference: R-16-AST-1 (b): (a)-(c)]

Location: Hyderabad and Dharwad

The experiment was initiated at Hyderabad and Dharwad centers from Rabi 2016-17 to study the feasibility of oats for varied dates of sowing subject to vagaries of agro-climatic conditions. The experiment consisted of four dates of sowing viz. first fortnight of October, second fortnight of October, first fortnight of November and second fortnight of November; two seed rates viz. 80 kg/ha, and 100 kg/ha; and two varieties viz. JHO 822 and Kent. The experiment was conducted under split-split plot design with sowing dates in main plots, seed rates in split plot and varieties in split-split plot. All normal agronomic practices were followed except the treatments.

The analyses of the data revealed that crop planted during second fortnight of October to first fortnight of November recorded higher growth and yield parameters both at 45 days after sowing and at second harvest after seed set. The seed rates did not have any significant influence on growth and yield parameters, while the variety JHO 822 recorded significantly higher values in all the parameters. Although fodder yield were satisfactory at 45 DAS, the fodder yield and grain yield were not very satisfactory at the final cut. This may be attributed to early cessation of winter and shooting temperature observed from February onwards.

Table R-16-AST-1(b): (a) Growth parameters of fodder oat production under different treatments

Time of sowing	Plant Height (cm)						No. of Tillers/ meter row					
	At 45 DAS			At 50% flowering			At 45 DAS			At 50% flowering		
	Hyderabad	Dharwad	Mean	Hydera-bad	Dhar-wad	Mean	Hyder-abad	Dhar-wad	Mean	Hydera-bad	Dhar-wad	Mean
First fort night of October	18.92	122	70.46	60.25	90.27	75.26	122.16	91.48	106.82	140.58	52.18	96.38
Second fortnight of October	32.75	121	76.88	71.83	86.33	79.08	126.56	94.91	110.74	158.08	56.31	107.20
First fortnight of November	27.25	122	74.63	62.25	86.25	74.25	124.40	93.64	109.02	164.58	56.96	110.77
Second fortnight of November	21.75	111	66.38	68.83	85.49	77.16	118.05	90.41	104.23	150.33	53.43	101.88
SE(m) ±	1.27	0.82		1.02	0.91		1.34	0.53		1.37	0.84	
C.D. (P=0.05)	4.41	2.82		3.53	3.16		4.61	1.82		4.75	2.92	
Seed rates												
S1-80 Kg/ha	25.45	118	71.73	63.50	87.35	75.43	121.39	92.43	106.91	152.33	55.15	103.74
S2-100 Kg/ha	24.87	119	71.94	66.58	86.83	76.71	124.20	92.79	108.50	154.46	54.29	104.38
SE(m) ±	0.36	0.73		0.79	0.51		0.87	0.35		1.30	0.87	
C.D. (P=0.05)	NS	NS		NS	NS		2.55	NS		NS	NS	
Variety												
V1-JHO-822	25.25	121	73.13	65.08	88.36	76.72	121.64	93.69	107.67	152.79	55.72	104.26
V2-Kent	25.08	116	70.54	65.00	85.81	75.41	123.95	91.52	107.74	154.00	53.73	103.87
SE(m) ±	0.36	0.80		0.79	0.72		0.87	0.43		1.30	0.37	
C.D. (P=0.05)	NS	2.38		NS	2.16		NS	1.28		NS	1.11	
Interaction												
SE(m) ±	1.02			2.24			2.47			3.68		
C.D. (P=0.05)	NS			NS			NS			NS		

Table R-16-AST-1(b): Productivity of fodder oat production under different treatments

Treatments	GFY (q/ha)						DMY (q/ha)						Test weight (g)
	At 45 DAS (kg/meter row)			At 50% flowering (q/ha)			At 45 DAS (kg/m row)			At 50% flowering (q/ha)			
	Hydera-bad	Dhara-wad	Mean	Hydera-bad	Hydera-bad	Mean	Hydera bad	Dhar-wad	Mean	Hyder-abad	Dhar-wad	Mean	Hydera-bad
Time of sowing													
First fort night of October	0.67	1.05	0.86	333.33	86.3	209.82	0.15	0.22	0.19	70.58	39.10	54.84	3.525
Second fortnight of October	0.76	1.31	1.04	423.33	135.2	279.27	0.23	0.27	0.25	102.52	66.00	84.26	4.108
First fortnight of November	0.79	1.27	1.03	448.33	134.8	291.57	0.22	0.27	0.25	103.77	66.20	84.99	4.179
Second fortnight of November	0.69	1.06	0.88	369.33	87.4	228.37	0.17	0.22	0.20	92.73	40.80	66.77	4.086
SE(m) ±	0.016	0.02		13.74	10.1		0.017	0.00		3.03	5.40		0.09
C.D. (P=0.05)	0.054	0.08		47.43	34.6		0.005	0.02		10.45	18.70		0.31
Seed rates													
S1-80 Kg/ha	0.73	1.18	0.96	405.83	115.9	260.87	0.193	0.25	0.22	90.85	55.90	73.38	3.965
S2-100 Kg/ha	0.72	1.17	0.95	415.83	106	260.92	0.194	0.24	0.22	93.95	50.10	72.03	3.984
SE(m) ±	0.01	0.01		8.21	5.2		0.004	0.00		1.76	3.10		0.058
C.D. (P=0.05)	NS	NS		NS	NS		NS	NS		NS	NS		NS
Variety													
V1-JHO-822	0.72	1.21	0.97	405.83	120	262.92	0.190	0.25	0.22	91.62	58.20	74.91	3.946
V2-Kent	0.73	1.14	0.94	415.83	101.9	258.87	0.197	0.24	0.22	93.19	47.90	70.55	4.086
SE(m) ±	0.01	0.01			3.4		0.004	0.00		1.76	2.00		0.058
C.D. (P=0.05)	NS	0.04		NS	10.2		NS	0.01		NS	6.00		NS
Interaction													
SE(m) ±	0.028						0.012			4.99			0.164
C.D. (P=0.05)	NS			NS			NS			NS			NS

Table R-16-AST-1(b): (c) Yield attributes, grain yield and quality of fodder oat production under different treatments

Treatments	CPY At 50% flowering (q/ha)			Crude protein content (%) at Dharwad		Spike length (cm)			No. of grains/spike			Grain yield (q/ha)		
	Hydera-bad	Dhar-wad	Mean	At 45 DAs	At Harvest	Hydera-bad	Dhar-wad	Mean	Hydera-bad	Dharwad	Mean	Hyderabad	Dhar-wad	Mean
Time of sowing														
First fort night of October	5.53	2.07	3.80	5.99	5.26	24.25	20.02	22.14	32.35	16.46	24.41	18.26	14.32	16.29
Second fortnight of October	8.19	3.71	5.95	6.10	5.57	24.44	21.24	22.84	33.21	16.92	25.07	28.11	15.37	21.74
First fortnight of November	9.43	3.75	6.59	6.11	5.64	23.90	21.49	22.70	31.80	16.79	24.30	22.86	15.58	19.22
Second fortnight of November	7.50	2.18	4.84	5.99	5.30	19.42	20.21	19.82	22.48	14.41	18.45	19.78	14.55	17.17
SE(m) ±	0.29	0.33		0.03	0.06	0.32	0.25		1.14	0.29			0.17	
C.D. (P=0.05)	1.00	1.13		0.10	0.22	1.105	0.85		3.93	1.01		2.7	0.59	
Seed rates														
S1-80 Kg/ha	7.35	3.11	5.23	6.04	5.50	23.01	20.93	21.97	27.78	16.10	21.94	21.88	15.09	18.49
S2-100 Kg/ha	7.97	2.75	5.36	6.05	5.39	22.99	20.54	21.77	30.14	16.18	23.16	22.63	14.82	18.73
SE(m) ±	0.16	0.20		0.03	0.06	0.215	0.25		0.547	0.25		0.25	0.18	
C.D. (P=0.05)	0.46	NS		NS	NS	NS	NS		NS	NS		NS	NS	
Variety														
V1-JHO-822	7.73	3.26	5.49	6.09	5.53	23.01	21.07	22.04	29.73	16.48	23.11	21.88	15.24	18.56
V2-Kent	7.60	2.60	5.1	6.01	5.36	22.99	20.41	21.70	30.19	15.81	23.00	22.63	14.67	18.65
SE(m) ±	0.16	0.13		0.02	0.03	0.215	0.12		0.547	0.15		0.25	0.10	
C.D. (P=0.05)	NS	0.38		0.05	0.10	NS	0.37		NS	0.44		NS	0.29	
Interaction														
SE(m) ±	0.45					0.609			1.54			0.706		
C.D. (P=0.05)	1.32					NS			NS			NS		

R-16-AST-2: Enhancing seed setting in Lucerne through foliar spray

[Table Reference: R-16-AST-2 (a)-(e)]

Location: Coimbatore, Ludhiana, Hyderabad, Bikaner and Anand

A trial was conducted at four centres (Coimbatore, Ludhiana, Hyderabad and Bikaner) to find out the suitable combination of chemical foliar spray, their effect on seed yield, vigour and economics of production of Lucerne. The trial could not be conducted at Anand. The eight treatments included seven chemicals namely; T_1: $ZnSO_4$ 0.25 %, T_2:K_2SO_4 1.0 %, $T_{3:}$ MAP 1.0 %, T_4: Salicylic acid 100 ppm, T_5: Mepiquat chloride 500 ppm
$T_{6:}$ TNAU Pulse wonder 1.0 %, $T_{7:}$ Brasinolide 1.0 ppm and one control i.e. no spray. The treatments were replicated thrice in randomised block design. The results indicated that on locational mean basis treatment $T_{7:}$ Brasinolide 1.0 ppm proved superior to the treatment it recorded higher number of pods/plant, number of seeds/pod. In case of number of seeds/ plant and number of seeds/pod, treatment T_1: $ZnSO_4$ 0.25 %, was at par with $T_{7:}$ Brasinolide 1.0 ppm. The treatment $T_{7:}$ Brasinolide 1.0 ppm also recorded gross returns (Rs 102999/ha), net returns (Rs.63618/ha) and B:C ratio (2.40).

Table R-16-AST-2 (a).Effect of foliar spray on yield parameters and seed yield of Lucerne

Treatments	No. of days taken for maturity				No. of pods per plant					No. of seeds per pod				
	Coimb-atore	Hyder abad	Bika-ner	Mean	Coimb-atore	Bika-ner	Hyder abad	Ludh-iana	Mean	Coim bator e	Bika ner	Hyder abad	Ludh-iana	Mean
T_1 : $ZnSO_4$ 0.25 %	90.2	173	156	139.73	408.4	54.2	24.4	125.3	153.08	4.94	3.93	4.9	3.07	4.21
T_2 : K_2SO_4 1.0 %	91.2	174	154.7	139.97	386.2	40.07	23.7	117.5	141.87	4.86	3.47	4.6	3.08	3.72
T_3: MAP 1.0 %	88.6	172	154	138.20	369.2	51.8	27.7	124.8	143.38	4.49	3.27	5.1	3.07	3.81
T_4 : Salicylic acid 100 ppm	91.3	174	155.3	140.20	380.4	44.8	25	119.3	142.38	5.12	3.53	4.8	3.08	3.80
T_5 : Mepiquat chloride 500 ppm	90.7	172	154	138.90	357.1	42.13	25.2	119.0	135.86	4.83	3.47	5	3.05	3.84
T_6 : TNAU Pulse wonder 1.0 %	89.4	175	153.7	139.37	381.4	42	23.2	114.5	140.28	4.98	3.33	4.7	3.03	3.69
T_7 : Brasinolide 1.0 ppm	91.4	176	155.7	141.03	415.3	53	25.2	119.1	153.15	5.29	3.93	4.9	3.03	3.95
T_8 :Control (No foliar spray)	90.8	177	155	140.93	346.7	46.6	20.9	114.4	132.15	4.84	3.87	4.4	2.98	3.75
SE(m) ±	2.41	1.87	0.92		17.42	2.98	N/A			0.21	0.24	0.40		
C.D. (P=0.05)	NS	0.61	2.79		36.39	9.04	1.46	NS		Ns	0.73	0.13	NS	

Table R-16-AST-2 (b).Effect of foliar spray on yield attributes and seed yield of Lucerne

Treatments	Seed yield (kg/ha)					1000 seed weight (g)				
	Coimba-tore	Hydera-bad	Bika-ner	Ludh-iana	Mean	Coimb - atore	Bika-ner	Hyder-abad	Ludh-iana	Mean
T_1: $ZnSO_4$ 0.25 %	256.3	168.79	26.92	129	145.3	3.37	2.1	2.95	2.59	2.75
T_2 : K_2SO_4 1.0 %	223.1	167.36	16.28	159	141.4	3.42	1.73	3.14	2.56	2.71
T_3 : MAP 1.0 %	202.7	172.35	15.22	121	127.8	3.38	1.65	3.13	2.5	2.67
T_4 : Salicylic acid 100 ppm	209.8	153.72	16.95	134	128.6	3.46	1.79	2.91	2.6	2.69
T_5 : Mepiquat chloride 500 ppm	199.7	175.13	17.2	136	132.0	3.63	1.98	3.05	2.53	2.80
T_6 : TNAU Pulse wonder 1.0 %	249.6	158.19	22.62	102	133.1	3.51	2.07	2.96	2.57	2.78
T_7 : Brasinolide 1.0 ppm	269.4	197.36	27.88	117	152.9	3.54	2.2	3.1	2.61	2.86
T_8 : Control (No foliar spray)	161.2	139.58	15.35	93	102.3	3.33	1.83	2.93	2.58	2.67
SE(m) ±	9.31	18.54	0.80			0.39	0.09	0.17		
C.D. (P=0.05)	20.12	6.05	2.41	17		NS	0.28	0.06	NS	

Table R-16-AST-2: (c). Effect of foliar spray on economics of Lucerne production

Treatments	Cost of Cultivation (Rs./ha)					Gross return (Rs./ha)				
	Coimb-atore	Hydera-bad	Bika-ner	Ludh-iana	Mean	Coimba-tore	Hydera-bad	Bika-ner	Ludh-iana	Mean
T_1 : $ZnSO_4$ 0.25 %	42875	60,943	17956	34440	39054	192225	1,09,714	26050	57916	96476
T_2 : K_2SO_4 1.0 %	43288	60,541	17906	34525	39065	167325	1,08,785	20257	64581	90237
T_3: MAP 1.0 %	43549	60,616	17956	34624	39186	152025	1,12,027	21599	56321	85493
T_4 : Salicylic acid 100 ppm	43375	60,986	18106	35250	39429	157350	99,921	21057	60017	84586
T_5 : Mepiquat chloride 500 ppm	43827	61,350	18006	35320	39626	149775	1,13,836	21884	59888	86346
T_6 : TNAU Pulse wonder 1.0 %	44001	61,016	17906	35100	39506	187200	1,02,826	24968	53379	92093
T_7 : Brasinolide 1.0 ppm	43260	60,990	18006	35265	39380	202050	1,28,285	25799	55860	102999
T_8 :Control (No foliar spray)	42632	60,416	17456	33250	38439	120900	90,729	21737	50992	71090
SE(m) ±		N/A	-				12,051	830		
C.D. (P=0.05)		237	-				3,935	2518		

Table R-16-AST-2: (d). Effect of foliar spray on economics of Lucerne

Treatments	Net Return (Rs./ha)					B:C Ratio				
	Coimb-atore	Hydera-bad	Bika-ner	Ludh-iana	Mean	Coimb-atore	Hydera-bad	Bika-ner	Ludh-iana	Mean
T_1 : $ZnSO_4$ 0.25 %	149350	48,771	8094	23476	57423	4.48	1.8	0.45	0.68	2.24
T_2 : K_2SO_4 1.0 %	124037	48,243	2351	30056	51172	3.87	1.79	0.13	0.87	1.93
T_3: MAP 1.0 %	108476	51,410	3643	21697	46307	3.49	1.84	0.2	0.63	1.84
T_4 : Salicylic acid 100 ppm	113975	38,935	2951	24767	45157	3.63	1.63	0.16	0.70	1.81
T_5 : Mepiquat chloride 500 ppm	105948	52,486	3878	24568	46720	3.42	1.85	0.22	0.70	1.83
T_6 : TNAU Pulse wonder 1.0 %	143199	41,810	7062	18279	52588	4.25	1.68	0.39	0.52	2.11
T_7 : Brasinolide 1.0 ppm	158790	67,295	7793	20595	63618	4.67	2.1	0.43	0.58	2.40
T_8 :Control (No foliar spray)	78268	30,313	4281	17742	32651	2.84	1.5	0.25	0.53	1.53
SE(m) ±		12,039	830				0.19	0.05		
C.D. (P=0.05)		3,931	2518				0.06	0.14		

Table R-16-AST-2: (e): Growth parameters of Lucerne as affected by foliar spray at Ludhiana

Treatments	1st cut		2nd cut		3rd cut	
	Plant height (cm)	Tiller per m row length	Plant height (cm)	Tiller per m row length	Plant height (cm)	Tiller per m row length
Name of chemical						
Boric Acid (0.3%)	20.6	105.4	31.0	98.2	40.3	91.6
ZnSO4 (0.25%)	21.4	107.1	31.7	92.8	41.5	92.7
K2SO4 (1.0%)	22.0	108.8	29.9	99.7	39.1	90.8
MAP (1.0%)	21.7	106.1	29.9	95.8	38.5	90.1
NAA (40 ppm)	22.4	109.3	30.1	97.8	42.2	91.4
Salicylic acid (100 ppm)	22.4	106.1	31.8	102.3	41.0	91.6
Mepiquat chloride (500 ppm)	22.4	105.8	32.1	93.7	38.9	92.0
TNAU Pulse wonder (1.0%)	22.7	104.6	31.2	97.4	41.2	86.7
Brasinolide (1.0 ppm)	21.8	106.6	30.8	102.8	41.5	88.7
Control	22.1	105.6	31.3	93.3	40.1	92.7
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS
Time of spray						
Before flower primordia initiation	21.6	104.4	30.8	97.9	40.4	90.7
Flowering	22.1	108.5	30.7	98.4	41.1	91.5
Both	22.1	106.7	31.5	95.8	39.7	90.3
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS
CV (%)	7.10	5.89	4.84	7.12	6.24	6.67

R-16-AST-3: Effect of nitrogen levels and seed rate on fodder productivity of rye grass (*Lolium multiflorum*) under rice fallows.

[Table Reference: R-16-AST-3 (a)-(e)]

Location: Jorhat and Bhubaneswar

The trial was initiated in Rabi 2017-18 at two locations (Jorhat and Bhubaneswar) to optimise the seed rate and nitrogen levels for ryegrass. The treatments included three seed rates i.e. 10 kg, 15 kg and 20 kg/ha and four nitrogen levels i.e., 0 kg (No nitrogen), 30 Kg, 60 Kg and 90kg N/ha. The treatments were replicated thrice in split- plot design. Rye grass variety PRG-1 was used for the study.

The result indicated that among in three seed rates, rye grass seed at 20 kg/ha was better. It yielded higher green fodder, dry matter and crude protein /ha. At Jorhat the plant height and CP Content remained unaffected by varying seed rate. Rye grass sowing at 20 kg/ha seed rate also recorded higher gross (Rs. 37470/ha) net return (Rs. 23230/ha) and B: C Ratio (1.47)

Table R-16-AST-3 (a): Productivity of Rye Grass (*Lolium multiflorum*) under rice fallow

Treatments	GFY (q/ha)			DMY (q/ha)			Crude Protein Yield (q/ha)		
	Bhubaneswar	Jorhat	Mean	Bhubaneswar	Jorhat	Mean	Bhubaneswar	Jorhat	Mean
Main Plots (Seed Rate-3)									
S_1	326.75	218.18	272.47	58.9	45.55	52.23	6.05	4.00	5.03
S_2	352.85	220.01	286.43	63.53	45.78	54.66	6.42	4.22	5.32
S_3	355.8	249.8	302.80	64.2	52.07	58.14	6.58	4.75	5.67
SE(m) ±	1.07	7.97		0.24	1.59		0.06	0.16	
C.D. (P=0.05)	3.36	26.50		0.74	5.27		0.19	0.55	
Sub Plots (Nitrogen level -4)									
N_1	325.43	69.38	197.41	58.54	14.46	36.50	5.85	1.13	3.49
N_2	338.63	221.54	280.09	61.14	46.41	53.78	6.31	4.04	5.18
N_3	356.4	287.21	321.81	64.38	59.83	62.11	6.74	5.51	6.13
N_4	360.07	339.19	349.63	64.77	70.5	67.64	6.51	6.61	6.56
SE(m) ±	1.64	5.48		0.36	1.10		0.06	0.08	
C.D. (P=0.05)	4.69	17.27		1.03	3.46		0.16	0.26	
Interaction S X N									
SE(m) ±	4.01	9.48		0.88	1.90		0.14	0.14	
C.D. (P=0.05)	11.50	NS		2.52	NS		0.40	NS	
CV (%)	2.14	12.7		2.63	11.36		6.49	13.3	

Table R-16-AST-3 (b): Growth quality and economics of Rye Grass (*Lolium multiflorum*) under rice fallows at Jorhat

Treatments	Plant height (cm)	Tiller /sq m	CP (%)	Gross Income (Rs./ha)	Net Income (Rs./ha)	B: C Ratio
Seed Rate						
S_1	41.37	153.50	8.58	32728	18488	1.15
S_2	43.35	173.17	8.99	33001	18761	1.18
S_3	43.17	184.58	8.96	37470	23230	1.47
SE(m) ±	0.64	2.96	0.05	1196	1196	
C.D. (P=0.05)	2.12	9.85	0.17	3975	3974	
Nitrogen level						
N_1	30.59	114.67	7.82	10407	907	0.10
N_2	40.60	171.22	8.82	33232	19072	1.35
N_3	46.62	182.89	9.29	43082	27012	1.68
N_4	52.70	212.89	9.45	50878	33648	1.95
SE(m) ±	0.64	3.62	0.05	821.31	821	
C.D. (P=0.05)	2.01	11.41	0.16	2590.16	2590.	
Interaction S X N						
SE(m) ±	1.10	6.27	0.09	1422	1422	
C.D. (P=0.05)	NS	19.50	NS	4425.94	NS	
CV (%)	5.65	6.68	2.21	12.3	21.3	

B. LOCATION SPECIFIC TRIALS

K-15-AST-1L: Studies on different models for year round green fodder production under irrigated condition

[Table Reference: K-15-AST-1L (a)-(b)]

Location: Mandya

The trial was initiated during *Kharif* 2015 with objective of identifying the suitable and economical year round fodder production system under irrigated situation. The experiment was laid out in Randomized Block design with four replications and six treatments (two seasonal and four round the year). The treatments included T_1- Fodder Maize + Cowpea (3:1), T_2- Fodder Sorghum + Cowpea (3:1), T_3- BN Hybrid + Cowpea (2:8), T_4- BN Hybrid + Lucerne (2:8), T_5- BN Hybrid + Desmanthus (2:8), T_6- BN Hybrid + *Sesbania grandiflora.* (2:8). The second year results revealed that year round fodder production system of B N hybrid + Lucerne (2:8) recorded higher green fodder yield (1755.30q/ha), DMY of (393.75 q/ha), Net returns (Rs 127632.0 /ha) and B:C ratio of 2.6 followed by B N hybrid +Cowpea (2:8) green fodder yield (1667.35 q/ha) with DMY of (380.94 q/ha), Net returns (Rs 120492.0 /ha) & B : C ratio of 2.6 and crude protein yield of B N hybrid + Cowpea (2:8) recorded higher CPY (40.60 q/ha), followed by B N hybrid + Lucerne (2:8) CPY (40.25 q/ha).

Table K-15-AST-1L (a): Yield and economics of year round fodder production models

Cropping systems	Kharif				Rabi			
	Yield (q/ha)				Yield (q/ha)			
	Green fodder	Dry matter	CPY	CP (%)	Green fodder	Dry matter	CPY	CP (%)
T_1-Fodder Maize + Cowpea (3:1)	504.39	110.32	10.54	10.94	232.27	47.92	6.76	15.33
T_2-Fodder Sorghum + Cowpea (3:1)	417.35	91.70	9.47	12.69	440.00	91.17	8.61	10.94
T_3-B N hybrid +Cowpea (2:8)	611.52	140.31	13.79	10.73	521.52	116.62	12.61	11.60
T_4-B N hybrid + Lucerne (2:8)	592.80	133.65	14.52	12.90	618.26	137.00	13.57	10.49
T_5-B N hybrid + Desmanthus (2:8)	437.65	100.08	7.77	9.41	447.20	101.39	11.10	12.90
T_6-B N hybrid + *Sesbania grandiflora* (2:8)	557.88	122.15	15.05	14.00	491.52	105.62	9.68	10.73
SE(m) ±	25.79	4.25	0.61	0.25	23.45	5.80	0.63	0.28
C.D. (P=0.05)	77.75	12.82	1.84	0.76	70.69	17.47	1.89	0.85
CV (%)	9.92	7.31	10.31	4.31	10.23	11.60	12.07	4.69

Table K-15-AST-1L (b): Yield and Economics of year round fodder production models

Cropping systems	Summer season				Total						
	Yield (q/ha)				Yield (q/ha)				Return (Rs/ha)		
	GFY	DMY	CPY	CP (%)	GFY	DMY	CPY	CP (%)	Gross returns	Net returns	B:C Ratio
T_1-Fodder Maize + Cowpea (3:1)	433.64	107.25	10.53	12.69	1170.3	265.49	27.83	12.98	128688	72763	2.25
T_2-Fodder Sorghum + Cowpea (3:1)	444.92	111.41	12.90	14.89	1302.27	294.28	30.98	12.84	144650	86929	2.51
T_3-B N hybrid +Cowpea (2:8)	534.32	124.00	14.20	13.78	1667.35	380.94	40.60	12.03	194810	120492	2.63
T_4-B N hybrid + Lucerne (2:8)	541.74	127.95	12.15	11.39	1755.30	393.75	40.25	11.59	206535	127632	2.62
T_5-B N hybrid + Desmanthus (2:8)	446.74	103.66	8.90	10.94	1331.59	305.12	27.77	11.09	147423	79217	2.18
T_6-B N hybrid + *Sesbania grandiflora* (2:8)	463.64	106.40	10.34	14.00	1513.3	334.17	35.07	12.91	174555	103175	2.45
SE(m) ±	21.81	5.16	0.74	0.34	61.73	13.73	2.13	0.30	8412.50	4707.36	0.11
C.D. (P=0.05)	65.74	15.55	2.23	1.02	186.08	41.39	6.43	0.92	25358.00	14189.50	0.34
CV (%)	9.13	9.10	12.88	5.24	8.48	8.35	12.64	4.98	10.13	9.57	9.13

K-15-AST-2L: Performance of bajra napier hybrids as influenced by nature of vegetative propagules [Table Reference: K-15-AST-2L (a)]

Location: Dharwad

The experiment was initiated from *kharif* 2015 to develop a suitable planting material for propagation of bajra napier hybrid varieties, as this crop is propagated both by stem cuttings and root slips. This involves movement of bulky material from one place to another. The experiment consisted of three popular varieties of the region viz. DHN 6, Co(BN) 5 and IGFRI 7; and four vegetative propagules viz. 1 eyed stem cutting, 2 eyed stem cutting, 1 eyed root slip and 2 eyed root slips. The planting was done in the month of May 2017 with pre-monsoon showers with all the recommended agronomic practices except the treatments. Observations were recorded before planting for the weight and volume of the material and at 30, 45 and 60 days after transplanting (DAT) for establishment. The first cutting was taken at 75 DAT while subsequent cuttings were taken at 60 (± 5 days coinciding with the peak vegetative growth). Observations on growth and yield parameters were recorded before each cutting. Observations of all the 6 cuttings were pooled and analyzed for all the parameters except the green fodder yield for which each cutting is provided.

The results revealed that weight of the vegetative propagules was lowest with the IGFRI 7 while the volume was lowest with the DHN 6. Among the vegetative propagules, the lowest weight and volume were recorded with the 1 eyed stem cutting, while the 2 eyed root slip recorded the highest weight and volume. The establishment of the vegetative propagules was faster with DHN 6 followed by IGFRI 7 at both 30 and 45 DAT and at 60 DAT all varieties had 100% establishment. Among the vegetative propagules, 2 eyed root slips followed by 2 eyed stem recorded the highest establishment and the lowest was in I eyed stem cutting. The BNH varieties did not show significant difference among themselves with regard to number of tillers/hill, weight of green and dry fodder per hill, while the plant weight was highest with Co(BN) 5 followed by IGFRI 7. The 2 eyed root slips recorded significantly higher values of tillers/hill, plant height, fresh weight and dry weight per hill while the lowest values were observed in 1 eyed stem cutting. The cutting interval wise green fodder yield per hectare showed differential performance. The varieties did not differ significantly in the green fodder yield. The 2 eyed rooted slips recorded significantly higher green fodder yield among the vegetative propagules except at 3rd cut, where all the treatments were at par. The mean and the total green fodder yield showed that 2 eyed root slips, while the lowest was with one eyed stem cutting. The 2 eyed stem cutting and 1 eyed rooted slip were at par. Further the dry fodder yield, crude protein and yield were at par among the varieties. The 2 eyed root slip recorded the highest dry fodder yield and Crude protein yield, while the 1 eyed stem cutting recorded the lowest dry fodder and crude protein yield.

iii. Recommendation

On the basis of the findings of this experiment, the highest green fodder, dry fodder, crude protein yield in bajra napier hybrid may obtained by planting 2 eye budded root slips. However owing to bulky nature of the material, two eye budded stem cutting may also be used with minimum reduction in productivity. The significant reduction in productivity will be during the initial 2 cuttings, thereafter, all the planting material may perform equally well. Nonetheless, under moisture stress conditions, the 2 eye budded root slips could perform better as compared to other planting material. There is no much difference among the varieties under normal growing conditions.

Table K-15-AST-2L (a): Performance of bajra napier hybrids as influenced by nature of vegetative propagules

Treatment	Weight (kg/ha)	Volume (m^3/ha)	Establishment of plants			Tillers / hill	Plant height (cm)	Fresh weight (kg/hill)	Dry weight (kg/hill)	Yield (t/ha/year)			Crude Protein (%)
			30 DAT	45 DAT	60 DAT					Green Fodder	Dry Matter	Crude Protein	
Varieties													
DHN 6	1088.18	161.94	88.29	95.44	100	31.01	175.2	1.22	0.293	202.75	46.81	3.08	6.50
CO(BN) 5	1052.53	188.25	84.33	94.84	100	30.02	191.1	1.27	0.306	211.44	48.68	3.28	6.73
IGFRI -7	1008.13	167.48	85.52	95.44	100	29.67	183.2	1.24	0.298	205.93	47.51	3.19	6.72
SE(m) ±	11.10	3.76	0.39	0.56		0.53	1.59	0.02	0.006	2.73	0.88	0.08	0.12
C.D. (P=0.05)	43.42	14.72	1.51	2.20		NS	6.21	NS	NS	NS	NS	NS	NS
Planting material													
Stem cutting 1 eyed	669.42	71.66	75.66	91.799	100	27.65	172.0	1.16	0.279	191.98	44.67	2.95	6.62
Stem cutting 2 eyed	1058.27	115.70	91.01	95.767	100	30.03	182.5	1.22	0.294	203.63	46.93	3.14	6.68
Root slip 1 eyed	900.43	204.37	84.66	95.238	100	30.12	181.9	1.22	0.296	203.97	47.07	3.14	6.69
Root slip 2 eyed	1570.33	298.50	92.86	98.148	100	33.13	196.3	1.36	0.327	227.24	52.00	3.51	6.62
SE(m) ±	10.77	2.57	0.65	0.671		0.54	1.87	0.03	0.006	3.83	1.06	0.08	0.07
C.D. (P=0.05)	31.99	7.65	1.95	1.994		1.59	5.56	0.09	0.017	11.38	3.14	0.22	NS
CV (%)	3.55	5.17	2.64	2.44		6.13	3.56	8.36	6.66	6.42	7.68	8.21	16.53

R-15-AST-2: Productivity of oat + pea intercropping system as influenced by integrated nutrient management [Table Reference: R-15-AST-2 (a)]

Location: Jorhat

The experiment on effect of oat + pea intercropping system under different INM practices were undertaken to study the performance of the cropping system on productivity of both food and forage. This was the third year of the trial. The treatment comprised of four cropping system i.e. oat (sole), pea (sole), oat+ pea at 3:2 row proportion and oat+ pea at 3:3 row proportion. All the cropping systems were evaluated with three INM practices viz. F_1 RDF (inorganic), F2 50% N of RDF+50% N through FYM and F_3 50% N of RDF+50%N through Vermicompost. The experiment was laid out in Split plot design taking cropping system in main plot and INM treatment in sub plot with three replications.

Perusal of the data, revealed that the highest GFEY of the system as a whole was found in pea sole (817.6 q/ha). However, intercropping system oat+ pea (3:3 ratio) recorded higher GFEY than oat+ pea (3:2 ratio) being 733.5 and 641.7 q/ha. INM with 50% RDF + 50% N through vermicompost recorded the highest GFEY (693.6 q/ha) than other treatments. The highest LER was also recorded (1.19) in oat+ pea (3:3 ratio) which also recorded the highest CP yield. INM treatment could not bring about difference in LER values. The highest net return was recorded in Pea sole followed by oat+ pea (3:3 ratio).

Table R-15-AST-2 (a) Productivity (q/ha) of oat + pea intercropping system as influenced by row proportion and integrated nutrient management

Treatments	yield				Dry matter yield			GFEY
	Oat	Pea		GFEY (Oat+ Pea +Pod)	Oat	Pea	Oat + Pea	
		GFY	Green Pod					
A. Intercropping system								
C_1- Oat sole	331.9	0.0	0	331.93	69.7	0.0	69.7	331.93
C_2- Pea Sole	0.0	232.8	23	817.67	0.0	41.9	41.9	349.22
C_3- Oat+Pea (3:2)	238.3	84.8	14	641.78	50.0	15.3	65.3	365.56
C_4- Oat+Pea (3:3)	239.2	108.3	17	733.56	50.2	19.5	69.8	401.78
SE(m) ±				17.078			2.036	10.440
C.D. (P=0.05)				66.661			13.708	70.280
B. Integrated Nutrient Management								
F_1= RDF (inorganic)	244.1	132.1	15	563.03	51.3	23.8	75.0	331.69
F_2= 50% N of RDF+50%N through FYM	267.5	142.7	18	637.06	56.2	25.7	81.9	361.23
F_3= 50% N of RDF+50%N through Vermicompost	297.8	151.2	20	693.62	62.5	27.2	89.8	393.45
SE(m) ±				3.597			0.787	3.710
C.D. (P=0.05)				11.497			2.516	11.859
Interaction C x F								
SE(m) ±				6.231			1.364	6.426
C.D. (P=0.05)				NS			NS	NS
CV (%)				8.1			9.9	8.6

R-15-AST-2 (a) Growth, quality and economics of oat + pea intercropping system

Treatments	Plant Height (cm)		Plant Population/m		Tillers /m	CP (%)		CPY (q/ha)			LER	Gross Return (Rs/ha)	Net Return (Rs/ha)
A. Intercropping system													
	Oat	**Pea**	**Oat**	**Pea**	**Oat**	**Oat**	**Pea**	**Oat**	**Pea**	**Total**			
C_1- Oat sole	101.3	0.0		0.0	103.0	8.31	0.00	5.80	0.00	5.80	1.00	33193	16008
C_2- Pea Sole	0.0	48.1		12.0	0.0	0.00	15.50	0.00	6.50	6.50	1.00	81764	60986
C_3- Oat+Pea (3:2)	98.0	50.7		13.0	96.0	8.40	15.27	4.21	2.33	6.54	1.08	64175	47297
C_4- Oat+Pea (3:3)	96.0	50.6		12.0	103.0	8.22	15.60	4.13	3.04	7.17	1.19	73353	56824
SE(m) ±										0.168	0.017	1707.97	1707.97
C.D. (P=0.05)										0.656	0.067	6666.61	6666.61
B. Integrated Nutrient Management													
F_1 RDF (inorganic)	92.4	48.7		12.0	95.0	8.21	15.03	4.20	3.57	5.83	1.07	56300	40462
F_2 50% N of RDF+50%N through FYM	98.7	48.5		12.0	101.0	8.26	15.60	4.65	4.02	6.50	1.06	63704	44797
F_3 50% N of RDF+50%N through Vermi compost	104.2	52.3		12.0	107.0	8.45	15.74	5.28	4.29	7.19	1.07	69360	50578
SE(m) ±										0.109	0.020	359.49	359.49
C.D. (P=0.05)										0.349	0.063	1148.98	1148.98
Interaction C x F													
SE(m) ±										0.189	0.034	622.66	622.66
C.D. (P=0.05)										NS	0.118	2166.22	2166.22
CV (%)										7.8		8.11	11.3

R-15-AST-2 (A): Productivity of oat - chickpea intercropping system as influenced by integrated nutrient management

[Table Reference: R-15-AST-2A (a)]

Location: Imphal

The experiment was initiated during Rabi season of 2015-16 to study the effect of productivity of oat - chickpea intercropping system as influenced by integrated nutrient management. The treatments included four intercropping Systems viz., S_1 Sole Oat, S_2 Sole Chickpea, S_3 Oat + Chickpea (3:2) and S_4 Oat + Chickpea (3:3) and three nutrient management practices viz., N_1 RDF (N, P_2O_5& K_2O @ 60: 40:40), N_2 50% N of RDF + 50% N through FYM and N_3 50% N of RDF + 50% N through Vermicompost. The results revealed that plant height, dry matter yield, green fodder and stover yield of oat and chickpea increased in both sole and intercropping systems due to application of all integrated sources of nutrients; significantly higher values of these parameters were recorded with application of 50% nitrogen through inorganic source + 50% through vermicompost. In the third year of experimentation, the data reveals that all parameters of both the crops were significantly higher under sole crop compared to its intercropping. Irrespective of nitrogen sources, intercropping system recorded LER above 1.0 which indicates tremendous advantage of intercropping of oat with chickpea. Total productivity of the systems in terms of green forage equivalent yield, gross returns and B:C ratio was higher in intercropping than sole cropping of oat and chickpea. Among nitrogen sources, supply of 50% of recommended N through inorganic source + 50% through vermicompost was most productive. But in terms of net monetary return, supply of 50% of recommended N through inorganic source + 50% through FYM recorded highest net return (Rs.111863/ ha).

R-15-AST-2 (A) (a): Productivity (q/ha) of oat - chickpea intercropping system as influenced by integrated nutrient management

Treatment	Oat			Chickpea				Green forage equivalent yield	LER of Intercropping System	Gross return (Rs. ha)	Net return (Rs./ha)	Benefit cost ratio
	Green fodder yield	Dry matter yield	Plant height (cm)	Seed yield	Harvest index (%)	Stover yield	Plant height (cm)					
A. Intercropping System												
Sole Oat	492.75	83.65	117.45	-	-	-	-	492.75	1	73913	36231	2.01
Sole Chickpea	-	-	-	18.57	44.94	23.09	54.63	547.66	1	109532	73050	3.05
Oat + Chickpea (3:2)	412.90	70.96	112.04	12.38	42.19	17.14	49.63	764.95	1.51	134957	97675	3.67
Oat + Chickpea (3:3)	387.49	65.34	113.41	15.39	41.42	22.02	51.30	843.44	1.62	148945	111863	4.10
SE(m) ±	6.58	2.91	2.15	0.75	3.68	1.88	2.59	18.89	0.05	3800	3800	0.11
C.D. (P=0.05)	25.85	11.43	NS	NS	NS	NS	NS	65.34	NS	13147	13147	0.37
B. Nutrient												
RDF (N, P_2O_5& K_2O @ 60: 40:40)	405.51	67.78	115.67	14.86	42.48	20.23	52.44	643.32	1.54	111353	80201	3.58
50% N of RDF + 50% N through FYM	414.25	70.39	114.41	15.52	40.46	23.05	51.67	659.97	1.56	115286	80414	3.31
50% N of RDF + 50% N through Vermicompost	473.38	81.78	112.81	15.96	45.60	18.98	51.44	683.32	1.61	123871	78499	2.73
SE(m) ±	6.52	2.25	2.33	0.48	1.46	0.70	1.18	12.38	0.05	2252	2252	0.07
C.D. (P=0.05)	20.09	6.94	NS	NS	NS	2.14	NS	NS	NS	6751	NS	0.20

R-15-AST-4: Study on lucerne + oats /sarson fodder production system at variable seed rates of mixed crop under irrigated condition

[Table Reference: R-15-AST-4 (a)]

Location: Bikaner

Field study was carried out at SKRAU, Bikaner on sandy soil during *rabi* season of 2017-18 to fulfil the objectives: to find out optimum seed rate of oats/ sarson mixed cropping for long term stable green fodder and to work out the economics of different treatments. Ten treatment combinations {100 % Seed rate lucerne (20kg/ha), 100 % Seed rate oats (100 kg/ha), 100 % Seed rate lucerne +10 kg/ha oats, 1100 % Seed rate lucerne +20 kg/ha oats, 100 % Seed rate lucerne +30 kg/ha oats, 100 % Seed rate lucerne + 40 kg/ha oats, 100 % Seed rate lucerne +0.625 kg/ha Sarson, 100 % Seed rate lucerne +1.250 kg/ha Sarson, 100 % Seed rate lucerne +1.880 kg/ha Sarson and 100 % Seed rate lucerne +2.500kg/ha Sarson} were evaluated in randomised block design with three replication. Experimental soil was sandy loam in texture with medium in fertility having OC 0.20%, and 110, 26.5, 225 kg/ha available NPK, respectively. Sowing was done on November 08, 2017 as per treatments. Fertilizers @ 20 kg N, 40 kg P_2O_5 and 20 kg K_2O 12.5 kg $ZnSO_4$ as basal were drilled at sowing. Further 20 kg N in two equal splits at 30DAS and after first cut for green fodder was applied. Total three cuts were harvested as green fodder, starting first at 50-55 DAS and next cuts at 35-40 days interval. The result reveal that 100 % Seed rate oats gave the higher GFY as compared to other treatments, but it was at par with 100 % Seed rate lucerne +10 kg/ha oats, 1100 % Seed rate lucerne +20 kg/ha oats, 100 % Seed rate lucerne +30 kg/ha oats and 100 % Seed rate lucerne +2.500kg/ha Sarson. The maximum DMY was obtained in 100 % Seed rate of lucerne +1.250 kg/ha Sarson which was at par with 100 % Seed rate of lucerne + 0.625 kg/ha Sarson & 100 % Seed rate. Crude protein content was significantly higher in 100 % Seed rate lucerne +2.500kg/ha Sarson over 100 % Seed rate oats. The maximum net return and B:C ratio was observed in 100 % Seed rate oats.

Table R-15-AST-4 (a): Growth, yield, quality and economics of lucerne + oats/sarson mixed fodder production system

Treatment	Yield (q/ha)			C P content (%)	Plant height (cm)	Plant population ('000)	Economics (Rs/ha)			B:C ratio
	GFY	DMY	C P yield				Cost of Cultivation	Gross return	Net return (Rs/ha)	
T_1 Lucerne-20 kg/ha	280.67	39.01	50.14	17.88	46.6	1026667	21851	56133	34282	1.57
T_2 Oat- 100 kg/ha	524.00	64.87	78.90	15.08	60.5	1163333	21851	104800	82949	3.80
T_3 (T_1+10 Oat kg/ha)	446.13	47.76	72.57	16.37	55.8	803333	22251	89227	66976	3.01
T_4 (T_1+Oat 20 kg/ha)	462.33	46.30	77.41	16.80	59.1	816667	22651	92467	69816	3.08
T_5 (T_1+Oat 30 kg/ha)	462.07	52.32	75.79	16.45	51.8	770000	23051	92413	69362	3.01
T_6 (T_1+Oat 40 kg/ha)	391.93	45.22	63.46	16.19	54.3	640000	23451	78387	54936	2.34
T_7 (T_1+Sarson 0.625 kg/ha)	402.07	65.24	64.87	16.09	67.6	303333	21893	80413	58520	2.67
T_8 (T_1+Sarson 1.25 kg/ha)	430.73	68.05	77.27	17.85	60.9	301667	21932	86147	64214	2.93
T_9 (T_1+Sarson 1.88 kg/ha)	399.17	53.56	68.33	17.07	58.0	290000	21973	79833	57860	2.63
T_{10} (T_1+ Sarson 2.50 kg/ha)	476.07	52.14	86.50	18.42	65.8	363333	22014	95213	73200	3.33
SE(m) ±	31.73	4.39	6.61	1.00	2.06	28140	--	11978	11978	0.5
C.D. (P=0.05)	94.28	13.04	19.62	2.98	6.13	83598	--	35586	35586	1.6

R-15-AST-5 (a): Effect of zinc sulphate and borax on seed production potentiality of oats under lateritic soil of West Bengal

[Table Reference: R-15-AST-5 (a)]

Location: Sriniketan, W.B.

A field experiment was conducted during *rabi* season of 2017-18 at Visva-Bharati University, Sriniketan, West Bengal to study the effect of zinc sulphate and borax on seed production potentiality of oats under lateritic soil of W.B. The experiment was laid out in factorial randomized block design with four levels of zinc sulphate (0, 15, 20 and 25 kg/ha) and four levels of borax (0, 5, 10 and 15 kg/ha) having sixteen treatment combinations with each treatment replicated thrice. The test crop oats (variety JHO-822) was raised with a row to row spacing of 30 cm and plant to plant spacing of 10 cm following the recommended package of practice.

The results indicated that, application of $ZnSO_4$ and borax at different levels significantly influenced yield attributes and yield, crude protein yield as well as economics of oats seed production. Combined application of $ZnSO_4$ @ 25 kg /ha along with borax @ 10 kg /ha produced the highest seed yield of oats (3.36 t / ha) which was at par with combined application of 20 kg ZnSO4 and 10 kg Borax/ha (3.23 t/ha). Higher levels of $ZnSO_4$ application @ 25 kg /ha produced at par seed yield with 20 kg /ha $ZnSO_4$ application.

The highest crude protein yield of oat was obtained with the application of @ 20 kg /ha $ZnSO_4$ (341.6 kg/ha) and borax @ 10 kg/ha (341.2 kg/ha) which was significantly higher than 15 kg /ha $ZnSO_4$ and 5 kg/ha borax application. The highest percentage of seed germination was found with the application of @ 25 kg/ha $ZnSO_4$ (93.92%) which was at par with 20 kg/ha (92.75%)

Combined application of $ZnSO_4$ at 25 kg/ha along with 10 kg/ha borax showed highest gross return (Rs. 122140/ha) and net return (Rs. 56438/ha) from seed production of oats but they were at par with $ZnSO_4$ application @ 20 kg/ha (Rs.117660 and Rs. 56438, respectively). The highest return per rupee investment was also obtained from application of 20 kg/ha $ZnSO_4$ (Rs.1.75) along with borax @10 kg/ha (Rs.1.85).

Thus, Application of Zinc sulphate @ 20 kg/ha along with Borax @ 10 kg/ha may be recommended for seed production of oats in red and lateritic soil of West Bengal.

Table R-15-AST-5 (a): Effect of zinc and boron on seed production potentiality of oats under lateritic soil

Treatment	Yield (t/ha)			Harvest Index (%)	Number of panicles/ m^2	Number of filled grains/ panicle	Test weight (g)	Return (Rs./ha)				Crude Protein Yield (kg/ha)	Seed Germination (%)
	Grain	Straw	Biological yield					Gross Return	Cost of Cultivation	Net Return	Return/Rupee Invested		
Levels of Zinc ($ZnSO_4$ kg/ha)													
0	19.60	46.80	2989.00	29.03	170.63	64.95	28.80	72775	42357	30418	1.70	270.0	90.00
15	26.00	58.70	3416.00	30.81	182.52	70.90	29.36	95720	55797	39923	1.71	298.9	91.25
20	28.90	64.00	3395.00	30.98	195.74	75.54	30.42	105825	60277	45548	1.75	341.6	92.75
25	28.70	68.30	97.00	29.47	198.14	70.84	29.13	106540	64757	41783	1.64	339.5	93.92
SE(m) ±	0.70	0.90	280.00	0.65	1.74	2.31	0.37	1962		1962	0.03	9.7	0.50
C.D. (P=0.05)	1.90	2.70	3.10	1.88	5.02	6.68	1.08	5666		5844	0.09	28.0	1.45
Levels of Boron(Borax kg/ha)													
0	20.90	53.40	74.30	27.69	169.29	64.81	28.53	78750	52961	25788	1.47	280.6	91.3
5	25.80	58.20	84.00	30.87	178.74	69.33	29.53	94908	54851	40056	1.74	294.1	91.6
10	28.60	63.70	92.30	30.84	203.10	75.74	30.06	104875	56741	48133	1.85	341.2	92.4
15	27.90	62.50	90.40	30.90	195.89	72.33	29.60	102328	58631	43696	1.76	334.0	92.7
SE(m) ±	0.70	0.90	1.10	0.65	1.74	2.31	0.37	1962		1962	0.03	9.7	0.5
C.D. (P=0.05)	1.90	2.70	3.10	1.88	5.02	6.68	1.08	5666		5844	0.09	28.0	NS
Zn x B Interaction													
SE(m) ±	1.3	1.8	2.1	1.30	3.47	4.60	0.74	3923		3923	0.00	19.40	1.0
C.D. (P=0.05)	3.7	NS	NS	3.75	NS	NS	NS	11332		11328	NS	NS	NS
CV (%)	8.82	5.47	4.43	7.50	3.22	11.35	4.40	7.14		17.24	6.63	10.76	1.88

K-15 AST-8-7L: Screening of genotypes of fodder oat under sodic soil

[Table Reference: K-15-AST-8-7L (a)]

Location: Faizabad

The field experiment was conducted during three consecutive seasons of Rabi 2015-16, 2016-17 and 2017-18 at Faizabad centre to screen out the fodder oat entries for their performance under sodic condition. The treatment comprised of total 8 genotypes including 2 checks *viz*; NDO-952, NDO-1101, NDO-1709, NDO-951, NDO-911, NDO-726, NDO-1 (check) and NDO-2 (check) replicated thrice in randomized block design. Experimental field soil was sodic in reaction and poor in fertility (pH-8.9, EC-0.72dSm^{-1}, ESP-16.7% , organic carbon -0.24%, available N-195.4 kg, P -16.2 kg and K -187.8 kg/ha), silty loam in texture and saline in reaction. The results indicated that among all the entries tested, NDO-951 was superior in all parameters viz., green fodder, dry matter and crude protein yields as well as per day productivity. This was closely followed by NDO-952.

