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Annual Report : Rabi-2016-17

AICRP on Forage Crops and Utilization

AICRPFUCU

अखिल भारतीय समन्वयित अनुसंधान परियोजना-

चारा फसलें एवं उपयोगिता

(भारतीय कृषि अनुसंधान परिषद)

भा. कृ. अ. प.-भा. च. चा. अनु. सं

झाँसी-284 003 (उ.प्र.)



वार्षिक प्रतिवेदन ANNUAL REPORT

(2016-17)

Part-II: Rabi-2016-17

September, 2017

ALL INDIA COORDINATED RESEARCH PROJECT
ON FORAGE CROPS AND UTILIZATION

(Indian Council of Agricultural Research)

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AICRP on Forage Crops and Utilization

ICAR-Indian Grassland and Fodder Research Institute,

Jhansi-284 003 (U.P.)

Phone/Fax: 0510-2730029

E-mail: pcforage@gmail.com

Web site: <http://www.aicrponforagecrops.res.in>

Compilation and Editing:

- | | |
|----------------------------|-----------------|
| 1. Crop Improvement | : A. K. Roy |
| 2. Crop Production | : R. K. Agrawal |
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PREFACE

Development and growth of livestock sector is limited by the availability of quality fodder. Various reports suggests that large gap exists between requirement and availability of feed and fodder in the country. The deficiency is more conspicuous in arid and semi-arid regions. This deficit of fodder is the result of numerous inter dependent as well as exogenous factors. The small farm holdings, large variations in climatic, edaphic and resource availability complexes the situation to extreme. In the current pursuit of urbanization, the probability of increasing area under fodder crops is like a delusion. The AICRP on Forage Crops and Utilization provides national level platform to ease the above bottlenecks. Annual Report (2016-17), Part II-Rabi 2016-17, embodies the results of various research trials conducted to evaluate the new breeding lines and develop technologies for augmenting forage resources under various niches in the country. The information on breeder seed production against the DAC indent is also provided. Other activities related to research, extension, training, tribal sub-plan etc. being carried out by centers has been included in the report.

The report is divided into several chapters, which include Crop Improvement, Crop Production, Crop Protection, Breeder Seed Production *etc.* The results of multi-locational test of newly developed genetic material for single and dual-purpose forage species of annuals and perennials are compiled in Crop Improvement chapter. The findings on improving the forage productivity of crops and cropping system through utilization of rice fallow and sodic soils, climate resilient fodder production technologies, productivity maximization of sole crops/ inter / mixed crops and micronutrient application are presented in Crop Production chapter. The chapter also encompasses the results of the studies Organic agriculture, carbon sequestration and Hydroponics fodder production. The results and response of AVT entries to graded levels of nutrients has also been comprehensively covered in this section. The chapter on plant protection deals with different aspects of plant protection in selected *Rabi* forage species, *viz.*, berseem, oat and lucerne and generation of technologies for pest management. Breeder Seed Production chapter provided variety wise and center wise breeder seed production. Other chapters include details of in-house breeding activities, weather details *etc.*

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

The cooperation of my colleagues at Project Coordinating Unit, Dr RK Agrawal (Principal scientist & PI, Agronomy) and Technical Officers, Shri ON Arya and Shri HK Agrawal in coordinating, analysis, synthesis and compilation of data of trials conducted at all the locations are appreciated. The sincere help rendered by contractual staff in accomplishing is acknowledged.

The administrative support and cooperation received from Dr P.K. Ghosh, Director and other colleagues at IGRI is thankfully acknowledged.

Meeting all the targeted activities would not have been possible but for the active leadership support, guidance and encouragement received from Dr. Trilochan Mohapatra, Secretary DARE & DG, ICAR; Dr. J.S. Sandhu, DDG (CS); Dr. A.K. Singh, DDG (Horticulture and CS). Dr. I.S. Solanki, ADG (FFC), Dr. Dinesh Kumar, PS (FFC), technical and administrative staff of FFC section have helped in all the ways for timely completion of various targets. Each and every one in the team at AICRP on Forage Crops & Utilization gratefully acknowledges their guidance and support.

Dated: August, 2017
Place: Jhansi

A K Roy
Project Coordinator

CONTENTS

Executive Summary

AICRP on Forage Crops & Utilization State-wise Zones and Coordinated Centers and Testing Locations

AICRP on Forage Crops & Utilization Entries Code with Name and Contributors Rabi-2016-17

CHAPTER-1: FORAGE CROP IMPROVEMENT			1-79
BERSEEM			1-18
1.	IVTB	Initial Varietal Trial in Berseem	1-8
2.	AVTB-1	First Advance Varietal Trial in Berseem	9-13
3.	AVTB-2	Second Advance Varietal Trial in Berseem	14-17
4.	AVTB-2 (seed)	Second Advance Varietal Trial in Berseem (seed)	18
OAT			19-64
5.	IVTO (SC)	Initial Varietal Trial in Oat (SC)	19-28
6.	AVTO (SC-1)	First Advanced Varietal Trial in Oat (SC)	29-35
7.	AVTO (SC)-2	Second Advanced Varietal Trial in Oat (SC)	36-42
8.	AVT Oat (SC-2) (Seed)	Second Advanced Varietal Trial in Oat (SC) for Seed	43
9.	IVTO (MC)	Initial Varietal Trial in Oat (Multi Cut)	44-50
10.	AVTO-1 (MC)	First Advanced Varietal Trial in Oat (Multi Cut)	51-53
11.	IVT Oat (Dual)	Initial Varietal Trial in Oat (Dual)	54-62
12.	AVTO-1 (Dual)	First Advanced Varietal Trial in Oat (Dual)	63-64
LUCERNE			65-70
13.	VTL (P)-2016-1 st Year	Varietal Trial in Lucerne (Perennial)-2016 1 st Year	65-70
VICIA			71-72
14.	VT Vicia (P)-1 st Year	Varietal trial in Vicia (Perennial) -1 st Year	71-72
LOLIUM Rye grass			73-74
15.	IVT Lolium-2016	Varietal Trial in Lolium Rye grass (Annual)	73-74
RED CLOVER			75
16.	VT Red Clover-2016	Varietal Trial in Red Clover (Perennial) -1 st Year	75
WHITE CLOVER			75
17.	VT White Clover-2016	Varietal Trial in White Clover (Perennial) -1 st Year	75
AVTO (SC)-2 REPEAT 2014-15			76-78
18.	AVTO (SC)-2	Second Advanced Varietal Trial in Oat (SC) Repeat-2014-15	76-78
19.	VT Repeat Lucerne (P)-2013	Varietal Trial in Lucerne (Perennial)-1 st Year	79
CHAPTER-2: FORAGE CROP PRODUCTION			80-152
A. ON-GOING COORDINATED TRIALS			80-96
1.	PS-13-AST-2	Performance of perennial fodder sorghum (<i>sorghum bicolor</i> cv. COFS- 29) as influenced by planting geometry and cutting intervals under irrigated conditions)	80-82
2.	K-14-AST-3	Study of intercropping system of Pigeon pea with different annual fodder crops	83-84
3.	K-15-AST-9 C	Development of climate resilient production technologies on productivity and economics of food - fodder based cropping systems	85-87
4.	K-15-AST-11 C	Studies on carbon sequestration in perennial grass based cropping systems	88-91
5.	R-15-AST-1	Productivity of oat - lathyrus intercropping system as influenced by integrated nutrient management	92-96

B. LOCATION SPECIFIC TRIALS			97-133
6.	PS-14-AST-2	Impact of Mg and B on nutrient uptake, quality and yield of bajra napier hybrid	97-98
7.	CS-14-AST-1	Studies on intensive fodder cropping systems for yield maximization	99
8.	CS-14-AST-2	Study of intensive annual fodder crop based cropping system	100
9.	K-15-AST-1L	Studies on Different model for year round Green fodder production under Irrigated condition	101-102
10.	K-15-AST-2L	Performance of bajra napier hybrids as influenced by nature of vegetative propagules	103-104
11.	K-15-AST-8-7 L	Screening of genotypes of fodder oat under sodic soil	105-106
12.	K-16-AST-6	Organic nutrient management in sorghum-berseem cropping sequence for sustainable fodder production	107-108
13.	K-16-AST-8	Resource management in rice-oat cropping system under sodic soils	109-110
14.	R-13-AST-1	Yield Potential of Cereals with Forage Legumes under Pure Stand and Mixtures	111-112
15.	R-14-AST-2	Effect of cutting and nutrient management on growth, yield and quality of oat	113-114
16.	R-15-AST-2	Productivity of oat - pea intercropping system as influenced by integrated nutrient management	115-116
17.	R-15-AST-2(A)	Productivity of oat - chickpea intercropping system as influenced by integrated nutrient management	117-118
18.	R-15-AST-3	Response of phosphogypsum to various cultivars of fodder oat in sodic soil.	119-120
19.	R-15-AST-4	Study on lucerne + oats /sarson fodder production system at variable seed rates of mixed crop under irrigated condition	121
20.	R-15-AST-5	Effect of zinc and boron on seed production potentiality of oats under lateritic soil of West Bengal	122-123
21.	R-15-AST-7	Standardization of seed rate of berseem with rye grass under mixed cropping system	124
22.	R-16-AST-4	Effect of stubble management and planting density on establishment and productivity of forage lathyrus under zero tillage condition in rice fallows	125
23.	R-16-AST-5	Seed yield maximization in Oat cv. RO-19 (Phule Harita)	125-126
24.	R-14-AST-3	Studies on the effect of additives on silage quality of different grasses	127-130
25.	K-16-AST-1	Feasibility of Hydroponics fodder production system - A Quantitative and Qualitative study	131-133
C. AVT-2 BASED AGRONOMY TRIALS			134-152
26.	R-16-AST-6	Effect of nitrogen levels on forage yield of promising entries of oat (AVTO-2-SC)	134-143
27.	R-16-AST-7	Effect of P levels on forage yield of promising entries of Berseem (AVTB-2-MC)	144-152
CHAPTER-3 : FORAGE CROP PROTECTION			153-179
1.	PPT-1	Survey of pathogens, insect pests and nematodes associated with Berseem and Oats ecosystems	153-160
2.	PPT-2A	Field screening of rabi breeding trials for resistance to diseases and insect-pest	160-169
3.	PPT-17	To study the pathogenic variability of <i>Blumeria graminis</i> (syn. <i>Erysiphe graminis</i> F. sp. Avenae on oats	170
4.	PPT-19	Management of soil borne diseases in clover seed crops	170-171
5.	PPT-20	Management of soil borne and powdery mildew diseases in red clover seed crop	171-172
6.	PPT-21	Management of foliar diseases of oat	172-173
7.	PPT-22	Studies on biological management of <i>Spodoptera litura</i> in relation with different time of application on Lucerne under field condition	173-175
8.	PPT-23	Biological control of <i>Helicoverpa armigera</i> on Lucerne/berseem seed crop	175-177
9.	PPT-26	Biological management of oat aphid <i>Rhopalosiphum padi</i> on oats	178-179
CHAPTER-4 : BREEDER SEED PRODUCTION			180-183
FORAGE TECHNOLOGY DEMONSTRATION			184
MONITORING DETAILS			185
APPENDICES			
1.	Appendix-I	In House Breeding Activities	A1 - A16
2.	Appendix-II	Other Activities	B1- B25
3.	Appendix-III	Weather Report Rabi 2016-17	C1- C15
4.	Appendix-IV	Forage Crop Breeding Trials at a Glance	D1
5.	Appendix-V	Forage Crop Production Trials at a Glance	D2
6.	Appendix-VI	Forage Crop Protection Trials at a Glance	D3
7.	Appendix-VII	Directory of Scientific Staff Rabi 2016-17	E1 – E6

EXECUTIVE SUMMARY

The present report describes compiled and edited results of the various trials conducted at different locations/ centers in the country on crop improvement, crop production, crop production, and Breeder seed production during Rabi 2016-17 as per approved technical programme. The outreach programme carried out during the season *viz.*, Forage Technology Demonstrations, Tribal sub-plan activities and the capacity building programmes, research guidance etc. were also included in the report. In house breeding activities, other activities of coordinated centres were also appended to give complete picture of activities in form of human resource development, technology dissemination, publications, breeding material generated etc. Weather data of various centres during the crop growth period is also appended to correlate the production as most of the experiments were in rainfed condition. In the end, directory of scientists and managers involved in forage research is also appended for ready reference and ease of communication.

A. FORAGE CROP IMPROVEMENT

In *rabi* 2016-17, Nineteen breeding trials were conducted on, Berseem, Oat, Lucerne, Vicia, White clover, Red clover and Lolium. Entries contributed by different institutions along with national and zonal checks were evaluated in multilocation trials in coded form in five zones of the country. A total of 202 trials at 34 locations were allocated out of which reports were received from 199 trials making a success rate of 98.5%.

BERSEEM

IVTB: An initial varietal trial in Berseem comprising of five entries along with one national check (Wardan) and three zonal checks was conducted at 21 centres in four zones (HZ, NWZ, NEZ, CZ). For GFY (q/ha), none of the entries showed significant higher yield than best check at zonal or all India level. For DMY, entry HFB-13-1 (4.4%) in HZ; JB-05-10 (6.5%) in NEZ; entry JHB-16-01 (4.6%) in CZ; JHB-16-01 (7.1%), HFB-13-10 (5.2%) at all India level, showed better performance than the checks. Entry JHB-16-01 was best performer followed by HFB-13-10 for CPY. For CP (%), entry BL-205 ranked first followed by check.

AVTB-1: An advanced varietal trial in Berseem comprising of four entries along with two national checks and two zonal checks was conducted at fifteen centres in three zones (Hill, Central and North West). In zones and at all India level, none of the entries performed better than best check for GFY and DMY except for DMY, entries JB-05-9 (5.5%) and PC-82 (4.8%) showed superiority over the best check in NW zone. In quality parameters, entry HFB-12-9 ranked first for CPY (q/ha). For CP (%), entries HFB-12-9 and PC-82 ranked joint first.

AVTB-2: Second advanced varietal trial in Berseem comprising of two entries along with two national checks and one zonal check was conducted at twelve centres in two zones (Central and North West). For GFY, DMY, CPY (q/ha) and CP %, in both the zones and at all India level, zonal checks were best performer.

AVTB-2 (SEED): Second advanced varietal trial (seed) in Berseem comprising of two entries along with two national checks and one zonal check was conducted at six centres in two zones (Central and North West). In all zones and at all India level, zonal check Bundel Berseem -2 was best performer.

OAT

IVTO (SC): In Oat (single cut), nine entries along with two national checks and five zonal checks for respective zones were evaluated in IVT at 30 locations across the five zones. For GFY (q/ha), entries OL-1861 (10.7%), SKO-229 (5.9%) in Hill zone; entries HFO-607 (9.4%), JO-05-7 (9.1%), OL-1869-1 (8.9%), OL-1861 (7.0%) in NWZ ; entry HFO-525 (7.6%) in NEZ; entries HFO-607 (9.6%), OL-1869-1 (8.5%), OL-1862 (8.4%), OL-1861 (7.1%), SKO-229 (5.1%) in central zone; HFO-607 (5.3%) in SZ exhibited superiority over best national/zonal check. At national level, entries HFO-607 (9.7%), OL-1869-1 (5.9%), OL-1861 (4.8%) were superior to checks. For DMY, entries SKO-229 (9.9%), OL-1861 (9.1%), NDO-1102 (4.5%), in Hill zone; HFO-607 (6.1%), in NWZ; HFO-525 (8.5%), HFO-607 (4.6 %) in NEZ; entries HFO-607 (18.0%), OL-1862 (14.5%), HFO-525 (13.7%), JO-05-7 (11.3%), OL-1861 (10.1%), UPO-16-4 (7.4%), OL-1869-1(6.6%), SKO-229 (5.2%) in central zone; entry HFO-607 (5.5%) in south zone exhibited superiority over checks. At national level, HFO-607 (12.5%), HFO-525 (6.4%) were best performers. For quality parameters, entry HFO-607 followed by UPO-16-4 and HFO-525 were best performers for CPY (q/h), whereas OL-1861 ranked first for CP content.

AVTO (SC)-1: Seven entries promoted from IVT were evaluated against two national checks) and four zonal checks in respective zones at 20 locations in four different zones (HZ, NWZ, NEZ, SZ). For GFY, entries SKO-227 (12.6%), HFO-427 (9.7%), JO-04-22 (7.6%), JHO-15-1 (5.5%) in HZ; HFO-427 (5.9%) in South zone exhibited superiority over the best check. At national level, HFO-427 registered 5.8% superiority for GFY. Similarly for DMY, entry SKO-227 (7.7%) in HZ; HFO-427 (4.6%) in NWZ performed better than the best check. For quality parameters, for CPY, HFO-427 and JHO-15-1 (6.9q/ha) ranked joint first followed by national check (6.6). For CP%, entry JHO-15-1 and check OS-6 (9.6 %) were best performers.

AVTO (SC)-2: Eight entries were evaluated against two national checks Kent and OS-6 and three respective zonal checks at 16 locations in three zones (HZ, NWZ, CZ). For GFY, entries SKO-225 (11.7%), OL-1766-1(8.7%), OL-1802-1 (7.3%), OL-1769-1 (5.1%) in HZ; entries OL-1769-1 (8.5%), OL-1802-1 (7.8%) in NWZ; entries OL-1802-1 (8.4%), JO-04-19 (6.8%), OL-1769-1 (6.1%) in central zone and OL-1802-1 (12.4%), OL-1769-1 (11.5%), JO-04-19 (7.6%), OL-1766-1 (7.3%), SKO-225 (7.0%), OS-424 (5.6%), OS-432 (4.6%) at all India level exhibited superiority over best zonal/national check. Similarly for DMY, entries SKO-225 (24%), OL-1766-1 (14.6%), OL-1802-1 (13.1%), OL-1769-1 (11.4%), OS-424 (10.3%) in HZ; OS-424 (6.6%), OL-1769-1 (5.6%) in NWZ; OL-1769-1 (10.5%), JO-04-19 (6.5%), OS-432 (6.1%), SKO-225 (5.1%) in CZ registered superiority over best check. At national level, OL-1769-1 (15.7%), SKO-225 (13.2%), OS-424 (11.3%), OL-1802-1 (10.5%), OL-1766-1 (10.4%), JO-04-19 (9.8%), OS-432 (6.9%) recorded superiority over best check. In quality parameters, entries OL-1769-1 (8.3) followed by OS-424 (8.2) in comparison to best check (7.0) for CPY (q/ha) and OS-432 (9.7) followed by UPO-10-3 (9.3) in comparison to best check (9.0) for CP% recorded superiority.

AVTO (SC)-2 (SEED): Advanced varietal trial in Oat for seed with eight entries along with two national checks and respective zonal checks were conducted at seven locations in three zones. For seed yield, entry OL-1802-1 (7.3%) and OS-424 (4.4%) were better than check in NWZ.

IVTO-MC: In initial varietal trial in Oat (multicut), seven entries were evaluated against three national checks at 18 locations in four zones (HZ, NWZ, NEZ, and CZ). For GFY, DMY & CPY, none of the entries showed significant superiority over the checks on zonal and national basis except for HFO-611 (7.0%) in HZ for DMY.

AVTO-1 (MC): Five entries of Oat promoted from IVTO (MC) along with three national checks were evaluated at eight centres in Hill and Central zones. For both GFY, DMY and CPY entries were either inferior or marginally superior to best check at zonal and national level, except for HFO-514 in CZ for DMY which showed 6.5% superiority over the best check. For Crude Protein, entry OL-1842 (10.7%) ranked first followed by OL-1866 (10.3%) as compared to best check (10.0%).

IVTO (DUAL): An initial varietal trial in Oat (Dual) comprising of nine entries along with two national checks (UPO-212 and JHO-822) was conducted at 18 centres at five zones. For GFY, entries RO 11-1(4.8%) in NWZ and HFO-619 (6.8%) in NEZ, entry RO-11-1 (12.1%) and JO-10-501 (5.3%) in Central zone and RO-11-1 (8.3%) at all India level (7.8%) registered superiority over the best check. For DMY, entry HFO-619 (9.7%) in NE zone, RO-11-1 (10.6%), OL-1769 (9.8%), HFO-619 (4.8%) in central zone and RO-11-1 (5.5%) at all India level registered superiority. For quality parameters, entry RO-11-1 for crude protein yield (4.3 q/ha) followed by HFO-619 (4.1q/ha) were superior to best check UPO-212 (4.0 q/ha). For seed yield, entry JO-10-501 was marginally superior to best check.

AVTO-1 (DUAL): An Advanced varietal trial -1 in Oat (Dual) comprising of three entries along with three national checks (UPO-212, RO-19 and JHO-822) was conducted at 4 centres located in NE zone. For GFY, DMY none of the entries could surpass national checks. For CP (%), entry OL-1802 (9.8%) was better than best check (9.5%). For seed yield (q/ha), national check UPO-212 was best.

AVTO (SC)-2: REPEAT 14-15: In Oat (single cut), AVT-2 trial was repeated. Seven entries were evaluated against 2 national and 1 zonal check at 3 locations in south zone. For GFY, DMY, CPY and CP (%) entry OS-405 performed better than checks.

LUCERNE

VT Lucerne -2016 (Perennial): The trial was established in 2016 and in first year data of twelve entries including checks were reported by 13 centres in three zones (North West, Central and South zone). The entries are coded and will be decoded after completion of trial. For GFY, entry VTL-1-8 in NWZ; entry VTL-1-9 in CZ; entry VTL-1-11 in south zone and entry VTL-1-9 at all India level, top ranked. For DMY, top ranking entries were VTL-1-2 in NWZ, entry VTL-1-3 in CZ, South zone and all India level. Entry VTL-1-9 for CPY also for crude protein (20.8%) ranked first.

VT- LUCERNE (P)-2013 REPEAT: In Lucerne repeat trial, five entries were evaluated against 2 checks, at 3 locations in south zone. For GFY, DMY and CPY entry TNLC-14 ranked first.

VT Vicia (Perennial): Five entries were evaluated in coded forms at three centers. For GFY and DMY, JVS-1 followed by JVS-2 showed superiority. For CPY entry JVS-4 and for crude protein, entry JVS-5 was superior.

IVT Lolium (Rye grass) -Annual: Five entries were evaluated along with one check at five centers. For GFY, PBRG-2 followed by Palam rye grass -1 showed superiority over the check. For DMY, entry PBRG-2, Palam rye grass -2, Palam rye grass -1 were superior over the checks. For CPY, CP (%), ADF %, NDF%, entry Palam rye grass-1 ranked first.

VT Red Clover 2016 & VT White Clover 2016: This was the establishment year. Data reporting will be done from next year onwards.

Forage Crop Production

The forage crop production programme was executed at 24 locations in five zones. In total 20 experiments were conducted, out of which 8 were in network (5 coordinated and 2 AVT based) and 20 were in location specific mode. The trials focussed on various dimensions of forage management *viz.*, aspects of intercropping of fodder-fodder, food-fodder, zinc and boron nutrition for enhancing the seed production. The studies on productivity maximization of sole crops *i.e.*, grasspea, oat, perennial fodder sorghum and bajra napier hybrids were undertaken to enhance the forage availability. The studies were also conducted for utilization of rice fallow and sodic soils for fodder production for horizontal expansion of forage crops. The use of phosphogypsum and micronutrients for yield maximization has been an important dimension of the research activities. This year studies has been initiated on emerging themes *viz.*, Organic agriculture, carbon sequestration, climate resilient fodder production technologies and Hydroponics fodder production. The studies on quality of conserved fodder were undertaken during the year, besides the regular activity of evaluation of promising entries of forage crops for their response to nutrient application.

PS-13-AST-2: Performance of perennial fodder sorghum (*Sorghum bicolor* cv. COFS-29) as influenced by planting geometry and cutting intervals under irrigated conditions)

The coordinated trial was started during *Rabi* 2013-14 at Bikaner, Raipur and Dharwad centres to assess the effect of planting geometry and cutting intervals on growth, yield and quality of perennial sorghum under irrigated condition. The green, dry and crude protein fodder yield was highest with 45 cm row spacing. The cutting interval of 60 days recorded higher green fodder and dry matter (1138.0 and 274.1 q/ha).

K-14-AST-3: Study of intercropping system of Pigeon pea with different annual fodder crops

The experiment was initiated during 2014 at Ranchi and Raipur to identify the suitable intercropping system. The results indicated that, in terms of GFY and DFY, Pigeon pea +Sorghum (2:1), Pigeon pea +Maize (2:1) intercropping system remained significantly superior to other systems. In terms of CPY and net returns, Pigeon pea + maize (2:1) proved superior.

K-15-AST-9 C: Development of climate resilient production technologies on productivity and economics of food - fodder based cropping systems

A trial was initiated at four centres (Pantnagar, Ranchi, Kalyani and Jabalpur) with the objective to study the effect of climate change on productivity and profitability of food-fodder based cropping systems and to identify suitable climate resilient production technology in different zones.

The results indicated that all the tillage operation except zero tillage- (all the crops), recorded green and dry matter yields on par with each other. Zero tillage- (all the crops) recorded significantly lower yields. Sorghum (Fodder) – Berseem – Maize (Baby Corn) cropping systems proved superior and recorded maximum yields (836.8 q green and 836.8q dry matter per hectare).

K-15-AST-11 C: Studies on carbon sequestration in perennial grass based cropping systems

A trial was initiated at six centers (Hyderabad, Coimbatore, Vellayani, Ranchi, Jabalpur, Anand) with the objective to study the effect of cropping system on Fodder yield, quality and carbon sequestration potential. The results indicated that on locational mean basis, BN hybrid in paired rows (60/120 cm) + cowpea (Kharif) - Lucerne and BN hybrid in paired rows (60/120 cm) + *Sesbania grandiflora* (1598.8q green and 382.7 q dry matter/ha) remained on par with each other but significantly superior to other treatments in terms of GFY, DFY and GMR. BN hybrid in paired rows (60/120 cm) + *Sesbania grandiflora* recorded higher crude protein yields. Guinea grass in paired rows (60/120 cm) + Desmanthus (Perennial) recorded the highest value (442.0t/ha in 7 cuts) for carbon dioxide sequestration.

R-15-AST-1: Productivity of oat - lathyrus intercropping system as influenced by integrated nutrient management

A field experiment was initiated from Rabi 2015-16 to study the productivity and profitability of food (lathyrus) + forage (oat) intercropping system influenced by INM at Kalyani, Bhubaneswar and Ranchi. Oat cv. OS-6 and Lathyrus Cv. Nirmal were used for the study. The mean over the locations indicated that oat + Lathyrus (3:2) recorded maximum GFY (299.81q). With respect to DFY and CPY, Sole oat (62.74q dry and 6.023 q CP) was superior. Application of 50% N (RDF) + 50% N (vermicompost) recorded significantly higher GFY (372.32 q), DFY (58.26 q), CPY (5.70 q), and GFEY (265.7q) per hectare.

PS-14-AST-2: Impact of Mg and B on nutrient uptake, quality and yield of bajra napier hybrid.

The trial was conducted at Vellayani to assess the influence of Mg and B nutrition on the performance of bajra napier hybrid. Open situation showed significantly higher values for all the growth and yield attributes as well yield. Among the nutrient levels, highest GFY and DFY was recorded in POP alone and it was found to be on par with POP + MgSO₄, 80 kg/ha.

CS-14-AST-1: Studies on intensive fodder cropping systems for yield maximization

The perennial based experiment was initiated during *kharif* 2014 at Raipur with objective to identify appropriate cropping system for maximum fodder production. The results indicated that, intercropping of berseem in winter and cowpea in summer with BN hybrid cropping system recorded significantly maximum green fodder, dry matter crude protein, gross return, net return and benefit cost ratio.

CS-14-AST-2: Study of intensive annual fodder crop based cropping system

The experiment was initiated during *kharif* 2014 at Raipur with the objective to find out appropriate annual cropping system for maximum fodder production. Significantly superior green fodder, dry matter, per day productivity and benefit cost ratio was recorded with maize + rice been (2:1)

K-15-AST-1L: Studies on Different model for year round Green fodder production under Irrigated condition

The trial was initiated during *Kharif* 2015 with objective of identifying the suitable & economical year round fodder production system under irrigated situation at Mandya (Karnataka). The results revealed that year round fodder production system of B N hybrid + Lucerne (2:8) recorded higher green fodder yield (1679.3 q/ha), DMY (367.6 q/ha), Net returns (Rs 154475.0/ha) and B:C ratio of 2.9.

K-15-AST-2L: Performance of BN hybrids as influenced by nature of vegetative propagules

The experiment started at Dharwad to identify most suitable planting material for propagation of popular bajra napier hybrid varieties viz. DHN 6, CO (BN) 5 and IGFRI 7. Lowest weight was recorded with the BNH var. CO (BN) 5 while the volume was lowest with the DHN 6. Two eyed root slips recorded the highest establishment, green fodder yield and crude protein content as well as yield.

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

The field experiment was conducted during two consecutive seasons of Rabi at Faizabad centre to screen the fodder oat entries for their performance under sodic condition. The results indicated NDO-951 was superior in all parameters i.e., green fodder, dry matter and crude protein yields as well as per day productivity.

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

The experiment was initiated in 2016 at Hisar to study the feasibility of organic nutrient management in sorghum-berseem cropping sequence for sustainable fodder production. Results revealed that during *kharif* 2016, highest green fodder and dry matter yield of berseem (five cuts) were recorded with 20 t FYM/ha (15t in sorghum + 5t in berseem) + biofertilizer (*Azotobacter* + PSB in sorghum and *Rhizobium*+ PSB in berseem).

K 16-AST-8: Resource management in rice-oat cropping system under sodic soils

The field experiment was initiated during *Kharif* 2016 at Faizabad centre to study the resource management in rice-oat cropping system under sodic soils. The results revealed that the values of grain and straw yields of paddy were significantly higher with RDF and being *at par* with 75% RDF+25% N through pressmud. 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 pressmud under rice – oat cropping system

R-13-AST-1: Yield Potential of Cereals with Forage Legumes under Pure Stand and Mixtures

Three cereals viz. oats (*Avena sativa* L.), barley (*Hordeum vulgare*) and annual rye grass (*Lolium multiflorum*) were evaluated in pure stands as well as in mixtures of 50:50 ratios with common vetch (*Vicia sativa* L.) and field pea (*Pisum sativum*) under temperate conditions Srinagar. The results revealed that oats+vetch mixture performed better in terms of green and dry matter yields. In pure stands maximum green fodder yield was recorded in oats crop. Higher content of crude protein was observed in sole vetch (20.89%) and higher crude protein yield was obtained in oat + vetch (11.31kg/ha),

R-14-AST-2-: Effect of cutting and nutrient management on growth, yield and quality of oat

This experiment was initiated at Imphal during *Rabi* season of 2014-15 with a view to evaluate oat for different purpose, viz. grain, fodder and both grain and fodder, under varying nutrients and cutting management practices. The data revealed that fodder oat variety JHO-822, grown for seed purpose only produced higher seed yield (21.69 q/ha). Oat grown for green fodder i.e. three cut (60, 90 & 120 DAS) was found to be dominant in green (533.64 q/ha) and dry matter yield (99.04 q/ha). For dual purpose (green forage +seed yield), one cut @ 60 DAS and left for seed was found to be the best. From economics point of view, highest net monetary return and benefit cost ratio was recorded in oat grown for green forage + seed.

R-15-AST-2: Productivity of oat - pea intercropping system as influenced by integrated nutrient management

the experiment on effect of oat + pea intercropping system under different INM practices was undertaken at Jorhat in Rabi 2016-17 to study the productivity of both food and forage. The data revealed that the highest GFEY of the system as a whole was found in pea sole (807.41 q/ha). However intercropping system oat+pea (3:3 ratio) recorded higher GFEY. The highest LER was also recorded (2.10) in oat+pea (3:3 ratio).

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

The experiment was initiated during Rabi season of 2015-16 to study the effect of integrated nutrient management on productivity of oat - chickpea intercropping system at Imphal. The data revealed that all parameters except plant height, stover and seed yield of chickpea were significantly higher under sole crop compared to its intercropping. Intercropping system recorded LER above 1.0 which indicates 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.

R-15 AST-3: Response of phosphogypsum to various cultivars of fodder oat in sodic soil.

The experiment was conducted during Rabi seasons at Faizabad to assess the effect of phosphogypsum on fodder productivity of cultivars of oat under sodic soils. The results indicated that oat cultivar NDO-711 was statistically superior in terms of GFY, DMY, CPY and per day productivity. A consistent increase in GFY, DMY, CPY and per day productivity were recorded with an increase in phosphogypsum levels from zero to 250 kg (40kg S)/ha.

R-15-AST-4: Study on 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 long term stable green fodder availability. The highest GFY (606 q/ha), DMY (68.1q/ha), CPY (10.3 q/ha), net return and

B: C ratio were recorded in lucerne+ oat mixed with 30kg each /ha.

R-15-AST-5: Effect of Zinc and Boron on seed production potentiality of oats under lateritic soil of West Bengal

A field experiment was conducted during *Rabi* 2016-17 at Sriniketan, West Bengal to study the effect of zinc and boron on seed production potentiality of oats under lateritic soil. Combined application of ZnSO₄ @ 20 kg/ha and Borax @ 10 kg/ha produced the highest seed yield (3.33 t/ha), straw yield (7.07 t/ha) and biological yield (10.81 t/ha) of oats.

R-15-AST-7: Standardization of seed rate of berseem with rye grass under mixed cropping system

A field experiment was conducted during *Rabi* 2016-17 at Karnal, to study the effect of varying seed rates of berseem and ryegrass on growth, yield, quality and economics of mixed cropping system. The results revealed that highest yields were recorded by t8 (115.80t green and 1.20 t dry matter /ha).

R-16-AST-5: Seed yield maximization in Oat cv. RO-19 (Phule Harita)

The trial was conducted at Rahuri 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 lodging percentage was significantly lower in application of silicon dioxide @ 400 kg ha⁻¹. Significantly higher lodging percentage was recorded with no cutting of crop (50%).

R-14-AST-3: Studies on the effect of additives on silage quality of different grasses

The experiment was conducted at Vellayani to study the effect of additives on silage quality of different grasses. Pooled analysis showed that seasons had no significant influence on quality parameters of silage. Highest value for fresh silage/pit, dry matter content and total ash was recorded in silage prepared from Guinea grass. Highest crude protein and ether extract was recorded in silage prepared from BN hybrid. Ether extract was found to be significantly high in silage prepared with urea 2% as additive.

K-16-AST-1: Feasibility of Hydroponics fodder production system-A Quantitative and Qualitative study.

The trial was conducted at Hyderabad with the objective to establish the suitability of different crops, ideal seed rate and cutting interval for quality biomass production under Hydroponics system. The quality of water used in experiment was of neutral pH (7.8) and E.C of 1.6 dS/m. The green fodder yield from one kg of Maize seed was highest at seed density of 200 g/sft. The green fodder yields harvested on 9th day, 11th day and 13th day were on par. Crude protein increased with delaying harvest from 9 to 15th day. The green fodder yield from one kg of cowpea seed was highest at seed density of 300 g/sft compared to other seed densities tested (3.92 kg GFY per kg seed). The green fodder yields of crop harvested on 9th day was highest (4.34 kg). Crude protein was highest at 400g/sft seed density but there was no effect of harvesting intervals on CP%. In sorghum the seed multiplication ratio into GFY was very poor i.e., not crossing 3 kg at any harvesting interval.

AVT-2 BASED AGRONOMY TRIALS

R-16-AST-6: Effect of nitrogen levels on forage yield of promising entries of oat (AVTO-2-SC)

In Oat (Single cut), eight entries (424, OL-1769-1, OL-1802, SKO-225, JO-04-19, UPO-10-3, OL-1766-1, OS-432) along with two national checks namely OS-6 and Kent and three zonal checks viz., SKO-90 (HZ), OL-125 (NWZ), JHO-822 (CZ), were evaluated at 9 locations across the three zones in the country. In North West zone, for GFY, DMY and CPY, entry OL-1802 was superior to other entries as well as national checks. In Hill zone, except entry UPO-10-3, all other entries recorded higher GFY and remained at par with each other. The entries were significantly superior over checks. In terms of DFY, SKO-225 (64.65) recorded superior yields over other entries and checks. In Central zone, for GFY and DFY, entry OL-1802, OL-1766-1 and OL-1769-1 were superior over other entries. In terms of CPY entry OL-1802 was superior. On all India mean basis, OL-1802 produced maximum GFY (533.3 q/ha) and DFY (104.01 q/ha). The entry also recorded highest CP yields as among all entries and national checks. The growth performance and yields of all the entries improved consistently with increase in level of nitrogen up to 120 kg/ha.

R-16-AST-7: Effect of P levels on forage yield of promising entries of Berseem (AVTB-2-MC)

Two berseem entries (JB-04-23 and JB-04-21) along with two national checks (Wardan and Mescavi) and one zonal check (BB-2) were evaluated at 7 centers located in two zones. Both the testing entries remained below or at par with checks (Bundel Berseem-2 (CZ & NWZ) and Mescavi (NC) in terms of GFY and DFY. The application of graded level of phosphorus brought consistent improvement in GFY, DMY recording maximum with 100 kg P₂O₅ kg/ha (574.2 and 84.6 q/ha).

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 5 centers *viz.*, Ludhiana, Rahuri, Palampur, Dharwad, and Bhubaneswar.

At Ludhiana, stem rot of berseem appeared in the last week of December, 2016 on variety BL-42, progressed till 2nd fortnight of March, 2017 with maximum incidence of 61.4% with favourable weather. **Leaf blight of oat** appeared on variety OL-10 in 1st week of January. From first week of February till first week of March increased at alarming rate upto 56.7% severity with favourable climate (6.2-30.4°C, RH% 43-96). **Downy mildew of Lucerne** on variety LLC 5 was observed in the 3rd week of January. Disease progressed at faster rate till 3rd week of March with disease severity of 52.4 percent and then it progressed at steady pace till first week of April with maximum severity of 58.3 percent. Low temperature range (6.2-25.5°C), high RH (64-96%) and high rainfall favoured the disease development.

At Ludhiana, population dynamics of major lepidopteran (green semilooper, *Trichoplusia orichalcea* and gram caterpillar, *Helicoverpa armigera* and *S. exigua*) as well as sucking insect pests was studied on three varieties of berseem (BL-10, BL-42 and PC 75), oats (Kent and OL-10) and one of lucerne (LLC-5). The population of green semilooper, *T. orichalcea* started on berseem in the first week of April and reached peak in the end of April to first week of May. *H. armigera* appeared on berseem in 3rd week of April and lasted till the IVth week of May, with highest peak during last week of April to first week of May. On Lucerne, weevil appeared from 1st week of February till mid March 2016 with highest peak in 3rd week of March. The population of oat aphid was comparatively higher as compared to previous year with maximum population during the last week of March to first week of April.

At Rahuri, the population of **pea aphid** (*Acyrtosiphon pisum*) was noticed on **Lucerne** during last week of December and increased steadily at its peak level up to the 3rd week of January (42.67 aphids/tiller) and decreased thereafter. Pea aphid appeared again on Lucerne during 2nd week of March and reached at its peak during last week of March with 24.00 aphids/tiller, disappearing on 4th week of April. During the aphid infestation, population of predatory lady bird beetles was moderate to high (1.00 to 3.67 grubs/tiller).

At Rahuri, in **Lucerne** the *Spodoptera litura* become a major and regular pest during summer season. Larval population was noticed during 2nd week of February, increased steadily reaching peak population (11.33 larvae/m²) during 1st week of May. *H. armigera* was noticed on Lucerne seed crop during 3rd week of February, increased up to 3rd week of April with highest population of 13.00 larvae/m². In **berseem**, aphid *R. maydis* was noticed during 1st week of January and disappeared after last week of January. Its population was very low (3.67 to 9.67).

Population of **oat aphid** (*Rhopalosiphum padi* L.) was noticed (13.90/tiller) during 3rd week of December (51 SMW), increased at faster rate and reached its peak (93.20 aphids/tiller) during the 1st week of February (7th SMW), started declining in 3rd week of February (8th SMW), with minimum in 1st week of March, 2017 (10th SMW).

Coccinellid predators: **At Rahuri**, The initial population of LBB grub was recorded during last week of December (52nd SMW) which increased very slowly up to the 1st week of February (6th SMW), started decreasing and disappeared on 2nd of March (11th SMW). The aphid population during the period was also showed in decreasing trend.

Chrysoperla carnea: **At Rahuri**, The population of *C. carnea* started at the 4th week of January (4th SMW), reaching peak (2.00/tiller) in last week of February (9th SMW). During this period, oat aphids were observed to be well established on oat. **At Rahuri**, There was no disease incidence recorded on oat crop throughout the crop period.

At Palampur, oat crop was severely affected by powdery mildew (95% severity), followed by leaf blights (15%), loose smut (3%) and sucking pest (16%). In berseem low incidence of root rot (5%) and moderate intensity of leaf spot (12%) and defoliating beetles (20%) was observed. Defoliating beetles (45%) and leaf spot (18%) was observed on Lucerne.

At Dharwad, In Lucerne, insect and disease incidence at 15 days interval revealed that aphid population started building from January onwards and reached peak during second fortnight of February (130 aphids /stem), started declining after second fortnight of April, disappearing in May. Rust was major disease reaching 30% severity during first fortnight of March.

At Bhubaneswar, observations were recorded on oat cv Kent and Berseem cv Mescavi. The diseases started appearing on 50th SMW and the peak was observed at 5th SMW. In oat, leaf blight caused by *Helminthosporium sp.* and root rot caused by *Sclerotium sp.* was observed. Nematode population was found to increase before sowing and after harvest.

At Hyderabad, incidence of thrips in Berseem and Lucerne started in 2nd SMW and continued up to 5th SMW. In Lucerne, appearance of Aphids and leaf webber started in 2nd and 3rd SMW respectively and continued till 5th SMW.

FIELD SCREENING OF RABI-BREEDING TRIALS

In Berseem IVTB, At Ludhiana, all entries showed moderately susceptible disease reaction to stem rot of berseem except HFB-13-1, JHB-16-01, JB -05-10 which were moderately resistant. All the entries showed moderate population of lepidopteran caterpillars with non significant differences. **At Rahuri**, all 5 test entries as well as national check was Resistant whereas Bundel Berseem -2 zonal check was moderately resistant. **At Palampur**, for root rot, entries JHB-16-01, JB -05-10 and national check Wardan were resistant whereas others were moderately resistant. **At Bhubaneswar**, For leaf spot and leaf blight, HFB-13-1 and BB 3 were susceptible whereas JHB-16-01 and JB -05-10 were moderately resistant, other entries were resistant. For leaf defoliators, JHB-16-01, Wardan and BB 3 were moderately resistant whereas other entries were resistant.

In AVT-I Berseem, At Ludhiana, all the entries were moderately resistant to stem rot except PC-82 which was moderately susceptible. All entries showed moderate population of lepidopteran caterpillars with non significant differences. **At Rahuri**, All entries were Resistant. **At Palampur**, all the entries were resistant to root rot.

Berseem- AVT-2, At Ludhiana, Entries BB2 and Wardan were moderately resistant to stem rot of berseem and rest entries were moderately susceptible. **At Rahuri**, all entries were Resistant to aphids.

Berseem – AVT-2 (Seed): At Ludhiana, all entries were moderately susceptible to stem rot. All entries recorded non significant differences for lepidopteran caterpillar population. **At Rahuri**, all the entries were resistant to aphids.

Oats – IVTO SC: At Ludhiana, UPO-16-4 was found resistant to leaf blight. All the entries showed moderately resistant disease reaction except HFO 607 which was moderately susceptible. The aphid population in the test genotypes varied non-significantly. **At Rahuri**, National check Kent was moderately Resistant; other entries including local check RO-19 were resistant. **At Palampur**, all entries were susceptible to Powdery mildew.

Oats - AVTOSC-1: At Ludhiana, HFO-529 was resistant to leaf blight of oats whereas rest of entries was found moderately resistant. The aphid population in the test genotypes varied non-significantly. **At Palampur**, almost all entries fall into susceptible category for Powdery mildew. **At Bhubaneswar**, for Alternaria leaf blight, entries JO-04-22 and OS-6 were moderately susceptible, whereas entries SKO-227 and HFO-529 were resistant. All other entries were moderately resistant. For sclerotium root rot, entries JO-04-22, JHO-99-2 (ZC-NEZ), JHO-15-1 were highly susceptible, whereas entry HFO-529 was resistant. Entries HFO-427, SKO-227, Kent (NC) were moderately resistant rest of the entries were moderately susceptible.

Oats- AVTOSC-2: At Ludhiana, Kent (NC) and OL-1802-1 showed resistant disease reaction to leaf blight. OL-1766-1, UPO-10-3, OL-1769-1, OS-424, JO-04-19 were moderately resistant and rest entries which were moderately susceptible except SKO-225 which was susceptible. The aphid population in the test genotypes varied non-significantly. **At Palampur**, Kent (NC) was resistant entries OL-1766-1, SKO-225, OL-1769-1, OS-432 were moderately resistant whereas all other entries were susceptible. **At Rahuri**, Resistant entries were UPO-10-3, OS-432, JO-04-19, JHO-822 (ZC-CZ) and RO-19, whereas moderately resistant entries were OL-1766-1, SKO-225, OL-1769-1. Susceptible entries were OL-1802-1, OS-6 (NC) and highly susceptible were Kent (NC), OS-424

AVTO (SC)-2 (SEED): At Rahuri, resistant entries were Kent (NC), SKO-225, OL-1769-1, OS-424, OS-432, JO-4-19, JHO-822 (ZC-CZ) and RO-19 (Local check). Moderately resistant entry was OL-1766-1 whereas entries OL-1802, UPO-10-3, OS-6 (NC) were susceptible. **At Palampur for Powdery mildew**, SKO-90 (ZC-HZ) was moderately resistant whereas all other entries were susceptible.

Oats – IVTOMC: At Ludhiana, OL-1869 showed resistant reaction to leaf blight and other entries showed moderately resistant reaction except PLP-18 which was moderately susceptible and HFO-609 was susceptible.

The aphid population varied significantly being highest in OL-1873 and lowest in UPO-212 (NC). **At Palampur**, all the entries were susceptible to highly susceptible for Powdery mildew. **At Bhubaneswar**, entry JO-05-301 was highly susceptible, entries RO-19 (NC) and HFO-611 were resistant, entries OL-1876, Kent (NC) were moderately resistant. All other entries were susceptible for Alternaria leaf blight. For sclerotium root rot, entries RO-19 (NC) and HFO-611 were moderately resistant whereas other entries fall into susceptible to highly susceptible categories. For leaf defoliators, minimum incidence was recorded at RO-19 (NC) and HFO-611 and maximum in JO-05-301. **At Rahuri**, Resistant entries were JO-05-301, OL-1869, OL-1873, UPO-212 (NC), RO-19 (NC), PLP-18, HFO-609 and RO-19(LC); moderately resistant entries were OL-1876, Kent (NC), and HFO-611.

At Rahuri, moderately resistant entries were OL-1842, UPO-212 whereas all other entries including local check RO-19 (LC) were resistant. **At Palampur**, all the entries were susceptible to highly susceptible for Powdery mildew

IVTO-Dual: At Bhubaneswar, for Alternaria leaf blight, entries HFO-610, JHO-822 (NC), RO-11-1, HFO-619 were highly susceptible, whereas entries OL-1804-1, RSO -8, UPO-212 (NC), RSO -60 were moderately resistant. All other entries were susceptible. For sclerotium root rot, entries HFO-610, JHO-822 (NC), RO -11-1, HFO-619, JO-10-501 were highly susceptible, whereas entry RSO -60 was resistant. Entries OL-1804-1, RSO -8, UPO-212 (NC) were moderately resistant rest of the entries were moderately susceptible. **At Palampur**, all the entries were susceptible to highly susceptible for Powdery mildew. **At Rahuri**, Moderately resistant entries were UPO-212 (NC), RSO-60, HFO-619, whereas all other entries including local check RO-19 were resistant.

AVTO -1 (Dual): At Bhubaneswar, for Alternaria leaf blight, entries OL-1802, JHO-822 (NC), UPO-212 (NC) were resistant, whereas entry NDO-11-01 was moderately resistant. Entry RO-19 (NC) was susceptible, entry OL-1760-1 was highly susceptible. For sclerotium root rot, entry OL-1760-1 was highly susceptible, whereas entry OL-1802, RO-19 (NC) was susceptible. Entries JHO-822 (NC), NDO-11-01, UPO-212 (NC) were moderately resistant.

Lucerne – VTL- 2016: At Ludhiana, VTL-1-9, 10, 11 and VTL-1-13 showed moderately resistant disease reaction to downy mildew. Rest entries were moderately susceptible. All entries showed non-significant variation for Lucerne weevil and *H. armigera* population. **At Rahuri**, all entries were found resistant

IVT VICIA (P): At Rahuri, Insect-pests and diseases were not observed on Vicia crop

IVT LOLIUM (P): At Palampur, Disease pressure was low and all the entries of Rye grass were resistant for powdery mildew.

VT- LUCERNE (P) -2013 REPEAT: All the entries were found resistant for aphids/tiller, rust at Coimbatore, Mandya and Hyderabad

AVTO (SC)-2: REPEAT 14-15: At Hyderabad, no incidence of leaf blight was recorded. All the entries were highly resistant. Data were recorded on 22-01-2017 and 02-02-2017. At Coimbatore and Mandya also no leaf blight incidence was recorded.

Pathogenic variability of *Blumeria graminis* f. sp. *avenae* on oat : At Palampur, during 2016-17 season, eleven isolates of powdery mildew i.e. Palampur, KVK Kangra, Bir, Utarala, Kholi 53 mile (Dist. Kangra), Bara (Hamirpur), Lad-Bharol, Tikkan, Shanaan (Mandi) and Udaipur, Jhalma (Lahaul and Spiti) were collected and maintained under controlled conditions (Green House). To study of inheritance of powdery mildew resistance, three resistant lines (OL-1847, OG-77 and AVTO-SC-2-Seed-9) were selected and crossed with HJ-8 (Susceptible check) in field and F1 seeds were harvested.

Management of soil borne diseases in clover (Egyptian clover) seed crop: At Ludhiana, spray with Carbendazim @ 1.0 kg/ha was best treatment exhibiting least disease incidence (14.38%) of stem rot having 55.20 percent disease control with 38.98 percent increase in GFY followed by application of neem seed powder @ 50 kg/ha (17.43%) with 35.25% in GFY and spray of NSKE @ 5% before disease appearance with disease incidence of 18.62%.

Management of soil borne and powdery mildew diseases in red clover seed crop: At Palampur, integrated management i.e. seed treatment with carbendazim @ 2 g/kg seed followed by three foliar spray of hexaconazole @ 0.1 % gave best management of powdery mildew having 3.8 percent disease severity and 93.9 per cent disease control with 45.7 per cent increase in yield as compared to control.

Seed treatment with carbendazim @ 2 g/kg seed followed by and one spray each of *Trichoderma*, wettable sulphur and hexaconazole provided best management of soil borne diseases and good control of powdery mildew with 62.9 per cent increase in yield over check.

Management of foliar diseases of oat: At Ludhiana and Bhubaneswar, seed treatment with Carbendazim 50WP @ 2g/kg seed + foliar application of Propiconazole 25 EC @ 1ml/lit after 21 DAS showed minimum disease severity of leaf blight.

Biological management of *Spodoptera litura* on Lucerne under field condition: At Rahuri, during Pre count, the interaction effect among the treatments in respect of survival population of larvae/m² before spray treatment was non-significant. The range of survival larval population/m² was from 7.85 to 10.50 larvae/m². After 5 DAS, statistically lower survival population/m² was observed in treatment with mixture of *B. bassiana*, *N. rileyi* and SINPV (1.76 larvae/m²) at 8 pm spraying time. Among the time of application, lower survival population of larvae/m² was observed at 8 pm recording 3.52 larvae/m² which is significantly superior over the other time of application such as 8 am and 4 pm. However, the treatments, mixture of *B. bassiana*, *N. rileyi* and SINPV was found significantly superior over all the treatments recording 3.57 larvae/m². Nevertheless, it was at par with mixture of *B. bassiana* and SINPV and mixture of *N. rileyi* and SINPV recording 3.74 and 3.80 larvae/m².

At Rahuri, after 7 DAS, Foliar application of *B. bassiana* + *N. rileyi* + SINPV, *B. bassiana* + SINPV and *N. rileyi* + SINPV at 8 pm recorded 0.00, 0.00 and 0.00 survival larva/m², respectively at 7 DAS which were significantly at par with each other and showed their superiority as compared to other time of application. Among the treatments, lower survival population of larvae was observed with mixture of *B. bassiana*, *N. rileyi* and SINPV recording 1.56 larvae/m². Among the time of application, statically lower survival population was observed at 8 pm, recording 2.64 larvae/m². **At Rahuri,** the higher GFY of Lucerne was obtained from the treatment combination of *B. bassiana*, *N. rileyi* and SINPV sprayed during 8 pm. Among the time of application, higher green forage was obtained at 8 pm, recording 91.16q/ha which is significantly superior over other time of application. Maximum ICBR (1:2.83) was due to treatment of *N. rileyi* alone. Application of biopesticides at 8 PM is suitable time for the highest return.

Biological control of *Helicoverpa armigera* on Berseem / Lucerne seed crop: The experiment was carried out with the objectives to find out the effectiveness of different entomopathogenic fungi in combination with *HaNPV* against *H. armigera* on berseem / Lucerne seed crop at Ludhiana, Dharwad, Rahuri and Hyderabad. **At Ludhiana, In Berseem var. BL-42 seed crop,** the number of *H. armigera* larvae before spray varied non-significantly. Among the biopesticides evaluated, the treatment effect was significantly evident as compared with control after 5 and 7 days after spray. Amongst all the treatments, T6 (*B. bassiana* @ 1x10⁸ CFU/g (5 g/lit) + *N. rileyi* @ 1x10⁸ CFU/g (5 g/lit) + *HaNPV* @ 1ml/lit) emerged as statistically superior treatment. The number of honeybees per plot before as well as after 12h of treatment varied non-significantly.

At Dharwad, Among all the treatments, combination of foliar application of *B. bassiana* @ 1×10^8 CFU/g (5g/lit) + *N. rileyi* @ 1×10^8 CFU/g (5 g/lit)+ *HaNPV* @ 1ml/lit proved superior over all the treatments in reducing the larval population of *H.armigera* and registered the highest seed yield of 2.94 q/ha. Combination of either of entomopathogen *B. bassiana* and *N.rileyi* with NPV were superior to sole treatments. All the entomopathogens are safe to honeybees after 12 hours of spray. **At Rahuri**, At 5 days after spraying treatment combinations of *B. bassiana*, *N. rileyi* and *HaNPV* gave excellent control of *H. armigera* (2.58 larvae/m²).**Honey bee activities:** There were non-significant differences in respect of bee visits and average number of bees/plot/min at 2nd days after treatment.

Biological management of oat aphid *Rhopalosiphum padi* on oats: The experiment was carried out with the objectives to find out the effectiveness of different entomopathogenic fungi and neem formulations against *R. padi* on oats at Rahuri, Ludhiana and Dharwad. **At Rahuri**, there was non-significant differences among the aphid population at pre-count. At 5 DAS *L. lecanii* @ 7.5 g/lit (25.30), *M. anisopliae* @ 7.5g/lit (25.38) recorded significantly lower number of aphids per tiller. At 7 DAS both treatments maintained their superiority. There was non-significant differences of coccinellid predators among the treatments. **At Ludhiana**, the number of *R. padi* before spray varied non-significantly in all the treatments. Among the biopesticides evaluated, the treatment effect was significantly evident as compared with control after 5 and 7 days after spray. **At Dharwad**, treatments were not imposed due to non-occurrence of the aphid *Rhopalosiphum padi* on oat.

Forage Crops Breeder Seed Production

The indent for Breeder Seed Production for **Indent year Rabi 2017-18 and Production year Rabi 2016-17** was received from DAC, GOI for 25 varieties in four forage crops *viz.*, Oat (12), Berseem (9), Lucerne (3) and Gobhi Sarson (1). The quantity allocated was 491.15q which was 20% higher than previous year indent of 409.13q. The production target was assigned to eleven Breeder Seed producing centres of the different SAUs/ NGO/ ICAR institutes. Among quantity indented for different forage crops, the maximum was for Oat (445 q) followed by Berseem (41.73 q) and Lucerne (4.30 q) and minimum for Gobhi Sarson (0.12 q).

In Berseem, the production was 46.35 q (4.62 q surplus) against the allocated quantity of 41.73 q. **In Oat**, the production was 406.16 q (38.84 q deficit) against the allocation of 445 q. **In Lucerne**, the target of (4.3 q) was achieved. **In Gobhi Sarson**, the production was 0.17 q against the allocation of 0.12 q (0.05 q surplus). The overall production was 456.98 q which was 34.17 q (6.95%) less than the indented target. There was surplus breeder seed available in many centers.

FORAGE TECHNOLOGY DEMONSTRATIONS

A total of 595 FTD's were allotted to 23 AICRP centres / voluntary for Rabi crops. It comprised of 112 FTDs to Berseem, 60 to Lucerne, 160 to Oat (Single cut), 88 to Oat (Multicut), 55 to Maize, 25 to Cowpea, 25 to Laythrus, and 70 to other crops.

**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.	Srinagar, SKUAS&T-K	2010	Jammu & Kashmir	2.	Rajouri, SKUAST-J	J & K	
II. North West States = 5 Locations = 13	3.	Ludhiana, PAU	1989	Punjab	3.	Bajoura (Kullu)	H P	
	4.	Hisar, CCS HAU	1970	Haryana	4.	Meerut, SVBPUA&T	Uttar Pradesh	
	5.	Pantnagar, GBPUAT	1995	Uttarakhand	5.	Ballowal Sankhari	Punjab	
	6.	Bikaner, SKRAU	1995	Rajasthan	6.	Avikanagar, IGFRI-RRS*	Rajasthan	
					7.	Jodhpur, ICAR-CAZRI*	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	
	III. North East States = 8 Locations = 9	7.	Faizabad, NDUAT	1982	Uttar Pradesh	13.	Umiam (Barapani), ICAR Res. Complex for NEH Region*	Meghalaya
		8.	Ranchi, BAU	1970	Jharkhand	14.	Visva Bharti, Shantiniketan Sriniketan	West Bengal
9.		Kalyani, BCKV	1972	West Bengal	15.	Medziphema	Nagaland	
10.		Bhubaneswar, OUAT	1987	Orissa				
11.		Jorhat, AAU	1970	Assam				
12.		Imphal, CAU	2010	Manipur				
13.		Pusa, RAU	2015 (Approved)	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	16.	Kanpur, CSAU&T	Uttar Pradesh
	15.	Jabalpur, JNKVV	1970	Madhya Pradesh	17.	Jhansi, ICAR-IGFRI*	Uttar Pradesh
	16.	Rahuri, MPKV	1971	Maharashtra	18.	Dhari, JAU	Gujarat
	17.	Urulikanchan, BAIF	1982	Maharashtra	19.	Karjat	Maharashtra
	18.	Raipur, IGKV	2010	Chhattisgarh	20.	Akola, PDKVV	Maharashtra
V. South States = 6 Locations = 7	19.	Mandya, UAS (B)	1986	Karnataka	22.	Dharwad, ICAR-IGFRI-RRS*	Karnataka
	20.	Coimbatore, TNAU	1976	Tamil Nadu	23.	Pudducherry, PJLNCA & RI, Karaikal	Pudducherry
	21.	Vellayani, KAU	1971	Kerala	24.	Tirupati/Guntur, ANGRAU	Andhra Pradesh
	22.	Hyderabad, PJTSAU	1970	Telangana	25. 26.	Raichur, UAS, Raichur Mattupetty	Karnataka Kerala

Summary: Zone = 5, States = 24, Coordinating Centers = 22, Testing Locations = 26

*ICAR Institute

Entries Code for Rabi 2016-17

1. IVTB: Berseem				5. IVTO (SC) Oat			
S. N.	Contributor	Entry name	Code name	S. N.	Contributor	Entry name	Code name
1	Ludhiana	BL-205	IVTB - 1	1	Ludhiana	OL-1861	IVTO SC- 1
2	Hisar	HFB-13-1	IVTB - 2	2	Faizabad	NDO-1102	IVTO SC- 2
3	Hisar	HFB-13-10	IVTB - 3	3	Pantnagar	UPO-16-4	IVTO SC- 3
4	Jhansi	JHB-16-01	IVTB - 4	4	(ZC-HZ)	SKO-90	IVTO SC- 4
5	Jabalpur	JB -05-10	IVTB - 5		(ZC-NWZ)	OL-125	IVTO SC- 4
6	(NC)	Wardan	IVTB - 6		(ZC-NEZ)	JHO-99-2	IVTO SC- 4
7	(ZC-CZ)	Bundel Berseem-2	IVTB - 7		(ZC-CZ)	OS-377	IVTO SC- 4
	(ZC-NEZ)	Bundel Berseem-3	IVTB - 7	(ZC-SZ)	JHO-2000-4	IVTO SC- 4	
	(ZC-NWZ)	Bundel Berseem-2	IVTB - 7	5	Hisar	HFO 525	IVTO SC- 5
	(ZC-HZ)	BL-22	IVTB - 7	6	Ludhiana	OL-1862	IVTO SC- 6
2. AVT-1 Berseem:				7	Hisar	HFO 607	IVTO SC- 7
S. N.	Contributor	Entry name	Code name	8	(NC)	OS-6	IVTO SC-8
1	(ZC-HZ)	BL-22	AVTB-1-1	9	Jabalpur	JO-05-7	IVTO SC- 9
	(ZC-CZ)	Bundel Berseem-2	AVTB- 1-1	10	Ludhiana	OL-1869-1	IVTO SC- 10
	(ZC-NWZ)	Bundel Berseem-2	AVTB- 1-1	11	(NC)	Kent	IVTO SC- 11
2	Jabalpur	JB-05-9	AVTB-1- 2	6. AVT Oat (SC-1):			
3	Hisar	HFB-12-4	AVTB- 1-3	S. N.	Contributor	Entry name	Code name
4	Hisar	HFB-12-9	AVTB- 1-4	1	Hisar	HFO-427	AVTO SC-1- 1
5	(NC)	Mescavi	AVTB- 1-5	2	Srinagar	SKO-227	AVTO SC-1- 2
6	(NC)	Wardan	AVTB- 1-6	3	Meerut	VOS-15-24	AVTO SC-1- 3
7	Ludhiana	PC-82	AVTB - 1-7	4	Ludhiana	OL-1844	AVTO SC-1- 4
3. AVT-2 Berseem:				5	Hisar	HFO-529	AVTO SC-1- 5
S. N.	Contributor	Entry name	Code name	6	Jabalpur	JO-04-22	AVTO SC-1- 6
1	Jabalpur	JB-04-23	AVTB-2 - 1	7	(ZC-HZ)	SKO-90	AVTO SC-1- 7
2	(ZC-CZ) (ZC-NWZ)	Bundel Berseem-2	AVTB-2 - 2		(ZC-NWZ)	OL-125	AVTO SC-1- 7
3	(NC)	Wardan	AVTB-2 -3		(ZC - NEZ)	JHO-99-2	AVTO SC-1- 7
4	Jabalpur	JB-04-21	AVTB-2 - 4		(ZC-SZ)	JHO-2000-4	AVTO SC-1- 7
5	(NC)	Mescavi	AVTB-2 - 5	8	Jhansi	JHO-15-1	AVTO SC-1- 8
4. AVT-2 Berseem (Seed):				9	(NC)	OS-6	AVTO SC-1- 9
S. N.	Location	Entries	Code name	10	(NC)	Kent	AVTO SC-1- 10
1	Jabalpur	JB-04-23	AVTB-2S - 1	7. AVT Oat (SC-2):			
2	(ZC-CZ) (ZC-NWZ)	Bundel Berseem-2	AVTB-2S - 2	S. N.	Contributor	Entry name	Code name
3	(NC)	Wardan	AVTB-2 S- 3	1	(NC)	Kent	AVTOSC-2- 1
4	Jabalpur	JB-04-21	AVTB-2S - 4	2	Ludhiana	OL-1766-1	AVTOSC-2- 2
5	(NC)	Mescavi	AVTB-2S - 5	3	Ludhiana	OL-1802-1	AVTOSC-2- 3
				4	Pantnagar	UPO-10-3	AVTOSC-2- 4

5	(NC)	OS-6	AVTOSC-2- 5	11. IVT Oat (Dual):				19: VT Repeat Lucerne (P)-2013:				
6	Srinagar	SKO-225	AVTOSC-2- 6	S. N.	Contributor	Entry name	Code name	S. N.	Contributor	Entry name	Code name	
7	Ludhiana	OL-1769-1	AVTOSC-2-7	1	Ludhiana	OL-1769	IVTO D - 1	1	Coimbatore	TNLC-14	R VTLu -2013 - 1	
8	Hisar	OS-424	AVTOSC-2- 8	2	Ludhiana	OL-1804-1	IVTO D - 2	2	Anand	Anand -25	R VTLu -2013 - 2	
9	Hisar	OS-432	AVTOSC-2- 9	3	Rahuri	RSO -8	IVTO D - 3	3	Anand	Anand -26	R VTLu -2013 - 3	
10	Jabalpur	JO-04-19	AVTOSC-2- 10	4	Ludhiana	OL-1871	IVTO D - 4	4	Rahuri	RL-10-2	R VTLu -2013 - 4	
11	(ZC-NWZ)	OL-125	AVTOSC-2- 11	5	(NC)	UPO-212	IVTO D - 5	5	Urulikanchan	ALP-1-1	R VTLu -2013 - 5	
	(ZC-CZ)	JHO-822	AVTOSC-2- 11	6	Hisar	HFO-610	IVTO D - 6	6	NC	RL-88	R VTLu -2013 - 6	
	(ZC-HZ)	SKO-90	AVTOSC-2- 11	7	(NC)	JHO-822	IVTO D - 7	7	NC	Anand -2	R VTLu -2013 - 7	
8. AVT Oat (SC-2)				8	Rahuri	RSO -60	IVTO D - 8	Entries Code Agronomy Rabi 2016-17				
S. N.	Contributor	Entry name	Code name	9	Rahuri	RO -11-1	IVTO D - 9	4A. AVT-2 Berseem Agron:				
1	(NC)	Kent	AVTOSC-2S- 1	10	Hisar	HFO-619	IVTO D- 10	S. N.	Contributor	Entry name	Code name	
2	Ludhiana	OL-1766-1	AVTOSC-2S- 2	11	Jabalpur	JO-10-501	IVTO D - 11	1	Jabalpur	JB-04-23	AVTB-2Ag - 1	
3	Ludhiana	OL-1802	AVTOSC-2S- 3	12. AVT -1 Oat (Dual):				2	(ZC-CZ) (ZC-NWZ)	Bundel Berseem-2	AVTB-2Ag - 2	
4	Pantnagar	UPO-10-3	AVTOSC-2S- 4	S. N.	Contributor	Entry name	Code name	3	(NC)	Wardan	AVTB-2 Ag- 3	
5	(NC)	OS-6	AVTOSC-2S- 5	1	Ludhiana	OL-1802	AVTO -1-D - 1	4	Jabalpur	JB-04-21	AVTB-2Ag - 4	
6	Srinagar	SKO-225	AVTOSC-2S-6	2	Ludhiana	OL-1760-1	AVTO -1-D - 2	5	(NC)	Mescavi	AVTB-2Ag - 5	
7	Ludhiana	OL-1769-1	AVTOSC-2S- 7	3	(NC)	JHO-822	AVTO -1-D - 3	7A. AVT Oat (SC-2) (Agron):				
8	Hisar	OS-424	AVTOSC-2S- 8	4	Faizabad	NDO-11-01	AVTO -1-D - 4	S. N.	Contributor	Entry name	Code name	
9	Hisar	OS-432	AVTOSC-2S- 9	5	(NC)	UPO-212	AVTO -1-D - 5	1	(NC)	Kent	AVTOSC-2Ag- 1	
10	Jabalpur	JO-04-19	AVTOSC-2S- 10	6	(NC)	RO-19	AVTO -1-D - 6	2	Ludhiana	OL-1766-1	AVTOSC-2Ag- 2	
11	(ZC-NWZ)	OL-125	AVTOSC-2S- 11	14. IVT Vicia:				3	Ludhiana	OL-1802	AVTOSC-2Ag- 3	
	(ZC-HZ)	SKO-90	AVTOSC-2S- 11	S. N.	Contributor	Entry name	Code name	4	Pantnagar	UPO-10-3	AVTOSC-2Ag- 4	
	(ZC-CZ)	JHO-822	AVTOSC-2S- 11	1	Jabalpur	JVS-1	IVTVc- 1	5	(NC)	OS-6	AVTOSC-2Ag- 5	
9. IVTO (MC)				2	Jabalpur	JVS-2	IVTVc- 2	6	Srinagar	SKO-225	AVTOSC-2Ag- 6	
S. N.	Contributor	Entry name	Code name	3	Jabalpur	JVS-3	IVTVc- 3	7	Ludhiana	OL-1769-1	AVTOSC-2Ag- 7	
1	Jabalpur	JO-05-301	IVTO-MC- 1	4	Jabalpur	JVS-4	IVTVc- 4	8	Hisar	OS-424	AVTOSC-2Ag- 8	
2	Ludhiana	OL-1869	IVTO-MC- 2	5	Jabalpur	JVS-5	IVTVc- 5	9	Hisar	OS-432	AVTOSC-2Ag- 9	
3	Ludhiana	OL-1873	IVTO-MC- 3	15. IVT Lolium:				10	Jabalpur	JO-04-19	AVTOSC-2Ag- 10	
4	NC	UPO-212	IVTO-MC- 4	S. N.	Contributor	Entry name	Code name	11	(ZC-HZ)	SKO-90	AVTOSC-2Ag- 11	
5	NC	RO-19	IVTO-MC- 5	1	Palampur	Palam rye grass -2	VTLRg - 1		(ZC-NWZ)	OL-125	AVTOSC-2Ag- 11	
6	Ludhiana	OL-1876	IVTO-MC- 6	2	Palampur	Palam rye grass -1	VTLRg - 2		(ZC-CZ)	JHO-822	AVTOSC-2Ag- 11	
7	NC	Kent	IVTO-MC- 7	3	Ludhiana	PBRG-2	VTLRg - 3					
8	Palampur	PLP-18	IVTO-MC- 8	4	Advanta	Advanta RG-1	VTLRg - 4					
9	Hisar	HFO-609	IVTO-MC- 9	5	NC	PBRG -1	VTLRg - 5					
10	Hisar	HFO-611	IVTO-MC- 10	6	Advanta	Advanta RG -2	VTLRg - 6					
10. AVTO-1 (MC):				18. Repeat AVT Oat (SC)-2:								
S. N.	Contributor	Entry name	Code name	S. N.	Contributor	Entry name	Code name					
1	Ludhiana	OL-1842	AVTO MC -1- 1	1	Srinagar	SKO-190	R AVTSC -14-15- 1					
2	Jabalpur	JO-4-321	AVTO MC -1- 2	2	Jhansi	JHO -2012-2	R AVTSC -14-15- 2					
3	(NC)	RO-19	AVTO MC -1- 3	3	Rahuri	RSO-59	R AVTSC -14-15- 3					
4	Ludhiana	OL-1866	AVTO MC -1- 4	4	Rahuri	RSO-60	R AVTSC -14-15- 4					
5	(NC)	UPO-212	AVTO MC -1- 5	5	Hisar	OS-405	R AVTSC -14-15- 6					
6	(NC)	Kent	AVTO MC -1- 6	6	Jhansi	JHO-2012-1	R AVTSC -14-15- 7					
7	Hisar	HFO-514	AVTO MC -1- 7	7	ZC -SZ	JHO-2000-4	R AVTSC -14-15- 8					
8	Hisar	HFO-417	AVTO MC -1- 8	8	NC	OS-6	R AVTSC -14-15- 10					
				9	NC	Kent	R AVTSC -14-15- 11					
				10	Ludhiana	OL-1760	R AVTSC -14-15- 12					

1. IVTB: INITIAL VARIETAL TRIAL IN BERSEEM

(Reference tables 1.1 to 1.9)

An initial varietal trial in Berseem comprising of five entries along with one national check (Wardan) and three zonal checks in respective zones [BL-22 (HZ), BB-2 (NWZ, CZ) and BB-3 (NEZ)] was conducted at 21 centres located in four different zones (HZ, NWZ, NEZ, CZ) of the country.

For green forage yield (q/ha), all the entries were below or at par or marginally superior in comparison to best check in HZ, NWZ, CZ, NEZ and all India. At all India level also, only JHB -16-01 was 4.6% superior over the check.

For dry matter yield, entry HFB-13-1 (4.4%) in HZ; JB-05-10 (6.5%) in NEZ; entry JHB-16-01 (4.6%) in CZ showed superiority over the best check. At all India level, entries JHB-16-01 (7.1%), HFB-13-10(5.2%), showed better performance than the checks. Other entries were below par or marginally superior in comparison to best check

For per day productivity, entry JHB-16-01 ranked first for GFY (q/ha/day), whereas for DMY (q/ha/day) entry HFB-13-1 and National check Wardan ranked joint first. Entry JB-05-10 ranked first for the character plant height. For the character leafiness, entry HFB 13-10 ranked best.

In quality parameters, for crude protein yield (q/ha), JHB-16-01 was best performer followed by HFB-13-10. For crude protein percentage, entry BL-205 ranked first followed by check Wardan. For other quality parameters, entries JHB-16-01 for ADF%, HFB-13-1 and JB-05-10 for NDF%, JHB-16-01 for IVDMD % and DDM% 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 four entries along with two national checks (Wardan and Mescavi) and two zonal checks [BL-22 (HZ), BB-2 (NWZ, CZ)] was conducted at fifteen centres located in three zones (Hill, Central and North West).

For green forage yield, in all zones and at all India level only marginal superiority of a few entries was observed. For dry matter yield (q/ha), entries JB-05-9 (5.5%) and PC-82 (4.8%) showed superiority over the best check in NW zone. In other zones and all India level, the entries performed at par or below par the checks.

In green forage production potential (q/ha/day), entry HFB-12-4 ranked first followed by JB-05-9. For dry matter production potential (q/ha/day), entry JB -05-9 and PC-82 ranked joint first. National check Wardan ranked first for the character plant height. For the character leafiness, entry HFB-12-4 performed better.

In quality parameters, entry HFB-12-9 ranked first for crude protein yield (q/ha). For crude protein content (%), entries HFB-12-9 and PC-82 ranked joint first. For other quality parameters, JB-05-9 for ADF%, and NDF% and PC-82 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	Sri-nagar	Rajo-uri	Aver-age	Ra-nk	Pant-nagar	His-ar	Ludh-iana	Mee-rut	Udai-pur	**Jal-ore	**Bika-ner	Aver-age	Ra-nk	Superi-osity%
BL-205	332.7	177.9	299.4	270.0	2	343.7	731.1	748.3	569.9	992.5	120.3	74.1	677.1	5	0.1
HFB-13-1	309.2	169.7	303.8	260.9	3	367.7	816.7	702.2	609.9	940.7	106.7	77.6	687.4	1	
HFB-13-10	282.6	178.6	269.4	243.5	5	338.5	679.6	870.8	519.9	951.8	120.7	33.1	672.1	6	
JHB-16-01	274.6	195.8	258.1	242.8	6	359.9	801.5	740.9	583.3	936.9	132.7	40.6	684.5	3	
JB-05-10	209.8	167.1	366.9	247.9	4	358.4	770.7	782.1	623.3	888.8	118.3	42.9	684.7	4	
Wardan (NC)	274.0	161.9	375.5	270.5	1	367.4	806.3	868.1	523.3	868.4	140.3	75.5	686.7	2	
BL-22 (ZC-HZ)	246.9	179.1	285.9	237.3	7										
Bundel Berseem-2 (ZC-NWZ)						390.0	801.5	770.8	556.7	903.6	138.0	108.4	684.5	3	
Mean	275.7	175.7	308.4	253.3		360.8	772.5	783.3	569.5	926.1	125.3	64.6	682.4		
CD at 5%	57.8	10.4	1.2			15.7	72.9	46.4	39.9	49.5	10.4	14.4			
CV%	11.8	6.5	5.7			5.7	5.6	5.6	3.9	3.0	4.7	12.6			

Note: ** Yield data very low hence not included in zonal and national average

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

Entries	North East Zone						
	Kal-yani	Ran-chi	Faiza-bad	Pu-sa	**Bhuban-eswar	Aver-age	Ra-nk
BL-205	350.4	407.4	213.5	228.0	92.8	299.8	7
HFB-13-1	348.1	370.3	298.0	258.0	81.3	318.6	6
HFB-13-10	336.9	342.5	397.6	261.0	89.6	334.5	5
JHB-16-01	322.7	361.1	425.3	251.0	76.4	340.0	4
JB-05-10	361.3	495.3	286.5	269.0	82.7	353.0	2
Wardan (NC)	322.7	467.5	449.1	273.0	84.5	378.1	1
Bundel Berseem-3 (ZC-NEZ)	313.7	435.1	383.7	265.0	79.2	349.4	3
Mean	336.5	411.3	350.5	257.9	83.8	339.1	
CD at 5%	9.5	62.8	76.2	21.4	5.8		
CV%	8.9	8.5	12.2	10.8	4.8		

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

Entries	Central Zone									All India		
	Jha-nsi	Rah-uri	Jabal-pur	Urulikan-chan	Rai-pur	**Pal-ghar	Aver-age	Ra-nk	Superi-riority%	Aver-age	Ra-nk	Superi-riority%
BL-205	711.5	527.8	1021.5	623.1	466.2	176.9	670.0	2	1.4	514.4	2	2.7
HFB-13-1	774.9	414.7	957.5	615.0	298.0	209.0	612.0	6		503.2	5	0.4
HFB-13-10	751.0	518.5	1004.9	574.0	438.9	178.6	657.4	4		512.7	3	2.3
JHB-16-01	726.6	597.9	991.0	760.1	319.5	162.3	679.0	1	2.8	523.9	1	4.6
JB-05-10	800.5	423.7	938.2	594.2	288.6	174.1	609.0	7		507.3	4	1.3
Wardan (NC)	702.2	475.1	906.3	358.9	314.2	170.4	551.3	5		500.8	6	
Bundel Berseem-2 (ZC-CZ)	745.1	614.7	1065.9	443.9	434.2	139.8	660.8	3				
Mean	744.5	510.3	983.6	567.0	365.7	173.0	634.2			510.4		
CD at 5%	129.1	92.1	210.3	75.7	44.9	32.5						
CV%	9.7	10.2	12.0	7.4	7.2	10.5						

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

Entries	Hill Zone						North West Zone					
	Palam-pur	Sri-nagar	Rajo-uri	Aver-age	Ra-nk	Superi-riority%	Pant-nagar	His-ar	Ludh-iana	**Bika-ner	Aver-age	Ra-nk
BL-205	58.7	35.8	47.6	47.4	2	3.9	37.5	92.0	116.0	21.4	81.8	7
HFB-13-1	59.9	33.8	49.2	47.6	1	4.4	37.1	99.2	121.1	24.9	85.8	6
HFB-13-10	49.9	35.1	42.6	42.5	5		35.1	93.1	152.4	9.8	93.5	3
JHB-16-01	53.3	38.2	41.6	44.4	4		34.5	108.3	122.2	14.3	88.3	4
JB-05-10	33.6	34.0	58.8	42.1	6		34.0	107.1	123.2	13.7	88.1	5
Wardan (NC)	43.5	33.3	60.1	45.6	3		36.3	102.3	156.3	22.5	98.3	1
BL-22 (ZC-HZ)	43.6	34.6	44.5	40.9	7							
Bundel Berseem-2 (ZC-NWZ)							41.6	105.8	146.5	37.2	98.0	2
Mean	48.9	35.0	49.2	44.4			36.6	101.1	134.0	20.5	90.6	
CD at 5%	12.1	3.0	0.2				1.8	11.7	11.0	6.7		
CV%	13.9	5.1	4.9				4.0	6.8	9.2	18.4		

Note: ** Yield data very low hence not included in zonal and national average

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

Entries	North East Zone							
	Kal-yani	Ran-chi	Faiza-bad	Pu-sa	**Bhuban-eswar	Aver-age	Ra-nk	Superi- ority%
BL-205	67.8	63.2	44.0	40.9	18.6	54.0	6	6.5
HFB-13-1	68.6	59.0	63.7	46.1	16.5	59.3	5	
HFB-13-10	62.9	57.1	80.4	46.8	18.0	61.8	4	
JHB-16-01	66.8	56.4	79.3	44.8	15.6	61.8	4	
JB-05-10	71.0	85.1	75.8	48.2	16.8	70.0	1	
Wardan (NC)	62.2	68.1	84.0	48.8	17.2	65.7	2	
Bundel Berseem-3 (ZC-NEZ)	61.5	71.3	81.6	47.5	16.2	65.5	3	
Mean	65.8	65.7	72.7	46.1	17.0	62.6		
CD at 5%	1.6	10.4	13.1	3.7	1.1			
CV%	10.7	8.0	10.1	8.6	4.7			

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

Entries	Central Zone									All India		
	Jha-nsi	Rah-uri	Jabal-pur	Urulikan- chan	Rai-pur	**Pal-ghar	Aver-age	Ra-nk	Superi- ority%	Aver-age	Ra-nk	Superi- ority%
BL-205	114.2	106.4	149.2	86.9	82.3	30.3	107.8	3	4.6	76.2	5	0.8
HFB-13-1	120.8	78.8	140.1	86.4	88.1	38.1	102.8	5		76.8	4	1.6
HFB-13-10	115.8	111.4	145.4	88.1	76.7	34.9	107.5	4		79.5	2	5.2
JHB-16-01	115.5	118.4	144.9	110.2	81.1	33.4	114.0	1		81.0	1	7.1
JB-05-10	130.1	86.4	135.6	82.0	71.7	33.4	101.2	6		78.5	3	3.8
Wardan (NC)	108.1	88.5	102.3	48.7	92.1	30.5	88.0	7		75.6	6	
Bundel Berseem-2 (ZC-CZ)	115.8	121.1	156.7	63.3	88.1	25.3	109.0	2				
Mean	117.2	101.6	139.2	80.8	82.9	32.3	104.3			77.9		
CD at 5%	22.3	18.3	23.5	10.9	13.3	7.1						
CV%	10.7	10.1	10.2	7.5	9.4	12.2						

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

Entries	His- ar	Ludh- iana	Kal- yani	Ran- chi	Faiza- bad	Bhuban- eswar	Urulikan- chan	Pal- ghar	Rai- pur	**Bika- ner	Aver- age	Ran- k
BL-205	6.01	3.70	2.80	3.39	1.61	1.86	5.56	2.60	3.59	0.19	3.46	4
HFB-13-1	6.79	3.50	2.78	3.09	2.25	1.66	5.49	2.86	2.38	0.22	3.42	5
HFB-13-10	5.50	4.30	2.69	2.85	3.01	1.83	5.12	2.51	3.38	0.08	3.47	3
JHB-16-01	6.62	3.70	2.58	3.00	3.22	1.74	6.79	2.08	2.46	0.12	3.58	1
JB-05-10	6.44	3.90	2.89	4.12	2.17	1.92	5.31	2.60	2.22	0.12	3.51	2
Wardan (NC)	6.61	4.30	2.58	3.89	3.40	1.72	3.20	2.58	2.51	0.20	3.42	5
Bundel Berseem-2 (ZC-NWZ)	6.66	3.80								0.32		
Bundel Berseem-3 (ZC-NEZ)			2.51	3.62	2.91	1.58						
Bundel Berseem-2 (ZC-CZ)							3.96	2.18	3.47			
Mean	6.38	3.89	2.69	3.42	2.65	1.76	5.06	2.49	2.86	0.18	3.33	

Note: ** Yield data very low hence not included in zonal and national average

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

Entries	His- ar	Ludh- iana	Bika- ner	Kal- yani	Ran- chi	Faiza- bad	Bhuban- eswar	Urulikan- chan	Pal- ghar	Rai- pur	Aver- age	Ran- k
BL-205	0.76	0.60	0.64	0.54	0.52	0.33	0.37	0.78	0.45	0.63	0.56	4
HFB-13-1	0.82	0.60	0.68	0.55	0.49	0.48	0.34	0.77	0.52	0.71	0.60	1
HFB-13-10	0.74	0.80	0.29	0.50	0.47	0.60	0.37	0.79	0.49	0.59	0.56	4
JHB-16-01	0.89	0.60	0.35	0.53	0.46	0.60	0.36	0.98	0.43	0.62	0.58	3
JB-05-10	0.90	0.60	0.37	0.57	0.70	0.57	0.39	0.73	0.50	0.55	0.59	2
Wardan (NC)	0.85	0.80	0.66	0.49	0.56	0.63	0.35	0.44	0.46	0.74	0.60	1
Bundel Berseem-2 (ZC-NWZ)	0.88	0.70	0.94									
Bundel Berseem-3 (ZC-NEZ)				0.50	0.59	0.62	0.32					
Bundel Berseem-2 (ZC-CZ)								0.57	0.39	0.71		
Mean	0.83	0.67	0.56	0.53	0.54	0.55	0.36	0.72	0.46	0.65	0.58	

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

Entries	Palam-pur	His-ar	Ludh-iana	Kal-yani	Ran-chi	Faiza-bad	Rah-uri	Jabal-pur	Urulikan-chan	Rai-pur	**Bika-ner	**Bhuban-eswar	Aver-age	Ra-nk
BL-205	11.1	13.2	21.7	8.5	9.7	7.4	18.8	21.3	16.0	13.6	3.5	3.0	14.1	3
HFB-13-1	11.2	13.4	25.3	6.9	7.4	11.1	13.5	19.7	16.0	13.0	4.4	2.6	13.8	4
HFB-13-10	9.0	12.3	29.3	7.2	7.4	13.8	20.4	20.6	16.5	10.9	1.5	3.0	14.7	2
JHB-16-01	10.6	15.5	24.1	7.7	8.6	13.5	18.0	20.8	20.7	10.9	2.0	2.4	15.0	1
JB-05-10	6.8	14.3	24.3	6.3	13.4	12.9	15.6	19.3	15.0	10.3	1.9	2.6	13.8	4
Wardan (NC)	7.9	13.8	32.8	6.0	10.3	14.3	13.9	18.6	9.1	14.0	4.2	2.7	14.1	3
BL-22 (ZC-HZ)	8.5													
Bundel Berseem-2 (ZC-NWZ, CZ)		14.3	29.4				20.9	22.3	11.6	13.3	6.5			
Bundel Berseem-3 (ZC-NEZ)				7.9	12.3	14.1						2.6		
Mean	9.3	13.8	26.7	7.2	9.9	12.4	17.3	20.4	15.0	12.3	3.4	2.7	14.3	

Note: ** Yield data very low hence not included in zonal and national average

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
BL-205	19.0	18.9	18.7	16.4	12.5	15.3	16.8	15.9	17.7	14.5	18.4	16.5	16.7	1
HFB-13-1	18.7	18.4	20.9	17.5	10.1	12.5	17.5	15.4	17.1	14.4	18.6	14.8	16.3	3
HFB-13-10	18.1	18.3	19.2	14.9	11.4	12.9	17.1	16.5	18.3	14.4	18.7	14.2	16.2	4
JHB-16-01	19.8	18.9	19.7	14.3	11.5	15.3	17.2	15.4	15.2	14.4	18.8	13.5	16.2	4
JB-05-10	20.1	18.3	19.7	14.1	8.9	15.8	17.0	15.5	18.0	14.4	18.3	14.4	16.2	4
Wardan (NC)	18.1	18.0	21.0	18.5	9.6	15.1	17.1	15.7	15.8	14.4	18.7	15.2	16.4	2
BL-22 (ZC-HZ)	19.5													
Bundel Berseem-2 (ZC-NWZ, CZ)		18.8	20.1	17.5					17.3	14.5	18.4	15.1		
Bundel Berseem-3 (ZC-NEZ)					12.9	17.3	17.3	16.1						
Mean	19.0	18.5	19.9	16.2	11.0	14.9	17.1	15.8	17.1	14.4	18.5	14.8	16.3	

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

Entries	Palam-pur	Sri-nagar	Pant-nagar	His-ar	Ludh-iana	Bika-ner	Udai-pur	Kal-yani	Ran-chi	Faiza-bad	Bhuban-eswar	Rah-uri	Jabal-pur	Urulikan-chan	Pal-ghar	Rai-pur	Aver-age	Ran-k
BL-205	39.8	39.4	53.8	69.8	59.9	51.0	62.5	63.2	49.5	58.4	71.5	43.9	46.9	64.5	59.3	19.5	53.3	2
HFB-13-1	38.7	37.8	53.5	68.9	54.2	46.0	61.4	64.0	50.5	56.8	63.5	47.2	59.8	57.5	53.0	22.1	52.2	6
HFB-13-10	40.1	40.5	48.9	70.7	55.5	55.0	60.1	60.8	37.7	59.6	68.3	50.5	52.5	60.4	58.0	24.1	52.7	3
JHB-16-01	35.8	42.1	54.7	71.5	52.6	41.0	65.2	61.5	39.7	59.7	60.2	56.6	50.3	62.5	62.0	22.6	52.4	5
JB-05-10	39.1	36.9	50.4	76.9	60.7	60.0	62.3	68.2	55.7	56.8	66.2	55.5	44.4	59.1	53.7	27.7	54.6	1
Wardan (NC)	40.9	36.6	50.1	75.0	58.2	51.0	60.4	61.2	56.6	56.4	65.5	51.0	44.2	52.8	57.7	22.5	52.5	4
BL-22 (ZC-HZ)	38.2	39.0																
Bundel Berseem-2 (ZC-NWZ, CZ)			50.7	73.4	54.6	32.0	61.1					54.4	57.8	57.2	53.3	25.2		
Bundel Berseem-3 (ZC-NEZ)								59.9	53.6	54.9	61.5							
Mean	38.9	38.9	51.7	72.3	56.5	48.0	61.9	62.7	49.0	57.5	65.2	51.3	50.8	59.2	56.7	23.4	52.9	

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

Entries	Palam-pur	Sri-nagar	His-ar	Ludh-iana	Bika-ner	Kal-yani	Ran-chi	Faiza-bad	Bhuban-eswar	Rah-uri	Jabal-pur	Urulikan-chan	Pal-ghar	Rai-pur	Aver-age	Ran-k
BL-205	0.70	0.89	0.83	1.10	1.06	0.63	0.68	0.74	1.10	0.59	0.72	0.66	0.65	0.75	0.79	3
HFB-13-1	0.70	0.81	0.90	1.10	1.08	0.73	0.54	0.75	0.85	0.53	0.91	0.88	0.63	0.70	0.79	3
HFB-13-10	0.80	0.92	0.90	1.10	1.10	0.76	0.88	0.76	1.17	0.53	0.87	0.65	0.66	0.69	0.84	1
JHB-16-01	0.70	1.02	0.55	1.00	1.10	0.73	0.55	0.70	0.71	0.42	0.84	0.77	0.71	0.63	0.74	5
JB-05-10	0.80	0.96	0.97	1.10	1.08	0.66	0.69	0.73	1.05	0.43	0.71	0.73	0.64	0.78	0.81	2
Wardan (NC)	0.80	0.91	0.76	1.00	1.05	0.65	0.55	0.74	0.94	0.54	0.72	0.68	0.64	0.66	0.76	4
BL-22 (ZC-HZ)	0.70	0.97														
Bundel Berseem-2 (ZC-NWZ)			0.74	1.20	1.08					0.59	0.88	0.76	0.62	0.85		
Bundel Berseem-3 (ZC-NEZ)						0.76	0.66	0.75	0.78							
Mean	0.74	0.93	0.81	1.09	1.08	0.70	0.65	0.74	0.94	0.52	0.81	0.73	0.65	0.72	0.79	

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
BL-205	23.0	4	36.1	5	61.9	72.7	67.3	7	52.1	6
HFB-13-1	22.6	2	32.6	1	63.9	76.4	70.2	3	56.8	5
HFB-13-10	22.9	3	34.8	4	63.9	72.7	68.3	6	49.4	7
JHB-16-01	21.6	1	34.3	3	63.4	77.7	70.5	1	64.1	1
JB-05-10	22.6	2	32.6	1	64.1	73.1	68.6	5	57.3	4
Wardan (NC)	23.0	4	34.2	2	63.2	75.0	69.1	4	58.2	2
Bundel Berseem-2 (ZC-NWZ)	21.6	1	34.3	3	65.4	75.2	70.3	2	58.1	3
Mean	22.5		34.1		63.7	74.7	69.2		56.6	

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

Entries	HZ					North West Zone								
	Palam-pur	Sri-nagar	Rajo-uri	Average	Rank	His-ar	Ludh-iana	Mee-rut	Udai-pur	**Bika-ner	**Jal-ore	Average	Rank	Superi-riority%
JB-05-9	264.8	157.5	309.2	243.8	6	803.6	783.7	544.8	892.5	100.7	76.0	756.2	5	0.6
HFB-12-4	296.3	170.3	308.7	258.4	4	819.4	746.2	559.8	1061.0	88.8	63.0	796.6	1	
HFB-12-9	270.3	178.6	271.7	240.2	7	792.6	759.9	552.3	899.9	121.7	62.0	751.2	6	
PC-82	320.9	191.3	298.3	270.2	2	766.1	819.1	552.3	972.1	96.8	66.0	777.4	4	
Mescavi (NC)	338.8	204.1	320.2	287.7	1	763.3	789.8	567.3	1036.9	117.8	74.0	789.3	3	
Wardan (NC)	322.2	165.3	269.2	252.2	5	818.3	734.4	584.7	835.1	111.6	69.0	743.1	7	
BL-22 (ZC-HZ)	323.4	188.3	284.2	265.3	3									
Bundel Berseem-2 (ZC-NWZ)						806.1	756.5	627.2	977.7	114.9	70.0	791.9	2	
Mean	305.2	179.3	294.5	259.7		795.6	769.9	569.8	953.6	107.5	68.6	772.2		
CD at 5%	49.5	16.5	29.8			144.0	27.6	44.2	61.8	26.8	12.3			
CV%	9.1	8.2	5.7			10.7	4.6	4.4	3.6	14.0	10.1			

Note: ** Yield data is very low hence not included in zonal and national average

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

Entries	Central Zone									All India		
	Jha-nsi	Rah-uri	Jabal-pur	Urulikan-ghan	Rai-pur	**Pal-ghar	Average	Rank	Superi-riority%	Average	Rank	Superi-riority%
JB-05-9	765.4	508.5	978.8	367.7	322.1	151.1	588.5	3	0.4	558.2	4	0.6
HFB-12-4	751.2	580.4	944.9	370.1	320.4	172.5	593.4	2	1.3	577.4	1	
HFB-12-9	755.4	517.8	1024.1	419.1	279.1	118.0	599.1	1	2.2	560.1	3	
PC-82	774.8	476.7	901.8	353.8	188.8	151.4	539.2	7		551.3	5	
Mescavi (NC)	785.6	536.6	911.2	315.8	315.4	150.3	572.9	5		573.7	2	
Wardan (NC)	808.4	557.1	915.0	327.2	241.1	139.7	569.8	6		548.2	6	
Bundel Berseem-2 (ZC-CZ)	787.6	512.2	954.5	360.7	315.0	138.1	586.0	4				
Mean	775.5	527.0	947.2	359.2	283.1	145.9	578.4			561.5		
CD at 5%	125.5	54.0	218.5	28.8	46.0	22.2						
CV%	9.1	5.8	12.9	4.5	9.5	8.5						