K-15 AST-8-7L (a): performance of genotypes of fodder oat under sodic soil

Genotype	GFY (q/ha)				DMY (q/ha)				CPY (q/ha)				Per day Productivity (q/ha/day)							
													Green fodder				Dry matter			
	2015-16	2016-17	2017-18	Mean	2015-16	2016-17	2017-18	Mean	2015-16	2016-17	2017-18	Mean	2015-16	2016-17	2017-18	Mean	2015-16	2016-17	2017-18	Mean
NDO-952	512.4	520.7	514.6	516	120.9	121.8	120.9	121.20	9.9	10.0	9.6	9.83	4.58	4.60	4.55	4.58	1.08	1.08	1.07	1.08
NDO-1101	460.7	466.4	459.5	462	106.9	106.8	106.6	106.77	8.4	8.4	8.4	8.40	4.11	4.13	4.06	4.10	0.95	0.94	0.94	0.94
NDO-1709	430.4	427.6	426.7	428	98.1	98.7	99.8	98.87	7.6	7.8	7.8	7.73	3.84	3.78	3.77	3.80	0.88	0.87	0.88	0.88
NDO-951	556.6	582.3	561.3	567	136.6	140.9	133.9	137.13	11.6	12.0	10.8	11.47	5.06	5.15	4.96	5.06	1.22	1.24	1.18	1.21
NDO-911	416.8	420.5	414.6	417	93.4	97.9	96.8	96.03	7.5	7.8	7.6	7.63	3.75	3.72	3.67	3.71	0.83	0.87	0.85	0.85
NDO-726	401.5	395.7	397.4	398	93.1	90.6	93.0	92.23	7.2	7.3	7.2	7.23	3.58	3.50	3.52	3.53	0.83	0.80	0.82	0.82
NDO-1(check)	385.3	388.4	380.8	385	82.2	88.5	89.5	86.73	6.6	6.8	7.1	6.83	3.44	3.43	3.37	3.41	0.79	0.78	0.79	0.79
NDO-2(check)	378.2	375.8	372.5	376	85.5	86.4	86.8	86.23	6.5	6.7	6.8	6.67	3.38	3.32	3.29	3.33	0.76	0.76	0.77	0.76
C.D. (P=0.05)	65.8	72.5	55.62		18.6	18.1	18.22		1.52	1.32	1.25		-	-	-		-	-	-	

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

[Table Reference: K-16-AST-6 (a)]

Location: Hisar

The experiment was initiated in 2016 to study the feasibility of organic nutrient management in sorghum-berseem cropping sequence for sustainable fodder production. The treatments included T_1: Recommended dose of fertilizers through inorganic source (75 kg N + 15 kg P2O5/ha; N in two splits i.e. 50 kg at sowing an 25 kg after one month, full dose of phosphorus as basal dose, Berseem : 25 kg N + 70 kg P2O5/ha both at the time of sowing; T_2: 20 t FYM/ha (15 t in sorghum and 5 t/ha in berseem); T_3: 20 t FYM/ha (15 t in sorghum + 5 t in berseem) + biofertilizer; T_4: 20 t FYM/ha (15 t in sorghum + 5 t in berseem) + Green manuring; T_5: 20 t FYM/ha (15 t in sorghum + 5 t in berseem) + biofertilizer + Green manuring; T_6: 7.5 t vermicompost/ha (5 t in sorghum + 2.5 t in berseem); T_7: 7.5 t vermicompost/ha (5 t in sorghum + 2.5 t in berseem) + biofertilizer; T_8: 7.5 t vermicompost/ha (5 t in sorghum + 2.5 t in berseem) + Green manuring and T_9: 7.5 t vermicompost/ha (5 t in sorghum + 2.5 t in berseem) + bio fertilizer + Green manuring the treatments were replicate thrice in Randomised Block Design. For single-cut forage sorghum, date of sowing was 28.07.2017 and variety used was HJ- 541 during Kharif. Berseem crop (HB-1) was taken during Rabi season. Sowing of berseem crop was done on 30.11.2017. Total five cuts were taken in the berseem crop in all the treatments.

Data revealed that, during Kharif 2017, highest green fodder and dry matter yield of sorghum were recorded with T_1 (427.20 q/ha and 109.51 q/ha, respectively) which were on a par with T_5 and T_9. During Rabi 2017-18, highest green fodder and dry matter yield of berseem were recorded with T_1 (645.03 q/ha and 90.93 q/ha, respectively) which were on a par with T_4, T_5, T_8 and T_9. Maximum total green fodder yield of the cropping sequence was recorded with T_1 (1072.24 q/ha) followed by T_9 and T_5. Economic analyses of sorghum-berseem cropping sequence reveal that maximum net returns and B: C ratio was fetched in T_1 followed by T_5.

Table K-16-AST-6 (a): Effect of organic nutrient management on sorghum-berseem cropping sequence

Treatments	Growth parameters				Yield (q/ha)						Economics (Rs.)			
	Sorghum		Berseem		Sorghum		Berseem		Total yield					
	No. of tillers/m row	Plant height (cm)	No. of tillers m^{-2}	Plant height (cm)	Green fodder	Dry matter	Green fodder	Dry matter	Green fodder	Dry matter	Cost of cultivation	Gross returns	Net returns	B:C ratio
T_1	10.00	241.89	545.1	64.93	427.20	109.51	645.03	90.93	1072.24	200.44	97697	134026	36328	1.37
T_2	10.34	211.56	455.6	57.90	359.91	87.97	538.40	70.27	898.31	158.24	100665	112287	11622	1.12
T_3	9.44	222.00	477.8	60.38	380.24	92.82	576.13	75.80	956.38	168.62	100819	119549	18730	1.19
T_4	10.00	225.67	517.8	62.73	383.50	96.15	600.17	85.30	983.67	181.45	100665	122961	22296	1.22
T_5	9.67	228.11	549.8	63.86	395.36	100.35	625.83	88.93	1021.20	189.28	100819	127652	26833	1.27
T_6	9.89	214.34	470.3	58.46	347.51	84.89	529.37	68.53	876.87	153.42	125328	109606	-15722	0.87
T_7	10.11	217.00	498.8	60.49	360.90	91.61	563.07	75.60	923.97	167.21	125481	115497	-9984	0.92
T_8	10.00	219.11	515.5	62.40	371.77	92.85	598.53	85.47	970.30	178.32	125328	121287	-4041	0.97
T_9	10.33	232.11	539.7	64.01	402.09	102.93	622.70	88.40	1024.79	191.33	125481	128098	2616	1.02
SE(m) ±	0.60	5.59	1.08	0.86	13.72	3.12	15.67	2.30	-					
C.D. (P=0.05)	NS	16.91	3.26	2.59	41.48	9.42	47.39	6.95	-					
CV %	10.46	4.33	4.09	2.40	6.24	5.65	4.61	4.91	-					

K-16-AST-8: Resource management in rice-oat cropping system under sodic soils
[Table Reference: K-16-AST-8 (a) - (c)]

Location: Faizabad

The field experiment was initiated during *Kharif* 2016 at Faizabad centre to optimize the sources of nutrient management in rice-oat cropping system under sodic soils. The treatments comprised of eight treatments viz.; control (No fertilizer), RDF ($120N:60P_2O_5:40K_2O$ kg/ha), combination of 75% RDF and 50% RDF with 25% N and 50% N substitution through pressmud, *Sesbania* and crop residue, respectively laid out in Randomized Block Design and replicated thrice .The soil of experimental field was sodic and poor in fertility (pH – 9.1, E.C.- 0.97dsm^{-1}, ESP-32.7%,Organic Carbon-0.23%, Available. N- 115.4 kg, P –15.6 kg and K-240.0 kg/ha), silty loam in texture and saline in reaction .The paddy var.Sarjoo-52 was transplanted on July 31, 2017 and fertilized as per treatment while fodder oat sown after harvest of paddy during Rabi 2017-18 and was fertilized with recommended dose of fertilizers. The results revealed that the grain and straw yields of paddy were significantly higher with RDF and being *at par* with 75% RDF+25% N through *Sesbania*. Non significant response was recorded for harvest index of paddy. The lowest value was observed with control for all the growth and yield parameters pertaining to paddy crop. The integrated nutrient applied to paddy crop did not affect the GFY, DMY& CPY of the preceding fodder oat under rice-oat cropping system during first and second year of experimentation. Total green forage yield, gross return, net return and net return per rupee investment were observed higher with RDF followed by 75% RDF+25% N through *Sesbania* under rice – oat cropping system during the year 2017-18. Observations recorded on physico- chemical properties of soil after harvest of the fodder oat during second year of experimentation showed consistent increase in available nitrogen and phosphorous with 75% RDF+25%N through *Sesbania* / pressmud over control. Subsequent decrease in pH, EC and ESP as well as increase in Organic Carbon percentage observed through organic substitution over its initial values.

Table K-16-AST-8 (a): Effect of integrated nutrient management on fodder production under rice-oat cropping system during 2017-18

Treatment	Rice			Oat forage equivalent Yield (q/ha)	Oat			Total Green Forage equivalent Yield (q/ha)
	Grain yield (q/ha)	Straw yield (q/ha)	Harvest index (%)		GFY (q/ha)	DMY (q/ha)	CPY (q/ha)	
Control	18.32	27.77	40.52	165.24	472.50	107.73	8.40	637.74
RDF(120N:60P_2O_5: 40K_2O kg/ha)	41.60	54.92	43.10	360.26	498.60	118.17	9.45	858.86
75% RDF+25% N through pressmud	34.70	47.20	42.40	301.20	491.7	115.06	9.09	792.90
75% RDF+25% N through *Sesbania*	38.45	51.13	42.92	333.16	494.80	117.76	9.42	827.96
75% RDF+25% N through crop residue	32.90	46.66	41.35	286.53	486.20	113.28	8.83	772.73
50% RDF+50% N through pressmud	32.12	45.93	41.15	279.92	488.30	114.28	9.03	768.22
50% RDF+50% N through *Sesbania*	33.32	47.07	41.45	290.10	492.50	116.72	9.34	782.60
50% RDF+50% N through crop residue	30.93	44.27	40.73	269.57	483.80	112.73	8.79	753.37
SE(m) ±	3.02	3.30	2.56	25.55	33.07	7.93	0.58	43.40
C.D. (P=0.05)	6.47	7.07	NS	54.80	NS	NS	NS	93.12
CV%	11.24	8.86	7.51	10.95	8.29	8.49	7.86	6.87

Table K-16-AST-8 (b): Monetary return as influenced by integrated nutrient management under rice-oat cropping system during 2017-18

Treatment	Cost of cultivation (Rs.)			Gross return (Rs.)	Net return (Rs.)	Net return/ rupee investment
	Rice	Oat	Total			
Control	33877	19851	53728	95661	41933	0.78
RDF(120N:60P_2O_5: 40K_2O kg/ha)	40355	19851	60206	128829	68623	1.14
75% RDF+25% N through pressmud	44200	19851	64051	118935	54884	0.86
75% RDF+25% N through *Sesbania*	41585	19851	61436	124194	62758	1.02
75% RDF+25% N through crop residue	43835	19851	63686	115910	52224	0.82
50% RDF+50% N through pressmud	48107	19851	67958	115233	47275	0.69
50% RDF+50% N through *Sesbania*	42815	19851	62666	117390	54724	0.87
50% RDF+50% N through crop residue	47315	19851	67166	113006	45840	0.68

Table K-16-AST-8 (c): Effect of integrated nutrient management on physico-chemical properties of soil after harvest of fodder oat under rice-oat cropping system during 2017-18

Treatment	Available nutrients(kg/ha)			pH value	EC dSm^{-1}	Exchangeable sodium (%)	O.C. (%)
	N	P	K				
Control	115.7	15.7	241	9.1	0.97	32.8	0.23
RDF(120N:60P_2O_5:40K_2O kg/ha)	123.4	16.5	254	9.0	0.94	31.8	0.24
75% RDF+25% N through pressmud	125.8	17.0	258	8.9	0.92	30.9	0.26
75% RDF+25% N through *Sesbania*	129.9	17.7	262	8.8	0.91	30.6	0.28
75% RDF+25% N through crop residue	124.2	16.6	254	8.9	0.93	31.2	0.24
50% RDF+50% N through pressmud	124.4	16.6	257	8.8	0.91	31.4	0.26
50% RDF+50% N through *Sesbania*	129.3	17.2	260	8.7	0.90	30.5	0.29
50% RDF+50% N through crop residue	122.7	16.3	250	8.9	0.92	31.3	0.25
Initial value	115.4	15.6	240	9.1	0.97	32.7	0.23
SE(m) ±	4.29	0.65	10.4	-	-	-	-
C.D. (P=0.05)	9.20	1.41	NS	-	-	-	-
CV%	4.22	4.76	5.0	-	-	-	-

K-17-AST-2: Standardization of seed production techniques in fodder Maize

[Table Reference: K-17-AST-2 (a)-(c)]

Location: Raipur

The field experiment was initiated during *Rabi* 2017-18 to standardize the seed production techniques in fodder maize under Chhattisgarh conditions with the objective of to study the seed production potentiality of fodder maize and economics of seed production of variety African Tall. The treatment comprised of different combinations of nitrogen levels as 0, 80,120 and 160 kg ha^{-1} and planting geometry of 50, 60 and 70 cm row to row and 20 cm plant to plant spacing. Total twelve treatment combination of nitrogen level and planting geometry were tested for higher seed yield in *Rabi* season. The treatment were replicated thrice in randomize block design in factorial arrangement. The trial was proposed for Kharif season but it could not be conducted due to rains. Hence, it was conducted in Rabi season.

The result indicated that the combination of application of 160kg ha^{-1} nitrogen with the planting geometry of 75 cm X20 cm recorded significantly higher seed yield 34.3 (q/ha) with the 126.7 (q/ha) straw yield. The gross return (Rs105367), net return (Rs64648) and return per rupee invested (2.59) was maximum with the combination of 160kg ha^{-1} nitrogen with 75 cm X20 cm planting geometry. The yield attributing parameters like plant height, no of cob per plant, cob length (cm), cob girth (cm), no of grain per cob weight and 100 seed weight was also higher in this combination.

Table K-17-AST-2 (a): Yield and economics of fodder maize grown for seed production

Nutrient (Kg ha^{-1})	Yield (q/ha)		Harvest index (%)	In Rs.			B: C Ratio
	Seed	Straw		Cost of cultivation	Gross Return	Net return	
N_1 0	10.44	92.56	10.26	35226	37456	2230	1.06
N_2 80	17.11	131.11	11.71	39925	59311	19386	1.49
N_3 120	24.78	140.44	15.23	40450	80944	40494	2.00
N_4 160	28.56	147.44	16.47	40969	91844	50875	2.24
SE(m) ±	0.58	2.48	0.35	--	1643	1643	0.04
C.D. (P=0.05)	1.69	7.28	1.02	--	4819	4819	0.12
Spacing (cm)							
S_1 50	16.33	143.42	9.96	39393	58442	19049	1.46
S_2 60	20.33	128.50	13.27	39143	67750	28608	1.71
S_3 75	24.00	111.75	17.02	38893	75975	37083	1.92
SE(m) ±	0.50	2.15	0.30	--	1423	1423	0.04
C.D. (P=0.05)	1.47	6.31	0.88	--	4174	4174	0.10
Interaction Nutrient X Spacing	S	NS	S	--	S	S	S

Table K-17-AST-2 (b): Yield and yield attributes at harvest of fodder maize grown for seed production

Nutrient (Kg ha^{1})	Plant population	No of cob	Cob length	Cob girth	No of grain	Cob weight	100 seed weight
	Per row m at 15 DAS	Per plant	(cm)	(cm)	Per cob	(g)	(g)
N_1 0	4.90	0.77	15.14	3.43	363	109	27.22
N_2 80	5.10	1.07	17.11	3.62	396	132	28.56
N_3 120	4.93	1.10	18.28	4.11	431	146	30.79
N_4 160	4.94	1.16	19.26	4.29	465	165	31.83
SE(m) ±	NS	0.05	0.44	0.05	4.59	3.70	0.55
C.D. (P=0.05)		0.15	1.28	0.14	13.47	10.85	1.61
Spacing (cm)							
S_1 50	5.00	0.98	16.59	3.66	381	130	28.33
S_2 60	4.89	1.02	17.31	3.80	423	139	29.46
S_3 75	5.02	1.07	18.44	4.12	438	145	31.01
SE(m) ±	NS	0.04	0.38	0.04	3.98	3.20	0.47
C.D. (P=0.05)		0.13	1.11	0.12	11.66	9.39	1.39
Interaction Nutrient X Spacing	NS	NS	NS	S	S	S	NS

Table K-17-AST-2 (c): Growth parameters of fodder maize grown for seed production

Nutrient (Kg ha^{1})	Plant height (cm)					Number of leaves			
	20 DAS	40 DAS	60DAS	80 DAS	Harvest	20 DAS	40 DAS	60DAS	80 DAS
N_1 0	11.49	25.87	56.19	138.42	182.06	3.38	4.58	8.23	10.16
N_2 80	12.35	30.56	70.24	174.24	234.04	3.44	4.81	9.34	11.50
N_3 120	12.70	34.30	79.79	191.98	268.43	3.47	5.20	9.59	12.29
N_4 160	13.01	34.98	83.70	200.59	301.10	3.56	5.38	10.01	12.94
SE(m) ±	NS	0.91	2.56	5.90	5.85	NS	0.11	0.19	0.21
C.D. (P=0.05)		2.67	7.52	17.32	17.16		0.33	0.57	0.62
Spacing (cm)									
S_1 50	12.10	29.25	63.94	166.15	233.47	3.35	4.88	8.43	10.87
S_2 60	12.38	31.49	73.37	173.51	243.09	3.42	4.96	9.43	11.65
S_3 75	12.68	33.54	80.13	189.26	262.65	3.62	5.14	10.03	12.65
SE(m) ±	NS	0.79	2.22	5.11	5.07	NS	0.10	0.17	0.18
C.D. (P=0.05)		2.31	6.51	15.00	14.86		0.28	0.49	0.53
Interaction Nutrient X Spacing	NS	NS	NS	NS	NS	NS	NS	S	S

R-17-AST-3: Evaluation of fodder productivity and quality in dual purpose wheat and berseem (single cut) intercropping system

[Table Reference: R-17-AST-3 (a)-(b)]

Location: Ludhiana

A field experiment was carried out during *rabi* 2017-18 at PAU, Ludhiana to study the effect of wheat + berseem mixture and time of cutting on fodder productivity, feasibility and economics of dual purpose wheat and single cut berseem intercropping system.

The crops (wheat and berseem) and their combinations harvested at 70 days after sowing, produced significantly higher green fodder (115.3 q/ha) and dry matter (14.2 q/ha) yields than crop harvested at 60 DAS. The plant height of wheat and berseem were also significantly higher at 70 DAS than at 60 DAS. The tillers of wheat were not significantly affected by harvest stage. The crude protein yield of fodder was also significantly higher at 70 DAS.

Among the different crops and their combinations, the lowest green fodder (71.7 q/ha) and dry matter (7.25 q/ha) yields were observed in pure berseem. Wheat + berseem 100 % of recommended seed rate recorded significantly higher green fodder (121.2 q/ha) and dry matter (14.73 q/ha) yields, which was at par with wheat + berseem (75 % of recommended seed rate) but was significantly higher than berseem pure, wheat pure and wheat + berseem (50 % of recommended seed rate). The highest crude protein yield (2.68 q/ha) was obtained in wheat + berseem 100 % of recommended seed rate which was at par with wheat + berseem 75 % of recommended seed rate (2.42 q/ha) but was significantly higher than berseem pure (1.39 q/ha), wheat pure (1.92 q/ha) and wheat + berseem 50 % of recommended seed rate (2.14 q/ha).

The seed yield of wheat was highest in wheat + berseem 100 % of recommended seed rate (41.6 q/ha) which was significantly higher over berseem pure, wheat pure and wheat + berseem (50 % of recommended seed rate) but was at par with (wheat + berseem 75 % of recommended seed rate). The wheat equivalent yield (49.9 q/ha), net returns (Rs. 51234/ha) and B:C ratio (1.45) were also highest in wheat + berseem 100 % of recommended seed rate.

Table R-17-AST-3 (a): Grain yield and economics of dual purpose wheat and single cut berseem intercropping system

Treatments	Grain yield (q/ha)	Straw yield (q/ha)	Harvest index	Wheat equivalent yield (q/ha)	Net returns (Rs/ha)	B:C ratio
Crop mixtures						
Wheat pure two cuts	38.6	84.2	31	46.2	44722	1.26
Berseem pure	-	-	-	5.0	-19345	-0.65
Wheat +berseem 50 %	39.5	80.3	33	46.8	45823	1.30
Wheat +berseem 75 %	40.4	78.5	34	48.5	48780	1.38
Wheat +berseem 100 %	41.6	74.9	36	49.9	51234	1.45
C.D. (P=0.05)	1.49	5.76	0.21	1.35	2333.1	0.068
SE(m) ±	0.69	2.69	0.10	0.64	1110.9	0.032
Harvest dates						
60 DAS	41.4	83.2	33	39.7	33392	0.94
70 DAS	38.7	75.7	34	38.9	35093	0.95
C.D. (P=0.05)	1.05	4.08	NS	NS	1475.6	NS
SE(m) ±	0.49	1.90	0.07	0.41	702.7	0.02
Interaction CD (P=0.05)	NS	NS	NS	NS	3299.5	NS
SE(m) ±	0.98	3.80	0.14	0.91	1571.2	0.058
Treatments mean v/s wheat no cut for fodder						
Wheat no cut for fodder	47.4	104.5	0.31	47.4	52384	1.75
Treatments mean	40.1	79.5	33.5	39.3	34243	0.95
C.D. (P=0.05)	4.46	6.97	0.69	1.37	2362.7	0.11
SE(m) ±	2.11	3.29	0.33	0.66	1132.7	0.05
CV %	8.43	6.55	5.11	2.70	5.21	5.38

Table R-17-AST-3 (b): Growth parameters and yield attributes of dual purpose wheat and single cut berseem intercropping system

Treatments	Plant height (cm)	Tillers/m row length	1000 grain weight (g)	Ear length (cm)	Grains/ear
Crop mixtures					
Wheat pure two cuts	96.4	62.6	35.8	9.67	50.5
Wheat +berseem 50 %	95.8	63.9	35.9	9.83	50.9
Wheat +berseem 75 %	96.4	62.9	34.7	9.83	51.7
Wheat +berseem 100 %	96.0	60.7	34.4	9.97	52.3
C.D. (P=0.05)	NS	NS	0.75	NS	NS
SE(m) ±	0.57	2.26	0.35	0.18	0.65
Harvest dates					
60 DAS	98.9	63.3	35.4	9.96	51.8
70 DAS	93.5	61.7	35.1	9.69	50.8
C.D. (P=0.05)	0.87	NS	NS	NS	NS
SE(m) ±	0.41	1.60	0.25	0.15	0.46
Interaction CD 5%	NS	NS	NS	NS	NS
SE(m)	0.81	3.19	0.49	0.29	0.92
Treatments mean v/s wheat no cut for fodder					
Wheat no cut for fodder	104.7	63.3	37.3	10.3	53.7
Treatments mean	96.2	62.5	35.3	9.83	51.3
C.D. (P=0.05)	1.28	4.83	0.90	0.10	1.42
SE(m) ±	0.60	2.28	0.43	0.047	0.67
CV %	7.02	5.94	4.96	5.78	2.12

R-17-AST-4: Effect of different nitrogen levels on productivity of perennial grasses under hilly terrace condition

[Table Reference: R-17-AST-4(a)]

Location: Nagaland University, Medziphema

A trial was conducted during 2017 at Nagaland University, Medziphema to identify the suitable perennial grass for the Nagaland and the effect of nitrogen application on its growth and yield. The treatments consisted of three grass species namely; G1-Congosignal, G2-Setaria and G3- BN Hybrid and four nitrogen levels i.e., N0-Control, N1-60kg N/ha, N2-80kg N/ha, N3-100kg N/ha and N4-120kg N/ha. During the first year of experimentation (2017) significant differences in green forage yield was recorded due to different doses of nitrogen on different perennial grasses. During the first cut in the month of August both grasses and nitrogen doses recorded significant yield differences and highest was recorded by the Setaria (219.73q/ha) followed by Congosignal (132.88q/ha) and lowest in BN Hybrid (84.16q/ha). Under different doses of nitrogen, the yields increased proportionally from 0 kg to 100 kg/ha, respectively. However, during the first cut no significant differences in yield was recorded due to interaction of grasses x N doses. The low yield during the first cut was due to initial establishment of the crops and low tillers per tussock, which tends to increased with due course of growth. After second cut in the end of October it was found that yield increased significantly almost similar trend i.e., Setaria recorded highest yield (479.64q/ha) followed by Congosignal (252.08q/ha), similarly N dose at 100kg/ha recorded highest yield of 418.71q/ha. The interaction effect of grasses and nitrogen doses found significant and Setaria at 100kg N recorded highest green fodder yield of 613.70q/ha.

Among the perennial grasses, setaria found to be higher Leaf: stem ratio (1.33) and BN Hybrid lowest (0.75) ratio but under different N doses it was found that as N doses increases L:S tend to increases and at highest dose (120kgN/ha) L:S ratio found highest (1.31).

Dry matter yield responses similar to green forage yield. Highest total dry matter yield (87.42q/ha) was recorded by Setaria and nitrogen dose at 100kg/ha (76.42q/ha). However, highest crude protein percentage was recorded by the Congosignal (9.70%).

Table R-17-AST-4 (a): Effect of different N doses on growth and yield of perennial grasses during 2017

Treatments	Plant height (cm)	Tillers /Tussok	Leaf: Stem Ratio	Green fodder yield (q/ha)			Dry matter yield(q/ha)			%N content	Crude Protein (%)
				I cut	II-cut	Total	I cut	II-cut	Total		
Grasses (G)											
G_1-Congosignal	121.82	20.4	1.14	132.88	252.08	384.96	16.61	31.54	48.15	1.55	9.7
G_2-Setaria	128.55	24.33	1.33	219.73	479.64	699.37	27.47	60.01	87.42	1.38	8.66
G_3-Hybrid Napier	183.11	11.26	0.75	84.16	178.26	265.51	11.58	22.24	33.82	1.18	7.43
SE(m) ±	3.331	1.49	0.132	12.555	6.483	19.552	1.675	0.835	2.232	0.013	0.081
C.D. (P=0.05)	11.156	4.992	0.443	42.052	21.715	65.491	5.612	2.798	7.477	0.043	0.273
Nitrogen (N)											
N_0-Control	128.03	21.22	0.9	97.25	192.54	289.79	12.15	24.06	36.21	1.25	7.86
N_1-60kg N/ha	131.96	24.33	1.03	126.67	241.63	368.3	17.61	30.33	47.94	1.31	8.18
N_2-80kg N/ha	146.77	16.55	1.15	154.87	309.66	469.67	19.35	38.81	58.06	1.36	8.52
N_3-100kg N/ha	167.7	15.66	0.97	193.32	418.71	612.03	24.16	52.26	76.42	1.44	9.03
N_4-120kg N/ha	148	15.55	1.31	155.85	354.08	509.94	19.48	44.19	63.67	1.5	9.41
SE(m) ±	4.3	1.924	0.171	16.208	8.369	25.242	2.163	1.078	2.882	0.016	0.105
C.D. (P=0.05)	14.403	6.445	NS	54.289	28.034	84.549	7.245	3.613	9.653	0.056	0.352
Interaction G x N											
SE(m) ±	7.448	3.332	0.295	28.073	14.497	43.721	3.746	1.868	4.992	0.029	0.182
C.D. (P=0.05)	24.947	NS	NS	NS	48.557	146.443	NS	6.258	16.721	0.097	0.611

R-17-AST-5: Seed yield maximization in Oat *cv.* RO-19 (Phule Harita)

[Table Reference: R-17-AST-5 (a)]

Location: Rahuri

A field trial was conducted with the objectives to study the effect of different levels of silicon dioxide and cutting intervals on lodging and seed yield of oat (RO-19-Phule Harita) and economics of different treatments. The treatments comprised of different combinations of Levels of Silicon dioxide; S_1- 0 (Control), S_2- 200, S_3- 300 and 400 Kg ha^{-1} and Cutting management; C_1- No cutting, C_2- 45 and C_3 - 55 Days after sowing. The treatments were replicated thrice in randomized block design.

The application of silicon dioxide @ 400 kg ha^{-1} recorded significantly higher plant height (113.5 cm). However, it was at par with silicon dioxide application @ 300kg ha^{-1}. As regards to cuts, no cut recorded significantly higher plant height (111.8 cm). However, it was at par with cutting at 45 DAS. As regards to seed productivity, application of silicon dioxide @ 400kg ha^{-1} recorded significantly higher seed yield (15.31 q ha^{-1}), straw yield (108.95 q ha^{-1}), but it was at par with silicon dioxide application @ 200 kg ha^{-1} and 300kg ha^{-1}. The lodging percentage was significantly lower in application of silicon dioxide @ 400 kg ha^{-1} while, it was at par with silicon application @ 300 kg ha^{-1} and 200 kg ha^{-1}. Similarly lignin content was significantly higher @ 400 kg $ha^{-1.}$ The application of silicon dioxide @ 400kg ha^{-1} recorded lower soil nutrients *viz*., nitrogen (177.8 kg ha^{-1}) Phosphorus (17.9 kg ha^{-1}) and potassium (347.6 kg ha^{-1}).

The cutting of oat at 45 DAS recorded significantly higher seed yield (15.97 q ha^{-1}). The treatment C_3 (cut at 55 DAS) recorded lower lodging percentage (45.33 %) with higher lignin percentage (9.31 %). The soil available nutrient *viz*., nitrogen (196 kg ha^{-1}) Phosphorus (14.46 kg ha^{-1}) and potassium (343 kg ha^{-1}) were recorded significantly lower at cutting on 55 DAS.

The application of silicon dioxide @ 400 kg ha^{-1} recorded significantly higher seed yield (15.31 q ha^{-1}), straw yield (108.95 q ha^{-1}). The cutting on 45 DAS produced higher seed yield (15.97 q ha^{-1}).

Table R-17-AST-5 (a): Effect of Oat *cv.* RO-19 (Phule Harita) on growth and yield and soil properties

Treatment	Plant population/ m row length	Plant height (cm)	Panicle length (cm)	Yield (q ha^{-1})		Lodging (%)	Lignin content in straw (%)	Soil pH at Harvest	Soil EC (dsm^{-1})	Soil OC- with soil	Available nutrients in soil after harvest (kg ha^{-1})		
				Seed yield	Straw yield						N	P	K
Levels of Silicon dioxide (kg ha^{-1})													
S_1- 0 (Control)	110	99.9	29.0	12.69	82.77	55.33	7.92	7.69	0.24	0.47	228	16.97	390
S_2- 200	110	103.2	29.7	13.56	104.74	48.00	8.88	7.62	0.24	0.47	207	15.53	372
S_3-300	111	108.8	30.7	14.37	107.36	42.89	9.41	7.87	0.26	0.48	197	14.49	357
S_4- 400	114	113.5	31.2	15.31	108.95	42.50	10.04	7.88	0.25	0.48	183	13.86	327
SE(m) ±	2.71	2.16	0.46	0.39	4.44	1.56	0.13	0.10	0.004	0.007	4.21	0.34	7.64
C.D. (P=0.05)	NS	6.23	1.32	1.11	12.80	4.50	0.38	NS	0.011	NS	12.13	0.99	22.02
Cutting management (DAS)													
C_1-No cutting	112	111.8	31.2	12.49	106.78	50.21	8.83	7.78	0.25	0.48	213	16.00	377
C_2- 45	112	106.5	29.9	15.57	100.26	46.00	9.04	7.73	0.24	0.48	202	15.18	364
C_3 - 55	110	100.8	29.4	13.49	95.82	45.33	9.31	7.78	0.25	0.48	196	14.46	343
SE(m) ±	2.34	1.87	0.40	0.33	3.85	1.35	0.11	0.08	0.003	0.006	3.65	0.30	6.62
C.D. (P=0.05)	NS	5.40	1.15	0.96	NS	3.89	0.33	NS	NS	NS	10.50	0.86	19.07
Interaction S x C													
SEm ±	4.69	3.75	0.80	0.67	7.70	2.70	0.23	0.17	0.007	0.012	7.29	0.59	13.24
SE(m) ±	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C.D. (P=0.05)	7.28	6.10	4.57	8.27	13.21	9.93	4.35	3.76	4.54	4.22	6.20	6.77	6.35
Initial soil fertility status								8.03	0.29	0.39	197.4	15.5	370

C. AVT-2 Trials

R-17-AST -5: Effect of N levels on forage yield of promising entries of oat (AVT-2 SC)

[Table Reference: R-17-AST-5 (a)-(g)]

Location: HZ: Palampur, Srinagar
SZ: Hyderabad, Mandya

In Oat (Single cut), four entries (HFO-427, SKO-227, JHO-15-1 and JO-04-22) along with two national checks, namely; OS-6 and Kent and two zonal checks *viz.*, SKO-90 (HZ) and JHO-2000-4 (SZ) were evaluated at 4 locations across the two zones in the country.

In Hill Zone, entry JHO-15-1 proved superior in terms of GFY & DFY. The entry was superior to other these entries as well as national and Zonal checks. It recorded 5.5% higher GFY and 6.7% higher DFY over best check (Kent-NC). In terms of CPY, it was at par with entry JO-04-22 and checks.

In South Zone also among four entries JHO-15-1 remained superior, but it was at par with national check (OS-6) in terms of GFY and lower to NC (OS-6) in terms of DFY. In terms of CP content, the entry was superior to all entries & checks but it could not surpass the checks in CP yield. On all India bases no entry could record significant superiority over the checks.

The growth performance and yields of all the entries on zonal mean basis and across the zone improved consistently with increase in level of nitrogen up to 120 kg/ha (303.5 q green and 61.95 q dry matter /ha), which was 20.8 and 5.9 % higher over 40 and 80kg N/ha, respectively, in terms of green fodder. The interaction effect for GFY, DMY and CPY was significant at Jabalpur.

Table- R-17-AST-5 (a): Effect of nitrogen levels on yields of promising entries of Oat (AVTO-2-SC)

Entries	Green Fodder Yield (q/ha)							Dry Matter Yield (q/ha)						
	Hill zone			South zone			Overall Mean	Hill zone			South Zone			Overall Mean
	Palam pur	Sri-nagar	Mean	Hydera-bad	Man-dya	Mean		Palam-pur	Sri-nagar	Mean	Hyder-abad	Man-dya	Mean	
HFO-427	182.70	392.70	287.70	345.37	240.85	293.11	290.41	36.02	79.22	57.62	59.29	60.18	59.74	58.68
SKO-227	149.37	367.57	258.47	247.22	209.6	228.41	243.44	28.75	72.08	50.42	38.53	49.64	44.09	47.25
JHO-15-1	196.89	407.97	302.43	374.99	235.19	305.09	303.76	38.80	83.31	61.06	63.15	55.18	59.17	60.11
JO-04-22	178.99	381.57	280.28	344.45	248.07	296.26	288.27	34.42	78.66	56.54	59.22	64.36	61.79	59.17
Kent (NC)	174.06	399.30	286.68	343.52	175.91	259.72	273.20	33.49	80.99	57.24	57.62	45.94	51.78	54.51
OS-6 (NC)	176.53	374.30	275.42	406.48	204.77	305.63	290.52	34.15	75.94	55.05	75.55	55.37	65.46	60.25
SKO-90 (ZC-HZ)	144.43	382.10	263.27					26.93	76.07	51.50				
JHO-2000-4 (ZC-SZ)				358.33	209.56	283.95	273.61				64.25	53.98	59.12	55.31
SE(m) ±	5.24	9.15		11.65	7.47			1.16	2.22		2.06	2.51		
C.D. (P=0.05)	16.14	26.52		33.54	23.03			3.58	6.45		5.94	7.75		
Nitrogen level (Kg/ha)														
40	151.31	371.27	261.29	309.92	172.56	241.24	251.27	28.77	73.73	51.25	56.74	37.57	47.16	49.20
80	173.79	389.14	281.47	358.33	225.18	291.76	286.61	33.86	79.06	56.46	63.67	56.42	60.05	58.25
120	190.46	399.09	294.78	369.04	255.42	312.23	303.50	37.03	81.33	59.18	58.56	70.86	64.71	61.95
SE(m) ±	1.42	3.61		12.31	3.67			0.46	0.87		1.99	1.19		
C.D. (P=0.05)	4.10	10.48		NS	10.63			1.32	2.54		NS	3.47		
Interaction: V X N levels														
SE(m) ±		13.71		32.57	9.71				3.34		12.31	3.16		
C.D. (P=0.05)	10.87	39.78		NS	NS			3.50	9.67		NS	NS		

Table- R-17-AST-5 (b): Effect of nitrogen levels on crude protein content and yield of promising entries of Oat (AVTO-2-SC)

Entries	Crude Protein Yield (q/ha)							Crude Protein (%)					
	Hill Zone			South Zone			Overall Mean	Hill Zone		South Zone			Overall Mean
	Palam pur	Sri-nagar	Mean	Hydera-bad	Man-dya	Mean		Sri-nagar	Mean	Hydera bad	Man-dya	Mean	
HFO-427	3.32	8.26	5.79	3.17	3.53	3.35	4.57	6.67	6.67	5.7	5.84	5.77	4.55
SKO-227	2.53	8.43	5.48	2.02	3.02	2.52	4.00	6.21	6.21	6.0	5.83	5.92	4.51
JHO-15-1	3.57	8.76	6.17	3.78	3.35	3.57	4.87	7.45	7.45	6.3	6.13	6.22	4.97
JO-04-22	3.07	9.20	6.14	3.46	3.61	3.54	4.84	7.37	7.37	6.8	5.54	6.17	4.93
Kent (NC)	3.15	9.76	6.46	3.38	2.86	3.12	4.79	8.09	8.09	5.4	6.26	5.83	4.94
OS-6 (NC)	3.01	9.10	6.06	5.76	3.35	4.56	5.31	7.04	7.04	5.3	6.12	5.71	4.62
SKO-90 (ZC-HZ)	2.50	10.10	6.30					7.84	7.84				
JHO-2000-4 (ZC-SZ)				3.74	3.12	3.43	4.87			6.3	5.83	6.07	4.99
SE(m) ±	0.11	0.34		0.18	0.16			0.22	0.22	0.11	0.06		
C.D. (P=0.05)	0.34	0.98		0.52	0.48			0.64	0.64		0.20		
Nitrogen level (Kg/ha)													
40	2.39	8.71	5.55	3.31	2.23	2.77	4.16	6.55	6.55	5.6	6.00	5.80	4.54
80	3.06	9.17	6.12	3.83	3.09	3.46	4.79	7.39	7.39	6.4	5.50	5.95	4.82
120	3.61	9.38	6.50	3.70	4.47	4.09	5.29	7.77	7.77	6.0	6.31	6.16	5.02
SE(m) ±	0.06	0.13		0.11	0.09			0.08			0.08		
C.D. (P=0.05)	0.18	0.38		NS	0.26			0.25			0.25		
Interaction: V X N levels													
SE(m) ±		0.50		0.29	0.24			0.34			0.23		
C.D. (P=0.05)	0.48	1.47		0.31	0.69			0.96			0.67		

Table- R-17-AST-5 (c): Effect of nitrogen levels on growth parameters of promising entries of Oat (AVTO-2-SC)

Entries	Plant Height (CM)							Leaf Stem Ratio						No. of Tillers		
	Hill Zone			South Zone			Overall Mean	Hill Zone			South Zone		Overall Mean			
	Palam-pur	Sri-nagar	Mean	Hyder-abad	Man-dya	Mean		Palam-pur	Sri-nagar	Mean	Man-dya	Mean		Palam-pur	Hydera-bad	Mean
HFO-427	84.8	117.4	117.47	108.3	100.57	104.45	81.59	0.61	0.51	0.56	0.40	0.4	0.38	76.2	140.33	108.2
SKO-227	41.2	90.0	90.07	62.0	53.31	57.65	51.35	2.19	0.50	1.345	0.46	0.46	0.79	76.1	121.56	98.8
JHO-15-1	95.2	109.9	109.97	112.6	94.66	103.66	79.33	0.34	0.55	0.445	0.51	0.51	0.35	87.4	149.56	118.4
JO-04-22	93.2	109.0	109.07	112.0	102.13	107.06	80.80	0.45	0.52	0.485	0.46	0.46	0.36	114.3	150.67	132.4
Kent (NC)	76.8	103.9	103.97	109.2	81.55	95.38	73.69	0.33	0.58	0.455	0.48	0.48	0.35	84.8	149.56	117.1
OS-6 (NC)	100.3	95.7	95.73	114.3	87.17	100.75	74.31	0.32	0.46	0.39	0.53	0.53	0.33	96.4	153.66	125.0
SKO-90 (ZC-HZ)	56.2	101.0	101.03					1.46	0.57	1.015				92.2		
JHO-2000-4 (ZC-SZ)				114.8	93.28	104.08	77.30				0.58	0.58	0.65		154.55	123.3
SE(m) ±	2.07	2.90		1.59	4.03			0.04	0.01		0.014			2.66	3.63	
C.D. (P=0.05)	6.39	8.43		4.58	12.42			0.13	0.03		0.044			8.21	10.46	
Nitrogen level (Kg/ha)																
40	71.4	98.0	98.09	101.1	81.87	91.50	70.27	0.72	0.50	0.61	0.40	0.4	0.41	81.5	145.00	113.2
80	78.3	104.9	104.93	108.4	87.86	98.16	75.32	0.81	0.53	0.67	0.47	0.47	0.45	90.6	144.00	117.3
120	85.0	108.6	108.69	104.4	92.84	98.63	76.49	0.92	0.54	0.73	0.60	0.6	0.52	96.9	147.85	122.3
SE(m) ±	0.94	1.15		1.58	1.59			0.01	0.003		0.010			1.15	4.71	
C.D. (P=0.05)	2.73	3.34		NS	4.62			0.03	NS		0.029			3.33	NS	
Interaction: V X N levels																
SE(m) ±		4.35		4.19	4.22				0.02		0.027				12.46	
C.D. (P=0.05)	7.24	12.64		8.82	NS			0.08	NS		0.077			8.81	NS	

Table R-17AST-5 (d): Interaction effects of nitrogen levels and promising entries on green and dry fodder yields of oat (AVTO-2 -SC) at Palampur

Entries	Green fodder yield (q/ha)			
	N levels (kg/ha)			
	40	**80**	**120**	**Mean**
HFO-427	148.13	174.06	225.90	182.70
SKO-227	133.32	148.13	166.65	149.37
JHO-15-1	185.17	198.13	207.39	196.89
JO-04-22	166.65	181.46	188.87	178.99
Kent (NC)	137.02	188.87	196.28	174.06
OS-6 (NC)	159.24	177.76	192.57	176.53
SKO-90 (ZC-HZ)	129.62	148.13	155.54	144.43
Mean	151.31	173.79	190.46	
	V	**N**	**V X N**	
SE(m) ±	5.24	1.42	3.75	
C.D. (P=0.05)	16.14	4.10	10.87	

R-17AST-5 (e): Interaction effects of nitrogen levels and promising entries on green and dry fodder yields of oat (AVTO-2 -SC) at Palampur

Dry matter yield (q/ha)				
HFO-427	28.19	34.85	45.01	36.02
SKO-227	25.27	28.26	32.71	28.75
JHO-15-1	35.29	39.79	41.31	38.80
JO-04-22	31.60	34.59	37.07	34.42
Kent (NC)	26.49	36.83	37.16	33.49
OS-6 (NC)	31.23	34.31	36.92	34.15
SKO-90 (ZC-HZ)	23.35	28.40	29.04	26.93
Mean	28.77	33.86	37.03	
	V	**N**	**VXN**	
SE(m) ±	1.16	0.46	1.21	
C.D. (P=0.05)	3.58	1.32	3.50	

R-17AST-5 (f): Interaction effect of nitrogen levels and promising entries on green fodder yield (q/ha) & dry matter yield (q/ha) of Oat (AVT-2SC) at Srinagar

Entries	Green forage yield (q/ha)				Dry matter yield (q/ha)			
	Nitrogen Levels (Kg/ha)			Mean	Nitrogen Levels (Kg/ha)			
	40	80	120		40	80	120	Mean
HFO-427	375.60	395.80	406.70	392.70	72.50	81.44	83.70	79.22
SKO-227	358.90	368.20	375.60	367.57	66.81	72.31	77.12	72.08
JHO-15-1	389.50	412.60	421.80	407.97	80.17	84.98	84.79	83.31
JO-04-22	365.20	382.70	396.80	381.57	75.15	78.78	81.74	78.66
Kent (NC)	378.60	402.80	416.50	399.30	74.27	82.92	85.77	80.99
OS-6 (NC)	365.20	376.30	381.40	374.30	75.16	73.88	78.79	75.94
SKO-90 (ZC-HZ)	365.90	385.60	394.80	382.10	71.72	79.09	77.42	76.07
Mean	371.27	389.14	399.09		73.73	79.06	81.33	
	E	**N**	**E x N**		**E**	**N**	**E x N**	
SE(m) ±	9.15	3.61	13.71		2.22	0.87	3.34	
C.D. (P=0.05)	26.52	10.48	39.78		6.45	2.54	9.67	

R-17AST-5 (g): Interaction effect of nitrogen levels and promising entries on crude protein yield of Oat (AVT-2SC) at Srinagar

Entries	Nitrogen Levels (Kg/ha)			Mean
	40	80	120	
HFO-427	6.05	6.88	7.08	6.67
SKO-227	5.30	6.33	7.01	6.21
JHO-15-1	6.95	7.63	7.78	7.45
JO-04-22	6.76	7.45	7.90	7.37
Kent (NC)	7.06	8.30	8.93	8.10
OS-6 (NC)	6.75	6.93	7.45	7.04
SKO-90 (ZC-HZ)	7.02	8.25	8.27	7.85
Mean	6.56	7.40	7.77	
	E	**N**	**E x N**	
SE(m) ±	0.22	0.08	0.34	
C.D. (P=0.05)	0.64	0.25	0.96	

R-17-AST -6: Effect of P levels on forage yield of promising entries of Berseem (AVTB 2-MC)
[Table Reference: R-17-AST-6 (a)-(d)]

Location: NWZ: Pantnagar, Hisar and Ludhiana

Two berseem entries (JB-05-9 and PC-82) along with two national checks (Wardan and Mescavi) and one zonal check (BB-2) were evaluated at 3 centres located in NWZ zones. Both the testing entries were marginally superior to national checks (Wardan and Mescavi) but were remained inferior to zonal check (BB-3) in terms of GFY, DFY, per day green and dry matter productivity. The entries were at par with national checks in terms of CP yield but inferior to ZC (BB-2). The CP content of entries was also marginally inferior is zonal check. The application of graded level of phosphorus brought consistent improvement in GFY and DMY recording maximum with 100 kg P_2O_5 kg/ha (663.43 and 89.29 q/ha). The corresponding increase in GFY and DFY with 100 kg P_2O_5 was 12.8 and 14.4 % over 60 kg/ha and 3.8% and 3.8% over 80 kg/ha on national mean basis, respectively.

Table R-17-AST -6 (a): Effect of P levels on forage yield of promising entries of Berseem (AVTB 2-MC)

Entries	Green Forage Yield (q/ha)				Dry Matter Yield (q/ha)				Per day Productivity (q/ha/day)			
									GFY			DMY
	Pant-nagar	His-ar	Ludh iana	Mean	Pant-nagar	Hisar	Ludh-iana	Mean	Pant-nagar	Ludh-iana	Mean	
JB-05-9	503.19	687.08	684.9	625.06	73.35	93.28	86.4	84.34	3.49	5.08	4.29	0.51
PC-82	540.32	667.88	683.1	630.43	79.50	91.44	84.5	85.15	3.75	5.06	4.41	0.55
Wardan (NC)	524.17	684.03	623.4	610.53	75.95	91.00	78.4	81.78	3.64	4.62	4.13	0.52
Mescavi (NC)	540.67	674.91	641.8	619.13	79.70	91.62	77.7	83.01	3.75	4.75	4.25	0.56
Bendel Berseem-2 (ZC-NWZ)	547.16	647.73	804.4	666.43	80.61	84.79	97.9	87.77	3.80	5.96	4.88	0.56
SE(m) ±	7.86	7.67	22.24		1.13	1.17	2.97		0.06	0.016		0.01
C.D. (P=0.05)	26.03	25.40	46.4		3.75	3.86	6.20		0.18	0.034		0.03
P levels (kgP_2O_5/ha)												
60	498.47	624.87	641.3	588.21	73.00	82.25	78.8	78.02	3.46	4.75	4.11	0.51
80	534.54	686.91	696.5	639.32	78.40	93.22	86.4	86.01	3.71	5.16	4.44	0.55
100	560.30	705.20	724.8	663.43	82.07	95.81	89.8	89.23	3.89	5.37	4.63	0.57
SE(m) ±	5.97	6.57	9.64		0.88	1.03	1.12		0.04	0.007		0.01
C.D. (P=0.05)	17.73	19.53	20.1		2.61	3.06	2.33		0.12	0.015		0.02
Interaction: V X P levels												
SE(m) ±										NS		
C.D. (P=0.05)	NS	NS	NS		NS	NS	NS		NS	6.18		NS
CV (%)		3.79	6.20			4.41	6.71					

Table R-17-AST -6 (b): Effect of P levels on growth parameters and quality of promising entries of Berseem (AVTB2-MC)

Entries	Crude Protein Yield (q/ha)				Crude Protein (%)				Plant height (CM)			NDF (%)	ADF (%)
	Pant-nagar	His-ar	Ludh-iana	Mean	Pant-nagar	His-ar	Ludh-iana	Mean	Pant-nagar	His-ar	Ludh-iana	Pant-nagar	Pant-nagar
JB-05-9	12.42	19.98	17.3	16.6	16.91	21.47	20	20.7	49.26	57.96	41.7	64.76	54.13
PC-82	13.91	19.43	17.1	16.8	17.5	21.45	20.1	20.8	49.48	56.4	39.3	65.34	54.5
Wardan (NC)	13.38	19.62	15.6	16.2	17.6	21.55	19.8	20.7	49.23	55.18	37.2	66	53.37
Mescavi (NC)	13.98	19.59	16	16.5	17.5	21.52	20.6	21.1	49	57.04	34.8	65.06	53.71
Bendel Berseem-2 (ZC-NWZ)	14.34	18.07	21.1	17.8	17.79	21.35	21.5	21.4	49.35	53.25	41.5	64.86	54.07
SE(m) ±	0.25	0.28	0.61		0.27	0.11	0.49		0.19	1	2.07	0.19	0.27
C.D. (P=0.05)	0.72	0.92	1.28		NS	NS	NS		NS	NS	4.32	0.55	NS
P levels (kgP_2O_5/ha)													
60	12.79	17.18	15.4	15.1	17.5	21.02	19.5	20.3	48.64	53.42	37.3	64.69	54.17
80	13.73	19.89	17.8	17.1	17.5	21.43	20.5	21	49.31	56.66	39	65.56	53.87
100	14.29	20.95	18.9	18.0	17.38	21.96	21.1	21.5	49.84	57.81	40.4	65.35	53.83
SE(m) ±	0.19	0.24	0.23		0.21	0.08	0.38		0.09	0.41	0.28	0.15	0.21
C.D. (P=0.05)	0.56	0.7	0.48		NS	0.22	1.11		0.28	1.22	0.59	0.42	NS
Interaction: V X P levels													
SE(m) ±													
C.D. (P=0.05)	NS		NS		NS				NS	NS	NS	NS	NS
CV (%)		4.71	6.77			1.36				2.84	10.22		

Table R-17-AST -6 (c): Effect of P levels on growth parameters of promising entries of Berseem (AVTB2-MC)

Entries	Tillers/ row m length				Leaf Stem Ratio		
	Pantnagar	Hisar	Ludhiana	Mean	Pantnagar	Ludhiana	Mean
JB-05-9	94	47.38	108.0	83.13	0.70	1.29	1.00
PC-82	97	46.67	98.5	80.72	0.70	1.21	0.96
Wardan (NC)	94	47.89	99.1	80.33	0.71	1.22	0.97
Mescavi (NC)	101	47.16	101.4	83.19	0.70	1.21	0.96
Bendel Berseem-2 (ZC-NWZ)	95	43.61	109.6	82.74	0.69	1.64	1.17
SE(m) ±	1.5	0.85	6.49		0.004	0.042	
C.D. (P=0.05)	NS	2.81	NS		NS	0.087	
P levels (kgP_2O_5/ha)							
60	95	43.72	98.2	78.97	0.69	1.41	1.05
80	98	47.26	104.8	83.35	0.70	1.29	1.00
100	97	48.65	106.9	84.18	0.71	1.22	0.97
SE(m) ±	0.88	0.50	1.00		0.01	0.024	
C.D. (P=0.05)	NS	1.49	2.10		0.02	0.051	
Interaction: V X P levels							
SE(m) ±							
C.D. (P=0.05)	NS	NS	4.71		NS	NS	
CV (%)		4.18	7.69			6.11	

Table R-17-AST -6 (d): Effect of P levels on economics of promising entries of Berseem (AVTB2-MC)

Entries	Net Return			B: C Ratio			Cost of Cultivation (Rs.)			Gross Return (Rs.)
	Hisar	Ludhiana	Mean	Hisar	Ludhiana	Mean	Hisar	Ludhiana	Mean	Hisar
JB-05-9	23160	34814	28987	1.37	0.73	1.05	62725	47370	55048	85885
PC-82	20759	34603	27681	1.33	0.73	1.03	62725	47370	55048	83484
Wardan (NC)	22777	27443	25110	1.36	0.58	0.97	62725	47370	55048	85502
Mescavi (NC)	21638	29645	25642	1.34	0.62	0.98	62725	47370	55048	84363
Bendel Berseem-2 (ZC-NWZ)	18239	49156	33698	1.29	1.04	1.17	62725	47370	55048	80964
SE(m) ±		2668			0.05					
C.D. (P=0.05)		5566			0.12					
P levels (kgP_2O_5/ha)										
60	16404	30208	23306	1.27	0.65	0.96	61703	46745	54224	78107
80	23140	36213	29677	1.37	0.76	1.07	62725	47370	55048	85865
100	24400	38975	31688	1.38	0.81	1.10	63748	47995	55872	88148
SE(m) ±		1154			0.02					
C.D. (P=0.05)		2408			0.05					
Interaction: V X P levels										
SEm±										
SE(m) ±		NS			NS					
C.D. (P=0.05)		14.57			14.60					

FORAGE CROP PROTECTION

PPT-1: Survey of pathogens, insect pests and nematodes associated with Berseem, Lucerne, Oats ecosystems

Objective: To record the occurrence and abundance of major diseases and insect-pests in Berseem, Lucerne and Oat.

Locations: Ludhiana, Rahuri, Palampur, Dharwad, Jhansi, Bhubaneswar

Ludhiana

At Ludhiana, the occurrence and abundance of major diseases of berseem, lucerne and oat was recorded at weekly intervals and percent disease incidence or severity was calculated (Table Ludhiana PPT1a) as explained below.

- **Stem rot of Berseem:** Stem rot on berseem was observed on variety BL-10. Its appearance was first observed in the first week of January, 2018. Disease progressed at faster rate till 2nd fortnight of March with maximum disease incidence of 55.87 % due to favourable weather conditions (Table Ludhiana PPT1a).
- **Leaf blight of Oat**: Leaf blight of oat appeared on OL-10 variety in the 2nd week of January. Disease development was fast upto end of February and thereafter, it increased at slow rate till first week of April with disease severity of 42.34 % (Table Ludhiana PPT1a).
- **Downy mildew of Lucerne:** Downy mildew of Lucerne was observed on variety LLC 5 in the first fortnight of January, 2018. Disease progressed at faster rate till end of March. Highest disease severity was 39.78 % (Table Ludhiana PPT1a).

Table Ludhiana PPT1a: Percent of disease incidence/ severity associated with berseem, lucerne and oat

Crop	Disease	Percent Disease Incidence / Severity DOO (Date of observation)													
		02/ 01/ 18	09/ 01/ 18	16/ 01/ 18	23/ 01/ 18	30/ 01/ 18	06/ 02/ 18	13/ 02/ 18	20/ 02/ 18	27/ 02/ 18	06/ 03/ 18	13/ 03/ 18	20/ 03/ 18	27/ 03/ 18	03/ 04/ 18
Berseem	Stem Rot	9.33*	14.34	22.00	29.00	31.67	35.43	36.76	40.00	42.00	44.00	47.00	50.00	55.87	
Oat	Leaf Blight		11.76*	17.67	23.86	26.78	28.34	32.00	33.76	36.00	38.00	39.34	41.46	44.32	42.34
Lucerne	Downy Mildew			10.34*	16.00	21.00	22.83	27.00	31.00	34.73	37.44	38.67	39.00	39.78	

*DOA: Date of appearance

Entomological observations: At Ludhiana, Population dynamics of major insect pests was studied throughout the cropping season on different *rabi* forages during 2017-18. Different varieties of berseem, oats and lucerne were sown in unreplicated plots (5m x 3m each). The population of lepidopteran insect-pests such as green semilooper (*Trichoplusia orichalcea*), gram caterpillar (*Helicoverpa armigera*) and *Spodoptera exigua* was recorded under unprotected conditions from these plots by counting the number of larvae per meter row length at weekly intervals starting at the time of appearance of pest from three random spots. The population of oat aphid was recorded from the plots of oat varieties by counting the number of aphids per tiller at weekly intervals.

Observations on number of lucerne weevils per plant and *H. armigera* larvae/metre row length were also recorded at weekly intervals in the months of March and April. The data was pooled and presented in Tables Ludhiana PPT1b&Ludhiana PPT1c.The population of green semilooper, *T. orichalcea* started appearing on the berseem genotypes in the first week of April with its highest peak was observed in the second fortnight of April. The population of *H. armigera* appeared on berseem crop in April with its highest peak during last week of April. *Spodoptera exigua* larvae were also recorded in berseem crop during April, with peak incidence in the last week of April. The insect populations were subsequently reduced owing to rain and windstorm in first week of May (Table Ludhiana PPT1b). Lucerne var. LLC-5 was infested with lucerne weevil in March. *H. armigera* and *S. exigua* incidence was at its peak in Lucerne during last week of April 2018 (Table Ludhiana PPT1c). Due to heavy rains during January-end to mid-February, all aphid population was washed off from oat tillers, hence no incidence was observed. The mean numbers of aphids recorded were 2, 2 and 3 per tiller on varieties Kent, OL 10 and OL 11, respectively. No incidence was observed in March-April.

Table Ludhiana PPT1b. Population dynamics of insect pests associated with *rabi* forages: Incidence of lepidopteran insect pests in different varieties of berseem

SN	Variety	No. of *T. orichalcea* larvae per m row length						Mean
		5.4.18	12.4.18	19.4.18	26.4.18	3.5.18	10.5.18	
1.	BL-10	0.33	0.66	1.00	0.66	0.33	0.33	**0.55**
2.	BL-42	0.66	1.00	1.33	1.00	0.33	0.00	**0.72**
		No. of *H. armigera* larvae per m row length						
1.	BL-10	2.66	3.00	3.66	5.00	2.00	2.66	**3.16**
2.	BL-42	3.00	3.33	4.00	5.33	1.66	2.00	**3.22**
No. of *Spodoptera exigua* larvae per m row length								
1	BL-10	0.66	1.00	1.33	2.00	0.33	1.00	**1.05**
2	BL-42	1.00	0.67	1.00	2.33	0.66	1.33	**1.16**

Table Ludhiana PPT1c. Incidence of insect pests in Lucerne var. LLC-5

Var.	No. of Lucerne weevils per plant										
	7.3.18	14.3.18	21.3.18	28.3.18	5.4.18	12.4.18	19.4.18	26.4.18	3.5.18	10.5.18	Mean
LLC-5	0.66	1.00	1.33	1.00	0.66	0.33	0.00	0.00	0.00	0.00	**0.50**
No. of *H. armigera* larvae per m row length											
LLC-5	0.33	0.66	1.00	1.66	1.67	2.33	2.33	2.66	0.33	0.66	**1.36**
No. of *Spodoptera exigua* larvae per m row length											
LLC-5	0.00	0.00	0.00	0.00	0.33	1.00	1.33	2.33	0.33	0.66	**0.60**

RAHURI

Lucerne

Aphids: The population of pea aphid (*Acyrthosiphon pisum*) was noticed on lucerne during1st week of January, 2018 (7.67 aphids/tiller) and increased steadily up to the 3rd week of January, 2018 (10.33 aphids/tiller). Thereafter, the decreasing trend of pea aphid population was noticed upto 1st week of February, 2018 (5.33 aphids/tiller). Again the population of pea aphid showed their increasing trend form 2nd week of Feb., 2018 (20.33) and reached at its peak level during 4th week of Feb., 2018 (69.00 aphids/tiller). During the season, population of cowpea aphid and spotted aphid was observed at low to moderate level in the range of 7.00 to 10.33 aphids/tiller from last week of Jan., 2018 to 2nd week of Feb., 2018 and 3.67 to 20.00 aphids/tiller from 1st week of Feb., 2018 to 2nd week of March 2018, respectively. During the aphid infestation, population of predatory lady bird beetles was observed at moderate to high level (1.00 to 3.00 grubs/tiller) (Table Rahuri PPT1a).

Lepidopteran pests: The *Spodoptrera litura* become a major and regular pest on Lucerne during summer season. Larval population was noticed during 1st week of March, 2018 with0.50 larva/m^2. Thereafter, population increased steadily and reached to its peak population (14.67 larvae/m^2) during 2ndweek of May, 2018. After that the population of *S. litura* declined and recorded nil during 1stweek of June, 2018. The population of *H. armigera* was noticed on lucerne seed crop during 3rd week of March, 2018 (1.67 larvae/m^2) and showed increasing trend upto 2ndweek of May, 2018 with highest population of 12.33 larvae/m^2. After that population declined and showed nil population during last week of May, 2018 when the seed crop was harvested (Table Rahuri PPT1a).

Oat

Aphid: Periodic abundance of oat aphid (*Rhopalosiphum padi* L.) was observed during the investigation (Table Rahuri PPT1b).

Diseases: There was no disease incidence recorded on oat crop throughout the crop period.

Berseem

In berseem crop, aphid *R. maidis* was noticed on crop from 2nd week of Dec., 2017 (6.33 aphids/tiller) to 3rd week of Dec., 2017 (7.33 aphids/tiller). Thereafter, aphid population disappeared from the crop (Table Rahuri PPT1c).

Table Rahuri PPT1a: Population dynamics of insect pests associated with *rabi* forages: Incidence of insect pests in Lucerne

Date	No. aphids/tiller				Lady bird beetle grubs/tiller	No. of larvae/m^2	
	Pea aphid	Cowpea aphid	Spotted aphid	Total		*S. litura*	*H. armigera*
01/01/2018	7.67	0.00	0.00	7.67	1.00	0.00	0.00
07/01/2018	8.00	0.00	0.00	8.00	1.33	0.00	0.00
15/01/2018	10.33	0.00	0.00	10.33	1.33	0.00	0.00
22/01/2018	7.00	0.00	0.00	0.00	1.00	0.00	0.00
29/01/2018	5.33	7.00	0.00	12.33	1.67	0.00	0.00
05/02/2018	17.66	10.33	3.67	31.67	1.67	0.00	0.00
12/02/2018	20.33	8.67	5.00	34.00	2.00	0.00	0.00
17/02/2018	47.67	0.00	17.33	65.00	2.33	0.00	0.00
24/02/2018	69.00	0.00	20.00	89.00	2.00	0.00	0.00
03/03/2018	49.33	0.00	11.67	61.00	2.33	0.50	0.00
10/03/2018	37.67	0.00	5.67	43.33	2.67	1.00	0.00
17/03/2018	10.00	0.00	0.00	10.00	3.00	3.33	1.67
25/03/2018	0.00	0.00	0.00	0.00	2.67	4.67	2.33
01/04/2018	0.00	0.00	0.00	0.00	2.00	6.67	3.67
08/04/2018	0.00	0.00	0.00	0.00	1.00	10.67	5.33
15/04/2018	0.00	0.00	0.00	0.00	0.00	10.67	7.00
22/04/2018	000	0.00	0.00	0.00	0.00	12.33	9.67
29/04/2018	0.00	0.00	0.00	0.00	0.00	13.00	10.00
06/05/2018	0.00	0.00	0.00	0.00	0.00	13.00	10.67
13/05/2018	0.00	0.00	0.00	0.00	0.00	14.67	12.33
20/05/2018	0.00	0.00	0.00	0.00	0.00	11.33	8.67
27/05/2018	0.00	0.00	0.00	0.00	0.00	5.33	0.00
03/06/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table Rahuri PPT1b: Population dynamics of insect pests associated with *rabi* forages: Incidence of insect pests in Oat

Date	No. aphids/tiller	Natural enemies/tiller		
		C. carnea	Lady Bird Beetle grubs	Syrphid fly larvae
01/01/2018	0.00	0.00	0.00	0.00
07/01/2018	0.00	0.00	0.00	0.00
15/01/2018	0.00	0.00	0.00	0.00
22/01/2018	0.00	0.00	0.00	0.00
29/01/2018	0.00	0.00	0.00	0.00
05/02/2018	0.00	0.00	0.00	0.00
12/02/2018	0.00	0.00	0.00	0.00
17/02/2018	0.00	0.00	0.00	0.00
24/02/2018	0.00	0.00	0.00	0.00
03/03/2018	0.00	0.00	0.00	0.00
10/03/2018	0.00	0.00	0.00	0.00
17/03/2018	0.00	0.00	0.00	0.00

Table Rahuri PPT1c: Population dynamics of insect pests associated with *rabi* forages: Incidence of insect pests in Berseem

Date	No. aphids/tiller	Natural enemies/tiller		
		C. carnea	Lady Bird Beetle grubs	Syrphid fly larvae
12/12/2017	6.33	0.00	0.00	**0.00**
19/12/2017	7.33	0.00	0.00	0.00
26/12/2017	0.00	0.00	0.00	0.00
2/01/2018	0.00	0.00	0.00	0.00
9/01/2018	0.00	0.00	0.00	0.00
16/01/2018	0.00	0.00	0.00	0.00
23/01/2018	0.00	0.00	0.00	0.00
30/01/2018	0.00	0.00	0.00	0.00
06/02/2018	0.00	0.00	0.00	0.00
03/03/2018	0.00	0.00	0.00	0.00
10/03/2018	0.00	0.00	0.00	0.00
17/03/2018	0.00	0.00	0.00	0.00
25/03/2018	0.00	0.00	0.00	0.00
01/04/2018	0.00	0.00	0.00	0.00
08/04/2018	0.00	0.00	0.00	0.00
15/04/2018	0.00	0.00	0.00	0.00

Palampur

At Palampur, during *Rabi* 2017-18season, oat crop was severely affected by powdery mildew (75% severity), followed by leaf blight (27%), loose smut (3%) and sucking pest (20%). In berseem, low incidence of root rot (5 %) and moderate intensity of leaf spot (15%) was observed. Defoliating beetles (20 %) and leaf spot (10 %) was observed on Lucerne.

Table Palampur PPT-1: Survey of pathogen, insect pests and nematodes associated with berseem, Lucerne and oat ecosystem

Crop	Diseases/ Insect-Pests	Date of observations (% Disease severity/incidence)									
		26.2.18	5.3.18	12.3.18	19.3.18	26.3.18	2.4.18	9.4.18	16.4.18	23.4.18	30.4.18
Oats	Powdery mildew	10	20	35	50	60	70	75	-	-	-
	Leaf blights	3	5	7	10	15	20	25	27	-	-
	Loose smut	-	-	-	-	-	2	3	3	3	3
	Aphids & Thrips	10	15	20	20	-	-	-	-	-	-
Berseem	Root rot	5	5	5	5	-	-	-	-	-	-
	Leaf spot	-	-	-	-	4	10	15	15	-	-
	Defoliating beetles										
Lucerne	Leaf spot	-	-	-	-	5	7	10	10	10	10
	Defoliating beetles	-	-	-	-	5	7	10	15	15	20

Dharwad

At Dharwad, insect and disease incidence taken at 15 days interval in Lucerne revealed that aphid population started building from January months onwards and reached peak during second fortnight of February (102 aphids / stem) and started declining after second fortnight of April and reached nil in May month (Table Dharwad PPT-1). Among diseases, rust was the major one and 25% of disease severity was seen during second fortnight of February. Disease intensity was almost nil during May.

Table Dharwad PPT-1. Monitoring of insect- pests and diseases associated with Lucerne ecosystem at IGFRI, RRS-Dharwad during *rabi* 2017-18

Period	No of aphids on stem/plant	Rust (disease severity in %)
I Fortnight of October	0	0
II Fortnight of October	0	0
I Fortnight of November	0	0
II Fortnight of November	0	0
I Fortnight of December	0	0
II Fortnight of December	0	0
I Fortnight of January	6	5
II Fortnight of January	12	10
I Fortnight of February	86	20
II Fortnight of February	102	25
I Fortnight of March	92	20
II Fortnight of March	32	15
I Fortnight of April	20	10
II Fortnight of April	5	0
I Fortnight of May	0	0
II Fortnight of May	0	0

Bhubaneswar

At Bhubaneswar, diseases and insect-pests were recorded on oat and Berseem. The diseases started appearing on 50th meteorological week and the peak was observed at 5th meteorological week with increase in temperature and relative humidity.

In oat, leaf blight caused by *Helminthosporium* sp. was observed with maximum leaf blight severity of 54.8%and root rot caused by *Sclerotium sp*. was also recorded with incidence of 22 %. Maximum leaf defoliators were recorded 4.8/ ten plants. In Berseem, leaf spot and blight severity recorded was 44.6%, whereas root rot incidence was 34.2%. Maximum defoliator population recorded was 4.8/ten plants in 3rd meteorological week.

Table Bhubaneswar PPT-1: Incidence of insect pest and disease on Berseem and Oat at Bhubaneswar

OAT										
Diseases	**01/12/17**	**8/12/17**	**15/12/17**	**22/12/17**	**29/12/17**	**05/01/18**	**12/01/18**	**19/01/18**	**26/01/18**	**02/02/18**
Leaf blight (%) disease severity) (*Helminthosporium* sp.)	-	-	8.4	15.8	24.0	29.4	35.6	39.8	45.7	54.8
Root rot (%) *Sclerotium* sp.	-	6.4	9.3	14.2	19.6	22.0	--	-	-	
Insects										
Leaf defoliators (No/10 Plants)		2.0	2.8	3.6	4.4	4.2	4.2	4.8	3.8	
BERSEEM										
Diseases										
Leaf spot and blight (% disease severity)	-	-	8.2	16.0	23.4	26.4	31.0	35.4	38.0	44.6
Root rot (Fungal) (%)			7.0	12.0	16.4	21.5	24.6	30.6	34.2	
Insects										
Leaf defoliators (No/10 Plants)			2.0	2.2	3.4	3.6	4.0	4.8	5.2	

Jhansi

Berseem: At Jhansi, in Berseem incidence of stem rot in sick plot started from third week of January with small lesions indicative of early infection and continued to increase up to third week of February with a maximum disease score of 1.88 indicative of moderate level of infection (lesion of 10-20 mm) with each plant showing 50% tissue mortality. Disease development was favoured by low temperature and high humidity. Leaf blight was observed during third week of January at a lower level (5.79%) and it continued to increase upto third week of February with maximum severity of 38.75 %.

Lucerne: Weevil infestation was observed during first week of February to first week of March with a maximum weevil incidence of 21.33 %.

Oat: In Oat, leaf blight was the major disease and it appeared during third week of January and maximum severity of 35.33 % was observed during third week of February.

Table Jhansi PPT-1: Incidence of insect pest and disease on Berseem, Oat and Lucerne at Jhansi

	Date of observation								
	8.1.18	**15.1.18**	**22.1.18**	**29.1.18**	**5.2.18**	**12.2.18**	**19.2.18**	**26.2.18**	**5.3.18**
Oat									
Leaf blight (% disease severity)	-	-	5.79	10.32	16.68	24.67	35.33	-	-
Berseem									
Diseases									
Leaf blight (% disease severity)	-	11.67	13.33	23.33	32.50	38.75	-	-	-
Stem rot (Disease score)			0.38	0.63	1.0	1.50	1.88	-	-
Lucerne									
Weevil (% incidence)					7.33	13.83	16.17	19.50	21.33

PPT-2: Field screening of *rabi*-breeding materials for resistance to diseases and insect- pests

IVTB: INITIAL VARIETAL TRIAL IN BERSEEM

In Berseem IVTB, At Ludhiana, All the entries showed moderately resistant disease reaction to stem rot of berseem. All the entries showed moderate population of lepidopteran caterpillars with non-significant differences.**At Rahuri,** all the entries were found resistant to aphids as recorded less than 10 aphids per tiller. **At Palampur,** root rot disease pressure was low and all the entries were resistant to disease except JB-05-12 & Wardan, which were moderately resistant. **At Bhubaneswar,** JB-05-12, BB-3 and HFB-13-7 were resistant to Leaf spot & blight. JHB-17-2 was moderately resistant and PC-91, Wardan, JHB-17-1 &HFB-14-7 moderately susceptible to Leaf spot & blight and Leaf defoliators. **At Jhansi,** all the entries were resistant to moderately resistant to stem rot and leaf blight.

Table: Disease –pest tolerance in IVT Berseem trial

Entries	Ludhiana (stem rot)		Ludhiana (insect-pest)	Palampur (Root rot)		Rahuri	Bhubaneswar			Jhansi			
	Incidence (%)	Reaction	*H. armigera*/m row length	% incidence	Reaction	No. of Aphids/ tiller	Leaf spot & Blight	Reaction	Leaf defoliators	Stem rot (score in sick plot)	Reaction	Leaf blight severity (%)	Reaction
PC-91	20.67	MR	1.33	10	R	4.67	24.62	MS	4.74	0.38	R	16.67	MR
JB-05-12	21.33	MR	2.00	12	MR	4.78	8.44	R	2.26	1.00	R	13.33	MR
Wardan	28.67	MR	1.66	18	MR	4.22	35.43	MS	3.54	1.00	R	18.33	MR
BL-180 ZC (HZ)				8	R	4.55							
BB-2 ZC (CZ-NWZ)	27.00	MR	1.66							1.75	MR	11.67	MR
BB-3 ZC (NEZ)							9.62	R	1.34				
JHB-17-1	21.00	MR	1.33	8	R	4.44	35.62	MS	3.32	1.75	MR	16.67	MR
HFB-14-7	20.00	MR	1.33	10	R	5.11	39.44	MS	3.36	1.00	R	20.00	MR
HFB-13-7	25.67	MR	1.66	9	R	4.67	10.42	R	1.47	1.13	R	21.67	MR
JHB-17-2	19.00	MR	2.00	10	R	5.33	26.78	MR	2.36	1.13	R	23.33	MR
SE (m)±						0.44							
CD 0.05	3.632		NS			N.S.							

AVTB-1: FIRST ADVANCED VARIETAL TRIAL IN BERSEEM

In AVT-1 Berseem, At Rahuri, All the entries were found resistant to aphids with less than 10 aphids per tiller. **At Bhubaneswar,** entries HFB-13-10, Mescavi and JB-05-10 were resistant to Leaf spot & blight. BB-3 &JHB-16-01 were moderately resistant whereas Wardan was moderately susceptible to Leaf spot & blight and Leaf defoliators respectively. **At Jhansi,** all the entries were resistant to moderately resistant to stem rot in sick plot, whereas for leaf blight, HFB-13-10, Wardan &JHB-16-01 were moderately resistant and rest were susceptible.

Table: Disease –pest tolerance in AVT-1 Berseem trial

	Rahuri (Aphid incidence)		Bhubaneswar			Jhansi			
SN	Entry	Mean	Leaf spot & blight severity (%)	Leaf Blight (disease reaction)	Leaf defoliators (no./10 plants)	Stem rot (disease score in sick plot)	Reaction	Leaf blight severity (%)	Reaction
1	HFB-13-10	4.00	9.33	R	1.74	0.63	R	17.50	MR
2	Wardan (NC)	4.45	45.67	MS	3.26	0.50	R	18.75	MR
3	Mescavi (NC)	4.56	10.33	R	2.54	1.38	R	32.50	S
4	BB-2 ZC (CZ-NWZ)	4.45	22.67	MR	3.34	1.50	MR	32.50	S
5	BB-3 ZC (NEZ)								
6	JHB-16-01	4.67	26.33	MR	3.32	1.88	MR	22.50	MR
7	JB-05-10	4.33	11.33	R	2.36	1.50	MR	38.75	S
	SE±	**0.25**							
	CD at 5%	**N.S.**							

AVTB-2: SECOND ADVANCED VARIETAL TRIAL IN BERSEEM

Berseem- AVT-2, At Ludhiana, All entries were moderately resistant to stem rot.

Table: Disease –pest tolerance in AVT-2 Berseem trial

Ludhiana				
SN	Entries	Stem Rot Incidence (%) (0-9 scale)	Disease Score	Disease Reaction
1	JB-05-9	20.50	5	MR
2	Wardan (NC)	28.50	5	MR
3	PC-82	26.50	5	MR
4	Mescavi (NC)	19.00	4	MR
5	BB-2 (ZC-NWZ)	27.25	5	MR
CD (0.05)		2.544		

AVTB-2 (SEED): SECOND ADVANCED VARIETAL TRIAL IN BERSEEM – SEED

Berseem-AVT-2 (Seed): At Ludhiana, All the entries were moderately resistant to stem rot. All entries recorded non-significant differences for gram pod borer *Helicoverpa armigera* population.

Table: Disease –pest tolerance in AVT-2 (seed) Berseem trial:

SN	Entries	Ludhiana		
		Stem Rot Incidence (%)	Disease Reaction	Larvae of *H. armigera* / m row length
1	JB-05-9	27.00	MR	1.33
2	Wardan (NC)	28.25	MR	1.66
3	PC-82	24.00	MR	2.00
4	Mescavi (NC)	17.75	MR	1.66
5	BB-2 (ZC-NWZ)	29.50	MR	1.33
	CD at 5%	1.859		NS

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

Oats – IVTO SC: At Ludhiana, All the entries showed moderately resistant disease reaction except JHO-17-1 and NDO-1501 which were moderately susceptible. **At Rahuri,** insect-pests and diseases were not observed throughout the crop period.**At Palampur,** all entries were highly susceptible to susceptible to Powdery mildew exceptSKO-96&JO-05-9 which were moderately resistant. **At Bhubaneswar**, UPO-17-2, Kent, RO-11-1, UPO-17-3, JHO-17-1, JO-05-9, OL 1893, OL 1896,NDO-1501 and HFO 529 were resistant to Leaf blight, *Sclerotium* root rot and Leaf defoliators, whereas, JHO-17-2, SKO-240, OS-6 and HFO 718 were moderately resistant to leaf blight. **At Jhansi,** all the entries were moderately resistant to leaf light except JHO-17-1 &NDO-1501 which were moderately susceptible.

Table: Disease –pest tolerance in IVT oat (SC) trial:

Entries	Bhubaneswar				Ludhiana		Palampur		Jhansi	
	Leaf blight Severity (%)	Leaf blight reaction	*Sclerotium* root rot (%)	Leaf defoliators (nos./10 plants)	Leaf Blight Severity (%)	Disease Reaction	% Powdery mildew severity	Disease Reaction	Leaf blight Severity (%)	Leaf blight reaction
UPO-17-2	7.55	R	6.78	3.12	14.67	MR	52	HS	14.67	MR
Kent(NC)	8.98	R	9.88	4.42	25.00	MR	30	S	25	MR
SKO-96 ZC (HZ)							25	MR		
RO-11-1 ZC (NWZ)					29.33	MR				
RO-11-1 ZC(NEZ)	7.96	R	10.97	6.24						
JHO-2009-1 ZC (CZ)									29.33	MR
UPO-17-3	9.42	R	7.76	1.34	19.00	MR	32	S	19	MR
JHO-17-2	4.54	MR	4.98	3.32	28.67	MR	42	S	28.67	MR
JHO-17-1	5.87	R	6.75	2.32	33.33	MS	30	S	33.33	MS
JO-05-9	10.32	R	8.56	1.97	28.67	MR	24	MR	28.67	MR
OL 1893	8.90	R	6.72	3.56	25.00	MR	52	HS	25	MR
OL 1896	8.28	R	7.90	2.42	20.33	MR	52	HS	20.33	MR
SKO-240	14.67	MR	8.87	3.32	22.67	MR	26	S	22.67	MR
OS-6 (NC)	16.78	MR	9.56	1.65	15.00	MR	30	S	15	MR
HFO 718	18.90	MR	5.68	2.34	29.33	MR	45	S	29.33	MR
NDO-1501	8.76	R	3.34	1.42	33.33	MS	55	HS	33.33	MS
HFO 529	9.24	R	4.56	1.56	30.00	MR	45	S	30	MR
CD (0.05)					4.245					

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

Oats-IVTO MC: At Ludhiana, All entries showed moderately resistant disease reaction except UPO-212 and PLP-21 which were found moderately susceptible. **At Rahuri,** insect-pests and disease incidence not observed throughout the crop period. **At Palampur,** all entries were highly susceptible to susceptible to Powdery mildew exceptHFO-706 which was moderately resistant. **At Bhubneshwar**, JHO-17-3, OL-1874 and OL-1908, were resistant to Leaf blight, whereas, JO05-304, UPO-212, RO-19and HFO-514were moderately resistant to leaf blight. HFO-706 and PLP-21 were susceptible to Leaf blight. **At Jhansi,** all the entries were moderately resistant to Leaf light except UPO-212 &PLP-21which were moderately susceptible.

Table: Disease –pest tolerance in IVT oat (MC) trial

Entries	Bhubaneswar				Ludhiana		Palampur		Jhansi	
	Leaf blight Severity (%)	*Leaf blight reaction*	*Sclerotium* root rot (%)	Leaf blight Severity (%)	Leaf blight reaction	Disease Reaction	% Powdery mildew severity	Disease Reaction	Leaf blight Severity (%)	Leaf blight reaction
JO05-304	27.87	MR	6.78	2.14	24.67	MR	40	S	24.67	MR
UPO-212 (NC)	26.66	MR	9.78	1.86	33.33	MS	30	S	33.33	MS
RO-19 (NC)	24.88	MR	4.46	2.64	19.33	MR	52	HS	19.33	MR
HFO-514	29.66	MR	7.42	2.96	22.33	MR	35	S	22.33	MR
HFO-706	47,42	S	8.94	3.52	24.33	MR	25	MR	24.33	MR
JHO-17-3	9.86	R	4.32	1.34	19.67	MR	30	S	19.67	MR
PLP-21	42.64	S	9.86	3.42	31.00	MS	35	S	31	MS
OL-1874	8.78	R	2.89	1.58	30.00	MR	45	S	30	MR
OL-1908	9.62	R	4.36	1.96	26.67	MR	55	HS	26.67	MR
CD (0.05)					2.432					

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

Oats – IVTO Dual: At Ludhiana, All entries were moderately resistant except HFO-611, OL-1876-2 and JHO-17-5, which showed moderately susceptible disease reaction to leaf blight. **At Rahuri,** insect-pests and diseases were not observed throughout the crop period. **At Bhubaneswar**, JHO-17-5, OL-1906 and JO-10-506 were resistant to Leaf blight, whereas, OL-1876-2, JHO-17-4 and HFO-608 were moderately resistant to leaf blight. The varieties JHO-822 and HFO-611 were susceptible to leaf blight. **At Jhansi,** entries HFO-611, OL-1876-2 and JHO-17-5were moderately susceptible, while rest were moderately resistant to leaf blight.

Table: Disease –pest tolerance in IVT oat (Dual) trial

Entries	Bhubaneswar				Ludhiana		Jhansi	
	Leaf blight Severity (%)	*Leaf blight reaction*	Leaf blight Severity (%)	Leaf blight reaction	Leaf Blight Severity (%)	Disease Reaction	Leaf blight Severity (%)	Leaf blight reaction
UPO-212 (NC)	36.42	MS	6.97	3.73	23.00	MR	23	MR
JHO-822 (NC)	39.67	S	12.56	3.22	19.00	MR	19	MR
HFO-611	42.68	S	14.23	3.54	33.33	MS	33.33	MS
OL-1876-2	37.42	MR	8.54	2.34	38.33	MS	38.33	MS
JHO-17-5	8.84	R	3.32	1.32	35.67	MS	35.67	MS
JHO-17-4	31.68	MR	5.56	2.36	27.00	MR	27	MR
OL-1906	9.12	R	3.32	1.47	19.67	MR	19.67	MR
JO-10-506	8.64	R	2.88	2.36	23.00	MR	23	MR
HFO-608	34.68	MR	6.72	2.88	30.00	MR	30	MR
CD (0.05)					2.683			

AVTO (SC)-1: FIRST ADVANCED VARIETAL TRIAL IN OAT (SINGLE CUT)

Oats - AVTOSC-1: At Ludhiana, All entries were found moderately resistant to leaf blight except UPO-16-4 and HFO-525, which are moderately susceptible. **At Rahuri,** insect-pests and diseases were not observed throughout the crop period. **At Palampur,** all entries were highly susceptible to susceptible to Powdery mildew. **At Bhubneshwar**, Kent, JO-05-7, OL-1869-1, OS-6, OL-1862, UPO-16-4 and HFO-525 were resistant to Leaf blight, whereas, SKO-229 and OL-1861 were moderately resistant to leaf blight. **At Jhansi,** all the entries were moderately resistant to leaf blight except, UPO-16-4 andHFO-525 which were moderately susceptible.

Table: Disease –pest tolerance in AVT-1 oat (SC) trial

Entries	Bhubaneswar				Ludhiana		Palampur		Jhansi	
	Leaf blight Severity (%)	*Leaf blight reaction*	*Sclerotium* root rot (%)	Leaf defoliators (nos./10 plants)	Leaf Blight Severity (%)	Disease Reaction	Powdery mildew severity (%)	Disease Reaction	Leaf blight Severity (%)	Leaf blight reaction
Kent (NC)	9.64	R	4.56	1.45	30.00	MR	34	S	30	MR
JO-05-7	8.68	R	6.67	1.47	24.00	MR	32	S	24	MR
OL-1869-1	6.94	R	9.33	2.53	26.33	MR	60	HS	26.33	MR
OS-6 (NC)	7.76	R	6.33	3.12	19.33	MR	45	S	19.33	MR
SKO-229	12.78	MR	8.89	2.87	14.00	MR	45	S	14	MR
HFO-607	42.52	S	9.67	4.32	24.33	MR	60	HS	24.33	MR
OL-1862	8.97	R	3.45	1.34	19.00	MR	40	S	19	MR
UPO-16-4	7.33	R	3.46	1.96	31.00	MS	35	S	31	MS
HFO-525	6.67	R	6.54	2.23	35.33	MS	60	HS	35.33	MS
SKO-90 ZC (HZ)							45	S		
OL-125 ZC(NWZ)					26.33	MR				
JHO-99-2 ZC (NEZ)	32.78	MS	8.67	2.42						
JHO-822 ZC (CZ)									26.33	MR
OL-1861	14.56	MR	6.89	3.76	26.67	MR	60	HS	26.67	MR
CD (0.05)					2.919					

AVTO (SC)-2: SECOND ADVANCED VARIETAL TRIAL IN OAT (SINGLE CUT)

Oats- AVTOSC-2: At Palampur, all the entries were moderately resistant except OS-6, which was susceptible to powdery mildew.

Table: Disease –pest tolerance in AVT-2 oat (SC) trial

S. No.	Entries	Palampur (Powdery mildew)		
		% Disease severity	Disease Rating	Disease Reaction
1	HFO-427	20	5	MR
2	SKO-227	15	5	MR
3	Kent (NC)	20	5	MR
4	SKO-90 ZC (HZ)	24	5	MR
5	OS-6 (NC)	30	7	S
6	JHO-15-1	15	5	MR
7	JO-04-22	25	5	MR

AVTO (SC)-2 (Seed): SECOND ADVANCED VARIETAL TRIAL IN OAT (SINGLE CUT) FOR SEED

AVTO (SC)-2 (Seed): At Palampur, all the entries were moderately resistant for Powdery mildew exceptHFO-427 and JO-04-22, which were susceptible.

Table: Disease –pest tolerance in AVTO (SC)-2 (Seed) trial

SN	Entries	Palampur (Powdery Mildew)		
		% Disease severity	Disease Rating	Disease Reaction
1	HFO-427	35	7	S
2	SKO-227	20	5	MR
3	Kent (NC)	25	5	MR
4	SKO-90 ZC (HZ)	20	5	MR
5	OS-6 (NC)	25	5	MR
6	JHO-15-1	25	5	MR
7	JO-04-22	35	7	S

AVTO-1 (DUAL): FIRST ADVANCED VARIETAL TRIAL IN OAT (DUAL)

AVTO -1 (Dual): At Rahuri, insect-pests and diseases were not observed throughout the crop period. **At Bhubaneswar,** UPO-212, JHO-822, RO-19, OL-1769 and HFO-619were resistant to Leaf blight, whereas, JO-10-501 and OL-1871were moderately resistant to leaf blight. **At Jhansi,** all the entries were moderately resistant (JO-10-501 and OL-1871) to resistant (UPO-212, JHO-822, RO-19, OL-1769 and HFO-619) against leaf blight.

Table: Disease –pest tolerance in AVTO-1 (Dual) trial

SN	Entries	Bhubaneswar				Jhansi	
		Leaf blight severity (%)	Disease reaction	*Sclerotium* root rot (%)	Leaf defoliators (no./10 plants)	Leaf blight Severity (%)	Leaf blight reaction
1	UPO-212(NC)	8.97	R	2.34	2.33	8.97	R
2	JHO-822(NC)	5.79	R	3.42	1.46	5.79	R
3	RO-19(NC)	9.57	R	1.56	2.37	9.57	R
4	OL-1769	10.32	R	2.76	1.78	10.32	R
5	JO-10-501	18.96	MR	2.42	3.43	18.96	MR
6	OL-1871	16.68	MR	1.98	2.32	16.68	MR
7	HFO-619	16.74	R	1.34	1.67	16.74	R

VT Lucerne (P) -2016: VARIETAL TRIAL IN LUCERNE (Perennial) - 2016 – 2nd Year

At Ludhiana, VTL-2016-7, 9, 10, 11, 12 showed moderately resistant reaction to downy mildew. Rest of the entries was moderately susceptible. All entries showed non-significant variation for Lucerne weevil and *H. armigera* population. **At Rahuri,** against Aphids VTLu-8 (21.33 aphids/tiller) was found moderately resistant, while, remaining all entries were moderately susceptible (MS).

Table: Disease –pest tolerance in VT Lucerne trial

SN	Entry	Rahuri	Ludhiana			
		No. of Aphids/ tiller	Lucerne weevil/ plant	*H. armigera*	Downy mildew severity (%)	Disease Reaction
1	VTLu-2016-1	26.06	3.00	1.66	34.00	MS
2	VTLu-2016-2	31.26	3.00	1.66	47.00	MS
3	VTLu-2016-3	32.78	3.00	2.00	33.00	MS
4	VTLu-2016-4	33.00	2.00	1.66	35.00	MS
5	VTLu-2016-6	31.67	2.33	1.33	30.33	MS

6	VTLu-2016-7	32.47	2.33	2.00	27.33	MR
7	VTLu-2016-8	21.33	2.33	1.66	35.67	MS
8	VTLu-2016-9	26.67	3.00	1.66	27.33	MR
9	VTLu-2016-10	34.78	2.33	2.00	28.67	MR
10	VTLu-2016-11	31.33	3.00	1.33	26.33	MR
11	VTLu-2016-12	34.99	2.00	2.00	19.00	MR
12	VTLu-2016-13	32.48	3.00	2.00	35.33	MS
	SE±	1.87				
	CD at 5%	5.40	NS	NS	2.463	

VT - Rye grass (VTRG-1): No major disease was observed except slight infection of powdery mildew.

Palampur				
SN	**Entries**	**Powdery mildew**		
		% Disease severity	**Disease Rating**	**Disease Reaction**
1	VTRG-1-1	5	3	R
2	VTRG-1-2	7	3	R
3	VTRG-1-3	10	3	R
4	VTRG-1-4	10	3	R

White clover (VTWC): In VTWC, at Palampur, entries VTWC-1 to 3 were moderately resistant and rest of the entries were susceptible.

SN	**Entries**	**Powdery mildew**		
		% Disease severity	**Disease Rating**	**Disease Reaction**
1	VTWC-1	22	5	MR
2	VTWC-2	25	5	MR
3	VTWC-3	25	5	MR
4	VTWC-4	30	7	S
5	VTWC-5	27	7	S
6	VTWC-6	35	7	S

Red clover (VTRC): In VTRC, at Palampur, all the entries were susceptible, except, VTRC-6 &7 which were moderately resistant to powdery mildew.

SN	**Entries**	**Powdery mildew**		
		% Disease severity	**Disease Rating**	**Disease Reaction**
1	VTRC-1	35	7	S
2	VTRC-2	27	7	S
3	VTRC-3	30	7	S
4	VTRC-4	27	5	S
5	VTRC-5	27	5	S
6	VTRC-6	20	5	MR
7	VTRC-7	20	5	MR

AVT-1 VICIA (P): VARIETAL TRIALS IN VICIA (PERENNIAL)

At Rahuri, Insect-pests and diseases were not observed on *Vicia* crop.

PPT-17: To study the pathogenic variability of *Blumeria graminis f. sp. avenae* on oat

Location: Palampur

Eleven isolates of *Blumeria graminis f. sp. avenae* were collected during 2017-18 along with previously collected eleven isolates during 2016-17 making the total number of isolates to twenty two and were maintained under controlled conditions. The reaction of these isolates will be studied on selected differential set to find out the pathogenic variability as per Banyal, 1995.

Screening of Oat germplasm against *Blumeria graminis f. sp. avenae*: Total of 347 lines were screened under field conditions during 2017-18 using scale given by Mayee and Datar (1986). Out of 347 lines evaluated, 10 lines were found to be resistant. Among these lines PLP-1 was found to be highly resistant.

Refinement of Differential set: For refinement of differential set, 347 lines of oat were evaluated at Palampur for powdery mildew under natural epiphytotic conditions. Disease pressure was very high reaching up to 80 per cent severity in susceptible checks. From these 347 lines evaluated, 160 lines were selected for *in vitro* screening with different isolates. For screening *in vitro,* the seedlings of the selected oat germplasm were grown in aluminium trays. The aluminium trays were divided into 40 blocks and each block was sown with the germplasm line. The trays were shifted to cages after 7 days of sowing and were dusted uniformly with the inoculum. The readings were taken 15 days after inoculation using 0-4 scale given by Banyal (1995) by both visual and stereo-microscopic observation. Till date, 80 lines were screened *in vitro* and among which, ADG-124, JPO-36, UPO-102, EC-605831, OATS-17, J0-10, OL-1847, OG-77 and HJ-8, showed differential reaction and were chosen for further screening. Other 80 lines will be evaluated with 3 isolates to make a set of 30 lines for further refinement and these 30 lines will be screened again with more isolates to develop final differential set. The final differential lines will be screened using all the collected isolates.

Inheritance of Powdery mildew in oat: To study the inheritance of powdery mildew resistance, three resistant lines (OL-1847, OG-77 and OL-1689) were selected and crossed with HJ-8 (Susceptible check) in field and F1 seeds were harvested.

Cross	Number of crosses made	Recovered F1 seeds
HJ8 X OL-1847	1000	75
HJ-8 X OG-77	1000	69
HJ8 X OL-1689	1000	55

These recovered F1 seeds will be evaluated for the powdery mildew inheritance and selfed F2 seeds will be evaluated to elucidate the nature of resistance.

PPT-20: Management of soil borne and powdery mildew diseases in Red clover seed crop

Location: Palampur
Design: RBD **Replication:** 3 **Plot size:** 2 x 2 m^2

Results: The experiment was conducted to manage the powdery mildew and soil borne diseases in the seed crop of red clover. It was observed that seed treatment with carbendazim @ 2g/kg seed followed by three foliar spray of hexaconazole @ 0.1 % gave best management of powdery mildew with 4.2 % disease severity and 92.8 % disease control of powdery mildew and 2.7% disease incidence with 78.7 % disease control of soil borne disease with an overall increase of 46% in yield as compared to control (Table PPT-20).

Table PPT-20: Management of soil borne and powdery mildew diseases in Red clover seed crop

Treatment	% Severity / incidence				Yield	
	Powdery mildew	% control	Soil borne disease	% control	(q/ha)	% increase
T_1 =Seed treatment with *Trichoderma* @ 5g/kg seed	56.3 (48.6)	3.5	7.1	43.2	0.8	11.4
T_2 = Seed treatment with carbendazim @ 2 g/kg seed	50.4 (45.2)	13.5	3.3	73.3	0.9	27.2
T_3= T_1 + Three foliar spray of *Trichoderma* @ 0.5%	47.5 (43.5)	18.6	6.6	47.5	0.8	22.8
T_4= T_2 + Three foliar spray of *Trichoderma* @ 0.5%	43.6 (41.3)	25.3	3.5	72.3	0.9	32.7
T_5= T_1 + Three foliar spray of wettable sulphur@ 0.3%	16.6 (24.0)	71.5	6.6	47.2	0.8	24.8
T_6 = T_2 + Three foliar spray of wettable sulphur@ 0.3%	15.8 (23.4)	72.9	3.2	74.1	0.8	25.2
T_7 = T_1 + Three foliar spray of hexaconazole @ 0.1 %	4.4 (12.1)	92.5	6.5	48.0	0.9	35.1
T_8 = T_2 + Three foliar spray of hexaconazole @ 0.1 %	4.2 (11.8)	92.8	2.7	78.7	1.0	46.0
T_9 = T_1 + One spray each of *Trichoderma,* wettable sulphur and hexaconazole	7.3 (15.6)	87.5	6.8	45.6	0.9	30.7
T_{10} =T_2 + One spray each of *Trichoderma,* wettable sulphur and hexaconazole	6.8 (15.1)	88.3	3.3	73.6	0.9	38.6
T_{11} =Control	58.3 (49.8)	0.0	12.5	0.0	0.7	0.0
CD (5%)	2.25		1.18		0.79	

PPT 21: Management of foliar diseases of oat

Location: Ludhiana and Bhubaneswar

Design: RBD **Replication:** 3 **Plot size:** 3x2.5m^2

Treatments

T_1 - Seed treatment with carbendazim 50WP @ 2g/kg seed
T_2 - Seed treatment with *Trichoderma viride* (CFU 10^6/g of formulation) @ 5g/kg of seed
T_3 - T2 + foliar spray of *T. viride* @ 0.5% at 21 DAS
T_4 - T_1 + foliar application of Carbendazim 12% + Mancozeb 63%WP @ 1g/lit at 21 DAS
T_5 - T_2+ foliar application of Carbendazim 12% + Mancozeb 63%WP @ 1g/lit at 21 DAS
T_6 - T_1 + foliar application of Propiconazole 25EC @ 1ml/lt after 21DAS
T_7 - T_2 + foliar application of Propiconazole 25EC @ 1ml/lt after 21DAS
T_8 -Untreated control

Results

At Ludhiana, the experiment was conducted for the management of foliar diseases of oats. The results showed that the seed treatment with Carbendazim 50WP @2g/kg seed + foliar application of Propiconazole 25 EC @ 1ml/lit after 21 DAS showed minimum disease severity (24.67%) of leaf blight with 38.84 % control of disease and 239.17 q/ha of green fodder and 34.10 q/ha of seed yield followed by seed treatment with *Trichoderma viride* (CFU 10^6/g of formulation) @ 5g/kg of seed+ foliar application of Propiconazole 25 EC @ 1ml/lit after 21 DAS which showed 29.67 % severity with 26.44 % disease control and 23.23 % increase in green fodder yield as compared to untreated check (40.33%) (Table PPT-21).

At Bhubaneswar also,seed treatment with carbendazim 50WP @ 2g/kg seed + foliar application of Propiconazole 25EC @ 1ml/lt after 21DAS sowed minimum diseases severity of leaf blight in oats(9.33%) with 79.8% disease control and 32.1% increase in yield over check. This treatment was followed by seed treatment with *Trichoderma viride* (CFU 10^6/g of formulation)@ 5g/kg of seed + foliar application of Propiconazole 25 EC @1ml/lt after 21 DAS with 74.0.3% disease control and 26.9% increase in yield over check with significant differences (Table PPT-21).

Table PPT 21: Effect of foliar spray and seed treatment on leaf blight and yield of Oats

	Ludhiana					Bhubaneswar			
Treatments	**Leaf Blight Severity (%)**	**Disease control (%)**	**GFY (q/ha)**	**% Increase Over control**	**Seed Yield (q/ha)**	**Leaf Blight severity (%)**	**Disease control (%)**	**GFY (q/ha)**	**% Increase Over control**
T_1	34.00	15.70	201.08	10.46	30.48	22.33	51.80	250.20	13.31
T_2	37.00	8.26	192.57	5.79	26.03	27.33	41.01	243.07	10.08
T_3	37.33	7.43	190.48	4.64	24.13	26.00	43.88	255.93	15.93
T_4	32.67	19.00	220.13	20.93	30.67	15.33	66.91	261.13	18.2
T_5	35.67	11.56	201.08	10.46	29.40	18.00	61.14	259.33	17.45
T_6	24.67	38.84	239.17	31.39	34.10	9.33	79.86	291.80	32.15
T_7	29.67	26.44	224.32	23.23	31.75	12.0	74.09	280.27	26.93
T_8	40.33	-	182.03	-	23.05	46.33		220.80	
SE (m)±						1.59		1.82	
CD (P=0.05)	1.100		1.665		1.428	4.78		5.47	
CV	1.834		2.898		5.356				

PPT-26: Biological management of oat aphid *Rhopalosiphum padi* on oats

Location: Rahuri, Ludhiana and Dharwad

Crop: Oat **Variety:** Kent **Plot size:** 3 x 4 m^2

Replication: 3 **Design:** RBD

Treatments:

T1- Foliar application of *L.lecani* @ $1x10^8$ CFU/g (5 g/lit)
T2- Foliar application of *L. lecani* @ $1x10^8$ CFU/g (7.5 g/lit)
T3- Foliar application of *M. anisopliae* @ $1x10^8$ CFU/g (5 g/lit)
T4- Foliar application of *M. anisopliae* @ $1x10^8$ CFU/g (7.5 g/lit)
T5- Commercial neem product (Azadirachtin – 10000 ppm) @ 2ml/lt
T6- NSE @ 5%
T7- Untreated control

Results: **At Rahuri,** infestation of aphids on oat was not seen throughout the season, hence the treatments were not imposed.**At Ludhiana,** the incidence of oat aphid was negligible owing to heavy rains, the trial on biological management could not be conducted. **At Dharwad,** crop was established and treatments were not imposed due to non-occurrence of the aphid *Rhopalosiphum padi* on oat.

PPT-27: Validation of best treatment of trial entitled "Management of soil borne diseases in clover seed crop".

Location: Ludhiana

Design: Paired plot **Replication:** 7 **Plot size:** 10x10m^2

Results: The experiment was conducted for the validation of best treatment of trial "management of soil borne diseases in clover". The results presented in table PPT-27 showed that foliar application of Carbendazim @ 1.0 kg/ha (after 1st and 2nd cut) exhibited very less incidence(18.29%) of stem rot with 48.17 % disease control, 23.95 % increase in green fodder yield and higher seed yield, as compare to control.

Table PPT-27: Effect of foliar spray on stem rot of clover

Treatments		Stem rot Incidence (%)	Disease Control (%)	Green Fodder Yield (q/ha)	Percent Increase	Seed Yield (q/ha)*
T_1	Foliar application of Carbendazim @ 1.0 kg/ha	18.29	48.17	635.70	23.95	3.20
T_2	Untreated control	35.29	-	512.84	-	2.50
CD (P=0.05)		3.652		4.211		3.56
CV		10.224		11.309		7.67

PPT-28: Validation of best treatments of trial entitled "Studies on biological management of *Spodoptera litura* in relation with different time of application on lucerne under field condition"

Location: Rahuri
Design: RBD **Replication:** 7 **Treatment:** 03

Treatments:
1. Foliar application of *SlNPV* @ 1ml/lit + *B. bassiana* @ $1X10^8$ CFU/g (5 g/lit) at 8 pm
2. Foliar application of *SlNPV* @ 1ml/lit + *N. releyi* @ $1X10^8$ CFU/g (5 g/lit) at 8 pm
3. Untreated control

Results: **At Rahuri,** larval count of *S. litura* recorded a day before spray was found statistically non-significant. Both the biopesticide combinations were found superior over control for *S. litura* management on Lucerne due to spray at 8 pm. At 5 and 7 days after spraying, combination of *Sl*NPV @ 1ml and *B. bassiana* @ 5 g/lit of water recorded significantly lowest number of larvae/m^2 (3.77 & 0.95 larvae/m^2, respectively). With regards to the green forage yield, combination of *Sl*NPV @ 1ml and *B. bassiana* @ 5 g/lit of water recorded significantly higher yield (86.02 q/ha), however, it was at par with *Sl*NPV+ *N. riley* (83.04 q/ha).
Economics: The highest ICBR was recorded in treatment combination of *SlNPV +B. bassiana* (1:2.14). Maximum net profit obtained due to treatment combination of *SlNPV +B. bassiana* (Rs. 4172.50/-) in one cut.