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

Entries	HZ					North West Zone					
	Palam-pur	Sri-nagar	Rajo-uri	Aver-age	Ra-nk	His-ar	Ludh-iana	**Bika-ner	Aver-age	Ra-nk	Superi-riority%
JB-05-9	50.1	30.5	48.1	42.9	7	108.0	158.7	14.6	133.4	1	5.5
HFB-12-4	55.2	35.1	50.4	46.9	2	106.4	130.6	13.1	118.5	5	
HFB-12-9	53.1	36.5	43.0	44.2	5	99.2	136.8	17.8	118.0	6	
PC-82	52.3	38.5	48.0	46.3	3	105.3	159.7	13.5	132.5	2	4.8
Mescavi (NC)	61.2	40.7	50.2	50.7	1	98.9	154.0	16.5	126.4	3	
Wardan (NC)	63.1	33.2	42.8	46.4	4	101.0	141.4	15.6	121.2	4	
BL-22 (ZC-HZ)	48.3	38.0	44.9	43.7	6						
Bundel Berseem-2 (ZC-NWZ)						103.1	126.7	16.8	114.9	7	
Mean	54.8	36.1	46.8	45.9		103.1	144.0	15.4	123.5		
CD at 5%	NS	3.3	4.7			22.8	9.1	3.6			
CV%	14.6	5.0	6.0			13.0	7.1	13.2			

Note: ** Yield data is very low hence not included in zonal and national average

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

Entries	Central Zone								All India		
	Jha-nsi	Rah-uri	Jabal-pur	Urulikan-chan	**Pal-ghar	**Rai-pur	Aver-age	Ra-nk	Superi-riority%	Aver-age	Ra-nk
JB-05-9	125.3	86.6	141.5	58.7	33.9	21.6	103.0	5		89.7	2
HFB-12-4	110.9	120.6	138.8	59.3	39.6	23.9	107.4	3		89.7	2
HFB-12-9	112.1	105.5	148.3	69.4	21.9	22.6	108.8	1	0.8	89.3	3
PC-82	119.3	92.7	131.6	56.5	34.2	24.6	100.0	7		89.3	3
Mescavi (NC)	118.9	101.5	136.9	50.4	33.2	23.0	101.9	6		90.3	1
Wardan (NC)	116.6	107.6	136.5	54.6	34.2	15.7	103.8	4		88.5	4
Bundel Berseem-2 (ZC-CZ)	120.0	109.1	140.9	61.6	31.9	27.0	107.9	2			
Mean	117.6	103.4	139.2	58.6	32.7	22.6	104.7			89.5	
CD at 5%	16.5	10.2	30.1	4.7	8.1	19.9					
CV%	7.9	5.6	12.3	4.5	13.9	7.7					

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

Entries	Hisar	Ludhiana	Urulikanchan	Palghar	Raipur	**Bikaner	Average	Rank
JB-05-9	6.74	3.90	3.31	2.22	3.22	0.86	3.88	2
HFB-12-4	6.86	3.70	3.33	2.40	3.20	0.76	3.90	1
HFB-12-9	6.60	3.70	3.78	1.74	2.54	1.04	3.67	5
PC-82	6.34	4.00	3.19	2.29	1.89	0.83	3.54	6
Mescavi (NC)	6.30	3.90	2.84	2.31	3.15	1.01	3.70	4
Wardan (NC)	6.86	3.60	2.95	1.97	2.19	0.95	3.51	7
Bundel Berseem-2 (ZC-NWZ-CZ)	6.72	3.70	3.25	2.16	2.86	0.98	3.74	3
Mean	6.63	3.79	3.24	2.16	2.72	0.92	3.71	

Note: ** Yield data is very low hence not included in zonal and national average

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

Entries	Hisar	Ludhiana	Urulikanchan	Palghar	**Raipur	**Bikaner	Average	Rank
JB-05-9	0.91	0.80	0.53	0.49	0.22	0.12	0.68	1
HFB-12-4	0.90	0.60	0.53	0.55	0.24	0.11	0.65	2
HFB-12-9	0.83	0.70	0.62	0.32	0.21	0.15	0.62	4
PC-82	0.88	0.80	0.51	0.52	0.25	0.12	0.68	1
Mescavi (NC)	0.82	0.80	0.45	0.51	0.23	0.14	0.65	2
Wardan (NC)	0.86	0.70	0.49	0.48	0.14	0.13	0.63	3
Bundel Berseem-2 (ZC-NWZ-CZ)	0.86	0.60	0.56	0.50	0.24	0.14	0.63	3
Mean	0.87	0.71	0.53	0.48	0.22	0.13	0.65	

Note: ** Yield data is very low hence not included in zonal and national average

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

Entries	Palam-pur	Bika-ner	His-ar	Ludh-iana	Rah-uri	Jabal-pur	Urulikan-ghan	Rai-pur	Aver-age	Ra-nk
JB-05-9	10.4	3.4	15.2	30.6	14.7	20.3	10.5	3.1	13.5	4
HFB-12-4	10.5	3.1	13.9	26.8	20.1	19.6	10.3	3.4	13.5	4
HFB-12-9	10.2	4.6	13.4	27.5	18.6	21.1	12.1	3.1	13.8	1
PC-82	9.5	3.4	14.3	34.3	16.3	18.7	9.8	3.6	13.7	2
Mescavi (NC)	12.0	3.9	14.5	30.2	15.8	20.7	8.8	3.1	13.6	3
Wardan (NC)	11.8	3.5	13.9	30.8	17.0	19.5	9.6	2.2	13.5	4
BL-22 (ZC-HZ)	9.0									
Bundel Berseem-2 (ZC-NWZ-CZ)		4.7	14.3	26.9	19.7	20.1	11.1	3.8		
Mean	10.5	3.8	14.2	29.6	17.5	20.0	10.3	3.2	13.6	

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

Entries	Palam-pur	Bika-ner	His-ar	Ludh-iana	Rah-uri	Jabal-pur	Urulikan-ghan	Rai-pur	Aver-age	Ra-nk
JB-05-9	20.7	23.6	18.9	19.3	16.9	14.3	17.9	14.5	18.3	2
HFB-12-4	19.0	23.4	18.9	20.5	16.7	14.4	17.4	14.3	18.1	3
HFB-12-9	19.3	25.7	19.0	20.1	17.6	14.4	17.5	13.9	18.4	1
PC-82	18.1	25.3	18.7	21.5	17.6	14.2	17.4	14.7	18.4	1
Mescavi (NC)	19.5	23.8	19.9	19.6	15.6	14.4	17.5	13.2	17.9	5
Wardan (NC)	18.7	22.6	19.2	21.8	15.8	14.4	17.5	13.8	18.0	4
BL-22 (ZC-HZ)	18.7									
Bundel Berseem-2 (ZC-NWZ-CZ)		28.0	19.0	21.2	18.1	14.3	18.0	13.9		
Mean	19.1	24.6	19.1	20.6	16.9	14.3	17.6	14.1	18.2	

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

Entries	Palam-pur	Sri-nagar	Bika-ner	His-ar	Ludh-iana	Udai-pur	Rah-uri	Jabal-pur	Urulikan-ghan	Pal-ghar	Rai-pur	Aver-age	Ra-nk
JB-05-9	38.2	33.0	36.0	74.4	63.7	57.8	52.6	50.4	59.6	55.7	36.9	50.8	2
HFB-12-4	41.6	37.4	31.5	69.9	54.2	61.2	51.5	43.5	53.8	51.3	35.1	48.3	6
HFB-12-9	39.0	37.8	28.0	68.5	52.1	56.7	49.0	56.5	55.4	58.0	36.2	48.8	5
PC-82	42.3	42.5	31.5	67.0	56.7	57.8	48.4	47.5	50.5	62.0	33.5	49.1	4
Mescavi (NC)	44.5	39.4	41.0	69.4	57.2	60.6	50.5	48.6	51.6	59.0	35.2	50.6	3
Wardan (NC)	40.4	34.6	46.5	72.8	54.2	60.2	52.3	62.7	52.1	64.0	34.1	52.2	1
BL-22 (ZC-HZ)	42.3	41.8											
Bundel Berseem-2 (ZC-NWZ-CZ)			32.5	74.0	58.8	61.8	50.8	48.6	53.3	49.0	35.6		
Mean	41.2	38.1	35.3	70.9	56.7	59.4	50.7	51.1	53.8	57.0	35.2	50.0	

Table 2.8 AVTB-1: First Advanced Varietal Trial in Berseem: Leaf Stem ratio

Entries	Palam-pur	Sri-nagar	Bika-ner	His-ar	Ludh-iana	Rah-uri	Jabal-pur	Urulikan-ghan	Pal-ghar	Rai-pur	Aver-age	Ra-nk
JB-05-9	0.60	0.92	1.20	0.65	1.00	0.59	0.82	1.00	0.59	0.72	0.81	4
HFB-12-4	0.70	0.84	1.10	0.81	1.10	0.63	0.83	0.81	0.70	0.85	0.84	1
HFB-12-9	0.70	0.83	1.10	0.69	1.10	0.72	0.88	0.85	0.72	0.71	0.83	2
PC-82	0.70	1.00	0.80	0.77	1.10	0.77	0.80	0.83	0.74	0.69	0.82	3
Mescavi (NC)	0.70	0.94	0.90	0.78	1.10	0.66	0.82	0.82	0.68	0.81	0.82	3
Wardan (NC)	0.80	0.81	0.90	0.71	1.00	0.71	0.91	0.76	0.77	0.93	0.83	2
BL-22 (ZC-HZ)	0.80	1.01										
Bundel Berseem-2 (ZC-NWZ-CZ)			1.10	0.71	1.10	0.54	0.81	0.78	0.69	0.76		
Mean	0.71	0.91	1.01	0.73	1.07	0.66	0.84	0.84	0.70	0.78	0.82	

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

Entries	ADF (%)					NDF (%)					IVDMD (%)				
	Rah-uri	Palam-pur	Ludh-iana	Aver-age	Ra-nk	Ludh-iana	Palam-pur	Rah-uri	Aver-age	Ra-nk	Ludh-iana	Rah-uri	His-ar	Aver-age	Ra-nk
JB-05-9	30.7	55.0	20.6	35.4	1	32.2	64.0	41.8	46.0	1	62.9	65.8	71.1	66.6	4
HFB-12-4	36.2	56.2	21.6	38.0	4	33.6	63.8	43.0	46.8	3	60.7	61.6	67.6	63.3	6
HFB-12-9	36.1	56.6	20.1	37.6	3	32.4	63.4	44.7	46.8	3	63.6	61.9	75.8	67.1	3
PC-82	33.1	56.6	20.3	36.7	2	30.7	65.8	42.6	46.4	2	64.4	63.4	75.6	67.8	1
Mescavi (NC)	34.3	55.8	22.8	37.6	3	33.7	66.6	43.9	48.1	4	62.4	62.2	74.0	66.2	5
Wardan (NC)	36.6	56.2	19.9	37.6	3	31.8	63.8	48.8	48.1	4	65.7	60.4	75.8	67.3	2
BL-22 (ZC-HZ)		54.6					63.6								
Bundel Berseem-2 (ZC-NWZ-CZ)	33.6		20.1			31.5		42.7			63.6	62.5	73.4		
Mean	34.4	55.9	20.8	37.1		32.3	64.4	43.9	47.0		63.3	62.5	73.3	66.4	

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, CZ)] was conducted at twelve centres located in two zones (Central and North West).

For green forage yield and dry matter yield (q/ha), in both the zones and at all India level zonal check Bundel Berseem -2 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. Entry JB-04-21 ranked first for the character plant height. For the character leafiness, check Wardan performed best.

In quality parameters, for crude protein yield (q/ha) and crude protein content (%), checks were best performers. For other quality parameters, JB-04-23 for ADF%, NDF% and IVDMD% was best performer. For DDM (q/ha) check performed best.

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, CZ)] was conducted at six centres located in two zones (Central and North West).

For seed yield, in all zones and at all India level, zonal check Bundel Berseem -2 was best performer and none of the entries showed better performance than the check.

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

Entries	North West Zone									Central Zone						All India		
	His-ar	Ludh-iana	Pant-nagar	Mee-rut	Udai-pur	**Bika-ner	**Jal-ore	Aver-age	Ra-nk	Jha-nsi	Rah-uri	Jabal-pur	Urulikan-cha	Rai-pur	Aver-age	Ra-nk	Aver-age	Ra-nk
JB-04-23	830.8	829.5	330.4	464.8	858.0	173.7	162.0	662.7	5	812.8	673.2	1014.9	550.6	361.1	682.5	3	672.6	4
JB-04-21	784.7	819.3	435.0	627.2	923.2	160.1	219.0	717.9	2	852.0	609.0	1001.8	451.0	345.3	651.8	4	684.9	2
Mescavi (NC)	826.3	760.3	365.2	622.2	839.9	129.4	111.0	682.8	3	812.5	691.6	921.2	530.7	226.9	636.6	5	659.7	5
Wardan (NC)	830.9	755.9	361.6	659.7	708.1	138.6	248.0	663.2	4	821.1	720.8	965.0	582.2	324.1	682.6	2	672.9	3
Bundel Berseem-2 (ZC-NWZ-CZ)	935.2	813.6	482.7	542.3	888.5	142.4	138.0	732.5	1	872.5	726.0	916.9	630.9	373.4	703.9	1	718.2	1
Mean	841.6	795.7	395.0	583.2	843.6	148.9	175.6	691.8		834.2	684.1	964.0	549.1	326.1	671.5		681.7	
CD at 5%	101.2	22.8	25.7	32.7	77.5	36.7	14.8			75.3	42.3	175.2	87.9	76.2				
CV%	8.2	6.7	6.6	3.9	5.2	16.3	5.5			5.9	4.0	12.1	10.3	15.8				

Note: ** Yield data very low hence not included in zonal and national average

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

Entries	North West Zone						Central Zone						All India		
	His-ar	Ludh-iana	Pant-nagar	**Bika-ner	Aver-age	Ra-nk	Jha-nsi	Rah-uri	Jabal-pur	Urulikan-cha	**Rai-pur	Aver-age	Ra-nk	Aver-age	Rank
JB-04-23	103.3	147.2	36.2	28.3	95.6	4	130.2	124.0	148.0	93.0	28.8	123.8	3	111.7	3
JB-04-21	96.8	145.4	58.0	25.4	100.1	2	135.6	120.6	142.3	78.7	22.0	119.3	5	111.1	4
Mescavi (NC)	104.9	133.1	46.3	21.7	94.8	5	132.1	131.8	132.2	95.9	27.0	123.0	4	110.9	5
Wardan (NC)	103.8	138.0	50.6	21.3	97.5	3	126.9	132.4	141.5	101.5	22.9	125.6	2	113.5	2
Bundel Berseem-2 (ZC-NWZ-CZ)	118.5	150.5	56.2	22.0	108.4	1	135.9	137.1	134.8	107.3	23.2	128.8	1	120.0	1
Mean	105.5	142.8	49.4	23.8	99.2		132.1	129.2	139.8	95.3	24.8	124.1		113.4	
CD at 5%	20.3	9.5	3.7	6.1			11.9	7.8	21.3	15.1	5.6				
CV%	13.1	6.9	8.2	17.0			5.8	3.9	10.5	10.2	15.3				

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

Entries	GFY (q/ha/day)							DMY (q/ha/day)						
	His-ar	Ludh-iana	Urulikan-ghan	Rai-pur	**Bika-ner	Aver-age	Ran-k	His-ar	Ludh-iana	Urulika-nchan	**Bika-ner	**Rai-pur	Aver-age	Ran-k
JB-04-23	6.83	4.10	4.96	3.83	1.48	4.93	2	0.84	0.70	0.84	0.24	0.27	0.79	4
JB-04-21	6.40	4.00	4.06	2.71	1.37	4.29	5	0.80	0.70	0.71	0.22	0.20	0.74	5
Mescavi (NC)	6.75	3.80	4.78	2.01	1.11	4.34	4	0.86	0.70	0.86	0.19	0.25	0.81	3
Wardan (NC)	6.78	3.70	5.24	2.60	1.18	4.58	3	0.84	0.70	0.91	0.18	0.21	0.82	2
Bundel Berseem-2 (ZC-NWZ-CZ)	7.69	4.00	5.68	3.15	1.22	5.13	1	0.96	0.70	0.97	0.19	0.22	0.88	1
Mean	6.89	3.92	4.94	2.86	1.27	4.65		0.86	0.70	0.86	0.20	0.23	0.81	

Table 3.4 AVTB-2: Second Advanced Varietal Trial in Berseem: Crude Protein Yield (q/ha) & Crude Protein (%)

Entries	Crude Protein Yield (q/ha)									
	His-ar	Ludh-iana	Rah-uri	Jabal-pur	Urulikan-ghan	**Bika-ner	**Rai-pur	Aver-age	Ran-k	
JB-04-23	9.8	32.7	20.2	20.2	17.1	5.2	4.3	20.0	2	
JB-04-21	8.8	29.5	18.7	20.3	14.4	5.7	3.4	18.3	5	
Mescavi (NC)	9.4	27.2	22.8	18.7	17.5	4.7	4.0	19.1	3	
Wardan (NC)	11.0	29.0	22.6	13.1	18.4	4.7	3.4	18.8	4	
Bundel Berseem-2 (ZC-NWZ-CZ)	12.0	31.6	23.5	18.9	19.5	5.0	3.5	21.1	1	
Mean	10.2	30.0	21.5	18.2	17.4	5.1	3.7	19.5		

Table 3.5 AVTB-2: Second Advanced Varietal Trial in Berseem: Crude Protein (%)

Entries	Crude Protein (%)									
	Bika-ner	His-ar	Ludh-iana	Rah-uri	Jabal-pur	Urulikan-ghan	Rai-pur	Pant-nagar	Aver-age	Ran-k
JB-04-23	18.5	21.0	22.2	16.3	14.4	18.4	15.1	20.1	18.3	3
JB-04-21	22.4	20.7	20.3	15.5	14.3	18.3	15.6	19.7	18.3	3
Mescavi (NC)	21.6	20.5	20.4	17.3	14.4	18.2	14.9	20.6	18.5	2
Wardan (NC)	22.1	22.3	21.0	17.1	14.4	18.1	15.0	18.8	18.6	1
Bundel Berseem-2 (ZC-NWZ-CZ)	22.6	21.2	21.0	17.1	14.3	18.1	15.2	18.8	18.5	2
Mean	21.4	21.1	21.0	16.7	14.4	18.2	15.2	19.6	18.4	

Table 3.6 AVTB-2: Second Advanced Varietal Trial in Berseem: Plant Height (cm)

Entries	Bikaner	Hisar	Ludhiana	Pantnagar	Udaipur	Rahuri	Jabalpur	Urulikanchan	Raipur	Average	Rank
JB-04-23	39.0	73.8	58.0	49.5	60.9	61.9	54.4	62.3	38.9	55.4	2
JB-04-21	35.0	75.9	58.3	47.7	63.6	63.0	60.1	63.0	37.3	56.0	1
Mescavi (NC)	36.5	70.5	57.4	63.0	59.5	59.9	41.6	59.8	34.6	53.6	4
Wardan (NC)	32.5	74.6	60.8	53.3	55.6	60.8	46.1	63.8	33.3	53.4	5
Bundel Berseem-2 (ZC-NWZ-CZ)	38.5	73.3	56.7	52.6	59.2	61.0	49.4	62.6	34.6	54.2	3
Mean	36.3	73.6	58.2	53.2	59.8	61.3	50.3	62.3	35.7	54.5	

Table 3.7 AVTB-2: Second Advanced Varietal Trial in Berseem: Leaf Stem ratio

Entries	Bikaner	Hisar	Ludhiana	Rahuri	Jabalpur	Urulikanchan	Raipur	Average	Rank
JB-04-23	0.90	0.82	1.00	0.87	0.84	0.64	0.85	0.85	3
JB-04-21	0.80	0.78	1.10	1.04	0.81	0.70	0.81	0.86	2
Mescavi (NC)	0.90	0.73	1.00	0.76	0.72	0.66	0.88	0.81	4
Wardan (NC)	1.10	0.72	1.10	0.88	0.77	0.68	0.88	0.88	1
Bundel Berseem-2 (ZC-NWZ-CZ)	0.90	0.59	1.00	0.81	0.80	0.67	0.76	0.79	5
Mean	0.92	0.73	1.04	0.87	0.79	0.67	0.84	0.84	

Table 3.8 AVTB-2: Second Advanced Varietal Trial in Berseem: ADF (%), NDF (%), IVDMD (%) & DDM (q/ha)

Entries	ADF (%)					NDF (%)					IVDMD (%)					DDM (q/ha)	
	Rah- uri	Ludh- iana	Pant- nagar	Aver- age	Ra- nk	Ludh- iana	Rah- uri	Pant- nagar	Aver- age	Ra- nk	Ludh- iana	Rah- uri	His- ar	Aver- age	Ra- nk	His- ar	Ra- nk
JB-04-23	27.5	20.4	51.8	33.2	1	31.4	39.3	61.1	43.9	1	63.6	66.5	73.4	67.8	1	35.1	4
JB-04-21	31.6	24.1	53.3	36.3	3	31.2	43.3	59.1	44.5	2	63.0	64.1	73.7	66.9	4	31.9	5
Mescavi (NC)	28.9	23.8	53.6	35.4	2	34.1	39.6	62.5	45.4	4	60.6	65.5	76.1	67.4	2	35.7	3
Wardan (NC)	36.2	23.4	53.3	37.6	5	31.2	42.2	60.5	44.6	3	63.8	61.2	76.6	67.2	3	38.5	2
Bundel Berseem-2 (ZC-NWZ-CZ)	36.3	22.6	53.5	37.5	4	33.2	45.9	63.2	47.4	5	63.4	60.6	75.0	66.3	5	43.8	1
Mean	32.1	22.9	53.1	36.0		32.2	42.1	61.3	45.2		62.9	63.6	74.9	67.1		37.0	

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

Entries	North West Zone				Central Zone						All India	
	His- ar	Ludh- iana	Aver- age	Ra- nk	Jha- nsi	Rah- uri	Jabal- pur	Urulikan- chan	Aver- age	Ra- nk	Aver- age	Ra- nk
JB-04-23	3.77	4.60	4.19	3	6.26	3.93	6.21	1.62	4.50	3	4.40	3
JB-04-21	3.28	3.43	3.36	4	5.75	2.47	5.04	2.93	4.05	4	3.82	4
Mescavi (NC)	2.54	4.11	3.33	5	6.39	0.42	2.77	2.95	3.13	5	3.20	5
Wardan (NC)	3.89	4.98	4.44	2	5.84	9.33	5.69	4.10	6.24	2	5.64	2
Bundel Berseem-2 (ZC-NWZ-CZ)	4.60	5.04	4.82	1	5.85	10.60	7.26	4.01	6.93	1	6.23	1
Mean	3.62	4.43	4.02		6.02	5.35	5.39	3.12	4.97		4.66	
CD at 5%	1.01	1.73			0.54	0.76	0.94	0.59				
CV%	18.93	4.15			5.79	9.16	10.18	12.18				

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

(Reference tables 5.1 to 5.9)

In Oat (single cut), nine entries along with two national checks namely OS-6 and Kent and five zonal checks *viz.*, SKO-90 (HZ), OL-125 (NWZ), JHO-99-2 (NEZ), OS-377 (CZ) and JHO-2000-4 (SZ) for respective zones were evaluated in initial varietal trial at 30 locations across the five zones in the country.

For green forage yield (q/ha), entries OL-1861 (10.7%), SKO-229 (5.9%) in Hill zone; entries HFO-607 (9.4%), JO-05-7 (9.1%), OL-1869-1 (8.9%), OL-1861 (7.0%) in NWZ ; entry HFO-525 (7.6%) in NEZ; entries HFO-607 (9.6%), OL-1869-1 (8.5%), OL-1862 (8.4%), OL-1861 (7.1%), SKO-229 (5.1%) in central zone; HFO-607 (5.3%) in SZ exhibited superiority over best national/zonal check. At national level, entries HFO-607 (9.7%), OL-1869-1 (5.9%), OL-1861 (4.8%) were superior to checks. Other entries were either inferior to or showed marginal superiority over best national/zonal check.

For dry matter yield (q/ha), entries SKO-229 (9.9%), OL-1861 (9.1%), NDO-1102 (4.5%), in Hill zone; HFO-607 (6.1%), in NWZ; HFO-525 (8.5%), HFO-607 (4.6 %) in NEZ; entries HFO-607 (18.0%), OL-1862 (14.5%), HFO-525 (13.7%), JO-05-7 (11.3%), OL-1861 (10.1%), UPO-16-4 (7.4%), OL-1869-1(6.6%), SKO-229 (5.2%) in central zone; entry HFO-607 (5.5%) in south zone exhibited superiority over checks. At national level, HFO-607 (12.5%), HFO-525 (6.4%) were best performers. Other entries were marginally superior or inferior to best check at zonal or national level.

For fodder production potential (q/ha/day), HFO-525 followed by HFO-607 for green as well as dry forage yield were best performers. For plant height, HFO-607 followed by HFO-525 were best performers. For the character leafiness (L/S ratio), entry SKO-229 followed by NDO-1102 performed better.

For quality parameters, entry HFO-607 followed by UPO-16-4 and HFO-525 were best performers for crude protein yield (q/h), whereas OL-1861 ranked first for crude protein (%). For other quality parameters, checks showed superiority for NDF, whereas, entry SKO-229 for ADF and OL-1869-1 for IVDMD 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	Average	Rank	Superiority%	Bika-ner	Jal-ore	His-ar	Ludh-iana	Pant-nagar	Udai-pur	Mee-rut	Average	Rank	Superiority%
OL-1861	284.8	449.6	122.9	285.8	1	10.7	334.3	290.0	573.3	630.7	528.1	724.0	641.1	531.7	4	7.0
NDO-1102	222.7	439.8	127.0	263.2	3	1.9	237.6	210.7	610.0	697.4	560.4	677.7	469.9	494.8	7	
UPO-16-4	210.7	432.3	117.9	253.6	6		251.5	190.7	681.9	693.0	577.8	501.8	403.3	471.4	11	
HFO-525	211.2	385.7	110.4	235.8	11		353.4	232.7	673.0	686.7	480.7	677.7	447.8	507.4	5	2.1
OL-1862	249.6	392.8	112.1	251.5	7		277.6	264.7	616.3	689.6	403.0	590.7	496.7	476.9	10	
HFO-607	275.7	382.9	129.8	262.8	4	1.8	407.9	157.7	674.4	738.5	693.3	555.5	577.8	543.6	1	9.4
JO-05-7	258.1	375.1	107.1	246.8	9		353.6	191.3	614.1	703.7	635.7	696.2	599.9	542.1	2	9.1
OL-1869-1	221.3	423.0	109.5	251.3	8		337.5	214.3	573.3	745.2	559.3	757.3	603.3	541.5	3	8.9
SKO-229	230.4	474.6	115.4	273.5	2	5.9	133.0	150.7	718.9	738.5	571.8	524.0	538.9	482.3	9	
OS-6 (NC)	193.6	378.5	118.8	230.3	12		129.2	207.7	554.8	700.0	398.7	594.4	374.4	422.7	12	
Kent (NC)	196.8	416.4	111.3	241.5	10		326.6	158.0	614.1	601.1	534.5	709.2	508.9	493.2	8	
SKO-90 (ZC-HZ)	236.3	406.1	132.1	258.2	5											
OL-125 (ZC-NWZ)							300.9	259.3	743.0	648.1	566.7	559.2	402.2	497.1	6	
Mean	232.6	413.1	117.9	254.5			286.9	210.6	637.3	689.4	542.5	630.6	505.4	500.4		
CD at 5%	49.7	38.5	15.9				83.0	19.9	145.0	68.7	32.1	125.2	41.6			
CV%	12.6	9.3	8.0				17.1	5.6	13.4	5.9	7.8	11.7	4.9			

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	Average	Rank	Superiority%
OL-1861	357.9	454.4	307.9	302.1	327.0	314.6	459.7	360.5	11	
NDO-1102	366.9	432.2	353.3	382.1	361.0	362.7	315.8	367.7	8	
UPO-16-4	394.5	495.5	324.6	480.0	338.0	397.9	278.7	387.0	6	
HFO-525	381.0	490.0	368.6	413.3	372.0	480.0	459.3	423.5	1	7.6
OL-1862	343.4	420.0	267.9	297.7	372.0	488.0	363.0	364.6	9	
HFO-607	446.5	475.5	374.6	324.4	316.0	397.3	446.9	397.3	3	1.0
JO-05-7	327.3	463.3	338.6	368.8	361.0	469.3	405.3	390.5	5	
OL-1869-1	427.7	438.8	365.2	302.1	359.0	474.7	418.3	398.0	2	1.1
SKO-229	296.7	428.8	389.2	302.1	383.0	314.7	271.3	340.8	12	
OS-6 (NC)	329.7	451.1	379.9	444.4	327.0	405.3	354.1	384.5	7	
Kent (NC)	334.0	411.1	298.6	462.1	366.0	384.0	294.9	364.4	10	
JHO-99-2 (ZC-NEZ)	448.1	421.1	347.9	431.1	327.0	440.0	339.3	393.5	4	
Mean	371.1	448.5	343.0	375.9	350.8	410.7	367.2	381.0		
CD at 5%	6.1	15.4	34.4	47.2	31.7	112.7	14.4			
CV%	5.4	7.4	5.9	7.4	9.3	14.2	3.3			

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	Kan- -pur	Aver- age	Ran- k	Super- iority%
OL-1861	622.9	725.3	560.0	463.8	322.2	316.9	275.2	525.9	476.5	4	7.1
NDO-1102	497.8	669.3	498.0	487.8	300.0	374.8	281.5	551.8	457.6	8	
UPO-16-4	585.4	668.8	423.0	478.3	233.3	291.5	218.9	470.3	421.2	12	
HFO-525	614.7	707.2	458.0	376.9	333.6	379.4	294.5	514.8	459.9	7	3.3
OL-1862	642.4	778.6	499.0	470.5	287.0	303.0	313.9	566.6	482.6	3	8.4
HFO-607	566.7	812.8	561.0	470.5	311.1	298.4	272.5	611.1	488.0	1	9.6
JO-05-7	509.3	568.0	593.0	586.5	303.5	333.1	278.4	529.6	462.7	6	3.9
OL-1869-1	512.4	666.6	601.0	509.2	359.3	365.5	295.0	555.5	483.1	2	8.5
SKO-229	525.3	661.8	544.0	467.8	281.5	424.3	228.8	607.4	467.6	5	5.1
OS-6 (NC)	454.0	582.4	558.0	485.2	292.6	393.3	247.2	548.1	445.1	9	
Kent (NC)	533.7	539.7	515.0	554.5	301.8	365.5	249.0	455.5	439.3	10	
OS-377 (ZC-CZ)	567.8	572.2	460.0	438.5	288.9	349.3	253.2	529.6	432.4	11	
Mean	552.7	662.7	522.5	482.5	301.2	349.6	267.3	538.8	459.7		
CD at 5%	56.1	60.1	55.6	102.5	63.4	19.0	52.1	55.9			
CV%	6.0	5.3	6.3	12.5	12.3	11.2	11.4	6.1			

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	Coimb- atore	**Tiru- pati	**Mattu- petty	Aver- age	Ran- k	Superi- ority%	Aver- age	Ran- k	Superi- ority%
OL-1861	325.9	235.5	396.3	26.4	118.3	319.2	5		424.0	3	4.8
NDO-1102	285.2	210.1	400.0	17.6		298.4	9		406.5	7	0.5
UPO-16-4	303.7	175.7	540.7	14.4	233.0	340.0	4		398.6	10	
HFO-525	314.8	242.3	370.4	32.4	200.0	309.2	7		422.5	4	4.4
OL-1862	322.2	274.8	440.7	22.6	244.0	345.9	3		412.3	6	1.9
HFO-607	325.9	289.0	525.9	17.1	141.0	380.3	1	5.3	443.6	1	9.7
JO-05-7	225.9	261.8	363.0	19.4	196.0	283.6	11		422.2	5	4.4
OL-1869-1	318.5	175.2	303.7	19.4	329.3	265.8	12		428.3	2	5.9
SKO-229	362.9	227.3	322.2	17.7	241.0	304.2	8		401.3	9	
OS-6 (NC)	333.3	232.9	366.7	25.1	163.0	311.0	6		387.0	11	
Kent (NC)	337.0	246.0	500.0	19.7	218.3	361.0	2		404.5	8	
JHO-2000-4 (ZC-SZ)	292.6	256.0	340.7	20.2	114.7	296.4	10				
Mean	312.3	235.6	405.9	21.0	199.9	317.9			413.7		
CD at 5%	50.7	23.1	36.6	4.5	22.8						
CV%	9.5	6.2	5.3	12.5	6.7						

Note: ** Yield data is very low hence not included in zonal and national average

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	Raj-our	Aver-age	Ran-k	Superi-ori-ty%	Bika-ner	His-ar	Ludhi-ana	Pant-nagar	Aver-age	Ran-k	Superi-ori-ty%
OL-1861	55.3	103.6	28.6	62.5	2	9.1	77.3	106.4	135.0	99.9	104.6	9	
NDO-1102	44.6	104.4	30.8	59.9	3	4.5	67.9	119.8	152.0	111.0	112.7	5	
UPO-16-4	44.6	96.8	27.1	56.2	8		55.2	123.8	155.2	92.0	106.6	8	
HFO-525	36.9	88.6	25.5	50.3	12		92.4	122.5	140.1	92.1	111.8	6	
OL-1862	54.3	94.7	26.4	58.5	5	2.1	73.1	99.5	153.8	83.7	102.5	10	
HFO-607	54.3	91.4	31.5	59.1	4	3.1	101.5	116.8	161.7	105.9	121.5	1	6.1
JO-05-7	51.5	91.7	24.1	55.8	9		97.3	118.1	147.8	107.0	117.6	2	2.7
OL-1869-1	47.6	97.7	23.6	56.3	7		94.0	98.3	157.2	93.7	110.8	7	
SKO-229	51.8	110.6	26.5	63.0	1	9.9	29.7	94.6	167.6	107.0	99.7	11	
OS-6 (NC)	41.9	90.2	28.0	53.4	11		36.7	106.4	151.9	77.2	93.1	12	
Kent (NC)	38.8	95.0	27.0	53.6	10		87.3	132.4	134.6	99.4	113.4	4	
SKO-90 (ZC-HZ)	49.3	92.5	30.2	57.3	6								
OL-125 (ZC-NWZ)							77.7	140.5	143.2	96.7	114.5	3	
Mean	47.6	96.4	27.4	57.1			74.2	114.9	150.0	97.1	109.1		
CD at 5%	NS	7.8	2.3				24.3	30.7	35.1	6.6			
CV%	16.0	8.5	5.8				19.4	15.7	13.4	12.7			

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

Entries	North East Zone										Central Zone											
	Jor-hat	Kal-yani	Bhuban-eswar	Ran-chi	Pu-sa	Faiza-bad	Imp-hal	Aver-age	Ran-k	Superi-ori-ty%	Rah-uri	Urulikan-chan	Ana-nd	Jabal-pur	Rai-pur	Jha-nsi	Pal-ghar	Kan-pur	Aver-age	Ran-k	Superi-ori-ty%	
OL-1861	63.2	65.0	61.8	66.9	65.5	85.9	101.7	72.9	10		134.0	161.8	82.9	82.3	66.5	101.6	50.4	183.3	107.8	5	10.1	
NDO-1102	69.3	67.4	74.8	76.8	71.9	85.3	84.2	75.7	9		87.9	150.1	81.6	90.2	59.6	75.7	47.7	192.2	98.1	9	0.2	
UPO-16-4	75.5	67.4	71.0	131.5	67.5	84.3	76.4	81.9	3	4.2	147.5	152.1	77.0	86.2	86.7	92.1	36.0	163.3	105.1	6	7.4	
HFO-525	62.4	75.0	77.7	96.3	74.1	94.4	117.6	85.3	1	8.5	142.3	151.9	86.1	94.3	94.2	85.5	55.7	180.0	111.3	3	13.7	
OL-1862	60.0	58.8	56.3	83.7	74.0	98.7	62.5	70.6	12		149.1	168.0	77.3	87.3	89.3	72.9	55.7	197.0	112.1	2	14.5	
HFO-607	76.8	68.0	79.7	70.1	62.7	85.3	132.7	82.2	2	4.6	146.6	141.9	100.4	86.7	100.5	75.6	58.3	213.7	115.5	1	18.0	
JO-05-7	57.4	64.9	72.5	84.5	72.1	91.7	95.7	77.0	7		110.7	117.8	122.1	109.3	85.9	95.0	48.7	182.2	109.0	4	11.3	
OL-1869-1	86.8	65.8	77.0	59.7	71.2	88.5	95.9	77.8	6		95.8	123.6	87.8	94.3	101.3	83.1	55.6	193.7	104.4	7	6.6	
SKO-229	56.8	64.3	82.0	76.0	76.5	80.0	64.9	71.5	11		136.8	118.1	90.3	85.6	67.8	80.9	40.8	203.7	103.0	8	5.2	
OS-6 (NC)	65.1	67.6	79.1	99.2	65.3	80.5	91.0	78.3	5		93.6	106.7	87.0	89.3	87.9	83.9	45.5	189.6	97.9	10		
Kent (NC)	66.0	58.8	65.2	100.9	72.6	92.3	78.6	76.3	8		108.7	99.9	104.0	103.0	61.2	73.8	49.3	157.8	94.7	11	1.1	
JHO-99-2 (ZC-NEZ)	79.5	61.5	73.0	104.7	65.0	91.7	75.1	78.6	4													
OS-377 (ZC-CZ)											103.6	115.2	68.1	77.0	87.5	71.0	42.8	184.1	93.7	12		
Mean	68.2	65.4	72.5	87.5	69.9	88.2	89.7	77.3			121.4	133.9	88.7	90.5	82.4	82.6	48.9	186.7	104.4			
CD at 5%	4.1	2.8	7.5	18.4	7.3	9.6	4.6				12.0	12.6	9.8	20.4	16.6	5.8	13.0	22.6				
CV%	8.5	10.5	6.1	12.4	10.1	6.4	4.3				5.8	5.5	6.5	13.5	11.8	3.4	15.6	7.2				

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

Entries	South Zone								All India		
	Hydera- bad	Man- dya	Coimb- atore	**Tiru- pati	**Mattu- petty	Aver- age	Ra- nk	Superi- ority%	Aver- age	Ra- nk	Superi- ority%
OL-1861	66.2	50.5	88.6	9.6	29.4	68.4	5		87.4	5	2.0
NDO-1102	64.5	49.5	78.8	6.5		64.3	10		85.5	8	
UPO-16-4	57.5	37.1	125.5	5.1	58.5	73.4	4		89.2	3	4.1
HFO-525	61.7	46.4	85.9	10.7	50.3	64.7	9		91.2	2	6.4
OL-1862	65.1	63.9	92.9	7.2	60.9	74.0	3		87.9	4	2.6
HFO-607	63.6	66.8	117.7	5.5	35.1	82.7	1	5.5	96.4	1	12.5
JO-05-7	45.4	54.4	81.6	7.4	49.5	60.5	11		89.2	3	
OL-1869-1	57.0	31.9	65.0	6.1	83.4	51.3	12		85.8	6	0.1
SKO-229	76.1	50.2	75.0	7.6	61.3	67.1	6		84.5	9	
OS-6 (NC)	68.8	53.1	78.7	7.7	41.0	66.9	7		82.6	10	
Kent (NC)	69.6	48.7	117.0	6.9	56.8	78.4	2		85.7	7	
JHO-2000-4 (ZC-SZ)	62.3	56.5	76.0	7.4	28.6	64.9	8				
Mean	63.2	50.7	90.2	7.3	50.4	68.0					
CD at 5%	13.2	7.7	12.7	1.3	14.8						
CV%	12.3	8.9	8.3	10.4	1.7						

Note: ** Yield data very low hence not included in zonal and national average

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

Entries	Palam- pur	Rajo- uri	Bika- ner	His- ar	Ludh- iana	Jor- hat	Kal- yani	Bhuban- eswar	Ran- chi	Pu- sa	Faiza- bad
OL-1861	3.09	1.23	3.25	5.85	5.40	2.90	5.05	4.22	3.18	3.55	2.75
NDO-1102	1.90	1.19	2.53	6.22	5.80	4.03	5.27	4.71	4.66	3.84	3.45
UPO-16-4	1.79	1.12	2.44	6.96	5.80	4.29	5.89	4.51	5.21	3.67	3.42
HFO-525	1.81	1.01	3.76	6.87	5.70	3.07	5.97	4.98	4.92	3.92	4.40
OL-1862	2.72	1.03	2.69	6.29	5.70	3.75	5.00	3.62	3.03	3.92	4.06
HFO-607	3.01	1.24	3.96	6.88	5.40	4.70	5.66	5.43	3.24	3.36	3.39
JO-05-7	2.80	1.05	3.43	6.27	5.90	3.56	5.38	4.34	3.96	3.84	4.15
OL-1869-1	2.40	1.05	3.28	5.85	6.20	3.46	5.22	5.07	3.21	3.78	4.16
SKO-229	2.45	1.05	1.29	7.34	5.40	3.12	4.76	5.33	3.55	4.07	2.62
OS-6 (NC)	1.66	1.15	1.37	5.66	5.80	3.43	5.37	5.28	5.05	3.55	3.68
Kent (NC)	1.68	1.08	3.47	6.27	5.00	3.66	5.01	4.21	5.37	3.85	3.55
SKO-90 (ZC-HZ)	2.53	1.10									
OL-125 (ZC-NWZ)			3.20	7.58	5.40						
JHO-99-2 (ZC-NEZ)						4.78	5.13	4.70	4.78	3.44	3.76
Mean	2.32	1.11	2.89	6.50	5.63	3.73	5.31	4.70	4.18	3.73	3.62

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	Kan- pur	Hydera- bad	Man- dya	Coimb- atore	**Mattu petty	Aver- age	Ra- nk
OL-1861	7.00	7.80	7.09	3.70	3.11	4.17	5.91	4.01	3.40	4.95	1.51	4.36	9
NDO-1102	6.15	8.16	6.30	4.48	4.03	4.33	6.98	4.21	3.05	5.56		4.61	3
UPO-16-4	6.81	9.29	4.75	2.68	2.91	3.37	5.81	4.16	2.44	6.59	2.03	4.47	7
HFO-525	14.64	8.13	5.15	4.70	3.95	4.60	6.60	4.68	3.45	4.75	2.56	5.10	1
OL-1862	7.83	9.98	5.61	3.56	3.70	4.76	6.83	4.06	3.42	5.25	3.13	4.61	3
HFO-607	5.97	9.79	6.30	3.87	3.64	4.26	6.80	3.98	3.68	7.01	1.80	4.84	2
JO-05-7	5.99	7.47	6.66	3.75	3.27	4.22	6.30	2.88	3.30	4.37	2.51	4.42	8
OL-1869-1	6.03	8.44	7.61	4.89	3.58	4.68	6.24	4.85	2.67	3.62	4.22	4.58	4
SKO-229	7.20	7.35	6.11	3.96	4.56	3.36	6.26	4.44	2.62	3.88	3.09	4.32	10
OS-6 (NC)	6.22	7.28	7.06	4.28	4.18	3.92	6.94	5.07	3.23	4.37	2.09	4.50	5
Kent (NC)	6.51	6.28	5.79	4.25	3.93	3.89	5.62	4.96	3.34	6.41	2.80	4.48	6
OS-377 (ZC-CZ)	6.92	6.36	5.82	4.31	3.76	3.90	6.70						
JHO-2000-4 (ZC-SZ)								4.09	3.40	4.54	1.47		
Mean	7.27	8.03	6.19	4.04	3.72	4.12	6.42	4.28	3.17	5.11	2.47	4.57	

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

Entries	Rajo- uri	Bika- ner	His- ar	Ludh- iana	Jor- hat	Kal- yani	Bhuban- eswar	Ran- chi	Pu- sa	Faiza- bad
OL-1861	0.29	0.75	1.09	1.20	0.51	0.72	0.85	0.70	0.71	0.75
NDO-1102	0.29	0.72	1.22	1.30	0.76	0.82	1.00	0.93	0.77	0.81
UPO-16-4	0.26	0.54	1.26	1.30	0.82	0.80	0.99	1.42	0.73	0.72
HFO-525	0.23	0.98	1.25	1.20	0.50	0.91	1.05	1.14	0.78	0.86
OL-1862	0.24	0.71	1.02	1.30	0.65	0.70	0.76	0.85	0.78	0.82
HFO-607	0.30	0.99	1.19	1.20	0.81	0.80	1.15	0.70	0.67	0.72
JO-05-7	0.24	0.95	1.20	1.20	0.62	0.75	0.93	0.90	0.77	0.81
OL-1869-1	0.23	0.91	1.00	1.30	0.70	0.78	1.07	0.63	0.75	0.77
SKO-229	0.24	0.29	0.97	1.20	0.60	0.71	1.12	0.89	0.81	0.66
OS-6 (NC)	0.27	0.39	1.09	1.30	0.68	0.74	1.10	1.12	0.71	0.73
Kent (NC)	0.26	0.93	1.35	1.10	0.72	0.71	0.92	1.16	0.76	0.85
SKO-90 (ZC-HZ)	0.25									
OL-125 (ZC-NWZ)		0.83	1.43	1.20						
JHO-99-2 (ZC-NEZ)					0.85	0.75	0.99	1.16	0.68	0.78
Mean	0.26	0.75	1.17	1.23	0.69	0.77	0.99	0.97	0.74	0.77

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

Entries	Rah- uri	Urulikan- chan	Ana- nd	Rai- pur	Pal- ghar	Kan- pur	Jha- nsi	Hydera- bad	Coimb- atore	Mattu- petty	Aver- age	Ra- nk
OL-1861	1.51	1.74	1.05	0.76	0.76	2.06	1.00	0.81	1.11	0.37	0.94	7
NDO-1102	1.09	1.83	1.03	0.89	0.73	2.43	0.81	0.95	1.09		1.03	3
UPO-16-4	1.72	2.11	0.87	1.00	0.55	2.02	0.92	0.79	1.53	0.75	1.05	2
HFO-525	3.39	1.75	0.97	1.33	0.87	2.31	0.89	0.92	1.10	0.64	1.15	1
OL-1862	1.82	2.15	0.87	1.03	0.84	2.37	0.89	0.82	1.11	0.78	1.03	3
HFO-607	1.54	1.71	1.13	1.16	0.91	2.37	0.92	0.78	1.57	0.45	1.05	2
JO-05-7	1.30	1.55	1.37	0.99	0.74	2.17	0.93	0.58	0.98	0.63	0.98	6
OL-1869-1	1.13	1.56	1.11	1.35	0.88	2.18	0.82	0.87	0.77	1.07	0.99	5
SKO-229	1.87	1.31	1.01	0.90	0.60	2.10	0.87	0.93	0.90	0.79	0.94	7
OS-6 (NC)	1.28	1.33	1.10	1.31	0.72	2.40	0.89	1.05	0.94	0.53	0.98	6
Kent (NC)	1.33	1.16	1.17	0.86	0.77	1.95	0.79	1.03	1.50	0.73	1.00	4
OS-377 (ZC-CZ)	1.26	1.28	0.86	1.31	0.66	2.33	0.76					
JHO-2000-4 (ZC-SZ)								0.87	1.01	0.37		
Mean	1.60	1.62	1.05	1.07	0.75	2.22	0.88	0.87	1.13	0.65	1.01	