Table PPT-28: Effect of biopesticides against *S. litura* on Lucerne and their impact on GFY

Treatments	Dose	Pre-count (Av. No. of larvae/m2)	Av. No. of larvae/m2 at 5 DAS	Av. No. of larvae/m2 at 7 DAS	Green Forage Yield (q/ha)	ICBR
T1- *SLNPV +B. bassiana*	1ml + 5 g/lit	8.21 **(2.95)**	3.77 **(2.06)**	0.95 **(1.14)**	86.02	1:2.14
T2- SLNPV + *N.* rileyi	1ml + 5 g/lit	8.39 **(2.98)**	6.03 **(2.55)**	3.19 **(1.92)**	83.04	1:1.76
T3- Untreated control		8.49 **(3.00)**	10.55 **(3.32)**	13.18 **(3.70)**	61.53	
SE±		0.03	0.05	0.11	1.23	
CD at 5%		N.S.	0.14	0.31	3.62	

Bold figures are transformed values square root (x+0.5)
Spray was given at 8 pm

PPT-29: Validation of best treatments of trial entitled "Biological control of *Helicoverpa armigera* on lucerne/ berseem seed crop"

Location: Rahuri and Ludhiana

Rahuri

Crop: Lucerne Variety: RL-88 Plot size: 100 m^2 each treatment
Treatments: 03 **Replication:** 07 **Design:** RBD

Ludhiana

Crop: Berseem Variety : BL- 42 Plot size: 50 m^2each treatment
Treatments: 03 **Replication:** 07 **Design:** RBD

Treatments:

T1: Foliar application of *HaNPV* @ 1ml/lit +*B. bassiana* @ $1X10^8$ CFU/g (5 g/lit)
T2: Foliar application of *HaNPV* @ 1ml/lit + *N. rileyi* @ $1X10^8$ CFU/g (5 g/lit)
T3: Untreated control

Results:

At Rahuri, larval count of *H. armigera* recorded a day before spray was found statistically non-significant. Both the biopesticide combinations were found superior over untreated control for the control of *H. armigera* on Lucerne. At 5 days after spraying, combination of *Ha*NPV @ 1ml and *B. bassiana* @ 5 g/lit of water recorded significantly lowest number of larvae/m^2 (4.65 larvae/m^2) as compared to other treatments. Next promising treatment was *Ha*NPV+ *N. rileyi* (5.52 larvae/m^2) which was superior as compared to untreated control (10.39 larvae/m^2). At 7 days after spraying also, combination of *Ha*NPV @ 1ml and *B. bassiana* @ 5 g/lit of water recorded significantly lower number of larvae/m^2 (1.10 larvae/m^2) as compared to other treatments. However, it was at par with treatment of *Ha*NPV + N. *rileyi* (1.76 larvae/m2). The maximum population was recorded in untreated control (12.49 larvae/m^2). With regard to the seed yield, combination of *Ha*NPV @ 1ml and *B. bassiana* @ 5 g/lit of water recorded significantly higher seed yield (2.02q/ha), however, it was at par with *Ha*NPV+ *N. rileyi*(1.96 q/ha).

Economics: The highest ICBR was recorded in treatment combination of *HaNPV +B. bassiana* (1:17.83). Maximum net profit was obtained due to treatment combination of *HaNPV +B. bassiana* (Rs. 70,450/ha) in a year.

Table PPT-29: Effect of biopesticides against *H. armigera* and their impact on seed yield of Lucerne

Rahuri						
Treatments	**Dose**	**Av. No. of larvae/m^2**			**Seed yield (q/ha)**	**ICBR**
		Precount	5 DAS	7DAS		
T1- *Ha*NPV +*B. bassiana*	1ml + 5g/lit	9.86 **(3.22)**	4.65 **(2.27)**	1.10 **(1.22)**	2.02	1:17.83
T2- *Ha*NPV + *N. rileyi*	1ml + 5 g/lit	9.34 **(3.14)**	5.52 **(2.45)**	1.76 **(1.49)**	1.96	1:16.62
T3- Untreated control		9.69 **(3.19)**	10.39 **(3.30)**	12.49 **(3.60)**	1.09	
SE ±		0.03	0.05	0.09	0.04	
CD at 5%		N.S.	0.16	0.27	0.12	

Bold figures are transformed values square root (x+0.5)

At Ludhiana, the results revealed that the number of *H. armigera* larvae before spray were non-significant in all the treatments. Both the biopesticide combinations were found superior over untreated control for the control of *H. armigera* on berseem. At 5 days after spraying, combination of *Ha*NPV @ 1ml and *B. bassiana* @ 5 g/lit of water recorded lowest number of larvae (2.33 larvae/m row length) as compared to other treatments. Next promising treatment was *Ha*NPV+ *N. rileyi* (2.66 larvae/m row length) which was superior as compared to untreated control (5.33 larvae/m row length). At 7 days after spraying also, combination of *Ha*NPV @ 1ml and *B. bassiana* @ 5 g/lit of water recorded significantly lower number of larvae (1.66larvae/m row length) as compared to other treatments. However, it was at par with treatment of *Ha*NPV + N. *rileyi* (2.00 larvae/m row length). The maximum population was recorded in untreated control (6.00larvae/m row length). With regard to the seed yield, combination of *Ha*NPV @ 1ml and *B. bassiana* @ 5 g/lit of water recorded significantly higher seed yield (2.40 q/ha), however, it was at par with *Ha*NPV+ *N. rileyi* (2.20 q/ha), but significantly different from control (1.70 q/ha).The number of honeybees per plot before as well as after 12h of treatment varied non-significantly in all the treatments and was in range of 14.33-16.40 honey bees.

Table PPT-29: Effect of biopesticides against *H. armigera* and their impact on seed yield of berseem

Ludhiana								
S. No.	**Treatment**	**Number of *H. armigera* larvae per m row length**			**Number of honeybees per plot**		**GFY (q/ha)**	**Seed yield (q/ha)**
		Before spray	**5 DAS**	**7 DAS**	**Before spray**	**12h after spray**		
T1	*HaNPV* @ 1ml/lit + *B. bassiana* @ 1X10^8 CFU/g (5 g/lit)	4.00	2.33 (1.82)	1.66 (1.63)	16.40	15.33	355	2.40
T2	*HaNPV* @ 1ml/lit + *N. rileyi* @ 1X10^8 CFU/g (5 g/lit)	4.33	2.66 (1.92)	2.00 (1.73)	15.87	14.50	322	2.20
T3	Untreated control	4.66	5.33 (2.51)	6.00 (2.64)	15.33	14.33	256	1.70
	C.D. (5%)	NS	(0.37)	(0.35)	NS	NS	3.2	0.54
	CV	14.22	11.70	9.67	13.88	15.30	8.45	0.678

PPT-30: Biological management of powdery mildew of oats caused by *Blumeria graminis f. sp. avenae*

Location: Palampur **Treatments:** 10 **Replications:** 3
Design: RBD **Plot size:** 3x2 m^2

Results: The experiment was conducted to manage the powdery mildew in oat through biological management practices. It was observed that chemical check i.e, three foliar spray of hexaconazole @0.1% gave best control of powdery mildew (13.3 % disease severity and 77.1 % disease control) with maximum increase (15.9%) in the seed yield over the control followed by biological management practices i.e, three foliar sprays of *Trichoderma viride* @ 0.5% and three foliar spray of *Trichoderma harzianum* @ 0.5% giving 48.6 and 45.7 % powdery mildew control with 10.5 and 10.4 % increase in the seed yield respectively over control. Minimum disease control and increase in the yield was provided by three foliar spray of NSE @ 5%. It was also observed that although the disease severity was high in biological treatments, however, yield obtained was almost at par with chemical check, thus indicating a positive role of biological treatments in enhancing seed yield.

Table PPT-30: Biological management of powdery mildew of oats caused by *Blumeria graminis f. sp. avenae*

Treatment	Powdery mildew		Seed Yield	
	% Severity	% control	(q/ha)	% increase
T1: Three foliar spray of *Trichoderma viride* @ 0.5%	30.0 (33.2)	48.6	19.9	10.5
T2: Three foliar spray of *Trichoderma harzianum* @ 0.5%	31.7 (34.2)	45.7	19.9	10.4
T3: Three foliar spray of *Psuedomonas flourescens*@ 0.5%	40.0 (39.2)	31.4	19.2	6.7
T4: Three foliar spray of extract of *Eupatorium adenophorum* @ 10%	40.0 (39.2)	31.4	19.0	5.2
T5: Three foliar spray of Azadirachtin 3000 ppm @ 0.3%	41.7 (40.2)	28.6	18.6	3.1
T6: Three foliar spray of NSE @ 5%	43.3 (41.1)	25.7	18.2	1.1
T7: Three foliar spray of Eucalyptus @ 10%	38.3 (38.2)	34.3	19.2	6.5
T8: Three foliar spray of Vitex @ 0.1%	38.3 (38.2)	34.3	19.3	7.0
T9: Three foliar spray of hexaconazole @0.1% (Chemical control)	13.3 (21.3)	77.1	20.9	15.9
T10: Control	58.3 (49.8)		18.0	
CD (5%)	3.06		0.73	

PPT-31: Eco-friendly pest management techniques in berseem ecosystem

Location: Ludhiana
Design: RBD **Replication:** 3 **Plot size:** 5x5 m^2

Results: 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 treatment T2 i.e, soil application of *Trichoderma viride* @ 5 g/l + foliar spray of carbendazim @ 2g/l exhibited least disease incidence of stem rot (19.33%) with 47.28 % disease control, but, the number of *H. armigera* larvae/m row length in berseem were high (5.66) in this as compared to other treatments except control (6.66). But, in spite of this fact, yield (both GFY (565.96 q/ha) and seed yield (3.11 q/ha)) was significantly high in T2 than from other treatments. T2 was followed by treatment involving recommended 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) which provided 41.82 % stem rot control and number of *H. armigera* larvae/m row length in berseem were also minimum (2.00) in this treatment. However, GFY (519.15 q/ha) and seed yield (2.82) was less thanT2, but significantly different from control and at par with other treatments except T2. It was also found that associated benefits with the use of trap crop & bird perches in treatments T3 & T4 were not reflected in terms of GFY and seed yield increase (Table PPT-31). The number of natural enemies per meter row length on Berseem varied from 1.66-3.00 (for coccinellids) and 0.66-1.33 (for spiders) in all the treatments.

Table PPT-31: Evaluation of eco-friendly disease and pest management techniques in berseem

Treatments	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		GFY (q/ha)	Seed Yield (q/ha)
					Coccinellids	Spiders		
T_1	24.00	34.55	4.00 (2.23)	-	2.00	1.00	512.06	2.72
T_2	19.33	47.28	5.66 (2.58)	-	2.00	1.00	565.96	3.11
T_3	27.87	24.01	3.66 (2.15)	1.66	2.33	1.33	502.13	2.24
T_4	26.50	27.73	3.00 (2.00)	2.33	3.00	1.00	499.29	2.28
T_5	21.33	41.82	2.00 (1.73)	-	1.66	0.66	519.15	2.82
T_6	36.67	0.00	6.66 (2.71)	-	2.33	1.33	472.34	2.03
CD (P=0.05)	1.98	-	(0.37)	-	-	-	5.77	0.19
CV	4.14	-	8.40	-	-		0.612	4.25

T_1	Soil application of *Trichoderma viride* @ 5 g/l + foliar spray of NSKE @ 5%
T_2	Soil application of *Trichoderma viride* @ 5 g/l + foliar spray of carbendazim @ 2g/l as and when required
T_3	Chickpea as trap crop on border row + Bird perches +spray of NSKE @ 3ml/lit of water
T_4	Sunflower as trap crop on border row + Bird perches+ Spray of NSKE @ 3ml/lit of water on trap crop
T_5	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)
T_6	Control

Forage Crops Breeder Seed Production

[Indent year Rabi 2018-19]
[Production year Rabi 2017-18]
(Table Reference: Tables BSP 1, 2, 3, 4)

The indent for Breeder Seed Production was received from DAC, GOI for 30 varieties in four forage crops *viz*., Oat (16), Berseem (10), Lucerne (3) and Gobhi Sarson (1). The quantity allocated was 704.66 q which was 43.5% higher than previous year indent of 491.15q. The production target was assigned to thirteen Breeder Seed producing centres of the different SAUs/ NGO/ ICAR institutes. Among quantity indented for different forage crops, the maximum was for Oat (654.6 q) followed by Berseem (45.14 q) and Lucerne (4.90 q) and minimum for Gobhi Sarson (0.02 q).

The final Breeder Seed Production Report (BSP-IV) received from different seed producing centres revealed that in Berseem, the overall breeder seed production was more than the allocated quantity. However, there was shortfall in Oat & Lucerne. In Gobhi Sarson, the target was achieved. The overall production was 613.84 q which was 90.82 q (12.89%) less than the indented target.

In Berseem, the production was 50.1 q and 3.67 q seed of previous years are also available. It makes a total of 53.77 q which is 8.63 q higher than the allocated quantity of 45.14 q. Center wise scenario indicates that PAU, Ludhiana; IGFRI, Jhansi; CCS HAU Hisar were net surplus producers whereas GBPUAT, Pantnagar was net deficit producer in Berseem.

In Oat, the production was 468.8 q and 87.23 q of previous year is also available. It makes a total of 556.03 q against the allocation of 654.6 q making a deficit of 98.57 q. IGFRI, Jhansi; SKUAST-K, Srinagar; HAU, Hisar; MPKV, Rahuri; NDRI, Karnal; were net surplus producers whereas GBPUAT, Pantnagar; AAU, Anand achieved the target. PAU, Ludhiana, NDUAT, Faizabad; BAIF, Urulikanchan; were net deficit producers in oat.

In Lucerne, the target of (4.9 q) was allotted out of which 4.02q was produced and there was deficit of 0.88 q. MPKV Rahuri was net surplus producer whereas AAU, Anand could not achieve the target. a.

In Gobhi Sarson, the production was 0.02 q against the allocation of 0.02 q was acheived and as indent was for only one variety, HPKVV, Palampur achieved the target.

The overall breeder seed production was 522.94 q and considering the previous year seed of 90.9 q thus making a total of 613.84 q against the indent of 704.66 q (Table BSP 1 & 2).

There was surplus breeder seed available in many centers of other improved varieties (Table BSP 3)

A quick analysis indicates that forage crop breeder seed demand is increasing rapidly (Table BSP 4). The current year indent is 43.47% more than previous year and it is more than double (115% increase over the 2015-16) in last 4 years. Similarly production is also 34.3% more than previous year and it is 137 % higher as compared to 2015-16 (4 years back).

Table BSP 1: Centre wise Breeder Seed Production (q) during *Rabi 2017-18*

[Indent Rabi 2018-19]

[Production year Rabi 2017-18]

Oat

SN	Producing centre	Variety	Allocation as per DAC	Allocation BSP-I	Production	Non-lifted seed available	Surplus/ Deficit
1.	**Punjab**						
	PAU, Ludhiana	OL-10	35.05	35.05	35.05		-
		Kent	371.45	75.00	20.00		(-) 55.00
2.	**Maharashtra**						
	BAIF, Urulikanchan	Kent	371.45	30.00	29.00		(-) 1.00
	MPKV, Rahuri	RO-19	5.00	5.00	3.20		(-) 1.80
		Kent	371.45	30.00	32.60		(+) 2.60
3.	**Gujarat**						
	AAU, Anand	Kent	371.45	60.00	60.00		-
4.	**Uttarakhand**						
	GBPUAT, Pantnagar	UPO-212	52.50	52.50	52.50		-
5.	**Uttar Pradesh**						
	IGFRI, Jhansi	JHO-2000-4	5.00	5.0	4.20	5.19	(+) 4.39
		JHO-99-2	5.00	5.00	5.0	2.40	(+)2.40
		JHO-882	20.00	20.00	20.0	5.0	(+) 5.0
		JHO 2009-1	25.00	25.00	5.60	-	(-)19.40
		JHO 2010-1	20.00	20.00	5.40	11.50	(-) 3.10
		Kent	371.45	50.00	10.0	63.14	(+) 23.14
	NDUA&T, Faizabad	NDO-1	4.00	4.00	0		(-) 4.00
6.	**Haryana**						
	CCS HAU, Hisar	OS-377	25.00	25.00	29.20		(+) 4.20
		OS-6	5.00	5.00	7.33		(+) 2.33
		Haryana Javi - 8	7.60	7.60	4.30		(-) 3.30
	NDRI, Karnal	Kent		0	70.00		(+) 70.00
7.	**Jammu & Kashmir**						
	SKUAST, Srinagar	Shalimar Oat-1 (SKO -20)	10.00	10.00	17.00		(+) 7.00
		Shalimar Oat-3	30.00	30.00	34.00		(+) 4.00
8.	**Madhya Pradesh**						
	JNKVV, Jabalpur	JO-03-93	25.00	25.00	5.04		(-) 19.96
		Kent	371.45	75.00	19.38		(-) 55.62
9.	**Rajasthan**						
	SKRAU, Bikaner	Kent	371.45	75.00	-		(-) 75.00
		Total	**654.60**	**669.15**	**468.8**	**87.23**	**(-) 98.57**

BAIF - less production due to crop damage by wild boar at the time of grain filling stage

HAU – HJ-8 poor germination of nucleus seed

IGFRI – JHO 2009-1 due to non availability of sufficient Nucleus seed as variety was notified in 2016.

Table BSP 1: Centre wise Breeder Seed Production (q) during *Rabi 2017-18—Contd...*

Berseem

SN	Producing centre	Variety	Allocation as per DAC	Allocation BSP-I	Production	Non-lifted seed available	Surplus/ Deficit
1.	**Punjab**						
	PAU, Ludhiana	BL-42	11.06	11.06	12.40		(+) 1.34
		BL-180	1.90	1.90	1.90		-
		BL-10	12.28	12.28	13.00		(+) 0.72
		BL-1	3.00	3.00	3.00		-
2.	**Uttar Pradesh**						
	IGFRI, Jhansi	BB-2 (JHB 146)	0.20	0.20	3.50	0.74	(+) 4.04
		BB-3	9.00	9.0	3.50	1.84	(-) 3.66
		Wardan	5.40	5.40	5.10	1.09	(+) 0.79
3.	**Haryana**						
	CCS HAU, Hisar	H. Berseem-2	1.40	1.40	3.60		(+) 2.20
		Mescavi	0.80	0.80	4.10		(+) 3.30
4.	**Uttarakhand**						
	GBPUAT, Pantnagar	UPB-110	0.10	0.10	-		(-) 0.10
Grand Total			**45.14**	**45.14**	**50.10**	**3.67**	**(+) 8.63**

Lucerne

SN	Producing centre	Variety	Allocation as per DAC	Allocation BSP-I	Production	Surplus/ Deficit
1.	**Maharashtra**					
	MPKV, Rahuri	RL-88	0.20	0.20	0.32	(+) 0.12
2.	**Gujarat**					
	AAU, Anand	Anand-3	1.30	1.30	0.30	(-) 1.00
		Anand-2	3.4	3.4	3.40	-
Total			**4.90**	**4.90**	4.02	(-) 0.88

Gobhi Sarson

SN	Producing centre	Variety	Allocation BSP-I	Allocation as per DAC	Production	Surplus/ Deficit
1	**Himachal Pradesh**					
	CSK HPKVV, Palampur	Him Sarson-1	0.02	0.02	0.02	-

Table BSP 2: Variety wise breeder seed production (q) during Rabi 2017-18

[Indent Rabi 2018-19]

[Production year Rabi 2017-18]

Crop	SN	Variety	Produced by	Notification Year	Allocation as per DAC	Allocation BSP-1	Production	Non-lifted seed available	Surplus (+) / Deficit (-)
Oat	1	OL-10	PAU, Ludhiana	2014	35.05	35.05	35.05		-
	2	Kent	PAU, Ludhiana	1975	371.45	75.00	20.00		(-) 55.00
	2		BAIF, Urulikanchan			30.00	29.00		(-) 1.00
	2		AAU, Anand			60.00	60.00		-
	2		SKRAU, Bikaner			75.00	-		-
	2		MPKV, Rahuri			30.00	32.60		(+) 2.60
	2		IGFRI, Jhansi			50.00	10.00	63.14	(+) 23.14
	2		JNKVV, Jabalpur			75.00	**19.38**		(-) 55.62
	2		NDRI, Karnal			-	70.00		(+) 70.00
	3	RO-19 (Phule Harita)	MPKV, Rahuri	2007	5.0	5.0	3.20		(-) 1.80
	4	JO-03-93	JNKVV, Jabalpur	2015	25.0	25.0	**5.04**		(-) 19.96
	5	UPO-212	GBPUAT, Pantnagar	1990	52.50	52.50	52.50		-
	6	JHO-2000-4	IGFRI, Jhansi	2006	5.0	5.0	4.20	5.19	(+) 4.39
	7	JHO-99-2	IGFRI, Jhansi	2005	5.0	5.0	5.0	2.40	(+) 2.40
	8	JHO-882	IGFRI, Jhansi	1989	20.0	20.0	20.0	5.0	(+) 5.0
	9	JHO 2009-1	IGFRI, Jhansi	2016	25.0	25.0	5.60		(-)19.40
	10	JHO 2010-1	IGFRI, Jhansi	2016	20.0	20.0	5.40	11.50	(-)3.10
	11	OS-377	CCS HAU, Hisar	2015	25.00	25.00	29.20		(+) 4.20
	12	OS-6	CCS HAU, Hisar	1982	5.0	5.0	7.33		(+) 2.33
	13	Haryana Javi -8	CCS HAU, Hisar	1998	7.60	7.60	4.30		(-) 3.30
	14	Shalimar Oat-1 (SKO -20)	SKUAST-K, Srinagar	2013	10.00	10.00	17.00		(+) 7.00
	15	Shalimar Oat-3	SKUAST-K, Srinagar	2016	30.0	30.0	**34.00**		(+) 4.00
	16	NDO-1	NDUAT, Faizabad	2010	4.0	4.0	0		(-) 4.0
			Total		**654.6**	**669.15**	468.80	87.23	(-) 98.57

Table BSP 2: Variety wise breeder seed production (q) during Rabi 2017-18……Contd.

Crop	SN	Variety	Produced by	Notification Year	Allocation as per DAC	Allocation BSP-1	Production	Non-lifted seed available	Surplus (+) / Deficit (-)
Berseem	1	BL-42	PAU, Ludhiana	2007	11.06	11.06	12.40		(+) 1.34
	2	BL-180	PAU, Ludhiana	2006	1.90	1.90	1.90		-
	3	BL-10	PAU, Ludhiana	1985	12.28	12.28	13.00		(+) 0.72
	4	BL-1	PAU, Ludhiana	1978	3.0	3.0	3.00		-
	5	BB-2 (JHB 146)	IGFRI, Jhansi	1997	0.20	0.20	3.50	0.74	(+) 4.04
	6	BB-3	IGFRI, Jhansi	2001	9.0	9.0	3.50	1.84	(-) 3.66
	7	Wardan	IGFRI, Jhansi	1982	5.4	5.4	5.10	1.09	(+) 0.79
	8	H. Berseem-2	CCS HAU, Hisar	2006	1.40	1.40	3.60		(+) 2.20
	9	Mescavi	CCS HAU, Hisar	1975	0.80	0.80	4.10		(+) 3.30
	10	UPB-110	GBPUAT, Pantnagar		0.10	0.10	-		(-) 0.10
	Total				**45.14**	**45.14**	**50.10**	**3.67**	**(+) 8.63**

Crop	SN	Variety	Produced by	Notification Year	Allocation as per DAC	Allocation BSP-1	Production	Non-lifted seed	Surplus (+) / Deficit (-)
Lucerne	1	RL-88	MPKV, Rahuri	1996	0.20	0.20	0.32		(+) 0.12
	2	Anand-2	AAU, Anand	1984	3.4	3.4	3.40		-
	3	AL-3 (ANAND Lucerne - 3	AAU, Anand	2009	1.30	1.30	0.30		(-) 1.00
	Total				**4.90**	**4.90**	4.02		(-) 0.88

Crop	SN	Variety	Produced by	Notification Year	Allocation as per DAC	Allocation BSP-1	Production	Non-lifted seed	Surplus (+) / Deficit (-)
Gobhi Sarson	1	Him Sarson-1	CSK HPKVV, Palampur	2009	0.02	0.02	0.02		-
	Total				**0.02**	**0.02**	**0.02**		**-**
Grand Total					**704.66**		**522.94**	**90.90**	**(-) 90.82**

Table BSP -3: Surplus breeder seed available

SN	Producing centre	Crop	Variety	Allocation BSP-I	Production	Surplus/ Deficit
1	PAU, Ludhiana	Metha	M-150	-	0.50	(+) 0.50
2	JNKVV, Jabalpur	Oat	JO-1	-	5.80	(+) 5.80
3	JNKVV, Jabalpur	Berseem	JB-5	-	1.87	(+) 1.87
4	MPKV, Rahuri	Oat	Phule Surabhi	-	2.70	(+) 2.70
5	IGFRI Jhansi	Oat	JHO 851	-	12.94	(+) 12.94
6	IGFRI Jhansi		JHO 99-1	-	0.88	(+) 0.88

Non- lifted seeds of previous year

SN	Producing centre	Crop	Variety	Non-lifted seed
1	**PAU, Ludhiana**	Berseem	BL-10	10.05
2		Berseem	BL-42	3.92
3		Oat	Kent	31.80
4	**MPKV, Rahuri**	Oat	Kent	4.85
5		Oat	Phule Surabhi	1.00

Table 4: analysis of breeder seed indent and production over last 4 years

	Breeder seed indent (q)			Breeder seed Production (q)		
Indent Year	**Indent Breeder seed (q)**	**% increase over previous year**	**% increase over 2015-16**	**Production**	**% increase over previous year**	**% increase over 2015-16**
2018-19	704.66q	43.47%	114.65%	613.84 q	34.33%	137.24%
2017-18	491.15q	20.05%		456.98q	11.33%	
2016-17	409.13q	24.63%		410.49q	58.65%	
2015-16	328.28q			258.74q		

FORAGE TECHNOLOGY DEMONSTRATIONS

To popularize the forage production technologies and make the farmers aware about various new fodder crop varieties, A total of 448 FTD's were allotted to 21 AICRP centres for Rabi crops. It included 80 FTDs to berseem, 40 to lucerne, 155 to oat (Single cut), 100 to oat (Multicut), 15 to cowpea, 58 to other crops viz., laythrus, rye grass etc. The centers are using the resources of their respective institutions for carrying out the activities. FTDs are being conducted in the new villages every year so that the technologies can be spread in large areas

Crop-wise FTDs to be conducted during Rabi 2017-18

SN	Centre name	Berseem	Lucerne	Oat (SC)	Oat (MC)	Cowpea	Other crops	Total
1.	AAU, Jorhat				20			20
2.	OUAT, Bhubaneswar			20				20
3.	BCKV, Kalyani	5		10			Lathyrus-10	25
4.	BAU, Ranchi	30			20			50
5.	NDUA&T, Faizabad			10				10
6.	JNKVV, Jabalpur	15		5				20
7.	AAU, Anand		10	5				15
8.	BAIF Urulikanchan	5		15				20
9.	MPKV, Rahuri			15				15
10.	SKRAU, Bikaner		10	15				25
11.	PAU, Ludhiana				20		Rye grass-20	40
12.	CCS HAU, Hisar	10		15				25
13.	GBPUA&T, Pantnagar	15			10			25
14.	TNAU, Coimbatore		5			5	Guinea -5	15
15.	PJTSAU, Hyderabad		10	10				20
16.	UAS, ZRS Mandya		5	5		10		20
17.	CSK HPKVV, Palampur				10	Tall fescue-5, White clover -3		18
18.	KAU, Vellayani						BNH-15	15
19.	IGKV, Raipur				10			10
20.	CAU, Imphal			10	10			20
21.	SKUAST-K, Srinagar			20				20
Total		80	40	155	100	15		448

Tribal Sub-plan (TSP) activities (2017-18)

BCKV, Kalyani: 84 tribal farmers of Taaldangra block under Bankura and Bagmundi block of Purulia district of West Bengal were benefitted. Agricultural, livestock and fodder & forage cum food related interventions were demonstrated for socio-economic condition uplift of tribal farmers/families. Maize (cv. J1006), *Moringa* seeds, Sorghum sudan, Rice bean (cv. Bidhan Ricebean-1 and Bidhan rice bean-2), Hybrid maize (cv. Disha), Coix (cv. Bidhan Coix-1), Lathyrus (cv. Prateek & Ratan), Toria (cv. B-54), Oats (cv. Kent), Berseem (cv. Wardan) seeds, planting materials (cuttings) of Bajra-Napier Hybrid along with r*hizobium* culture, insecticides and fungicides were distributed among selected tribal farmers. Tribal farmers' meet cum demonstrations on improved cultivation practices of forage crops was conducted.

BAIF, Urulikanchan: Activities were implemented in two villages namely Umarani & Shelkuvi in Nandurbar district of Maharashtra. It was need based and participatory programme. This is a hilly terrain area and farmers cultivate maize, sorghum, minor millets and pulses as rainfed crop during rainy season while very small area is under crop cultivation in winter season due to non availability of irrigation facility. Two meetings were conducted and during the discussion, farmers demanded some support for lift irrigation, to lift the water from the water source and use it for cultivation of crops during the winter season. Considering the need, following activities were implemented. Identified two farmers user group with twenty farmers, one from each village to undertake the activity. Survey of the area was done for water resource, installation of water lifting scheme, cultivation of crop to be taken under irrigation. Procurement of diesel pumps, PVC pipes and sprinkler set and handover to farmers user group, Technical support to the farmers through field visits.

CSKHPKV Palampur: Interactions were made with the families adopted under TSP activities in Baijnath block. The intervention *viz*. improved grass species, feeding of mineral mixtures and UMM bricks in the areas resulted in an increase of about 50q/ha in herbage yield over existing system vis-à-vis better animal health, their productivity and overall improvement in family income. One lakh root slips of Napier bajra hybrid and Setaria grass have been reserved for distribution to selected families.

SKUAST-K, Srinagar: TSP interventions were implemented at cold arid regions of Drass and Kargil of Ladakh region. The activities include (a) Introduction of African tall (fodder maize) in district Kargil as a source of fodder. Forty (40) tribal families of Lobar, Pandress and Mattayn villages were selected. The standoff crop was excellent and farmers were very much enthusiastic to extend fodder maize (African tall) cultivation. (b) Popularization of improved varieties of Oats as a summer crop in cold arid regions of Ladakh: The seed of improved varieties of Oats var. SKO-90 (Shalimar fodder oats-2) and SKO-96 (Shalimar fodder oats-3) were provided to the fifty (50) beneficiaries tribal farmers. Perennial fodder grasses were given to tribal families of district Bandipora of Kashmir region for demonstration in apple orchards as horti-pastoral system. (c) Fencing of oats demonstration plots in Mattayn Drass of Kargil district was executed for prevention from animal grazing. (d) Organization of Forage day: A Tribal Forage Day was organised at Mattayn village of Drass Kargil on 16-17 of October 2017, to aware tribal farmers of latest technological innovations. More than 40 tribal families participated and farm implements viz Tangroo, Spade, Serrated skills and Garden shivel, fodder maize (African tall) and Oats seed (SKO-90) etc were distributed among selected tribal farmilies.

AAU, Jorhat: TSP programme during 2017-18 was taken in two districts of Assam viz Karbi Anglong and Dhemaji district. One village i.e. Arlong pira from Doigrung block and three villages from Dhemaji viz. Bejguri (Jonai block) and Koloulua and Udoipur from Sisi borgaon block were selected. The activities covered were distribution of planting materials/seed of fodder crops along with other essential inputs. Dairy farming is more popular in Dhemaji than Karbianglong districts. Karbi Anglong falls under Hill zone and Dhemaji districts falls under North Bank Plain Zone. The later is dominated by Missing tribe and Karbi Anglong districts are dominated by Karbi hill tribe. Training programme for 126 farmers were organized. Farmers were trained for scientific fodder production, fodder storage and animal health

care. Farmers were also enlightened with the scope of integrated farming system and better resource management for improving their livelihood. Availability of green and nutritious fodder by growing both annual and perennial fodder makes them confident enough to feed animal at lower cost. Moreover establishment of fodder nurseries makes them aware of producing sufficient numbers of planting materials of perennial grasses like hybrid napier, setaria, congosignal, guinea and para for their own requirement as well as cater to the need of nearby farmers and relatives. Advisory service for growing other important crops like rice and vegetables in rice growing areas were given.

IGKV, RAIPUR: Different activities like demonstrations on fodder production, distribution of farm implements, distribution of crum chick feed and Kadak *Nath* Chick were undertaken. In Summer total 14 demonstration on fodder production technology on sudan sorghum of Lohari, Patharmohanda, Fulkarra, Aamdi *etc* village of Gariyband district. Small implements like hand hoe (30) and improved sickle (30) will be distributed to small and marginal farmers. To improve the livelihood of tribal farmers of village Patharmohanda of Gariyaband district, farmers were selected for the distribution of *Kadak Nath* chick.

CAU, Imphal: 90 nos. of families from 3 different villages of Churachandpur, senapati and kangpokpi District, Manipur were benefited from various activities including improved seed, training, forage days.

MPKV, Rahuri: 15 tribal farmers of village Dhanrat, Tal. Navapur, Dist- Nandurbar, Maharashtra State were benefitted. Oat truthful seed (Phule Surbhi), Cycle hoe (manually operated), University (*krishi darshny)* diary were provided.

BAU, Ranchi: 32 Demonstration of Hybrid Napier, Guinea, Maize & Cowpea in Itaki Block of Ranchi district was carried out with 75 Farmers. Kisan sangosthi was organized at village-Mallar, Block-Itaki, Dist.-Ranchi on 13th Oct. 2017 with 52 farmers. Farmer's Training Programme was organized at village-Mallar, Block-Itaki, Dist.-Ranchi from 18th 20th Jan. 2018 with 30 farmers. Farmer's training at Fodder farm BAU, Block-kanke, Dist.-Ranchi was organized on 26th March 2018 with 75 farmers.

JNKVV, Jabalpur: Quality seeds of Berseem, Oat, Maize, Hybrid Napier and Rice bean along with fertilizer, literature and package of practice have been distributed. 21 Farmers families are trained for cutting management and package of practices of berseem and Oat. 16 Farmers families are trained for cutting management and package of practices of Maize, rice bean and Hybrid Napier. The activities were carried out in Kanhiasang, Ghana ghah and Dhanuasagar (Distt. Dindori)

CSK HPKV, Palampur: 50 farmers' families of Nanahar Panchayat in Baijnath block were selected. Inputs like UMM bricks, mineral mixture, sickles and weedicide supplied to the selected farmers. Improved grass species and their production technologies were implemented on farmers' own lands as well as on one hectare Lantana and Eupatorium infested community land under TSP in Karnarthu village. Three lakh root slips of NBH and Setaria grass have been reserved for distribution to selected families. These interventions have resulted in increase in herbage yield to the tune of about 90q/ha.

GBPUAT, Pantnagar: Activities carried out include In US Nagar, the activities include 15T raining /capacity building/ Farmers' Meeting with 450 beneficiaries in Salmata (Tharu-ST); 412 Front line demonstrations in Matiha (Tharu-ST); 25 Awareness camp/ exhibitions/ exposure visits/Group Discussion in Kanpura (Tharu-ST) with 300 beneficiaries ; 13 Forage based lectures in Kaithulia (Tharu-ST) with 270 beneficiaries, 11 Radio Talks for Khatola (Buxa-ST); 42 FTDs in Madpuri (Buxa-ST) making a total of 1420 beneficiaries.

PJTSAU, Hyderabad: Establishment of perennial fodders like APBN1 and Hedge Lucerne in 15 tribal famillies in Palem Thanda Tribal village in Chintapally mandal of Nalgonda district of Telangana. Distributed perennial fodder, Bajra Napier hybrid cuttings and Hedge Lucerne seeds and fertilizer (Urea). Monitoring of fodder crops that are established and technology transfer through trainings

Monitoring Details of Rabi 2017-18 of AICRP (FC&U) Trials

Name of Centre	Monitoring Team	Date of Monitoring
AAU, Jorhat	Drs. AH Sonone and AB Tambe	6-7th Feb., 2018
CAU, Imphal	Drs. AH Sonone and AB Tambe	9-10th Feb., 2018
OUAT, Bhubaneswar	Drs. US Tiwana and Yogesh Jindal	27th Feb., 2018
BCKV, Kalyani	Drs. Birendra Kumar and Yogendra Prasad	15-16th Feb., 2018
BAU, Ranchi	Drs. U. S. Tiwana and Yogesh Jindal	28th Feb., 2018
NDUAT, Faizabad	Drs. S.S. Shekhawat and RC Bairwa	27-28th Feb., 2018
JNKVV, Jabalpur	Drs. T. Shashikala and G Shanti	31st Jan., 2018
AAU, Anand	Drs. M.S. Pal and Birendra Prasad	1th March, 2018
BAIF, Urulikanchan	Drs. B.G. Shekhara and P Mahadevu	2nd March, 2018
MPKV, Rahuri	Drs. BG Shekhara and P Mahadevu	28th Feb., 2018
RAU, Bikaner	Drs. P.S. Takawale and R.V. Kale	25th Feb, 2018
PAU, Ludhiana	Drs. A.K. Mehta and S.K. Jha	21th Feb., 2018
CCS HAU, Hisar	Drs. A.K. Mehta and S.K. Jha	23rd Feb., 2018
GBPUA&T, Pantnagar	Drs. P.S. Takawale and R.V. Kale	27-28th Feb., 2018
TNAU, Coimbatore	Drs. Mareen Abraham and Usha Thomas	2-3rd Feb., 2018
ANGRAU, Hyderabad	Drs. Rahul Kapoor and Kalyan Jana	5th Feb., 2018
UAS, B (ZRS, Mandya)	Drs. Rahul Kapoor and Kalyan Jana	6th Feb., 2018
CSK HPKV, Palampur	Drs. Mehfooza Habib and Ansar Ul Haq	24-25th April, 2018
KAU, Vellayani	Drs. Naveen Kumar and V.K. Sood	22-23rd Feb., 2018
IGKV, Raipur	Drs. T. Shashikala and G. Shanti	29-30th Jan., 2018
SKUAS & T, Srinagar	Drs. Rajan Katoch and D.K. Banyal	4-5th May, 2018

APPENDIX -I

Forage In-house Breeding Activities Rabi 2017-18

AICRP (FC&U), PAU, Ludhiana

Varieties developed in last 3 years: Ten

Year	Crop	Varieties developed	Features
2014-15	Oats	OL 10	It is a multicut (2 cuts) oats variety recommended for irrigated areas of Punjab. Its plants are tall with profuse tillering and leafy growth. The leaves are longer and broader. Its fodder quality is superior to checks OL 9 and Kent. On an average, it yields about 680 quintals of green fodder per ha and has high seed yield.
2015-16	Oats	OL 1804	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 GFY is 400q/ha.
		OL 1802	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 560q/ha.
	Bajra Napier Hybrid	PBN 346	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 1750 quintal of green fodder per ha.
2016-17	Oats	OL 11	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 600 quintals of green fodder and 21 quintals of seed per ha.
		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 360 quintals of green fodder per ha. Its fodder quality is better than the checks OS 6 and Kent.
		OL 1769-1	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 500 quintals of green fodder per ha.
		OL 1802-1	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 540 q/ha.
	Bajra Napier Hybrid	PBN 342	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 1100q/ha
	Berseem	BL 43	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 1000 quintals per acre up to first week of June and gave good seed yield.

PGR status (evaluated/maintained):

- Germplasm maintained/ handled (600) including Oats (500) and Berseem (100)

Entries contributed in AICRP (FCU) breeding Trials during *Rabi* 2017-18 (14)

Crop	Proposed in Trial	Name of entry
Oat	IVTO-Dual	OL 1906, OL 1876-2
	IVTO-SC	OL 1893, OL 1896
	IVTO-MC	OL 1908, OL 1874
	AVTO -SC-1	OL 1861, OL 1862, OL 1869-1
	AVTO-1 Dual	OL 1769, OL 1871
Berseem	AVTB-2	PC 82
	IVTB	PC 91
Lolium	VT Lolium	PBRG-2

OATS

Conduct of station and Multi location Trials: A total of seven evaluation trials (5 station and 2 multi location) were conducted. The promising entries identified on yield basis are given below:

SN	Description of the Trial	Promising entries
1.	Multilocation Fodder Trial in oats-multi cut	OL 1876, OL 1869, OL 1873, OL 1842, OL 1866
2.	Multilocation Fodder Trial in oats—Single cut	OL 1766-1, OL 1769-1 OL 1802, OL 1861, OL 1862, OL 1869-1
3.	Station trial Oats- Dual purpose	OL 1804-1, OL 1871, OL 1802, OL 1760-1
4.	Station trial Oats-multicut	OL 1874, OL 1882, OL 1897
5.	Station trial Oats -Single cut	OL 1893, OL 1898, OL 1896

Germplasm Collection, Maintenance and Evaluation: A total of 500 germplasm lines were maintained following standard breeding procedures.

Hybridization: A total of One hundred fifty crosses have been attempted involving promising genotypes and exotic germplasm accessions.

Breeding material handled

Generation	Number of progenies handled	Generation	Number of progenies handled
F_1	140	**F_2**	80
F_3	550	**F_4**	950
F_5	60	**F_6**	154
Total	**1934**		

Berseem

- A total of two evaluation trials (1 station and 1 multilocation) were conducted and three promising entries PC 75, PC 82, BL 205 were identified on yield basis:
- A total of 75 polycross progenies were maintained and evaluated.
- Single plant selections made from M_3 population of gamma rays irradiated BL 42.

Seed Production (Q)

Crop	Variety	Nucleus seed	Breeder Seed	Foundation seed
Oats	Kent	1.20	90.0	
	OL 9	0.40		
	OL 10	1.25	15.0	
	OL 1760	1.50		
Berseem	BL 10	0.50	10.0	
	BL 42	0.50	8.00	2.0
	BL 1	0.10	1.50	
	BL 22	0.10		
	BL 180	0.40	1.0	
Ryegrass	PBRG1	0.50	0.30	
Metha	ML 150		0.50	

Besides the recommended varieties, seed of advanced lines and selected elite material was also produced in oats, berseem and lucerne.

AICRP (FC&U), UAS (B), ZARS, Mandya

I. Crossing Programme in Cowpea: (DOS: 27-12-2017) **F_2 generations harvested**

1.	MFC-09-1 x BL-1	19	C-152 x KBC-2	36	KBC-4 x KBC-9
2.	MFC-09-1 x BL-1	20	C-152 x KBC-2	37	KBC-7 x KBC-9
3.	V-578 x BL-1	21	KBC-9 x KBC-2	38	KBC-4 x KBC-9
4.	EC-170578-1-1 x BL-1	22	Goa Local x KBC-2	39	Goa Local x EC-170578-1-1
5	Goa Local x BL-1	23	Goa Local x KBC-2	40	Goa Local x EC-170578-1-1
6	C-152 x BL-1	24	KBC-7 x MFC-09-13	41	BL-1 x EC-170578-1-1
7	KBC-4 x BL-1	25	KBC-7 x MFC-09-13	42	V-16 x C-152
8	KBC-4 x BL-1	26	KBC-9 x MFC-09-13	43	IC-402154 x C-152
9	EC-170578-1 x BL-1	27	EC-170578-1-1 x V-16	44	C-152 x IC-402154
10	KBC-7 x BL-1	28	C-152 x V-16	45	V-16 x IC-402154
11	C-152 x BL-1	29	BL-1x V-16	46	C-152 x MFC-09-3
12	C-152 x BL-1	30	Goa Local x V-16	47	V-16 x MFC-09-3
13	C-152 x BL-1	31	IC-402154 x V-16	48	KBC-4 x KBC-7
14	IC-402154 x BL-1	32	IC-1071 x V-16	49	KM-5 x NBC-41
15	V-16 x BL-1	33	KBC-7 x V-16	50	KBC-9 x NBC-41
16	KBC-9 x BL-1	34	V-578 x V-16	51	V-16 x MFC-16-4
17	IC-402154 x KBC-2	35	EC-170578-1-1 x KBC-9	52	KBC-7 x MFC-09-23
18	BL-1 x KBC-2				

Parents							
1.	BL-1	4.	IC-1071	7	IC-4021-54	10	KBC-4
2.	EC-170578-1-1	5	KBC-8	8	NBC-41	11	KM-5
3.	V-578	6	KBC-9	9	C-152	12	V-16

II. Crossing Programme in Maize

SN	**New crosses made**	**SN**	**New crosses made**
1.	African Tall x CML-1443	**2.**	J-1006 **x** CML-1443
SN	**Advancing generations**	**SN**	**Advancing generations**
1.	African Tall x J-1006	**2.**	J-1006 **x** African Tall

New Inbreds Identified for different Fodder traits and disease resistance

- **White seeded inbreds-** MAI-2**,** MAI-291, MAI-316, MAI-179, MAI-194, HCLW-1, HCLW-2, HCLW-3, HCLW-4
- **Yellow seeded inbreds-** MAI-27, MAI-62
- **Pigmented –** CML 31188, MAI 298
- **Inbreds with more leaves & short inter node -** CML-40375, CML-40013, MAI-769, MAI-767, MAI-187, CML-451, CML-1441,
- **Resistant donors -** SKV-50, MAI-715, NAI-137, MAI-105

Advancing of forage maize population of five crosses

Crosses	**No. of Population**	**Crosses**	**No. of Population**
African tall X Sujay 2671	36	African tall X Sujay 2671	7
African tall X NAC-6004	2	African tall X Sujay 121	4
African tall X Sujay 121	6		

Evaluation of advanced generation of five crosses of Forage Maize). Screening of progenies of five crossed for *Tursicum* leaf blight and *Maydis* leaf blight led to identification of nine promising populations: 1-17-19, 1-23-4, 1-42-4, 1-44-9, 1-82-3, 2-10-2, 2-1-3-1, 5-2-3-2 & 1-6-2

AICRP (FC&U), TNAU, Coimbatore

Variety released

- **Lucerne TNLC 14 as CO 3:** Poly cross derivative involving CO 1 Released by CVRC in 2017 for Tamil Nadu, Karnataka and Telangana states. Higher green fodder yield (125 t/ha/yr) and dry matter content (19.05 %)

Interspecific hybridization in Lucerne

- Lucerne crop improvement programme through polycross is under progress.
- Interspecific hybridization involving various other species of *Medicago viz*., *M. falcata, M. truncatula etc*., is planned.
- Attempt made to collect various species of Lucerne from Leh & Ladak regions of Jammu & Kashmir which is found to be more diverse region for Lucerne crop.

Characterization of tree fodders for yield and its component traits

- Tree fodder bank comprising of 21 different species has been established at FC&RI, Mettupalayam. Plant samples collected from tree fodder bank were analyzed for quality parameters at Dept. of Forage Crops, Coimbatore during 2016-17 and fodder yield of these trees were recorded at FC&RI, Mettupalayam during 2017-18. Among them, *Dalbergia sissoo* (North Indian Rosewood/Sisoo) has recorded the highest GFY of 690.40 t/ha/yr followed by *Leucaena leucocephala* (617.30 t/ha/yr). *Pterocarpus santalinus* (*Red sandal*) recorded highest dry matter content (57.43 %) followed by *Pithecellobium dulce* with 50.61 %. In case of crude protein content, *Leucaena leucocephala* (Subabul) recorded highest crude protein content of 21.70 % followed by *Sesbania grandiflora* (Agathi) with 21.35 %.

S. No.	Name of the tree	Fodder yield (t/ha/yr)	DM (%)	Protein (%)	Fibre (%)	Fat (%)
1.	*Dalbergia sissoo* (Rosewood/Sisoo*)*	690.40	42.93	16.52	18.50	4.39
2.	*Leucaena leucocephala* (Subabul)	617.30	43.00	21.70	16.50	3.02
3.	*Leucaena diversifolia* (Subabul)	580.10	37.28	20.34	16.00	2.35
4.	*Gliricidia sepium* (*Gliricidia*)	532.50	23.80	16.14	12.50	1.34
5.	*Moringa oleifera* (Drumstick)	491.50	32.57	20.62	12.50	2.68
6.	*Sesbania grandiflora* (Agathi)	367.80	21.07	21.35	16.50	1.67
7.	*Neolamarckia cadamba* (Vellai Kadambam)	279.60	26.27	16.35	11.00	2.60
8.	*Holoptelea integrifolia* (Aaya maram)	259.70	44.72	11.90	15.00	3.03
9.	*Pithecellobium dulce* (Kodukkaipuli)	230.10	50.61	20.16	20.00	3.36
10.	*Albizia lebbeck* (*Vaagai*)	193.10	45.30	17.08	24.50	3.03
11.	*Melia dubia* (Malai vembu)	146.60	32.06	19.43	16.00	2.69
12.	*Thespesia populnea* (Puvarasu)	123.90	34.45	13.06	10.50	2.68
13.	*Morus indica* (Mulberry)	26.30	45.38	12.04	16.50	2.01
14.	*Bauhinia variegata* (*Sem*-Mantharai)	178.60	46.29	12.71	32.00	2.34
15.	*Hibiscus tiliaceus* (Malai Puvarasu)	40.60	40.00	12.60	21.00	2.70
16.	*Ficus benghalensis* (Banyan tree)	86.00	44.60	9.07	25.00	2.68
17.	*Terminalia arjuna* (*Maruthu*)	18.30	48.89	8.95	14.00	4.05
18.	*Melia composita* (Malai vembu)	30.00	43.90	15.02	14.50	3.02
19.	*Pterocarpus santalinus* (*Red sandal*)	8.30	57.43	11.66	26.50	2.00
20.	*Ficus religiosa* (*Peepal tree / Arasu*)	-	40.28	10.82	22.50	4.70
21.	*Ceiba pentandra* (Kapok)	-	35.85	9.66	22.50	3.71

Based on fodder yield and quality, five promising tree fodders *viz., Dalbergia sissoo, Gliricidia sepium, Moringa oleifera, Sesbania grandiflora* and *Neolamarckia cadamba* were identified and raised in nursery at FC&RI, Mettupalayam for further evaluation.

AICRP (FC&U), NDUAT, Faizabad

Variety Developed

- **NDO-1101(Narendra Jayee-1101):** One new dual purpose oat variety NDO-1101(Narendra Jayee- 1101) was released by S.V.R.C., Lucknow in 2018 and recommended for cultivation under normal and salt affected soils of whole U.P.

Germplasm collection, evaluation & maintenance

SN	Crop	New collections	Sources of collection	Total collections
1.	oat	06	Barabanki , Ghazipur, Raebareli & Sultanpur	170
2.	Berseem	05	Barabanki , Ghazipur, Raebareli & Sultanpur	24

Breeding Programme in oat: Twelve new crosses were made during Rabi 2017-18

S.N.	Cross combinations	S.N.	Cross combinations
1	NDO1501 x *Avena sterilis*	7	NDO 1202x *Avena sterilis*
2	NDO1501 x LC-6	8	NDO 1202 x LC-6
3	NDO1501 x LC-7	9	NDO 1202 x LC-7
4	NDO10 x *Avena sterilis*	10	NDO724 x *Avena sterilis*
5	NDO10 x LC-6	11	NDO 724 x LC-6
6	NDO10 x LC-7	12	NDO 724 x LC-7

Segregating generations: Advance lines - 11

Generation	Lines	Generation	Lines	Generation	Lines
F_1	**11**	**F_2**	**15**	**F_3**	**14**
F_4	**10**	**F_5**	**8**	**F_6**	**05**

One station trial viz., VT Station on Forage oat was conducted. Fourteen genotypes were tested against two checks viz., NDO-1 and NDO-2.

AICRP (FC&U), JNKVV, Jabalpur

Germplasm holding: Oat (127) + Berseem (109)

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_2 generation3
- In Wardan, five superior bulks were selected from mutated population.

Oat

- Under National crossing programme crosses have been attempted with Kent and JO1 with *Avena sterilis*. Seeds were grown as fourth filial generation.
- 42 advanced lines were evaluated for different fodder traits.
- No. of crosses made - 13
- Segregating material advanced/ handled - 27 (F_2 onwards)
- Advance breeding lines - 51

AICRP (FC&U), AAU, Anand

Varieties released/endorsed at State / National Level (in last 3 years): Two

Sr. No.	Crop	Variety	Year of release
1.	Forage Sorghum	GAFS-12	2016 (Middle Gujarat)
2.	Guinea Grass	CO(GG)-3	2016 (Whole Gujarat)

Forage Sorghum : Gujarat Anand Forage Sorghum-12 (GAFS-12): recommended by 12th Combined Joint Agresco Meeting of SAUs held on 11th to 13th April, 2016 at NAU, Navsari and accepted for release. The variety has single cut nature, tall, thin stem and non lodging, Very quick and fast regeneration capacity after each harvest/cut. Plant height 205.8 cm; 2.76 Tillers/plant; Leaf steam ratio1.33; Stem thickness 0.60 cm; Av. CP 8.83%; Av. NDF 83.0%; Av. IVDMD 35.34%; GFY 300; DMY101 q/ha

Guinea Grass : CO (GG) – 3: recommended by 12th Combined Joint Agresco Meeting of SAUs held on 11th to 13th April, 2016 at NAU, Navsari and accepted for release. The variety is tall type, high tillering with very quick and fast regeneration capacity after each harvest /cut. Av. Plant height 170.6 cm; Av. No. of Tillers/plant 48.82; Stem thickness 0.25 cm; Av. CP 8.71%; Av. NDF 72.0%; Av. Oxalate1.46% ; Av. IVDMD5 6.43 %. GFY 2517 q/ha/year; DMY 553.7 q/ha/year

Contribution of entries for AICRP / State Trials

Sr. No.	Crop	Entry	Name of trial
1.	Forage Maize	AFM-6	AVTM-2 (Seed) & AVTM-1 &2
2.	Forage Pearl millet	AFB-38	IVTPM

Maintenance of germplasm

Sr. No.	Crop	No. of Lines
1.	Sorghum	609
2.	Maize	198
3.	Pearl millet	115
4.	Cowpea	42
5.	Sorghum Sterile line & its maintainer	8
6.	Pearl millet Sterile line & its maintainer	4
7.	Clitoria	24
8.	Opuntia	2

New germplasm collection

Sr. No.	Name of the Crop	Total numbers of lines	Source
1.	Forage Sorghum	13	NDDB & North Gujarat
2.	Forage Pearl millet	15	ICRISAT & North Gujarat
3.	Barley	15	ICRISAT

Forage Pearl millet

- New crosses – 12 made with objectives of Higher GFY, Higher tillering, Multicut type

SN	Cross combination			SN	Cross combination		
1.	BAIF-1	x	ICMV-1601	**7.**	BAIF-1	x	ICMV-1607
2.	BAIF-1	x	ICMV-1602	**8.**	BAIF-1	x	ICMV-1608
3.	BAIF-1	x	ICMV-1603	**9.**	BAIF-1	x	ICMV-1609
4.	BAIF-1	x	ICMV-1604	**10.**	BAIF-1	x	ICMV-1610
5.	BAIF-1	x	ICMV-1605	**11.**	BAIF-1	x	ICMV-1611
6.	BAIF-1	x	ICMV-1606	**12.**	BAIF-1	x	ICMV-1612

Population improvement: Two populations each consisting of five genotypes were maintained

SN	Population-1	SN	Population-2
1.	AFB-3	**1.**	RBC-2
2.	Giant Bajra	**2.**	AFB-32
3.	BAIF Bajra	**3.**	AFB-37
4.	GFB-1	**4.**	AFB-38
5.	Bajra Bawal	**5.**	AFB-3

Segregating materials

Generation	Sown	Selected IPS	Generation	Sown	Selected IPS
F_1	20	19 (Selfed)	**F_4**	21	11
F_2	8	17	**F_5**	15	9 + 3 Bulk
F_3	13	18	**F_6**	8	5 Bulk

Forage Maize: 12 new crosses made with a view to develop tillering type maize

SN	Name of cross			SN	Name of cross		
1.	IC-131131	x	*Teosinte*	**7.**	Narendra Moti	x	*Teosinte*
2.	Mexico-3928	x	*Teosinte*	**8.**	Pratap makka chari	x	*Teosinte*
3.	Mexico-3929	x	*Teosinte*	**9.**	GWC-0801	x	*Teosinte*
4.	Mexico-6341	x	*Teosinte*	**10.**	GDRFG-1635	x	*Teosinte*
5.	Hyd-997-1514	x	*Teosinte*	**11.**	*Teosinte*	x	African Tall
6.	Hyd-997-1515	x	*Teosinte*	**12.**	African Tall	x	*Teosinte*

Population improvement: Four populations each consisting of five genotypes were raised and maintained:

Population-1	Population-2	Population-3	Population-4
AFM-1	AFM-5	Pratap Makka Chari	GWC-0803
AFM-2	AFM-6	GWQPM-68-3	GWC-0609
AFM-3	AFM-7	GWC-0320	Narmada Moti
AFM-4	AFM-8	GWC-0801	GWC-0400
African Tall	African Tall	African Tall	African Tall

Maintained eight populations viz. AFM-1, 2, 3, 4, 5, 6, 7 & 8.

Segregating materials

Generation	Sown	Selected IPS	Generation	Sown	Selected IPS
F_1	21	21 (Selfed)	**F_5**	9	19
F_2	29	40	**F_7**	45 + 8 (Bulk)	19 Bulk
F_3	15	25			

Forage Cowpea: New crosses : 12 Nos.

1.	UPC-618	x	UPC-5286	**7.**	EC-244415	x	EC-244423
2.	UPC-9202	x	BL-2	**8.**	EC-244425	x	EC-244430
3.	BL-2	x	EC-244415	**9.**	IC-244438	x	EC-244430
4.	EC-4216	x	Kohinur	**10.**	PLL-133	x	PLL-362
5.	EC-241021	x	EC-240938	**11.**	PLL-362	x	PLL-133
6.	EC-244231	x	EC-244415	**12.**	UPC-9202	x	EC-4216

Forage Sorghum: New crosses: 9

1.	GAFS-12	x	Gundari	**6.**	AFS-52	x	C-10-2
2.	AFS-64	x	Gundari	**7.**	AFS-53	x	C-10-2
3.	AFS-67	x	Gundari	**8.**	AFS-64	x	C-10-2
4.	AFS-52	x	Gundari	**9.**	AFS-65	x	C-10-2
5.	AFS-53	x	Gundari				

Segregating materials

Generation	Sown	Selected IPS	Generation	Sown	Selected IPS
F_1	4	3 (Selfed)	F_4	16	19
BC_2	50	45	F_5	12	15
F_2	5	7	F_6	17	14 Bulk
F_3	24	56			

Truthful seed production/ status

SN	Crop/ Variety	Quantity (kg)
1.	Oats *var.* Kent	1550
2.	Oats *var.* JO-03-91	150
3.	Lucerne *var.* Anand-2	1055
4.	Fodder *bajra var.* GFB-1	390
5.	Forage Sorghum *var.* S-1049	450
6.	Sorghum *var.* GAFS-11	20
7.	Sorghum *var.* GAFS-12	25
8.	Sorghum *var.* CoFS-29	109
9.	Green gram *var.* GAM-5	280
10.	Hybrid Napier Nos.APBN-1 & Co-3 (Rooted slips No.)	3,42,210

AICRP (FC&U), BAU, Ranchi

- **Station Trial of Oat (Dual)**: Out of eleven entries tested along with national checks UPO-212 and Kent, the varietal differences were found significant. Maximum GFY was reported by entry OL-1769 (339.7 q/ha) followed by HFO-619 (337.8 q/ha).
- **Station Trial of Lathyrus**: Out of nine entries tested along with national checks Nirmal and Mohateora, the varietal differences were found significant. The entry BL-3 reported maximum GFY (150.1 q/ha) & DMY (33 q/ha).
- **Maintenance of oat germplasm line**: 23 germplasm lines were sown on 24th Nov. 2017 for maintenance.
- **New Crosses made**
  i. HFO-619 x UPO-212
  ii. RSO-60 x UPO-212
  iii. SKO-170 x OL-1871
  iv. JHO 13-14 x UPO-212
- **Segregating generation**
  F_3: The following four F_2 population were planted and 40-50 single plant selected from each population were made:
  i. JHO-10 x JHO-2000-4
  ii. UPO-12-1 x UPO-10-3
  iii. RSO-59 x OS-6
  iv. OS-377 x JHO-10
- F_5 : The following three F_5 population were planted and 80-90 single plant selected from each population were made:
  i. Kent x JHO-13-14
  ii. JHO 13-14 x UPO-212
  iii. JHO 99-2 x OS-403
- **Lathyrus**:
  - Three germplasm were collected from Ranchi (Block-Bundu & Pitoriya) and Chaibasa (Block- Tungari) district.
  - One Pink flower plant selected from entries-JLJ-09-2.

AICRP (FC&U), CCS HAU, Hisar

Varieties released and notified

- **Berseem Variety HB 2** released and notified for Haryana state vide **SO 1146 (E) dated 24.4.2014**. It is a longer duration variety with light green foliage, big head size, higher leaf: stem ratio, better regeneration, variety is resistant to stem rot disease which is the major problem in Haryana. GFY – 750-800q/ha.

- **Oats variety OS 377** released and notified for Uttar Pradesh, Maharashtra, Gujarat, Chhattisgarh and Madhya Pradesh vide **SO 268 (E)** dated **28.1.2015**. It is suitable for timely sown, irrigated and single cut system. This variety is capable of providing 537q/ha of green fodder. It is moderately resistant to Leaf Blight disease. It is also bold seeded and is capable of giving 25q/ha of seed.

- **CENTRAL OAT OS 403** was notified for cultivation in Assam, Manipur, Odhisha, West Bengal, Eastern UP, Bihar, Jharkhand, Telengana, Andhra Pradesh, Karnataka and Tamil Nadu vide **S.O. 1379 (E)** dated **27.3.2018**. GFY 530 q/ha, DMY 108 q/ha, Seed yield 18-20q/ha with good nutritional qualities, moderately resistance to leaf blight, bold seeded.

Varieties Identified

- **CENTRAL OAT OS 405:** Forage oat variety identified for timely sown, irrigated and single cut system for Uttar Pradesh, Maharashtra, Gujarat, Chhattisgarh, Madhya Pradesh, Central U.P. in 2016. Average GFY 513.0 q/ha, DMY 115 q/ha, seed yield 16.7q/ha. It has better nutritional qualities, moderately resistant to *Helminthosporium* leaf blight and bold seeded.

- **CENTRAL OAT OS 424:** suitable for timely sown, irrigated under single cut system, Identified for Himachal Pradesh, J&K and Uttrakhand. Average GFY 296 q/ha, DMY 65.1 q/ha, seed yield 13.5q/ha. It has better nutritional qualities 9.0% crude protein.

Research projects applied: Two submitted

Title of the project	Investigators	Budget	Funding Agency
Establishment of Eco-Friendly Hydroponic Unit for Round the Year Green Fodder Production for Peri Urban/ Dairy Farmers of Haryana	Yogesh Jindal (PI), Pummy Kumari, Uma Devi, Satyawan Arya, Jayanti Tokas, Sajjan Sihag	1.12 Crores	RKVY
Development of oat (*Avena sp.*) genotypes with higher yield and nutritive value	Yogesh Jindal (PI), Jayanti Tokas	10.00 Lakhs	CCS HAU, Hisar

Research Activity

- A total of 19 experiments consisting of 31 trials on 9 crops were conducted
- Conducted 11 experiments during *Kharif* 2017 consisting of 15 trials on 7 crops *viz*. Cowpea, Pearl millet, Teosinte, Maize, Bajra Napier Hybrid, *Cenchrus ciliaris* and *Pennisetum*.
- Conducted 8 experiments during *Rabi* 2017-18 consisting of 16 trials on Berseem and Oats.

BERSEEM

Collection, maintenance and evaluation of germplasm: Half of the total germplasm (225 indigenous lines and 27 exotic) was grown this year for maintenance purpose.

Evaluation of varietal trials for fodder yield and its components: Three station trials *viz*., LST, SST and PRT on berseem were conducted with four checks *viz*., Wardan, Mescavi, HB 1 and HB 2

- **Large Scale Trial (LST):** 8 genotypes evaluated
- **Small Scale Trial (SST):** 8 genotypes evaluated.
- **Progeny Row Trial (PRT):** 16 genotypes were tested.

Mutation breeding in berseem - creation of genetic variability for morphological characters in berseem using chemical mutagen i.e. EMS.

- **M1 generation:** three doses of EMS (0.05%, 0.1%, 0.3% and 0.5%) were given to dry seeds of HB 1, HB 2 and Mescavi. Treated and untreated seeds (100 in each treatment) were sown immediately in the field in three rows of five meter length each to raise the M_1 generation.
- **Selection of superior plant progenies in different generations:** 9 superior progenies were selected from M_2 generation of different treatments which will be grown in M_3 for evaluated for fodder yield in next year.

OATS

Collection, maintenance and evaluation of Oats germplasm: The oats germplasm contains 580 lines were grown for maintenance and evaluation of yield and some ancillary characters.

Development of breeding material through hybridization in oat: Fresh crosses were attempted between desirable and diverse parents. Breeding material in different filial generations were advanced and single plants selected. Results are being compiled.

Evaluation of varietal trials for fodder yield and its components: Following seven trials conducted

1.	LST (Single Cut)	: 9+3checks;	2.	LST (Multi Cut):	12+4checks;
3.	LST (Dual)	: 8+4checks;	4.	SST (Single Cut):	9+3checks;
5.	SST (Multi Cut)	: 12+4checks;	6.	PRT (Single Cut):	18+3checks;
7.	PRT (Multi Cut)	: 18+3checks;			

Evaluation of promising Oats genotypes for fodder yield (AICRP-FCU): A total of six trials on Oats were conducted during *Rabi* 2017-18

Genotypes contributed/promoted in AICRP (FC) trials during *rabi* 2017-18

Trial	Entry	Trial	Entry
Berseem IVTB	HFB 13-7, HFB 14-7	**Berseem** AVTB-1	HFB 13-10
Oats IVT (SC)	HFO 529, HFO 718	**Oats** AVT-1 (SC)	HFO 525, HFO 607
Oats AVT -2 (SC)	HFO 427	**Oats** AVT (SC-2-SEED)	HFO 427
Oats IVT (MC)	HFO 514, HFO 706	**Oats** IVT (DUAL)	HFO 611, HFO 608
Oats AVT-1 (DUAL)	HFO 619		

Nucleus and TFL Seed Production: Sufficient quantity of Mescavi, HB 1 and HB 2 seed was produced along with 60 Kgs. of nucleus seed of these three varieties.

AICRP (FC&U), SKRAU, Bikaner

Variety development: One lucerne variety RRB-07-1 (Krishna) developed from Bikaner centre has been released and notified for North West zone of the country in 2016.

Breeding work: Seeds obtained from plycrosses made during Rabi-2016-17 were evaluated during Rabi-2017-18. Superior plants were selected to make better composite population. New polycrosses were made among ten selected entries of lucerne. Seed harvested from such crosses will be evaluated in Rabi-2018-19 for further use. Selection of superior plants was also done from the seed material generated from crosses made in previous years**.**

Germplasm: 25

Seed multiplication: Seed of newly developed variety Krishna of lucerne from Bikaner centre was further multiplied to take its seed production on a large isolated area in future for distribution to farmers.

AICRP (FC&U), PJTSAU, Hyderabad

Germplasm Holding

SN	Crop	Collections (no.)	Source
1.	Fodder Cowpea *(Vigna unguiculata)*	52	1. NBPGR, Regional Station, Hyderabad 2. RARS, ANGRAU, Tirupathi 3. Local collections
2.	Fodder Maize *(Zea mays)*	45	1.Winter Nursery, DMR, Hyderabad 2.NBPGR , New Delhi
3.	Fodder Bajra *Pennisetum glaucum* *Pennisetum Orientale*	56 48 8	ICRISAT, Hyderabad.
4.	Napier Lines *(Pennisetum purpureum)*	15	TNAU, Coimbatore.
5	Lucerne *(Medicago sativa)*	10	Local collections from Gujarat and Maharashtra
6	Hedge lucerne	6	Local Collections
7	Perennial Sorghum	4	Local collection
8	Para grass	3	*Bracharia mutica, B. brizzantha, B. ruzzivensis*

- Eight local germplasm with red kernel in sorghum are multiplied during summer, 2018

Entries proposed for minikit testing in the state of Telangana :

- Fodder Maize entry TSFM 15-2
- Fodder Bajra entry TSFB 14-10

Fodder Maize

- Seed multiplication of a promising fodder maize culture **TSFM 15-2,** developed through mass selection in source population of IC 83220 was taken up during Rabi 2017-18.The entry is proposed for 1st year of minikit testing during Kharif 2018 in the state of Telangana. The culture has recorded 7.1% and 18.4% increase in green fodder yield and dry fodder yield respectively over check variety African tall in south zone at national level in Kharif 2016.

- Seed multiplication of Promising Maize population **TSFM -15-5** developed from G1 group (African tall) of polycross population was taken up during Rabi 2017-18. The entry was found to be promising with 11.2% and 10.4% increase in green fodder and dry fodder yield over African tall in coordinated IVTM trial and in CAVT 1&2 for dry matter yield the entry has recorded 8.1% over the best check J1006 in NE Zone , while 9.2 % at South Zone.

Forage cowpea

- Seed multiplication of promising entry TSFC 11-6 (CO4 X UPC 625) was taken up during Rabi 2017-18.The entry was found to be promising with 7.6% increasing green fodder yield over the best check variety BL-1in IVTC, Kharif 2016.
- Seed of the promising entry TSFC 12-15 was multiplied during Rabi 2017-18 to propose for minikit testing.
- 20 Cowpea germplasm lines were multiplied during summer, 2018

Fodder bajra

- Seed of the promising entry, TSFB14-10 was multiplied during Rabi 2017-18. The entry is proposed for 1st year of minikit testing during Kharif 2018 in the state of Telangana.

AICRP (FC&U), CSKHPKV, Palampur

Germplasm Holding

Crop	Number 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

Generation of breeding material

Oat

- One hundred and twenty one genotypes of oat were evaluated for forage yield and powdery mildew resistance in simple lattice design for three consecutive years. Genotypes KRR-AK-26, JPO-30, JPO-38IG-03-205, EC-528896 and EC-528889 were found resistant to powdery mildew as well as superior for forage yield and related traits. Resistance to powdery mildew resistance was governed by a single dominant gene in crosses HJ-8 x JPO-46 and HJ-8 x KRR-AK-26.
- Forty different crosses among diverse genotypes involving *Avena sativa* x *A. sativa* and *A. sativa* x *A. sterilis* were made to create genetic variability and the material is in segregating, backcross and advance generations. About 300 breeding lines have been selected. Promising entries developed through hybridization programme were evaluated in station trials. Seed of four promising entries have been multiplied..
- Wide crosses were also attempted of oat genotypes with maize and *Impereta cylindrica* for induction of haploid embryos. Effect of various growth hormones on the development of karyopsis was studied.
- Mapping populations involving HJ-8 (susceptible) and JPO-46 and KRR-AK-26 (resistant) parents have been developed to identify molecular markers linked to powdery mildew resistance. Resistant and susceptible parents were screened for polymorphic survey using 75 SSR markers. Among these, 26 markers were found to be polymorphic.Based on linkage analysis, only one markar i.e. AM-102 showed significant association with the resistance locus at 7.5 cM distance and can be utilised in oat powdery mildew resistance breeding.

Tall Fescue Grass

- Genotypes Hima-4, Sel.-8, Hima-1, Sel.-49, Sel.-85, Sel.-88, EC-178181, Hima-3 and Sel.-48 showing genetic diversity on the basis of D^2 statistic, RAPD and SSR were used as parents in polycross breeding programme for development of synthetics in Tall Fescue grass. Seed of polycross progenies was harvested for sowing in ensuing rabi season.

Lolium x Festuca hybridisation

- Perennial rye grass (*Lolium perenne*) parents were crossed with Tall fescue grass (*Festuca arundinacea*) parents to develop different eleven F_1 hybrids. Hybrids were backcrossed to both the parents so as to introgress drought tolerance from *Festuca* to *Lolium* and quality traits from *Lolium* to *Festuca.* Hybridity was confirmed using SSR markers.

White clover

- Seed of four populations namely, PWC-3, PWC-22, PWC- 25 and PWC-26 was multiplied. Two entries have been contributed in coordinated trials.

Red clover

- Restricted Recurrent Phenotypic Selection has been taken up for developing superior populations.

AICRP (FC&U), BCKV, Kalyani

Germplasm maintained

crop	Total number of lines
Rice bean	250
Lathyrus	5

- Five (5) germplasm lines of lathyrus were evaluated against two checks *viz*., Nirmal and Ratan (BIO L 212) as Large Scale Trial (LST) on production of green forage cum seed production as dual purpose.

Breeder seed production

- Rice bean (Bidhan Rice bean 1) - 65 kg
- Rice bean (Bidhan Rice bean 2) - 125 kg

Nucleus Seed production

- Ricebean (Bidhan Ricebean-1) – 7.6 kg
- Ricebean (Bidhan Ricebean-2) - 8.4 kg

TFL seed production

- Oat (cv. Kent) – 30 kg
- Lathyrus (cv. Ratan: BIO L 212) – 45 kg
- Lathyrus (cv. Prateek) – 60 kg
- Berseem (cv. BL 42) – Very good vegetative growth as green forage

Management of BN hybrid during *rabi*, 2017-18

- BN hybrid (CO-3) : 7550 cuttings (Approx.)
- BN hybrid (CO-4) : 8530 cuttings (Approx.)

Study on gamma ray induced mutagenesis in Bidhan Rice Bean 1: 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. The selected plants from the M1 generation will be evaluated in the M2 and M3 generations for confirmed selection of desired mutants.

Development of production technology

- Effect of seed priming methods on grasspea
- Effect of cutting and foliar application of KNO_3 on grasspea

AICRP (FC&U), GBPUA&T, Pantnagar

Germplasm maintenance: A total of 300 oat germplasm lines comprising indigenous, exotic and improved genetic stocks have been planted and maintained during the season.

Hybridization nursery: Based on germplasm evaluation and field screening for disease(s) and pest reaction / tolerance, some important genetic donors with desirable traits / trait combinations on the basis of growth habit, leafiness, tillering, days to heading, growth rate, maturity and seed yielding ability, had been identified for their use in the crossing nursery. Ten new crosses were attempted during the season. However, the F_1 seed from the following eight cross combinations only could be obtained due to low seed setting percentage most probably because of strong desiccating winds and temperature rise during the crossing operations.

New F_1 Crosses -

- UPO 276 x EC 246207
- UPO 216 x UPO 201/Swan (OX 766)
- (UPO 201/Swan) x (Gopher/UPO 212//UPO 212)
- UPO 276 x (Portal/Kent//UPO 212)
- EC 46 x (Portal/Kent//UPO 212)
- (Gopher/UPO 212//UPO 212) x ((Portal/Kent//UPO 212)
- (Gopher/UPO 212//UPO 212) x EC 107
- EC 44 x UPO 353

F_2 Populations :

The following F_2 populations were space planted in 30-35 m2 plots and 20-50 single plant selections from each population were made on the basis of desired character combination(s).

- (Fulgham / No. 2672) x (Wright / UPO 256)- 11-1-2
- (Gopher / UPO 212 // UPO 212)-4-1-1 x (EC 246123 / UPO 262)-22-1-1
- UPO 94 x TPS -1
- (Gopher / UPO 212 // UPO 212)-3-1-1 x (EC 246123 / UPO 262)-22-1-1
- (Portal / Kent // UPO 212) -5-2-1 x No. 1450 / (UPO 201 / PI295932 // UPO 201)
- (Fulgham / No. 2672) x (Wright / UPO 265) -11-1-1

Later Generation Breeding Materials: Oat Breeding materials of other segregating and advanced generations comprising F_3 (132), F_4 (157), F5 (140), F_6 (149), F_7 (95) & $_{F8}$ (75) progenies were grown during the season. Within- line single plant selections were made in F3, F4 & F5 progenies. In advanced generation progenies, planted in 2-3m long 2 row plots, between- line selections were made the following the pedigree breeding.

Standard Varietal Trial: A trial of advanced generation improved oat lines comprising seven entries was also conducted to assess the performance of promising lines *vis-à-vis* the checks.

Coordinated Varietal Trials: All the seven Coordinated Varietal Trials including 3 in berseem and 4 in oat allotted to the Centre were successfully conducted as per the approved technical programme. However, in berseem (AVTB-2) trial for seed yield evaluation, the seed could not be harvested due to severe damage of the crop by heavy hailstorm and rains prior to harvesting of seed from this trial .

Multiplication of Promising Lines: Fifteen promising advanced breeding lines and the entries/ check varieties already in the National Coordinated and State Varietal Trials were multiplied for their use in the ongoing oat research programme and as experimental seed materials for different trials.

Basic and Breeder Seed Production: Basic seed production of our released oat varieties UPO 212 and UPO 94 was undertaken during the season. Breeder seed of UPO 212 (52.5 qtls.) was also produced during *Rabi* 2017-18 season as per BSP – I (51.5 q NDDB & 1.0 q DADH)) received from the PC (FCU), IGFRI, Jhansi.

AICRP (FC & U), MPKV, Rahuri

POLYCROSS PROGRAMME OF LUCERNE: The new polycross programme was initiated from Rabi-2011-12 onwards. The details of parental lines included in the programme are as follow.

Center Code	Center	Entry Code	Name of the entry
A	AAU, Anand	A	Anand-24
B	AAU, Anand	L	AL-3
C	TNAU, Coimbatore	C	TNFD-118
D	BAIF, Urilikanchan	B	BAIF- Lucerne-1
E	MPKV, Rahuri	R	RLG-08-01

Season		Activity
Rabi-2011-12	:	Sowing of Lucerne Polycross Programme
Summer-2012	:	Polycross Seed Production Programme under insect proof net.
	:	The Seed obtained from 100 plants in polycross progrmme at each location were harvested individually, numbered and shared among the participating centers.
Rabi-2012-13	:	The seed obtained from 100 plants (25 x 4) centers) was sown in single row of 4 m length spaced at 30 cm along with checks in an augmented block design (November,2012)
	:	The 100 progenies were evaluated for GFY and DMY.
Rabi-2013-14	:	Out of 100 progenies the best 24 progenies were identified on the basis of one year data on GFY, DMY and pest/disease resistance
	:	From selected progenies, most promising individual plants (48) were identified, tagged and numbered (November, 2013).
Summer 2014	**:**	The promising plants in selected progenies were allowed to random mate by open pollination
	:	The OP seed of selected promising plants (48) was harvested individually.
Rabi-2014-15	:	The OP seed of 48 IPS were sown in a single row of 3m length spaced at 30 cm for progeny test (Dec., 2014).
	:	The 48 progenies were evaluated for forage yield
Rabi-2015-16	**:**	From 48 progenies, best 30 progenies were selected.
Rabi-2016-17		The clones of 30 superior plants were made.
Rabi 2017-18	:	Syn-I seed of selected clones will be made in summer 2018

DEVELOPMENT OF MULTICUT SORGHUM VARIETY: Nine sorghum x sudan grass crosses were made with the objective of development of multi cut fodder sorghum variety. The 126 F_2 plant to row progenies were sown during kharif 2017 for evaluation and selection.

SN	Cross [Sorghum x sudan grass]	IPS
1.	Ruchira x IS-3225	11
2.	Ruchira x IS-3261	21
3.	Phule Amruta x IS-3277	13
4.	Phule Amruta x IS-3309	6
5.	Phule Godhan x IS-3261	6
6.	Phule Godhan x IS-3277	3
7.	Phule Godhan x IS-3309	22
Cross [Sudan grass x sorghum]		
1.	IS-3323 x Ruchira	17
2.	IS-3225 x Ruchira	27
Total		**126**

DEVELOPMENT OF DUAL PURPOSE FODDER OAT: A hybridization programme involving ten lines and three testers is undertaken during rabi-2017-18 for development of dual purpose improved variety of Oat.

	Lines		**Tester**
1	RO- 11 - 1- 3	1	P. Surabhi
2	RO- 11 - 1- 4	2	P. Harita
3	RO- 11 - 1- 6	3	Kent
4	RO- 11 - 1- 8		
5	RO- 11 - 1- 12		

	Lines		**Tester**
1	RO- 11 - 1- 13	1	RSO-8
2	RO- 11 - 2- 2	2	P. Surabhi
3	RO- 11 - 2- 8	3	P. Harita
4	RO- 11 - 2- 11		
5	RO- 11 - 2- 12		

The F_1s with parents will be tested in field during rabi-2018-19.

AICRP (FC&U), BAIF, Urulikanchan

Lucerne

Polycross progeny evaluation programme: New cycle of polycross was initiated in *Rabi* 2016-17. The cross seed (F_1) obtained from eight genotypes namely BAL08-1, RLG 08-1, ALS-11, BAL08-6, RLG 08-10, ALS-2, BAIF lucerne-1 and Alamdar-51 was sown in 30 x 10 cm distance along with parental lines. The progenies were evaluated for GFY, DMY, CPY and plant characters.

Evaluation of germplasm: The germplasm (48 accessions) collected from different parts of Maharashtra, Gujarat and Rajasthan state and two check varieties namely RL 88 and Co-1 were sown in Randomized Block Design. All the accessions will be evaluated for growth, forage yield, quality traits and perenniality. As well as diversity at molecular level will also be studied. Morphological data for five cut was generated.

Population improvement programme: BAIF Lucerne -4 is grown for improvement and evaluation for forage yield and quality parameters.

Evaluation of Maize x Teosinte crosses

Progeny of seven IPS from F_2 generation was grown for progeny study in F_3 generation. The objectives are to develop the tillering ability, increase leaf stem ratio and dual cut fodder maize variety. Twenty two IPS were done for further studies.

Multicut Pearl millet

Nine germplasm lines collected from ICRISAT, Hyderabad along with BAIF Bajra-1 as check variety were evaluated in RBD under multicut system. All the lines were assessed for forage growth, yield and quality traits for three cut.

AICRP (FC&U), SKUAST-K, Srinagar

Germplasm maintained

SN	Crop	No. of accessions	Source /Area
1.	Oats	145	USDA,VIR, Japan, Czech Republic, Canada, Romania
2.	Alfalfa	54	USDA, Drass , Kargil and Leh
3.	Maize	10	CIMMYT Mexico
4.	Sorghum	6	DSR, Hyderabad
5.	Barley	42	Italy, Drass, Kargil and Leh
6.	Cowpea	25	USDA
7.	Red clover	02	Institute For Agricultural and Fisheries Research (ILVO),Plant Sciences Unit Belgium
8.	White clover	02	
9.	Perennial ryegrass	02	

Exotic Germplasm received during 2017-18

SN	Crop	No. of accessions	Source /Area
1	Alfalfa (Medicago sativa)	13	Canada & USA
2	Oats (Dual grazing type)	63	Australia
3	Caragana arborescence	10	Uzbekistan, China, Russian Federation USA,

Local Germplasm collected during 2017-18

SN	Crop	No. of accessions	Source /Area
1	Alfalfa (*Medicago sativa, falcata & varia*)	17	Doks, Bembhat, Goshan of Cold arid regions of Ladakh
2	Prongs	13	Zanaskar, Akchimal, Sankoo of Cold arid regions of Ladakh
3	Red clover	10	Sankoo. Matayan, Pandrass of Ladakh

Oats

Evaluation of advanced generation: F6 families of below detailed bi-parental crosses were evaluated and selections made among families for further studies.

SN	Cross Combination	SN	Cross Combination
1	SKO-208 X SKO-204	4	SKO-212 X SKO-204
2	SKO-207 X Sabzar	5	SKO-210 X SKO-207
3	SKO-212 X SKO-209	6	SKO-207 X SKO-204

Selections from Segregating generations

S. No	Segregating generations	No. of individual plant selections (IPS) made
1	F 4 (8 crosses)	20 families
2	F 5 (3 crosses)	10 families

New Initiatives: Biochemical characterization of genetic resources (exotic) carried out in collaboration with AICRP Forage centre PAU, Ludhiana for 55 lines to identify contrasts for quality traits to develop mapping population for quality traits in oats.

Alfalfa Improvement programme: In order to improve the fodder production potential of Alfalfa (Medicago spp.) Which major fodder crop in the cold arid region of Ladakh, efforts have been to collect and document *Medicago spp.* gene pool which includes *Medicago falcate, Medicago sativa, Medicago sativa, sub spp.* Varia sub populations. The sub population representative samples have been documented using morphological characters and studies are underway to assess their diversity using molecular markers (SSR markers) to supplement morphological data for identification of promising sub populations and promising genotypes for use in alfalfa improvement programme.

Extension and Evaluation of fodder oats cultivation as a summer crop in cold arid region of Zanaskar

Scientists of AICRP-Forage staff experimented with extension of Fodder Oat cultivation in the areas falling in the altitude range of beyond 11500ft amsl and in this connection laid evaluation trials of all the released fodder oat varieties at KVK Zanaskar as well as in farmers field in participatory mode of about 1 ha during *kharif* -2017. The standoff crop was excellent and farmers were very much enthusiastic to extend fodder oats cultivation in these areas. Keeping in view success of fodder oats cultivation as well as seed production, the scientists of AICRP-Forage decided to supply of seed of improved varieties on a large scale for uplifting the socio-economic condition of tribal farmers under adopted villages during *kharif* -2018.

SN	Variety	GFY (q/ kanal)	DFY (q/kanal)	Seed yield (q/kanal)
1	Sabzaar	8.8	1.76	0.30
2	SKO-20	9.4	1.88	0.35
3	SKO-90	10.3	2.16	0.38
4	SKO-96	9.8	1.96	0.34
5	SKO-108	8.7	1.65	0.37

AICRP (FC&U), AAU, Jorhat

Maize

- **Development of composite forage maize variety:** The 27 numbers of maize germplasm lines were selfed in *rabi* 2016-17. The selfed progeny were evaluated with the check variety African Tall and J-1006. On the basis of plant growth, green forage yield, dry matter yield and quality data 10 promising progenies were selected and will be evaluated in next rabi season.
- **Evaluation of maize germplasm**: 27 germplasm were evaluated with African Tall and J-1006 in *rabi* 2016-17 and promising entries were evaluated in *rabi* 2017-18.

Ricebean

- **Evaluation of Ricebean germplasm for rabi season:** Suitable entries selected for *rabi* season were grown and evaluated for their fodder yield and quality.

Lathyrus

- **Evaluation of Lathyrus germplasm**: Ten selected promising entries were grown and evaluated for fodder yield and quality.
- **Hybridization programme in lathyrus**: A diallel cross was made in *rabi* 2016-17among four selected local 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* 2017-18 promising entries were selected and will be evaluated in next *rabi* season.
- **Mutation breeding programme**: M_3 progenies were evaluated.

AICRP (FC&U), IGKV, Raipur

Oat

- Germplasm maintenance and evaluation: 22
- Cross attempted for F_1's in between 10 released variety with specific breeding design.

Lathyrus

- Crossing Block Date of sowing 10 -11-2017
- Parents Used: Mahateora (M), Pusa-24 (P), Ratan (R), BK-5 (B), Nirmal (N), RLK-1950 (R_2) {with different objectives}
- F_2 's planted in Rabi 2017-18
    - (M x B), (M x N), (M x P), (P x R), (P x R_2)
- Cross attempted in (Parteek & Mahateora and vise versa){Color and Pod size inheritance objectives} Date of sowing 20-11-2017

Seed multiplication of Lab lab bean promising entries for forage.

Trait specific germplasm characterization and identification for forage type

Lathyrus (Germplasm evaluation validation III year again in *Rabi* 2018 and identification for forage type) = 139 Germplasm Accessions Date of sowing 10-11-2017

- Low ODAP Group
- Late Flowering Group
- Broad Leaf Group

AICRP (FC&U), OUAT, Bhubaneswar

Germplasm Collection: During Rabi 2017-18, 29 germplasm were collected from Kandhamal and Rayagada districts of Odisha (13 in Maize, 9 in Cowpea and 7 in Rice bean).

AICRP (FC&U), KAU, Vellayani

Evaluation of Guinea grass cultures for yield, quality and flowering nature: Five guinea grass cultures are evaluated for yield, quality and flowering nature.

Evaluation of BN hybrid cultures for yield and forage quality: Four cultures along with control are being evaluated.

Evaluation of fodder cowpea cultures for yield and rationing ability

APPENDIX-II

Other Activities Rabi-2017-18

AICRP (FC&U), PAU, Ludhiana

Research papers

Kapoor Rahul and Singh Gagandeep (2017). An attempt to produce oat haploids using oat x maize hybridization technique. *Int. J Pure App Biosc.* 234-240.

Kaur Ajinder, Kaur Kamal Preet, Kalia Anu, Rani Upasana, Kahlon Jagroop Gill, Sharma Rajesh, Malaviya Devendra, Kapoor Rahul and Sandhu Jagdeep Singh (2017) Generation of interspecific hybrids between *Trifolium vesiculosum* and *T. alexandrinum* using embryo rescue. *Euphytica*, **213:** 253.

Toor A.K., Kumar Ashok and Kapoor Rahul (2017) Evaluation of napier bajra hybrids for yield and other parameters. *Int. J. Genet.* **9(7):**287-291.

Kapoor Rahul (2018) Inter-relationship of green fodder yield with yield contributing and quality traits in *Avena sativa*. *Forage Res*. **43 (4):** 330-333

Kaur Rajvir, Kapoor Rahul, Vikal Yogesh and Kaur Kamalpreet (2018) Assessing genetic diversity in dual purpose oat (*Avena sativa* L.) cultivars based on morphological and quality traits. *Int. J. Curr. Microbiol. App. Sci. 7***(5):**

Goyal M, Kaur H, Singh DP and Tiwana US. (2017). Evaluation of nutritional quality and yield of winter forages prevalent in Punjab. *Range Mgmt. & Agroforestry*. **38 (2):** 249-253.

Singh R, Tiwana US and Goyal M. (2018). Fodder productivity and quality of Napier Bajra Hybrid (*Pennisetum purpureum* × *Pennisetum glaucum*) and summer fodder intercrops with different seed rates. *Forage Research* **43:** 299-303

Kaur N and Goyal M. (2018). Phytohormones influence biochemical metabolites and quality traits of oats (*Avena sativa* L.) genotypes. *Agric Res J (accepted)*

Kaur N and Goyal M. (2018). Low temperature induces oxidative stress tolerance in oats (*Avena sativa* L.) genotypes. *Indian J Plant Physiol. (accepted)*

Rani Meena, Singh Sukhpreet, Tiwana US, Sarlach RS and Goyal Meenakshi. (2017). Effect of plant growth regulators on yield and quality of berseem (*Trifolium alexandrinum* L.) seed. *Forage Research* **42 (4):** 243-247.

Tiwana US, Rani Upasana, Singh Pritpal and Singh Sukhpreet. (2017). Effect of nitrogen on the fodder yield and quality of multicut oats varieties and their compatibility with berseem under different seed rates. *Progressive Research – An International Journal* **12 (2):** 137-140.

Kaur Rupinder, Goyal Meenakshi and Tiwana US. (2017). Yield and quality attributes with seasonal variation in Napier Bajra hybrid (*Pennisetum purpureum* × *Pennisetum glaucum*) under different nitrogen environments. *Journal of Applied and Natural Science* **9 (3):** 1350 - 1357.

Tiwana US, Chaudhary DP and Singh Pritpal. (2017). Sustaining quality, nutrient uptake and soil fertility through integrated nutrient management in food –Forage cropping system. *Forage Res.* **43 (3):**231-234.

Ashlesha, Oberoi Kaur Harpreet and Tiwana US (2017). Integrated management of maydis leaf blight of fodder maize. *Plant Disease Research* **32 (2):** 267.

Papers presented in Symposia/Workshops

Ashlesha, Kumar Ravinder and Tiwana US 2018. Endophytes as biocontrol agents against *Sclerotinia* stem rot in berseem (*Trifolium alexandrinum* L.). *Souvenir*. All India Coordinated Research Project on Forage crops & Utilization, National group meet, Kharif 2018, April 6-7, 2018 held at TNAU, Coimbatore, Tamil Nadu, pp 30-32.

Kapoor Rahul (2018) Genetic variability and association studies in Guinea grass (*Panicum maximum* Jacq.) AP-43; In: 21st Punjab Science Congress, PAU, Ludhiana, 7-9 February, 2018.

Kapoor Rahul (2018) Designer Fodder Crops: Addressing Animal Nutrition: In Souvenir National Group Meet of All India Coordinated Research project on Forage Crops-*Kharif* 2018, April 6-7, 2018, TNAU, Coimbatore, pp 33-41.

Kapoor Rahul (2017) Pre breeding and germplasm enhancement in Oats, Centre of Advanced Faculty Training in Genetics and Plant Breeding (ICAR), Department of Plant Breeding and Genetics, PAU, Ludhiana, August 7-27, 2017 held at PAU, Ludhiana, Pp. 235-242

Extension publications

Singh Devinder Pal, Goyal Meenakshi and Tiwana Udham Singh. 2017. J 1006: The most suitable variety for silage making. *Progressive farming* 53: 24-25 and *Changi Kheti* 53: 24-25

Students guided:

- M. Sc. : 7
- Ph.D. : 3

Lectures delivered -9

TV/Radio talks: Radio: 1

Details of seed/Planting material sold to farmers during Rabi 2017-18:

Crop	Variety	TL (q)	C/S (q)	F/S (q)	B/S (q)
Berseem	BL 1	-	-	-	1.35
	BL 10	20.88	39.99	-	14.48
	BL 42	5.50	55.01	10.00	6.43
	BL 180	-	-	-	1.18
Oats	OL 9	-	-	-	2.00
	OL 10	44.80	-	-	28.70
	Kent	-	-	-	62.30
	OL 11	40.15	-	-	4.00
Rye grass	PBRG 1	13.34	-	-	0.46
Total		**124.67**	**95.00**	**10.00**	**120.90**

External funded Projects: (1)

Project/Scheme Name	Funding Agency	Amount	PI/ Co-PI
Breeding for development of baby corn hybrids	ICAR-Indian Institute of Maize Research, Ludhiana	1,09,59,000	Dr. Meenakshi Goyal

AICRP (FC&U), UAS (ZARS), Mandya

Awards and Honours: Best Centre Award for Outstanding research on Forage crops presented during National Group meet Kharif-2018, held at TNAU, Coimbatore on 6th to 7th April -2018

Research Papers: 3

Kumar Anil, Lohithaswa CHC, Uma MS, and Mahadevu P. (2018). Analysis of combining ability and heterosis for yield and yield contributing traits in newly developed inbred lines of Maize *(Zea mays L.), International Journal of Agriculture Sciences.***10(6):** 5460-5464

Manjanagouda S, Sannagoudar BS Lalitha, Shekara BG and Bhavya V. (2017). Growth and yield of dual purpose pearl millet *(Pennisetum glaucum L.)* varieties as influenced by cutting and Nitrogen management**.** *Trends in Bio sciences.* **10(33):**7055-7061.

Muttagi Gopika C, Ravindra Usha and Mahadevu P. (2017). Functional properties of traditional rice varieties of Karnataka. *The Mysore Journal of Agricultural Sciences*, **51(4):** 896-899.

Chapters in book: 4

Cauvery Acchukattupradeshada bele hagu bele paddhathiyallineerina uthpadhakathe hecchisuva margopayagalu, **pp:** 67-83**: 3**

Cauvery Acchukattupradeshadalli anusarisa bahudada suktha paryaya belegalu hagu bele paddhathigalu-2018,

Mysuru Samsthanada avadhialli hatthi bele samsodhana pakshinota-2018, Souvenirs, Centenary celebration, **pp:** 58-59

Mysuru Samsthanadalli mevubele samsodhane matthu abhivruddhi ondhu paksinota,2018, Centenary celebration, **pp:** 60-66

Kannada Folders: 8

Mahadevahaiah Dhinakar and Shekara BG (2018). Misratalige hinurasigala Sharira thuka thilidukolluva kostaka.

Sashikumar C, Shekara BG, Druvakumar, Shivaraya Navi, Somu G and Chadachanakar Abdul Rajak (2018). Hatthi beleya uthpadhana thantrikathegalu

Shekara BG, Mahadevu P and Manasa N (2018). Misratali Hasuvinalli Adhika Halina iluvarigagi samatolan ahara.

Shekara BG, Mahadevu P, and Manasa N(2018). Kuri matthu meke sakanikege suktha mevina belegalu hagu tanthrikathegalu.

Shekara BG, Mahadevu P, and Manasa N(2018). Vividha Mevina Belegala Sudharit Utpadana Tantrikategalu.

Shivaraya Navi, Shekara BG, Sashikumar C, Druvakumar, Somu G and Abdul Rajak chadachanakar (2018). Hatthiya pramuka rogagalu hagu avugala nirvahane

Shivaraya Navi, Shekara BG, Sashikumar C, Druvakumar, Somu G and Abdul Rajak chadachanakar (2018). Hatthiyalli samagra keeta nirvahane

Shivaraya Navi, Shekara BG, Sashikumar C, Druvakumar, Somu G and Abdul Rajak chadachanakar (2018). Hatthiyalli gulabi kayikoraka badhe matthu hathote kramagalu

Important persons visit to AICRP-FC centre

- Director of Research UAS, Bengaluru.
- Vice Chancellor UAS, Bengaluru
- Board of Management, UAS, Bengaluru

Meetings / Workshop/Winter School

- Training programme -**3**
- Field days- **4**

TV/ Radio talk delivered by AICRP-FC staff/ extension activities: 2

Seed/ planting material sold

S. No.	Crops	Root Slips Sold (In Lakhs)
1.	Napier Bajra Hybrid (Co-3)	0.40
2	Guinea grass (JHGG-08-1)	0.15
3	Rhodes grass (Selection)	0.06
4	Signal grass (Selection)	0.03

Externally funded projects: 2

RKVY projects

- ✓ Augmenting Fodder Production and establishing fodder seed bank at University of Agricultural Sciences, Bangalore (2013-14) (RKVY project) with budget outlay of **100 lakhs**.
- ✓ Enhancing quality seed production in important fodder crops and demonstration of production technologies and low cost forage equipments to accelerate fodder production in Karnataka with budget outlay of **50 lakhs.**

AICRP (FC&U), JNKVV, Jabalpur

Publications

- Monica Jyoti Kujur, Bilaiya SK and Mehta AK. (2017) Character association study among components of green fodder yield in ricebean. *Indian Journal of Agricultural Research* **51 (4) :** 370-374.
- Monica Jyoti Kujur, Bilaiya SK, Mehta AK and Meena V (2017) Genetic divergence in fodder ricebean (*Vigna umbellata*) *Forage Research* **43 (2) :** 106-109

Important Persons visit

- Board Members of Vishwa Vidyalaya.
- Dr. P. M. Gaur International Scientist, ICRISAT Hyderabad.
- Dr. A. K.Roy, Project coordinator (FC)
- Dr. Hanchinal , Chairman PPVFRA authority.
- Dr. Ashok Kumar, Scientist NBPGR, New Delhi

Students guided: M. Sc. - 1

FTDs conducted: Berseem JB1, JB5 = 10; Oat JO1, Kent = 5

TSP activity: 31 demonstration 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

AICRP (FC&U), TNAU, Coimbatore

Awards and Honours: '**Best AICRP Centre award**' for the year 2016-17 during the National Group Meet-*Kharif* 2017 held at CSK HPKV, H.P on 18 & 19.04.2017

Book (with ISBN): 1

Babu C, Iyanar K, Sivakumar SD and Ganesamurthy K (2018) Forage Crops and Dairying. TNAU offset Press, Coimbatore – 3. (ISBN: 978-93-83799-91-6).

Book chapters (with ISBN): 8

Babu C and Vijayakumar G. (2018). Performance Analysis on TNAU Released Forage Crop Varieties. Forage Crops and Dairying. pp. 9-25 (ISBN: 978-93-83799-91-6).

Babu C, Iyanar K and Vijayakumar G. (2018). Cumbu Napier Hybrid Grass CO (BN) 5 – A Stupendous Success. Forage Crops and Dairying. pp. 26-31 (ISBN: 978-93-83799-91-6).

Sivakumar SD and Pavithra N. (2018). Fodder Production Technologies. Forage Crops and Dairying. pp. 32-37 (ISBN: 978-93-83799-91-6).

Iyanar K and Babu C (2018). Tree Fodder Production and Non-Conventional Feeds. Forage Crops and Dairying. pp. 38-61 (ISBN: 978-93-83799-91-6).

Babu C, Iyanar K and Pavithra N. (2018). Seed Production Methods in Major Forage Crops. Forage Crops and Dairying. pp. 62-72 (ISBN: 978-93-83799-91-6).

Pavithra N and Thenmozhi P. (2018). Fodder Quality and Preservation Techniques. Forage Crops and Dairying. pp. 98-108 (ISBN: 978-93-83799-91-6).

Sivakumar SD, Babu C and Pavithra N (2018). Hydroponic System of Fodder Production. Forage Crops and Dairying. pp. 109 -115 (ISBN: 978-93-83799-91-6).

Sivakumar SD, Babu C and Thenmozhi P (2017). Silvi Pasture System - A Way to Solve the Fodder Crisis in Tamil Nadu. Forage Crops and Dairying. pp. 124-130 (ISBN: 978-93-83799-91-6).

Research articles: 5

Santhosh Kumar, Babu C, Revathi S and Sumathi P (2017). Estimation of genetic variability, heritability and association of green fodder yield with contributing traits in fodder pearl millet. International journal of advanced biological research, 7(1): 119-126.

Babu C, Pavithra N and Sivakumar SD. (2017). Fodder cowpea varieties as contingent crops during late onset of monsoon in Tamil Nadu. Souvenir 'Role of contingent crops during aberrant weather conditions' of NGM Kharif 2017 at UAS, Bengaluru (p: 41-45).

Sivakumar SD, Babu C and Pavithra N. (2017). Silvipasture to combat deviant rainfall conditions in Tamil Nadu. Souvenir 'Role of contingent crops during aberrant weather conditions' of NGM Kharif 2017 at UAS, Bengaluru (p: 70-73).

Karthikeyan Balasamy Jayaraman, Babu Chakrapani and Amalraj John Joel. (2017). Exploring the diversity of cyanogenic potential in Sorghum (*Sorghum bicolor* (l.) Moench) at different growth stages through trend analysis. *Forage Res.,* 43 (3): pp. 187-196.

Seminar/Symposia papers: 2

Sivakumar SD, Babu C and Thenmozhi P. (2018). Pasture systems in Tamil Nadu and its management for prosperity. Souvenir 'Fodder crops for prosperity and ushering in white revolution' of NGM *Kharif* 2018 at TNAU, Coimbatore (p: 16-19).

Babu C, Kalamani A and Pavithra N. (2018). Desmanthus and Cenchrus: Potential forage crops for drought prone areas in Tamil Nadu. Souvenir 'Fodder crops for prosperity and ushering in white revolution' of NGM *Kharif* 2018 at TNAU, Coimbatore (p: 76-81).

National group meet – *Kharif* 2018

- Organized National Group Meet, *Kharif* 2018 of All India Coordinated Research Project on Forage Crops & Utilization during April 6th and 7th 2018. A total of 130 scientists from ICAR institutes/ SAU from across States were participated.

Important persons visited to AICRP FC centre

- Dr. I. S. Solanki, ADG (FFC), ICAR, New Delhi
- Dr. A. K. Roy, Project Coordinator AICRP on Forage Crops and Utilization,
- Dr. R.V. Kumar, Director, ICAR- IGFRI, Jhansi

Student(s) guided: M.Sc. (Agri.) in PBG – 2; Ph.D. in PBG - 1

No. of FTDs conducted: 20

Training conducted for farmers/ NGO/ Govt. officials:

- Training on '**Improved Varieties and Technologies in Forage Crops'** imparted to **200 Veterinary Assistant Surgeons** funded by State Fodder Development Scheme (2017-18) Department of Animal Husbandry, Tamil Nadu with a budget outlay of Rs.10.40 lakhs

Title of training	No. of trainees	Date	Districts
Improved Varieties and Technologies in Forage Crops	I batch (50)	12.12.2017 to 14.12.2017	All 32 districts of Tamil Nadu
	II batch (50)	26.12.2017 to 28.12.2017	
	III batch (50)	23.01.2018 to 25.01.2018	
	IV batch (50)	29.01.2018 to 31.01.2018	
Total	**200**		

Details of seed/ planting material sold

SN	Crop/ variety	Class of seeds	Quantity produced	Quantity supplied	Expected production (2018-19)
1.	Multicut Fodder sorghum CO (FS) 29	BS	146.00	146.00	145.0
		TFL	98.50	98.50	100.00
2.	Fodder sorghum CO 31	BS	-	-	300.00
		TFL	245.50	245.50	500.00
3.	Maize African tall	TFL	509.00	509.00	600.00
4.	Fodder cowpea CO 9	TFL	315.50	315.50	500.00
5.	*Desmanthus*	TFL	499.45	499.45	750.00
6.	Agathi	TFL	132.68	132.68	200.00
Total			**1,946.63**	**1,946.63**	**3,095.00**

	PLANTING MATERIAL (Nos.)					
1.	CN hybrid CO (CN) 4 stem cuttings	35,500	30,500	5,000	50,000	55,000
2.	CN hybrid CO (BN) 5 stem cuttings	13,39,202	13,09,202	30,000	15,00,000	15,30,000
3.	Guinea grass CO (GG) 3 rooted slips	23,220	22,220	1,000	25,000	26,000
4.	*Cenchrus* CO 1 rooted slips	6,250	5,250	1,000	5,000	6,000
Total		**14,04,172**	**13,67,172**	**37,000**	**15,80,000**	**16,17,000**

Externally funded project: 1

Training on '**Improved Varieties and Technologies in Forage Crops'** imparted to **200 Veterinary Assistant Surgeons** funded by State Fodder Development Scheme (2017-18) Department of Animal Husbandry, Tamil Nadu with a budget outlay of Rs.10.40 lakhs

AICRP (FC&U), AAU, Anand

Research Paper

Damor HI, Parmar HP and Parmar DJ (2017). D^2 analysis in Forage Sorghum (*Sorghum bicolor* (L.) Monch]: *International Journal of Chemical Studies* **5 (4) :** 337-341.