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

Entries	Palam- pur	Bika- ner	Ludh- iana	Jor- hat	Kal- yani	Bhuban- eswar	Ran- chi	Faiza- bad	Imp- hal	Rah- uri	Urulikan- chan	Ana- nd	Jabal- pur	Rai- pur	Hydera- bad	Coimb- atore	Man- dya	Aver- age	Ra- nk
OL-1861	4.7	6.8	8.6	5.7	7.2	5.7	4.7	7.3	6.6	7.4	13.9	11.2	6.7	5.0	3.8	14.0	5.3	7.3	4
NDO-1102	4.1	5.6	10.6	6.4	6.2	6.4	5.2	6.8	4.5	5.2	13.2	8.9	7.2	4.2	4.2	13.1	3.3	6.8	6
UPO-16-4	4.1	5.6	13.5	7.4	6.1	6.0	8.9	7.2	4.2	11.0	13.2	8.6	6.9	5.1	5.3	12.0	4.1	7.6	2
HFO-525	3.1	10.7	8.5	5.7	5.3	6.6	6.7	7.9	6.8	12.5	12.6	10.5	4.7	6.7	4.3	12.1	4.5	7.6	2
OL-1862	6.2	6.8	10.1	6.1	6.4	4.8	5.7	8.5	3.5	8.2	13.3	9.4	6.9	6.0	5.4	13.8	3.9	7.4	3
HFO-607	5.5	11.1	14.1	7.1	5.6	6.8	4.9	6.8	7.3	9.2	11.9	11.9	6.9	6.0	5.0	18.5	5.3	8.5	1
JO-05-7	5.1	8.4	8.9	5.6	7.5	6.2	5.5	7.6	5.5	9.6	9.6	12.8	8.9	4.6	2.9	9.3	5.7	7.3	4
OL-1869-1	4.3	8.0	15.1	9.7	6.8	6.5	3.3	8.4	5.5	7.5	9.9	8.7	7.6	5.1	2.5	9.7	2.8	7.1	5
SKO-229	4.8	3.5	13.7	5.2	6.0	6.9	4.2	6.6	4.1	9.7	8.3	10.6	6.7	4.1	4.9	8.9	4.8	6.6	7
OS-6 (NC)	4.5	3.8	9.7	6.0	5.3	6.6	6.9	6.9	5.4	7.2	8.0	10.2	7.2	6.2	6.0	6.9	4.6	6.6	7
Kent (NC)	4.1	8.6	11.7	7.2	5.6	6.1	7.1	7.4	4.8	7.4	7.3	10.7	8.4	3.7	3.3	18.2	4.3	7.4	3
SKO-90 (ZC-HZ)	5.0																		
OL-125 (ZC-NWZ)		7.1	12.2																
JHO-99-2 (ZC-NEZ)				7.8	6.8	6.2	8.5	7.8	4.3										
OS-377 (ZC-CZ)										7.3	9.9	8.4	6.1	5.6					
JHO-2000-4 (ZC-SZ)															3.2	7.3	4.9		
Mean	4.6	7.2	11.4	6.6	6.2	6.2	6.0	7.4	5.2	8.5	10.9	10.2	7.0	5.2	4.2	12.0	4.5	7.3	

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

Entries	Palam-pur	Bika-ner	Ludh-iana	Jor-hat	Kal-yani	Bhuban-eswar	Ran-chi	Faiza-bad	Imp-hal	Rah-uri	Urulikan-chan	Ana-nd	Jabal-pur	Rai-pur	Hydera-bad	Coimba-tore	Man-dya	Aver-age	Ran-k
OL-1861	8.5	8.8	6.4	9.2	11.1	9.3	7.0	8.5	6.5	5.5	8.6	13.6	8.1	7.6	5.7	15.8	10.5	8.9	1
NDO-1102	9.0	8.3	7.0	9.3	9.3	8.5	6.8	8.0	5.3	5.9	8.8	10.9	8.1	7.1	6.6	16.6	6.6	8.3	6
UPO-16-4	9.3	10.1	8.7	9.8	9.1	8.4	6.8	8.6	5.6	7.4	8.7	11.2	8.0	5.9	9.2	9.6	10.9	8.7	2
HFO-525	8.5	11.6	6.1	9.1	7.1	8.4	7.0	8.4	5.8	8.8	8.3	12.2	7.7	7.1	7.0	14.0	9.6	8.6	3
OL-1862	11.4	9.4	6.6	10.4	10.8	8.6	6.8	8.6	5.6	5.5	7.9	12.2	8.1	6.8	8.3	14.9	6.1	8.7	2
HFO-607	10.2	10.9	8.7	9.3	8.2	8.5	7.0	8.1	5.5	6.3	8.4	11.8	8.0	5.9	7.9	15.8	7.9	8.7	2
JO-05-7	9.9	8.7	6.0	9.9	11.6	8.5	6.6	8.3	5.7	8.7	8.2	10.5	8.2	5.4	6.6	11.4	10.5	8.5	4
OL-1869-1	9.0	8.5	9.6	11.2	10.3	8.4	5.5	8.0	5.8	7.9	8.0	9.9	8.1	5.0	4.4	14.9	8.7	8.4	5
SKO-229	9.3	11.9	8.2	9.2	9.3	8.4	5.5	8.2	6.3	7.1	7.0	11.7	7.8	6.1	6.5	11.8	9.6	8.5	4
OS-6 (NC)	10.8	10.2	6.4	9.3	8.8	8.4	7.0	8.2	5.9	7.7	7.5	11.7	8.1	7.1	8.7	8.7	8.8	8.4	5
Kent (NC)	10.5	9.8	8.7	11.0	9.5	9.3	7.0	8.1	6.1	6.8	7.3	10.3	8.2	6.1	4.8	15.8	8.8	8.7	2
SKO-90 (ZC-HZ)	10.2																		
OL-125 (ZC-NWZ)		9.2	8.5																
JHO-99-2 (ZC-NEZ)				9.8	11.0	8.4	8.1	8.5	5.7										
OS-377 (ZC-CZ)										7.0	8.6	12.3	8.0	6.4					
JHO-2000-4 (ZC-SZ)															5.2	9.6	8.7		
Mean	9.7	9.8	7.6	9.8	9.7	8.6	6.7	8.3	5.8	7.0	8.1	11.5	8.0	6.4	6.7	13.2	8.9	8.6	

Table 5.7 IVT Oat (SC): Initial 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
OL-1861	107.3	139.3	108.5	80.0	138.4	143.5	149.7	166.7	171.1	167.6	134.5	115.0	113.4	142.8
NDO-1102	102.7	128.8	106.8	93.0	143.8	129.9	139.3	137.8	146.5	165.2	149.2	105.0	89.6	109.3
UPO-16-4	98.7	135.0	99.8	90.0	146.7	139.2	140.7	141.7	159.8	165.2	137.5	112.0	104.4	118.9
HFO-525	107.0	125.2	104.5	100.0	158.2	144.0	146.0	151.1	173.9	162.9	157.2	136.0	113.6	142.6
OL-1862	106.0	125.4	103.5	98.0	137.2	129.8	142.0	144.0	165.1	157.3	124.7	108.0	102.6	132.0
HFO-607	111.0	116.9	105.6	77.0	150.0	150.6	153.3	158.3	186.2	160.1	159.9	112.0	123.0	172.3
JO-05-7	108.7	112.1	96.5	97.0	137.3	148.8	157.7	149.9	164.9	139.8	142.5	104.0	116.2	129.0
OL-1869-1	100.7	125.0	110.2	112.0	136.9	141.9	146.3	163.1	139.2	144.5	154.3	109.0	127.2	133.8
SKO-229	90.7	128.7	102.5	50.0	131.3	132.4	144.7	136.6	101.9	124.2	164.2	107.0	70.2	125.7
OS-6 (NC)	102.7	109.3	103.6	108.0	143.2	142.3	150.3	152.7	157.9	156.8	161.5	113.0	121.0	131.0
Kent (NC)	98.7	123.5	112.3	102.0	143.9	129.4	143.3	143.2	151.1	124.3	129.3	111.0	112.4	111.3
SKO-90 (ZC-HZ)	77.3	118.4	102.4											
OL-125 (ZC-NWZ)				110.0	159.8	145.7	160.7	133.6						
JHO-99-2 (ZC-NEZ)									160.4	163.6	145.6	114.0	100.5	133.0
Mean	101.0	124.0	104.7	93.1	143.9	139.8	147.8	148.2	156.5	152.6	146.7	112.2	107.8	131.8

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	Kan- pur	Hydera- bad	Man- dya	Coimb- atore	Tiru- pati	Aver- age	Ra- nk
OL-1861	81.2	84.8	139.0	104.5	152.9	147.6	71.7	144.8	98.1	79.2	121.4	35.6	120.7	5
NDO-1102	123.5	71.0	140.0	113.9	146.0	138.9	59.0	146.1	71.4	78.7	118.1	35.2	115.0	10
UPO-16-4	131.8	96.2	142.2	134.0	140.7	134.8	62.3	145.9	88.8	77.0	128.8	37.1	119.6	6
HFO-525	145.0	82.3	139.5	72.1	152.6	160.8	78.3	154.7	99.3	84.7	122.0	30.1	124.8	2
OL-1862	122.5	79.3	125.2	118.4	149.3	140.2	63.0	135.2	91.6	88.7	99.5	39.0	116.4	8
HFO-607	143.4	86.8	146.8	118.1	153.2	157.9	81.7	144.8	94.1	83.5	129.8	32.1	127.2	1
JO-05-7	115.5	69.5	124.2	136.6	133.7	147.0	61.0	134.1	86.2	94.0	100.2	36.7	117.0	7
OL-1869-1	127.3	64.2	139.9	119.6	147.0	152.2	67.3	156.9	90.2	79.9	125.0	34.0	121.1	4
SKO-229	115.0	69.7	130.1	114.1	120.2	137.7	54.0	156.7	76.4	85.2	98.0	35.6	107.8	11
OS-6 (NC)	139.8	70.3	137.7	111.7	150.0	146.6	77.0	146.3	98.9	81.1	118.0	38.8	121.9	3
Kent (NC)	124.3	65.2	143.7	129.1	147.0	142.6	60.3	134.9	78.7	87.6	126.5	24.7	115.4	9
OS-377 (ZC-CZ)	120.6	86.7	139.6	99.0	140.0	142.2	56.7	146.3						
JHO-2000-4 (ZC-SZ)									95.9	95.1	125.5	33.7		
Mean	124.2	77.2	137.3	114.3	144.4	145.7	66.0	145.6	89.1	84.6	117.7	34.4	118.8	

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

Entries	Palam- pur	Sri- nagar	Bika- ner	His- ar	Ludh- iana	Pant- nagar	Jor- hat	Kaly- ani	Bhuban- eswar	Ran- chi	Faiza- bad	Imp- hal
OL-1861	0.50	0.55	1.04	0.40	1.10	0.63	0.75	1.00	0.79	0.38	0.71	0.41
NDO-1102	0.50	0.52	0.54	0.31	1.10	0.55	0.65	1.00	1.19	0.47	0.72	0.31
UPO-16-4	0.50	0.55	0.77	0.33	0.70	0.49	0.68	0.70	0.87	0.37	0.70	0.30
HFO-525	0.70	0.51	0.55	0.37	0.90	0.48	0.97	1.00	1.25	0.46	0.74	0.30
OL-1862	0.50	0.45	0.65	0.46	0.50	0.58	0.64	0.70	0.70	0.36	0.71	0.40
HFO-607	0.50	0.39	0.72	0.47	0.50	0.45	0.55	0.70	1.24	0.54	0.70	0.21
JO-05-7	0.60	0.38	0.76	0.34	0.80	0.51	0.66	1.00	0.98	0.46	0.73	0.30
OL-1869-1	0.50	0.44	0.76	0.42	1.10	0.47	0.54	0.80	1.27	0.46	0.72	0.30
SKO-229	0.50	0.58	1.07	0.68	0.50	0.49	0.67	0.80	1.35	0.49	0.69	0.31
OS-6 (NC)	0.50	0.34	0.56	0.30	0.80	0.45	0.76	0.80	1.29	0.46	0.72	0.29
Kent (NC)	0.60	0.44	0.36	0.32	0.70	0.52	0.54	0.70	0.71	0.42	0.70	0.25
SKO-90 (ZC-HZ)	0.50	0.52										
OL-125 (ZC-NWZ)			0.43	0.38	0.10	0.49						
JHO-99-2 (ZC-NEZ)							0.80	0.80	1.09	0.35	0.76	0.27
Mean	0.53	0.47	0.68	0.40	0.73	0.51	0.68	0.83	1.06	0.44	0.72	0.30

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	Rai- pur	Pal- ghar	Kan- pur	Hydera- bad	Man- dya	Coimb- atore	Mattu- petty	Aver- age	Ran- k
OL-1861	0.50	0.57	1.27	0.56	0.38	0.65	2.54	0.43	0.87	0.32	0.64	0.74	5
NDO-1102	0.50	0.78	0.85	0.58	0.41	0.86	3.69	0.49	0.71	0.36		0.78	2
UPO-16-4	0.30	0.66	0.92	0.79	0.51	0.85	2.74	0.42	0.73	0.40	0.72	0.70	7
HFO-525	0.40	0.53	1.08	0.46	0.67	0.67	3.16	0.38	0.68	0.38	0.76	0.76	4
OL-1862	0.40	0.65	1.27	0.63	0.65	0.83	2.27	0.46	0.78	0.28	0.85	0.68	8
HFO-607	0.30	0.62	1.50	0.66	0.66	0.59	2.45	0.54	0.71	0.44	0.59	0.70	7
JO-05-7	0.40	0.66	0.92	0.82	0.58	0.81	2.32	0.51	0.65	0.26	0.89	0.71	6
OL-1869-1	0.50	0.63	0.92	0.74	0.65	0.82	2.51	0.46	0.69	0.40	0.91	0.74	5
SKO-229	0.50	0.75	1.50	0.66	0.61	0.92	3.34	0.50	0.76	0.58	0.88	0.83	1
OS-6 (NC)	0.40	0.73	1.78	0.71	0.41	0.60	3.45	0.42	0.63	0.49	0.72	0.77	3
Kent (NC)	0.40	0.75	1.08	0.77	0.41	0.86	3.23	0.56	0.75	0.44	0.80	0.71	6
OS-377 (ZC-CZ)	0.80	0.50	1.17	0.51	0.37	0.88	3.30						
JHO-2000-4 (ZC-SZ)								0.47	0.62	0.31	0.61		
Mean	0.45	0.65	1.19	0.66	0.53	0.78	2.92	0.47	0.72	0.39	0.76	0.74	

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

Entries	NDF (%)		ADF (%)		IVDMD (%)	
	Ludhiana	Rank	Ludhiana	Rank	Ludhiana	Rank
OL-1861	57.0	5	48.2	12	43.8	12
NDO-1102	57.4	6	47.6	9	47.2	7
UPO-16-4	56.9	4	46.0	4	49.3	4
HFO-525	58.2	7	47.4	8	44.2	11
OL-1862	59.3	9	47.8	10	45.3	9
HFO-607	56.4	3	46.6	6	51.6	3
JO-05-7	58.8	8	46.9	7	44.8	10
OL-1869-1	56.4	3	45.1	2	54.2	1
SKO-229	56.1	2	45.0	1	48.2	6
OS-6 (NC)	59.9	10	48.1	11	46.1	8
Kent (NC)	55.8	1	45.4	3	52.1	2
OL-125 (ZC-NWZ)	55.8	1	46.1	5	48.6	5
Mean	57.3		46.7		48.0	

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

In Oat (single cut), seven 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 2000-4 (SZ)] at 20 locations in four different zones (HZ, NWZ, NEZ, SZ) of the country.

For green forage yield (q/ha), entries SKO-227 (12.6%), HFO-427 (9.7%), JO-04-22 (7.6%), JHO-15-1 (5.5%) in HZ; HFO-427 (5.9%) in South zone exhibited superiority over the best check. At national level, HFO-427 registered 5.8% superiority 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), entry SKO-227 (7.7%) in HZ; HFO-427 (4.6%) in NWZ performed better than the best check. At all India level and zonal level, other entries were inferior or marginally superior over the best check.

In green forage production potential (q/ha/day), National check Kent performed best, whereas for dry matter production potential (q/ha/day), JHO-15-1 was the best. For plant height (cm), entry HFO-529 (131 cm) ranked first, whereas for the character leafiness, HFO-427 and JHO-15-1 (0.66) were adjudged best performers.

For quality parameters, for crude protein yield, HFO-427 and JHO-15-1 (6.9q/ha) ranked joint first followed by national check (6.6). For crude protein content, entry JHO-15-1 and check OS-6 (9.6 %) were best performers. For other quality parameters, check Kent ranked first for ADF% whereas JO-04-22 ranked first for NDF and IVDMD.

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

Entries	Hill Zone						North West Zone								
	Palam-pur	Sri-nagar	Rajo-uri	Aver-age	Ra-nk	Superi- ority%	Bika- ner	Jal- ore	His- ar	Ludh- iana	Pant- nagar	Udai- pur	Aver- age	Ra- nk	Superi- ority%
HFO-427	216.0	384.7	101.0	233.9	2	9.7	427.3	244.7	593.3	655.8	641.0	590.0	525.4	1	3.4
SKO-227	147.7	458.8	113.9	240.1	1	12.6	325.0	224.7	650.0	736.4	489.0	602.5	504.6	5	
VOS-15-24	165.9	397.4	98.5	220.6	5	3.4	303.3	210.7	606.7	705.3	486.0	602.5	485.8	8	
OL-1844	137.6	391.8	92.7	207.4	8		343.2	196.3	620.8	714.3	585.0	538.7	499.7	7	
HFO-529	132.3	372.8	124.8	210.0	7		256.0	214.7	560.0	739.6	667.7	577.5	502.6	6	
JO-04-22	186.7	406.6	95.2	229.5	3	7.6	363.6	244.0	572.2	534.4	604.3	541.5	476.7	10	
JHO-15-1	145.1	417.8	112.1	225.0	4	5.5	346.1	268.3	661.7	671.1	475.3	635.9	509.7	2	0.4
OS-6 (NC)	156.8	349.7	102.7	203.1	9		316.3	316.0	621.4	676.4	489.0	626.1	507.5	4	
Kent (NC)	138.1	358.8	111.0	202.6	10		344.1	244.7	539.4	669.7	504.0	569.2	478.5	9	
SKO-90 (ZC-HZ)	182.4	363.9	93.5	213.3	6										
OL-125 (ZC-NWZ)							289.3	288.7	631.4	694.1	527.3	616.4	507.9	3	
Mean	160.9	390.2	104.5	218.5			331.4	245.3	605.7	679.7	546.9	590.0	499.8		
CD at 5%	33.0	32.5	13.7				97.0	13.2	135.7	41.8	31.6	57.6			
CV%	12.0	10.3	7.7				16.9	3.5	13.2	3.6	6.3	5.8			

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

Entries	North East Zone									
	Jor-hat	Kal-yani	Bhuban-eswar	Ran-chi	Pu-sa	Faiza-bad	Imp-hal	Aver-age	Ra-nk	Superi- ority%
HFO-427	299.2	384.2	342.0	210.0	316.0	400.0	457.3	344.1	2	2.5
SKO-227	349.6	370.8	364.5	173.3	305.0	310.5	337.2	315.8	6	
VOS-15-24	298.9	317.5	285.0	196.6	338.0	301.0	396.4	304.8	9	
OL-1844	270.0	356.7	246.0	193.3	349.0	352.4	403.1	310.1	8	
HFO-529	281.8	393.3	375.6	220.0	383.0	405.7	361.1	345.8	1	3.0
JO-04-22	261.6	371.7	226.0	196.6	349.0	373.3	304.2	297.5	10	
JHO-15-1	315.2	370.0	315.0	210.0	361.0	419.0	322.2	330.3	4	
OS-6 (NC)	313.7	404.2	212.0	223.3	394.0	360.0	357.3	323.5	5	
Kent (NC)	360.6	387.5	297.5	270.0	305.0	436.2	293.0	335.7	3	
JHO-99-2 (ZC-NEZ)	335.7	325.8	265.0	193.3	383.0	293.3	407.4	314.8	7	
Mean	308.6	368.2	292.9	208.6	348.3	365.1	363.9	322.2		
CD at 5%	4.1	18.7	39.1	37.9	32.7	84.4	12.5			
CV%	4.3	9.2	7.8	10.5	9.3	13.5	2.8			

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	Man- dya	Coimb- atore	Mattu- petty	Aver- age	Ra- nk	Superi- ority%	Aver- age	Ra- nk	Superi- ority%
HFO-427	327.6	251.3	369.4	364.0	328.1	1	5.9	378.7	1	5.8
SKO-227	352.6	207.5	333.3	361.0	313.6	2	1.3	360.7	2	0.8
VOS-15-24	344.3	171.0	269.4	275.0	264.9	10		338.5	8	
OL-1844	344.3	233.0	316.7	261.0	288.7	6		347.3	7	
HFO-529	272.1	180.2	372.2	286.0	277.6	8		358.8	4	0.3
JO-04-22	374.9	168.6	330.6	239.0	278.3	7		337.2	9	
JHO-15-1	322.1	182.3	394.4	264.0	290.7	5		360.4	3	0.7
OS-6 (NC)	333.2	196.8	327.8	381.0	309.7	3		357.9	5	
Kent (NC)	308.2	224.4	358.3	311.0	300.5	4		351.5	6	
JHO-2000-4 (ZC-SZ)	272.1	171.6	405.6	244.0	273.3	9				
Mean	325.1	198.7	347.8	298.6	292.5			354.6		
CD at 5%	42.8	20.7	24.6	29.1						
CV%	7.6	6.1	4.1	6.7						

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%
HFO-427	36.9	80.6	23.8	47.1	7		106.1	101.9	146.9	121.6	119.1	1	4.6
SKO-227	30.4	100.9	27.6	53.0	1	7.7	66.7	90.3	160.5	105.0	105.6	10	
VOS-15-24	35.0	87.7	23.2	48.6	5		78.7	120.8	160.1	109.9	117.4	3	3.1
OL-1844	29.5	82.6	20.8	44.3	10		91.0	108.3	155.7	120.4	118.8	2	4.3
HFO-529	27.8	81.5	28.8	46.0	9		58.8	105.9	154.6	117.6	109.2	7	
JO-04-22	37.0	89.0	21.8	49.3	3	0.2	89.1	93.9	118.6	123.7	106.3	9	
JHO-15-1	31.3	91.6	27.0	50.0	2	1.6	86.9	110.5	153.0	114.6	116.2	4	2.0
OS-6 (NC)	37.4	87.3	22.9	49.2	4		72.9	120.0	148.8	113.9	113.9	5	
Kent (NC)	28.2	87.2	24.8	46.7	8		67.0	108.4	142.7	111.8	107.5	8	
SKO-90 (ZC-HZ)	36.1	83.4	22.7	47.4	6								
OL-125 (ZC-NWZ)							58.8	118.8	155.5	115.6	112.2	6	
Mean	33.0	87.2	24.3	48.2			77.6	107.9	149.6	115.4	112.6		
CD at 5%	NS	6.2	1.5				24.3	28.0	21.4	5.3			
CV%	14.2	8.5	7.9				18.1	15.3	8.2	3.3			

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

Entries	North East Zone										South Zone						All India		
	Jor-hat	Kal-yani	Bhuban-eswar	Ran-chi	Pu-sa	Faiza-bad	Imp-hal	Aver-age	Ran-ck	Superi-riority%	Hydera-bad	Man-dya	Coimb-atore	Mattu-petty	Aver-age	Ran-ck	Aver-age	Ran-ck	Superi-riority%
HFO-427	61.3	56.1	72.7	55.4	63.0	92.2	104.0	72.1	1	1.3	59.5	49.8	67.9	92.6	67.5	2	77.3	1	3.5
SKO-227	69.3	53.0	76.4	44.7	60.0	72.0	104.5	68.6	4		41.5	41.2	75.3	90.6	62.1	6	72.8	6	
VOS-15-24	59.9	43.2	60.3	52.2	67.9	69.3	89.5	63.2	10		72.3	32.1	61.3	68.5	58.6	10	71.8	8	
OL-1844	54.5	51.0	51.8	45.7	68.8	91.4	95.1	65.5	8		79.4	54.0	62.8	67.7	66.0	5	73.9	5	
HFO-529	49.0	60.2	78.2	51.8	76.0	89.9	80.1	69.3	3		59.4	33.1	82.1	73.0	61.9	7	72.7	7	
JO-04-22	51.4	55.7	51.2	48.9	69.1	86.1	109.6	67.4	5		74.6	37.7	67.0	59.8	59.8	9	71.3	9	
JHO-15-1	56.7	55.5	66.2	55.6	71.8	84.6	76.5	66.7	6		71.5	39.0	93.9	65.2	67.4	3	75.1	2	0.5
OS-6 (NC)	56.3	60.6	44.7	55.3	78.2	74.3	93.1	66.1	7		71.5	40.7	70.3	96.9	69.9	1	74.7	3	
Kent (NC)	66.8	54.2	63.7	76.0	60.3	104.4	73.0	71.2	2		68.3	44.9	77.6	78.2	67.3	4	74.3	4	
JHO-99-2 (ZC-NEZ)	65.9	45.6	59.2	40.4	75.7	66.7	96.8	64.3	9										
JHO-2000-4 (ZC-SZ)											57.6	33.4	92.2	61.6	61.2	8			
Mean	59.1	53.5	62.4	52.6	69.1	83.1	92.2	67.4			65.6	40.6	75.1	75.4	64.2		73.8		
CD at 5%	3.7	4.0	8.0	9.6	6.8	11.8	4.5				11.0	5.2	6.9	3.5					
CV%	8.8	5.4	7.2	10.6	10.4	8.3	4.1				9.7	7.4	5.4	4.1					

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

Entries	Palam-pur	Raj-ouri	Bika-ner	His-ar	Ludh-iana	Jor-hat	Kal-yani	Bhuba-neswar	Ran-chi	Pu-sa	Faiza-bad	Hydera-bad	Man-dya	Coimb-atore	Mattu-petty	Aver-age	Ran-ck
HFO-427	1.71	1.04	4.15	5.28	5.40	2.82	4.46	4.62	2.02	3.40	3.57	3.74	3.09	4.51	4.67	3.63	4
SKO-227	1.15	1.10	3.16	5.42	5.40	3.30	4.12	4.86	1.62	3.20	3.16	4.05	2.51	4.02	4.63	3.45	6
VOS-15-24	1.39	0.97	3.23	5.37	6.10	2.96	3.87	4.05	2.21	3.60	2.81	4.81	2.49	3.74	3.53	3.41	7
OL-1844	1.12	0.79	3.33	5.49	5.90	2.55	4.25	3.47	2.05	3.75	3.52	4.00	3.09	3.91	3.35	3.37	8
HFO-529	1.07	1.18	2.49	5.00	6.40	2.66	4.57	5.29	2.42	4.12	4.27	3.18	2.40	4.77	3.67	3.57	5
JO-04-22	1.46	0.90	3.53	4.98	4.40	2.59	4.13	3.10	2.07	3.71	3.55	4.47	2.25	3.98	3.06	3.21	9
JHO-15-1	1.11	1.12	3.36	5.86	5.80	2.79	4.51	4.48	2.28	3.81	4.14	4.39	2.41	5.26	3.38	3.65	2
OS-6 (NC)	1.33	1.04	3.36	5.50	5.80	3.11	4.92	3.03	2.48	4.15	3.59	4.67	2.68	4.10	4.88	3.64	3
Kent (NC)	1.08	1.10	3.66	4.77	5.80	3.19	4.61	4.19	3.07	3.21	4.64	4.07	3.13	4.37	3.98	3.66	1
SKO-90 (ZC-HZ)	1.42	0.92															
OL-125 (ZC-NWZ)			2.81	5.69	6.00												
JHO-99-2 (ZC-NEZ)						2.97	3.78	3.73	2.08	4.03	2.79						
JHO-2000-4 (ZC-SZ)												3.20	2.19	5.20	3.12		
Mean	1.28	1.02	3.31	5.34	5.70	2.89	4.32	4.08	2.23	3.70	3.60	4.06	2.62	4.39	3.83	3.51	

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

Entries	Rajo- uri	Bika- ner	His- ar	Ludh- iana	Jor- hat	Kal- yani	Bhuban- eswar	Ran- chi	Pu- sa	Faiza- bad	Hydera- bad	Coimb- atore	Mattu- petty	Aver- age	Ra- nk
HFO-427	0.25	1.03	0.91	1.20	0.58	0.65	0.98	0.53	0.68	0.82	0.68	0.83	1.19	0.79	5
SKO-227	0.27	0.65	0.75	1.20	0.65	0.59	1.02	0.42	0.63	0.73	0.48	0.91	1.16	0.73	7
VOS-15-24	0.23	0.84	1.07	1.40	0.59	0.53	0.86	0.58	0.73	0.64	1.01	0.85	0.88	0.79	5
OL-1844	0.18	0.88	0.96	1.30	0.51	0.61	0.73	0.48	0.74	0.91	0.92	0.78	0.87	0.76	6
HFO-529	0.27	0.57	0.95	1.30	0.46	0.70	1.10	0.56	0.82	0.94	0.69	1.05	0.94	0.80	4
JO-04-22	0.21	0.87	0.82	1.00	0.51	0.62	0.70	0.51	0.74	0.82	0.89	0.81	0.77	0.71	8
JHO-15-1	0.27	0.84	0.98	1.30	0.50	0.68	0.94	0.60	0.76	0.83	0.98	1.25	0.84	0.83	1
OS-6 (NC)	0.23	0.78	1.06	1.30	0.56	0.73	0.64	0.61	0.82	0.74	1.00	0.88	1.24	0.81	3
Kent (NC)	0.25	0.71	0.96	1.20	0.59	0.64	0.90	0.86	0.63	1.11	0.90	0.95	1.00	0.82	2
SKO-90 (ZC-HZ)	0.22														
OL-125 (ZC-NWZ)		0.57	1.07	1.30											
JHO-99-2 (ZC-NEZ)					0.58	0.53	0.83	0.43	0.80	0.63					
JHO-2000-4 (ZC-SZ)											0.68	1.18	0.79		
Mean	0.24	0.77	0.95	1.25	0.55	0.63	0.87	0.56	0.74	0.82	0.82	0.95	0.97	0.78	

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

Entries	Palam- pur	Bika- ner	Ludh- iana	Jor- hat	Kal- yani	Bhuban- eswar	Ran- chi	Faiza- bad	Imp- hal	Hydera- bad	Coimb- atore	Man- dya	Aver- age	Ra- nk
HFO-427	3.6	9.8	12.5	7.3	5.7	6.1	4.1	7.7	5.8	4.7	11.6	3.5	6.9	1
SKO-227	3.1	8.6	10.0	7.7	4.8	6.5	2.9	5.8	5.8	3.6	11.2	3.6	6.1	4
VOS-15-24	3.0	8.3	10.6	6.2	2.2	5.1	4.3	5.7	5.4	5.7	6.9	2.9	5.5	7
OL-1844	2.6	9.2	9.3	5.4	5.7	4.4	4.1	7.5	5.4	6.2	7.7	4.7	6.0	5
HFO-529	2.8	5.3	9.3	4.9	6.4	6.7	3.5	7.5	4.4	3.1	13.6	2.9	5.9	6
JO-04-22	3.9	10.3	8.2	5.5	3.1	4.7	4.2	6.9	6.5	3.6	9.9	4.0	5.9	6
JHO-15-1	2.9	10.6	14.1	5.9	5.9	5.6	5.2	6.9	4.6	6.6	10.7	4.3	6.9	1
OS-6 (NC)	3.3	9.1	13.2	5.8	4.8	3.8	5.2	5.9	5.2	6.3	10.8	4.3	6.5	3
Kent (NC)	2.5	7.8	10.8	6.9	5.0	5.3	6.3	8.6	4.5	5.1	12.9	3.6	6.6	2
SKO-90 (ZC-HZ)	3.8													
OL-125 (ZC-NWZ)		6.8	14.0											
JHO-99-2 (ZC-NEZ)				6.4	4.2	4.7	3.4	5.6	5.3					
JHO-2000-4 (ZC-SZ)										5.0	8.9	3.1		
Mean	3.2	8.6	11.2	6.2	4.8	5.3	4.3	6.8	5.3	5.0	10.4	3.7	6.3	

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

Entries	Palam-pur	Bika-ner	Ludh-iana	Jor-hat	Kal-yani	Bhuban-eswar	Ran-chi	Faiza-bad	Imp-hal	Hydera-bad	Coimb-atore	Man-dya	Pant-nagar	Aver-age	Ra-nk
HFO-427	9.6	9.3	8.5	12.0	10.1	8.4	7.4	8.4	5.5	7.9	17.1	7.0	9.6	9.3	2
SKO-227	10.2	13.0	6.2	11.2	9.1	8.5	6.6	8.1	5.5	8.7	14.9	8.7	9.6	9.2	3
VOS-15-24	8.5	10.6	6.6	10.5	5.3	8.4	8.3	8.2	6.0	7.9	11.4	9.2	11.4	8.6	6
OL-1844	8.8	10.2	6.0	10.0	11.2	8.5	9.0	8.2	5.6	7.9	12.3	8.7	10.5	9.0	4
HFO-529	9.9	9.0	6.0	10.1	10.6	8.6	6.8	8.3	5.5	5.3	16.6	8.8	10.5	8.9	5
JO-04-22	10.5	11.6	6.9	10.9	5.6	9.3	8.5	8.0	6.0	4.8	14.9	10.5	8.8	8.9	5
JHO-15-1	9.3	12.3	9.2	10.5	10.6	8.5	8.9	8.1	6.0	9.2	11.4	10.9	10.5	9.6	1
OS-6 (NC)	8.8	12.5	8.9	10.5	7.9	8.5	9.4	8.0	5.6	8.7	15.3	10.5	10.5	9.6	1
Kent (NC)	8.8	11.6	7.6	10.5	9.3	8.3	8.3	8.2	6.1	7.4	16.6	7.9		9.2	3
SKO-90 (ZC-HZ)	10.5														
OL-125 (ZC-NWZ)		11.6	9.0										9.6		
JHO-99-2 (ZC-NEZ)				9.8	9.3	8.0	8.5	8.4	5.4						
JHO-2000-4 (ZC-SZ)										8.7	9.6	9.2			
Mean	9.5	11.2	7.5	10.6	8.9	8.5	8.2	8.2	5.7	7.7	14.0	9.1	10.1	9.2	

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	Hydera-bad	Man-dya	Coimb-atore	Aver-age	Ra-nk
HFO-427	104.0	117.5	102.0	93.0	150.6	132.5	159.3	147.6	155.5	132.8	152.3	96.0	110.6	151.7	96.1	73.9	106.8	122.5	3
SKO-227	86.3	122.7	99.0	75.0	141.2	147.8	160.3	149.9	129.9	136.2	155.6	68.0	77.4	149.7	87.4	87.4	123.0	117.5	9
VOS-15-24	86.0	126.7	98.0	112.0	150.6	134.2	166.3	155.0	137.9	168.2	143.2	107.0	88.4	145.9	98.5	86.3	86.6	123.0	2
OL-1844	88.0	116.6	101.0	69.0	155.7	143.4	167.0	156.0	140.9	169.6	129.5	109.0	89.6	140.8	82.4	78.0	103.2	120.0	6
HFO-529	94.7	112.5	104.0	99.0	167.2	142.8	185.7	163.7	143.1	168.2	159.9	111.0	124.8	151.2	96.8	85.3	117.0	131.0	1
JO-04-22	98.3	118.7	104.0	95.0	140.2	132.5	164.3	156.9	149.7	164.6	127.7	111.0	96.0	150.3	88.3	78.9	102.0	122.3	4
JHO-15-1	96.3	132.3	98.0	102.0	142.0	134.7	169.7	143.4	134.7	146.3	147.5	112.0	112.1	134.4	89.4	79.5	95.7	121.8	5
OS-6 (NC)	99.3	96.4	100.0	94.0	148.2	125.5	164.0	156.7	138.2	168.7	123.6	126.0	117.4	129.4	73.9	76.7	96.8	119.7	7
Kent (NC)	101.3	102.7	101.0	93.0	152.3	131.6	154.3	134.8	136.5	138.7	144.6	120.0	127.7	117.8	79.6	73.1	105.6	118.5	8
SKO-90 (ZC-HZ)	88.7	106.5	99.0																
OL-125 (ZC-NWZ)				113.0	161.8	140.8	174.0	148.9											
JHO-99-2 (ZC-NEZ)									155.3	135.7	135.2	95.0	111.5	131.4					
JHO-2000-4 (ZC-SZ)															91.7	78.4	114.6		
Mean	94.3	115.26	100.6	94.5	151.0	136.6	166.5	151.3	142.2	152.9	141.9	105.5	105.6	140.3	88.4	79.8	105.1	121.8	

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

Entries	Palam-pur	Sri-nagar	Bika-ner	His-ar	Ludh-iana	Pant-nagar	Jor-hat	Kal-yani	Bhuban-eswar	Ran-chi	Faiza-bad	Imp-hal	Hydera-bad	Man-dya	Coimb-atore	Mattu-petty	Aver-age	Ran- nk
HFO-427	0.40	0.38	0.87	0.53	1.00	0.47	0.69	0.80	1.23	0.38	0.69	0.28	0.53	0.89	0.48	0.92	0.66	1
SKO-227	0.40	0.37	0.67	0.61	0.50	0.41	0.58	1.00	1.26	0.38	0.70	0.24	0.83	0.75	0.49	0.88	0.63	3
VOS-15-24	0.40	0.37	0.56	0.38	0.90	0.45	0.62	0.80	1.04	0.33	0.72	0.31	0.46	0.69	0.37	0.80	0.58	6
OL-1844	0.50	0.39	0.85	0.49	0.80	0.49	0.73	0.70	0.85	0.45	0.65	0.28	0.54	0.63	0.56	0.68	0.60	4
HFO-529	0.40	0.39	0.89	0.33	0.70	0.62	0.69	1.00	1.31	0.43	0.69	0.38	0.35	0.80	0.42	0.76	0.64	2
JO-04-22	0.50	0.32	0.92	0.53	0.70	0.56	0.79	0.80	0.81	0.75	0.68	0.20	0.53	0.73	0.49	0.72	0.63	3
JHO-15-1	0.40	0.39	0.57	0.49	0.80	0.40	1.27	1.00	1.19	0.43	0.72	0.36	0.44	0.72	0.47	0.99	0.66	1
OS-6 (NC)	0.40	0.34	0.47	0.37	0.80	0.36	0.50	0.80	0.78	0.35	0.73	0.29	0.33	0.73	0.37	0.90	0.53	7
Kent (NC)	0.50	0.30	0.50	0.41	0.90	0.47	0.56	0.70	1.09	0.41	0.70	0.31	0.46	0.73	0.47	0.94	0.59	5
SKO-90 (ZC-HZ)	0.60	0.40																
OL-125 (ZC-NWZ)			0.85	0.39	0.70	0.39												
JHO-99-2 (ZC-NEZ)							0.47	0.70	0.95	0.36	0.70	0.23						
JHO-2000-4 (ZC-SZ)													0.47	0.73	0.47	0.50		
Mean	0.45	0.37	0.72	0.45	0.78	0.46	0.69	0.83	1.05	0.43	0.70	0.29	0.49	0.74	0.46	0.81	0.61	

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

Entries	ADF (%)						NDF (%)						IVDMD (%)			
	Palam-pur	Ludh-iana	Ran-chi	Pant-nagar	Aver-age	Ran- nk	Palam-pur	Ludhi-ana	Ran-chi	Pant-nagar	Aver-age	Ran- nk	Ludh-iana	Ran-chi	Aver-age	Ran- nk
HFO-427	56.6	44.9	33.8	56.4	47.9	6	67.4	55.2	57.0	60.4	60.0	2	49.0	62.5	55.8	3
SKO-227	57.6	46.8	33.7	54.6	48.2	7	66.6	58.4	60.4	64.6	62.5	6	45.4	62.1	53.8	7
VOS-15-24	56.6	47.2	35.2	57.2	49.1	8	63.6	57.9	61.6	66.6	62.4	5	47.0	61.4	54.2	6
OL-1844	54.6	46.4	35.2	54.2	47.6	5	66.6	57.0	63.5	63.8	62.7	7	46.2	60.8	53.5	8
HFO-529	53.4	45.9	33.7	54.6	46.9	4	65.6	58.8	58.5	67.2	62.5	6	45.2	63.1	54.2	6
JO-04-22	54.2	46.2	27.6	55.8	46.0	2	66.0	56.4	46.6	63.4	58.1	1	46.8	68.0	57.4	1
JHO-15-1	54.4	42.3	33.0	57.2	46.7	3	64.6	54.1	62.6	64.0	61.3	3	51.2	63.4	57.3	2
OS-6 (NC)	53.8	43.4	34.1	56.2	46.9	4	67.0	54.9	61.8	66.2	62.5	6	49.3	61.9	55.6	4
Kent (NC)	54.6	45.2	33.3		44.4	1	68.4	55.8	62.1		62.1	4	47.4	63.6	55.5	5
SKO-90 (ZC-HZ)	56.4						63.4									
OL-125 (ZC-NWZ)		42.8		54.6				54.4		62.6			50.6			
JHO-99-2 (ZC-NEZ)			35.3						60.4					60.6		
Mean	55.2	45.1	33.5	55.6	47.1		65.9	56.3	59.5	64.3	61.4		47.8	62.7	55.3	

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

In Oat (single cut), eight entries were evaluated against two national checks Kent and OS-6 and three respective zonal checks SKO-90 (HZ), OL-125 (NWZ), JHO-822 (CZ) at 16 locations in three different zones (HZ, NWZ, CZ).

For green forage yield (q/ha), entries SKO-225 (11.7%), OL-1766-1(8.7%), OL-1802-1 (7.3%), OL-1769-1 (5.1%) in HZ; entries OL-1769-1 (8.5%), OL-1802-1 (7.8%) in NWZ; entries OL-1802-1 (8.4%), JO-04-19 (6.8%), OL-1769-1 (6.1%) in central zone and OL-1802-1 (12.4%), OL-1769-1 (11.5%), JO-04-19 (7.6%), OL-1766-1 (7.3%), SKO-225 (7.0%), OS-424 (5.6%), OS-432 (4.6%) at all India level exhibited superiority over best zonal/national check. Other entries were either inferior or showed marginal superiority over the best check.

Similarly for dry matter yield (q/ha), entries SKO-225 (24%), OL-1766-1 (14.6%), OL-1802-1 (13.1%), OL-1769-1 (11.4%), OS-424 (10.3%) in HZ; OS-424 (6.6%), OL-1769-1 (5.6%) in NWZ; OL-1769-1 (10.5%), JO-04-19 (6.5%), OS-432 (6.1%), SKO-225 (5.1%) in CZ registered superiority over best check. At national level, OL-1769-1 (15.7%), SKO-225 (13.2%), OS-424 (11.3%), OL-1802-1 (10.5%), OL-1766-1 (10.4%), JO-04-19 (9.8%), OS-432 (6.9%) recorded superiority over best check. Other entries were either inferior or showed marginal superiority over the best check.

For forage production potential (q/ha/day), entries OL-1769-1 followed by OS-432 for both green and dry matter production potential were adjudged superior performers. For plant height, entry OL-1766-1 (128.2 cm) ranked first. For the character leafiness, entry OS-432 (0.71) was superior.

In quality parameters, entries OL-1769-1 (8.3) followed by OS-424 (8.2) in comparison to best check (7.0) for crude protein yield (q/ha) and OS-432 (9.7) followed by UPO-10-3 (9.3) in comparison to best check (9.0) for crude protein content recorded superiority. For other quality parameters, SKO-225 for ADF (%), JO-04-19 for NDF (%) and entry OS-424 for IVDMD (%) 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 eight entries along with two national checks, Kent and OS-6 and respective zonal checks conducted at seven locations in three zones across the country revealed that for seed yield (q/ha), entry Kent performed best at HZ, CZ and All India level. Entry OL-1802-1 (7.3%) and OS-424 (4.4%) were better than check in NWZ.