Book Chapter

Parmar HP, Saiyad MR and Padheriya DR (2017). Lucerne breeding : Problems and prospects. Published in Souvenir during NGM *Kharif*-2017 held at Palampur. Pp 15-18.

Parmar HP, Saiyad MR and Padheriya DR (2017). Emasculation and pollination technique in Forage crops. Published in Souvenir during NGM *Kharif*-2017 held at Palampur.

Parmar HP, Saiyad MR, Patel PM, Shroff JC and Padheriya DR (2017). Forage crops under aberrant weather condition in Gujarat State. Published in Souvenir during NGM *Rabi*-2017 held at UAS, GKVK, Bengaluru Page 15-17.

Popular articles

Parmar HP, Shroff JC, Saiyad MR and Padheriya DR (2017). Grass charana pakoni adhunic kheti paddhati. Krushijivan. August-2017, Page 74.

Workshop / Training/ Meeting Attended

- H.P. Parmar attended 45th Regional Coordination Committee Meeting on Fodder Crops held at Dhamrod (Surat) on 22/05/2017.

Student guided: Plant Breeding: 1 (M.Sc.) Agronomy: 1 (M.Sc.)

Teaching Courses

GP-511: Breeding for cereals, forage and sugarcane.
GP-515 (2+1): Maintenance Breeding and concepts of variety release and seed production.
Agron. 509 (2+1): Agronomy of fodder and forage crops.
Agron-502: Principles and practices of soil fertility and nutrient management.

FTD conducted: Forage Pearl millet (GFB-1): 5; Hybrid Napier (Co-3): 7

Monitoring Programme

H.P. Parmar Monitored AICRP centre, Urulikanchan and Rahuri during 13 to 16 September, 2017 for *kharif* trials/ research activities and seed production programmme.

Externally funded project: Quality Seed Production in Fodder Crop" under Fodder Development Programme-RKVY.

Extension activities

- Participated in "Krushi Mahotsav-2017" programme for dissemination of Forage technology.
- Delivered lectures in short term training programme of women organized by the Department of R.B.R.U., A.A.U., Anand.
- Lectures in *Rabi* and *Kharif*: Pre-seasonal training under T & V programme.
- Delivered lectures in short term refreshers training course organized by the Extension Education Institute, A.A.U., Anand.

AICRP (FC&U), BAIF, Urulikanchan

Research papers

Thorat Vipool, Kirdat Kiran, Takawale Pramod and Yadav Amit. (2017). First report of 16SrII-D phytoplasmas associated with fodder crops in India. *Phytopathogenic Mollicutes.* **7 (2):** 106-110

Singh VK, Sinha AK, Takawale PS, and Srivastav MK (2017). Azolla feeding status and its benefit for livestock in Odisha. *International Journal of Recent Advances in Multidisciplinary Research.,* **4(12):** 3281-3282

Singh VK, Sinha, AK, Takawale PS, Shindey DN and Srivastav MK. (2018). Evaluation of different oat varieties for green fodder and seed production yields. *International Journal of Recent Advances in Multidisciplinary Research*. **5 (3):** 3668-3670

Book

- **Hirva Chara Utpadan** a book containing green fodder production of various crops, fodder trees, non conventional fodder resources and fodder preservation

Important persons visit

- Dr. Sue Desmond-Hellman, CEO, Bill & Melinda Gates Foundation, U.S. A
- Col. N. R. Kulkarni, Director, Military Farms, Southern Command

FTDs conducted

20 Field Technology Demonstrations of oat (15) and berseem (5) were established at farmer's field in nine villages.

TSP activities

Activities were implemented in two villages namely Umarani & Shelkuvi in Nandurbar district of Maharashtra. It was need based and participatory programme. Two meetings were conducted with villagers in Umarani and Shelkuvi villages separately to identify the needs of the farmers. During the discussion it has been emerged that there is scarcity of irrigation water during the winter. It was told by the farmers that if some support for lift irrigation is made available, then farmers can lift the water from the water source and use it for cultivation of crops during the winter season and it will be an income generating activity for them. Considering the need, following activities were implemented under TSP.

- Identified two farmers user group one from each village to undertake the activity. Total no. of participating farmers was twenty.
- Survey of the area for water resource, installation of water lifting scheme, cultivation of crop to be taken under irrigation was done
- Meetings were conducted with selected group of farmers to decide the guidelines for using the facility
- Procurement of one diesel pump, 30 PVC pipes of 2.5" diameter and 20 sprinkler set were supplied to two groups of 10 farmers.
- Technical support to the farmers through field visits.

Training conducted for farmers/ NGO/ Govt. officials

- Two days trainings on "Fodder Development Programme" to Thirty five officers of Agriculture Dept., Commissionerate of Agriculture, M.S. officers.
- 24 trainings in "Livestock Development programmes" were conducted by BAIF and 479 participants from Maharashtra, Odisha, Jharkhand, Uttarakhand and Madhya Pradesh attended the trainings. The lectures on Fodder production technologies and visits to fodder demonstration plots were delivered by the scientists.

Details of seed/ planting material sold: 597 kg seed of oat and 91 kg seed of berseem.

AICRP (FC&U), SKRAU, Bikaner

Technical article

Shekhawat SS (2018). Kamai Charagah Se (Income from pasture). *Kheti* (ICAR) (January, 2018 Special Issue for Doubling Income of Farmers): 53-54.

Book

Shekhawat SS, Garg DK and Verma JS (2018). *Oats Germplasm Evaluation Report (For Zone Ic of Rajasthan, India)*. Lambert Academic Publishing, Dusseldorf, Germany. (ISBN: 978-613-7-31876-8)

Souvenir/ book chapter

Shekhawat SS and Bairwa RC (2017). Green fodder production for prosperity and ushering in white revolution in arid region of Rajasthan. In: Souvenir, edited by C. Babu, S. D. Sivakumar, N. Pavithra and P. Thenmozhi. TNAU, Coimbatore.

Other publication

Shekhawat SS and Bairwa RC (2017). Bahu varshia ghason se chara utpadan (Fodder production from perennial grasses). Centre for Forage management, ARS, SKRAU, Bikaner.

Seminar/ Symposium/ Workshop

- Dr. SS Shekhawat attended Workshop cum Review Meeting of the Experiential Learning Modules at Dr. Y.S.P. University of Horticulture and Forestry, Nauni, Solan
- Dr. SS Shekhawat attended the Workshop on "Academic Ethics and Integrity" at Directorate of Human Resource Development, SKRAU, Bikaner on May 15, 2018.

Student (s) guided and teaching work

- Dr. SS Shekhawat - one M Sc (Ag) and one Ph D students as Major Adviser and taught three PG courses (PBG-521: Plant Genetic Resources and Seed Technology; PBG-522: Principles of Quantitative Genetics; PBG-625: Advances in Breeding of Major Field Crops).
- Dr. RC Bairwa: Students guiding for M. Sc. (Ag.): 2; teaching of courses: UG – 1, PG – 1; Hostel Warden

FTDs conducted

14 for oat (UPO-212) and 2 for lucerne (T9).

Training conducted for farmers/ NGO/Govt. Officials

1. Farmers were given training for green fodder production in Rabi season in November, 2017 at the time of distribution of demonstrations under AICRP on Forage Crops.
2. Training to farmers of Garhwala village for improved seed production and seed storage under collaboration of Department of PBG on January 31, 2018.

Details of fodder/ seed/ planting material sold to farmers/ others

Green fodder sale: 52.8 quintals @ Rs. 200 per quintal = Rs. 10560/-
Oat and barley grain: Rs. 3000/-

List of important persons visited to AICRP- FC centre

Mr. P. S. Takawale, Forage Breeder and Mr. R. V. Kale, Asstt. Agronomist from BAIF, Urulikanchan, Pune on February 25, 2018.

Work in other projects

Dr. R. C. Bairwa: PI in RKVY Project on Water Productivity of Dil crop

Other activities of Dr. S. S. Shekhawat

- University Head of Department of Plant Breeding and Genetics, SKRAU, Bikaner.
- A member of Academic Council of SKRAU, Bikaner.
- Breeder Incharge of seed production at KVK, Abusar, Jhunjhunu.

AICRP (FC&U), KAU, Vellayani

Publications

Thomas Usha C and Abraham Mareen (2018). Effect of season, additives and grass types on silage quality of fodder grasses. *Forage Res*. **43(3):** 304-307

Anita MR, Lakshmi S and Bhaskar Babitha (2018). Growth, yield and water use efficiency of fodder cowpea varieties as influenced by water stress. *Forage Res*. **43(3):** 274-278

Ishrath PK, Thomas Usha C and Ganesh Dhanya (2018). Impact of additives on quality silage production. International conference on advances in agriculture and allied science technologies for sustainable development.10-12.2.2018. PGRRCDE, Osmania university, Hyderabad.

Student(s) guidance

M.Sc. (Agri.) in Plant Breeding and Genetics – 2;
Ph. D. in Plant Breeding and Genetics – 2,
M.Sc. (Agri.) in Agronomy-2

Teaching- Courses Handled

Dr. Mareen Abraham

B Sc (Ag) courses- Breeding of crops
PG courses- Breeding of major crops, Genetics in crop improvement
Genomics and proteomics**,** Biotechnology for crop improvement

Dr. Usha C Thomas-

BSc (Ag) courses-Irrigation and water management (1+1)
Field Crops II

Trainings

Lectures on 'Cultivation aspects of Fodder millets and legumes' for agricultural Assistants - HRD training programme on 'Popularization of pulses and millets' on 19.03.2018.

Lectures on 'Germplasm evaluation and their importance in biodiversity conservation' for agri professionals - training programme on 'Biodiversity for sustainable living' conducted by TBGRI, Palode' on 08.06.2018

Trainings/conference participated – Dr. Usha C Thomas participated in the International conference on water resources: Innovations in quality and quantity, sustainable development, challenges and management- 15-17.03.2018 at University of Kerala, Thiruvananthapuram.

AICRP (FC&U), MPKV, Rahuri

Research paper

Gate DV, Damame SV and Gore SB. (2018). Assessment of forage nutritional quality of B x N hybrid between Giant Bajra and Napier grass. *Forage Research* **43 (4):** 279-282.

Popular articles

Sonone Ajit and Surana Prasanna. (2018). *Kharip Hangamatil Chara Pikanche Niyojan*, Shri. Sugi- Kharif- 2018, pp: 43-44.

Surana Prasanna and Sonone Ajit (2018). *Kharip hangamatil sudharit chara va gawat pikanchi lagwad, Shetkari Masik* June 2018.

Visits

- Dr. B. G. Shekara and Dr. P. Mahadevu, ZARS, Mandya, UAS, Bangalore

Students Guided:

Plant Breeding	Prof. A. H. Sonone	: 02 M. Sc. (Agri.) students
Entomology	Dr. A. B. Tambe	: 01 M. Sc. (Agri.) student
Biochemistry	Dr. S. V. Damame	: 01 M. Sc. (Agri.) student
Agronomy	Dr. B. T. Sinare	: 01 M. Sc. (Agri.) student

FTDs conducted: Fifteen FTD's conducted during rabi 2017-18 on Oat variety Phule Surabhi

Tribal Sub Plan: Activities at village Dhanrat, Tal. Navapur, Dist- Nandurbar during *rabi* season of the year 2017-18 are as below:

SN	Particulars	Quantity	No. of beneficiaries
1	Oat *cv*. Phule Surbhi seed	150 kg.	15
2	Cycle hoe (manually operated)	15 nos.	15
3	Krishi darshani	15 nos.	15

Training conducted for farmers/ NGO/ Govt. Officials: 06

Radio talk delivered: 02

- H. Sonone: *Kharif hangamasathi chara pikanche lagwad tantradyan* : Ahmednagar Akashwani in May, 2018
- H. Sonone: *Pashupalan va dugdha vyavasayatil hirvya chryache mahatva* : Ahmednagar Akashwani on 06-06-2018

Seed Production (rabi-17-18)

Crop	Stage	Yield (Qtl)
Oat/ P. Harita	Nucleus	0.50
Oat/ P. Harita	Breeder	3.50
Oat/ P. Harita	Truthful	5.00`
Oat/ P. Surabhi	Nucleus	0.50
Oat/ P. Surabhi	Breeder	4.00
Oat/ P. Surabhi	Truthful	4.30
Oat/ Kent	Breeder	6.50
Berseem/ Vardan	Truthful	1.30
Sorghum /Ruchira	Truthful	4.00
Lucerne/RL-88	Nucleus	0.16

Externally funded project: Laboratory testing of forage quality during rabi 2015-16

SN	Company	Particulars	Testing fee (Rs.)
1	Ajeet Seeds Ltd	fodder quality of 20 sorghum hybrids.	Rs. 10,000/-
2	UPL Advanta, Hyderabad	fodder quality of 1 lucerne variety	Rs. 8,800/-
3	UPL Advanta, Hyderabad	Multilocation Field testing of lucerne hybrid Delight	Rs. 2,25,000/-

AICRP (FC&U), CCS HAU, Hisar

BEST CENTER AWARD

Team of "All India Co-ordinated Research Project on Forage Crops & Utilization", CCS HAU, Hisar has been appreciated for outstanding performance in the field of Forage Resource Development at the National Group Meet (*Rabi* 2017-18) on AICRP on Forage Crops & Utilization held at University of Agricultural Sciences, GKVK Campus, Bengaluru from September 4-5, 2017.

Appreciation Letter

Received letter from Director, IHAR-PIB, Radzików, 05-870 Błonie, **Poland** reading **"In Appreciation of Your Contribution to Triticale Breeding Research"** during **International Conference at Poland.**

Publications in Research Journals

Kumari Tanvi, Jindal Y and Satpal (2017) Estimates of Genetic Variability, Heritability and Genetic Advance of Oat (*Avena sp.*) for seed and fodder yield traits. *Forage Research* **43 (2):** 130-135.

Kumari Tanvi, Jindal Y and Kumari Pummy (2018). Characterization of oat (*Avena sp*) genotypes for morphological traits. *Forage Research* **43 (4):** 261-265.

Satpal, Sheoran RS, Tokas J and Jindal Y (2018). Quality, yield and economics of oat (*Avena sativa* L.) Genotypes for fodder under different nitrogen levels. *International Journal of Chemical Studies* **6 (1):** 1987-1991.

Seminar/symposium

Gaur Arpit, Parray Ghulam Ahmad, Shikari Asif Bashir, Najeeb S, Wani Shabir H. and Jindal Yogesh Kumar (2017). Molecular Diversity for Amylose Content and Aroma Traits in a set of traditional landraces of rice in Kashmir. Abstract accepted for presentation at International Seminar on Sustainable Intensification of Agriculture Through Resource Management and Conservation from July 7-9, 2017 At Afro Asian Studies Promotion Association (AASF), Goettingen, Germany.

Jindal Y and Tokas Jayanti (2018) Performance of cereal fodder crops as compared to fodder Triticale in semi arid region of North West Haryana in India. Abstract of the paper accepted for "**2nd International Conference on Triticale and Wheat Biology, Breeding and Production**" to be held from June 25-28, 2018 ***at*** East Anatolian Agricultural Research Institute, Erzurum, **Turkey**

Jindal Y, Kumari Pummy, Tokas Jayanti, Pahuja SK and Bishnoi OP (2017). Evaluation of high nutritive fodder Triticale (X *Triticosecale* Wittmack) vis-a-vis *rabi* fodder crops in semi arid region of North West Haryana in India. In: "International Conference on Triticale Biology, Breeding and Production" held from July 2-5, 2017 at Plant Breeding and Acclimatization Institute & National Research Institute, IHAR-PIB, Radzików, 05-870 Błonie, Poland held from July 2-5, 2017.

Jindal Y, Yadav Rajesh and Phogat DS (2017) Principal component analysis and determination of the selection criteria in fodder cowpea (*Vigna unguiculata* (L) Walp.) genotypes. Paper presented In: National Symposium on "New directions in managing forage resources and livestock productivity in 21st century: Challenges and Opportunities" from 3-4 March 2017 held at RVSKVV, Gwalior. Abstract pp 53.

Extension Activities

- Interacted with farmers and dignitaries during "Krishi Mela" in Sept. 2017
- 2nd Haryana Agri. Conclave and Expo. held on March, 2018.
- 3rd Agri. Leadership Summit - 2018 at Rohtak on 26.3.2018
- Interacted with state officials during AO's workshop in Oct. 2017

- Delivered lectures during "Monthly T & V" schedules.
- Delivered a lecture on "***Rabi* Fodder Crops**" to a group of farmers from Vrindavan organized by Regional Station for Fodder Production & Demonstration, Govt. of India, Hisar on 28.3.2017.
- Different duties were assigned during *'Kisan Mela', 'Farm Darshan'* and T & V training system on monthly basis on the stall and on demonstration plot.

Research projects applied during 2017-18: One Submitted

Title of the project	Principal Investigator	Budget	Funding Agency
Establishment of Eco-Friendly Hydroponic Unit for Round the Year Green Fodder Production for Peri Urban/ Dairy Farmers of Haryana	Dr. Yogesh Jindal	1.12 Crores	RKVY

Research projects applied during 2016-17: One

Title of the project	**Principal Investigator**	**Budget**	**Funding Agency**	**Status**
Development of oat (*Avena sp*.) genotypes with higher yield and nutritive value	PI: Dr. Yogesh Jindal Co-PI: Dr. Jayanti Tokas	10.00 Lakhs	CCS HAU Ad-hoc Project	Applied

Courses under teaching

Course No.	**Course title**	**Name of the teacher**
GP 201	Principles of Plant Breeding	Dr. Y. Jindal
GP 202	Breeding of Field Crops	Dr. Y. Jindal
GP 401	Crop Improvement	Dr. Y. Jindal
GP 403	Heterosis Breeding in Crop Plants	Dr. Y. Jindal
Agron. 509	Agronomy of Fodder & Forage Crops	Drs. Uma, Satpal

Ph.D. /M.Sc. Students being supervised

Student	**Degree**	**Research Title**	**Guide**
Arpit Gaur	Ph.D.	Genome Wide Association Mapping for Stem Water Soluble Carbohydrate under Drought Stress Conditions in Bread Wheat	Dr. Y. Jindal
Deepak Kaushik	M.Sc.	Genetic Diversity and Path Analysis in Sorghum for Fodder and Grain Yield	Dr. Y. Jindal
Atman Poonia	M.Sc.	Evaluation of oat genotypes for yield and quality characters	Dr. D.S. Phogat Dr. Y. Jindal

Additional Duties

- **In charge, Computer Centre, COA**
- **Nodal officer** – Post Matric Scholarship and Merit cum Means Scholarship for minorities students of CCS HAU, Hisar.
- **Nodal officer** –Scholarship of minorities– collection of Statistics in the University.
- **Nodal officer** – Centre Sector Scheme of Scholarship for College and University.
- **Nodal Officer** – State Resident Database
- Acted as **Rapporteur** in Session – III of Agricultural Officers Workshop (*Rabi* 2017).

AICRP (FC&U), IGKV, Raipur

Research papers

Sahu M and Sahu D (2017). Characterization and association studies in Linseed (*Linum usitatissimum* L.) germplasm accessions .*Bull. Env. Pharmacol. Life Sci*. **6(4):** 291-297

Sahu D, Sahu Mayuri and Banerjee Subha (2017). Morpho-Molecular Diversity Studies in Linseed (*Linum usitatissimum* L.) Early germplasm accessions. *Bull. Env. Pharmacol. Life Sci*. **6(4):** 145-152 (Online ISSN: 2277-1808)

Sahu Mayuri (2017): Morpho-Molecular Diversity Pattern; Elucidating Choice of parents for Hybridization in Cowpea, *Vigna unguiculata* (L.)" Abstract published in national Symposium on pulses for Nutritional security and Agricultural Sustainability, ICAR-IIPR, during 2-4 December, Page No. 90.

Chandrakar Manisha and Jha SK (2018). Assessment of weed efficiency (WCE) and weed growth rate (WGR) using different weed management practices on pigeonpea (*Cajanus cajan L.Mill sp*.). *Int. J. Pure. App. Biosci* **6 (1):** 192-195 (2018)

Chandrakar Manisha and Jha SK (2018). Effect if weed management Practices on root nodulation of Pigeonpea (*Cajanus cajan L. Mill sp*). *Trends in Biosciences* **11(8):** 1882-1884.

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 *university annual diary in 2018*
- Published package of practices of fodder crops production in *Krishi Youg Panchang in 2018*
- Demonstrated fodder *production technology in Agriculture Museum* at IGKV, Raipur
- Developed *computer based programme* of fodder production technology for demonstration in museum
- *Training for SMS , PC of KVK's* on fodder production
- Training for *REO, ADO, DDA of C.G. Government Agriculture department* on fodder production

Externally Funded Projects **(Rs In Lakhs)**

SN	Projects	Title	PI	Funding source	Budget
1	AGRON -8	Standardization of oat seed production	SK Jha	VV fund	0.4
2.	AGRON-42	Hydroponics fodder production, evaluation, standardization and demonstration under Chhattisgarh condition.	SK Jha	VV fund	2.0
3.	Public Private	Evaluation of Tembotrione 34.4 % SC along with surfactant against mix weed flora in Maize	SK Jha	Sponsor	2.0
4.	Adhoc project	Gamma ray mutagenesis for delayed flowering (65-75 days) and increased leaf stem ratio of Lathyrus. (Parteek & Mahateora)	Mayuri Sahu	BRNS, BARC, Mumbai	21.0

Teaching

Dr S. K. Jha

- PG - AGRON -501- Modern Concept in crop production 3+0
- UG- AGRO- 5121 Agricultural Water Management 1+1
- UG AGRON -322 - Practical Crop Production - 0+2

Dr. Mayuri Sahu

- UG- ACP-422- Seed production technology -3+1
- PG - GP 509- Biotechnology for Crop Improvement - 2+1
- NCC Officer cum Care Taker for; 8th CG Girl's BN, CoA, Raipur

Research Guidance

Subject	No of student registered
Dr S. K. Jha	**PG:** Major advisor- 1, Co-advisor -6 **Ph. D.:** Major advisor- 1
Dr. Mayuri Sahu	**PG:** Major advisor- 1 , Co-advisor -2 **Ph. D.:** Co Major advisor- 1

Capacity building

Dr. S. K. Jha participated on training programme on **"**Leadership Developmental team building skills for extension functionary" organized by Extension Education Institute Anand (Gujarat) during 12/03/2018 to 14/03/2018 at IGKV, Raipur

Fodder Seed production

Perennial sorghum COFS-29 -30 kg TL
Initiated foundation and certified seed production programme in 2016-17.
Incorporated fodder seed production programme in university.
Fodder seed production programme at different seed farms and KVK

Linkage with other programmes and institutes

- AICRP (Dry Land), CARS, Jagdalpur, Bastar (Chhattisgarh)
- AICRP (IFS)
- KVK's of Chhattisgarh

Rastriya Kishan Mela Chhattisgarh -2018

AICRP on FC & U participated in Rastriya Kishan Mela Chhattisgarh -2018 held at IGKV, Raipur during 24-28 th January, 2018

Extension Articles

Pkkjs okyh Qly eDds dh [ksrh dSls djsa MkW- ,l- ds- >k] papy iksrsZ] d`".k dqekj ukjax(Kriskak Doot Page No10-12
Pkkjs dk jktk % cjlhe dh [ksrh dSls djsa MkW- ,l- ds- >k] papy iksrsZ] d`".k dqekj ukjax Kriskak Shrinkala
Gjs pkj slsÞlkbystÞ ,oaÞgsÞdSls cuk;sa MkW-,l-ds->k-]papy iksrsZ Chhattisgarh Kheti page no 32-33

Conference attended

Jha SK and Pandey N (2018) "Studies on broadcast and direct line seeded rice (*Oryza sativa* L.) under different seed rate and weed management practices for alternatives of beushening (*biasi*) operation" National Seminar on Sustainable rice production technology for increasing the farmer's income held at IGKV, Raipur Page No 87

AICRP (FC&U), PJTSAU, Hyderabad

Publications

Shashikala T, Susheela R, Balazzii Naaiik R, Shanti M, Suneetha devi KB, Chandrika V and Murali B. (2017) Forage resources of Telangana State and research technology for enhancing fodder production. *International journal of economic plants* **4(4):** 162-169

Shashikala T, Susheela R, Balazzii Naaiik R, Shanti M, Murali B and Chandrika V. (2017) Assessment of fodder production potential of Lucerne (*Medicago sativa* L.,) genotypes for sustainable livestock production. *International journal of economic plants* 4**(4):** 137-140

Shanti M, Susheela R, Umakanth AV, Anuradha M and Shashikala T. (2017). Evaluation of sweet sorghum genotypes for fodder yields and quality under different levels of NPK *Forage Research* **43 (4):** 238-242

Soujanya T and Shashikala T. Heterosis studies in sweet sorghum for fodder yield and yield attributing traits *Forage Research* (accepted).

Shaik Wasim Chand, Susheela R, Sreelatha D, Shanti M and Surendra babu P (2017). Growth and yield as influenced by zinc fertilization in baby corn (*Zea mays L.*) *International journal of current microbiology and applied sciences* **5(6):**1362-1364

Shaik Wasim Chand, Susheela R, Sreelatha D, Shanti M, and Soujanya T (2017). Quality studies and yield of baby corn (*Zea mays* L.) as influenced by zinc fertilization *International journal of chemical studies* **6(10):**2454-2460

Shaik Wasim Chand, Susheela R, Sreelatha D, Shanti M, and Surendra babu P. (2017). Effect of zinc fertilizer on yield and economics of baby corn *Journal of pharmacognosy and phyto chemistry* **6(5):**989-992

Souvenirs

Shashikala T, Shanti M, Ekambram, Murali B, Susheela R and Sri Ramreddy P (2018) Scope of fodder crops ushering in second white revolution in state of Telangana. Souvenir National Group meet, Kharif 2018 held at TNAU, Coimbatore 6th-7th April 2018.

Popular articles

Shashikala T, Shanti M, Susheela R, Murali B and Balazzii Naik RVT (2018). Vesaviki Anuvaina Pasugrasapu Sajja- Moti bajra. Published in Vyavasayam, April 2018 pg25-26.

Maheshwaramma S, Shashikala T, Sameer Kumar CV, Nagesh Kumar MV and Venkata Ramana M (2018). Pasugrasa Jonna Saagu – Laabalu bagu. Vyavasayam. 2(4): 23-25

Susheela R, Shanti M, Anuradha M and Shashikala T Perennial fodder jowar Vyavasayam May 17

Susheela R, Shanti M, Anuradha M, Shashikala T Hedge Lucerne cultivation Vyavasayam April 17

National Conferences participation

- T. Shashikala Participated in National seminar on Seed production – Quality organised by TSSDC, Govt of Telangana 6th & 7th October 2017 PARK hotel, Rajbhavan Road, Hyderabad
- R. Susheela, V. Chandrika, M. Shanti, T. Shashikala, RVT Balazzii Naaiik, M. Anuradha 2nd May 2017 Subabul based silvi-pastoral systems for year round fodder production National conference on 'Agronomic approaches for climate resilience in agriculture" at RARS, Nandhyal, A.P.
- M. Shanti, R. Susheela, M. Anuradha and T. Shashikala 2nd May 2017 Evaluation of sorghum genotypes for fodder yields and quality. National conference on 'Agronomic approaches for climate resilience in agriculture" at RARS, Nandhyal, A.P.
- M. Shanti, R. Susheela, M. Anuradha and T. Shashikala 3 &4th, March, 2017 Evaluation of Silage Quality And Shelf Life Of Maize And Sorghum Silage Prepared In Polythene Bags National Symposium on "New Directions in managing forage resources and livestock productivity in 21st century: Challenges and opportunities at Gwalior.
- R. Susheela, M. Shanti, T. Shashikala and M. Anuradha 3 &4th, March, 2017Fodder and grain yield of dual purpose pearl millet genotypes as influenced by different cutting management practices National Symposium on "New Directions in managing forage resources and livestock productivity in 21st century: Challenges and opportunities at Gwalior.

- T. Shashikala, Kamala Venkateshan, RVT Balazzi Naiik, M. Shanthi, R. Susheela, M. Anuradha 3 & 4th, March, 2017 Phenotypic quantitative characters association with fodder yield in cowpea, *Vigna unguiculata* (L.) National Symposium on "New Directions in managing forage resources and live stock productivity in 21st century: Challenges and opportunities at Gwalior.
- M. Anuradha, M.Santhi, R.Susheela and T.Shashikala 3 &4th, March, 2017 Efficacy of biopesticides against cowpea aphid National Symposium on "New Directions in managing forage resources and livestock productivity in 21st century: Challenges and opportunities at Gwalior.
- R. Susheela, V. Chandrika, M. Shanti, T. Shashikala, RVT. BalazziiNaaiik, M. Anuradha 3 & 4th, March, 2017 Subabul based silvi-pastoral systems for year round fodder production National Symposium on "New Directions in managing forage resources and livestock productivity in 21st century: Challenges and opportunities at Gwalior.

International Conferences

M. Shanti, M. Anuradha, R. Susheela and T. Shashikala (2017) Quality of Feed and Fodder used in Livestock Production in Ranga Reddy District, Telangana- An appraisal At International Conference & Expo on Agril. & Veterinary Sciences: Research & Technology 'Agriconference', 2017, PJTSAU 23rd to 25th October 2017

R. Susheela, M. Shanti, M. Anuradha and T. Shashikala (2017) Studies on perennial fodder systems for year round fodder production 3rd International Conference on Bioresource and stress management held at Jaipur 8-11 November, 2017

Important persons visit

- Scientists from University of Tokyo, Japan
- Dr. Rajiv Agarwal, IGFRI, Jhansi.
- Dr. M. Venkatramana, ADR of the zone
- Dr. Rahul Kapoor, PAU Ludhiana
- Dr. Kalyan Jana, BCKV, Kalyani
- Dr. B. Joseph University Head, Department of Agronomy.

Scientists visit to other centres

- Rabi Monitoring of Raipur & Jabalpur centres by Dr. T. Shashikala and Dr. M. Shanti

Radio talks

Scientist	Topic	Date-recording	Date-broadcast
T. Shashikala	Raitu sevalo pasugrasa parishodana sthanam	9.1.2017	12.1.2017
M. Shanti	"Choudu nelalalo pasugraasala pantala saagu"	09.01.17	27.1.17

TV Programmes

SN	Scientist	Title of programme	Channel	Telecast Date
1	T. Shashikala	Vesavilo pachimeta koratha nivarana	Recorded on 3.3.2018	19.03.2018
2	T. Shashikala	Vesavi pasugrasala saagu vivaralu	DD Phone in Live programme In Rytunestham	21.03.2018
3	T. Shashikala	Pasugrasalasaaguvivaralu	DD Yadagiri	27.12.2017
4	T. Shashikala	Pachimetha pramukyata	Yadagiri	21.8.17
5	M. Shanti	Gorrelaku meta earpatlu	DD yadagiri	27.6.17
6	M. Shanti	Vesaviki pasugrasala saagu	DD Yadagiri, live-in	29.3.17
7	M. Shanti	Chetla pasugrasalu	Recording	28.3.17
8	T. Shashikala	Vesavikianuvaina pasugrasa pantalu	DD Yadagiri, live-in	26.02.2017

FTDs during *rabi* 2017-18 Total- 40

- Lucerne – 10; Oats – 20; Hedge Lucerne - 10

Student Guidance/Teaching

S.No	Major advisor	Minor advisor	Courses taught
Dr. T. Shashikala	1	-	-
Dr. M.Shanti	-	2	1

Guest lectures

- 14.03.18: Dr. T. Shashikala on "Enhancement of fodder production'' in the meeting on" MAOs as Agronomists". at EEI, Hyderabad for two batches
- 26.02.18: Dr. M. Shanti at Centre for Entrepreneurship Development (CED), Pragatinagar on "Macro and Micro Nutrient deficiency-Identification and Corrective measures & Development of fodder block for dairy industry"
- 23.02.18: Dr. T. Shashikala on "Enhancement of fodder production'' in the meeting on" MAOs as Agronomists". at EEI, Hyderabad on for two batches
- 03.02.18: Dr. M. Shanti on "Enhancement of fodder production'' in the meeting on" MAOs as Agronomists". at EEI, Hyderabad on 29.11.2017.
- 29.11.17: Dr. T. Shashikala on "Enhancement of fodder production'' in the meeting on" MAOs as Agronomists". at EEI, Hyderabad on 29.11.2017 for two batches
- 10.10.17: Dr. M. Shanti at Centre for Entrepreneurship Development (CED), Pragatinagar on "Macro and Micro Nutrient deficiency-Identification and Corrective measures & Development of fodder block for dairy industry"

AICRP (FC&U), CAU, Imphal

Extension Activities: Fodder Oat seed, chemical fertilizers 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. Scientist and staff of AICRP on Forage crops of CAU Imphal centre are also actively involved in many activities in the Directorate of Research office of CAU, Imphal

- Agri-Fare : 2
- Farmers' Field Day : 1
- Resource person : 2
- Interaction programme : 3
- Radio talks : 1

Lectures delivered on

- "Strategies for round the year fodder availability for feeding of dairy animals in NEH region with special reference to Manipur" organized by Young Voluntary Organization Manipur.
- "Issues and strategies for development of dairy farmers of Manipur" organized by Manipur Milk Producers' Co-operative Union Ltd.

FTDs conducted in *Rabi* Season2017-18

Crop (variety)	**No. of FTDs conducted**	**Yield farmers practice (Approx)**	**Improved (range) yield**
Oat var. JHO-822 & Kent	20	395q/ha	420 /ha

M. Sc. /Ph. D. students guided as Co-guide
Ph. D. (Agri.) -01; M. Sc. (Agri.) -01
Courses taught B. Sc. (Agri.)/ M. Sc. (Agri.)/ Ph. D. (Agri.)
Fodder crops and Organic farming

AICRP (FC&U), GBPUAT, Pantnagar

Publications in Journals

Roy Chandan and Verma JS. (2017). Identification of morphological traits using Smith index for grain yield improvement in oat (*Avena sativa* L.). *Agric. Res. Jr.* **54(1):** 11-15

Verma JS and Yadav VK. (2018). DUS test guideline for Oat (*Avena sativa* L.). *Plant Variety Journal of India* **12 (30):** 79-93.

Chauhan Anju, Rajput N, Kumar A, Verma JS and Chaudhary AK. (2018). Interactive effects of gibberellic acid and salt stress on growth parameters and chlorophyll content in oat cultivars. *Jr. Environmental Biol.* **39(15):** accepted.

Ruwali Y and Verma JS (2018). Analysis of GxE interaction and stability parameters for yield and its components in Oat (*Avena sativa* L.) under natural conditions. *Range Mgmt. & Agroforestry*. Accepted

Kumar Amrendra, Pal MS and Bhatnagar A and Qureshi A. (2018). Effect of tillage and nutritional management on growth, yield, harvest index and nutrient use efficiency of corn (*Zea mays* L.) in Indo-Gangetic plains of India. *International Journal of Current Microbiology & Applied Sciences 7(special issue): 4185-4191.*

Pal MS and Joshi YP. (2018). Tillage options and its effect on productivity, profitability and quality of forage under feed/fodder-food based cropping systems. *Forage Research* **43 (4):** 291-294**.**

Conferences/Workshops

Pal MS and Joshi YP. (2018). Tillage options and its effect on productivity, profitability and quality of forage under feed/food-fodder based cropping system in Mollisols. National Agronomy Congress held at Department of Agronomy, GBPUAT, Pantnagar on 20-22 Feb 2018.

Pal MS. (2018). Paradigm shift in crop residue management. In: AGRICO-2018,to be held on 16 & 17th August 2018 Colombo, Sri Lanka (TIIKM) (Accepted for oral presentation).

Pal MS. (2018). Productivity and profitability of sunflower (*Helianthus annuus* L.) hybrids under spring planting conditions for oilseed security in India. In: AGRICO-2018,to be held on 16 & 17th August 2018 Colombo, Sri Lanka (TIIKM) (Accepted for oral presentation).

Book Review/Others

Pal MS. (2017). Role of fodder in improving income and livelihood of farming communities in Uttarakhand. Souvenir: Strategies for enhancing farmers' income in Uttarakhand. 31st Convocation, 16 Nov 2017, GBPUAT, Pantnagar. pp.135-139.

Pal MS. (2017). Problems and prospects of fodder production in India. CAFT training in Sept. 2017,

Pal MS (2018). Water Management for Sustainable Agriculture. In: Green Technologies for Sustainable Management of Natural Resources (book) eds by R S Sengar) (Accepted).

Shekhawat SS, Garg DK and Verma JS **(2018).** Oats Germplasm Evaluation Report. Lambert Academic publishers

Pal MS. (2017). Adoption of resource efficient agriculture production systems for greater monetary returns. Souvenir: Strategies for enhancing farmers' income in Uttarakhand. 31st Convocation, 16 Nov 2017, GBPUAT, Pantnagar. pp. 177-180.

Popular Articles

Kumar Udit, Chandra Garish and Prasad Birendra. (2017). Legumes vegetable for better soil and human health. *Indian Farmers' Digest,* Issue September: 12-14.

Pal MS (2017). Harvest green fodder round the year. *India Farmers' Digest* **50 (9):** 9-13.

Pal MS (2017). How to grow bajra for green fodder. *Kisan Bharti* **48(8):**18-21.

Pal MS (2017). Maize production in India. *Indian Farmers' Digest* **50 (10):** 6-13

Pal MS (2018). Barley: A dual purpose cereal. *Indian Farmers' Digest* **51 (03):** 16-24.

Pal MS (2018). Hydroponic green fodder production. *Kisan Bharti* **51 (5):** 4-7.

Pal MS (2018). Spring sunflower cultivation for boosting net profit. Kisan Bharti ***49*** **(6):** 9-13.

Prasad B (2017). Seed production technology of forage cowpea. *Indian Farmers' Digest* **50(6):** 19-20.

Prasad Birendra and Kumar Amarjeet. (2017). Seed Production Technology of Forage Cowpea. *Indian Farmers' Digest,* Issue June: **50 (6)**:19-20.

Prasad Birendra, Shukla PS, and Kumar Amarjeet. (2018). Phasal Beej Utpadan Kar Aay mem virdhi kaise karen. *Kisan Bharati,* March, **49(06):**18-31.

Singh NK, Kumar Amarjeet and Prasad Birendra (2017). Makke Ki Kheti : Bhutte Ke Saath Chara bhi deti *Kisan Bharati* **49(2) :** 4-7.

Verma JS (2017). Quality seed production in Berseem. *Kisan Bharti* **49 (1):** 31-35.

Radio Talks= 05

Visitors

- Officer-in Charge, Haldwani Zoo and Safari, Haldwani (Uttarakhand),
- Representative group of Govt of Nepal,
- WWF, Haldwani

Course Coordinator in 21 days training on "Precision Agriculture for Sustainable Development' was organized under CAFT Agronomy w.e.f. 9 Feb to 1 March 2018.

Guidance of Students = 04

AICRP (FC&U), NDUAT, Faizabad

Publications

Yadav RS, Singh Bhagwan, Singh SP, Singh AK and Singh RP (2017). Response of phosphogypsum on fodder production of various cultivars of oat under sodic soils. Paper presented in National Seminar on "Agriculture Research and Education in relation to development of Integrated Agriculture: Challenges & Solutions" jointly organized by UPCAR, IISR & U.P. Academy of Agricultural Sciences on 28th Foundation Day of UPCAR at Lucknow on June14, 2017 p.63-64.

Gautam RK, Chaudhary RK, Yadav RDS, Kumar P, Yadav HC, Yadav RS and Yadav CB (2017). Studies on seed yield and its quality parameters in Barley (*Hordeum vulgare* L.). *Progressive Research* **12(spl.-1):**1094-96.

Yadav RS, Kumar R, Singh SP, Singh AK, Singh RP and Singh RK (2017). Effect of phosphogypsum on fodder production of various cultivars of oat under sodic soils. Paper presented in National Conference on "Livelihood and Food Security, 2018 organized by Society for Agriculture Innovation and Development, Ranchi at Bihar Veterinary College, Patna held on January 27-28, 2018 p. 113.

Participation in Seminar/Symposia: 2

Linkage with departments:

- Department of Animal Husbandry, N D U A T, Faizabad.
- Department of Agroforestry, N D U A T, Faizabad.

Courses taught:

- Agron 221(V) - (B.Sc. Ag.)- Crop production technology (Rabi crops)
- Agron 624- (Ph. D.) –Management of saline and alkali soils

Guided student:

- Mr. Mohan Singh M.Sc. (Ag.)
- Mr. Ankit Singh M.Sc. (Ag.)

FTD conducted: Forage oat-NDO-1 -10; Radio Talks - 2

AICRP (FC&U), CSK HPKV Palampur

Publications

Journals

Arushi, Malannavar AB and Banyal DK (2017). Effect of spacing and planting dates on the development of powdery mildew of tomato. *Pl. Dis. Res.* **32 (2):** 226-227

Guleria Gunjan and Kumar Naveen. 2018. Production efficient, forage yield, nutrient uptake and quality of sorghum sudan grass hybrid + cowpea intercropping system as influenced by sowing methods and varying seed rates of cowpea. *Indian Journal of Agronomy* **63 (2)** Accepted

Katoch R and Tripathi A. 2017. Nutraceutical and pharmacological properties of *Vigna* species. *Indian J. of Agricultural Biochemistry* **30 (1):** 10-20.

Katoch R, Apoorva, Tripathi A and Sood S. 2017. Improving nutritive value and digestibility of maize. *Forage Res*., **43(3):** 174-180.

Seminar

Arora A, Sood VK, Chaudhary HK and Devi Rajni. (2017). Performance of elite oat (*Avena sativa* L.) genotypes for forage yield and related traits under mid hill conditions of North-Western Himalayas. In: abstracts: *The third International Conference on Bioresources and Stress Management*, Jaipur p 187

Katoch R, Singh SK and Thakur N (2017). Biotechnological interventions for improvement of plant nutritional value: From mechanism to application. In*: Phytonutritional improvement of crops,* (eds. Noureddine Benkeblia). Wiley press, West Sussex, pp. 83-111

Katoch R, Singh SK, Tripathi A and Kumar Naveen. 2017. Effect of seasonal variation in biochemical composition of leaves of fodder trees prevalent in the mid-hill region of Himachal Pradesh. *Range Mgt. & Agroforestry* **38(2):** 234-240.

Katoch R, Tripathi A, Kumar N, Sood VK and Banyal DK. 2018. Revisiting prospects in red clover: A potential temperate fodder legume. All India Coordinated Research Project on Forage Crops, Souvenir of National Group Meet,TNAU, COA, 55-61.

Katoch R, Thripati T, Kumar N, Sood VK and Banyal DK. 2018. Revisiting prospects in red clover: A potential temperate fodder legume. National group meet – *Kharif* 2018 held at TNAU Coimbatore on 6th -7th April, 2018. Souvenir 55-61

Katoch Rajan, Kumar Naveen, Sood VK and. Banyal DK 2017. Effect of environmental factors on the quality of forage crops. National group meet - Rabi 2017 held at GKVK, Bengaluru, Karnataka-560065 from September 4th to 5th, 2017. Souvenir 50-54p.

Kumari Anjali, Sood VK, Devi Rajni and Sharma Ankita. 2017. Genetic evaluation of different frost tolerant bajra-napier hybrids for forage yield and quality traits in North Western Himalayas. The Bioscan. **12 (3):** 1825-31

Mawar, R and Banyal DK. 2017.Influence of sowing time on efficiency of chemical and biological management of anthracnose of cowpea. *Indian Phytopath*ology. **70 (2) :** 262-264 (2017)

Shweta, Katoch R, and Kumari M 2017. Proximate and anti-nutritional composition of underutilized and common *Vigna* species of Himachal Pradesh. *Bull EnvPharmacol Life Sci* **6:** 24-31.

Singh Amar and Banyal DK. 2017. *Poly house mai ugai jane wali sabjiaon ke permukh rog abum unki roktham (hindi). Parvatia Kheti Bari*. **37 (1):** 20-22

Courses Taught

Course No	Course Title	Cr. Hr.
Agron 510	Agroforestry and Agrostology	2+1
Biochem 501	Basic Biochemistry	3+1=4
Biochem.505	Intermediary metabolism	3+0=3
Biochem.602	Advanced Mol. Biology	2+0=2
GP 509	Biotechnology for Crop Improvement	2+1=3
GP 608	Advances in Breeding of Major Field Crops	2+0= 2
GP 691	Doctoral Seminar	1+0= 1
LPM	Livestock production and Management	1+1
Pl Path 511	Chemicals in Plant Disease Management	2+1=3
Pl Path 509	Diseases of Vegetable and Spices Crops	2+2=3

Other activities

Project Monitoring	:	AICRP (FC) of Rabi 2016-17 at KAU Vellayani; SKAUST Kashmir
Students guidance	:	M. Sc. - 9 , Ph. D. 9- (as major advisor) ; 32 (Member advisory committee)
Forage technology consultations	:	14
Lectures delivered to farmers and developent officers	:	2
Radio talk	:	1
Tribal Sub plan:	:	−The performance of families in Gont village (Nanahar) in Baijnath block of Kangra District supplied with inputs like UMM Bricks, mineral mixture for livestock; and implements like sickle; planting material of Lemon and mulberry trees, Setaria grass and Napier bajra hybrid were monitored. Planting material of improved species has been procured for distribution among new selected farmers.
Linkage with other programmes and institutes	:	−IVRI Regional Research Station Palampur −AICRP (IFS) −AICRP (Agro forestry)
Association in Adhoc Projects	:	−Scientists are associated in 2 Ad hoc projects −4 new project proposal has been submitted
Resource generation	:	−Rs. 4,33,170/- (September 2017 to May 2018)

AICRP (FC&U), SKUAST-K, Srinagar

Publications

Dar NA, Singh KN and Haq S Ansarul (2017). Effect of sowing dates, different cultivars and fertility levels on growth and yield of fodder Oats. *Forage Research* **41(4) :** 249-252

Ahmad M, Zaffar G, Razvi SM, Dar ZA (2017). Genetic analysis for beta glucan, grain protein and other important traits in oats (*Avena sativa* L.) *Indian Journal of Genetics and Plant Breeding*. **75(1):**136-139.

Haq S Ansarul, Shiekh TA., Bahar FA., Dar NA and Alie BA (2018). Yield and Quality of Winter Cereal-Legume Fodder Mixtures and their Pure Stand under Temperate Conditions of Kashmir Valley, India. *Int. J. Curr. Microbiol. App. Sci* (2018) ***7*(1):** 395-398

Haq S Ansarul, Zaffar G, Shiekh TA, Dar Khurshid A, Bahar FA, Khuroo NS, Raja Waseem and Habib Mehfuza (2018). Cropping System Studies in Fodder Maize with Legume Intercropping under Temperate Conditions of Kashmir. National Conference on Innovative Technological Interventions for Doubling Farmers Income held at SKUAST-Jammu from 8-10th February, 2018. P 96

Haq S Ansarul, Zaffar G, Shiekh TA, Dar Khurshid A, Bahar FA, Bhat MA, Raja Waseem, Khuroo NS and Habib Mehfuza (2018). Effect of Varying Seed Rate of Forage Legumes on Productivity of Fodder Maize under Kashmir Conditions. National Conference on Innovative Technological Interventions for Doubling Farmers Income held at SKUAST-Jammu from 8-10th February, 2018. P 108

Forage Technology Demonstration Programme

- During *Rabi* 2017-18, twenty (20) FTD's were conducted on Fodder Oats var. (SKO-90 & SKO-20) in District Budgam and Ganderbal areas through concerned KVKs to promote location specific varieties/package of practices/technologies

Variety	Districts covered	Area covered (kanals)	No. Of beneficiaries	Improved variety GFY (q/ha)	Local check GFY q/ha)	% increase over check
SKO-90 (Shalimar fodder oats-2)	Ganderbal	30	15	390.5	325.6	19.93
	Budgam	20	10	370.0	295.2	25.33
Average Green fodder yield (q/ha) over districts		50 kanals	25	380.25	310.4	22.5
SKO-20 (Shalimar fodder oats-1)	Ganderbal	20	10	365.0	335.0	8.95
	Budgam	10	5	385.0	325.0	18.45
Average Green fodder yield (q/ha) over districts		30 kanals	15	375.0	330	13.63

Tribal Sub Plan (TSP) Programme: TSP interventions were implemented at cold arid region of Drass and Kargil of Ladkh region. Agricultural, Livestock and fodder related interventions were demonstrated to uplift the socio-economic condition of tribal farmers under adopted villages during 2017-18. A Tribal Forage Day was organised by AICRP Centre Srinagar at Mattayn village of Drass Kargil on 16-17 of October 2017,to aware tribal farmers of latest technological innovations so that they can benefit by translating them in their fields and harness the benefits in terms of making crop production a sustainable venture. More than 40 tribal families representing a major group involved in fodder cultivation participated in the said Forage day. On this occation farm implements viz Tangroo,Spade,Serrated skills and Garden shivel etc were distributed among selected tribal farmilies.In addition to this all the selected beneficiaries (40 families) were distributed fodder maize (African tall) @ 10kg/family and Oats seed (SKO-90) @ 20kg/family as a source of fodder.

Oats seed production details (2017-18):

SN	Crop	Variety	Total Quantity (quintals)	
			Nucleus seed	Breeder seed
1.	Oats	Sabzaar	0.30	9.00
2.		SKO-90	0.25	15.00
3.		SKO-20	0.20	17.00
4.		SKO-96	0.30	34.00
5.		SKO-108	0.15	6.00
Grand Total			**1.20**	**81.00**

Students Guided

- M. Sc. (Ag) in Agronomy -02 (Co-advisor)
- M. Sc. (Ag) in Plant Breeding -01 (Major advisor)

Teaching

- Agron 510 (2 +1) – Agrostology and Agro forestry
- Agron 503 (2 + 1)- Soil fertility and their management

AICRP (FC&U), AAU, Jorhat

Research Paper - 1

Bepary RH, Wadikar DD, Neog SB and Patki PE (2017). Studies on physic-chemical and cooking characteristics of rice bean varieties grown in NE Region of India. J. Food Sci. and Technol **54:** 973-986

Extension leaflet – 2

- Round the year fodder production for successful dairy farming in Assam (in Assamese)
- Feeding nutritious tree fodder (in Assamese)

Student(s) guided: M.Sc. (Agri.) in 3 in PBG and in Agronomy-3; Ph.D in Agronomy- 2

No. of FTDs conducted: 40

TSP activities: Adopted 4 villages in two TSP districts viz. Dhemaji and Karbi Anglong

Training conducted for farmers/ NGO/ Govt. officials: 4

TV/ Radio talk delivered by AICRP-FC staff/ extension activities: 2

Details of seed/ planting material sold

SN	Forage crops	Total quantity (kg)		
		Total Slips (No)	Foundation seed	TFL seed
1.	Hybrid Napier CO-4,CO-5	0.70 lakh		
2.	Setaria Kazungula,PSS-1	1.10 lakh	-	
3.	Rice bean Var. Shyamalima		25 kg	
4.	Oat Var. Kent and JHO 822			4.00 q
	Grand Total	**1.80 lakh**	**25.00 Kg**	**4.00 q**

AICRP (FC&U), BAU, Ranchi

Research Publication

Surin Supriya, Kumar Arun, Kumari Suruchi, Prasad Yogendra, Tuti Ashisan and Suman Aradhna (2018). Heterosis for Yield and Its Component in Indian mustard (*Brassica juncea* (L.) Czern & Coss). *Int. J. Curr. Microbiol. App. Sci* **Special Issue-7:** 3866-3871.

Kumar Birendra and Yadav Naresh Prasad (2017). Crops and livestock management under aberrant weather condition. *Souvenir Rabi.* **2017-18** *(58-62) UAS Bengaluru.*

Kumar Birendra, Kerketta JK and Singh Uday Kumar (2017). Herbicidal responce on yield and quality of Berseem (*Trifolium alexandrinum* L) under slight acidic soil condition of Jharkhand *Chemical Science Review and letter* (ISSN 2278-6783) **6(24):** 2463-2468 .

Kumar Birendra, Tirkey Niketa and Kumar Sanjay (2017). Anti-Nutrient in fodders: A Review. *Chemical Science Review and letter* (ISSN 2278-6783) **6(24):** 2513-5219.

Popular Articles

Prasad Yogendra and Kumar Birendra (2017). Rabi Chara Utpadan techniue in "Oat", Nov. 2017.

Surya Prakash, Tuti Ashisan, Surin SS and Prasad Yogendra (2017). Hindi Article Published in Pathari Krishi- Gehu me saphal beej utpadan, Vol.18, Part:3-4 Sept. to Dec. 2017.

Kumar Ravi, Mahato CS, Prasad Yogendra and Kumar Kamleshwar (2017). Hindi Article Published in Pathari Krishi- Kharif Aiwam Garma Mung Ka Pramanit Beejotpadan, Vol.18, Part: 1-2, March to June, 2017.

Extension

- Organised One Day Farmer's training programme in Forage crops in Ranchi district at Itaki Block, Village- Mallar on 13th Oct. 2017.
- Organised Three Day's training programme on Hara chara utpadan technique on Forage crops at Itaki Block, Vill.-Mallar from 18th Jan. to 20th Jan. 2018.
- Participated in Agro tech kisan Mela at BAU from 3rd to 5th Feb. 2018.
- Preparation of contingency plan for Jharkhand state.

Teaching Courses

Dr. Birendra Kumar

- Agron-501: Modern concept in crop production
- Agron-504: Principal and Practice of water Management
- Agron-509: Agronomy of Fodder and Forage crops
- Agron-510: Agrostology and Agro forestry
- Agron-512: Dry land farming and watershed Management

Dr. Yogendra Prasad

- PBG-121: Principle of Plant Breeding
- GP-503 : Principle of Plant Breeding
- GP-608 : Advances in Breeding of Major Field crops

Important visitors

- Dr. U. S. Tiwana, PAU, Ludhiana
- Dr.Yogesh Jindal, HAU, Hisar

AICRP (FC&U), BCKV, Kalyani

Research papers

Jana K, Das SK, Roy DC, Kundu MK, Kundu A. and Sathish G (2018). Seed yield of linseed varieties grown as '*paira*' crop as influenced by dates of sowing. *Journal of Applied and Natural Science* (ISSN 0974-9411) **10 (1):** 17-23.

Jana K, Karmakar R, Banerjee S, Sana M, Goswami S and Puste AM (2018). Aerobic rice cultivation system: Eco-friendly and water saving technology under changed climate. *Agricultural Research & Technology* (ISSN 2471-6774) **13 (2):** 1-5.

Jana K, Mallick GK, Das SK, Biswas B, Kundu MK, Koireng RJ and Puste AM (2017). Evaluation of potential rice (*Oryza sativa* L.) genotypes with different levels of N under rainfed shallow lowland situation. *Archives of Agriculture and Environmental Science* (ISSN 2456 6632) **2 (3):** 202-205.

Koireng RJ, Anal PSR, Jana K and Devi KHP (2018). Prospect of sustainable livestock farming in NEH region of India. *International Journal of Current Microbiology and Applied Sciences* (ISSN 2319-7706) **7 (1):** 1285-1292.

In Souvenirs

Jana K, De DK, Sarkar S, Banerjee J and Kundu CK (2017). Ricebean germplasm variability: Development of molecular markers and variety for salinity and other abiotic stress conditions. Souvenir, National Group Meet, *Kharif,* 2017, AICRP on Forage Crops and Utilization held at CSKHPKV, Palampur, April 18-19, 2017: 25-32.

Jana K, Kundu CK, Sarkar S, Banerjee J and De DK (2017). Strategies for enhancement of food-forage production for sustainability and secure livelihood of resource poor farmers in West Bengal. Souvenir, National Group Meet, *Rabi,* 2017-18, AICRP on Forage Crops and Utilization held at GKVK, UAS, Bangalore, September 4-5, 2017: 77-81.

Jana K, Kundu CK, Sarkar S, Banerjee J and De DK (2018). Forages as contingent crops in stress condition and problematic soils of West Bengal. Souvenir, National Group Meet, *Kharif*-2018, AICRP on Forage Crops and Utilization held at TNAU, Coimbatore, April 6-7, 2018.

Popular articles: 1(in bengali)

Leaflet on Ricebean: Important legume forage crop under drought areas of West Bengal

Student(s) guided: M. Sc. (Ag.) in Agronomy – 3 Ph. D. in Agronomy- 3

Courses taught: Agronomy of fodder and forage crops and other courses

FTDs conducted: 25 units (*Rabi*, 2017-18).

TSP activities: 84 tribal farmers of Taaldangra block under Bankura and Bagmundi block of Purulia district of West Bengal were benefitted by different field activities organized under TSP Programme. Agricultural, livestock and fodder & forage cum food related interventions, Tribal farmers' meet cum demonstrations on improved cultivation practices of fodder & forage crops were demonstrated for socio-economic condition uplift of tribal farmers/families under adopted villages under red and laterite zone (western part) of West Bengal. Maize (cv. J1006), *Moringa* seeds, Sorghum sudan, Rice bean (cv. Bidhan Ricebean-1 and Bidhan rice bean-2), Hybrid maize (cv. Disha), Coix (cv. Bidhan Coix-1), Lathyrus (cv. Prateek & Ratan), Toria (cv. B-54), Oats (cv. Kent), Berseem (cv. Wardan and BL-42) seeds, planting materials (cuttings) of Bajra-Napier Hybrid along with r*hizobium* culture, insecticides and fungicides were distributed among selected tribal farmers.

Breeder Seed production programme

- Ricebean (Bidhan Ricebean-1) - 65 kg
- Ricebean (Bidhan Ricebean-2) – 125 kg

Nucleus Seed production programme

- Ricebean (Bidhan Ricebean-1) - 7.6 kg
- Ricebean (Bidhan Ricebean-2) – 8.4 kg

TFL seed production

- Oat (cv. Kent) – 30 kg
- Lathyrus (cv. Ratan: BIO L 212) – 45 kg
- Lathyrus (cv. Prateek) – 60 kg
- Berseem (cv. BL 42) – Very good vegetative growth as green forage

Farmers' Meeting: 2 (Two)

Externally Funded Project: 1 (Private Company)

Ad-hoc Project Funded by ATMA, Govt. of West Bengal: Enhancement of Pulses Production in drought prone areas

Participation in seminar/farmers' meeting etc:

- Farmers and Women Self Help Group (SHGs) Meet on forage production technology with tribal families/farmers at Baghmundi block of Purulia district and Taaldangra block of Bankura district.
- In Short Course training programme on Recent advances in processing technologies for value addition of jute and allied fibres at ICAR-NIRJAFT, from 11th to 20th December, 2017.
- As expert in training programme on improved pulse production under IFAD-ICARDA, BCKV Project on 12th October, 2017 at BCKV, Kalyani.
- As expert in training programme at BCKV, Kalyani on improved rice, oil seed & pulses production on 13th November, 2017
- In interaction cum orientation meeting on the Govt. of West Bengal-ICARDA collaborative project at ICAR-NIRJAFT, Kolkata on 6th November, 2017.
- As resource person in 7th krishi mela at Ramakrishna Mission, Kamarpukur, Hooghly on 17th January, 2018.

Awareness development on 'seed production' of forage crops: Seed production of lathyrus (cv. Prateek and Ratan) and Oats (cv. Kent) by farmers.

Transfer of technology

- Distributed seeds of berseem (cv. BL 42) and lathyrus (cv. Prateekl & Ratan) to farmers for popularizing as an under canopy legume crop in nutrient enrichment and fodder production in the litchi, mango, banana and guava orchards.
- Introduced berseem and oats as green forage crop and grasspea as '*paira'* crop in Taaldangra block area, Bankura district and Baghmundi block of Purulia district.
- Given trainings to the farmers, SHGs of different districts of West Bengal.
- Participated in Agricultural Fair (*Krishi Mela*) at Gayeshpur.
- Distributions of leaflets on forage crops among the farmers.
- Distributed the planting material (cuttings) of BN hybrid (Variety: CO 3 & CO 4) to the resource poor farmers in Bankura, Purulia, Paschim Medinipur, Jhargram, Nadia, North-24 PGS, Cooch Behar, Hooghly and Burdwan districts etc.
- Distributed hybrid maize seed (cv. Nisha 3503) to tribal farmers for baby corn cum green forage/ green cob cum green forage as well as grain cum stover production.
- Act as external examiner of UBKV, Cooch Behar.
- Got *Rizobium* accession number KY609327: *Rizobium* leguminosarum strain BCKV LAMU2 16S-23S ribosomal RNA intergenic spacer, partial sequence
- Act as reviewer Pesticides Research Journal : Journal of Crop and Weed

APPENDIX-III

WEATHER REPORT

The weather report of the AICRP-FCU Coordinating centers, Voluntary centers and Headquarter across the different zones during *Rabi* 2017-18 have been presented in this section. The weather parameters prevalent during 40th Standard Meteorological Week (SMW) (October 01-07, 2017) to 21st SMW (May 21-27, 2018) were taken into consideration, which covers the *Rabi* season, 2017-18 for all the testing/ experimenting locations for trial conduction (Tables M1 to M13) and depicted (Figs. M1 to M3). 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 surveillance of insect-pest and diseases of forage crops.

Temperature

In Hill zone, Srinagar was the coolest location recording -5.8^{0}C during 2nd SMW. Maximum temperature was recorded at Rajouri (36.0^{0}C) during 21st SMW. The mean T_{Min} over the season was recorded lowest at Srinagar (1.6^{0}C). Whereas, the highest mean T_{max} was recorded at Rajouri (25.4^{0}C). In North-East zone, Ranchi centre recorded the lowest minimum temperature (2.0^{0}C) during 2nd SMW. The highest maximum was also recorded at Ranchi (39.0^{0}C) during 21st SMW. The higher mean T_{Max} was recorded at Bhubaneswar (32.4^{0}C) and lowest mean T_{min} was recorded at Imphal (11.9^{0}C). In North-West zone, Hisar recorded lowest minimum temperature (2.6^{0}C) during 2nd SMW, whereas, maximum temperature was recorded at Bikaner (44.8^{0}C) during 21st SMW. The higher mean T_{max} was noted at Bikaner (33.4^{0}C); whereas, lowest mean T_{min} was noted at Hisar (10.9^{0}C). In Central zone, Jabalpur recorded the lowest minimum temperature (3.9^{0}C) during 52nd SMW, whereas the maximum temperature was recorded at Raipur (42.9^{0}C) during 19th SMW. In South zone, the lowest minimum and maximum temperature was recorded at Hyderabad (9.6^{0}C during 51st SMW and 32.2^{0}C during 21st SMW, respectively). The higher mean T_{max} and lower mean T_{min} was also recorded at Hyderabad (32.9 and 16.6 ^{0}C, respectively). Least variation in minimum and maximum temperature was recorded at Vellayani.

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 J & K, Tamil Nadu and Andhra Pradesh as evident from the rainfall data presented in tables (M1 to M13). In Hill zone, Palampur received higher rainfall (382.4 mm) as compared to other centres in the zone. In North-East zone, Jorhat centre received highest rainfall (652.0 mm in 38 rainy days) followed by Imphal (379.2 mm) and lowest being at Kalyani (123.0 mm). In North-West zone, Ludhiana received highest rainfall (112.4 mm) in 7 rainy days followed by Pantnagar (64.4 mm). Bikaner centre received lowest rainfall (13.6mm) in 2 rainy days. In Central zone, maximum rainfall and maximum number of rainy days (119.0 mm, 12 days) was recorded at Raipur followed by Uralikanchan (107.0 mm) and lowest being at Anand (5.4 mm). In South zone, Vellayani received maximum rainfall (1019.6 mm) in 53 rainy days followed by Coimbatore (489.9 mm in 27 days).

Relative Humidity

In Hill zone, higher average RH during morning hours was recorded at Rajouri (85%) and Srinagar (82%) center as compared to Palampur or Almora. In afternoon hours Srinagar centre recorded higher RH followed by Srinagar. In North-East zone, maximum average RH of 95.6 % during morning hours was recorded at Jorhat during followed by Faizabad (90.9%). The average minimum RH during afternoon hours was recorded at Bhubaneswar (42.0 %) and Imphal (49.2 %) respectively. In North-West zone, higher average RH of the season during morning hours was recorded at Hisar (86.3 %) and Pantnagar (85.9 %) and in afternoon also higher RH was recorded at Pantnagar and Hisar. The lowest RH during morning as well as evening hours was recorded at Bikaner (59.3 & 24.2%, respectively). In Central zone, maximum RH in morning hours was recorded at Anand (80.7%) and Jhansi (80.5%). The mean evening RH varied in limited range of 28 to 33% at all the centers in the zone. In South zone, maximum average RH of the season in morning and evening hours (92.3 and 77.5%) was recorded at Vellayani. The lowest average RH (82.7 & 34.4%) in morning and evening hours, respectively, was recorded at Hyderabad. In the tables RH1 and RH2 refers to morning and afternoon RH respectively.

Sunshine hours

In Hill zone, maximum average sunshine hours were recorded at Almora (7.7 hours/ day) and Palampur (7.7) followed by Rajouri (7.1). This indicates the weather was fairly clear at both the stations during the period. In North-West zone, higher average sunshine hours were recorded at Ludhiana and Pantnagar (6.8). Lowest average sunshine hours were recorded at Hisar (5.8) in the zone. In North-East zone, maximum average sunshine hours were recorded at Ranchi (7.7) followed by Bhubaneswar (7.5) and lowest at Jorhat (4.8). In Central zone, maximum average sunshine hours were recorded at Anand (8.8) followed by Raipur (8.1) and lowest at Jabalpur (8.0). In South zone, maximum average sunshine hours were recorded at Hyderabad (8.0) and lowest at Mandya (6.9). It is evident from the above that among all the zones, central zone remained the brightest recording highest number of sunshine hours in a day.

Std. Week No.	Period	Std. Week No.	Period
40	01-07 Oct, 2017	05	29-04 Feb, 2018
41	08-14 Oct, 2017	06	05-11 Feb, 2018
42	15-21 Oct, 2017	07	12-18 Feb, 2018
43	22-28 Oct, 2017	08	19-25 Feb, 2018
44	29-04 Nov, 2017	09	26-04 March, 2018
45	05-11 Nov, 2017	10	05-11 March, 2018
46	12-18 Nov, 2017	11	12-18 March, 2018
47	19-25 Nov, 2017	12	19-25 March, 2018
48	26-02 Dec, 2017	13	26-01 April, 2018
49	03-09 Dec, 2017	14	02-08 April, 2018
50	10-16 Dec, 2017	15	09-15 April,2018
51	17-23 Dec, 2017	16	16-22 April,2018
52	24-31 Dec, 2017	17	23-29 April,2018
01	01-06 Jan, 2018	18	30-06 May, 2018
02	07-14 Jan, 2018	19	07-13 May, 2018
03	15-21 Jan, 2018	20	14-20 May, 2018
04	22-28 Jan, 2018	21	21-27 May, 2018

Table M 1: Meteorological data in Hill zone during crop growth period of Rabi 2017-18

Std. Week no.	PALAMPUR						ALMORA						
	Temperature (C)		Humidity (%)		Rainfall	Sunshine hrs	Temperature (C)		Humidity (%)		Rainfall	No. of Rainy days	Sunshine hrs
	Max.	Min.	RH1	RH2	(mm)		Max.	Min.	RH1	RH2	(mm)		
40	26.6	15.6	84	66	18.6	6.8	30.2	17.6	90.7	62.6	0.0	0	7.2
41	27.8	14.2	70	55	0.0	9.9	30.4	13.0	79.7	53.0	0.0	0	7.8
42	27.4	13.0	66	38	0.0	10.0	29.6	8.2	76.1	56.4	0.0	0	9.2
43	25.2	11.6	64	37	0.0	9.0	26.7	5.5	59.9	40.4	0.0	0	8.6
44	22.8	10.6	74	51	0.0	7.9	25.6	5.7	68.4	36.6	0.0	0	7.6
45	23.7	10.2	77	50	0.0	8.0	26.2	4.9	66.9	30.6	0.0	0	8.5
46	21.0	9.0	75	51	0.1	4.6	24.6	3.9	71.3	29.4	0.0	0	8.3
47	19.8	5.7	68	36	0.0	7.3	23.2	0.9	76.6	27.3	0.0	0	8.0
48	19.7	6.0	69	46	0.0	8.6	23.6	0.4	72.4	29.0	0.0	0	7.6
49	22.8	9.4	70	44	0.0	8.0	21.2	5.3	82.0	51.7	0.0	0	4.4
50	16.4	8.2	84	67	94.6	3.9	22.6	2.7	81.6	33.1	4.5	1	7.0
51	21.6	7.3	60	37	0.0	8.9	24.3	-0.6	71.3	28.3	0.0	0	8.3
52	18.4	5.9	60	46	0.0	5.2	22.3	-1.1	82.9	31.0	0.0	0	8.1
1	16.0	3.1	77	42	0.0	8.1	19.6	-3.4	87.7	42.6	0.0	0	7.3
2	17.4	3.7	64	42	0.0	7.7	22.6	-2.9	97.6	32.1	0.0	0	7.1
3	19.6	5.0	59	35	0.0	8.9	23.1	-2.9	80.9	32.3	0.0	0	8.0
4	16.4	3.1	71	56	9.4	7.6	19.6	0.4	94.3	37.1	14.5	1	7.0
5	20.1	6.3	62	36	0.0	9.2	22.0	-0.2	72.0	27.0	0.0	0	8.4
6	22.6	8.6	56	36	0.0	9.3	21.0	2.4	77.4	44.0	0.0	0	6.5
7	17.7	5.5	77	50	42.8	5.9	21.5	2.5	87.4	41.9	0.0	0	6.5
8	21.1	9.1	67	42	4.6	7.1	23.7	5.0	81.1	31.4	5.0	1	8.2
9	18.7	5.4	67	43	4.6	7.7	25.7	6.0	80.2	32.9	2.5	1	7.8
10	22.6	8.6	56	36	0.0	9.3	25.8	4.1	75.4	28.3	0.0	0	8.5
11	23.9	10.5	48	37	7.6	9.1	25.6	5.5	67.8	24.1	2.0	1	7.8
12	23.2	10.2	57	38	20.4	7.2	26.4	5.4	64.5	30.9	4.0	2	7.2
13	27.0	12.6	51	36	0.0	9.7	29.2	6.8	64.9	32.9	0.0	0	8.8
14	26.5	15.3	67	45	12.6	6.8	26.7	10.9	66.9	43.4	16.3	3	5.8
15	24.2	12.7	68	44	43.2	6.1	24.9	10.6	85.4	50.6	33.0	3	7.8
16	26.4	14.4	47	39	17.0	7.8	29.3	9.4	63.3	32.7	5.0	1	8.2
17	28.5	16.5	49	38	12.2	8.7	30.7	9.6	57.3	30.7	22.0	1	8.9
18	28.3	17.6	56	53	45.8	8.0	28.8	11.6	64.9	45.5	13.0	1	8.0
19	26.9	15.6	63	53	48.9	6.3							
20	29.9	17.0	48	31	0.0	6.6							
Mean/ Total	**22.7**	**9.9**	**64.5**	**44.1**	**382.4**	**7.7**	**25.1**	**4.7**	**75.8**	**37.1**	**121.8**	**16**	**7.7**

Table M 2: Meteorological data in Hill zone during crop growth period of Rabi 2017-18

Std. Week No.	SRINAGAR						RAJOURI					
	Temperature (C)		Humidity (%)		Rainfall (mm)	Sunshine hrs	Temperature (C)		Humidity (%)		Rainfall (mm)	Sunshine hrs
	Max.	Min.	RH1	RH2			Max.	Min.	RH1	RH2		
40	28.7	6.4	85	33	0.0	8.1	31.8	13.7	87	43	0.0	9.5
41	26.7	4.7	75	40	0.0	7.4	32.1	10.3	87	37	0.0	9.2
42	24.9	2.6	71	45	0.0	6.7	31.5	8.3	88	31	0.0	8.9
43	23.3	1.6	74	51	0.0	7.4	29.3	7.1	86	28	0.0	8.6
44	22.6	1.0	85	52	0.0	6.0	26.1	7.0	85	39	0.0	6.9
45	21.1	0.1	81	53	0.0	3.9	25.7	7.0	86	36	0.0	6.5
46	13.4	-0.1	84	64	6.6	1.8	20.9	5.9	87	43	15.2	3.1
47	11.6	-2.4	88	62	9.0	2.4	23.0	4.3	87	39	0.0	7.3
48	13.9	-2.5	84	58	0.0	1.6	23.3	2.6	88	35	0.0	7.4
49	14.3	-4.3	86	50	0.0	4.5	22.7	1.7	85	30	0.0	7.0
50	6.6	-1.0	93	81	43.2	1.3	15.3	3.7	90	59	56.6	3.4
51	8.1	-1.4	87	76	6.7	1.8	22.3	3.1	90	33	0.0	7.0
52	10.4	-3.7	89	69	0.0	2.8	21.6	2.0	88	36	0.0	6.2
1	9.2	-4.9	93	60	1.0	4.0	19.4	1.1	90	34	0.0	7.0
2	10.5	-5.8	91	49	0.0	3.7	21.8	-0.6	92	27	0.0	7.7
3	12.1	-5.0	93	51	0.0	4.7	21.9	0.2	91	31	0.0	7.0
4	11.7	-5.7	94	41	0.0	5.1	19.0	-0.4	93	40	0.0	7.1
5	11.9	-1.3	93	49	6.2	2.8	22.6	3.1	86	29	0.0	6.5
6	14.4	-3.7	89	31	0.0	5.8	21.1	1.2	89	29	0.0	7.9
7	7.6	-0.5	89	73	32.3	1.7	20.3	3.9	88	38	47.8	6.4
8	12.8	0.5	89	42	14.3	3.2	20.2	6.1	84	29	12.6	5.4
9	13.3	3.7	89	66	21.8	1.1	21.6	8.7	87	43	6.8	3.4
10	17.6	0.8	87	40	0.0	6.4	24.9	6.8	83	32	2.4	7.5
11	15.7	3.1	80	55	20.6	4.3	25.2	8.5	84	35	0.0	7.8
12	20.2	3.8	64	39	0.0	5.8	25.3	8.6	81	40	1.4	6.4
13	25.4	5.0	57	19	0.0	8.8	31.0	9.5	83	31	0.0	8.8
14	22.9	7.7	78	43	4.0	4.7	28.3	11.4	83	43	8.2	6.2
15	18.1	7.3	85	57	75.3	5.4	28.1	10.7	87	44	19.8	7.8
16	16.3	6.4	84	66	81.0	3.5	26.2	11.6	88	55	22.6	5.8
17	26.3	6.4	66	45	0.0	10.0	33.4	11.7	83	25	0.0	10.0
18	23.8	8.9	75	54	2.8	6.3	31.3	14.8	80	34	0.0	5.2
19	23.0	8.6	75	60	38.8	6.0	29.2	14.2	83	40	20.8	6.4
20	21.7	9.7	77	63	9.2	5.4	31.9	16.1	75	26	0.0	8.1
21	28.1	8.0	60	37	0.0	10.4	36.0	15.8	69	18	0.0	11.8
Mean/ Total	**17.3**	**1.6**	**82.1**	**52.2**	**372.8**	**4.9**	**25.4**	**7.1**	**85.8**	**35.6**	**214.2**	**7.1**

Table M 3: Meteorological data in North West zone during crop growth period of Rabi 2017-18

Std. Week No.	HISAR						BIKANER					
	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	36.6	19.3	81	28	0.0	8.2	39.4	21.0	53.4	20.4	0	0.0
41	35.3	18.8	89	30	0.0	6.8	39.8	19.9	51.6	16.7	0	0.0
42	35.7	16.2	91	25	0.0	7.6	40.2	16.8	44.7	23.4	0	0.0
43	33.8	15.5	84	26	0.0	5.9	36.8	16.9	47.1	21.9	0	0.0
44	31.0	15.3	88	43	0.0	2.2	35.6	15.4	51.0	20.9	0	0.0
45	29.8	12.7	99	46	0.0	1.6	33.4	13.6	78.1	24.0	0	0.0
46	25.0	13.7	90	51	0.0	0.3	27.4	12.4	81.0	41.4	0	1.4
47	24.7	6.4	82	28	0.0	6.2	27.2	6.9	68.6	23.4	0	0.0
48	26.8	6.7	87	24	0.0	6.6	30.5	9.8	55.7	22.7	0	0.0
49	23.1	6.8	84	33	0.0	4.2	27.8	7.9	54.9	26.3	0	0.0
50	16.9	7.4	92	61	3.8	3.1	20.5	7.1	81.3	46.1	0	2.0
51	22.4	6.0	88	42	0.0	6.3	26.1	4.9	81.4	27.4	0	0.0
52	23.4	4.5	97	42	0.0	6.5	26.2	5.3	76.8	27.9	0	0.0
1	17.5	4.0	100	56	0.0	3.8	23.6	3.8	82.4	29.0	0	0.0
2	21.9	2.6	94	43	0.0	6.9	25.8	5.0	74.1	26.3	0	0.0
3	22.9	5.0	94	48	0.0	6.9	26.1	6.0	78.3	29.9	0	0.0
4	18.2	7.2	97	75	10.9	3.8	24.4	5.5	81.6	35.4	0	0.0
5	22.9	5.7	97	60	0.0	6.9	27.6	7.7	69.7	25.3	0	0.0
6	22.0	4.7	86	67	0.0	7.0	26.6	7.9	55.3	20.4	0	0.0
7	22.8	8.1	93	54	1.2	5.7	28.1	9.3	82.0	33.1	0	0.0
8	27.9	10.6	90	44	0.0	6.5	32.6	13.7	73.9	30.4	0	0.0
9	28.1	12.1	91	47	0.0	5.9	32.8	15.4	69.7	28.0	0	0.6
10	28.9	10.5	86	36	0.0	7.2	34.0	14.2	61.3	20.4	0	0.0
11	31.8	12.7	80	31	0.0	7.3	35.0	16.9	55.6	17.7	0	0.8
12	29.8	12.5	82	42	0.0	6.7	33.6	16.4	58.6	23.1	0	0.0
13	34.7	13.8	73	27	0.0	7.8	40.7	19.5	35.9	12.0	0	0.0
14	35.7	19.8	61	33	0.0	5.4	39.9	21.4	46.3	19.9	1	3.2
15	33.7	18.0	72	39	14.0	7.0	38.9	22.2	47.4	21.7	0	0.0
16	37.6	19.4	56	31	0.0	8.3	37.6	21.5	44.3	18.7	0	0.0
17							43.5	21.6	28.4	14.1	0	0.0
18							43.7	26.8	37.6	18.9	0	0.0
19							41.8	25.9	45.6	23.3	1	5.6
20							43.2	27.4	37.3	18.9	0	0.0
21							44.8	25.8	24.0	13.1	0	0.0
Mean/ Total	**27.6**	**10.9**	**86.3**	**41.8**	**29.9**	**5.8**	**33.4**	**14.5**	**59.3**	**24.2**	**2**	**13.6**

Table M 4: Meteorological data in North West zone during crop growth period of Rabi 2017-18

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	34.9	21.0	86	38	0	0.0	9.9	33.1	23.8	88	61	0	0.0	5.2
41	34.4	21.1	91	43	0	0.0	7.1	33.6	20.3	78	48	0	0.0	8.3
42	34.3	17.3	90	32	0	0.0	8.3	33.5	18.0	86	50	0	0.0	9.0
43	31.3	16.2	87	36	0	0.0	4.8	30.8	14.5	87	46	0	0.0	7.9
44	28.0	15.3	91	53	0	0.0	0.0	28.4	14.7	90	53	0	0.0	4.4
45	26.1	14.1	96	57	0	0.0	1.7	28.7	12.8	94	52	0	0.0	4.8
46	22.3	12.9	90	60	1	7.0	1.3	27.9	11.3	86	40	0	0.0	6.9
47	23.9	7.4	94	29	0	0.0	7.9	26.1	8.6	93	43	0	0.0	7.3
48	24.7	11.5	93	47	1	7.0	3.8	24.7	7.8	92	48	0	0.0	7.1
49	22.7	7.3	87	30	0	0.0	6.2	23.3	10.9	93	60	0	0.0	3.7
50	17.1	9.3	90	70	1	24.0	3.4	23.1	11.4	94	66	1	2.8	5.0
51	21.9	7.4	91	47	0	0.0	7.9	21.3	8.3	95	64	0	0.0	5.6
52	20.7	6.3	96	49	0	0.0	4.9	22.5	7.2	96	66	0	0.0	6.2
1	15.9	5.4	96	66	0	0.0	2.6	15.2	6.0	95	81	0	0.0	2.5
2	20.8	5.3	94	43	0	0.0	7.6	12.9	5.3	95	79	0	0.0	1.2
3	22.0	6.1	92	40	0	0.0	7.7	20.2	4.2	93	65	0	0.0	5.5
4	15.5	7.6	93	76	1	18.4	3.6	18.6	6.4	94	70	1	6.8	3.6
5	21.2	7.6	91	46	0	0.0	8.1	20.6	6.9	94	60	0	0.0	5.8
6	21.1	5.6	89	38	0	2.4	8.0	23.2	5.6	95	50	0	0.0	6.4
7	21.1	9.3	89	53	1	21.4	7.4	23.0	9.2	93	61	1	4.0	6.1
8	25.5	11.7	88	48	0	3.2	7.5	26.9	11.5	89	51	0	0.0	7.7
9	25.8	13.1	89	51	0	0.0	6.5	28.7	11.5	91	44	0	0.0	7.5
10	27.2	12.2	88	42	0	0.0	10.4	29.5	10.7	92	39	0	0.0	8.8
11	29.9	14.1	85	30	0	0.0	10.0	31.1	11.8	81	44	0	0.0	8.5
12	29.2	14.2	86	44	0	0.0	7.8	31.9	12.7	83	40	0	0.0	9.0
13	33.1	16.5	74	29	0	0.0	10.1	33.6	14.5	78	47	0	0.0	8.2
14	34.8	20.3	69	33	0	0.0	5.9	33.4	18.7	78	52	1	29.2	8.0
15	33.1	18.0	73	32	1	10.0	7.4	31.3	16.2	81	49	1	13.0	6.4
16	35.4	19.5	58	24	0	0.0	9.7	37.2	17.2	73	19	0	0.0	9.4
17	39.6	21.5	45	19	0	0.0	11.0	36.2	19.5	65	36	0	0.0	9.2
18	36.5	24.3	56	28	1	15.4	6.7	35.1	21.9	69	40	1	2.8	9.0
19	38.4	23.2	55	23	0	3.6	9.0	37.0	21.1	67	32	0	0.0	8.4
20	38.4	23.3	51	23	0	0.0	6.2	35.6	23.1	76	52	1	5.8	8.4
21	42.1	23.7	33	9	0	0.0	10.0	39.7	22.5	65	34	0	0.0	9.3
Mean/ Total	**27.9**	**13.8**	**81.6**	**40.8**	**7**	**112.4**	**6.8**	**28.2**	**13.1**	**85.9**	**51.2**	**7**	**64.4**	**6.8**

Table M 5: Meteorological data in Central zone during crop growth period of Rabi 2017-18

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			Max.	Min.	RH1	RH2		
40	33.9	22.9	75	1	10.2	34.7	23.7	86	48	0	0.0
41	30.6	23.0	93	4	89.0	36.1	20.4	83	48	0	0.0
42	33.0	22.0	77	0	0.0	36.3	15.4	83	50	0	0.0
43	32.7	19.7	67	0	0.0	35.5	15.4	81	49	0	0.0
44	30.8	16.7	56	0	0.0	33.0	12.8	82	46	0	0.0
45	30.4	16.2	64	0	0.0	31.1	13.0	87	45	0	0.0
46	30.5	15.1	64	0	0.0	29.4	11.4	88	48	0	0.0
47	31.1	18.6	74	1	7.8	26.3	9.9	86	49	0	0.0
48	29.5	14.7	63	0	0.0	28.2	7.5	85	45	0	0.0
49	28.7	19.4	67	0	0.0	25.4	9.4	89	53	0	1.2
50	29.9	17.3	63	0	0.0	24.1	10.0	90	68	0	0.0
51	28.8	15.4	43	0	0.0	23.8	8.9	90	69	0	0.0
52	29.2	14.1	48	0	0.0	24.4	5.3	92	77	0	0.0
1	16.2	28.9	65	0	0.0	19.8	5.0	92	77	0	0.0
2	13.4	27.2	64	0	0.0	22.3	5.3	88	71	0	0.0
3	16.2	30.5	58	0	0.0	25.0	6.2	88	61	0	0.0
4	13.8	29.9	58	0	0.0	23.6	5.7	90	65	0	0.0
5	23.6	22.4	56	0	0.0	27.5	8.7	85	54	0	0.0
6	30.1	17.9	61	0	0.0	23.1	8.1	86	67	0	0.0
7	30.9	18.6	63	0	0.0	24.5	10.3	87	67	1	0.0
8	32.8	19.7	56	0	0.0	31.4	11.9	79	45	0	0.0
9	34.0	20.8	53	0	0.0	34.7	13.3	78	44	0	0.0
10	34.4	22.6	55	0	0.0	35.5	13.0	82	50	0	0.0
11	32.4	22.4	53	0	0.0	34.5	14.0	84	41	0	0.0
12	34.4	21.0	53	0	0.0	34.2	15.1	79	43	0	0.8
13	36.5	22.8	52	0	0.0	37.6	15.2	69	40	0	0.0
14	36.1	24.6	52	0	0.0	38.8	18.5	74	41	1	6.6
15	36.0	22.9	50	0	0.0	36.4	20.0	76	42	0	0.8
16	36.9	25.6	54	0	0.0	40.1	21.9	64	37	0	0.0
17	37.4	23.8	48	0	0.0	40.4	20.8	57	36	0	1.8
18	38.5	23.9	26	0	0.0	41.3	24.9	63	37	0	0.0
19	38.7	25.0	22	0	0.0	**42.2**	25.0	56	35	0	0.0
20	38.4	25.4	25	0	0.0	42.2	23.8	**58**	36	1	7.0
21	37.4	25.9	26	0	0.0						
Mean/ Total	**30.8**	**21.7**	**56**	**6**	**107.0**	**31.6**	**13.6**	**80.5**	**51**	**3**	**18.2**

Table M 6: Meteorological data in Central zone during crop growth period of Rabi 2017-18

Std. Week No.	ANAND						RAHURI					
	Temperature (C)		Humidity (%)		Rainfall	Sunshine hrs	Temperature (C)		Humidity (%)		No. of Rainy	Rainfall
	Max.	Min.	RH1	RH2	(mm)		Max.	Min.	RH1	RH2	days	(mm)
40	36.7	22.3	84	44	0	9.4	33.9	21.5	70	43	-	0.0
41	35.5	23.1	91	49	0	6.5	31.2	22.5	84	64	3	49.4
42	37.3	19.2	93	39	0	9.5	32.8	20.6	65	50	-	0.0
43	36.1	16.8	91	30	0	9.6	32.7	16.9	61	36	-	0.0
44	35.9	14.8	90	25	0	9.4	31.4	13.8	53	29	-	0.0
45	34.6	15.5	85	30	0	9.3	30.3	13.3	63	36	-	0.0
46	32.4	13.2	91	34	0	8.4	30.0	12.2	66	34	-	0.0
47	30.7	14.6	84	41	0	8.3	30.2	16.6	74	25	-	0.0
48	31.9	12.5	88	31	0	9.3	29.8	11.4	66	34	-	0.0
49	24.9	16.1	86	65	5.4	2.7	28.5	17.6	71	49	-	0.0
50	28.7	13.9	87	45	0	6.7	29.8	14.6	73	39	-	0.0
51	27.2	14.3	71	42	0	4.4	28.2	10.8	70	31	-	0.0
52	25.2	8.5	78	31	0	8.0	28.8	9.4	59	31	-	0.0
1	27.2	9.4	87	40	0	8.7	28.4	10.6	67	36	-	0.0
2	27.5	13.2	77	40	0	6.2	28.1	12.2	63	35	-	0.0
3	31.2	12.3	85	37	0	9.3	29.9	12.8	70	32	-	0.0
4	29.0	8.8	92	35	0	9.4	28.4	9.5	55	27	-	0.0
5	31.6	10.6	90	31	0	9.6	30.3	10.6	59	21	-	0.0
6	29.2	12.2	88	38	0	7.0	31.2	13.8	53	23	-	0.0
7	30.8	12.3	81	31	0	9.5	30.4	13.5	66	34	-	0.0
8	34.4	14.1	86	30	0	9.3	33.7	15.0	53	24	-	0.0
9	35.9	16.4	79	25	0	9.0	34.6	17.0	49	20	-	0.0
10	36.0	15.7	78	26	0	9.1	34.6	18.2	44	20	-	0.0
11	36.3	16.7	63	18	0	9.6	33.1	18.9	48	25	-	0.0
12	35.7	17.6	60	22	0	8.7	35.0	16.4	44	19	-	0.0
13	40.3	17.3	83	18	0	9.9	37.6	18.0	40	15	-	0.0
14	39.3	20.8	59	22	0	9.4	37.5	19.8	40	19	-	0.0
15	39.2	21.6	86	29	0	9.6	37.2	20.0	44	19	-	0.0
16	40.3	21.3	60	20	0	10.6	39.3	22.3	41	21	-	1.0
17	40.5	20.8	58	21	0	11.3	39.4	19.7	30	13	-	0.0
18	40.5	24.7	89	33	0	10.7	40.6	21.0	36	17	-	0.0
19	41.2	24.9	67	31	0	11.0	40.2	24.2	32	18	-	0.0
20	41.6	25.4	81	28	0	9.8	39.8	24.3	36	19	-	0.0
21	42.3	26.0	75	23	0	10.5	38.8	25.2	40	20	-	0.0
Mean/ Total	**34.3**	**16.7**	**80.7**	**32.5**	**5.4**	**8.8**	**33.1**	**16.6**	**55.4**	**28.8**	**3**	**50.4**

Table M 7: Meteorological data in Central zone during crop growth period of Rabi 2017-18

Std. Week No.	JABALPUR						RAIPUR						
	Temperature (C)		Humidity (%)		Rainfall (mm)	Sunshine hrs	Temperature (C)		Humidity (%)		No. of Rainy days	Rainfall (mm)	Sunshine hrs
	Max.	Min.	RH1	RH2			Max.	Min.	RH1	RH2			
40	33.4	20.3	90	51	7.4	8.9	31.8	24.7	93	72	2	34.2	5.2
41	32.6	21.7	92	56	9.2	8.4	31.9	24.9	95	70	1	9.6	4.8
42	33.6	17.9	87	40	0.0	8.8	33.5	23.1	89	45	1	6.6	7.7
43	33.1	15.9	81	26	0.0	8.9	33.2	22.7	86	44	0	0.0	7.9
44	31.1	12.2	87	29	0.0	8.4	31.2	18.5	87	39	0	0.0	7.8
45	30.0	10.2	86	27	0.0	8.8	30.3	16.3	90	34	0	0.0	9.0
46	28.9	11.9	87	42	0.0	7.2	28.5	18.3	88	55	0	1.0	5.2
47	27.6	10.1	86	31	0.0	5.9	30.3	17.5	82	38	0	0.0	6.9
48	28.1	5.1	82	21	0.0	8.6	29.7	12.0	84	26	0	0.0	8.8
49	26.7	8.1	80	30	0.0	6.7	28.5	13.0	85	30	0	0.0	8.5
50	27.5	9.0	88	35	0.0	6.6	29.8	12.3	85	29	0	0.0	8.5
51	24.8	5.5	88	32	0.0	4.2	28.8	11.1	86	29	0	0.0	7.9
52	25.2	3.9	86	28	0.0	7.3	28.3	9.5	85	26	0	0.0	8.7
1	28.8	9.7	87	30	0.0	7.8	27.4	10.0	82	26	0	0.0	7.8
2	24.7	12.6	88	29	0.0	9.1	28.2	10.1	80	23	0	0.0	8.9
3	28.4	10.5	88	30	0.0	9.3	29.5	9.9	85	22	0	0.0	9.3
4	31.0	12.7	86	25	0.0	9.2	28.6	10.2	83	25	0	0.0	8.5
5	26.7	6.8	85	28	0.0	9.8	30.8	11.0	80	17	0	0.0	9.8
6	26.6	12.4	81	52	0.0	5.4	31.3	16.2	78	34	0	0.0	6.3
7	25.2	11.5	91	45	18.0	6.4	28.4	14.5	89	41	3	16.4	7.9
8	31.2	12.5	80	28	0.0	9.8	33.5	15.7	78	22	0	0.0	9.5
9	32.4	14.0	79	26	15.0	8.9	35.5	17.2	76	22	0	0.0	9.4
10	30.9	14.1	75	33	1.0	6.9	34.7	19.6	65	22	0	0.0	7.4
11	33.3	15.4	74	30	0.8	7.4	34.3	20.3	73	33	0	1.2	6.3
12	34.4	14.7	64	20	17.0	8.4	37.5	20.1	54	16	0	0.0	8.8
13	37.0	13.5	54	18	0.0	9.0	39.2	19.8	58	15	0	0.0	9.1
14	38.0	18.1	56	22	0.0	7.5	38.3	21.8	68	23	3	21.6	7.7
15	37.0	20.6	67	40	0.0	7.4	37.0	23.4	68	28	1	17.8	7.5
16	39.3	20.3	53	18	0.0	9.4	40.3	24.2	64	19	0	2.0	10.4
17	39.5	18.5	51	15	0.0	9.7	41.0	24.8	47	19	0	0.0	9.6
18	40.7	24.0	46	25	0.0	8.5	41.2	26.2	60	24	1	2.8	9.9
19	41.1	26.5	39	24	0.0	9.2	42.9	28.2	49	20	0	5.8	9.3
20	41.7	26.5	49	29	3.2	6.7							
21	42.6	28.6	50	33	0.0	7.5							
Mean/ Total	**32.2**	**14.6**	**75.4**	**30.8**	**71.6**	**8.0**	**33.0**	**17.7**	**77.3**	**30.9**	**12.0**	**119.0**	**8.1**

Table M 8: Meteorological data in North East zone during crop growth period of Rabi 2017-18

Std. Week No.	JORHAT							RANCHI					
	Temperature (C)		Humidity (%)		No. of Rainy days	Rainfall (mm)	Sunshine hrs	Temperature (C)		Humidity (%)		Rainfall (mm)	Sunshine hrs
	Max.	Min.	RH1	RH2				Max.	Min.	RH1	RH2		
40	33.4	24.5	95	76	3	52.8	7.1	29.9	21.5	86	70	53.0	3.2
41	33.6	25.0	94	73	1	45.8	5.4	29.5	21.6	86	68	2.0	2.1
42	31.3	23.2	97	80	2	30.2	3.7	28.5	16.7	86	70	27.6	6.8
43	27.6	20.3	97	79	2	57.0	4.9	29.6	15.3	84	69	0.0	6.9
44	28.1	18.5	93	74	1	7.0	7.1	27.1	13.1	84	66	0.0	8.5
45	30.1	16.2	93	65	0	0.0	9.2	26.4	11.5	85	66	0.0	9.3
46	28.2	16.3	96	67	0	0.3	5.8	24.9	12.8	84	68	2.0	4.3
47	28.7	17.1	97	68	1	7.0	7.4	25.0	9.2	87	68	0.0	9.0
48	26.0	13.6	99	70	1	7.4	6.6	24.2	5.4	85	68	0.0	9.3
49	26.5	11.2	99	66	0	0.0	6.3	24.1	6.1	86	67	0.0	8.7
50	25.7	16.5	98	77	0	0.0	1.3	25.3	10.4	85	68	0.0	6.5
51	25.2	12.5	100	68	0	0.0	5.5	24.0	4.9	85	68	0.0	8.5
52	25.8	11.1	100	65	0	0.0	7.3	23.7	5.2	85	69	0.0	10.1
1	23.7	11.8	98	73	0	0.5	4.6	22.5	2.7	83	67	0.0	8.8
2	23.2	8.9	98	65	0	0.0	6.9	20.0	2.0	85	67	0.0	8.9
3	25.2	11.8	99	67	0	0.0	4.8	23.3	4.3	85	66	0.0	9.2
4	24.1	12.5	98	73	0	2.2	3.2	26.5	6.2	86	52	0.0	8.6
5	22.6	12.2	98	72	0	1.0	1.3	26.9	6.8	85	36	0.0	9.0
6	22.5	13.2	99	73	0	1.4	2.1	27.3	8.7	86	36	0.0	7.0
7	26.7	11.6	95	55	1	10.7	7.3	26.8	10.5	87	36	4.2	7.2
8	26.4	14.5	96	63	0	4.3	3.2	28.8	11.8	86	35	0.0	9.3
9	23.7	15.6	97	79	3	56.3	1.5	29.7	12.6	86	36	0.0	8.7
10	27.4	15.2	94	60	1	3.2	2.5	30.5	13.6	84	36	0.0	8.0
11	26.9	15.8	95	66	2	13.8	2.4	30.9	16.1	84	36	0.0	6.9
12	28.0	15.5	95	60	1	11.3	4.7	31.7	16.2	86	34	0.0	7.9
13	28.7	17.5	93	57	0	3.1	5.5	34.2	15.7	85	36	0.0	8.5
14	31.5	18.4	92	56	1	20.1	4.5	29.1	14.1	86	36	8.5	7.5
15	28.2	19.2	96	69	4	37.6	3.8	29.2	15.5	86	38	18.6	6.5
16	29.1	19.9	93	69	3	43.0	3.7	35.2	19.7	84	35	0.0	7.8
17	30.4	20.0	85	66	1	11.1	5.9	37.4	21.1	85	39	0.0	8.5
18	28.6	20.5	93	72	2	39.7	3.1	33.9	20.2	85	41	3.2	6.7
19	28.1	21.2	96	77	3	25.5	2.8	39.0	22.7	85	41	5.2	8.9
20	32.0	22.1	90	64	2	73.4	7.1	37.6	22.9	84	40	0.0	5.3
21	33.2	24.1	91	72	3	86.3	3.7	39.0	22.7	86	45	4.3	8.7
Mean/ Total	**27.7**	**16.7**	**95.6**	**68.7**	**38**	**652**	**4.8**	**28.9**	**12.9**	**85.2**	**52.2**	**128.6**	**7.7**

Table M 9: Meteorological data in North East zone during crop growth period of Rabi 2017-18

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	30.4	21.0	90	71	21.7	4	6.9	32.5	25.9	95	90	6	44.6	3.5
41	29.6	20.8	92	74	21.8	5	4.1	35.1	26.6	96	69	4	32.2	6.3
42	26.8	19.1	95	72	99.4	4	3.1	35.0	27.1	94	72	2	17.5	6.2
43	23.7	15.0	94	63	86.7	3	4.3	33.6	26.6	96	76	5	26.7	4.6
44	27.4	13.6	95	44	0.0	0	9.4	33.9	26.7	96	75	7	59.6	3.3
45	27.3	12.9	93	50	0.0	0	8.2	33.1	25.3	98	81	4	36.3	5.2
46	26.7	16.2	95	61	7.5	3	6.4	32.4	25.5	98	79	6	84.9	5.1
47	25.6	11.6	90	81	0.0	0	8.8	31.9	25.5	95	77	3	99.6	5.5
48	23.4	7.8	94	48	0.0	0	9.1	32.0	22.7	99	69	2	16.9	7.0
49	20.7	13.5	96	77	116.3	4	2.8	30.2	20.2	95	62	--	0.0	7.4
50	22.0	9.8	93	61	0.0	0	7.3	31.8	19.9	94	54	--	0.0	9.7
51	22.8	8.8	93	54	0.0	0	7.0	28.0	20.4	95	76	4	37.0	3.5
52								28.5	16.1	92	52	--	0.0	8.7
1	22.7	8.8	94	54	7.8	1	4.6	23.2	9.3	93	52	--	0.0	6.9
2	20.8	5.6	92	49	0.0	0	8.3	21.5	7.3	91	54	--	0.0	4.2
3	22.1	6.5	91	45	0.0	0	6.6	25.0	8.5	91	46	--	0.0	7.1
4	23.8	6.8	87	47	0.0	0	9.1	26.4	9.8	89	42	--	0.0	7.8
5	21.0	5.4	85	45	0.0	0	8.1	28.3	11.3	91	45	--	0.0	6.8
6	22.6	8.9	86	45	0.0	0	6.0	29.4	17.2	89	44	--	0.0	5.0
7	25.4	9.5	89	42	0.0	0	7.2	29.4	14.0	88	43	--	0.0	8.4
8	25.8	7.8	91	45	0.0	0	8.6	33.4	17.6	91	44	--	0.0	5.7
9	25.4	9.6	86	47	10.6	1	6.5	34.8	19.9	91	35	--	0.0	6.3
10	27.1	12.3	82	36	0.0	0	8.5	34.4	18.2	84	30	--	0.0	9.0
11	25.6	9.7	88	42	27.6	1	7.5	35.3	20.9	89	39	2	0.3	6.9
12	26.4	13.2	91	50	28.6	3	6.1	35.5	22.0	92	44	1	0.2	5.5
13	28.7	13.1	90	37	6.5	1	6.7	34.6	24.3	92	56	1	1.0	5.5
14	28.8	13.5	83	39	7.5	2	7.2	33.9	21.9	91	51	2	6.6	6.5
15	27.5	15.4	85	53	23.6	3	5.2	34.8	22.1	90	55	2	36.1	8.7
16	28.1	15.8	89	51	16.8	3	6.1	37.1	25.9	92	54	2	8.6	8.1
17	27.5	16.8	88	56	22.7	3	5.1	36.2	24.2	85	50	1	0.2	7.6
18	26.9	16.2	89	59	32.0	3	4.6	34.1	24.7	91	64	1	30.4	7.4
19	25.6	18.0	94	71	138.2	7	2.7	36.0	25.7	91	62	3	6.0	6.6
20	26.2	17.0	90	63	56.6	5	5.2	33.7	23.9	92	64	2	15.4	5.6
21	29.7	20.5	83	57	0.7	1	6.7	35.2	26.4	90	64	1	18.2	6.1
Mean/ Total	**25.6**	**11.9**	**88.2**	**49.2**	**379.2**	**34**	**6.5**	**32.0**	**18.8**	**90.2**	**49.5**	**18**	**123**	**6.4**

Table M 10: Meteorological data in North East zone during crop growth period of Rabi 2017-18