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

Entries	HZ						North West Zone								
	Palam-pur	Sri-nagar	Rajo-uri	Average	Rank	Superiority%	Bika-ner	Jal-ore	His-ar	Ludh-iana	Pant-nagar	Udai-pur	Average	Rank	Superiority%
OL-1766-1	170.1	432.9	120.5	241.2	2	8.7	285.0	250.0	616.7	682.8	638.7	680.3	525.6	6	
OL-1802-1	163.2	442.8	108.2	238.1	3	7.3	307.6	429.0	599.4	714.3	517.0	749.7	552.8	2	7.8
UPO-10-3	152.5	382.7	112.4	215.9	8		208.2	307.7	586.4	659.4	598.0	624.8	497.4	9	
SKO-225	152.5	487.5	103.6	247.9	1	11.7	256.5	361.7	575.3	651.8	658.0	660.8	527.4	4	2.8
OL-1769-1	170.7	417.5	111.7	233.3	4	5.1	306.6	334.7	619.4	824.7	557.0	696.9	556.5	1	8.5
OS-424	177.1	386.4	115.4	226.3	5	2.0	349.0	270.3	596.1	727.9	572.0	683.1	533.1	3	3.9
OS-432	161.6	408.2	104.9	224.9	6	1.4	230.5	226.0	598.9	656.6	608.0	680.3	500.1	8	
JO-04-19	107.2	398.9	110.3	205.5	10		263.7	311.7	531.9	762.8	651.3	635.9	526.2	5	2.6
Kent (NC)	181.3	372.3	112.0	221.9	7		216.0	198.0	592.2	570.8	498.7	699.7	462.6	11	
OS-6 (NC)	134.4	378.2	117.6	210.1	9		232.4	284.7	556.9	653.7	485.3	683.1	482.7	10	
SKO-90 (ZC-HZ)	105.6	361.6	107.9	191.7	11										
OL-125 (ZC-NWZ)							301.7	261.3	491.1	720.9	619.0	683.1	512.9	7	
Mean	152.4	406.3	111.3	223.3			268.8	294.1	578.6	693.2	582.1	679.8	516.1		
CD at 5%	23.3	27.3	6.0				68.5	14.5	80.7	41.9	36.6	54.5			
CV%	9.0	8.7	7.9				15.0	2.9	8.2	3.6	6.7	4.7			

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

Entries	Central Zone										All India		
	Jha-nsi	Rah-uri	Urulikan-chan	Ana-nd	Jabal-pur	Rai-pur	**Pal-ghar	Average	Rank	Superiority%	Average	Rank	Superiority%
OL-1766-1	374.3	504.7	516.6	718.0	427.0	388.9	241.4	488.3	5	2.3	453.8	4	7.3
OL-1802-1	362.0	520.0	552.8	701.0	506.0	462.9	298.4	517.5	1	8.4	475.7	1	12.4
UPO-10-3	357.9	426.0	507.5	583.0	417.0	385.6	184.0	446.2	10		420.6	9	
SKO-225	359.9	465.0	550.9	615.0	540.0	351.9	254.0	480.5	6	0.6	452.7	5	7.0
OL-1769-1	366.1	552.5	554.4	792.0	550.0	223.2	248.2	506.4	3	6.1	471.8	2	11.5
OS-424	353.7	480.7	476.3	732.0	503.0	277.8	227.7	470.6	8		446.7	6	5.6
OS-432	329.1	523.0	416.8	752.0	595.0	344.4	164.5	493.4	4	3.4	442.4	7	4.6
JO-04-19	345.5	423.6	573.4	786.0	483.0	446.5	231.8	509.7	2	6.8	455.4	3	7.6
Kent (NC)	333.2	531.9	460.6	642.0	545.0	351.7	214.8	477.4	7		420.4	10	
OS-6 (NC)	345.5	504.8	577.2	622.0	466.0	304.1	245.9	469.9	9		423.1	8	
JHO-822 (ZC-CZ)	337.3	350.6	552.5	642.0	402.2	381.5	234.3	444.3	11				
Mean	351.3	480.2	521.7	689.5	494.0	356.2	231.4	482.2			446.3		
CD at 5%	16.9	32.7	53.4	56.1	105.4	116.3	50.4						
CV%	10.1	4.0	6.0	4.8	12.5	19.1	12.7						

Note: ** Yield data is very low hence not included in zonal and national average

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

Entries	HZ						North West Zone						
	Palam-pur	Sri-nagar	Rajo-uri	Average	Rank	Superiority%	Bika-ner	His-ar	Ludh-iana	Pant-nagar	Average	Rank	Superiority%
OL-1766-1	33.0	95.3	29.2	52.5	2	14.6	81.5	87.2	148.9	132.0	112.4	6	0.1
OL-1802-1	35.1	95.3	24.9	51.8	3	13.1	73.1	114.6	157.9	119.8	116.3	3	3.6
UPO-10-3	24.5	79.2	25.7	43.1	10		51.6	102.9	147.0	136.4	109.5	8	
SKO-225	34.6	112.0	23.7	56.8	1	24.0	66.6	94.3	145.4	153.3	114.9	4	2.3
OL-1769-1	34.3	91.6	27.1	51.0	4	11.4	63.1	112.4	184.0	115.1	118.6	2	5.6
OS-424	38.7	85.0	27.7	50.5	5	10.3	90.4	99.0	164.5	124.8	119.7	1	6.6
OS-432	30.5	86.5	23.4	46.8	6	2.2	49.2	103.6	137.9	128.5	104.8	9	
JO-04-19	21.3	87.9	23.8	44.3	8		68.7	94.3	171.6	120.2	113.7	5	1.2
Kent (NC)	33.6	77.8	26.0	45.8	7		47.7	100.5	120.4	111.0	94.9	11	
OS-6 (NC)	23.4	80.8	27.2	43.8	9		51.9	95.7	142.5	97.8	97.0	10	
SKO-90 (ZC-HZ)	21.6	85.0	26.2	44.3	8								
OL-125 (ZC-NWZ)							75.3	76.1	163.6	134.1	112.3	7	
Mean	30.1	88.8	25.9	48.2			65.4	98.2	153.1	124.8	110.4		
CD at 5%	6.9	6.5	0.7				20.9	19.5	17.8	8.0			
CV%	13.5	7.4	7.3				18.7	11.7	11.1	4.3			

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

Entries	Central Zone										All India		
	Jha-nsi	Rah-uri	Urulikan-ghan	Ana-and	Jabal-pur	Rai-pur	**Pal-ghar	Average	Rank	Superiority%	Average	Rank	Superiority%
OL-1766-1	93.1	121.2	79.0	103.4	77.0	64.4	46.3	89.7	5	3.9	88.1	5	10.4
OL-1802-1	78.1	121.6	89.8	92.5	94.0	50.2	63.7	87.7	6	1.6	88.2	4	10.5
UPO-10-3	82.3	109.2	87.9	99.1	76.0	52.7	40.7	84.5	9		82.7	8	3.6
SKO-225	81.1	118.5	105.5	89.8	100.0	49.1	50.2	90.7	4	5.1	90.3	2	13.2
OL-1769-1	81.5	127.1	98.7	95.0	102.0	67.9	52.8	95.4	1	10.5	92.3	1	15.7
OS-424	75.4	109.0	80.0	113.4	93.0	53.6	50.2	87.4	7	1.3	88.8	3	11.3
OS-432	66.9	130.4	77.3	92.5	116.0	66.7	30.7	91.6	3	6.1	85.3	7	6.9
JO-04-19	84.1	106.3	107.1	111.5	94.0	48.3	41.7	91.9	2	6.5	87.6	6	9.8
Kent (NC)	64.5	114.9	68.4	93.7	102.0	55.5	46.2	83.2	10		78.2	10	
OS-6 (NC)	68.2	114.1	98.8	102.0	86.0	48.4	44.7	86.3	8		79.8	9	
JHO-822 (ZC-CZ)	77.8	78.1	100.1	84.1	73.0	46.2	53.3	76.6	11				
Mean	77.6	113.7	90.2	97.9	92.1	54.8	47.3	87.7			86.1		
CD at 5%	13.5	7.7	9.0	8.2	18.8	9.9	11.8						
CV%	8.1	4.0	5.8	4.9	12.0	10.6	14.5						

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

Entries	Palampur	Rajouri	Bikaner	Hisar	Ludhiana	Jhansi	Rahuri	Urulikanchan	Palghar	Anand	Raipur	Average	Rank
OL-1766-1	1.39	1.14	2.77	5.36	5.90	3.82	6.47	5.44	3.83	9.84	5.72	4.70	4
OL-1802-1	1.33	1.05	2.99	5.21	5.90	3.48	6.05	7.68	4.52	8.35	5.79	4.76	3
UPO-10-3	1.24	0.95	2.02	5.10	5.40	3.51	4.90	6.77	2.79	6.94	6.32	4.18	10
SKO-225	1.24	0.96	2.49	5.00	5.40	3.53	5.60	6.56	4.03	7.88	4.40	4.28	8
OL-1769-1	1.47	1.08	3.26	5.39	7.20	3.77	7.78	6.84	3.88	11.31	3.28	5.02	1
OS-424	1.44	1.14	3.39	5.18	6.30	3.65	6.24	5.67	3.50	9.38	4.55	4.59	5
OS-432	1.41	1.04	2.45	5.21	7.00	3.43	7.58	6.13	2.53	11.39	5.65	4.89	2
JO-04-19	0.87	1.08	2.56	4.63	6.60	3.39	5.10	6.75	3.74	10.08	5.58	4.58	6
Kent (NC)	1.47	1.14	2.30	5.15	5.00	3.47	6.65	4.95	3.46	8.23	4.40	4.20	9
OS-6 (NC)	1.11	1.09	2.47	4.84	5.70	3.42	6.56	8.02	3.90	7.97	4.47	4.50	7
SKO-90 (ZC-HZ)	0.86	1.07											
OL-125 (ZC-NWZ)			2.93	4.27	6.30								
JHO-822 (ZC-CZ)						3.48	4.44	6.07	3.72	8.79	4.77		
Mean	1.26	1.07	2.69	5.03	6.06	3.54	6.12	6.44	3.63	9.11	4.99	4.57	

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

Entries	Rajouri	Bikaner	Hisar	Ludhiana	Jhansi	Urulikanchan	Palghar	Anand	Raipur	Rahuri	Average	Rank
OL-1766-1	0.28	0.79	0.76	1.30	0.95	0.83	0.73	1.42	0.95	1.55	0.96	4
OL-1802-1	0.24	0.71	1.00	1.30	0.75	1.25	0.96	1.10	0.63	1.41	0.94	5
UPO-10-3	0.22	0.50	0.89	1.20	0.81	1.17	0.62	1.18	0.86	1.25	0.87	9
SKO-225	0.22	0.65	0.82	1.20	0.80	1.26	0.80	1.15	0.61	1.43	0.89	8
OL-1769-1	0.26	0.67	0.98	1.60	0.84	1.22	0.83	1.36	1.00	1.79	1.06	1
OS-424	0.27	0.88	0.86	1.40	0.78	0.95	0.77	1.45	0.88	1.42	0.97	3
OS-432	0.23	0.52	0.90	1.50	0.70	1.14	0.47	1.40	1.09	1.89	0.98	2
JO-04-19	0.23	0.67	0.82	1.50	0.82	1.26	0.67	1.43	0.60	1.28	0.93	6
Kent (NC)	0.26	0.51	0.87	1.00	0.67	0.74	0.75	1.20	0.69	1.44	0.81	10
OS-6 (NC)	0.25	0.55	0.83	1.20	0.67	1.37	0.71	1.31	0.71	1.48	0.91	7
SKO-90 (ZC-HZ)	0.26											
OL-125 (ZC-NWZ)		0.73	0.66	1.40								
JHO-822 (ZC-CZ)					0.80	1.10	0.85	1.15	0.58	0.99		
Mean	0.25	0.65	0.85	1.33	0.78	1.12	0.74	1.29	0.78	1.45	0.93	

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

Entries	Palampur	Bikaner	Ludhiana	Rahuri	Urulikanchan	Anand	Jabalpur	Raipur	Average	Rank
OL-1766-1	3.5	9.6	9.2	9.5	6.4	10.5	6.2	5.3	7.5	5
OL-1802-1	2.9	7.1	10.4	8.9	8.1	10.0	7.5	4.4	7.4	6
UPO-10-3	2.8	5.4	8.8	9.2	6.8	12.1	5.9	4.7	7.0	7
SKO-225	3.2	8.5	10.0	9.1	8.3	9.1	8.1	3.2	7.4	6
OL-1769-1	3.6	5.5	16.6	9.5	8.2	10.6	8.3	4.1	8.3	1
OS-424	4.1	9.0	15.1	7.8	6.9	11.6	7.5	3.8	8.2	2
OS-432	3.4	5.5	12.3	10.4	6.5	11.9	9.5	5.5	8.1	3
JO-04-19	2.3	8.7	13.0	8.8	8.2	10.5	7.7	3.3	7.8	4
Kent (NC)	3.1	4.5	10.2	8.3	5.5	11.5	8.3	4.3	7.0	7
OS-6 (NC)	2.3	5.5	8.6	6.5	8.0	10.7	6.9	3.6	6.5	8
SKO-90 (ZC-HZ)	2.0									
OL-125 (ZC-NWZ)		7.7	12.8							
JHO-822 (ZC-CZ)				4.8	8.0	10.0	5.7	3.7		
Mean	3.0	7.0	11.5	8.4	7.4	10.8	7.4	4.2	7.5	

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

Entries	Palampur	Bikaner	Ludhiana	Rahuri	Urulikanchan	Anand	Jabalpur	Raipur	Pantnagar	Average	Rank
OL-1766-1	10.5	11.7	6.2	7.9	8.1	10.2	8.0	8.2	9.6	8.9	5
OL-1802-1	8.2	9.7	6.6	7.4	9.0	10.8	8.1	8.8	9.6	8.7	7
UPO-10-3	11.4	10.5	6.0	8.5	7.8	12.2	7.8	8.8	10.5	9.3	2
SKO-225	9.3	12.8	6.9	7.7	7.8	10.2	8.1	6.6	10.5	8.9	5
OL-1769-1	10.5	8.7	9.0	7.5	8.3	10.6	8.2	6.0	10.5	8.8	6
OS-424	10.5	10.0	9.2	7.1	8.6	10.2	8.1	7.1	11.4	9.1	3
OS-432	11.1	11.3	8.9	8.0	8.4	12.9	8.2	8.2	10.5	9.7	1
JO-04-19	10.8	12.6	7.6	8.3	7.7	9.5	8.2	6.9	9.6	9.0	4
Kent (NC)	9.3	9.5	8.5	7.2	8.0	12.3	8.1	7.8	10.5	9.0	4
OS-6 (NC)	9.6	10.7	6.0	5.7	8.1	10.5	8.0	7.4	11.4	8.6	8
SKO-90 (ZC-HZ)	9.3										
OL-125 (ZC-NWZ)		10.2	7.8								
JHO-822 (ZC-CZ)				6.1	8.0	11.9	7.8	8.0	9.6		
Mean	10.0	10.7	7.5	7.4	8.2	11.0	8.1	7.6	10.3	9.0	

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

Entries	Palam-pur	Sri-nagar	Rajo-uri	Bika-ner	His-ar	Ludh-iana	Pant-nagar	Udai-pur	Jha-nsi	Rah-uri	Urulikan-chan	Pal-ghar	Ana-nd	Jabal-pur	Rai-pur	Aver-age	Ra-nk
OL-1766-1	100.0	119.5	102.7	136.0	145.0	133.0	185.0	138.1	178.6	129.2	90.2	90.0	150.3	103.0	122.2	128.2	1
OL-1802-1	85.3	122.5	99.1	123.0	153.3	140.5	173.0	150.9	155.0	139.8	90.5	73.7	146.9	119.7	138.6	127.5	2
UPO-10-3	85.7	114.2	101.9	88.0	156.0	149.0	172.7	161.8	152.4	140.5	78.3	57.3	147.9	100.2	143.6	123.3	5
SKO-225	91.3	126.2	103.6	105.0	144.3	153.2	179.0	153.3	157.4	141.5	90.3	66.3	138.0	122.4	111.1	125.5	3
OL-1769-1	98.0	118.7	102.1	125.0	162.3	140.9	175.0	138.6	167.8	118.9	93.2	75.0	151.6	135.4	109.6	127.5	2
OS-424	86.0	116.1	100.6	110.0	144.3	120.0	171.0	130.9	134.3	113.7	96.8	75.0	143.1	114.0	116.6	118.2	8
OS-432	95.7	118.3	98.3	94.0	150.3	112.0	170.0	130.7	137.4	108.9	97.8	84.3	138.5	144.0	116.4	119.8	7
JO-04-19	73.3	121.9	105.8	129.0	147.3	126.1	171.3	147.1	143.8	127.6	91.8	69.3	138.3	141.8	133.8	124.5	4
Kent (NC)	98.0	101.0	105.4	96.0	153.0	120.7	161.3	146.7	136.0	107.4	79.3	65.0	137.7	129.7	118.4	117.0	9
OS-6 (NC)	82.7	107.2	104.4	102.0	165.7	125.1	160.7	158.6	156.4	120.2	86.8	80.0	142.7	110.0	113.4	121.1	6
SKO-90 (ZC-HZ)	63.3	107.4	112.8														
OL-125 (ZC-NWZ)				157.0	153.7	138.2	179.7	139.1									
JHO-822 (ZC-CZ)									136.0	89.8	80.5	55.7	141.9	96.3	123.8		
Mean	87.2	115.7	103.3	115.0	152.3	132.6	172.6	145.1	150.5	121.6	88.7	72.0	143.4	119.7	122.5	123.3	

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

Entries	Palam-pur	Sri-nagar	Bika-ner	His-ar	Ludh-ana	Pant-nagar	Rah-uri	Urulikan-chan	Pal-ghar	Ana-nd	Jabal-pur	Rai-pur	Aver-age	Ra-nk
OL-1766-1	0.50	0.41	0.71	0.61	0.70	0.46	0.40	0.92	0.58	1.44	0.58	0.64	0.66	3
OL-1802-1	0.40	0.42	0.61	0.40	0.90	0.58	0.50	0.50	0.70	1.22	0.69	0.50	0.62	6
UPO-10-3	0.50	0.40	1.09	0.48	0.90	0.64	0.40	0.67	0.89	0.93	0.53	0.44	0.66	3
SKO-225	0.50	0.47	0.78	0.56	0.90	0.55	0.50	0.50	0.75	1.27	0.74	0.62	0.68	2
OL-1769-1	0.50	0.39	0.40	0.40	0.80	0.56	0.40	0.90	0.72	1.33	0.76	0.58	0.65	4
OS-424	0.40	0.38	1.19	0.48	0.50	0.56	0.30	0.57	0.73	1.13	0.68	0.47	0.62	6
OS-432	0.50	0.45	0.43	0.37	1.50	0.55	0.70	0.74	0.70	1.00	0.89	0.69	0.71	1
JO-04-19	0.50	0.38	0.82	0.40	0.90	0.55	0.50	0.66	0.76	1.00	0.85	0.58	0.66	3
Kent (NC)	0.50	0.43	0.50	0.54	0.80	0.45	0.30	0.74	0.76	1.22	0.73	0.48	0.62	6
OS-6 (NC)	0.40	0.36	0.51	0.39	1.50	0.45	0.30	0.65	0.64	1.00	0.66	0.66	0.63	5
SKO-90 (ZC-HZ)	0.50	0.54												
OL-125 (ZC-NWZ)			0.38	0.39	0.50	0.57								
JHO-822 (ZC-CZ)							0.30	0.80	0.75	1.18	0.53	0.47		
Mean	0.47	0.42	0.68	0.46	0.90	0.54	0.42	0.70	0.73	1.16	0.69	0.56	0.65	

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

Entries	ADF (%)						NDF (%)						IVDMD (%)			
	Palam-pur	Ludh-iana	Rah-uri	Pant-nagar	Aver-age	Ra-nk	Palam-pur	Ludh-iana	Rah-uri	Pant-nagar	Aver-age	Ra-nk	Ludh-iana	Rah-uri	Aver-age	Ra-nk
OL-1766-1	56.2	46.8	46.1	55.4	51.1	8	63.8	58.4	63.4	63.2	62.2	6	45.4	53.1	49.2	8
OL-1802-1	58.0	47.2	41.6	56.2	50.8	6	67.4	57.9	64.3	64.0	63.4	9	47.0	56.4	51.7	4
UPO-10-3	56.2	46.4	42.8	54.6	50.0	5	64.6	57.0	63.2	67.2	63.0	8	46.2	56.5	51.4	5
SKO-225	54.2	46.2	41.0	55.4	49.2	1	63.8	56.4	63.6	65.6	62.4	7	46.8	56.5	51.7	4
OL-1769-1	55.4	42.8	44.9	56.2	49.8	3	64.0	54.4	63.2	62.4	61.0	2	50.6	53.6	52.1	3
OS-424	58.6	42.3	40.8	58.0	49.9	4	66.0	54.1	61.7	63.4	61.3	3	51.2	56.6	53.9	1
OS-432	56.2	43.4	45.9	58.6	51.0	7	65.8	54.9	64.1	62.6	61.9	4	49.3	52.6	51.0	6
JO-04-19	54.6	45.2	39.7	58.0	49.4	2	63.8	55.8	60.1	63.8	60.9	1	47.4	57.3	52.4	2
Kent (NC)	54.8	44.9	48.9	58.6	51.8	9	65.4	55.2	66.1	61.8	62.1	5	49.0	51.1	50.1	7
OS-6 (NC)	54.6	45.9	43.3	55.8	49.9	4	66.2	58.8	64.7	66.6	64.1		45.2	53.8	49.5	
SKO-90 (ZC-HZ)	55.0						64.8									
OL-125 (ZC-NWZ)		45.9		56.6				56.6		67.2			47.8			
JHO-822 (ZC-CZ)			36.8						58.4					60.5		
Mean	55.8	45.2	42.9	56.7	50.1		65.1	56.3	63.0	64.3	62.2		47.8	55.3	51.5	

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

Entries	HZ				North West Zone					Central Zone					All India	
	Palam-pur	Sri-nagar	Average	Rank	His-ar	Pant-nagar	Average	Rank	Superiority%	Jha-nsi	Jabal-pur	Rah-uri	Average	Rank	Average	Rank
OL-1766-1	11.20	18.07	14.64	7	8.75	19.64	14.20	9	7.3	20.57	15.50	24.72	20.26	10	16.92	8
OL-1802	8.80	19.03	13.92	8	17.50	19.84	18.67	1		20.57	41.80	28.12	30.16	5	22.24	3
UPO-10-3	10.80	16.20	13.50	10	11.56	15.86	13.71	10	4.4	18.10	24.20	18.69	20.33	9	16.49	10
SKO-225	10.30	22.53	16.42	3	11.39	17.59	14.49	8		27.56	34.00	23.65	28.40	7	21.00	6
OL-1769-1	17.90	18.17	18.04	2	8.81	16.87	12.84	11	4.4	21.80	22.50	25.56	23.29	8	18.80	7
OS-424	9.50	17.53	13.52	9	14.69	21.62	18.16	2		23.45	32.50	32.41	29.45	6	21.67	4
OS-432	10.20	15.67	12.94	11	9.89	22.21	16.05	4	4.4	16.45	16.80	25.28	19.51	11	16.64	9
JO-04-19	13.30	17.53	15.42	5	13.11	17.69	15.40	5		28.79	34.80	33.06	32.22	3	22.61	2
Kent (NC)	18.10	18.47	18.29	1	18.00	16.79	17.40	3	4.4	30.44	37.10	35.35	34.30	1	24.89	1
OS-6 (NC)	10.90	18.90	14.90	6	13.86	16.31	15.09	7		28.79	37.40	24.43	30.21	4	21.51	5
SKO-90 (ZC-HZ)	15.10	17.40	16.25	4	11.86	18.39	15.13	6	4.4	28.79	44.20	26.91	33.30	2	20.28	
OL-125 (ZC-NWZ)																
JHO-822 (ZC-CZ)																
Mean	12.37	18.14	15.25		12.67	18.44	15.56			24.12	30.98	27.11	27.40			
CD at 5%	3.20	0.98			2.66	1.35				3.52	7.01	4.08				
CV%	15.00	4.30			12.33	5.71				2.11	13.28	8.83				

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 three national checks (RO-19, Kent and UPO-212) at 18 locations in four zones (HZ, NWZ, NEZ, and CZ).

For green fodder yield (q/ha), entry HFO-611 (7.0%) in HZ exhibited superiority over the best zonal/national check. At national level or in other zones, other entries were either inferior to or exhibited marginal superiority over checks. For dry matter yield (q/ha) none of the entries showed significant superiority over the checks on zonal and national basis. For fodder production potential (q/ha/day), national check RO-19 for GFY and national entry HFO-611 for DMY were top rankers.

For quality parameters, National check UPO-212 for crude protein yield (q/ha) and crude protein content (%) ranked first. For ADF % and IVDMD %, entry JO-05-301 and for NDF %, national check UPO-212 ranked first. For growth parameters, national check RO-19 for plant height and JO-05-301 ranked first for leafiness.

10. AVTO-1 (MC): FIRST ADVANCED VARIETAL TRIAL IN OAT (MULTI CUT)

(Reference tables 10.1 to 10.6)

In AVTO-1 MC, five entries promoted from IVTO (MC) along with three national checks were evaluated at eight centres in Hill and Central Zones. Except for HFO-514 in central zone for dry matter yield which showed 6.5% superiority over the best check, other entries were either inferior or marginally superior to best check at zonal and national level for both green and dry fodder yield. For fodder production potential (q/ha/day) entry OL-1842 for green and HFO-514 for dry matter ranked first.

For CPY (q/ha) national check Kent ranked first. For crude protein content (%) entry OL-1842 (10.7%) ranked first followed by OL-1866 (10.3%) as compared to best check (10.0%). For ADF%, check Kent and for NDF % and IVDMD %, entry HFO-417 ranked first.

For plant height, national check RO-19 and for leafiness, entry JO-4-321 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	Aver-age	Ra-nk	Superi- ority%	His-ar	Jal-ore	Ludh-iana	Pant-nagar	Aver-age	Ra-nk
JO-05-301	168.0	259.4	75.7	167.7	9		447.8	164.7	477.6	315.2	351.3	10
OL-1869	222.9	228.8	91.5	181.1	8		490.0	190.7	739.3	791.5	552.9	2
OL-1873	205.3	272.9	91.1	189.8	2	1.1	543.3	223.0	745.6	618.1	532.5	6
OL-1876	202.1	245.1	99.5	182.2	6		349.4	408.3	546.0	799.6	525.8	7
PLP-18	233.6	240.9	82.0	185.5	5		408.5	446.0	518.5	825.9	549.7	4
HFO-609	175.5	285.8	95.7	185.7	4		454.5	319.3	701.5	703.3	544.7	5
HFO-611	225.1	265.6	111.7	200.8	1	7.0	404.8	241.7	667.9	731.5	511.5	8
UPO-212 (NC)	206.4	252.7	86.2	181.8	7		436.7	170.0	706.3	713.7	506.7	9
RO-19 (NC)	177.6	280.1	105.4	187.7	3		452.6	370.0	565.2	880.0	567.0	1
Kent (NC)	176.0	232.0	73.7	160.6	10		385.1	376.0	615.7	823.7	550.1	3
Mean	199.3	256.3	91.3	182.3			437.3	291.0	628.4	720.3	519.2	
CD at 5%	25.6	18.3	8.7				102.0	20.6	113.4	32.8		
CV%	7.5	8.4	5.5				13.7	4.6	10.5	6.9		

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	Jha-nsi	Ana-nd	Jabal-pur	Rah-uri	Urulikan- chan	Aver-age	Ra-nk	Aver-age	Ra-nk
JO-05-301	197.3	199.1	171.3	432.7	288.0	240.0	254.7	10	384.6	510.0	778.4	417.3	872.5	592.6	9	355.5	10
OL-1869	266.7	353.6	323.9	455.5	355.0	346.7	350.2	5	450.4	691.0	613.1	446.6	788.2	597.9	8	435.8	7
OL-1873	373.3	292.8	298.4	388.5	322.0	324.4	333.2	8	390.8	697.0	590.5	487.4	1044.7	642.1	5	439.4	6
OL-1876	301.3	327.7	365.2	403.7	384.0	315.5	349.6	6	454.5	902.0	691.8	623.9	859.7	706.4	2	460.0	2
PLP-18	266.7	316.0	237.3	423.0	399.0	364.4	334.4	7	386.7	564.0	681.1	525.6	800.5	591.6	10	428.9	8
HFO-609	240.0	341.8	354.1	596.2	399.0	408.8	390.0	2	462.8	626.0	657.1	475.7	898.1	623.9	6	455.3	3
HFO-611	258.7	355.9	392.1	386.6	388.0	373.3	359.1	3	440.1	663.0	514.5	563.1	1134.3	663.0	3	451.0	4
UPO-212 (NC)	349.3	312.4	312.6	453.3	380.0	302.1	351.6	4	390.8	694.0	642.5	503.3	1062.3	658.6	4	443.0	5
RO-19 (NC)	328.0	338.7	466.3	556.0	388.0	284.4	393.6	1	415.4	917.0	661.1	634.7	1044.2	734.5	1	492.5	1
Kent (NC)	316.8	306.2	266.6	336.6	366.0	311.1	317.2	9	409.3	627.0	557.2	518.3	896.5	601.7	7	421.9	9
Mean	289.8	314.4	318.8	443.2	366.9	327.1	343.4		418.5	689.1	638.7	519.6	940.1	641.2		438.3	
CD at 5%	61.9	7.0	16.0	30.9	35.2	38.4			19.7	50.5	146.4	55.4	59.5				
CV%	12.5	1.8	2.9	18.0	7.8	6.8			11.5	4.7	13.3	6.2	3.7				

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

Entries	Hill Zone						North West Zone					
	Palam-pur	Sri-nagar	Alm-ora	Aver-age	Ran-k	Superi-riority%	His-ar	Ludh-iana	Pant-nagar	Aver-age	Ran-k	Superi-riority%
JO-05-301	36.2	57.9	15.2	36.4	9		90.1	104.1	72.7	89.0	10	
OL-1869	46.0	48.7	22.0	38.9	8		102.9	168.6	149.8	140.4	1	2.2
OL-1873	45.8	59.9	23.7	43.1	1	0.9	119.5	157.3	138.1	138.3	2	0.7
OL-1876	44.0	53.8	23.9	40.6	4		80.1	113.6	152.2	115.3	9	
PLP-18	50.6	50.9	19.7	40.4	6		85.3	117.2	177.6	126.7	7	
HFO-609	40.0	62.5	23.0	41.8	3		92.6	157.1	147.2	132.3	6	
HFO-611	40.8	53.9	26.8	40.5	5		82.4	152.3	143.8	126.2	8	
UPO-212 (NC)	46.8	53.0	20.7	40.2	7		99.8	153.3	159.1	137.4	3	
RO-19 (NC)	38.9	61.8	27.4	42.7	2		98.0	122.1	186.9	135.7	4	
Kent (NC)	33.0	49.2	17.7	33.3	10		86.6	137.3	175.9	133.3	5	
Mean	42.2	55.2	22.0	39.8			93.7	138.3	150.3	127.5		
CD at 5%	8.2	6.4	2.1				26.3	32.5	8.8			
CV%	11.4	5.4	5.6				16.5	10.1	3.7			

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	Ran-k	Superi-riority%	Jha-nsi	Ana-nd	Jabal-pur	Rah-uri	Urulikan-chan	Aver-age	Ran-k	Aver-age	Ran-k
JO-05-301	46.9	37.6	34.3	79.9	57.5	46.1	50.4	8		47.4	85.6	153.7	76.5	135.0	99.6	7	69.2	10
OL-1869	54.9	67.6	63.3	91.7	70.6	68.1	69.4	4		54.7	98.9	117.3	84.7	124.5	96.0	8	84.4	6
OL-1873	71.5	55.9	58.2	80.8	64.0	68.1	66.4	6		54.6	98.3	112.5	116.4	164.0	109.2	2	87.6	4
OL-1876	67.2	61.1	71.7	78.6	76.5	71.5	71.1	3		53.2	97.0	134.3	106.6	139.1	106.0	5	83.8	7
PLP-18	65.6	61.9	47.5	81.3	78.9	72.7	68.0	5		48.9	89.8	131.1	89.3	121.1	96.0	8	81.7	8
HFO-609	57.6	66.6	70.8	123.1	79.5	75.1	78.8	1	3.3	56.2	101.5	128.6	87.7	143.1	103.4	6	88.9	2
HFO-611	67.7	66.3	76.2	76.1	76.7	63.5	71.1	3		58.2	99.1	96.5	103.4	181.1	107.7	3	86.2	5
UPO-212 (NC)	68.3	60.3	60.9	99.8	75.9	61.6	71.1	3		50.5	108.2	123.7	94.1	159.4	107.2	4	88.0	3
RO-19 (NC)	69.3	61.3	90.2	103.0	77.0	57.1	76.3	2		50.4	97.9	132.8	109.5	158.9	109.9	1	90.7	1
Kent (NC)	70.4	53.8	53.8	69.7	72.8	63.1	63.9	7		49.5	96.6	105.7	86.5	140.5	95.8	9	80.1	9
Mean	63.9	59.2	62.7	88.4	72.9	64.7	68.6			52.4	97.3	123.6	95.5	146.7	103.1		84.1	
CD at 5%	12.6	3.6	3.5	6.7	6.9	11.3				14.5	7.2	28.2	10.8	9.3				
CV%	11.5	8.5	3.2	3.9	8.4	10.2				8.4	4.3	13.3	6.6	3.7				

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

Entries	Hisar	Ludhiana	Faizabad	Jorhat	Bhubaneswar	Pusa	Ranchi	Anand	Rahuri	Urulikanchan	Average	Rank
JO-05-301	3.42	3.20	1.67	1.99	2.14	3.10	2.26	4.68	3.90	8.15	3.45	10
OL-1869	3.77	5.50	2.46	3.72	4.10	3.82	3.85	6.71	4.21	7.37	4.55	7
OL-1873	4.16	5.50	3.42	2.54	3.64	3.39	3.48	6.77	4.64	9.76	4.73	4
OL-1876	2.68	3.60	3.04	3.15	4.57	4.13	3.21	8.28	5.89	8.03	4.66	5
PLP-18	3.13	3.40	2.33	3.16	3.00	4.29	3.83	5.17	4.45	7.48	4.02	9
HFO-609	3.50	5.20	2.47	3.42	4.32	4.24	4.69	5.74	4.40	8.39	4.64	6
HFO-611	3.11	4.90	2.69	3.75	4.72	4.08	4.34	6.44	5.17	10.6	4.98	2
UPO-212 (NC)	3.35	5.20	3.63	3.00	3.77	4.09	3.32	6.74	4.75	9.93	4.78	3
RO-19 (NC)	3.49	3.70	3.28	3.57	5.98	4.04	2.96	8.41	5.77	9.76	5.10	1
Kent (NC)	2.96	4.60	3.37	2.94	3.42	3.89	3.65	6.09	4.89	8.38	4.42	8
Mean	3.36	4.48	2.84	3.12	3.97	3.91	3.56	6.50	4.81	8.79	4.53	

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

Entries	Hisar	Ludhiana	Faizabad	Jorhat	Bhubaneswar	Pusa	Ranchi	Anand	Rahuri	Urulikanchan	Average	Rank
JO-05-301	0.70	0.70	0.39	0.38	0.43	0.62	0.43	0.79	0.72	1.26	0.64	8
OL-1869	0.80	1.20	0.51	0.71	0.80	0.76	0.75	0.96	0.80	1.16	0.85	4
OL-1873	0.93	1.20	0.65	0.56	0.71	0.67	0.73	0.95	1.11	1.53	0.90	2
OL-1876	0.63	0.80	0.68	0.59	0.90	0.82	0.72	0.89	1.01	1.30	0.83	5
PLP-18	0.67	0.80	0.57	0.62	0.60	0.85	0.76	0.82	0.76	1.13	0.76	7
HFO-609	0.72	1.20	0.59	0.66	0.86	0.85	0.86	0.93	0.81	1.34	0.88	3
HFO-611	0.64	1.10	0.70	0.70	0.92	0.81	0.73	0.96	0.95	1.69	0.92	1
UPO-212 (NC)	0.78	1.10	0.71	0.59	0.73	0.82	0.67	1.05	0.89	1.49	0.88	3
RO-19 (NC)	0.77	0.80	0.69	0.63	1.16	0.80	0.59	0.90	1.00	1.49	0.88	3
Kent (NC)	0.68	1.00	0.74	0.52	0.69	0.77	0.74	0.94	0.82	1.31	0.82	6
Mean	0.73	0.99	0.62	0.59	0.78	0.78	0.70	0.92	0.88	1.37	0.84	

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	Ana-nd	Jabal-pur	Rah-uri	Urulikan-chan	**Ran-chi	Aver-age	Ra-nk
JO-05-301	2.9	1.8	14.8	3.8	1.8	2.9	5.6	12.7	12.5	5.6	12.7	2.8	7.0	7
OL-1869	4.6	3.7	23.3	4.6	3.1	4.8	6.4	14.1	9.1	5.7	11.6	4.6	8.3	3
OL-1873	4.1	3.7	20.1	6.1	2.8	4.4	4.8	13.1	8.7	7.6	15.6	3.3	8.3	3
OL-1876	4.0	3.1	15.9	5.5	3.1	5.4	4.8	11.1	10.9	6.8	13.2	4.2	7.6	4
PLP-18	4.3	3.2	16.3	5.4	3.4	3.6	5.5	9.6	10.7	6.3	11.1	4.4	7.2	6
HFO-609	3.3	4.4	15.7	4.8	3.6	5.3	9.1	13.9	12.5	6.0	12.5	4.6	8.3	3
HFO-611	3.7	3.7	18.9	5.4	3.7	5.8	5.6	13.2	7.3	7.4	16.3	3.2	8.3	3
UPO-212 (NC)	4.2	3.3	22.1	5.5	3.2	4.9	6.9	15.6	9.9	6.7	15.0	3.5	8.8	1
RO-19 (NC)	4.1	4.8	13.7	5.5	3.2	6.9	7.0	13.0	10.2	10.6	15.7	2.5	8.6	2
Kent (NC)	3.1	3.1	16.5	5.8	3.0	4.0	4.7	13.4	8.1	6.2	12.9	4.3	7.4	5
Mean	3.8	3.5	17.7	5.3	3.1	4.8	6.0	13.0	10.0	6.9	13.7	3.7	8.0	

Note: **Yield Data is very low hence not included in zonal and national average

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	Ana-nd	Jabal-pur	Rah-uri	Urulikan-chan	**Ran-chi	Aver-age	Ra-nk
JO-05-301	8.2	8.2	14.2	8.2	10.0	8.4	7.6	17.9	8.3	7.3	9.4	6.1	9.8	1
OL-1869	9.9	8.1	13.8	8.4	10.2	7.6	7.1	16.2	8.1	6.8	9.3	6.8	9.6	3
OL-1873	9.0	9.2	12.8	8.5	10.4	7.6	7.0	14.4	8.0	6.5	9.5	4.8	9.4	5
OL-1876	9.0	9.5	14.0	8.2	10.5	7.6	7.3	12.7	8.2	6.3	9.5	5.9	9.3	6
PLP-18	8.5	9.3	13.9	8.3	11.0	7.5	6.7	13.4	8.2	7.1	9.2	6.1	9.4	5
HFO-609	8.2	9.1	10.0	8.4	11.1	7.4	7.5	15.5	8.1	6.9	8.7	6.1	9.2	7
HFO-611	9.0	9.5	12.4	8.0	11.1	7.6	7.4	14.3	7.8	7.1	9.0	5.0	9.4	5
UPO-212 (NC)	9.0	9.3	14.4	8.1	10.6	8.1	7.5	15.8	8.1	7.1	9.4	5.7	9.8	1
RO-19 (NC)	10.5	9.0	11.2	8.0	10.5	7.6	7.2	14.8	8.1	9.7	9.9	4.4	9.7	2
Kent (NC)	9.3	8.8	12.0	8.3	11.5	7.4	7.0	15.5	8.0	7.2	9.2	6.8	9.5	4
Mean	9.1	9.0	12.9	8.2	10.7	7.7	7.2	15.0	8.1	7.2	9.3	5.8	9.5	

Note: **Yield Data is very low hence not included in zonal and national average

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

Entries	Palam-pur	Sri-nagar	His-ar	Ludh-iana	Pant-nagar	Faiza-bad	Jor-hat	Bhuban-eswar	Imp-hal	Ran-chi	Jha-nsi	Ana-nd	Jabal-pur	Rah-uri	Urulikan-ghan	Aver-age	Ran-k
JO-05-301	61.8	108.1	73.4	105.3	61.2	45.8	43.5	89.7	59.3	45.0	103.8	83.0	78.4	62.8	52.3	71.6	10
OL-1869	63.8	98.8	92.9	106.8	109.6	99.2	85.0	109.2	75.9	49.0	116.1	105.1	72.4	83.0	67.7	89.0	7
OL-1873	75.7	116.6	91.8	108.3	108.1	90.0	78.1	97.5	89.3	48.0	103.2	104.5	78.3	82.2	66.1	89.2	6
OL-1876	78.5	116.3	89.4	132.3	112.3	91.5	89.3	119.5	84.0	68.0	111.7	104.1	76.6	99.4	73.8	96.4	3
PLP-18	76.5	110.6	83.9	114.5	117.2	88.2	81.8	92.5	72.7	64.0	93.0	95.4	82.4	79.7	61.1	87.6	8
HFO-609	76.0	116.6	94.9	115.1	115.7	116.8	93.5	117.2	91.1	64.0	102.3	113.7	72.1	100.6	77.9	97.8	2
HFO-611	73.7	118.4	82.2	103.2	111.7	104.8	89.2	123.2	75.8	62.0	92.2	99.6	65.3	98.1	71.9	91.4	4
UPO-212 (NC)	73.7	113.6	89.6	122.0	110.3	78.8	81.4	107.1	89.4	67.0	106.9	104.8	74.8	80.3	61.5	90.7	5
RO-19 (NC)	80.3	114.6	95.6	137.7	114.2	94.8	97.5	127.6	91.8	75.0	107.2	108.0	78.4	99.6	75.8	99.9	1
Kent (NC)	73.5	102.6	84.4	105.2	113.2	95.3	77.7	95.6	81.8	63.0	104.7	98.2	67.5	83.1	55.2	86.7	9
Mean	73.4	111.6	87.8	115.0	107.3	90.5	81.7	107.9	81.1	60.5	104.1	101.6	74.6	86.9	66.3	90.0	

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-ghan	Aver-age	Ran-k
JO-05-301	0.40	0.38	1.78	3.40	0.39	0.78	1.19	0.79	1.99	0.88	1.10	0.78	1.50	0.98	1.17	1
OL-1869	0.50	0.38	1.17	2.10	0.52	0.71	1.59	0.95	1.39	0.40	1.48	0.60	1.00	0.85	0.97	2
OL-1873	0.60	0.43	1.70	2.10	0.53	0.70	0.78	0.89	1.31	0.51	1.23	0.69	0.70	0.98	0.94	4
OL-1876	0.60	0.39	1.17	1.50	0.52	0.75	1.34	1.04	1.30	0.34	1.27	0.71	0.65	0.78	0.88	7
PLP-18	0.50	0.41	1.78	1.70	0.50	0.77	1.18	0.82	1.50	0.76	1.10	0.78	0.95	0.85	0.97	2
HFO-609	0.50	0.44	1.38	1.00	0.60	0.71	1.48	0.98	0.79	0.35	1.27	0.70	0.75	0.73	0.83	8
HFO-611	0.50	0.35	1.56	1.90	0.52	0.70	1.41	1.11	1.07	0.41	1.40	0.51	0.81	1.02	0.95	3
UPO-212 (NC)	0.50	0.39	1.86	1.50	0.50	0.69	1.47	0.93	1.21	0.36	1.36	0.69	0.95	0.88	0.95	3
RO-19 (NC)	0.70	0.46	1.00	1.40	0.46	0.71	1.48	1.25	0.94	0.40	1.38	0.72	0.70	0.83	0.89	6
Kent (NC)	0.60	0.45	1.63	1.50	0.58	0.76	1.13	0.85	0.97	0.48	1.17	0.57	1.00	0.94	0.90	5
Mean	0.54	0.41	1.50	1.81	0.51	0.73	1.31	0.96	1.25	0.49	1.28	0.68	0.90	0.88	0.95	

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

Entries	ADF (%)		NDF (%)		IVDMD (%)	
	Ludhiana	Rank	Ludhiana	Rank	Ludhiana	Rank
JO-05-301	24.7	1	35.2	2	58.2	1
OL-1869	25.1	4	36.9	5	57.6	3
OL-1873	25.9	6	36.8	4	55.2	7
OL-1876	25.0	3	36.0	3	58.1	2
PLP-18	25.4	5	37.0	6	57.0	5
HFO-609	26.9	9	39.9	10	52.6	10
HFO-611	26.8	8	39.1	9	55.9	6
UPO-212 (NC)	24.8	2	35.1	1	57.4	4
RO-19 (NC)	27.0	10	38.9	8	54.1	9
Kent (NC)	26.2	7	37.4	7	54.9	8
Mean	25.8		37.2		56.1	

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

Entries	Hill Zone					Central Zone								All India		
	Palam-pur	Sri-nagar	Alm-ora	Aver-age	Ra-nk	Jha-nsi	Ana-nd	Jabal-pur	Rah-uri	Urulikan-chan	Aver-age	Ra-nk	Superi- ority%	Aver-age	Ra-nk	Superi- ority%
OL-1842	173.3	276.5	57.3	169.0	7	351.5	566.0	656.0	724.9	765.8	612.8	3	2.0	446.4	3	0.5
JO-4-321	174.9	306.6	59.8	180.4	4	314.5	566.0	770.0	681.6	685.4	603.5	4		444.9	4	
OL-1866	170.7	299.2	51.5	173.8	5	346.9	435.0	534.0	693.6	947.6	591.4	6		434.8	6	
HFO-514	189.3	255.9	61.0	168.7	8	370.0	490.0	693.0	658.7	922.4	626.8	1		455.0	1	
HFO-417	156.3	294.7	62.4	171.1	6	359.2	451.0	625.0	647.8	763.5	569.3	8		420.0	8	
RO-19 (NC)	155.2	319.4	72.2	182.3	1	365.4	458.0	692.0	657.4	899.2	614.4	2		452.3	2	
UPO-212 (NC)	204.3	264.7	76.8	181.9	2	370.0	507.0	636.0	647.7	696.1	571.4	7		425.3	7	
Kent (NC)	182.9	307.9	53.8	181.5	3	282.1	468.0	709.0	695.9	823.0	595.6	5		440.3	5	
Mean	175.9	290.6	61.8	176.1		344.9	492.6	664.4	675.9	812.9	598.2			439.9		
CD at 5%	27.1	21.1	8.2			13.2	58.6	130.9	42.2	133.4						
CV%	8.8	10.3	7.5			7.5	6.8	11.2	3.6	9.3						

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

Entries	Hill Zone					Central Zone								All India				
	Palam-pur	Sri-nagar	Alm-ora	Aver-age	Ra-nk	Jha-nsi	Ana-nd	Jabal-pur	Rah-uri	Urulikan-chan	Aver-age	Ra-nk	Superi- ority%	Aver-age	Ra-nk	Superi- ority%		
OL-1842	35.8	56.8	12.6	35.1	6	43.3	89.8	129.2	107.1	123.7	98.6	5	2.4	74.8	5	1.8		
JO-4-321	37.1	63.5	16.7	39.1	2	45.2	92.4	154.7	111.9	118.0	104.5	2		80.0	2			
OL-1866	36.0	62.7	13.4	37.4	5	44.4	76.9	102.9	110.4	136.9	94.3	8		73.0	7			
HFO-514	34.8	53.5	14.6	34.3	7	45.8	103.2	137.2	113.8	143.4	108.7	1		6.5	80.8		1	2.8
HFO-417	26.4	58.6	15.0	33.3	8	44.9	95.4	122.8	105.4	121.4	98.0	6		73.7	6			
RO-19 (NC)	33.7	66.9	17.3	39.3	1	39.9	86.8	137.7	114.4	131.8	102.1	3		78.6	3			
UPO-212 (NC)	40.2	55.5	20.0	38.6	3	49.6	88.8	124.9	108.8	110.6	96.5	7		74.8	5			
Kent (NC)	40.9	62.1	11.8	38.3	4	33.4	89.0	139.5	118.2	121.7	100.3	4		77.1	4			
Mean	35.6	60.0	15.2	36.9		43.3	90.3	131.1	111.3	125.9	100.4			76.6				
CD at 5%	7.4	6.6	2.0			7.3	10.2	26.6	7.1	N.S.								
CV%	11.9	8.3	7.4			4.2	6.5	11.6	3.6	9.5								

Table 10.3: AVTO-1 (MC): First Advanced Varietal Trial in Oat (Multi cut): GFY (q/ha/day) & DMY (q/ha/day)

Entries	GFY (q/ha/day)					DMY (q/ha/day)				
	Anand	Rahuri	Urulikanchan	Average	Rank	Anand	Rahuri	Urulikanchan	Average	Rank
OL-1842	5.55	8.05	7.09	6.90	1	0.88	1.19	1.15	1.07	3
JO-4-321	5.55	7.10	6.35	6.33	5	0.91	1.17	1.09	1.06	4
OL-1866	4.26	7.22	8.77	6.75	2	0.75	1.15	1.27	1.06	4
HFO-514	4.54	7.01	8.54	6.70	3	0.96	1.21	1.33	1.17	1
HFO-417	4.18	6.61	7.07	5.95	8	0.88	1.08	1.12	1.03	5
RO-19 (NC)	4.24	6.03	8.33	6.20	6	0.80	1.05	1.22	1.02	6
UPO-212 (NC)	4.97	6.89	6.45	6.10	7	0.87	1.16	1.02	1.02	6
Kent (NC)	4.59	7.56	7.62	6.59	4	0.87	1.29	1.13	1.10	2
Mean	4.74	7.06	7.53	6.44		0.87	1.16	1.17	1.06	

Table 10.4: AVTO-1 (MC): First Advanced Varietal Trial in Oat (Multi cut): Crude Protein Yield (q/ha) & Crude Protein (%)

Entries	Crude Protein Yield (q/ha)							Crude Protein (%)						
	Palam-pur	Ana-nd	Jabal-pur	Rah-uri	Urulikan-cha-n	Aver-age	Rank	Palam-pur	Ana-nd	Jabal-pur	Rah-uri	Urulikan-cha-n	Aver-age	Rank
OL-1842	3.6	12.2	10.4	8.4	11.6	9.2	3	10.2	17.9	8.2	7.9	9.4	10.7	1
JO-4-321	3.4	10.1	12.6	8.0	11.0	9.0	4	9.0	16.2	8.2	7.1	9.3	10.0	3
OL-1866	3.5	9.6	7.9	9.7	12.8	8.7	6	9.6	15.8	7.9	8.8	9.4	10.3	2
HFO-514	3.5	11.3	11.0	8.2	13.1	9.4	2	10.2	15.5	8.2	7.2	9.2	10.0	3
HFO-417	2.4	10.0	9.8	9.9	11.5	8.7	6	9.0	13.4	8.1	9.4	9.5	9.9	4
RO-19 (NC)	3.5	8.6	11.1	8.8	12.2	8.8	5	10.5	14.4	8.2	7.7	9.3	10.0	3
UPO-212 (NC)	3.7	11.0	9.9	9.3	9.8	8.7	6	9.3	14.8	8.1	8.5	8.9	9.9	4
Kent (NC)	4.1	10.6	11.2	11.4	11.4	9.7	1	9.9	12.7	8.2	9.6	9.4	10.0	3
Mean	3.5	10.4	10.5	9.2	11.7	9.1		9.7	15.1	8.1	8.3	9.3	10.1	

Table 10.5: AVTO-1 (MC): First Advanced Varietal Trial in Oat (Multi cut): Plant Height (cm) & Leaf Stem Ratio

Entries	Plant Height (cm)									Leaf Stem Ratio						
	Palam-pur	Sri-nagar	Jha-nsi	Ana-nd	Jabal-pur	Rah-uri	Urulikan-chan	Aver-age	Ra-nk	Palam-pur	Sri-nagar	Jabal-pur	Rah-uri	Urulikan-chan	Aver-age	Ra-nk
OL-1842	67.8	100.0	122.3	100.6	74.3	78.0	71.0	87.7	8	0.50	0.38	0.89	0.80	1.04	0.72	2
JO-4-321	69.3	116.8	129.9	97.6	88.5	78.0	52.8	90.4	3	0.50	0.45	0.89	1.05	0.94	0.77	1
OL-1866	66.0	108.2	123.0	94.3	81.2	75.7	71.3	88.5	7	0.50	0.44	0.92	0.75	1.00	0.72	2
HFO-514	68.7	99.1	134.2	100.3	69.2	92.2	68.0	90.2	4	0.40	0.36	1.04	0.65	1.02	0.69	5
HFO-417	67.7	110.5	128.9	103.7	68.0	84.9	73.3	91.0	2	0.60	0.44	0.79	0.75	0.77	0.67	6
RO-19 (NC)	68.5	115.2	128.1	100.5	80.8	97.0	68.2	94.0	1	0.60	0.39	1.02	0.66	0.85	0.70	4
UPO-212 (NC)	84.0	103.2	118.4	98.1	74.0	76.7	65.6	88.6	6	0.60	0.43	0.81	0.90	0.87	0.72	2
Kent (NC)	67.5	120.8	117.8	94.6	88.8	73.5	60.8	89.1	5	0.50	0.37	1.09	0.70	0.88	0.71	3
Mean	69.9	109.2	125.3	98.7	78.1	82.0	66.3	89.9		0.53	0.41	0.93	0.78	0.92	0.71	

Table 10.6: AVTO-1 (MC): First Advanced Varietal Trial in Oat (Multi cut): ADF (%), NDF (%) & IVDMD (%)

Entries	ADF (%)				NDF (%)				IVDMD (%)	
	Palampur	Rahuri	Average	Rank	Palampur	Rahuri	Average	Rank	Rahuri	Rank
OL-1842	56.4	45.2	50.8	7	63.8	68.7	66.2	8	53.9	7
JO-4-321	54.6	39.8	47.2	2	64.6	60.2	62.4	4	57.5	4
OL-1866	54.6	40.8	47.7	5	64.2	58.7	61.5	3	56.9	5
HFO-514	55.4	39.2	47.3	3	64.6	63.8	64.2	5	58.4	3
HFO-417	56.2	35.9	46.0	1	63.2	54.7	58.9	1	61.3	1
RO-19 (NC)	55.8	39.4	47.6	4	63.4	65.3	64.4	6	58.4	3
UPO-212 (NC)	57.4	42.4	49.9	6	65.8	65.5	65.6	7	55.6	6
Kent (NC)	55.8	36.1	46.0	1	66.0	55.3	60.7	2	60.5	2
Mean	55.8	39.9	47.8		64.5	61.5	63.0		57.8	

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

(Reference tables 11.1 to 11.10)

An initial varietal trial in Oat (Dual) comprising of nine entries along with two national checks (UPO-212 and JHO-822) was conducted at 18 centres located at five zones of the country. Results obtained from different centres revealed that for green forage yield (q/ha), entries RO 11-1(4.8%) in NWZ and HFO-619 (6.8%) in NEZ, entry RO11-1 (12.1%) and JO-10-501 (5.3%) in Central zone and RO-11-1 (8.3%) at all India level (7.8%) registered superiority over the best check.