Std. Week No.	BHUBANESWAR							FAIZABAD				
	Temperature (C)		Humidity (%)		Rainy days	Rainfall (mm)	Sunshine hrs	Temperature (C)		Humidity (%)		Sunshine hrs
	Max.	Min.	RH1	RH2				Max.	Min.	RH1	RH2	
40								33.5	24.8	93	66	6.8
41								33.0	33.9	92	66	7.0
42								33.7	21.4	92	91	7.6
43								32.7	16.7	94	41	6.5
44	31.1	20.6	90	62	0	0.0	8.2	29.9	17.0	95	56	5.0
45	31.4	19.5	86	52	0	0.0	9.3	29.2	15.3	94	53	4.3
46	27.3	20.7	87	66	4	55.2	3.5	29.3	13.9	91	42	4.5
47	29.6	18.7	91	56	0	0.0	6.5	26.8	11.9	86	46	5.6
48	29.4	13.9	92	40	0	0.0	8.4	25.9	8.1	87	39	5.6
49	27.1	14.0	88	49	1	36.3	5.6	26.1	9.8	91	42	5.7
50	29.5	18.3	94	59	0	0.0	6.3	25.5	10.1	95	44	5.5
51	28.0	13.6	92	43	0	0.0	7.8	23.3	8.1	95	61	3.9
52	28.0	12.5	93	43	0	0.0	7.8	19.4	8.4	97	74	2.2
1	26.5	12.6	91	38	0	0.0	6.6	15.1	4.7	98	71	0.6
2	28.0	11.2	91	34	0	0.0	7.0	13.8	5.2	98	78	0.5
3	27.6	11.0	95	35	0	0.0	7.8	21.8	4.8	98	50	4.1
4	29.1	13.4	93	35	0	0.0	7.2	21.3	5.9	97	53	4.1
5	31.1	12.0	91	24	0	0.0	8.9	24.3	7.2	95	45	4.7
6	33.5	17.1	93	31	0	0.0	7.7	34.3	8.1	87	35	4.6
7	31.6	15.0	90	33	0	0.0	7.8	24.7	10.7	92	53	3.5
8	35.2	16.5	94	29	0	0.0	8.8	28.7	11.8	89	44	6.5
9	37.4	19.6	93	27	0	0.0	8.5	30.1	14.1	92	42	6.6
10	36.4	20.4	89	31	0	0.0	7.2	31.1	12.3	91	39	6.6
11	36.3	21.3	91	27	0	0.0	5.3	32.8	13.7	82	35	7.1
12	37.6	23.2	94	34	0	0.0	6.9	34.2	14.2	83	26	7.1
13	36.9	25.5	90	48	0	0.0	6.0	35.2	15.5	85	24	7.3
14	35.3	22.6	87	52	3	26.7	7.5	35.3	18.7	81	35	7.4
15	36.5	24.0	86	48	3	10.3	8.4	34.4	18.3	74	32	7.1
16	39.2	26.8	85	42	0	0.0	9.3					
17	38.5	25.3	89	43	2	6.9	9.0					
18	35.4	24.3	89	52	2	34.0	9.0					
Mean/ Total	**32.4**	**18.3**	**90.5**	**42**	**15**	**169.4**	**7.5**	**28.1**	**13**	**90.9**	**49.4**	**5.3**

Table M 11: Meteorological data in South zone during crop growth period of Rabi 2017-18

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	30.1	21.8	98	69	3	153.4	2.9	31.7	25.1	91.9	78.6	4	63.2	8.6
41	30.7	21.4	99	67	4	111.0	5.2	31.4	24.8	93.7	85.1	4	68.6	7.3
42	31.6	19.6	95	48	1	100.4	6.4	30.7	24.6	95.6	89.1	5	48.1	5.6
43	31.0	19.9	95	53	1	13.4	6.5	31.0	24.9	95.9	85.1	1	21.7	8.0
44	30.1	15.1	91	39	0	0.0	9.0	30.6	24.8	94.6	86.9	3	21.0	5.2
45	29.9	14.9	90	43	0	0.0	9.2	30.6	24.4	96.4	85.3	5	104.0	5.3
46	30.0	15.0	87	51	0	0.0	7.7	31.6	24.1	94.3	74.1	-	-	8.2
47	31.3	17.9	91	45	0	0.0	7.5	31.1	23.9	94.0	80.7	1	45.3	4.8
48	30.1	11.1	86	35	0	0.0	8.2	29.5	22.5	97.1	92.0	5	205.9	1.1
49	28.3	14.4	91	41	0	0.0	7.5	31.3	23.2	95.1	77.4	1	9.4	8.0
50	30.2	11.7	89	30	0	0.0	9.0	31.4	24.1	95.1	78.9	-	0.9	5.7
51	28.1	9.6	90	32	0	0.0	8.4	32.3	23.8	94.3	74.1	-	-	8.8
52	28.3	8.6	86	32	0	0.0	8.9	32.6	23.7	93.3	74.1	-	-	9.4
1	29.0	11.1	86	32	0	0.0	8.4	31.8	22.1	94.1	72.4	-	-	9.2
2	29.2	12.0	88	36	0	0.0	8.5	31.3	21.7	93.4	79.8	-	-	8.2
3	30.1	10.2	83	27	0	0.0	8.7	32.2	21.6	93.7	73.3	-	-	8.8
4	29.2	10.9	87	28	0	0.0	8.9	31.7	21.5	93.7	71.1	-	-	7.7
5	30.4	9.1	82	19	0	0.0	9.7	31.6	22.8	92.7	72.6	-	-	9.1
6	30.5	13.1	84	27	0	0.0	6.9	32.4	24.2	94.6	74.4	-	-	9.0
7	30.9	14.3	83	28	0	0.0	8.4	32.6	23.6	93.9	75.6	-	-	9.1
8	32.9	14.3	80	22	0	0.0	9.5	32.4	23.0	92.1	77.9	4	63.8	9.1
9	34.6	13.5	68	18	0	0.0	9.7	33.5	24.0	90.4	73.7	-	-	9.6
10	36.3	15.6	72	15	0	0.0	8.4	32.9	24.1	93.9	74.0	2	62.6	8.9
11	34.0	18.9	77	27	0	2.0	5.7	33.3	24.5	92.3	76.4	1	5.9	7.9
12	36.4	17.7	75	22	0	0.0	8.0	33.6	25.0	90.1	74.9	1	5.3	9.0
13	37.8	19.9	77	26	0	0.0	7.9	33.9	25.6	88.4	74.0	-	-	9.3
14	36.6	19.3	88	30	2	21.8	6.0	34.4	25.7	87.9	73.1	-	1.1	9.4
15	35.1	21.4	79	37	1	3.0	8.6	33.6	25.6	89.4	73.6	3	52.7	8.2
16	38.4	22.5	73	26	0	0.0	9.3	33.3	25.9	90.0	76.7	-	4.5	7.3
17	39.5	23.0	69	31	0	0.0	9.7	34.3	26.3	84.0	74.4	2	13.0	9.1
18	39.8	23.6	73	31	0	1.5	9.3	34.7	26.1	82.0	73.7	-	2.0	8.8
19	39.5	24.6	60	29	0	1.0	7.5	33.2	25.7	89.6	75.0	3	47.3	6.1
20	38.6	23.0	70	35	1	35.4	8.5	32.1	24.8	89.3	75.0	3	109.2	4.8
21	39.0	24.9	68	38	0	0.0	8.6	32.2	24.8	91.0	81.6	5	64.1	2.9
Mean/ Total	**32.9**	**16.6**	**82.7**	**34.4**	**13**	**442.9**	**8**	**32.3**	**24.2**	**92.3**	**77.5**	**53**	**1019.6**	**7.6**

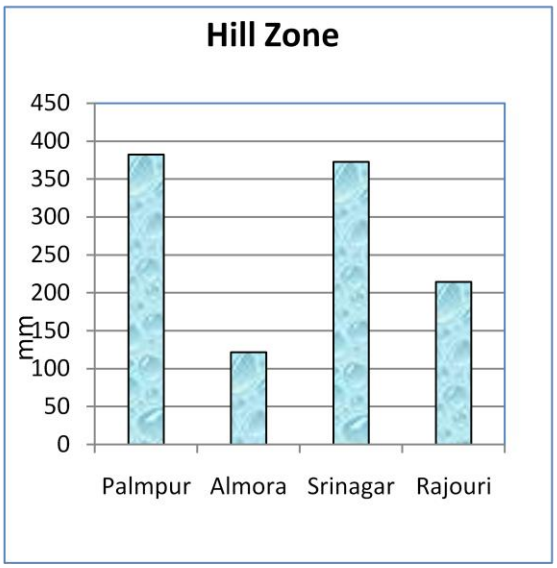
Table M 12: Meteorological data in South zone during crop growth period of Rabi 2017-18

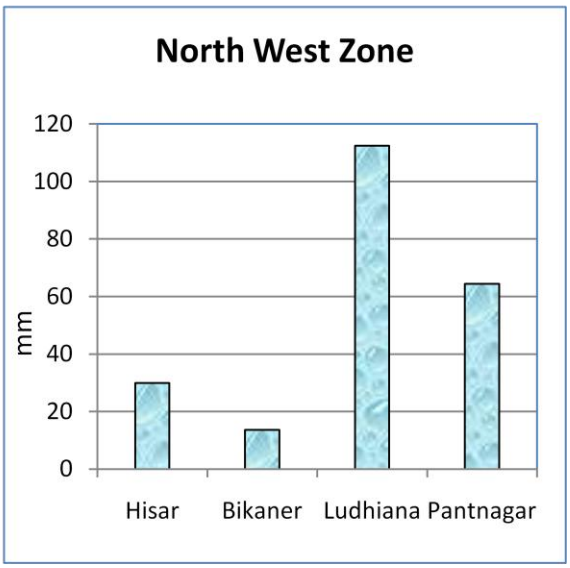
Std. Week No.	COIMBATORE						MANDYA						
	Temperature (C)		No. of Rainy days	Rainfall (mm)	RH (%) (07-22) hrs)	Sunshine hrs	Temperature (C)		Humidity (%)		No. of Rainy days	Rainfall (mm)	Sunshine hrs
	Max.	Min.					Max.	Min.	RH1	RH2			
40	31.3	22.8	-	0.4	89	5.2	30.9	21.4	95	75	3	42.5	3.5
41	32.2	23.3	2	83.5	88	4.8	30.9	20.7	96	70	1	11.0	4.7
42	30.2	22.6	1	36.8	89	4.5	30.4	20.4	94	80	1	5.2	2.0
43	31.9	21.6	2	11.9	90	6.6	30.1	19.4	93	76	1	4.8	5.8
44	30.0	22.4	1	4.0	87	5.8	29.8	19.6	89	73	0	0.0	5.4
45	28.5	21.9	4	49.8	90	4.3	29.7	19.4	93	67	3	5.0	4.0
46	31.3	21.5	-	1.2	88	5.6	30.6	18.4	93	76	0	0.0	8.0
47	31.8	23.2	-	-	88	6.1	30.4	19.6	92	78	0	0.0	8.0
48	29.0	22.6	2	27.1	88	2.0	29.9	18.8	92	79	1	3.0	4.0
49	29.9	21.7	-	1.2	89	6.2	29.4	17.9	93	77	0	0.0	7.0
50	30.4	22.1	-	-	88	3.9	29.4	18.4	91	74	0	0.0	7.0
51	29.1	19.5	-	-	85	6.4	29.0	16.9	91	74	0	0.0	9.0
52	29.8	19.3	-	-	88	8.3	28.4	14.0	94	78	0	0.0	9.0
1	30.5	18.5	-	-	86	6.3	29.6	14.3	93	77	0	0.0	8.0
2	29.1	19.3	-	2.2	89	5.3	29.9	14.9	92	78	0	0.0	6.0
3	30.6	18.3	-	-	86	7.6	29.8	14.6	91	77	0	0.0	9.0
4	31.0	18.8	-	-	83	7.4	30.1	13.1	92	81	0	0.0	8.0
5	31.0	16.1	-	-	82	10.1	30.7	12.8	86	80	0	0.0	9.0
6	32.4	21.1	-	-	87	7.8	31.4	15.9	85	84	0	0.0	8.0
7	31.9	20.7	-	-	84	7.5	32.4	18.4	88	86	0	0.0	9.0
8	32.9	19.1	-	-	86	10.1	32.9	17.1	83	80	0	0.0	9.0
9	34.1	20.1	-	-	82	10.5	33.0	16.4	87	82	0	0.0	9.0
10	35.0	20.3	-	-	79	9.6	34.0	15.4	90	87	0	0.0	9.0
11	32.5	23.5	2	18.2	88	5.2	33.1	16.8	93	87	1	3.0	7.0
12	34.6	23.5	-	-	85	8.7	33.8	17.7	89	85	0	0.0	7.0
13	35.2	23.8	-	1.0	86	7.9	34.1	18.1	95	91	1	1.0	6.0
14	35.1	23.9	1	12.2	84	8.8	33.4	19.4	93	89	0	0.0	6.0
15	35.2	25.0	1	2.8	82	8.7	33.6	21.0	89	86	0	0.0	7.0
16	35.9	25.6	1	4.4	84	8.5	33.3	21.6	92	81	2	3.0	6.0
17	35.8	24.7	2	25.0	86	8.7	32.5	22.0	90	86	1	2.0	8.0
18	33.9	23.2	4	86.0	57	6.1	34.1	21.8	90	76	3	9.0	7.0
19	33.2	23.3	4	122.6	60	8.6	32.6	21.4	90	82	3	11.0	6.0
20							31.9	20.5	96	85	1	4.0	5.0
Mean/ Total	**32.0**	**21.7**	**27**	**489.9**	**84.5**	**7**	**31.4**	**18.1**	**91.2**	**79.9**	**22**	**104.5**	**6.9**

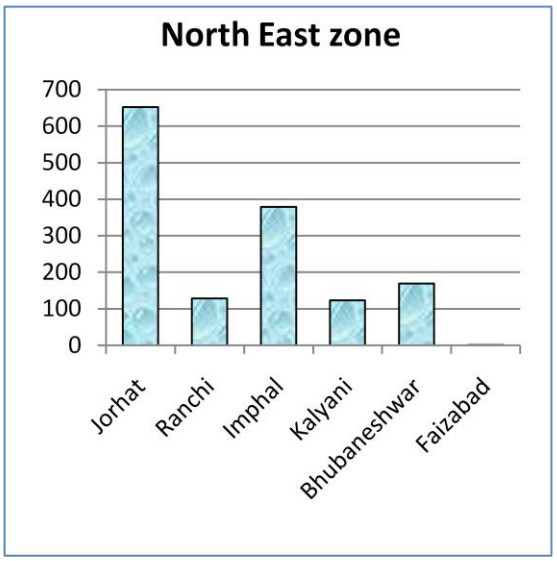
Table M 13: Meteorological data in South zone during crop growth period of Rabi 2017-18

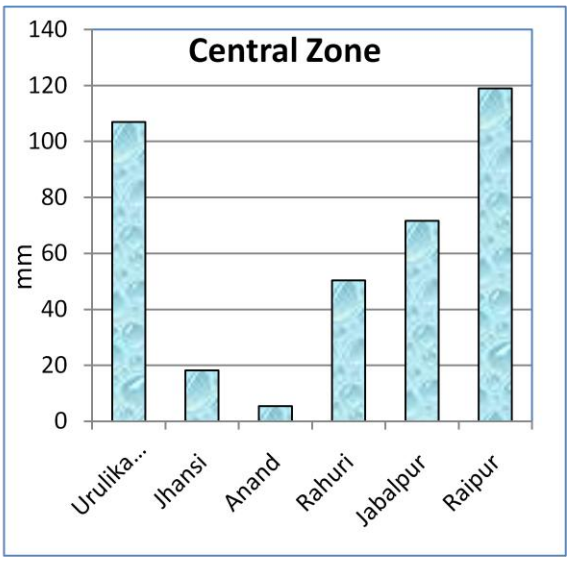
Std. Week No.	DHARWAD					
	Temperature (C)		Humidity (%)		No. of Rainy days	Rainfall (mm)
	Max.	Min.	RH1	RH2		
40	29.2	20.7	95	91	2	21.4
41	28.9	21.5	95	86	3	19.0
42	30.0	20.1	95	81	2	30.8
43	29.7	19.1	91	81	0	1.4
44	30.0	15.6	89	80	0	0.0
45	29.6	15.9	81	72	0	0.0
46	30.1	15.0	81	65	0	0.0
47	30.1	18.1	88	73	1	16.2
48	28.9	15.1	80	60	0	0.0
49	28.7	17.9	86	68	0	0.4
50	29.6	14.6	84	68	0	0.0
51	28.0	12.2	85	73	0	0.0
52	28.3	10.9	77	74	0	0.0
1	28.9	13.4	85	67	0	0.0
2	29.8	15.2	76	55	0	0.0
3	30.3	13.9	71	58	0	0.0
4	30.1	13.7	75	55	0	0.0
5	31.0	12.6	49	43	0	0.0
6	30.5	16.3	58	46	0	1.0
7	31.9	16.1	62	45	0	0.0
8	33.3	16.7	59	33	0	0.0
9	34.7	16.4	40	23	0	0.0
10	35.3	18.0	68	16	0	0.0
11	33.5	20.1	67	32	1	26.8
12	34.5	19.5	56	29	2	45.6
13	36.4	20.6	81	33	0	0.0
14	35.7	20.8	98	38	1	5.2
15	48.4	37.2	47	37	1	12.4
16	54.6	54.4	55	49	1	15.2
17	37.8	20.8	76	27	0	0.0
18	37.5	21.9	75	40	0	0.4
19	35.8	21.8	76	51	3	92.0
20	33.4	20.2	81	61	4	81.8
21	33.6	20.9	77	61	1	63.8
Mean/Total	**23.9**	**19**	**75.2**	**55**	**22**	**433.4**

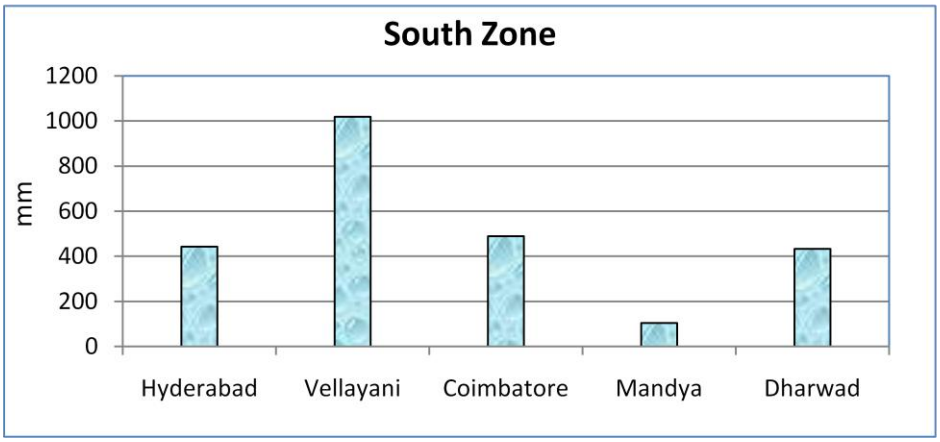
M1: Rainfall received during *Rabi* 2017-18



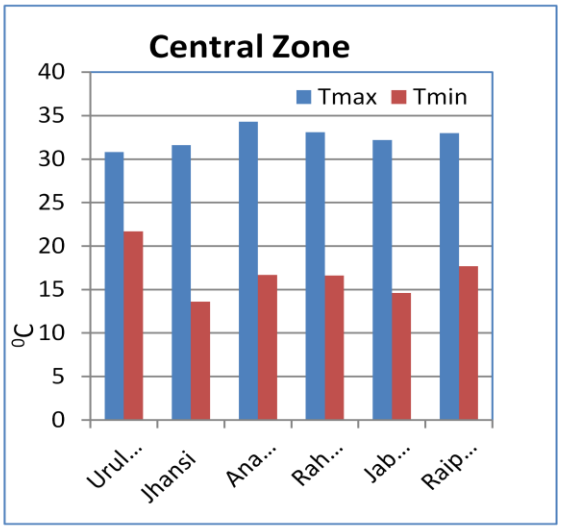


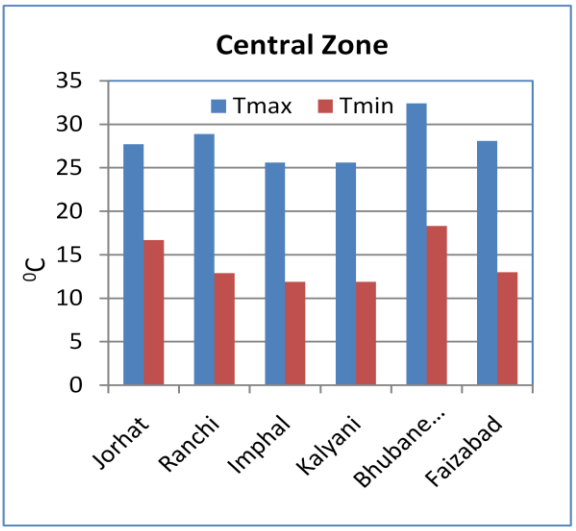


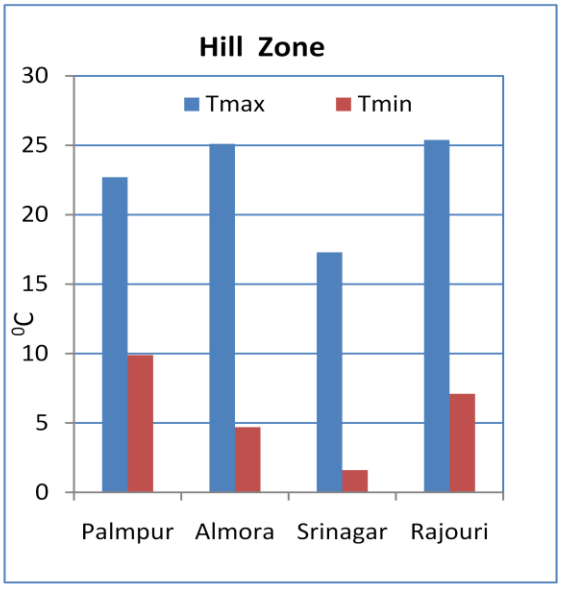


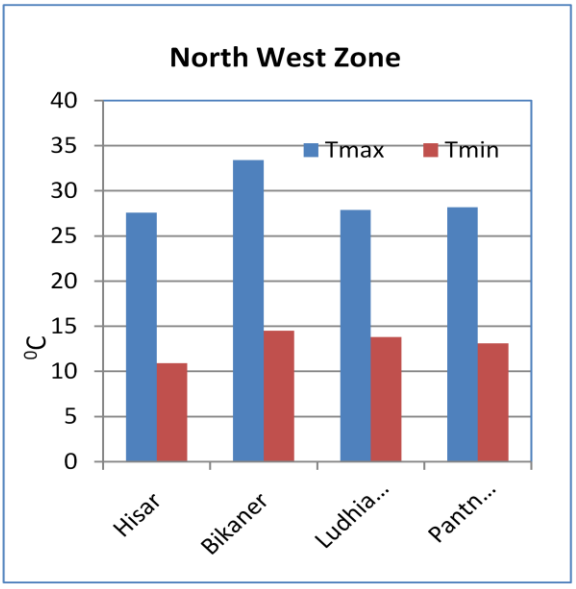


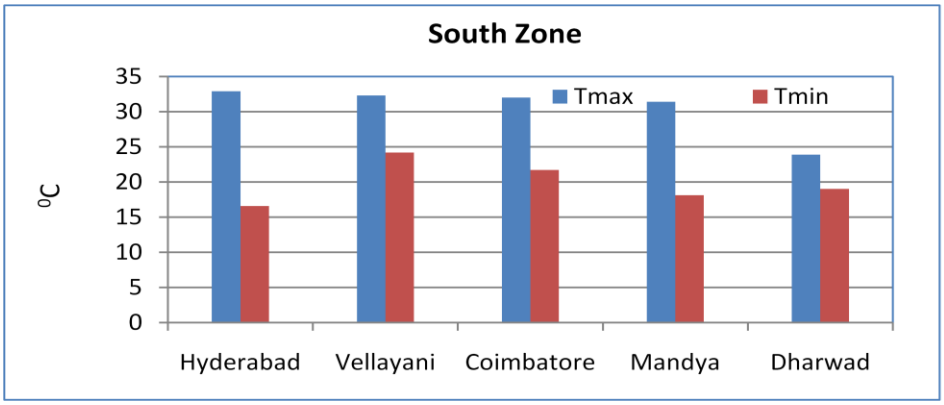
M2: Mean Minimum and maximum Temperature during *Rabi* 2017-18











APPENDIX-IV: FORAGE CROPS BREEDING TRIALS AT A GLANCE: (RABI-2017-18)

one	Location	Tr.-1 IVTB	Tr.-2 AVTB-1	Tr.-3 AVTB-2	Tr.-4 AVT-2 B (Seed)	Tr.-5 IVTO (SC)	Tr.-6 AVT Oat (SC-1)	Tr.-7 AVTO (SC-2)	Tr.-8 AVTO (SC-2) (Seed)	Tr.-9 IVTO (MC)	Tr. -10 IVT Oat (Dual)	Tr. 11 AVT-1 Oat Dual	Tr.-12 VT Lucerne (P)-2016 2nd Year	Tr.-13 AVT-1 Vicia	Tr. 14 VT Lolium-2016 (Annual) Rye grass	Tr.-15 VT Red Clover-2016 2nd Year	Tr.-16 VT White Clover-2016 2nd Year	Tr.-17 IVT Bajra (Multi cut)	Total
1 (HZ)	Palampur	DR				DR	DR	DR	DR	DR					DR	DR	DR		9/9
2	Srinagar	TF				DR	DR	DR	DR	DR					DR	DR	DR		8/9
3	Almora									DR					DR	DR	DR		4/4
4	Rajouri	DR				DR	DR	DR		DR									5/5
5	Bajoura (Kullu)														DR	DR	DR		3/3
6 (NWZ)	Bikaner	DR		DR	TF	DR	DR				DR		DR						6/7
7	Jalore			DNR									DNR						0/2
8	Hisar	DR		DR	DR	DR	DR			DR	DR								7/7
9	Ludhiana	DR		DR	DR	DR	DR			DR	DR		DR		DR				9/9
10	Pantnagar	DR		DR	TF	DR	DR			DR	DR								6/7
11	Udaipur	DR		DR		DR	DR				DR		DNR						5/6
12 (CZ)	Jhansi	DR	DR			DR	DR			DR	DR	DR		DR					8/8
13	Rahuri	DR	DR			DR	DR			DR	DR	DR	DR	DR				DR	10/10
14	Urulikanchan	DR	DR			DR	DR			DR	DR	DR	DR					DR	9/9
15	Anand					DR	DR			DR	DR	DR	DR					DR	7/7
16	Jabalpur	DR	DR			DR	DR			DR	DR	DR		DR				DR	9/9
17	Raipur	DR	DR			DR	DR				DR	DR	TF	DR					7/8
18	Palghar					DR	DR												2/2
19 (NEZ)	Jorhat					DR	DR			DR	DR	DR							5/5
20	Kalyani	DR	DR			DR	DR												4/4
21	Bhubaneswar	DR	DR			DR	DR			DR	DR	DR							7/7
22	Ranchi	DR	DR			DR	DR			DR	DR	DR							7/7
23	Pusa	DR	DR			DR	DR			DR									5/5
24	Faizabad	DR	DR			DR	DR			DR	DR	DR							7/7
25	CAU Imphal					DR	DR			DR									3/3
26 (SZ)	Hyderabad					DR	DR	DR	DR				DR					DR	6/6
27	Mandya					DR	DR	DR	DR				DR					DR	6/6
28	Coimbatore					DR	DR	DR					DR						4/4
29	Karaikal							TF											0/1
30	Vellayani/Mattupetty					DR	DR	DR										DR	4/4
31	Dharwad												DR						1/1
32	Tirupti/Guntur					DR	DR						DR						3/3
Total Location		17/18	10/10	5/6	2/4	27/27	27/27	7/8	4/4	18/18	15/15	10/10	10/13	4/4	5/5	4/4	4/4	7/7	176/184

Abbreviations: DR = Data reported, **DNR**= Data not reported, **TF** = Trial failed, **Data Reporting (%)** = 176/184=95.65 (%)

APPENDIX-V: FORAGE CROP PRODUCTION TRIALS AT A GLANCE: (RABI-2017-18)

Location	PS-14-AST-4	R-14-AST-1	K-15-AST-11C	K-15-AST-12C	R-15-AST-1	K-16-AST-1	R-16-AST-1	R-16-AST-1 (b)	R-16-AST-2	R-16-AST-3	K-15-AST-1L	K-15-AST-2L	R-15-AST-2	R-15-AST-2A	R-15-AST-4	R-15-AST-5	K-15-AST-8-7	K-16-AST-6	K-16 AST-8	K-17-AST-2	R-17-AST-3	R-17-AST-4	R-17-AST-5	R-17-AST-5	R-17-AST-6	Total
Hill Zone																										
Palampur	DR	DR		DR																				DR		4/4
Srinagar	DR	DR		DR																				DR		4/4
North West zone																										
Hisar																		DR							DR	2/2
Pantnagar																									DR	1/1
Bikaner									DR						DR											2/2
Ludhiana						DR			DR												DR				DR	4/4
Karnal																										0/0
Faizabad																	DR		DR							2/2
Ranchi			DR		DR																					2/2
Kalyani					DR																					1/1
Bhubaneswar					DR					DR																2/2
Jorhat										DR			DR													2/2
Imphal														DR												1/1
Medziphema																						DR				1/1
Sri Niketan																DR										1/1
Central Zone																										
Jabalpur			DR				DR																			2/2
Rahuri																							DR			1/1
Urulikanchan																										0/0
Anand			DNR						DNR																	0/2
Raipur							DR													DR						2/2
South Zone																										
Hyderabad			DR					DR	DR															DR		4/4
Coimbatore			DR						DR																	2/2
Mandya						DR					DR													DR		3/3
Vellayani			DR																							1/1
Dharwad							DR	DR				DR														3/3
Total (DR & TC)	2/2	2/2	5/6	2/2	3/3	2/2	3/3	2/2	4/5	2/2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	4/4	3/3	47/49

DR- Data reported; **DNR-**Data not reported**;** Success (%) of data reporting/trial conducted – 95.9%

APPENDIX –VI: FORAGE CROP PROTECTION TRIALS AT A GLANCE (RABI- 2017-18)

Locations/Trials	PPT-1	PPT-2	PPT-17	PPT-20	PPT-21	PPT-26	PPT-27	PPT-28	PPT-29	PPT-30	PPT-31	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										**2/2**
(SZ)												
Dharwad	DR	DNR				DR						**2/3**
Total	**6/6**	**5/6**	**1/1**	**1/1**	**2/2**	**3/3**	**1/1**	**1/1**	**2/2**	**1/1**	**1/1**	**24/25**

Abbreviations: DR = Data Reported; **DNR** =Data not reported; **Data Reporting (%)** = 24/25= 96.0 (%)

APPENDIX VII: DIRECTORY OF SCIENTIFIC STAFF: AICRP ON FORAGE CROPS & UTILIZATION CENTERS

Name	Designation & Discipline	Tel. Office	Tel. Residence	Fax	E-mail
Anand Agricultural University, Anand Campus, Anand-388 110 (Gujrat)					
Dr. D. P. Gohil	Research Scientist (FC)	02692-264179/ 225861	9974175796	02692-261520/ 261526	forageanand@gmail.com
Dr. H. K. Patel	Scientist (Agronomy)		9898977551		hiren@aau.in
Dr. P. H. Rathod	Scientist (Biocehmistry)		9408856727		rathod23904@aau.in
Dr. D. R. Kathiria	Director (Research)	02692-263600	02692-262159 09998009961	02692-263600	dr@aau.in
Assam Agricultural University, Jorhat-785013 (Assam)					
Dr. K. K. Sharma	Principal Scientist (Agronomy)	0376-2340044	09435352157	0376-2310831	kksharma6@yahoo.com
Dr. S. Bora Neog	Principal scientist (PB)	0376-2340044	09435091670		seujiboraneog@yahoo.com
Dr. G. N. Hazarika	Director (Research)	0376-2340044	09435096186	0376-2310831	dr_agri@aau.ac.in
BAIF Development Research Foundation, Urulikanchan, Pune-412 202 (Maharashtra)					
Mr. P.S. Takawale	Forage Breeder (PBG) & OIC	020-26926248 020-26926265	09881369750	020-26926347	pramodkumar.takawale@baif.org.in takawalep@gmail.com
Mr. R. V. Kale	Scientist	020-26926248 020-26926265	09096590204		rahul.kale@baif.org.in
Bidhan Chandra Krishi Vishwavidyalaya, Kalyani-741 235, Distt. Nadia (West Bengal)					
Dr. Kalyan Jana	Officer In Charge & Assistant Professor, Agronomy	033-25828407	09932250618	033-25828407	foragebckv@gmail.com kjanarrs@gmail.com
Dr. Sutanu Sarkar	Assistant Professor, Plant Breeding	033-25828407	09883084507	033-25828407	sutanumax@gmail.com
Prof. B. K. Senapati	Director of Research	033-25828407	09433841648	033-25828407	bckvdr@gmail.com
Birsa Agricultural University, Kanke, Ranchi-834 006 (Jharkhand)					
Dr. Yogendra Prasad	Jr. Scientist (Plant Breeding) & OIC		09431322453		yogendraprasad_bau@rediffmail.com
Dr. Birendra Kumar	Jr. Agronomist		8434273314		kbirendra1973@gmail.com
Dr. D.N. Singh	Director of Research	0651-2450610	09430362061	0651-2451011	dnsingh@bauranchi.org
C.S.K. Himachal Pradesh Krishi Vishwavidyalaya, Palampur-176 062 (Himachal Pradesh)					
Dr. Naveen Kumar	Principal Scientist (Agronomy) & OIC	01894-230392	09418149173	01894-230511	nkumarhp@gmail.com nkumar@hillagric.ac.in
Dr. V. K. Sood	Principal Scientist (PB)	01894-230391	08628040403		vkspbg23@rediffmail.com
Dr. D. K.Banyal	Principal Scientist (PP)	01894-230326	09418111480		dkbanyal@gmail.com
Dr. Rajan Katoch	Scientist Biochemistry	01894-230391	09418121870		rajankatoch@yahoo.com
Dr. R. S Jamwal	Director (Research)	01894-230406	09418035666(M)	01894-320406	drtech@hillagric.ac.in

Name	Designation & Discipline	Tel. Office	Tel. Residence	Fax	E-mail
C.C.S. Haryana Agricultural University, Hisar-125 004 (Haryana)					
Dr. Yogesh Jindal	Assistant Scientist (PB)	01662-255270	09416290774		yjindalhau@gmail.com yjindal@hau.ernet.in
Dr. Uma	Assistant Agronomist	01662255270	0812441560		umakansal0010@gmail.com
Dr. D. S. Phogat	Assistant Scientist (PB)	01662-255270	09254437796		forages@hau.ernet.in
Dr. S. K. Sehrawat	Director of Research	01662-255210	05354312724	01662-284340	dr@hau.ernet.in
Central Agricultural University, Post Box No.23, Imphal–795 004 (Manipur)					
Dr. R. Joseph Koireng	Junior Agronomist & OIC	0385-2410427	09612976457		aicrpforagecauimphal@gmail.com/ josephkoireng@rediffmail.com
Dr. C.A. Srinivasamurthy	Director of Research	0385-2410415	09901073913	0385-2410415	drcau@yahoo.co.in dorcau@gmail.com
G.B. Pant University of Agriculture & Technology, Pantnagar-263 145 (Uttrakhand)					
Dr. Mahedra Singh Pal	Professor Agronomy	05944-234448 7579177380	05944233279	05944 233473	drmspal1@gmail.com
Dr. Birendra Prasad	Senior Research Officer (PB)		09411398516		prasadbsst@gmail.com
Dr. J. S. Verma	Professor, GPB		05944234407 09720895558	05944-233473 05944-233257	jsverma21@yahoo.in drshankar54@gmail.com
Dr. S. N. Tiwari	Director Research	05944-233363	07500241418	05944-233473	des@gbpuat.ernet.in
Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chattisgarh)–492 006					
Dr. S. K. Jha	Scientist (Agronomy)	07716888879	09926113737		skjha_igau@yahoo.co.in
Dr. Mayuri Sahu	Scientist (PB)		09406318642		mayuri_pbg@rediffmail.com mayuri.igkv@gmail.com
Dr. J. S. Urkurkar	Director (Research)	0771-2443035	9425510045	0771-2442131 0771-2443035	drs_igkvr@yahoo.com
Jawahar Lal Nehru Krishi Vishwavidyala, Jabalpur–482 004 (Madhya Pradesh)					
Dr. A. K. Mehta	Pr. Scientist (PB) & OIC	2681773 PBX-308	0761-2343854 09424307262	0761-2681074	anoop.mehta@yahoo.co.in
Dr. Amit Jha	Scientist (Agronomy)		09425469854		amitagcrewa@rediffmail.com
Dr. S. K. Biliaya	Principal Scientist (PB)		09425165543		
Dr. Dr. Dhirendra Khare	Director (Research)	0761-2681200 0761-2681074	0761-2681614	0761-2681074	drsjnkvv@gmail.com
Kerala Agricultural University, College of Agriculture,Vellayani-665 522 Thiruvananthapuram (Kerala)					
Dr. Mareen Abraham	Professor (PB)	0471-2381002	9995213650		mareenabraham@yahoo.com
Dr. Usha C. Thomas	Assistant Professor (Agronomy)		9496301170		ushacthomas@gmail.com
Dr. Indira Devi	Director of Research	0487-2438101	9447416875		dr@kau.in
Mahatma Phule Krishi Vidyapeeth, Rahuri-413722 (Maharastra)					
Prof. A. H. Sonone	Forage Breeder & OIC	09422727814	07588695304	02426-243223	ajitsonone@gmail.com
Dr. A. B. Tambe	Scientist-1 (Entomology)	07588695375	02426-243123	02426-243223	abtambe200054@gmail.com
Dr. S. V. Damame	Scientist-1 (Biochemistry)		08275592262	02426-243223	shivajidamame@gmail.com
Dr. S. R. Gadakh	Director of Research	02426-243261	0 9423164967	02426-243223	dormpkv@rediffmail.com
N.D. University of Agriculture & Technology, Kumarganj, Faizabad-224 221 (Uttar Pardesh)					
Dr. Ramesh Singh Yadav	Jr. Scientist (Agronomy)	05270-262051	09415890200	05270-262051	dr.ramesh1959@gmail.com
Dr. Rachna Verma	Dy. Director (Research)	05270-262024	8874942350	-	drnduat@gmail.com

Name	Designation & Discipline	Tel. Office	Tel. Residence	Fax	E-mail
Orissa University of Agriculture & Technology, Bhubaneswar-751003 (Odisha)					
Dr. Arabinda Dhal	Jr. Pathologist		09937193430		foragebbrr@gmail.com
Dr. P. N. Jagdev	Dean of Research	0674-2397692			deanresearch_03@hotmail.com
Punjab Agricultural University, Ludhiana-140 004 (Punjab)					
Dr. U. S. Tiwana	Senior Agronomist & OIC I/C Forage & Millet Section	0161-2401960 Ext. 443	09814702076 09501111448	0161-2400945 0161-2409891	inchargeforages@pau.edu utiwana@yahoo.co.in ustiwana@pau.edu
Dr. Rahul Kapoor	Asstt. Forage Breeder	-do-	09815585599	-do-	rahulkapoor@pau.edu
Dr. Ashlesha Singla	Asstt. Plant Pathologist	-do-	09872874383	-do-	ashlesha-atri@pau.edu
Dr. Meenakshi Goyal	Asstt. Biochemist	-do-	09216176800	-do-	meenakshigoyal@pau.edu
Dr. N. S. Bains	Director Research	0161-2401221	0161-2404433	0161-2407309	drpau@pau.edu
Professor Jayashankar Telangana State Agricultural University (PJTSAU) Rajendranagar, Hyderabad-500 030 (Telangana)					
Dr. T. Shashikala	Principal Scientist (PB) & Head	040-24001706	09849152482	040-24001706	tshashikala69@gmail.com forage_hyd@yahoo.com
Dr. M. Shanti	Principal Scientist (SSAC)		040-27224229 09848940225		shantigoka@yahoo.com
Sri. B. Murali	Scientist (Agro.)		9603377711 9849622290	040-24001706	muralibellamkonda1@gmail.com
Dr. M. V. Ramana	Associate Director of Research	08008311779	09440019029	08540-221177	adrpalem@gmail.com
Dr. T. Pradeep	Director of Research	040-24015078	08008333783	040-24017453	dr.pjtsau@yahoo.com
Rajendra Agricultural University, Pusa, Samastipur, 848 125 (Bihar)					
Dr. Nilanjaya	Sr. Scientist (Agronomy)		06274-2430394	06274-240255	nilanjayapbg@mail.com
S.K. Rajasthan Agricultural University, Bikaner-334 006 (Rajasthan)					
Dr. S. S. Shekhawat	Prof. (PBG) & OIC	0151-2111406	0151-2205740 09828282082	0151-2250576 0151-2250570	srn_shekhawat@yahoo.co.in surendrashekhawat884@gmail.com
Dr. R. C. Bairwa	Assistant Prof. (Agronomy)	0151-2111406	09413969540	0151-2250570	ramesh_ag@hotmail.com
Dr. P. L. Nehra	Director Research	0151-2250199 0151-2250576	09413714828	0151-2250576	dor@raubikaner.org
S.K. University of Agriculture Science & Technology, Srinagar-190 121, Kashmir (J & K)					
Dr. Ansar-ul-Haq	Agronomist	09797901312	09797901312		ansarulhaqs2@gmail.com
Dr. N.Saleem Khuroo	Assoc. Prof. (PB)	09596769713	07889723718	-	Skhuroo0909@gmail.com
Dr. Gulzafar	Associate Director Research	09419072588	0194-2305084	0194-2305084	drasbudgam@gmail.com
Tamil Nadu Agricultural University, Coimbatore-641 003 (Tamil Nadu)					
Dr. C. Babu	Professor (PBG) & OIC	0422-6611228	09443669045	0422-6611415	forage@tnau.ac.in babutnau@gmail.com
Dr. S. D. Sivakumar	Assistant Prof. (Agronomy)	0422-6611228	09047269324	0422-6611415	rainfedsiva@yahoo.co.in
Dr. K. Ramnaraju	Director of Research	0422-6611447, 547	9489033000	0422-2436325	drres@tnau.ac.in

Name	Designation & Discipline	Tel. Office	Tel. Residence	Fax	E-mail
University of Agricultural Sciences (Bengaluru) Zonal Agril. Res. Station, VC Farm, Mandya-571405 (Karnataka)					
Dr. B. G. Shekara	Principal Scientist (Agronomy) & OIC	08232-277925	09900618898		shekara_gundanaik@rediffmail.com bgshekar66@gmail.com
Dr. P Mahadevu	Sr. Scientist (GPB)	08232-277925	09945332633	08232-277966	pmahadevu69@gmail.com
Dr. S. N. Vasudevan	Associate Director of Research	08232-277147	09449866917		adrzarsmandya@gmail.com
Dr. Y. G. Shadakshari	Director of Research	080-23330206	09449866903	080-23330206	druasgkvkb@gmail.com
ICAR-All India Coordinated Research Project on Plant Parasitic Nematode, Div. of Nematology, IARI, New Delhi-110 012					
Dr. R. K. Jain	Project Coordinator	011-25846400	011-27550355	011-25846400	rameshjain1952@yhoo.co.in rkjain-nem@iari.res.in
ICAR-Central Arid Zone Research Institute, Jodhpur-342 003 (Rajasthan)					
Dr. O.P. Yadav	Director	0291-2786584	0291-2788484	0291-2788706	director.cazri@icar.gov.in
Dr. M. P. Rajora	Pr. Sci. (PB)	0291-27 86483	09461269336	0291-2788706	mprajora1@gmail.com
Dr. J. P. Singh	Pr. Sci. (Eco Bot)		09929273918		
Nagaland University- School of Agricultural Sciences & Rural Development, Medziphema-797106, Nagaland					
Dr. Tankeswar Gohain	Assistant Professor		09436430276		tankeswar1968@gmail.com
ICAR- National Dairy Research Institute, Karnal-132001 (Haryana)					
Dr. Magan Singh	Senior Scientist		08901122193		magansingh07@gmail.com
ICAR - CAZRI Regional Research Centre CAZRI Jaisalmer, (Rajasthan)					
	Head	02992 252412			
ICAR – Indian Institute of Maize Research, PAU Campus Ludhiana, 141004 (Punjab)					
Dr. Sujoy Rakshit	Director	011-5841805		011-25848195	pdmaize@gmail.com
ICAR -Directorate of Maize Research, Regional Maize Research and Seed Production Centre, Begusarai (Bihar)					
Dr. V. K. Yadav	Sr. Scientist I/c Station	06243-215254			
ICAR- Indian Institute of Seed Research, P. B. No. 11, Village : Kushmaur (P.O. Kaithauli, Mau–275 101 (U.P.)					
Dr. D. K. Agarwal	Director	0547-2530326	0547-2530325		pd_dsr2005@yahoo.co.in
ICAR-Indian Institute of Wheat & Barley Research, P.B. No. 158, Karnal–132 001 (Haryana)					
Dr. G. P. Singh	Project Director	0184-2267490	0184-2267559	0184-2267390	indu.dwr@icar.org.in
Dr. R. P. S. Verma	PS & PI, Barley Network	0184-2267490/ 2265632/2267495	09416468414	0184-2267390	rpsverma.dwr@icar.org.in
ICAR- Indian Agricultural Research Institute, Pusa Campus New Delhi 110012					
Dr. Sanjay Kumar	Principal Scientist	09013563919			incharge_spu@iari.res.in iariseed@gmail.com
ICAR-IARI Regional Research Station, Karnal–132 001 (Haryana)					
Dr. V. K. Pandita	Head	0184-2267169	0184-2267365	0184-2266672	ssatwal.iari@gmail.com
ICAR-Indian Institute of Millets Research, Rajendranagar, Hyderabad-500 030, (A.P.)					
Dr. Vilas Tonapi	Director		040 - 2459 9301	040 - 24599304	millets.icar@nic.in director.millets@icar.gov.in
ICAR- Indian Institute of Farming Systems Research, Modipuram, Meerut-250110					
Dr. A. S. Panwar	Director	0121-2888711		0121-2888546	directoriifsr@yahoo.com

Name	Designation & Discipline	Tel. Office	Tel. Residence	Fax	E-mail
ICAR-National Bureau of Plant Genetic Resources, New Delhi–110 012					
Dr. Kuldeep Singh	Director	011-25843697	011-25841177	011-25842495	director@nbpgr.emet.in
Dr. Anjali Kak	Principal Scientist	011-25841835		011-25841835	anjali@nbpgr.ernt.in
ICAR Research Complex for NEH Region, Umroi Road (Umiam) Barapni-793 103 (Meghalaya)					
	Director	0364-2570257	0364-2570302	0364-2570288/ 2570501/	director@icarneh.ernet.in
National Dairy Development Board, Anand-388 001 (Gujarat)					
Dr. Digvijay Singh	Sr. Manager (PS-AH)	02692-226246 (O)	02692-226517(R)	09426389619	dsingh@nddb.coop
Agriculture Research Station, Mahim Road, Palghar, District– Palghar (Maharastra)-401 404					
Dr. Umesh S. Kudtarkar	Jr. Agrostologist	02525-241048	08390982994		umeshb4u59@rediffmail.com
Dr. U. V. Mahadkar	Director Research				dorbskkv@rediffmail.com
Chandra Shakhar Azad University of Agriculture & Technology, Kanpur–208 002 (Uttar Pradesh)					
Dr. K. C. Arya	In charge Sorghum & Forage, Deptt. of Genetics		09415161749		kshvarya302@gmail.com
Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri-415 712 (Maharashtra)					
Dr. R. B. Ulemale	Jr. Agronomist & OIC Forage	0724-258200/ 2258467	0724-2451631		
Institute of Agriculture, Visva-Bharati University, Sriniketan, West Bengal					
Prof. A. K. Barik	Head, Dept. of Agronomy		09434838041		akbarikpsbvb@rediffmail.com
Grassland Research Station Junagadh Agricultural University, Dhari (Distt. Amreli), Gujarat					
Dr. Anshuman Dalpatrai Rathod	Assoc. Research Scientist (Agronomy)	02797-221117			
Mr. V. V. Ansodariya	Assistant Research Scientist (Pl.Br.)	02797-221117	09824156656		grsdhari@jau.in
Main Agricultural Research Station, University of Agricultural Sciences, P. B. No. 24, Raichur-548 101 (Karnataka)					
Dr. AjithKumar K.	Scientist (Pathology) In-charge Forage Section	08532-220193	9008333006	08532-220193	ajithk.path@gmail.com
Maharana Pratap University of Agriculture & Technology, Udaipur 313 001 (Rajasthan)					
Dr. N. S. Solanki	Prof. (Agrometeorology)		09414809895		solanki.narayan@rediffmail.com
Dr. Mukesh Vyas	Senior Maize Breeder				vyas.mukesh66@gmail.com
Dr. P. L. Maliwal	Director Research	0294-2417334	9414162568	0294-24220447	dr@mapuat.ac.in
Pandit Jawahar Lal Nehru College of Agril. & Research Institute, Karaikal – 609 603 (Pudduchery)					
Dr. S. Mala	Prof. (Agronomy)	04368-261372 (O)	09487820451		mala_ap@yahoo.co.in
Pearl Millet Research Station Junagadh Agricultural University, Junagadh, Jamnagar-361 006					
Dr. P. R. Padhar	Research Scientist (Pearl Millet)	0288-2711793			
Regional Agricultural Research Station, Karjat, Raigad–410 201 (Maharastra)					
Dr. Mahendra Gawai	Jr. Rice Breeder				mahendra_gawai@yahoo.com
Sardar Vallabh Bhai Patel University of Agriculture and Technology, Meerut–250 110 (U.P.)					
Dr. S. A. Kerkhi	Prof. (PB)	0121-2888518	09319820296	0121-2411505	sakerkhi@gmail.com
S.K. Rajasthan Agriculture University, Agricultural Research Station, Keshwana Jalor -343001					
Dr. S. D. Ratnoo	Zonal Director Research	02973-265915	09414269366 07665440907		sdratnooars@gmail.com arsjalore@gmail.com

Name	Designation & Discipline	Tel. Office	Tel. Residence	Fax	E-mail
S. K. University of Agril. Sciences & Technology, Regional Research Station, Rajouri B.P.O. Tandwal 185 131 (Jammu)					
Dr. Deepak Kumar	Sr. Scientist (Agril. Extension)		7006959781		rarsrajouri@gmail.com
ICAR- Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora 263 601 (Uttrakhand)					
Dr. A. Pattanayak	Director	05962230208	05962230130	05962231539	vpkas@nic.in, director.vpkas@icar.gov.in
Dr. J. K. Bisht	Pl. Sci. (Agron.) & OIC Forage Research	05962-230208/ 230060	05962-230130	05962-231539	bishtjk@hotmail.com
Mr. T. Mondal	Jr. Scientist (Agri. Chemistry)	05962-241008	08938999197	25962-231539	mondalt.vpkas2013@gmail.com
Mr. R. P. Yadav	Jr. Scientist (Agroforestry)	05962-241008	09410159392	25962-231539	rams34052@gmail.com
ICAR- Indian Grassland and Fodder Research Institute. Jhansi–284 003 (U.P.)					
Dr. R.V. Kumar	Director	0510-2730666	9415505742	0510-2730833	igfri.director@gmail.com
Dr. B. G. Shivakumar	OIC IGFRI- SRRS, Dharwad	0836-2447150	0836-2776551 09731924228	0836-2743459	bgskumar@yahoo.com
Dr. Shahid Ahmad	Pri Sci & Head CI Division		945077665		shahidigfri@gmail.com
Dr. Vijay Yadav	Pri Sci & Head ST Division		94124463923		vijayyadav777@gmail.com
Dr. S. S. Meena	OIC, IGFRI RRS, Avikanagar		09461642052		ssmeena123@yahoo.com
ICAR- AICRP on Forage Crops and Utilization, Project Coordinating Unit, IGFRI, Jhansi 284 003 (U.P.)					
Dr. A. K. Roy	Project Coordinator	0510-2730029	0510-2730639 09415412144	0510-2730029/ 2730833	pcforage@gmail.com
Dr. R. K. Agrawal	Pr. Scientist (Agronomy)	0510-2730029	09415179141	0510-2730029	rajiv68@gmail.com
Dr. N. R. Bhardwaj	Scientist (Plant Pathology)	0510-2730029	7525060745	8954094647	nitish.rattanbhardwaj@gmail.com
ICAR HQ, New Delhi					
Dr. A. K. Singh	Deputy Director General (CS)	011-25842068 /23382545	011-25842508 0124-246166	011-23097003	ddgcs.icar@nic.in
Dr. R. K. Singh	Asstt. Director General (FFC)	011-2338433		011-23384323	adgcc.icar@nic.in