For dry matter yield, entry HFO-619 (9.7%) in NE zone, RO-11-1 (10.6%), OL-1769 (9.8%), HFO-619 (4.8%) in central zone and RO-11-1 (5.5%) at all India level registered superiority. Other entries showed marginal superiority or were inferior over the best check at zonal and national level for both green and dry fodder yield.

For the character fodder production potential (q/ha/day), entries RSO-8 (3.84) followed by OL-1769 (3.75) were superior than best check JHO-822 (3.59). For dry matter production potential, entry OL-1769 & HFO-619 were best and followed by RSO-8.

Entry OL-1769 (93.5 cm) ranked first for the character plant height. For the character leafiness, entry HFO-619 performed best.

For quality parameters, entry RO-11-1 for crude protein yield (4.3 q/ha) followed by HFO-619 (4.1q/ha) were superior to best check UPO-212 (4.0 q/ha). National check UPO -212 was best for crude protein content. Entry OL-1769 ranked first for ADF (%), NDF (%), and IVDMD (%).

For seed yield (q/ha), entry JO-10-501 was marginally superior to best check.

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

(Reference tables 12.1 to 12.6)

An Advanced varietal trial -1 in Oat (Dual) comprising of three entries along with three national checks (UPO-212, RO-19 and JHO-822) was conducted at 4 centres located in North east 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.

For crude protein content (%), entry OL-1802 (9.8%) was better than best check (9.5%). Entry NDO-11-01 ranked first for ADF (%), NDF (%), and IVDMD (%). For seed yield (q/ha), national check UPO-212 was best.

National check UPO-212 ranked first for the character plant height and leafiness.

Table 11.1 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Green Forage Yield (q/ha)

Entries	Hill Zone					North West Zone							
	Palam-pur	Sri-nagar	Aver-age	Ran-k	Superi- ority%	Ludh- iana	His- ar	Bika- ner	Pant- nagar	Udai- pur	Aver- age	Ran- k	Superi- ority%
OL-1769	100.0	124.5	112.3	6		193.0	287.8	113.1	286.7	414.8	259.1	5	
OL-1804-1	119.4	118.7	119.1	3		132.4	414.1	76.2	253.0	338.9	242.9	9	
RSO-8	115.5	118.0	116.8	4		170.2	364.4	206.4	231.0	403.7	275.1	2	1.5
OL-1871	114.4	84.3	99.4	11		136.9	296.2	132.4	280.0	333.3	235.8	10	
HFO-610	119.9	137.9	128.9	1	1.1	196.5	232.2	136.5	314.3	374.0	250.7	8	
RSO-60	121.1	102.2	111.7	7		146.7	234.2	125.5	335.7	437.0	255.8	7	
RO-11-1	103.9	107.9	105.9	8		198.7	360.0	119.2	317.3	425.9	284.2	1	4.8
HFO-619	113.3	111.6	112.5	5		168.3	228.9	108.0	360.3	296.3	232.4	11	
JO-10-501	103.3	98.5	100.9	9		165.6	246.3	161.1	346.3	427.7	269.4	4	
UPO-212 (NC)	122.7	132.2	127.5	2		193.3	280.7	184.4	315.7	381.4	271.1	3	
JHO-822 (NC)	111.1	89.2	100.2	10		188.9	237.8	132.0	343.0	385.1	257.4	6	
Mean	113.1	111.4	112.3			171.9	289.3	135.9	307.6	383.5	257.6		
CD at 5%	14.6	12.3				52.6	77.3	34.1	38.9	71.8			
CV%	7.6	8.5				15.7	15.3	14.7	8.7	11.1			

Table 11.1 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Green Forage Yield (q/ha)

Entries	North East Zone						
	Jor-hat	Bhuban- eswar	Ran- chi	Faiza- bad	Aver- age	Ran- k	Superi- ority%
OL-1769	259.9	146.6	266.7	173.3	211.6	5	
OL-1804-1	177.2	151.6	257.7	162.7	187.3	11	
RSO-8	209.7	147.2	248.8	157.3	190.8	10	
OL-1871	198.4	140.5	246.6	192.0	194.4	8	
HFO-610	228.1	140.0	253.3	236.6	214.5	4	
RSO-60	174.3	153.9	244.4	250.7	205.8	6	
RO-11-1	213.2	138.0	235.5	272.0	214.7	3	
HFO-619	223.0	136.6	302.1	269.3	232.8	1	6.8
JO-10-501	190.5	138.8	240.0	206.4	193.9	9	
UPO-212 (NC)	218.0	150.0	240.0	194.7	200.6	7	
JHO-822 (NC)	186.6	139.8	266.7	278.9	218.0	2	
Mean	207.2	143.9	254.7	217.6	205.9		
CD at 5%	5.5	13.1	36.3	69.4			
CV%	6.8	5.3	8.3	13.5			

Table 11.1 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Green Forage Yield (q/ha)

Entries	Central Zone									South Zone		All India		
	Jha-nsi	Rah-uri	Urulikan-ghan	Ana-nd	Jabal-pur	**Rai-pur	Aver-age	Ra-nk	Superi-riority	**Tirupati (Hyd.)	Ra-nk	Aver-age	Ra-nk	Superi-riority
OL-1769	425.7	388.1	501.3	179.0	146.3	144.4	328.1	4	2.2	68.0	2	250.4	4	1.0
OL-1804-1	360.0	327.3	391.4	159.0	149.3	114.9	277.4	10		50.8	9	224.3	11	
RSO-8	407.1	384.0	548.8	155.0	178.6	128.4	334.7	3	4.2	60.6	4	252.9	2	2.1
OL-1871	337.7	317.9	489.6	192.0	163.9	92.6	300.2	8		70.6	1	228.5	10	
HFO-610	374.8	351.0	378.1	135.0	204.0	114.6	288.6	9		58.1	7	238.3	8	
RSO-60	351.6	467.8	471.4	179.0	153.3	134.0	324.6	5		58.4	6	246.8	6	
RO-11-1	416.4	488.6	417.0	204.0	274.6	137.0	360.1	1	12.1	59.8	5	268.3	1	8.3
HFO-619	370.1	339.9	563.7	161.0	148.0	84.1	316.5	7		49.5	10	243.8	7	
JO-10-501	407.1	403.1	549.8	186.0	143.9	130.3	338.0	2	5.3	41.5	11	250.9	3	1.3
UPO-212 (NC)	342.4	324.1	402.1	150.0	153.3	107.4	274.4	11		57.9	8	236.5	9	
JHO-822 (NC)	342.4	370.7	572.8	156.0	163.9	96.3	321.1	6		63.6	3	247.8	5	
Mean	375.9	378.4	480.6	168.7	170.8	116.7	314.9			58.1		244.4		
CD at 5%	17.3	16.1	46.6	40.6	43.8	26.2				14.1				
CV%	10.3	2.5	5.7	13.9	15.4	13.2				11.2				

Note: ** Yield Data is very low hence not included in zonal and national level

Table 11.2 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Dry Matter Yield (q/ha)

Entries	Hill Zone				North West Zone					
	Palampur	Srinagar	Average	Rank	Ludhiana	Hisar	Bikaner	Pantnagar	Average	Rank
OL-1769	21.6	25.8	23.7	6	43.2	51.5	23.1	58.2	44.0	9
OL-1804-1	24.0	25.4	24.7	5	29.9	77.0	14.3	53.5	43.7	10
RSO-8	26.3	24.8	25.6	3	37.3	71.6	35.9	54.7	49.9	2
OL-1871	23.9	17.7	20.8	8	32.0	57.3	25.1	66.9	45.3	7
HFO-610	25.3	28.7	27.0	2	46.0	47.1	26.3	72.4	48.0	4
RSO-60	23.0	22.2	22.6	8	31.4	46.2	25.3	74.1	44.3	8
RO-11-1	22.2	23.1	22.7	7	41.9	68.4	21.4	63.4	48.8	3
HFO-619	25.6	23.7	24.7	4	38.4	43.5	23.2	69.7	43.7	10
JO-10-501	21.5	21.1	21.3	7	36.8	47.4	31.1	68.7	46.0	6
UPO-212 (NC)	26.1	28.3	27.2	1	45.6	56.6	34.9	67.4	51.1	1
JHO-822 (NC)	23.5	18.6	21.1	9	43.8	49.1	25.3	66.9	46.3	5
CD at 5%	3.2	1.2			5.5	12.9	8.1	5.9		
CV%	7.8	5.2			11.6	13.6	18.4	7.5		

Table 11.2 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Dry Matter Yield (q/ha)

Entries	North East Zone						
	Jor-hat	Bhuban-eswar	Ran-chi	Faiza-bad	Aver-age	Ra-nk	Superi- ority%
OL-1769	45.8	29.9	43.5	40.5	39.9	7	9.7
OL-1804-1	34.7	29.8	36.0	52.3	38.2	10	
RSO-8	36.5	30.2	36.8	49.6	38.3	9	
OL-1871	35.3	30.3	28.3	57.1	37.7	11	
HFO-610	41.3	28.2	36.5	58.1	41.0	5	
RSO-60	33.5	31.1	33.1	65.6	40.8	6	
RO-11-1	39.5	28.7	29.3	67.7	41.3	4	
HFO-619	42.3	28.4	43.9	70.9	46.4	1	
JO-10-501	31.8	28.4	34.1	62.4	39.2	8	
UPO-212 (NC)	41.3	32.3	36.7	55.5	41.5	3	
JHO-822 (NC)	33.7	28.9	37.3	69.3	42.3	2	
Mean	37.8	29.7	35.9	59.0	40.6		
CD at 5%	1.8	2.9	7.2	13.4			
CV%	5.2	5.7	11.7	13.2			

Table 11.2 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Dry Matter Yield (q/ha)

Entries	Central Zone									South Zone		All India		
	Jha-nsi	Rah-uri	Urulikan- chan	Ana-nd	Jabal- pur	Rai- pur	Aver- age	Ra-nk	Superi- ority	**Tirupati (Hyd.)	Ra-nk	Aver- age	Ra-nk	Superi- ority
OL-1769	98.9	69.7	64.7	28.7	26.5	40.8	54.9	2	9.8	23.1	6	44.5	3	1.8
OL-1804-1	77.4	61.6	46.4	21.5	26.9	35.3	44.8	11		20.0	9	40.4	9	
RSO-8	84.2	59.5	64.6	22.5	32.8	33.0	49.4	7		27.8	1	43.8	4	0.2
OL-1871	80.6	54.4	60.8	22.5	30.0	39.5	48.0	8		24.5	4	41.3	8	
HFO-610	63.9	61.0	57.9	18.9	37.4	46.9	47.7	9		22.4	7	43.5	6	
RSO-60	70.5	91.3	51.6	26.0	27.7	42.5	51.6	5	3.2	23.5	5	43.4	7	
RO-11-1	86.3	79.5	50.0	27.1	49.7	38.9	55.3	1	10.6	25.5	2	46.1	1	5.5
HFO-619	90.0	58.6	75.8	22.8	26.8	40.6	52.4	3	4.8	18.6	10	45.3	2	3.7
JO-10-501	89.9	66.6	60.9	26.4	25.2	42.1	51.9	4	3.8	15.0	11	43.4	7	
UPO-212 (NC)	86.3	56.7	46.9	23.2	27.8	34.1	45.8	10		22.1	8	43.7	5	
JHO-822 (NC)	78.1	65.4	75.9	22.1	30.0	28.8	50.0	6		24.9	3	43.5	6	
Mean	82.4	65.8	59.6	23.8	31.0	38.4	50.2			22.5		43.5		
CD at 5%	9.5	2.9	2.8	5.9	5.6	5.3				4.6				
CV%	5.7	2.6	5.7	14.2	10.5	8.3				11.6				

Note: ** Yield Data is very low hence not included in zonal and national level

Table 11.3 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Green Forage Yield (q/ha/day)

Entries	Ludh-iana	His-ar	Bika-ner	Jor-hat	Bhuban-eswar	Ran-chi	Faiza-bad	Jha-nsi	Urulikan-chan	Ana-nd	Rai-pur	Aver-age	Ra-nk
OL-1769	2.80	4.50	1.62	4.56	2.67	2.93	1.57	4.78	9.64	3.38	2.83	3.75	2
OL-1804-1	1.90	6.47	1.09	3.11	2.76	2.80	1.51	4.04	7.53	3.00	2.25	3.31	10
RSO-8	2.40	5.69	2.95	3.68	2.68	2.82	1.51	4.57	10.55	2.92	2.52	3.84	1
OL-1871	2.00	4.63	1.89	3.48	2.56	2.65	1.71	3.79	9.41	3.62	1.81	3.41	7
HFO-610	2.80	3.63	1.95	4.00	2.55	2.69	2.07	4.21	7.27	2.55	2.25	3.27	11
RSO-60	2.10	3.66	1.79	3.06	2.80	2.71	2.25	3.95	9.07	3.38	2.63	3.40	8
RO-11-1	2.80	5.63	1.70	3.74	2.51	2.45	2.38	4.68	8.02	3.85	2.69	3.68	3
HFO-619	2.40	3.58	1.54	3.91	2.48	3.08	2.54	4.16	10.84	3.04	1.65	3.57	6
JO-10-501	2.40	3.85	2.30	3.34	2.52	2.52	1.85	4.57	10.57	3.51	2.55	3.64	4
UPO-212 (NC)	2.80	4.39	2.63	3.82	2.73	2.63	1.72	3.85	7.73	2.83	2.11	3.39	9
JHO-822 (NC)	2.70	3.72	1.89	3.27	2.54	2.99	2.73	3.85	11.01	2.94	1.89	3.59	5
Mean	2.46	4.52	1.94	3.63	2.62	2.75	1.99	4.22	9.24	3.18	2.29	3.53	

Table 11.4 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Dry Matter Yield (q/ha/day)

Entries	Ludh-iana	His-ar	Bika-ner	Jor-hat	Bhuban-eswar	Ran-chi	Faiza-bad	Jha-nsi	Urulikan-chan	Ana-nd	Rai-pur	Aver-age	Ra-nk
OL-1769	0.60	0.81	0.33	0.80	0.54	0.47	0.37	1.11	1.24	0.54	0.80	0.69	1
OL-1804-1	0.40	1.20	0.20	0.61	0.54	0.39	0.48	0.87	0.89	0.41	0.69	0.61	6
RSO-8	0.50	1.12	0.51	0.64	0.55	0.42	0.47	0.95	1.24	0.42	0.65	0.68	2
OL-1871	0.50	0.90	0.36	0.62	0.55	0.30	0.51	0.91	1.17	0.42	0.77	0.64	5
HFO-610	0.70	0.74	0.38	0.72	0.51	0.38	0.51	0.72	1.11	0.36	0.92	0.64	5
RSO-60	0.40	0.72	0.36	0.59	0.57	0.36	0.59	0.79	0.99	0.49	0.83	0.61	6
RO-11-1	0.60	1.07	0.31	0.69	0.52	0.30	0.59	0.97	0.96	0.51	0.76	0.66	3
HFO-619	0.50	0.68	0.33	0.74	0.52	0.44	0.67	1.01	1.46	0.43	0.80	0.69	1
JO-10-501	0.50	0.74	0.44	0.56	0.52	0.36	0.56	1.01	1.17	0.50	0.83	0.65	4
UPO-212 (NC)	0.70	0.88	0.50	0.73	0.59	0.40	0.49	0.97	0.90	0.44	0.67	0.66	3
JHO-822 (NC)	0.60	0.77	0.36	0.59	0.53	0.42	0.68	0.88	1.46	0.42	0.56	0.66	3
Mean	0.55	0.88	0.37	0.66	0.54	0.39	0.54	0.93	1.14	0.45	0.75	0.65	

Table 11.5 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Crude Protein Yield (q/ha)

Entries	Palam-pur	Ludh-iana	His-ar	Bika-ner	Jor-hat	Bhuban-eswar	Faiza-bad	Rah-uri	Urulikan-chan	Ana-nd	Jabal-pur	Rai-pur	**Ran-chi	Aver-age	Ra-nk
OL-1769	2.2	6.2	4.8	2.2	5.2	2.6	3.3	3.7	5.3	3.6	2.1	3.1	2.4	3.7	5
OL-1804-1	2.3	4.0	4.8	1.7	3.8	2.7	4.2	5.3	3.9	3.0	2.1	2.7	2.0	3.4	7
RSO-8	2.1	4.5	6.4	6.1	3.8	2.6	4.2	4.4	5.6	2.7	2.7	2.3	2.7	3.9	4
OL-1871	2.0	3.8	5.4	4.0	3.8	2.5	5.0	3.1	5.5	2.7	2.4	2.4	1.9	3.5	6
HFO-610	2.2	5.2	4.5	2.6	4.5	2.5	4.9	5.2	5.5	2.2	3.1	3.7	2.2	3.8	5
RSO-60	2.1	4.2	3.0	3.3	3.9	2.8	5.3	7.0	4.7	3.1	2.3	3.5	2.1	3.8	5
RO-11-1	2.1	4.9	4.2	3.1	4.2	2.5	5.7	7.0	4.4	3.8	4.1	6.1	1.8	4.3	1
HFO-619	2.7	4.3	4.1	2.2	4.6	2.5	6.0	4.1	6.6	3.7	2.1	6.1	2.8	4.1	2
JO-10-501	2.3	4.4	4.5	3.3	3.5	2.5	5.1	4.4	5.6	3.3	2.0	6.1	1.9	3.9	4
UPO-212 (NC)	2.4	5.9	5.5	5.3	4.6	2.7	4.6	4.7	4.3	3.2	2.3	2.6	2.0	4.0	3
JHO-822 (NC)	2.5	4.8	4.6	3.1	3.4	2.5	5.5	4.3	7.2	3.0	2.4	2.3	2.2	3.8	5
Mean	2.3	4.7	4.7	3.4	4.1	2.6	4.9	4.8	5.3	3.1	2.5	3.7	2.2	3.8	

Table 11.6 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Crude Protein (%)

Entries	Palam-pur	Ludh-iana	His-ar	Bika-ner	Jor-hat	Bhuban-eswar	Faiza-bad	Rah-uri	Urulikan-chan	Ana-nd	Jabal-pur	Rai-pur	**Ran-chi	Aver-age	Ra-nk
OL-1769	10.2	14.4	9.3	9.5	11.5	8.8	8.2	5.3	8.2	12.4	8.2	7.6	5.5	9.5	5
OL-1804-1	9.6	13.5	6.3	12.0	11.1	9.2	8.1	8.7	8.4	14.0	8.2	7.5	5.5	9.7	3
RSO-8	8.2	12.0	8.9	17.1	10.7	8.8	8.4	7.4	8.6	12.1	8.3	6.9	7.2	9.8	2
OL-1871	8.2	11.8	9.5	15.8	10.8	8.4	8.7	5.8	9.1	12.0	8.3	6.2	6.8	9.5	5
HFO-610	8.8	11.4	9.6	9.8	11.0	8.9	8.5	8.6	9.4	11.6	8.3	7.9	5.9	9.5	5
RSO-60	9.3	13.5	6.2	13.0	11.7	8.9	8.1	7.7	9.1	11.9	8.2	8.2	6.3	9.6	4
RO-11-1	9.6	11.6	6.0	14.4	10.8	8.7	8.4	8.8	8.8	14.1	8.3	7.3	6.1	9.7	3
HFO-619	10.5	11.3	9.4	9.5	11.1	8.6	8.5	7.0	8.7	16.0	8.2	7.5	6.3	9.7	3
JO-10-501	10.8	12.0	9.6	10.6	11.1	8.8	8.2	6.6	9.2	12.5	8.1	7.7	5.5	9.6	4
UPO-212 (NC)	9.0	13.0	9.8	15.1	11.3	8.3	8.3	8.3	9.2	13.9	8.2	7.7	5.5	10.2	1
JHO-822 (NC)	10.5	11.0	9.3	12.4	10.2	8.7	8.0	6.6	9.5	13.6	8.3	8.1	5.9	9.7	3
Mean	9.5	12.3	8.5	12.6	11.0	8.7	8.3	7.3	8.9	13.1	8.2	7.5	6.0	9.7	

Table 11.7 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Plant Height (cm)

Entries	Palam-pur	Ludh-iana	His-ar	Bika-ner	Pant-nagar	Udai-pur	Jor-hat	Bhuban-eswar	Ran-chi	Faiza-bad	Rah-uri	Urulikan-chan	Ana-nd	Rai-pur	Tirupati (Hyd.)	Aver-age	Ra-nk
OL-1769	69.0	135.3	110.0	71.0	67.3	150.2	96.1	109.3	66.0	108.4	99.1	71.8	91.9	60.4	96.8	93.5	1
OL-1804-1	53.0	95.2	114.4	62.0	56.7	152.8	81.5	120.2	63.0	110.5	90.6	63.8	96.4	65.4	86.0	87.4	6
RSO-8	51.0	128.7	109.7	80.0	55.7	146.8	88.7	115.1	52.0	115.8	99.4	72.3	85.5	65.0	95.8	90.8	3
OL-1871	55.0	102.1	102.8	62.0	61.3	143.1	85.0	105.4	45.0	110.5	81.5	57.3	85.4	58.8	87.5	82.9	9
HFO-610	76.3	142.7	90.0	90.0	55.0	134.7	89.7	101.1	49.0	115.2	83.1	52.5	67.4	64.5	87.7	86.6	7
RSO-60	59.3	106.7	88.4	66.0	47.7	145.1	80.6	124.4	61.0	112.2	100.4	71.0	95.0	63.4	91.6	87.5	5
RO-11-1	63.0	145.0	117.4	71.0	43.3	154.9	96.1	90.2	61.0	119.5	98.7	65.0	86.3	66.9	102.0	92.0	2
HFO-619	53.0	133.6	83.2	63.0	46.3	118.8	72.1	85.5	47.0	120.6	82.2	69.2	81.7	52.7	68.7	78.5	11
JO-10-501	71.7	132.4	100.3	68.0	56.7	134.6	80.5	93.4	51.0	118.7	95.2	68.3	97.9	65.4	84.3	87.9	4
UPO-212 (NC)	64.3	139.1	96.3	71.0	49.3	136.4	84.5	117.6	45.0	120.2	83.6	60.5	81.0	58.9	87.6	86.4	8
JHO-822 (NC)	58.0	135.4	87.3	57.0	45.3	117.3	82.6	95.7	51.0	110.5	82.4	59.7	90.1	53.0	78.1	80.2	10
Mean	61.2	126.9	100.0	69.2	53.2	139.5	85.2	105.3	53.7	114.7	90.6	64.7	87.1	61.3	87.8	86.7	

Table 11.8 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Leaf Stem Ratio

Entries	Palam-pur	Sri-nagar	Ludh-iana	His-ar	Bika-ner	Pant-nagar	Bhuban-eswar	Faiza-bad	Rah-uri	Urulikan-chan	Ana-nd	Rai-pur	Aver-age	Ra-nk
OL-1769	0.70	0.31	1.50	0.67	1.18	0.67	0.94	0.69	1.40	0.73	2.35	0.63	0.98	10
OL-1804-1	0.80	0.28	2.30	1.00	0.97	0.59	1.21	0.71	0.90	1.29	2.27	0.67	1.08	6
RSO-8	0.80	0.34	1.90	0.79	1.15	0.58	0.98	0.75	0.80	0.89	2.45	0.66	1.01	8
OL-1871	0.60	0.34	1.50	2.33	0.88	0.55	0.87	0.76	1.50	1.20	2.94	0.69	1.18	3
HFO-610	0.60	0.30	2.10	1.56	0.80	0.65	0.84	0.70	1.20	0.90	2.93	0.84	1.12	4
RSO-60	0.80	0.34	1.90	1.00	0.76	0.51	1.07	0.75	1.00	0.61	2.49	0.71	1.00	9
RO-11-1	0.70	0.28	1.50	1.17	1.03	0.54	0.75	0.75	1.00	1.08	2.30	0.59	0.97	11
HFO-619	0.70	0.31	4.70	1.70	1.20	0.48	0.71	0.72	1.50	1.03	3.48	0.76	1.44	1
JO-10-501	0.60	0.33	2.20	1.00	1.07	0.47	0.72	0.74	1.10	0.80	2.83	0.63	1.04	7
UPO-212 (NC)	0.80	0.33	2.30	0.92	0.94	0.59	1.15	0.71	1.00	1.14	2.37	0.79	1.09	5
JHO-822 (NC)	0.80	0.27	4.00	1.94	0.97	0.62	0.81	0.72	1.00	1.06	3.31	0.79	1.36	2

Table 11.9 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): ADF (%), NDF (%) & IVDMD (%)

Entries	NDF (%)		ADF (%)		IVDMD (%)	
	Ludhiana	Rank	Ludhiana	Rank	Ludhiana	Rank
OL-1769	38.3	1	27.3	1	56.2	1
OL-1804-1	40.2	3	28.2	2	55.8	2
RSO-8	41.2	6	30.0	6	54.6	5
OL-1871	42.7	9	31.4	10	53.6	7
HFO-610	43.7	11	30.9	8	52.7	9
RSO-60	40.3	4	29.0	4	55.0	3
RO-11-1	41.4	7	30.8	7	53.0	8
HFO-619	41.0	5	31.4	10	52.1	10
JO-10-501	41.8	8	29.7	5	54.2	6
UPO-212 (NC)	38.9	2	28.4	3	54.9	4
JHO-822 (NC)	43.0	10	31.2	9	52.0	11
Mean	41.1		29.8		54.0	

Table 11.10 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Seed Yield (q/ha)

Entries	Palam-pur	Sri-nagar	Ludh-iana	His-ar	Bika-ner	Udai-pur	Bhuban-eswar	Jor-hat	Faiza-bad
OL-1769	6.10	9.60	11.30	12.22	5.93	18.50	8.60	14.87	15.66
OL-1804-1	9.70	8.90	23.60	21.85	6.81	20.90	9.20	14.40	14.66
RSO-8	11.90	7.00	20.50	19.44	10.22	13.70	10.06	12.57	20.26
OL-1871	13.40	6.80	22.20	14.41	7.04	16.50	8.29	9.23	19.46
HFO-610	14.00	8.00	31.10	18.89	7.96	15.60	8.13	11.17	18.02
RSO-60	6.10	7.30	19.70	15.15	7.63	20.90	8.40	14.62	18.13
RO-11-1	5.30	6.40	14.40	10.78	7.22	19.70	7.53	14.27	13.86
HFO-619	4.90	7.80	24.20	31.00	10.54	17.30	7.33	14.13	14.40
JO-10-501	12.70	6.90	24.30	15.48	9.39	17.90	7.48	13.37	16.00
UPO-212 (NC)	8.00	8.40	26.80	17.59	8.48	23.80	8.33	11.00	19.73
JHO-822 (NC)	8.40	5.80	23.30	19.70	13.80	16.90	7.93	11.85	21.22
Mean	9.1	7.5	21.9	17.9	8.6	18.3	8.3	12.9	17.4
CD at 5%	3.00	0.54	4.82	5.00	2.20	4.29	1.10	1.12	4.87
CV%	19.30	4.30	12.56	16.48	14.97	13.80	7.27	5.56	15.57

Table 11.10 IVT Oat (Dual): Initial Varietal Trial in Oat (Dual): Seed Yield (q/ha)

Entries	Urulikan- chan	Ana- nd	Jha- nsi	Jabal- pur	Rai- pur	Rah- uri	*Ran- chi	Aver- age	Ra- nk	Superi- ority%
OL-1769	19.73	8.37	22.21	35.70	14.60	19.77	23.46	14.88	11	
OL-1804-1	19.20	11.89	32.39	37.20	15.87	26.22	33.73	18.19	7	
RSO-8	22.93	10.74	27.76	39.20	21.23	29.48	27.06	18.47	5	
OL-1871	32.00	5.15	24.98	27.50	21.80	24.48	34.13	16.88	9	
HFO-610	34.13	11.56	27.76	34.90	19.13	25.39	40.00	19.05	4	
RSO-60	18.13	16.44	27.76	35.00	21.30	25.31	43.46	17.46	8	
RO-11-1	30.93	7.15	27.76	33.70	13.34	23.07	34.66	15.69	10	
HFO-619	25.60	24.93	33.31	38.60	23.21	31.74	46.13	20.60	1	0.14
JO-10-501	22.40	13.89	33.31	39.90	11.47	29.51	42.13	18.27	6	
UPO-212 (NC)	38.93	14.56	29.61	40.20	20.51	22.88	41.33	19.92	2	
JHO-822 (NC)	28.26	10.31	30.54	41.00	18.69	31.63	48.80	19.29	3	
Mean	26.6	12.3	28.9	36.6	18.3	26.3	37.7	18.1		
CD at 5%	4.19	3.79	3.65	6.63	4.88	5.21	14.00			
CV%	9.21	16.99	2.18	10.73	15.65	11.62	21.66			

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

Table 12.1 AVT-1 Oat (Dual): First Advanced Varietal Trial in Oat (Dual): Green Forage Yield (q/ha) & Dry Matter Yield (q/ha)

Entries	GFY (q/ha)							DMY (q/ha)						
	North East Zone							North East Zone						
	Jorhat	Bhubaneswar	Ranchi	Faizabad	Average	Rank	Superiority%	Jorhat	Bhubaneswar	Ranchi	Faizabad	Average	Rank	Superiority%
OL-1802	175.5	161.3	90.0	141.4	142.1	6		33.9	34.9	12.4	40.3	30.4	6	
OL-1760-1	203.1	134.0	122.5	170.0	157.4	4		33.8	27.7	16.3	50.9	32.2	4	
NDO-11-01	196.8	175.0	87.5	194.3	163.4	3		35.7	35.2	11.5	50.9	33.3	2	
JHO-822 (NC)	217.3	182.0	87.5	176.9	165.9	2		41.0	37.3	12.9	51.4	35.6	1	
UPO-212 (NC)	202.7	183.5	80.0	205.7	168.0	1		32.1	37.7	8.8	51.1	32.5	3	
RO-19 (NC)	238.1	141.0	82.5	149.7	152.8	5		39.8	30.6	11.4	44.3	31.5	5	
Mean	205.6	162.8	91.7	173.0	158.3			36.1	33.9	12.2	48.1	32.6		
CD at 5%	3.3	11.7	23.7	36.6				3.2	2.5	3.1	6.7			
CV%	6.3	5.7	16.8	14.0				14.5	6.0	17.0	9.2			

Table 12.2 AVT-1 Oat (Dual): First Advanced Varietal Trial in Oat (Dual): Green Forage Yield (q/ha/day) & Dry Matter Yield (q/ha/day)

Entries	GFY (q/ha/day)						DMY (q/ha/day)					
	Jorhat	Bhubaneswar	Ranchi	Faizabad	Average	Rank	Jorhat	Bhubaneswar	Ranchi	Faizabad	Average	Rank
OL-1802	2.79	2.93	0.87	1.38	1.99	6	0.54	0.64	0.12	0.39	0.42	5
OL-1760-1	3.22	2.44	1.25	1.71	2.16	4	0.54	0.50	0.16	0.51	0.43	4
NDO-11-01	3.12	3.18	0.85	1.98	2.28	3	0.57	0.64	0.11	0.51	0.46	2
JHO-822 (NC)	3.45	3.31	0.87	1.82	2.36	1	0.65	0.68	0.14	0.53	0.50	1
UPO-212 (NC)	3.22	3.34	0.84	1.97	2.34	2	0.51	0.69	0.09	0.49	0.44	3
RO-19 (NC)	3.78	2.56	0.80	1.46	2.15	5	0.63	0.56	0.11	0.43	0.43	4
Mean	3.26	2.96	0.91	1.72	2.21		0.57	0.62	0.12	0.48	0.45	

Table 12.3 AVT-1 Oat (Dual): First Advanced Varietal Trial in Oat (Dual): Crude Protein Yield (q/ha) & Crude Protein (%)

Entries	CPY (q/ha)						Crude Protein (%)					
	Jorhat	Bhubaneswar	Ranchi	Faizabad	Average	Rank	Jorhat	Bhubaneswar	Ranchi	Faizabad	Average	Rank
OL-1802	3.7	3.1	1.3	3.4	2.9	3	11.2	9.0	10.5	8.5	9.8	1
OL-1760-1	3.6	2.6	1.3	4.1	2.9	3	10.8	9.4	8.1	8.1	9.1	3
NDO-11-01	3.7	3.4	0.9	4.2	3.1	2	10.4	9.7	8.1	8.3	9.1	3
JHO-822 (NC)	4.4	3.5	1.2	4.2	3.3	1	10.8	9.5	9.6	8.2	9.5	2
UPO-212 (NC)	3.2	3.6	0.7	4.3	2.9	3	10.1	9.5	8.1	8.4	9.0	4
RO-19 (NC)	4.1	2.7	0.7	3.5	2.8	4	10.4	9.0	6.3	8.0	8.4	5
Mean	3.8	3.2	1.0	4.0	3.0		10.6	9.4	8.5	8.3	9.2	

Table 12.4 AVT-1 Oat (Dual): First Advanced Varietal Trial in Oat (Dual): Plant Height (cm) & Leaf Stem Ratio

Entries	Plant Height (cm)						Leaf Stem Ratio				
	Jor-hat	Bhubaneswar	Ranchi	Faizabad	Average	Rank	Jor-hat	Bhubaneswar	Faizabad	Average	Rank
OL-1802	86.4	107.5	61.0	115.2	92.5	5	0.70	0.98	0.69	0.79	5
OL-1760-1	90.5	98.7	65.0	110.5	91.2	6	0.87	0.89	0.70	0.82	4
NDO-11-01	90.7	113.5	66.0	105.6	93.9	4	0.81	1.04	0.75	0.87	2
JHO-822 (NC)	90.8	117.5	58.0	111.6	94.5	3	0.66	1.09	0.72	0.82	4
UPO-212 (NC)	93.7	121.2	63.0	115.8	98.4	1	1.24	1.18	0.76	1.06	1
RO-19 (NC)	110.4	101.2	63.0	114.5	97.3	2	0.82	0.93	0.76	0.84	3
Mean	93.7	109.9	62.7	112.2	94.6		0.85	1.02	0.73	0.87	

Table 12.5 AVT-1 Oat (Dual): First Advanced Varietal Trial in Oat (Dual): ADF (%), NDF (%) & IVDMD (%)

Entries	ADF (%)		NDF (%)		IVDMD (%)	
	Ranchi	Rank	Ranchi	Rank	Ranchi	Rank
OL-1802	37.4	4	65.5	5	59.8	4
OL-1760-1	35.5	2	62.6	2	61.2	2
NDO-11-01	35.3	1	61.1	1	61.7	1
JHO-822 (NC)	38.5	5	66.1	6	59.3	5
UPO-212 (NC)	36.0	3	62.8	3	61.0	3
RO-19 (NC)	40.4	6	64.0	4	58.4	6
Mean	37.2		63.7		60.2	

Table 12.6 AVT-1 Oat (Dual): First Advanced Varietal Trial in Oat (Dual): Seed Yield (q/ha)

Entries	Bhubaneswar	Ranchi	Faizabad	Average	Rank
OL-1802	6.60	20.00	15.71	14.10	6
OL-1760-1	6.05	24.20	16.85	15.70	4
NDO-11-01	6.85	24.00	21.08	17.31	3
JHO-822 (NC)	7.10	18.00	21.85	15.65	5
UPO-212 (NC)	7.35	38.70	18.85	21.63	1
RO-19 (NC)	6.20	32.00	13.99	17.40	2
Mean	6.69	26.15	18.06	16.97	
CD at 5%	0.42	9.30	4.57		
CV%	5.20	23.46	16.83		

13. VT Lucerne (P) -2016: VARIETAL TRIAL IN LUCERNE (Perennial) - 2016 – 1ST YEAR

(Reference tables 13.1 to 13.8)

The trial was established in 2016 and in first year data of twelve entries including checks were reported by 13 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 VTL-1-8 (458.4q) ranked first followed by VTL-1-9 (456.7q) in NWZ; entry VTL-1-9 (556q) ranked first followed by VTL-1-3 (550.1q) in CZ; Entry VTL-1-11 (346.8 q) ranked first followed by VTL-1-10 (340.6q) in south zone. At all India level, VTL-1-9 top ranked with average yield of 437.1 q.

Similarly for dry matter yield (q/ha), entry VTL-1-2 (72.6) ranked first followed by VTL-1-9 (66.8q) in NWZ. Entry VTL-1-3 top ranked in CZ, South zone and all India level with average yield of 127.2 q, 81.9 q and 94.6 q respectively.

For fodder production potential, VTL-1-9 for green fodder and dry matter production potential (q/ha/day) was top ranker. For growth parameters, VTL-1-10 ranked first for plant height while for leaf stem ratio, entry VTL-1-9 was superior.

For quality parameters, Entry VTL-1-9 (17 q/ha) for CPY (q/ha) also for crude protein (20.8%) ranked first. For ADF% entry VTL-1-6 and for NDF and IVDMD VTL-1-7 ranked first.

Table 13.1 VT Lucerne (P)-2016: Varietal Trial in Lucerne (Perennial)-1st Year: Green Forage Yield (q/ha)

Entries	North West Zone						Central Zone					
	Ludhiana	Bikaner	Jalore	Udai-pur	Average	Rank	Rahuri	Urulikan- chan	Anand	Rai- pur	Average	Rank
VTL-1-1	461.8	239.8	118.7	833.0	413.3	9	540.9	872.2	409.0	242.6	516.2	5
VTL-1-2	481.7	251.5	186.7	842.7	440.6	5	507.5	844.0	536.0	261.1	537.1	3
VTL-1-3	411.7	325.4	168.0	827.4	433.1	6	554.2	976.3	418.0	251.9	550.1	2
VTL-1-4	356.7	287.4	210.7	819.1	418.5	8	479.1	912.2	415.0	235.2	510.4	8
VTL-1-6	179.2	267.5	236.0	830.2	378.2	12	432.0	810.5	466.0	253.7	490.5	11
VTL-1-7	362.5	367.1	256.0	792.7	444.6	3	444.8	763.9	493.0	283.3	496.3	10
VTL-1-8	472.5	327.0	254.0	780.2	458.4	1	537.5	917.1	338.0	231.4	506.0	9
VTL-1-9	550.8	324.0	195.3	756.6	456.7	2	562.0	933.0	468.0	261.1	556.0	1
VTL-1-10	455.0	258.9	174.7	816.3	426.2	7	448.2	868.5	384.0	253.7	488.6	12
VTL-1-11	408.3	353.5	176.3	824.7	440.7	4	466.7	882.8	441.0	274.1	516.1	6
VTL-1-12	395.0	266.3	187.3	728.9	394.4	11	432.3	944.5	426.0	241.0	510.9	7
VTL-1-13	417.5	282.1	126.0	777.5	400.8	10	575.6	845.2	468.0	240.7	532.4	4
Mean	412.7	295.9	190.8	802.4	425.5		498.4	880.8	438.5	252.5	517.6	
CD at 5%	47.6	38.6	15.7	53.4			74.4	79.0	78.5	34.4		
CV%	5.1	7.7	4.9	3.9			8.8	5.3	10.6	8.0		

Table 13.1 VT Lucerne (P)-2016: Varietal Trial in Lucerne (Perennial)-1st Year: Green Forage Yield (q/ha)

Entries	South Zone						All India		
	Hyderabad	Coimbatore	Mandya	Tirupati	Dharwad	Average	Rank	Average	Rank
VTL-1-1	208.3	526.6	326.9	23.1	323.1	281.6	11	394.3	11
VTL-1-2	227.7	533.0	374.4	32.7	326.4	298.8	8	415.8	4
VTL-1-3	188.8	807.5	301.3	24.5	342.2	332.9	3	430.5	2
VTL-1-4	191.6	546.4	340.1	38.4	320.8	287.5	9	396.4	10
VTL-1-6	208.3	593.0	266.8	24.4	291.9	276.9	12	373.8	12
VTL-1-7	224.9	603.0	376.1	19.2	300.8	304.8	7	406.7	7
VTL-1-8	199.9	556.9	297.6	40.8	318.3	282.7	10	405.5	8
VTL-1-9	216.6	723.3	352.5	23.2	315.8	326.3	4	437.1	1
VTL-1-10	291.6	672.2	370.3	41.4	327.8	340.6	2	412.5	5
VTL-1-11	247.1	775.5	350.9	22.6	338.1	346.8	1	427.8	3
VTL-1-12	252.7	638.9	357.9	31.5	327.2	321.6	5	402.3	9
VTL-1-13	216.6	650.0	330.2	24.5	363.3	316.9	6	409.0	6
Mean	222.8	635.5	337.1	28.8	324.7	309.8		409.3	
CD at 5%	56.8	8.0	39.8	3.0	23.7				
CV%	13.3	0.7	6.4	6.2	4.3				

Table 13.2 VT Lucerne (P)-2016: Varietal Trial in Lucerne (Perennial)-1st Year: Dry Matter Yield (q/ha)

Entries	North West Zone				Central Zone					
	Ludhiana	Bikaner	Average	Rank	Rahuri	Urulikanchan	Anand	Raipur	Average	Rank
VTL-1-1	61.6	59.7	60.6	7	148.6	174.0	92.5	66.5	120.4	6
VTL-1-2	85.7	59.5	72.6	1	121.1	173.7	120.3	59.6	118.7	7
VTL-1-3	43.0	79.2	61.1	6	134.7	193.1	94.3	86.7	127.2	1
VTL-1-4	40.1	68.8	54.5	11	125.3	180.5	90.6	87.5	121.0	5
VTL-1-6	19.1	66.2	42.6	12	110.9	162.8	101.2	94.2	117.3	9
VTL-1-7	39.4	89.0	64.2	4	115.9	148.0	106.1	89.3	114.8	10
VTL-1-8	49.9	75.3	62.6	5	136.6	182.7	74.6	100.5	123.6	3
VTL-1-9	58.9	74.7	66.8	2	133.1	184.5	100.5	87.9	126.5	2
VTL-1-10	49.7	60.2	54.9	9	106.7	165.9	85.7	85.9	111.0	12
VTL-1-11	47.2	82.2	64.7	3	118.2	174.4	93.9	101.3	122.0	4
VTL-1-12	46.6	66.1	56.4	8	109.2	182.2	92.4	61.2	111.3	11
VTL-1-13	47.8	61.6	54.7	10	143.3	159.5	100.3	67.8	117.7	8
Mean	49.1	70.2	59.6		125.3	173.4	96.0	82.4	119.3	
CD at 5%	10.6	10.0			18.6	15.5	17.6	16.6		
CV%	5.7	8.4			8.8	5.2	10.8	11.8		

Table 13.2 VT Lucerne (P)-2016: Varietal Trial in Lucerne (Perennial)-1st Year: Dry Matter Yield (q/ha)

Entries	South Zone							All India	
	Hyderabad	Coimbatore	Mandya	Tirupati	Dharwad	Average	Rank	Average	Rank
VTL-1-1	39.5	128.3	65.6	7.7	89.7	66.1	9	84.9	7
VTL-1-2	46.3	129.1	56.5	9.5	89.1	66.1	9	86.4	4
VTL-1-3	38.3	206.1	62.1	8.5	94.5	81.9	1	94.6	1
VTL-1-4	37.7	138.7	64.4	10.6	88.3	67.9	8	84.8	8
VTL-1-6	42.3	144.3	42.9	7.3	81.5	63.7	11	79.3	11
VTL-1-7	43.8	144.9	67.3	6.7	87.8	70.1	7	85.3	6
VTL-1-8	40.5	137.3	41.4	13.9	89.1	64.5	10	85.6	5
VTL-1-9	43.4	178.6	58.8	7.7	87.5	75.2	3	92.3	2
VTL-1-10	56.4	163.8	60.6	12.3	84.6	75.5	2	84.7	9
VTL-1-11	50.3	186.6	40.7	8.0	78.3	72.8	4	89.2	3
VTL-1-12	47.6	157.5	48.8	8.9	90.7	70.7	6	82.8	10
VTL-1-13	43.4	162.1	51.0	8.2	93.5	71.7	5	85.3	6
Mean	44.1	156.5	55.0	9.1	87.9	70.5		86.3	
CD at 5%	14.3	5.1	12.4	1.8	9.2				
CV%	16.0	1.9	6.7	11.2	6.2				

Table 13.3 VT Lucerne (P)-2016: Varietal Trial in Lucerne (Perennial)-1st Year: Green Forage Yield (q/ha/day) & Dry Matter Yield (q/ha/day)

Entries	GFY (q/ha.day)								DMY (q/ha/day)							
	Ludhiana	Bikaner	Rahuri	Anand	Raipur	Dharwad	Average	Rank	Ludhiana	Bikaner	Rahuri	Anand	Raipur	Dharwad	Average	Rank
VTL-1-1	2.80	1.53	2.85	2.38	2.55	1.79	2.32	6	0.20	0.38	0.78	0.54	0.70	0.50	0.52	3
VTL-1-2	2.90	1.60	2.67	3.12	2.75	1.81	2.48	2	0.30	0.38	0.64	0.70	0.63	0.50	0.52	3
VTL-1-3	2.50	2.07	2.92	2.43	2.65	1.90	2.41	4	0.10	0.50	0.71	0.55	0.91	0.53	0.55	2
VTL-1-4	2.10	1.83	2.52	2.41	2.48	1.78	2.19	9	0.10	0.44	0.66	0.53	0.92	0.49	0.52	3
VTL-1-6	1.10	1.70	2.27	2.71	2.67	1.62	2.01	10	0.02	0.42	0.58	0.59	0.99	0.45	0.51	4
VTL-1-7	2.20	2.34	2.34	2.87	2.98	1.67	2.40	5	0.10	0.57	0.61	0.62	0.94	0.49	0.55	2
VTL-1-8	2.80	2.08	2.83	1.97	2.44	1.77	2.32	6	0.10	0.48	0.72	0.43	1.06	0.49	0.55	2
VTL-1-9	3.30	2.06	2.96	2.72	2.75	1.75	2.59	1	0.20	0.48	0.70	0.58	0.93	0.49	0.56	1
VTL-1-10	2.70	1.65	2.36	2.23	2.67	1.82	2.24	7	0.10	0.38	0.56	0.50	0.90	0.47	0.49	5
VTL-1-11	2.40	2.25	2.46	2.56	2.89	1.88	2.41	4	0.10	0.52	0.62	0.55	1.07	0.43	0.55	2
VTL-1-12	2.40	1.70	2.28	2.48	2.54	1.82	2.20	8	0.10	0.42	0.57	0.54	0.64	0.50	0.46	6
VTL-1-13	2.50	1.80	3.03	2.72	2.53	2.02	2.43	3	0.10	0.39	0.75	0.58	0.71	0.52	0.51	4
Mean	2.48	1.88	2.62	2.55	2.66	1.80	2.33		0.13	0.45	0.66	0.56	0.87	0.49	0.52	

Table 13.4 VT Lucerne (P)-2016: Varietal Trial in Lucerne (Perennial)-1st Year: Crude Protein Yield (q/ha)

Entries	Ludhiana	Bikaner	Rahuri	Urulikanchan	Anand	Raipur	Hyderabad	Coimbatore	Mandya	Average	Rank
VTL-1-1	13.0	9.8	23.1	31.3	22.0	10.7	8.1	4.9	14.3	15.2	6
VTL-1-2	20.0	9.6	18.5	32.1	28.0	9.7	7.9	3.6	9.4	15.4	5
VTL-1-3	9.7	13.6	20.8	35.7	21.9	13.9	7.3	8.2	12.6	16.0	2
VTL-1-4	9.5	12.0	20.6	32.1	20.9	13.8	5.1	3.7	13.5	14.6	9
VTL-1-6	4.4	12.3	20.6	29.5	23.6	15.6	8.7	5.7	9.4	14.4	10
VTL-1-7	9.4	16.7	19.3	26.0	25.0	14.1	8.6	5.9	14.7	15.5	4
VTL-1-8	10.0	11.9	23.0	34.0	16.9	16.2	8.8	6.6	6.5	14.9	7
VTL-1-9	12.8	15.2	21.3	33.7	23.3	15.1	10.0	8.0	13.4	17.0	1
VTL-1-10	10.5	10.3	17.5	29.1	20.3	13.8	11.9	7.0	11.6	14.7	8
VTL-1-11	8.4	14.0	18.1	32.4	22.1	17.7	11.7	8.6	8.6	15.7	3
VTL-1-12	11.1	12.1	17.9	33.3	21.2	10.0	11.0	8.5	9.4	14.9	7
VTL-1-13	10.5	10.2	22.3	27.5	23.6	11.1	9.3	6.8	10.3	14.6	9
Mean	10.8	12.3	20.2	31.4	22.4	13.5	9.0	6.5	11.1	15.2	

Table 13.5 VT Lucerne (P)-2016: Varietal Trial in Lucerne (Perennial)-1st Year: Crude Protein (%)

Entries	Ludhiana	Bikaner	Rahuri	Urulikanchan	Anand	Raipur	Hyderabad	Coimbatore	Mandya	Average	Rank
VTL-1-1	21.1	16.5	15.5	18.0	23.0	16.0	20.6	24.1	21.9	19.6	5
VTL-1-2	23.3	16.1	15.3	18.5	22.4	16.3	17.1	17.1	16.6	18.1	11
VTL-1-3	22.5	17.2	15.5	18.5	22.5	16.0	19.0	21.0	20.1	19.1	8
VTL-1-4	23.6	17.5	16.4	17.8	22.8	15.9	13.6	15.3	21.0	18.2	10
VTL-1-6	22.9	18.6	18.6	18.1	22.5	16.5	20.7	23.2	21.9	20.3	3
VTL-1-7	23.9	18.8	16.6	17.6	22.6	15.9	19.8	21.9	21.9	19.9	4
VTL-1-8	20.0	15.8	16.8	18.6	22.3	16.1	21.8	24.5	15.8	19.1	8
VTL-1-9	21.8	20.4	16.0	18.3	22.7	17.1	23.0	25.4	22.8	20.8	1
VTL-1-10	21.1	17.1	16.4	17.5	22.5	16.0	21.1	23.6	19.3	19.4	7
VTL-1-11	17.8	17.0	15.3	18.6	22.7	17.5	23.4	25.4	21.0	19.9	4
VTL-1-12	23.9	18.3	16.4	18.3	22.1	16.3	23.0	26.3	19.3	20.4	2
VTL-1-13	21.9	16.5	15.5	17.2	22.9	16.4	21.5	23.6	20.1	19.5	6
Mean	22.0	17.5	16.2	18.1	22.6	16.3	20.4	22.6	20.1	19.5	

Table 13.6 VT Lucerne (P)-2016: Varietal Trial in Lucerne (Perennial)-1st Year: Plant Height (cm)

Entries	Ludhiana	Bikaner	Udaipur	Rahuri	Urulikanchan	Anand	Raipur	Mandya	Tirupati	Average	Rank
VTL-1-1	62.4	61.8	70.0	49.8	64.3	71.7	56.3	65.5	50.4	61.4	8
VTL-1-2	67.3	56.8	73.2	47.7	68.3	74.7	58.4	65.4	45.2	61.9	7
VTL-1-3	77.4	62.8	68.9	51.9	65.7	72.3	54.3	62.1	46.9	62.5	6
VTL-1-4	67.5	54.0	69.6	50.2	53.2	72.0	50.8	67.5	59.8	60.5	11
VTL-1-6	54.3	64.0	71.3	50.4	64.2	72.8	63.7	67.9	60.2	63.2	5
VTL-1-7	74.7	58.5	73.7	51.0	65.0	73.9	61.4	73.9	55.6	65.3	2
VTL-1-8	64.2	52.3	68.1	50.0	54.7	69.3	55.7	66.7	47.6	58.7	12
VTL-1-9	70.4	58.5	72.5	50.7	69.3	73.5	59.2	73.1	49.0	64.0	4
VTL-1-10	86.9	67.3	75.6	54.3	58.2	71.0	55.4	74.8	55.6	66.6	1
VTL-1-11	85.2	65.3	69.6	51.4	61.3	72.8	54.2	72.3	51.4	64.8	3
VTL-1-12	63.4	58.5	65.2	51.5	54.5	75.0	55.5	68.8	53.2	60.6	10
VTL-1-13	76.3	53.3	71.3	52.1	58.3	73.5	62.8	72.5	56.2	64.0	4
Mean	70.8	59.4	70.8	50.9	61.4	72.7	57.3	69.2	52.6	62.8	

Table 13.7 VT Lucerne (P)-2016: Varietal Trial in Lucerne (Perennial)-1st Year: Leaf Stem Ratio

Entris	Ludhiana	Bikaner	Rahuri	Urulikanchan	Raipur	Mandya	Average	Rank
VTL-1-1	1.00	1.50	1.86	0.76	0.97	0.52	1.10	7
VTL-1-2	0.90	1.10	1.90	0.98	1.24	0.57	1.11	6
VTL-1-3	1.20	1.30	1.94	0.88	1.03	0.58	1.16	3
VTL-1-4	0.80	1.50	1.38	1.05	0.94	0.58	1.04	9
VTL-1-6	0.80	1.40	1.99	1.01	1.21	0.56	1.16	3
VTL-1-7	1.00	1.20	2.57	0.92	0.80	0.67	1.19	2
VTL-1-8	1.00	1.30	2.13	0.93	0.98	0.51	1.14	4
VTL-1-9	1.20	1.40	2.23	0.87	0.88	0.63	1.20	1
VTL-1-10	1.00	1.10	2.33	0.97	0.84	0.73	1.16	3
VTL-1-11	0.90	1.10	1.98	0.97	0.67	0.69	1.05	8
VTL-1-12	1.00	1.50	1.88	0.83	1.34	0.59	1.19	2
VTL-1-13	1.00	1.20	2.08	0.83	1.04	0.62	1.13	5
Mean	0.98	1.30	2.02	0.92	1.00	0.60	1.14	

Table 13.8 VT Lucerne (P)-2016: Varietal Trial in Lucerne (Perennial)-1st Year: ADF (%), NDF (%) & IVDMD (%)

Entries	ADF (%)				NDF (%)				IVDMD (%)			
	Ludhiana	Rahuri	Average	Rank	Ludhiana	Rahuri	Average	Rank	Ludhiana	Rahuri	Average	Rank
VTL-1-1	23.4	29.8	26.6	7	31.8	40.5	36.1	5	68.7	65.6	67.1	8
VTL-1-2	20.7	38.7	29.7	10	31.0	47.9	39.5	10	71.4	58.5	65.0	10
VTL-1-3	22.4	33.9	28.2	9	32.4	43.7	38.1	9	72.3	62.8	67.6	5
VTL-1-4	20.1	31.4	25.7	3	31.4	40.6	36.0	4	71.2	64.2	67.7	4
VTL-1-6	20.1	26.4	23.2	1	32.2	36.4	34.3	2	69.4	68.0	68.7	2
VTL-1-7	20.0	27.6	23.8	2	30.4	37.2	33.8	1	71.2	67.2	69.2	1
VTL-1-8	23.4	28.6	26.0	4	32.8	38.1	35.5	3	68.1	66.3	67.2	7
VTL-1-9	22.6	25.1	23.8	2	33.1	34.4	33.8	1	68.6	68.6	68.6	3
VTL-1-10	22.9	29.7	26.3	6	33.2	41.2	37.2	8	69.2	65.5	67.4	6
VTL-1-11	24.6	30.9	27.8	8	34.1	38.9	36.5	6	67.4	65.1	66.3	9
VTL-1-12	19.8	32.6	26.2	5	29.9	44.4	37.1	7	70.3	62.3	66.3	9
VTL-1-13	21.2	38.1	29.7	10	33.0	47.2	40.1	11	69.2	58.4	63.8	11
Mean	21.8	31.1	26.4		32.1	40.9	36.5		69.8	64.4	67.1	

14. VT Vicia (P): Varietal trials in Vicia (Perennial) -1st Year

(Reference tables 14.1 to 14.4)

In varietal trial on Vicia, five entries were evaluated at three centers. The entries were coded and being evaluated. For green fodder yield JVS-1 (11.1%) and JVS-2 (9.5%) showed superiority over the general mean. Similarly for dry matter yield, JVS-1 (12.1%) and JVS-2 (7.1%) showed superiority over the general mean. For fodder production (q/ha/day), entry JVS-5 for green fodder and JVS-1 for dry matter ranked first. For crude protein yield (q/ha) entry JVS-4 and for crude protein % entry JVS-5 were superior. For plant height, entry JVS-2 was top ranked followed by JVS-1. For leafiness entry JVS-1 was top ranked followed by JVS-5.

15. IVT Lolium (P): Varietal trials in rye grass (Annual)

(Reference tables 15.1 to 15.5)

In Initial varietal trial on Lolium, five entries were evaluated along with one check at five centers. For green fodder yield, PBRG-2 (8.4%) followed by Palam rye grass -1 (7.1%) showed superiority over the check. For dry matter entry PBRG-2 (12.3%), Palam rye grass -2 (8.7%), Palam rye grass -1 (6.3%) 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) CP (%), ADF %, NDF%, entry Palam rye gras-1 ranked first. For plant height PBRG-2 and for leafiness national check PBRG-1 ranked first.

16. VT Red Clover 2016: VARIETAL TRIAL IN RED CLOVER (Perennial) - 2016 – 1ST YEAR

(Reference tables 16.1)

This being the establishment year, the data recording and analysis will be done from next year onwards.

17. VT White Clover 2016: VARIETAL TRIAL IN WHITE CLOVER (Perennial) - 2016 – 1ST YEAR

(Reference tables 17.1)

This being the establishment year, the data recording and analysis will be done from next year onwards.

Table 14.1 IVT Vicia (P): Varietal Trial in Vicia (Perennial)-1st Year: Green Forage Yield & Dry Matter Yield (q/ha)

Entries	Green Forage Yield (q/ha)						Dry Matter Yield (q/ha)					
	Jabal-pur	Rah- uri	Rai- pur	Aver- age	Ra- nk	Superi- ority%	Jabal- pur	Rah- uri	Rai- pur	Aver- age	Ra- nk	Superi- ority%
JVS-1	310.9	201.0	93.2	201.7	1	11.1	61.0	64.8	26.7	50.8	1	12.1
JVS-2	315.0	176.0	105.0	198.7	2	9.5	61.6	58.4	25.4	48.5	2	7.1
JVS-3	272.0	159.1	97.4	176.1	3		52.7	52.8	23.0	42.8	3	
JVS-4	190.1	200.5	95.8	162.2	5		36.3	68.7	23.3	42.8	3	
JVS-5	216.5	188.3	101.7	168.9	4		43.0	55.3	27.0	41.8	4	
Mean	260.9	185.0	98.6	181.5			50.9	60.0	25.1	45.3		
CD at 5%	45.9	24.6	12.6				1.3	8.1	4.2			
CV%	11.4	8.6	18.4				11.2	8.8	10.9			

Table 14.2 IVT Vicia (P): Varietal Trial in Vicia (Perennial)-1st Year: GFY (q/ha/day) & DMY (q/ha/day)

Entries	GFY (q/ha/day)				DMY (q/ha/day)			
	Rahuri	Raipur	Average	Rank	Rahuri	Raipur	Average	Rank
JVS-1	2.16	0.92	1.54	2	0.70	0.32	0.51	1
JVS-2	1.87	0.99	1.43	4	0.62	0.27	0.45	4
JVS-3	1.71	0.98	1.35	5	0.57	0.24	0.40	5
JVS-4	2.13	0.92	1.53	3	0.73	0.25	0.49	2
JVS-5	2.03	1.07	1.55	1	0.59	0.28	0.44	3
Mean	1.98	0.98	1.48		0.64	0.27	0.46	

Table 14.3 IVT Vicia (P): Varietal Trial in Vicia (Perennial)-1st Year: Crude Protein Yield (q/ha) & Crude Protein (%)

Entries	Crude Protein Yield (q/ha)					Crude Protein (%)				
	Rahuri	Raipur	Jabalpur	Average	Rank	Rahuri	Raipur	Jabalpur	Average	Rank
JVS-1	10.1	4.2	8.7	7.6	3	15.5	15.7	14.6	15.3	5
JVS-2	10.6	4.0	8.8	7.8	2	18.2	15.9	14.6	16.2	4
JVS-3	11.7	3.5	7.5	7.6	3	22.2	15.3	14.5	17.3	3
JVS-4	15.4	3.7	5.1	8.1	1	22.5	15.7	14.3	17.5	2
JVS-5	13.5	4.0	5.9	7.8	2	24.4	14.9	14.5	17.9	1
Mean	12.3	3.9	7.2	7.8		20.5	15.5	16.8	3.0	

Table 14.4 IVT Vicia (P): Varietal Trial in Vicia (Perennial)-1st Year: Plant Height (cm) & Leaf Stem Ratio

Entries	Plant Height (cm)					L/S Ratio				
	Jabalpur	Rahuri	Raipur	Average	Rank	Jabalpur	Rahuri	Raipur	Average	Rank
JVS-1	93.5	67.8	81.6	81.0	2	1.19	1.00	0.46	0.88	1
JVS-2	102.6	72.7	73.5	82.9	1	1.05	0.60	0.56	0.74	5
JVS-3	91.4	69.7	70.7	77.3	3	1.02	0.70	0.61	0.78	3
JVS-4	84.9	68.6	77.0	76.8	4	0.96	0.60	0.76	0.77	4
JVS-5	87.3	64.8	72.0	74.7	5	1.14	0.60	0.75	0.83	2
Mean	91.9	68.7	74.9	78.5		1.07	0.70	0.63	0.80	

Table 15.1 IVT 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-osity%	Palam-pur	Sri-nagar	Alm-ora	Baja-ura	Ludh-iana	Aver-age	Ra-nk	Superi-osity%
Palam rye grass-2	529.1	252.3	105.1	399.6	771.4	411.5	3	3.8	109.9	70.6	18.9	85.5	96.4	76.3	2	8.7
Palam rye grass-1	527.7	281.5	133.5	367.5	811.9	424.4	2	7.1	92.9	82.6	21.4	78.6	97.4	74.6	3	6.3
PBRG-2	495.3	308.6	108.7	343.3	891.7	429.5	1	8.4	107.3	88.5	17.4	73.6	107.1	78.8	1	12.3
Advanta RG-1	470.3	305.5	104.6	319.4	702.1	380.4	6		93.1	86.5	18.8	68.5	87.7	70.9	5	1.0
Advanta RG-2	495.3	270.8	100.7	368.2	750.0	397.0	4	0.2	102.5	77.4	16.1	78.8	90.0	73.0	4	4.0
PBRG-1 (NC)	493.5	258.5	103.4	337.2	789.3	396.4	5		91.8	73.0	16.5	72.3	97.5	70.2	6	
Mean	501.9	279.5	109.3	355.9	786.1	406.5			99.6	79.8	18.2	76.2	96.0	74.0		
CD at 5%	38.5	15.3	10.9	15.0	107.4				NS	2.3	1.8	3.2	5.3			
CV%	5.1	7.2	6.6	8.4	9.1				11.6	5.1	6.6	8.5	8.9			

Table 15.2 IVT 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	4.30	4	0.50	2
Palam rye grass-1	4.50	2	0.50	2
PBRG-2	4.90	1	0.60	1
Advanta RG-1	3.90	6	0.50	2
Advanta RG-2	4.10	5	0.50	2
PBRG-1 (NC)	4.40	3	0.50	2
Mean	4.35		0.52	

Table 15.3 IVT Lolium-2016: Varietal Trial in Rye grass (Annual): Crude Protein Yield (q/ha) & Crude Protein (%)

Entries	CPY (q/ha)				Crude Protein (%)			
	Palampur	Ludhiana	Average	Rank	Palampur	Ludhiana	Average	Rank
Palam rye grass-2	14.2	15.4	14.8	3	12.9	16.0	14.5	3
Palam rye grass-1	13.4	17.4	15.4	1	14.4	17.9	16.2	1
PBRG-2	12.7	17.1	14.9	2	11.8	16.0	13.9	5
Advanta RG-1	11.6	15.1	13.4	4	12.5	17.2	14.8	2
Advanta RG-2	12.1	14.2	13.2	5	11.8	15.8	13.8	6
PBRG-1 (NC)	10.2	16.5	13.4	4	11.2	16.9	14.0	4
Mean	12.4	16.0	14.2		12.4	16.6	14.5	

Table 15.4 IVT Lolium-2016: Varietal Trial in Rye grass (Annual): Plant Height (cm) & Leaf Stem Ratio

Entries	Plant Height (cm)						L/S Ratio				
	Palampur	Srinagar	Bajaura	Ludhiana	Average	Rank	Palampur	Srinagar	Ludhiana	Average	Rank
Palam rye grass-2	55.2	62.3	84.6	42.8	61.2	4	0.60	1.62	2.70	1.64	2
Palam rye grass-1	52.6	74.3	78.1	40.8	61.5	2	0.70	1.67	2.10	1.49	6
PBRG-2	51.8	82.3	79.8	41.5	63.8	1	0.50	1.69	2.60	1.60	4
Advanta RG-1	45.6	81.4	71.9	37.0	59.0	5	0.50	1.60	2.80	1.63	3
Advanta RG-2	52.7	77.9	74.1	40.5	61.3	3	0.50	1.46	2.80	1.59	5
PBRG-1 (NC)	54.9	65.7	73.8	41.5	59.0	5	0.60	1.47	2.90	1.66	1
Mean	52.1	74.0	77.0	40.7	61.0		0.57	1.59	2.65	1.60	

Table 15.5 IVT Lolium-2016: Varietal Trial in Rye grass (Annual): ADF (%) & NDF (%)

Entries	ADF (%)				NDF (%)			
	Ludhiana	Palampur	Average	Rank	Ludhiana	Palampur	Average	Rank
Palam rye grass-2	20.5	34.6	27.6	2	44.6	49.8	47.2	2
Palam rye grass-1	18.2	36.4	27.3	1	43.8	49.2	46.5	1
PBRG-2	19.2	39.8	29.5	4	45.2	52.6	48.9	4
Advanta RG-1	18.7	39.2	29.0	3	44.1	51.8	48.0	3
Advanta RG-2	19.9	45.0	32.5	5	44.9	54.0	49.5	6
PBRG-1 (NC)	18.9	40.0	29.5	4	44.2	53.8	49.0	5
Mean	19.2	39.2	29.2		44.5	51.9	48.2	

Table 16.1 VT Red Clover-2016: Varietal Trial in Red Clover (Perennial) -1st Year: Green Forage Yield & Dry Matter Yield (q/ha)

Entries	GFY (q/ha)		DMY (q/ha)	
	Almora	Rank	Almora	Rank
VTRC-1-1	25.8	6	5.2	5
VTRC-1-2	39.1	2	6.3	3
VTRC-1-3	19.2	7	3.1	6
VTRC-1-4	34.3	4	6.2	4
VTRC-1-5	40.2	1	6.4	2
VTRC-1-6	34.2	5	6.2	4
VTRC-1-7	37.5	3	6.7	1
Mean	32.9		5.7	
CD at 5%	7.6		1.3	
CV%	12.8		12.9	

Table 17.1 VT White Clover-2016: Varietal Trial in White Clover (Perennial) -1st Year: Green Forage Yield & Dry Matter Yield (q/ha)

Entries	Almora	Rank	Almora	Rank
VTWC-1-1	64.6	4	14.2	4
VTWC-1-2	70.4	2	15.5	2
VTWC-1-3	61.8	5	12.4	5
VTWC-1-4	51.2	6	10.2	6
VTWC-1-5	75.8	1	16.7	1
VTWC-1-6	67.7	3	14.9	3
Mean	65.2		14.0	
CD at 5%	5.8		1.3	
CV%	5.9		5.9	

**18. AVTO (SC)-2: SECOND ADVANCED VARIETAL TRIAL IN OAT (SINGLE CUT)
REPEAT 14-15**

(Reference tables 18.1 to 18.4)

In Oat (single cut), AVT-2 trial was repeated. Seven entries were evaluated against two national checks (Kent, OS-6) and one zonal checks at 3 locations in south zone.

For green forage yield (q/ha), entry OS-405 (11.4 %) in SZ registered superiority over best zonal/national check. In dry matter production (q/ha), entry OS-405 (15.8%) followed by OL-1760 (7.3%) performed better than checks in SZ.

For fodder production potential (q/ha/day), entries RSO-59 and OS-405 exhibited superiority over best check for green forage production potential. For dry matter production potential entry OS-405 followed by RSO-59 ranked first and second respectively. For growth parameter, plant height and leafiness, checks were adjudged best performers.

For quality parameters, OS-405 (8.4 q/ha) and national check ranked first for crude protein yield and crude protein content respectively. For crude protein yield (q/ha), OS-405 (8.4q) followed by SKO-190 (7.3 q) were superior to the best national check OS-6 (7.2q). For crude protein content (%) national check OS-6 was best.

**19. VT- LUCERNE (P) REPEAT: VARIETAL TRIAL IN LUCERNE (P)-2013 REPEAT
(Reference tables 19.1 to 19.2)**

In Lucerne repeat trial, five entries were evaluated against 2 checks, at 3 locations in south zone. For GFY and DMY entry TNLC-14 ranked first with 9.9% and 7.2% superiority respectively over the best check. For crude protein yield also TNLC-14 (10.1) ranked first as against the best check (9.5), For crude protein % national check Anand-2 ranked first.. For plant height RL-10-2 and for leafiness check Anand -2 ranked fist.

Table 18.1: Repeat AVT Oat (SC)-2: Second Advanced Varietal Trial in Oats (Single cut) (Repeat 14-15): Green Forage Yield (q/ha) & Dry Matter Yield (q/ha/day)

Entries	GFY (q/ha)						DMY (q/ha)					
	Hyderab- bad	Man- dya	Coimb- atore	Aver- age	Ra- nk	Superi- ority%	Hydera- bad	Man- dya	Coimba- tore	Aver- age	Ra- nk	Superi- ority%
SKO-190	216.6	318.5	322.2	285.8	5		43.5	72.3	64.5	60.1	4	2.2
JHO-2012-2	199.9	239.3	394.4	277.9	6		40.3	52.6	80.7	57.9	7	
RSO-59	269.3	316.4	291.7	292.5	2	0.9	52.0	67.0	65.4	61.4	3	4.4
RSO-60	252.7	285.3	272.2	270.1	8		46.1	70.5	51.7	56.1	8	
OS-405	319.3	323.9	325.0	322.7	1	11.4	69.2	71.1	64.1	68.1	1	15.8
JHO-2012-1	272.1	238.9	308.3	273.1	7		60.0	53.2	62.8	58.7	6	
OL-1760	244.3	301.6	330.6	292.2	3	0.8	55.8	62.6	70.9	63.1	2	7.3
OS-6 (NC)	255.5	245.1	252.8	251.1	10		54.2	49.2	60.9	54.8	9	
Kent (NC)	216.6	313.9	338.9	289.8	4		44.1	61.0	71.2	58.8	5	
JHO-2000-4 (ZC-SZ)	233.2	250.1	280.6	254.6	9		50.2	51.9	54.9	52.3	10	
Mean	248.0	283.3	311.7	281.0			51.5	61.1	64.7	59.1		
CD at 5%	56.8	30.6	19.9				14.3	6.3	7.1			
CV%	13.3	6.3	3.7				16.0	6.0	6.4			

Table 18.2: Repeat AVT Oat (SC)-2: Second Advanced Varietal Trial in Oats (Single cut) (Repeat 14-15): Green Forage Yield (q/ha/day) Dry Matter Yield (q/ha/day)

Entries	GFY (q/ha/day)					DMY (q/ha/day)			
	Hyderabad	Mandya	Coimbatore	Average	Rank	Hyderabad	Coimbatore	Average	Rank
SKO-190	2.98	4.19	3.84	3.67	6	0.60	0.77	0.68	9
JHO-2012-2	2.66	2.98	4.93	3.52	8	0.54	1.01	0.77	5
RSO-59	4.13	4.75	3.89	4.26	1	0.80	0.87	0.84	2
RSO-60	3.72	4.37	3.20	3.76	5	0.68	0.61	0.64	10
OS-405	4.77	4.00	3.87	4.21	2	1.03	0.76	0.90	1
JHO-2012-1	3.92	3.03	3.71	3.55	7	0.86	0.76	0.81	4
OL-1760	3.43	3.88	4.03	3.78	4	0.78	0.87	0.82	3
OS-6 (NC)	3.57	3.68	3.16	3.47	9	0.76	0.76	0.76	6
Kent (NC)	3.04	4.57	4.03	3.88	3	0.62	0.85	0.73	7
JHO-2000-4 (ZC-SZ)	3.40	3.33	3.51	3.41	10	0.73	0.69	0.71	8
Mean	3.56	3.88	3.82	3.75		0.74	0.79	0.77	

Table 18.3: Repeat AVT Oat (SC)-2: Second Advanced Varietal Trial in Oats (Single cut) (Repeat 14-15): Crude Protein Yield (q/ha), Crude Protein (%)

Entries	CPY (q/ha)					CP (%)				
	Coimbatore	Hyderabad	Mandya	Average	Rank	Coimbatore	Hyderabad	Mandya	Average	Rank
SKO-190	9.6	3.4	8.9	7.3	2	14.9	7.9	12.3	11.7	4
JHO-2012-2	9.9	3.2	6.5	6.5	7	12.3	7.9	12.3	10.8	7
RSO-59	6.9	4.3	8.8	6.7	5	10.5	8.3	13.1	10.6	8
RSO-60	7.9	4.0	8.0	6.6	6	15.3	8.7	11.4	11.8	3
OS-405	10.4	5.5	9.3	8.4	1	16.2	7.9	13.1	12.4	2
JHO-2012-1	7.7	5.2	7.0	6.6	6	12.3	8.7	13.1	11.4	5
OL-1760	7.1	4.9	8.2	6.7	5	10.1	8.7	13.1	10.6	8
OS-6 (NC)	9.6	5.2	6.7	7.2	3	15.8	9.6	13.6	13.0	1
Kent (NC)	9.1	3.5	8.0	6.9	4	12.7	7.9	13.1	11.2	6
JHO-2000-4 (ZC-SZ)	5.7	4.4	6.2	5.4	8	10.5	8.8	11.8	10.4	9
Mean	8.4	4.4	7.8	6.8		13.0	8.4	12.7	11.4	

Table 18.4: Repeat AVT Oat (SC)-2: Second Advanced Varietal Trial in Oats (Single cut) (Repeat 14-15): Plant Height (cm) & Leaf Stem Ratio

Entries	Plant Height (cm)					Leaf Stem Ratio				
	Hyderabad	Mandya	Coimbatore	Average	Rank	Hyderabad	Mandya	Coimbatore	Average	Rank
SKO-190	87.8	93.5	107.3	96.2	6	0.45	0.79	0.40	0.55	2
JHO-2012-2	96.8	101.0	108.3	102.0	2	0.39	0.74	0.39	0.51	4
RSO-59	60.9	84.5	95.0	80.1	10	0.50	0.67	0.47	0.55	2
RSO-60	73.6	78.7	92.7	81.7	9	0.41	0.59	0.30	0.43	7
OS-405	100.5	110.5	89.0	100.0	3	0.43	0.73	0.47	0.54	3
JHO-2012-1	83.4	87.6	109.0	93.3	7	0.34	0.88	0.47	0.56	1
OL-1760	90.1	96.7	102.5	96.4	5	0.39	0.80	0.31	0.50	5
OS-6 (NC)	100.0	81.6	94.0	91.9	8	0.26	0.74	0.39	0.46	6
Kent (NC)	92.3	103.7	111.0	102.3	1	0.33	0.85	0.36	0.51	4
JHO-2000-4 (ZC-SZ)	96.9	84.1	111.7	97.6	4	0.41	0.74	0.52	0.56	1
Mean	88.2	92.2	102.1	94.2		0.39	0.75	0.41	0.52	

Table 19.1 VT Repeat Lucerne (P)-2013: Varietal Trial in Lucerne (Perennial)-1st Year: Green Forage Yield (q/ha) & Dry Matter Yield (q/ha/day)

Entries	GFY (q/ha)						DMY (q/ha)					
	Hyderabad	Coimbatore	Mandya	Average	Rank	Superiority%	Hyderabad	Coimbatore	Mandya	Average	Rank	Superiority%
TNLC-14	269.3	816.0	294.8	460.0	1	9.9	49.4	205.2	77.1	110.5	1	7.2
Anand-25	266.6	652.3	291.9	403.6	3		51.6	160.2	72.9	94.9	3	
Anand-26	283.2	616.4	264.7	388.1	4		59.5	148.2	68.6	92.1	4	
RL-10-2	227.7	590.6	303.2	373.8	6		44.7	145.7	79.8	90.1	6	
ALP-1-1	249.9	644.8	240.5	378.4	5		50.8	158.9	65.6	91.8	5	
Anand-2 (NC)	241.6	605.2	265.5	370.8	7		50.1	149.7	69.1	89.6	7	
RL-88 (NC)	238.8	778.3	238.2	418.4	2		48.5	195.6	65.3	103.1	2	
Mean	253.9	671.9	271.2	399.0			50.7	166.2	71.2	96.0		
CD at 5%	21.0	4.9	15.2				6.4	4.4	6.6			
CV%	4.6	0.5	6.0				7.1	1.8	8.9			

Table 19.2 VT Repeat Lucerne (P)-2013: Varietal Trial in Lucerne (Perennial)-1st Year: Green Forage Yield (q/ha/day), Crude Protein Yield (q/ha), Crude Protein (%), Plant height (cm), Leaf stem ratio

Entries	Crude Protein Yield (q/ha)				Crude Protein (%)				Plant height (cm)		Leaf Stem Ratio	
	Coimbatore	Hyderabad	Average	Rank	Coimbatore	Hyderabad	Average	Rank	Mandya	Rank	Mandya	Rank
TNLC-14	9.0	11.2	10.1	1	25.4	22.6	24.0	2	63.3	6	0.56	2
Anand-25	4.6	8.7	6.7	7	16.6	16.8	16.7	7	64.2	5	0.47	6
Anand-26	5.2	12.7	8.9	4	23.2	21.4	22.3	5	66.4	3	0.56	2
RL-10-2	6.2	10.1	8.2	5	25.0	22.5	23.7	3	69.6	1	0.54	3
ALP-1-1	6.6	9.7	8.1	6	22.3	19.2	20.8	6	64.2	5	0.52	5
Anand-2 (NC)	6.4	11.7	9.1	3	26.3	23.3	24.8	1	67.4	2	0.58	1
RL-88 (NC)	8.4	10.6	9.5	2	25.4	21.9	23.6	4	64.3	4	0.53	4
Mean	6.6	10.7	8.6		23.4	21.1	22.3		65.6		0.54	

Forage Crop Production

The forage crop production programme was executed at 24 locations in five zones. In total 27 experiments were conducted, out of which 7 were in network (5 coordinated and 2 AVT based) and 20 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 and supplementation of forage crops with micronutrients has also been covered in the section. The salient research achievements of the forage crop production trials during *Rabi* 2016-17 are as follows:

A. ON GOING COORDINATED TRIALS

PS-13-AST-2: Performance of perennial fodder sorghum (*Sorghum bicolor* cv. COFS- 29) as influenced by planting geometry and cutting intervals under irrigated conditions

[Table Reference: PS-13-AST-2 (a)-(d)]

Locations: Dharwad, Raipur and Bikaner

A coordinated trial was started during *Rabi* 2013-14 at Bikaner, Raipur and Dharwad centres to assess the effect of planting geometry and cutting intervals on growth, yield and quality of perennial sorghum under irrigated condition. The treatment included three planting spacing; 30, 45 and 60 cm row to row and four cutting intervals of 45, 60, 75 and 90 days. The experiment was conducted in Split Plot Design with three replications. The results of different locations indicated that planting geometry had significant influence on the growth parameter and yields (Table PS-13-AST-2a to d). The green and dry fodder yield was highest with 45 cm row spacing (1199.3 and 297.3 q/ha, respectively) followed by 30 cm row planting (1107.8 and 269.6 q/ha, respectively). The crude protein content varied in limited range and did not exhibited remarkable variation due to planting geometry or cutting interval. The crude protein yield was highest with 45 cm row planting (50.18 q/ha) followed by 30 cm row planting (45.00 q/ha). The cutting interval of 90 days recorded the higher plant height (169.40 cm) whereas, cutting interval of 60 days recorded higher green fodder and dry matter (1138.0 and 274.1 q/ha). Among the different locations, higher values of green fodder, dry matter and CP yields were recorded at Dharwad. The interaction effect of treatments was significant for GFY, DMY and CPY at Dharwad.

PS-13-AST-2 (a): Effect of planting geometry and cutting intervals on yields of perennial fodder sorghum (COFS- 29)

Treatment	Green Forage Yield (q/ha)				Dry Matter Yield (q/ha)			
	Dharwad	Raipur	Bikaner	Mean	Dharwad	Raipur	Bikaner	Mean
A. Planting geometry								
30 cm row spacing	1602	853.5	867.8	1107.8	383	184.9	241.0	269.6
45 cm row spacing	1779	895.1	923.7	1199.3	434	197.5	260.4	297.3
60 cm row spacing	1359	811.7	790.2	987.0	326	179.1	244.0	249.7
SEm±	34	14.9	10.5		8	2.4	2.7	
CD (P=0.05)	101	59.9	30.7		24	9.8	7.8	
B. Cutting interval								
45 DAS	1554	777.2	614.7	982.0	377	166.7	172.1	238.6
60 DAS	1762	1020.0	631.9	1138.0	421	220.9	180.5	274.1
75 DAS	1625	857.8	683.9	1055.6	391	189.9	198.4	259.8
90 DAS	1380	758.8	651.2	930.0	336	171.1	194.4	233.8
SEm±	40	11.5	12.1		10	2.9	3.1	
CD (P=0.05)	117	34.5	35.5		28	8.7	9.0	
Interaction								
SEm±		22.8				5.0		
CD (P=0.05)		78.3				16.2		
CV (%)	7.5		5.6		7.6		5.0	

PS-13-AST-2 (b): Interactive effect of treatments on green, dry matter and crude protein yield at Dharwad

Treatments	Green fodder yield (q/ha)					Dry matter yield (q/ha)					Crude protein yield (g/ha)				
	45 DAS	60 DAS	75 DAS	90 DAS	Mean	45 DAS	60 DAS	75 DAS	90 DAS	Mean	45 DAS	60 DAS	75 DAS	90 DAS	Mean
30 cm row spacing	1475	1786	1731	1416	1602	344	432	409	348	383	87	106	104	86	96
45 cm row spacing	1714	2098	1820	1486	1779	424	495	450	366	434	101	127	110	91	107
60 cm row spacing	1475	1401	1324	1237	1359	362	336	314	293	326	88	86	81	76	83
Mean	1554	1762	1625	1380		377	421	391	336		92	106	98	85	
SEm±		69					17					4			
CD (P=0.05)		202					49					12			

PS-13-AST-2 (c): Effect of planting geometry and cutting intervals on crude protein and growth characters of perennial fodder sorghum (COFS- 29)

Treatment	Crude Protein Yield (q/ha)				Crude Protein (%)				Plant Height (CM)			
	Dhar-wad	Rai-pur	Bika-ner	Mean	Dhar-wad	Rai-pur	Bika-ner	Mean	Dhar-wad	Rai-pur	Bika-ner	Mean
A. Planting geometry												
30 cm row spacing	95.7	13.72	17.04	45.00	5.97	7.39	7.07	6.81	149.90	157.56	94.60	134.02
45 cm row spacing	107.5	14.86	18.76	50.18	6.04	7.52	7.21	6.92	147.20	158.78	92.20	132.73
60 cm row spacing	82.6	13.50	17.42	40.76	6.08	7.55	7.14	6.92	147.60	162.41	90.10	133.37
SEm±	2.1	0.22			0.02	0.03	0.06		1.27	2.23	1.12	
CD (P=0.05)	6.1	0.90			0.06	0.12	0.16		NS	NS	3.28	
B. Cutting interval												
45 DAS	92.0	11.92	8.89	40.56	5.92	7.14	5.17	6.08	130.10	133.72	63.00	108.94
60 DAS	106.3	16.62	9.55	47.34	6.04	7.52	5.29	6.28	139.40	156.56	67.30	121.09
75 DAS	98.2	14.38	10.99	44.85	6.04	7.58	5.54	6.39	153.90	171.94	71.20	132.35
90 DAS	84.5	13.17	10.54	39.58	6.13	7.71	5.42	6.42	169.40	176.11	75.30	140.27
SEm±	2.4	0.24			0.02	0.05	0.07		1.50	3.72	1.29	
CD (P=0.05)	7.0	0.72			0.07	0.15	0.37		4.30	11.14	3.79	
C. Interaction												
SEm±		0.43				0.08						
CD (P=0.05)		1.39				0.25						
CV (%)	7.57				1.16		1.78		2.98		5.60	

PS-13-AST-2 (d): Effect of planting geometry and cutting intervals on growth characters of perennial fodder sorghum (COFS- 29)

Treatment	Tillers /m row				L:S ratio				Gross return (Rs/ha)	Net Return (Rs/ha)	B:C ratio
	Dhar- wad	Rai- pur	Bika- ner	Mean	Dhar- wad	Rai- pur	Bika- ner	Mean	Raipur	Raipur	Raipur
A. Planting geometry											
30 cm row spacing	75.4	57.93	70.91	68.1	0.36	0.32	1.13	0.60	106687	72703	3.14
45 cm row spacing	89	60.02	81.22	76.7	0.34	0.34	1.19	0.62	111890	77906	3.29
60 cm row spacing	87.2	61.38	79.74	76.1	0.35	0.27	1.2	0.61	101466	67482	2.99
SEm _±	1.0	0.65	1.01		0	0.02	0.01		1861		
CD (P=0.05)	2.93	2.63	2.97		0.01	NS	0.04		7504		
B. Cutting interval											
45 DAS	67.85	42.48	55	55.1	0.37	0.39	0.85	0.54	97153	61791	2.75
60 DAS	79.09	55.18	58.89	64.4	0.36	0.36	0.79	0.50	127500	93091	3.71
75 DAS	91.09	68.78	59.91	73.3	0.34	0.32	0.91	0.52	107223	73854	3.21
90 DAS	97.45	72.67	58.07	76.1	0.33	0.27	0.98	0.53	94849	62054	2.89
SEm _±	1.15	0.94	1.17		0.01	0.13	0.02		1444		
CD (P=0.05)	3.38	2.81	3.43		0.02	0.04	0.05		4324		
C. Interaction											
SEm _±		1.55							2856		
CD (P=0.05)		4.94							9810		
CV (%)	4.12		6.06		4.27		5.27				

K-14-AST-3: Study of intercropping system of Pigeon pea with different annual fodder crops

[Table Reference: K-14-AST-3 (a)-(b)]

Locations: Ranchi, Raipur

The experiment was initiated during 2014 to identify the suitable intercropping system higher yields of pigeon pea as well as fodder and profit maximization. The treatment consisted of seven pigeon pea based intercropping system namely; T₁-Pigeonpea +Sorghum (2:1), T₂-Pigeon pea +Maize (2:1), T₃-Pigeonpea + Pearl Millet (2:1), T₄-Pigeon pea + Soybean (2:1), T₅-Pigeon pea + Rice bean (2:1), T₆-Pigeonpea + Cowpea (2:1), T₇-Pigeon pea + Cluster bean (2:1). The experiment was laid out in RBD & replicated three times. The results indicated that, in terms of GFY and DFY, Pigeon pea +Sorghum (2:1), Pigeon pea +Maize (2:1) intercropping system remained at par with each other (160.43 & 165.98 q green fodder and 33.7 & 36.12 q dry matter /ha, respectively) but significantly superior to other systems on location mean basis (Table K-14-AST-3a to b). In terms of CPY and net returns, Pigeon pea + maize (2:1) proved superior. The minimum pigeon pea seed yields were recorded in T₂ Pigeon pea +Maize 2:1 system (9.06 q/ha). The T₁-Pigeonpea +Sorghum (2:1), T₃-Pigeonpea + Pearl Millet (2:1) and T₆-Pigeonpea + Cowpea (2:1) treatments remained at par with each other but significantly superior to other treatments in terms of net monetary return and B: C ratio.

Table K-14-AST-3 (a): Biomass and crude protein yields of intercropping system of pigeon pea with different annual fodder crops

Treatments	GFY (q/ha)			DMY (q/ha)			Crude Protein yield (q/ha)			Crude Protein (%)		
	Rai-pur	Ran-chi	Mean	Rai-pur	Ran-chi	Mean	Rai-pur	Ran-chi	Mean	Rai-pur	Ran-chi	Mean
T ₁ - Pigeon pea + Sorghum (2:1)	124.32	196.53	160.43	27.9	39.57	33.74	2.4	3.15	2.78	8.5	7.94	8.22
T ₂ -Pigeon pea + Maize (2:1)	157.62	174.34	165.98	36.6	36.12	36.12	3.4	3.10	3.25	9.2	8.59	8.90
T ₃ -Pigeon pea + Pearl millet (2:1)	165.39	149.35	157.37	34.7	26.14	30.42	3.0	1.75	2.38	8.5	6.68	7.59
T ₄ -Pigeon pea + Soybean (2:1)	107.67	65.67	86.67	15.9	11.61	13.76	2.1	1.54	1.82	13.5	13.27	13.39
T ₅ -Pigeon pea + Rice bean (2:1)	113.22	100.69	106.96	23.6	18.89	21.25	3.5	2.18	2.84	14.9	11.53	13.22
T ₆ -Pigeon pea + Cowpea (2:1)	107.67	118.05	112.86	14.1	21.18	17.64	2.2	2.64	2.42	15.3	12.46	13.88
T ₇ - Pigeon pea + Cluster bean(2:1)	21.09	74.64	47.87	2.6	11.41	7.01	0.3	1.13	0.72	13.5	9.89	11.70
SEm±	6.64	6.81	160.43	1.49	1.30	33.74	0.16	0.18	2.78	0.14	0.30	8.22
CD (P=0.05)	20.47	3.09	165.98	4.60	0.59	36.12	0.50	0.08	3.25	0.42	0.13	8.90
CV (%)	10.11	3.015	157.37	11.66	3.075	30.42	11.54	4.56	2.38	1.98	1.65	7.59

Table K-14-AST-3 (b): Yields and monetary parameters of intercropping system of pigeon pea with different annual fodder crops

Treatments	Pigeon pea Seed yield (q/ha)			PP Stover Yield (q/ha)	Leaf Stem Ratio			Gross return (Rs/ha)			Net returns (Rs/ha)			B:C ratio		
	Rai-pur	Ran-chi	Mean		Rai-pur	Rai-pur	Ran-chi	Mean	Rai-pur	Ran-chi	Mean	Rai-pur	Ran-chi	Mean	Rai-pur	Ran-chi
T ₁ - Pigeon pea + Sorghum (2:1)	8.7	9.92	9.31	29.8	0.32	0.37	0.35	77434	88929	83182	52009	65,379	58694	3.05	3.78	3.41
T ₂ -Pigeon pea + Maize (2:1)	8.2	9.91	9.06	28.1	0.30	0.30	0.30	82389	88772	85581	57589	65,522	61555	3.32	3.82	3.57
T ₃ -Pigeon pea + Pearl millet (2:1)	8.9	11.35	10.13	30.3	0.34	0.38	0.36	85940	86605	86273	61220	63,055	62137	3.48	3.68	3.58
T ₄ -Pigeon pea + Soybean (2:1)	10.4	11.39	10.90	34.7	0.58	0.96	0.77	85789	74985	80387	59989	51,235	55612	3.33	3.16	3.24
T ₅ -Pigeon pea + Rice bean (2:1)	9.7	11.29	10.50	32.9	0.71	1.19	0.95	81864	84138	83001	56964	60,388	58676	3.29	3.54	3.42
T ₆ -Pigeon pea + Cowpea (2:1)	10.2	11.40	10.80	34.7	0.84	1.06	0.95	84456	89445	86951	59556	65,695	62625	3.39	3.77	3.58
T ₇ - Pigeon pea + Cluster bean(2:1)	12.0	11.37	11.69	39.6	0.32	1.10	0.71	80565	77359	78962	56065	53,609	54837	3.29	3.26	3.27
SEm±	0.42	0.65		1.64	0.01	0.18		3009.8	3,683		3009.8	3,683		0.12	0.15	
CD (P=0.05)	1.28	0.30		5.06	0.03	0.08		9274.2	1,672		9274	1,671		0.37	0.07	
CV (%)	7.40	3.52		8.65	5.54	12.92		6.3	2.43		9.05	3.374		8.92		

K-15-AST-9 C: Development of climate resilient production technologies on productivity and economics of food - fodder based cropping systems
 [Table Reference: K-15-AST-9 C (a)-(c)]

Locations: Pantnagar, Ranchi, Kalyani, Jabalpur

A trial was initiated at four centres with the objective to study the effect of climate change on productivity and profitability of food– fodder based cropping systems and to identify suitable climate resilient production technology in different zones. The treatments included four Tillage Options namely Zero tillage- (All the crops), Minimum tillage single pass of cultivator + sowing with seed drill, Conventional tillage and Zero tillage- minimum tillage- Zero tillage in the main plot and four Cropping Systems namely Rice (upland)-Berseem- Maize+Cowpea, Maize (Baby corn) – Berseem – Sorghum (Fodder), Maize (Baby corn) – Wheat – Rice bean (Fodder) and Sorghum (Fodder) – Berseem – Maize (Baby Corn). The trial was laid out in Split Plot Design with four replications. The results indicated that among tillage operations, all the tillage operation except zero tillage- (all the crops), recorded green and dry matter yields on par with each other. Zero tillage- (all the crops) recorded significantly lower yields (597.4 q green and 207.3 q dry matter per hectare). As regards to cropping systems Sorghum (Fodder) – Berseem – Maize (Baby Corn) proved superior and recorded maximum yields (836.8 q green and 836.8q dry matter per hectare). Maize (Baby corn) – Wheat – Rice bean (Fodder) system recorded lowest yields.

Table K-15-AST-9 C (a): Green fodder & Dry matter productivity of food - fodder based climate resilient production systems

Treatments	Green Fodder Yield (q/ha)					Dry Matter Yield (q/ha)				
	Pant-nagar	Kal-yani	Ran-chi	Jabal-pur	Mean	Pant-nagar	Kal-yani	Ran-chi	Jabal-pur	Mean
Tillage Options: 04										
Zero tillage- (All the crops)	900	549.6	307.0	1015.6	597.4	148.6	93.7	80.01	506.8	207.3
Minimum tillage single pass of cultivator + sowing with seed drill.	913	618.3	471.0	1164.0	686.4	131.8	114.4	120.28	581.5	237.0
Conventional tillage	933	666.4	289.0	1341.7	692.1	149.8	120.9	69.38	472.0	203.0
Zero tillage- minimum tillage- Zero tillage.	934	621.7	471.0	1107.4	677.4	149.9	111.9	127.09	556.6	236.4
SEm±	8.8	5.3	9.64			6.22	2.3	3.63		
CD (P=0.05)	25	15.9	34.02			Ns	6.9	12.89		
Cropping Systems: 04										
Rice (upland) – Berseem - Maize + Cowpea	883	447.8	407.6	1374.9	778.3	117.6	72.3	105.82	649.4	236.3
Maize (Baby corn) – Berseem – Sorghum (Fodder)	813	652.7	372.3	1329.5	791.9	114.8	122.2	96.66	513.6	211.8
Maize (Baby corn) – Wheat – Rice bean (Fodder)	968	393.0	379.2	543.7	571.0	166.6	83.5	98.54	212.9	140.4
Sorghum (Fodder) – Berseem – Maize (Baby Corn)	1015	573.3	378.1	1380.6	836.8	181.0	100.5	95.74	741.0	279.6
SEm±	8.8	6.8	0.57			6.32	4.1	0.65		
CD (P=0.05)	25	20.4	1.54			18.06	12.3	1.92		
Interaction (T x CS)	s					s	4.3			
CV (%)		7.2					72.3			

Table K-15-AST-9 C (b): Crude Protein Yields Crude Protein (%) and L: S Ratio, Grain yield, Straw Yield, Fodder equivalent yields of food - fodder based climate resilient production systems

Treatments	CPY (q/ha)		Mean	CP (%)	L:S Ratio	Grain Yield (t/ha)	Straw yield (t/ha)	Fodder equivalent yield
	Kal-yani	Jabal-pur		Kal-yani	Kal-yani	Kal-yani	Kal-yani	Jabal-pur
Tillage Options: 04								
Zero tillage (ZT))	10.42	9.87	10.15	12.5	0.91	2.87	3.92	1873.0
Minimum tillage (MT)	13.71	12.67	13.19	13.8	0.78	3.11	4.18	1967.7
Conventional tillage (CT)	13.80	11.98	12.89	14.6	0.90	3.37	4.53	1829.7
ZT-CT-ZT	12.91	11.07	11.99	13.9	0.76	3.18	4.41	1719.8
SEm±	0.45	0.23		--	--	0.06	0.09	4.5
CD (P=0.05)	1.35	0.78		--	--	0.17	0.265	15.8
Cropping Systems: 04								
Rice (upland)-Berseem-Maize+Cowpea	9.18	8.90	9.04	13.5	0.82	--		1616.5
Maize (BC)-Berseem- Sorghum (fodder)	12.35	16.87	14.61	14.8	0.83	--		2151.7
Maize (BC) -Wheat - Ricebean	10.73	12.87	11.80	--	--	3.13		1900.6
Sorghum – Berseem- Maize (BC)	11.03	10.15	10.59	12.7	0.86	--		1721.5
SEm±	0.61	0.07		--	--	NS		6.9
CD (P=0.05)	1.83	0.18		--	--			18.7
Interaction (T x CS)								
CV	5.5					8.25	4.12	

K-15-AST-9 C (c): Monetary parameters of food - fodder based climate resilient production systems

Treatments	GMRs (Rs/ha)			NMR (Rs/ha)			B: C ratio			
	Pant-nagar	Jabal-pur	Ran-chi	Pant-nagar	Jabal-pur	Ran-chi	Pant-nagar	Jabal-pur	Ran-chi	Mean
Tillage Options: 04										
Zero tillage (ZT)	359925	224760	69065	294550	135135	48815	5.51	2.51	3.41	3.81
Minimum tillage (MT)	365175	236118	105873	298675	155493	84623	5.56	4.53	4.98	5.02
Conventional tillage (CT)	373050	219561	65044	305550	141936	42794	5.59	4.81	2.92	4.44
ZT-CT-ZT	373650	206379	105906	308275	124754	84655	5.8	4.58	4.98	5.12
SE _{m±}	3536		2170	3536		2170	0.06		0.1	
CD (P=0.05)	1,104		7656	10104		7656	0.2		0.36	
Rice (upland)-Berseem- Maize+ Cowpea	360600	193977	91711	290105	114227	71211	4.95	4.52	4.47	4.65
Maize (BC)-Berseem- Sorghum (fodder)	321500	228069	83774	252000	145319	63274	4.63	3.89	4.09	4.2
Maize (BC) -Wheat - Ricebean	399600	258198	85331	335100	172448	61831	5.92	4.66	3.63	4.74
Sorghum – Berseem- Maize (BC)	412900	206574	85070	355900	125324	64570	7.04	5.08	4.15	5.42
SE _{m±}	3536		128				0.06		0.01	
CD (P=0.05)	10104		377				0.2		0.03	

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, Anand

A trial was initiated at six centers with the objective to study the effect of cropping system on Fodder yield, quality, economics and carbon sequestration potential. The treatments included T₁ -BN hybrid at recommended spacing, T₂- Guinea grass at recommended spacing, T₃-BN hybrid in paired rows (60/120 cm) + Fodder cowpea (*Kharif*) - Lucerne (*Rabi*), T₄ -BN hybrid in paired rows (60/120 cm) + *Desmanthus* (Perennial), T₅- BN hybrid in paired rows (60/120 cm) + *Sesbania grandiflora*, T₆ -Guinea grass in paired rows (60/120 cm) + Fodder cowpea (*Kharif*) - Lucerne (*Rabi*), T₇ -Guinea grass in paired rows (60/120 cm) + *Desmanthus* (Perennial), T₈ -Guinea grass in paired rows (60/120 cm) + *Sesbania grandiflora*. Cowpea was included instead of lucerne in treatment T₂ and T₆ at Kerala (Vellayani). Treatments were replicated thrice in randomised block design.

The first year results indicated that on locational mean basis, treatment T₃ BN hybrid in paired rows (60/120 cm) + Fodder cowpea (*Kharif*) - Lucerne (1595.7 q green and 384.9 q dry matter/ha) and T₅ BN hybrid in paired rows (60/120 cm) + *Sesbania grandiflora* (1598.8q green and 382.7 q dry matter/ha) remained on par with each other but significantly superior to other treatments. The treatment T₇. Guinea grass in paired rows (60/120 cm) + *Desmanthus* (Perennial) recorded lowest yield (1065.6 q green and 271.6 q dry matter/ha). However, as regards to crude protein yields, T₅ BN hybrid in paired rows (60/120 cm) + *Sesbania grandiflora* proved superior to T₃ 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 T₃ BN hybrid in paired rows (60/120 cm) + Fodder cowpea (*Kharif*) – Lucerne and T₅ BN hybrid in paired rows (60/120 cm) + *Sesbania grandiflora* also recorded higher gross monetary returns. However, T₅ BN hybrid in paired rows (60/120 cm) + *Sesbania grandiflora* recorded significantly higher BC ratio over rest of the treatment.

In terms of total biomass carbon dioxide sequestered by different systems, T₇ Guinea grass in paired rows (60/120 cm) + *Desmanthus* (Perennial) recorded the highest value (442.6t/ha in six cuts), which was at par with T₃, T₄, T₅, T₆ and T₈. T₁ BN hybrid at recommended spacing sequestered minimum Total biomass carbon dioxide among all treatments.

Table K-15-AST-11 C (a): Total biomass yields perennial grass based cropping systems in carbon sequestration trial

Treatments	Total green fodder yield during the year (q/ha)							Total Dry matter yield during the year (q/ha)						
	Coimbatore	Hyderabad	Anand	Ranchi	Vellayani	Jabalpur	Mean	Coimbatore	Hyderabad	Anand	Ranchi	Vellayani	Jabalpur	Mean
T ₁ -BN hybrid	3129	1306.6	939	576	1703.23	1443	1516.1	775	309.5	216.55	183.06	413.52	298.7	366.06
T ₂ - Guinea grass	2172	666.6	618	437	1812.47	721	1071.2	566	225.1	168.35	132.46	444.61	178.11	285.77
*T ₃ - BN hybrid+ Lucerne	3251	1216.9	846	793	2085.2	1382	1595.7	802	256.7	196.35	271.92	507.54	274.42	384.82
T ₄ - BN hybrid+Desmanthus	3349	1166.8	733	657	1674.02	1258	1473	829	243.2	184.75	227.3	411.02	285.12	363.4
T ₅ -BN hybrid+Sesbania(Agati)	3282	1599.6	871	611	1879.97	1325	1594.8	810	356.4	192.52	209.57	458.723	268.82	382.67
*T ₆ -Guinea grass+ Lucerne	2296	616.4	684	555	1487	883	1086.9	598	182.9	185.93	187.22	370.82	197	286.98
T ₇ - Guinea grass+Desmanthus	2416	642.5	708	498	1259.57	815	1056.5	622	174.6	191.87	169.12	309.15	162.8	271.59
T ₈ -Guinea grass + Sesbania (Agati)	2344	1016.3	738	442	1870.32	797	1201.3	615	246.9	179.3	149.64	458.44	182.38	305.28
S.Em(+)	127	24.6	18.02	12.16	0.818	104.3		29	20.1	4.38	6.62	0.783	26.41	
CD (0.05)	259	75.3	54.65	37.2	49.345	392.03		61	61.7	13.29	20.26	11.586	87.99	
CV (%)			14.12	4.01		14.63				13.91	5.99		16.93	

Table K-15-AST-11 C (a): Total Crude protein yield of perennial grass based cropping systems in carbon sequestration trial

Treatments	Total Crude Protein yield (q/ha)				
	Coimbatore	Hyderabad	Anand	Jabalpur	Mean
T ₁ -BN hybrid	121	16.15	19.29	38.5	48.74
T ₂ - Guinea grass	57	11.30	10.89	22.4	25.40
*T ₃ - BN hybrid+ Lucerne	129	17.15	15.13	35.7	49.25
T ₄ - BN hybrid+Desmanthus	133	15.70	19.88	36.9	51.37
T ₅ -BN hybrid+Sesbania(Agati)	130	29.17	21.35	35.6	54.03
*T ₆ -Guinea grass+ Lucerne	65	10.41	12.79	24.2	28.10
T ₇ - Guinea grass+Desmanthus	70	11.04	21.34	23.2	31.40
T ₈ -Guinea grass + Sesbania (Agati)	69	23.11	18.71	27.9	34.68
S.Em(+)	4.0	1.55	0.39	1.07	
CD (0.05)	8.2	4.70	1.17	3.28	
CV (%)			13.34	15.23	

K-15-AST-11 C (c): growth parameters in perennial grass based cropping systems in carbon sequestration trial

Treatments	Plant height (cm)					No. of tillers/ m ²					Leaf stem ratio			
	Hydera- bad	Coimb- atore	Vella- yani	Jabal- pur	Mean	Hydera- bad	Coimb- atore	Vella- yani	Jabal- pur	Mean	Hydera- bad	Coimb- atore	Vella- yani	Mean
T ₁ -BN hybrid	70.58	197.1	163.83	163.16	148.67	44.00	34.4	157.4	46.96	70.69	0.54	0.80	1.893	1.08
T ₂ - Guinea grass	96.33	180.7	143.9	172.11	148.26	40.33	47.9	163.3	52	75.88	0.46	0.68	0.753	0.63
*T ₃ - BN hybrid+ Lucerne	85.75	191.0	165.87	168.42	152.76	43.00	35.0	146.13	44.59	67.18	0.57	0.76	1.603	0.98
T ₄ - BN hybrid+Desmanthus	96.83	180.3	153.6	162.78	148.38	42.00	35.1	193.17	47.18	79.36	0.48	0.76	1.846	1.03
T ₅ -BN hybrid+Sesbania(Agati)	80.67	184.3	157.3	163.56	146.46	44.00	34.5	184.63	47.59	77.68	0.59	0.73	1.723	1.01
*T ₆ -Guinea grass+ Lucerne	73.17	181.5	163.07	169.4	146.79	38.00	55.6	243.83	46.96	96.10	0.45	0.66	0.733	0.61
T ₇ - Guinea grass+Desmanthus	95.00	174.1	157.17	173	149.82	36.33	48.4	309.5	45.55	109.95	0.43	0.65	0.88	0.65
T ₈ -Guinea grass + Sesbania (Agati)	94.67	172.4	168.43	170.78	151.57	40.67	49.7	280.57	48.89	104.96	0.52	0.65	0.863	0.68
S.Em(±)	6.72	7.4	NS			3.85	1.8	1.89			0.05	0.03	5.58	
CD (0.05)	NS	15.1				NS	3.7	13.573			NS	0.06	0.256	

K-15-AST-11 C (d): Economics (Rs./ha) of studies on carbon sequestration in perennial grass based cropping systems

Treatments	Cost of cultivation			GMR					NMR				B: C ratio			
	Hyder- abad	Coimb- atore	Mean	Hyder- abad	Coimb- atore	Ana- nd	Ran- chi	Mean	Hyder- abad	Coimb- atore	Ana- nd	Mean	Hyder- abad	Coimb- atore	Ana- nd	Mean
T ₁ -BN hybrid	63133	155497	109315	196000	469350	93935	57567	204213	132867	313853	71555	172758	3.10	3.02	4.20	3.44
T ₂ - Guinea grass	44333	131246	87789.5	100000	325800	61817	43700	132829	55667	194554	39437	96553	2.25	2.48	2.76	2.50
*T ₃ - BN hybrid+ Lucerne	58838	162012	110425	185063	487650	84745	85608	210766	126224	325638	61970	171277	3.14	3.01	3.72	3.29
T ₄ - BN hybrid + Desmanthus	57837	159391	108614	181042	502350	78421	70956	208192	123205	342959	55396	173853	3.13	3.15	3.41	3.23
T ₅ -BN hybrid+ Sesbania(Agati)	65993	157915	111954	273577	492300	94473	65988	231584	207585	334385	71448	204473	4.15	3.12	4.10	3.79
*T ₆ -Guinea grass+ Lucerne	42828	135291	89059.5	95938	344400	68530	59940	142202	53109	209109	45505	102574	2.24	2.55	2.98	2.59
T ₇ - Guinea grass+ Desmanthus	43350	133217	88283.5	104125	362400	79635	53748	149977	60775	229183	56610	115523	2.40	2.72	3.46	2.86
T ₈ -Guinea grass + Sesbania (Agati)	50328	134989	92658.5	191431	351600	83617	47700	168587	141103	216611	60592	172758	3.80	2.60	3.63	3.34
S.Em(+)	491			4089				1299	3633				0.05			
CD (0.05)	1506			12525				3978	11128				0.16			

K-15-AST-11 C (e): Total carbon sequestered by crops in perennial grass based cropping system (7 cuts) during the year (t/ha) at coimbatore centre

Treatments	Total carbon sequestered (q/ha/yr)			
	BN hybrid	Inter crop (legume component)	Lucerne (q/ha/yr)	Total C sequestered
T1	415.9			415.9
T2	303.8			303.8
T3	407.3	7.1	14.1	428.5
T4	407.9	34.8		442.6
T5	408.9	24.4		433.4
T6	294.1	7.8	16.6	318.5
T7	295.7	35.5		331.2
T8	302.1	26.0		328.1
S.Em (±)	15.81			18.27
CD (0.05)	32.73			37.25

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

A field experiment was initiated from Rabi 2015-16 to study the productivity and profitability of food (lathyrus) + forage (oat) intercropping system influenced by INM at Kalyani, Bhubaneswar and Ranchi. The experiment was laid out in split plot design with three replications. The treatments consisted of crops in the main plot: T₁-sole oat, T₂- sole lathyrus, T₃- oat + lathyrus (3:2) and T₄- oat + lathyrus (3:3). INM was assigned in the sub plot: F₁- RDF (inorganic), F₂- 50% N (RDF) + 50% N (FYM) and F₃-50% 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 T₃ – oat + Lathyrus (3:2) recorded maximum GFY (299.81q). However, in with respect to DFY (62.74q), and CPY (6.023 q) T₁ – Sole oat recorded significant superiority over other treatments, on locational mean basis. Among the centres, maximum green and dry matter productivity was recorded at Bhubaneswar. Recommended dose of 80, 40 and 40 kg ha N, P₂O₅ and K₂O per hectare respectively were applied for the study. On location mean basis, F₃-50% N (RDF) + 50% N (vermicompost) recorded significantly higher GFY (372.32 q), DFY (58.26 q), CPY (5.70 q), and GFEY (265.7q) per hectare. However in monetary parameters, F₁- RDF (inorganic) proved better (B:C Ratio- 1.29).

R-5-AST-1 (a): GFY of oat and lathyrus as influenced by intercropping system and integrated nutrient management

Treatments	GFY (q/ha)									
	Kalyani			Bhubaneswar			Ranchi			Mean
Intercropping system										
	Oat	Lathyrus	Total	Oat	Lathyrus	Total	Oat	Lathyrus	Total	Mean
T ₁ – Sole oat	175.5	--	175.5	298.4	-	298.4	301.67	-----	301.67	258.52
T ₂ – Sloe Lathyrus	--	98.5	98.5		487.6	487.6	----	109.11	109.11	231.74
T ₃ – oat + Lathyrus (3:2)	168.2	39.7	207.9	217.6	148.0	365.6	243.56	82.44	326	299.83
T ₄ – oat + Lathyrus (3:3)	137.2	55.2	192.4	167.0	230.5	397.5	174.56	54.222	228.78	272.89
S Em (±)	1.24	2.51	--	-	-		5.60	1.69		
CD (0.05)	3.68	7.45	--	-	-		22.71	6.82		
Integrated nutrient management										
F ₁	144.4	65.2	209.6	209.1	281.2	490.3	250.89	87.22	338.11	346.00
F ₂	161.1	52.4	213.5	224.4	290.1	514.5	227.89	78.00	305.89	344.63
F ₃	175.5	75.8	251.3	249.4	294.7	544.1	241.00	80.56	321.56	372.32
SEm (±)	1.72	2.23	--	-	-		3.68	1.02		
CD (0.05)	5.11	6.62	--	-	-		11.47	3.19		

R-15-AST-1 (b): DMY of oat and lathyrus as influenced by intercropping system and integrated nutrient management

Treatments	DMY (q/ha)								
	Kalyani			Bhubaneswar		Ranchi			Mean
	Oat	Lathyrus	Total	Oat	Total	Oat	Lathyrus	Total	
Intercropping system									
T ₁ – Sole oat	23.6	--	23.6	57.4	0	107.22	----	107.22	62.74
T ₂ – Sole Lathyrus	--	13.3	13.3	0	0	----	25.67	25.67	12.99
T ₃ – oat + Lathyrus (3:2)	23.4	5.4	28.8	39.0	0	46.33	12.69	59.02	42.27
T ₄ – oat + Lathyrus (3:3)	19.2	7.5	26.7	29.4	0	63.67	17.18	80.85	45.65
SEm (±)	0.75	0.52	--	-	-	1.44	0.20		
CD (0.05)	2.22	1.54	--	-	-	5.81	0.80		
Integrated nutrient management									
F ₁	20.1	8.80	28.9	40.6		73.11	18.99	92.1	53.87
F ₂	21.9	7.1	29.0	41.7		66.56	17.13	83.69	51.46
F ₃	24.1	10.2	34.3	43.5		77.56	19.41	96.97	58.26
SEm (±)	0.68	0.45	--			1.83	0.66		
CD (0.05)	2.01	1.33	--			5.70	NS		

R-15-AST-1 (c): CP content and yield of oat and lathyrus as influenced by intercropping system and integrated nutrient management

Treatments	CP (%)				CPY (q/ha)							
	Kalyani			Ran- chi	Kalyani			Bhubaneswar		Ranchi	Overall mean	
	Oat	Lathyrus	Mean		Oat	Lathyrus	Total	Oat	Lathyrus	Total		
Intercropping system												
T ₁ – Sole oat	9.22	--	9.22	9.41	2.17	--	2.17	5.27	1.00	6.27	10.26	6.23
T ₂ – Sole Lathyrus	--	18.5	18.5	13.85	--	2.5	2.5	0.00	0.30	0.3	3.56	2.12
T ₃ – oat + Lathyrus (3:2)	7.97	16.2	12.09	11.73	1.86	0.90	2.76	3.81	0.47	4.28	11.16	6.07
T ₄ – oat + Lathyrus (3:3)	7.39	13.6	10.50	12.32	1.53	1.10	2.63	2.95		2.95	8.80	4.79
SEm (±)	0.25	0.38		0.01	0.21	0.35	--				0.13	
CD (0.05)	0.74	1.12		0.03	0.62	1.03	--		0.00		0.46	
Integrated nutrient management												
F ₁	7.65	19.5	13.58	11.69	1.82	1.72	3.54	3.74	0.59	4.33	8.83	5.57
F ₂	7.43	12.7	10.07	11.81	1.63	0.91	2.54	3.96	0.61	4.57	7.99	5.03
F ₃	10.20	16.1	13.15	11.98	2.05	1.6	3.65	4.33	0.61	4.94	8.50	5.70
SEm (±)	0.32	0.45	--	0.03	0.32	0.27	--	-	-		0.12	
CD (0.05)	0.95	1.33	--	0.05	0.95	0.80	--	-	-		0.36	

R-15-AST-1 (d): Plant height and L: S of oat and lathyrus as influenced by intercropping system and integrated nutrient management

Treatments	Plant height (cm) at harvest						L:S ratio		Plant population (tillers/m)			
	Kalyani		Bhubaneswar		Ranchi		Kalyani		Bhubaneswar		Ranchi	
Intercropping system												
	Oat	Lathyrus	Oat	Lathyrus	Oat	Lathyrus	Oat	Lathyrus	Oat	Lathyrus	Oat	Lathyrus
T ₁ – Sole oat	118.1	--	107.2	-	128.0	---	0.78	--	91	-	35.34	
T ₂ – Sloe Lathyrus	--	101.8		48.4	---	92.0	--	1.52		19.7	----	17.22
T ₃ – oat + Lathyrus (3:2)	116.6	77.9	111.6	45.6	128.55	68.0	0.81	1.49	93	19.6	34.67	17.0
T ₄ – oat + Lathyrus (3:3)	112.4	90.9	114.9	46.7	132.0	74.34	0.76	1.45	95	19.7	35.22	17.0
SEm (±)	1.11	2.72	-	-	1.61	0.75	--	--	-	-	0.66	0.15
CD (0.05)	3.2	8.07	-	-	NS	3.03	--	--	-	-	NS	NS
Integrated nutrient management												
F ₁	111.9	86.1	104.6	45.6	122.34	61.11	0.79	1.48	90	19.4	34.78	17.22
F ₂	114.7	94.0	111.2	46.7	125.56	68.22	0.72	1.47	93	19.6	34.89	17.0
F ₃	120.5	90.4	117.9	48.3	140.67	78.11	0.85	1.51	95	19.8	35.56	17.0
SEm (±)	0.78	1.05	-	-	1.97	1.13	--	--	-	-	0.68	0.22
CD (0.05)	2.31	3.12	-	-	6.17	3.52	--	--	-	-	NS	NS

R-15-AST-1 (e): Grain and stover yield & harvest Index of oat and lathyrus

Treatments	Seed yield (q/ha)		Stover yield (q/ha)			Harvest Index		
	Kalyani		Kalyani		Bhubaneswar	Kalyani		Bhubaneswar
	Oat	Lathyrus	Oat	Lathyrus	Lathyrus	Oat	Lathyrus	Lathyrus
Intercropping system (T)								
T ₁	13.5	--	31.2	--	-	30.2	--	-
T ₂	--	6.83	--	13.4	5.77	--	33.8	45.8
T ₃	8.5	2.86	20.3	5.7	1.80	29.5	33.4	45.1
T ₄	7.4	3.83	18.6	7.7	2.82	28.5	33.2	45.0
SEm (±)	0.12	0.18	0.48	0.13	-	--	--	-
CD (0.05)	0.35	0.53	1.42	0.38	-	--	--	-
CV (%)	6.52	7.68	5.23	8.23		--	--	
Integrated nutrient management (F)								
F ₁	6.5	3.96	14.6	7.9	3.49	30.8	33.5	44.5
F ₂	10.3	4.30	25.8	8.6	3.47	28.5	33.3	45.3
F ₃	12.6	5.26	29.7	10.5	3.44	29.8	33.4	45.9
SEm (±)	0.15	0.15	0.75	0.16	-	--	--	-
CD (0.05)	0.44	0.44	2.22	0.47	-	--	--	-
CV (%)	5.62	9.56	6.84	8.73		--	--	

R-15-AST-1 (f): LER and GFEY of oat and lathyrus intercropping system and integrated nutrient management on LER and GFEY

Treatments	LER		GFEY (q/ha)			
	Kalyani	Ranchi	Kalyani	Bhubaneswar	Ranchi	Mean
Intercropping system (T)						
T ₁	1.00	1.0	175.5	298.4	303.222	259.0
T ₂	1.00	1.0	108.35	245.2	120.625	158.1
T ₃	1.05	1.241	211.87	292.0	295.681	266.5
T ₄	1.11	1.176	197.92	283.0	246.181	242.4
SEm±		0.02		2.73		
CD (P=0.05)		0.05		9.45		
Integrated nutrient management (F)						
F ₁	1.07	1.097	227.78	262.9	247.938	246.2
F ₂	1.39	1.085	218.74	277.7	224.656	240.4
F ₃	1.70	1.13	247.22	298.2	251.688	265.7
SEm±		0.02		2.96		
CD (P=0.05)		NS		8.63		

R-15-AST-1 (g): Production economics and B:C ratio of oat and lathyrus intercropping system as influenced by integrated nutrient management

Treatments	Cost of Cultivation (Rs./ha)	GMR (Rs./ha)				NMR (Rs./ha)				B:C ratio			
		Kal-yani	Kal-yani	Bhubaneswar	Ran-chi	Mean	Kal-yani	Bhubaneswar	Ran-chi	Mean	Kal-yani	Bhubaneswar	Ran-chi
Intercropping system (T)													
T ₁	25,700	52,570	29837	60,333	47,580	26,870	14837	34,783	25,497	2.05	1.99	1.17	1.73
T ₂	20,600	38,325	24523	24,125	28,991	17,725	10523	-1,875	8,791	1.86	1.75	0.94	1.52
T ₃	23,250	55,676	29200	59,136	48,004	32,426	14700	33,436	26,854	2.39	2.01	1.14	1.85
T ₄	24,360	53,386	28296	49,236	43,639	29,026	13796	23,461	22,094	2.19	1.95	1.10	1.75
SEm±			273	858			273.1	858			0.02	0.03	
CD (P=0.05)			945	3027			944.8	3027			0.06	0.12	
Integrated nutrient management (F)													
F ₁	22,950	50,685	26294	49,970	42,316	27,735	13794	24,214	21,914	1.83	2.10	1.02	1.75
F ₂	21,220	53,224	27775	45,414	42,138	32,004	12275	19,658	21,312	1.66	1.79	1.08	1.75
F ₃	23,520	57,620	29822	49,237	45,560	34,100	14322	23,481	23,968	1.69	1.92	1.16	1.75
SEm±			296	6.37			295.8	637			0.02	0.02	
CD (P=0.05)			863	19.27			863.3	1927			0.06	0.07	

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)	N	P	K
T ₁	F ₁	6.76	0.15	172.4	27.4	168.2
	F ₂	6.62	0.16	175.8	29.4	182.2
	F ₃	6.54	0.15	174.4	28.2	184.5
T ₂	F ₁	6.82	0.14	179.6	30.7	188.9
	F ₂	6.63	0.13	183.5	31.2	189.5
	F ₃	6.64	0.15	184.1	30.4	194.7
T ₃	F ₁	6.53	0.14	180.6	28.7	182.4
	F ₂	6.72	0.15	180.7	29.4	189.2
	F ₃	6.68	0.16	182.8	30.5	195.1
T ₄	F ₁	6.52	0.14	178.6	28.9	198.4
	F ₂	6.76	0.15	182.4	30.4	189.4
	F ₃	6.68	0.13	183.8	32.7	198.8
Initial		6.58	0.14	198.2	42.5	211.4

B. Location Specific Trials

PS-14-AST-2: Impact of Mg and B on nutrient uptake, quality and yield of bajra napier hybrid. [Table Reference: PS-14-AST-2 (a)-(b)]

Location: Vellayani

The trial was conducted to assess the influence of Mg and B nutrition on the performance of bajra napier hybrid. Treatments consisted of two field conditions (open and coconut garden) and five nutrient levels- N₁-POP recommendation + MgSO₄ 80 kg/ha+ Borax 10 kg/ha, N₂-POP + MgSO₄, 80 kg/ha, N₃-POP +Borax, 10 kg/ha, N₄- POP alone and N₅-POP without FYM. Application of 200:50:50 kg NPK/ha and 25 t/ha of Farm yard manure is taken as the Package of practice (POP) recommendation.

Open situation showed significantly higher values for all the growth and yield attributes and yield. Among the nutrient levels, highest GFY and DFY was recorded in POP alone (N₄) and it was found to be on par with POP + MgSO₄, 80 kg/ha (N₂). Highest tiller number were recorded in POP alone (N₄) and it was found to be on par with all other nutrient levels. Maximum value for plant height was noted in POP alone (N₄) and it was on par with POP recommendation + MgSO₄ 80 kg/ha+ Borax 10 kg/ha (N₁). Interaction effect was significant on plant height, number of tillers/hill, GFY and DFY. Significantly superior values of tiller numbers was recorded in open situation+ POP (200:50:50 kg NPK/ha and 25 t/ha of Farm yard manure) +Borax, 10 kg/ha and Open situation +POP alone (200:50:50 kg NPK/ha and 25 t/ha of Farm yard manure). Tallest plant was recorded in Open situation+ POP recommendation (200:50:50 kg NPK/ha and 25 t/ha of Farm yard manure) + MgSO₄@80 kg/ha+ Borax, 10 kg/ha and was on par with Open situation+ POP alone (200:50:50 kg NPK/ha and 25 t/ha of Farm yard manure). In case of GFY highest value was recorded in Open situation+ POP alone (200:50:50 kg NPK/ha and 25 t/ha of Farm yard manure) and was on par with open situation+ POP (200:50:50 kg NPK/ha and 25 t/ha of Farm yard manure) + MgSO₄@80 kg/ha. Similar trend was noticed in DFY also.

Table PS-14-AST-2 (a): Effect of Mg and B on growth and yield of bajra napier hybrid

Treatments	Plant height (cm)	Number of tillers/hill	L:S Ratio	GFY (q/ha/year)	DFY (q/ha/year)
A. Field condition					
S ₁ -Open situation	159.75	27.53	2.03	1382.51	343.72
S ₂ -Coconut garden	118.96	24.07	2.251	559.85	139.203
CD (P=0.05)	7.67	1.459	NS	26.759	5.863
B. Nutrient levels					
N ₁ .POP recommendation (200:50:50 kg NPK/ha and 25 t/ha of Farm yard manure) + MgSO ₄ , 80 kg/ha+ Borax, 10 kg/ha	146.73	24.0	2.48	923.78	227.88
N ₂ .POP(200:50:50 kg NPK/ha and 25 t/ha of Farm yard manure) + MgSO ₄ , 80kg/ha	134.06	22.92	2.003	1027.82	256.426
N ₃ .POP (200:50:50 kg NPK/ha and 25 t/ha of Farm yard manure) +Borax, 10 kg/ha	133.98	29.08	2.263	944.61	235.693
N ₄ .POP alone((200:50:50 kg NPK/ha and 25 t/ha of Farm yard manure)	147.23	29.75	2.087	1053.14	260.44
N ₅ .POP without FYM (200:50:50 kg NPK/ha	134.78	23.25	1.872	907.35	226.86
CD (P=0.05)	12.12	7.41	NS	42.31	9.27
SEm ±	3.765	1.154		1.85	1.47

Table PS-14-AST-2 (b): Interaction effect of field situation and nutrient levels on growth and yield of bajra napier hybrid

Treatments	Plant height (cm)	Tiller number/hill	L:S ratio	GFY (q/ha/year)	DFY (q/ha/year)
S ₁ N ₁	169.78	23.67	2.30	1293.86	317.38
S ₁ N ₂	157.28	26.33	1.99	1481.25	370.6
S ₁ N ₃	155.67	30.5	2.21	1359.81	340.13
S ₁ N ₄	162.45	30.5	1.80	1500.08	370.34
S ₁ N ₅	153.56	26.67	1.84	1277.56	320.15
S ₂ N ₁	123.67	24.33	2.65	553.70	138.38
S ₂ N ₂	110.84	19.5	2.02	572.82	142.25
S ₂ N ₃	112.28	27.67	2.31	529.41	131.26
S ₂ N ₄	132.01	29.0	2.37	606.2	150.54
S ₂ N ₅	116.0	19.83	1.90	537.14	133.58
CD (P=0.05)	17.14	3.263	NS	59.835	13.11
SEm ±	3.765	1.154		1.85	1.47

CS-14-AST-1: Studies on intensive fodder cropping systems for yield maximization
[Table Reference: CS-14-AST-1 (a)]

Location: Raipur

The perennial based experiment was initiated during *kharif* 2014 at Raipur with objective to identify appropriate cropping system for maximum fodder production. The treatments consisted of eight cropping systems viz., BN hybrid + lucerne, setaria+ lucerne, BN hybrid + cowpea (*summer*) lucerne (*winter*), setaria+ cowpea (*summer*)/ berseem (*winter*) and setaria + cowpea (*summer*) berseem (*winter*). The treatments were replicated thrice in Randomized block Design. The results indicated that, intercropping of berseem in winter and cowpea in summer with BN hybrid perennial cropping system recorded significantly maximum green fodder (789 q/ha), dry matter (156.15 q/ha) and crude protein (15.53 q/ha) and it was at par with intercropping of lucerne in winter and cowpea in winter between BN Hybrid with 738 q/ha green fodder yield and 149.99 dry fodder yield and 15.35 q/ha crude protein yield. Economics of perennial cropping system revealed that maximum gross return (Rs 123200), net return (Rs 84431) and benefit cost ratio (2.2) was found maximum under the intercropping of berseem in winter and cowpea in summer with BN Hybrid perennial cropping system and was at with intercropping of lucerne in winter and cowpea in winter between the BN Hybrid.

Table CS-14-AST-1 (a): Studies on intensive fodder cropping systems for yield maximization

Treatment	Yield (q/ha)			Income (Rs/ha)		B:C Ratio
	Green fodder	Dry matter	Crude Protein	Gross Income	Net Income	
T ₁ -BN Hybrid + Lucerne	606	124.14	12.28	92125	56066	1.6
T ₂ -Setaria + Lucerne	620	125.69	10.95	81875	45816	1.3
T ₃ -BN Hybrid + Cowpea (<i>summer</i>) / Lucerne (<i>winter</i>)	738	149.99	15.35	113150	74081	1.9
T ₄ -Setaria + Cowpea (<i>summer</i>) / Lucerne (<i>winter</i>)	595	134.91	12.23	92375	53306	1.4
T ₅ -BN Hybrid + Berseem (<i>winter</i>)	670	134.58	13.11	102375	66616	1.9
T ₆ -Setaria + Berseem (<i>winter</i>)	569	128.73	10.86	87325	51566	1.4
T ₇ -BN Hybrid + Cowpea (<i>summer</i>) / Berseem (<i>winter</i>)	789	156.15	15.53	123200	84431	2.2
T ₈ -Setaria + Cowpea (<i>summer</i>) / Berseem (<i>winter</i>)	660	145.13	12.83	102750	63981	1.7
SEm±	23.54	4.95	0.43	3223	4819	0.12
CD (P=0.05)	71.40	15.01	1.29	9775	14618	0.36
CV	6.99	5.96	5.44	5.41	11.93	11.11

CS-14-AST-2: Study of intensive annual fodder crop based cropping system

[Table Reference: CS-14-AST-2 (a)]

Location: Raipur

The experiment was initiated during *kharif* 2014 at Raipur with the objective to find out appropriate annual cropping system for maximum fodder production. The treatments consisted of eight cropping system viz., (T₁) sorghum multi cut + cowpea (2:1)- lucerne, (T₂) maize+ cowpea (2:1)- lucerne, (T₃) pearl millet multi cut + cowpea (2:1) – lucerne (T₄) maize + rice bean (2:1) – berseem – sorghum multi cut + cowpea (2:1) (T₅) maize + rice bean (2:1) – oat multi cut - sorghum multi cut + cowpea (2:1) (T₆) pearl millet multi cut + rice bean (2:1) –oat multi cut – maize + cowpea (2:1) (T₇) pearl millet multi cut + rice bean (2:1) – berseem – maize + cowpea (2:1) (T₈) pearl millet multi cut + rice bean (2:1) – berseem – sorghum multi cut + cowpea (2:1). The treatments were replicated thrice in Randomized Block Design.

The results indicated that significantly superior green fodder yield (1118 q/ha) and dry matter yield (247 q/ha) was recorded under (T₅) maize + rice bean (2:1) oat (multi cut) –sorghum (multi cut) + cowpea (2:1) cropping system followed by (T₆) pearl millet multi cut + rice bean (2:1) –oat multi cut – maize + cowpea (2:1) cropping system. Significantly higher crude protein yield was recorded under (T₇) pearl millet multi cut + rice bean (2:1) – berseem – maize + cowpea (2:1). Cropping system (T₅) maize + rice bean (2:1) oat (multi cut) –sorghum (multi cut) + cowpea (2:1) produced 3.7q/ha green fodder yield per day and 0.82 q/ha dry fodder yield, respectively. Economics of the different system was calculated and it shows that maximum gross return Rs 137385 , net return Rs 90445 and benefit cost ratio 1.93 was under the maize based cropping system Maize + Rice bean (2:1) – Oat multi cut - Sorghum multi cut + Cowpea (2:1).

Table CS-14-AST-2 (a): Study of intensive annual fodder crop based cropping system 2016-17

Treatment	Yield (q/ha)					Return (Rs/ha)		B:C ratio
	Green fodder	Dry matter	Crude Protein	Green fodder per day	Dry fodder per day	Gross return	Net return	
T ₁ . Sorghum multi cut + Cowpea (2:1) - Lucerne	556	123	15.92	2.1	0.46	52257	23537	0.82
T ₂ . Maize + Cowpea (2:1) - Lucerne	594	135	17.24	2.2	0.50	59407	29787	1.01
T ₃ . Pearl millet multi cut + Cowpea (2:1) - Lucerne	646	141	17.50	2.4	0.52	69990	41615	1.47
T ₄ . Maize + Rice bean (2:1) – Berseem – Sorghum multi cut + Cowpea (2:1)	1062	221	23.08	3.5	0.74	128304	79384	1.62
T ₅ . Maize + Rice bean (2:1) – Oat multi cut - Sorghum multi cut + Cowpea (2:1)	1118	247	21.27	3.7	0.82	137385	90445	1.93
T ₆ . Pearl millet multi cut + Rice bean (2:1) –Oat multi cut – Maize + Cowpea (2:1)	1091	238	18.92	3.6	0.79	134181	86386	1.81
T ₇ . Pearl millet multi cut + Rice bean (2:1) – Berseem – Maize + Cowpea (2:1)	1047	220	23.49	3.5	0.73	125342	76767	1.58
T ₈ . Pearl millet multi cut + Rice bean (2:1) – Berseem – Sorghum multi cut + Cowpea (2:1)	1041	213	22.07	3.5	0.71	128846	81171	1.70
SEm±	16.48	3.45	0.72	0.06	0.01	2558	2558	0.06
CD (P=0.05)	50.00	10.46	2.25	0.17	0.04	7759	7759	0.20
CV	5.65	4.89	6.25	3.21	3.10	4.24	6.96	7.53

K-15-AST-1L: Studies on Different model 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 & 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 T₁. Fodder Maize + Cowpea (3:1), T₂- Fodder Sorghum + Cowpea (3:1), T₃- BN Hybrid + Cowpea (2:8), T₄- BN Hybrid + Lucerne (2:8), T₅- BN Hybrid + Desmanthus (2:8), T₆- BN Hybrid + *Sesbania sps.* (2:8). The first year results revealed that year round fodder production system of B N hybrid + Lucerne (2:8) recorded higher green fodder yield (1679.3 q/ha), DMY of (367.6 q/ha), Net returns (Rs 154475.0/ha) and B:C ratio of 2.9 followed by B N hybrid +Cowpea (2:8) (1491.7 q/ha) with DMY of (321.6 q/ha), Net returns (Rs 129390.0/ha) & B : C ratio of 2.9.

Table K-15-AST-1L (a): Yield & Economics of different Models of Year round fodder production during *Kharif* and Rabi season

Entries	Kharif					Rabi				
	Yield (q/ha)		Return (Rs/ha)		B:C Ratio	Yield (q/ha)		Return (Rs/ha)		B:C Ratio
	Green fodder	Dry matter	Gross return	Net return		Green fodder	Dry matter	Gross return	Net return	
T ₁ -Fodder Maize + Cowpea (3:1)	431.4	90.8	51650.0	33200.0	2.8	210.1	39.2	25710.0	12560.0	2.0
T ₂ -Fodder Sorghum + Cowpea (3:1)	395.1	89.7	48260.0	32370.0	3.0	411.0	90.2	41100.0	22650.0	2.2
T ₃ -B N hybrid +Cowpea (2:8)	505.9	110.8	67270.0	43350.0	2.8	510.4	97.2	67820.0	45370.0	3.0
T ₄ -B N hybrid + Lucerne (2:8)	600.7	130.5	85480.0	58480.0	3.2	581.2	135.2	81970.0	55720.0	3.1
T ₅ -B N hybrid + Desmanthus (2:8)	435.0	93.7	52990.0	29065.0	2.2	416.9	91.3	50490.0	28595.0	2.3
T ₆ -B N hybrid + <i>Sesbania sps.</i> (2:8)	494.1	108.4	65100.0	39875.0	2.6	457.1	101.0	58880.0	34230.0	2.4
SEm±	17.9	5.2				13.3	4.2			
CD (P=0.05)	54.0	15.6				40.1	12.8			

Table K-15-AST-1L (b): Yield & Economics of different Models of Year round fodder production during (summer season and all the season)

Entries	summer season					Total				
	GFY (q/ha)	DMY (q/ha)	Gross returns (Rs/ha)	Net returns (Rs/ha)	B:C Ratio	GFY (q/ha)	DMY (q/ha)	Gross returns (Rs/ha)	Net returns (Rs/ha)	B:C Ratio
T ₁ -Fodder Maize + Cowpea (3:1)	329.7	85.1	38460.0	24570.0	2.8	971.1	215.1	115820.0	70330.0	2.5
T ₂ -Fodder Sorghum + Cowpea (3:1)	344.6	89.1	40448.0	26558.0	2.9	1150.7	269.0	129808.0	81578.0	2.7
T ₃ -B N hybrid +Cowpea (2:8)	475.4	113.6	61650.0	40670.0	3.0	1491.7	321.6	196740.0	129390.0	2.9
T ₄ -B N hybrid + Lucerne (2:8)	497.4	101.9	66600.0	40275.0	2.5	1679.3	367.6	234050.0	154475.0	2.9
T ₅ -B N hybrid + Desmanthus (2:8)	393.5	86.1	46090.0	24015.0	2.1	1245.3	271.1	149570.0	81675.0	2.2
T ₆ -B N hybrid + <i>Sesbania sps.</i> (2:8)	432.9	106.7	54580.0	30620.0	2.3	1384.0	316.0	178560.0	104725.0	2.4
SEm±	14.9	4.0				42.1	11.3			
CD (P=0.05)	45.1	12.0				126.8	34.1			

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

This experiment started from *kharif* 2015 to identify most suitable planting material for propagation of popular bajra napier hybrid varieties, as this crop is propagated both by stem cuttings and root slips, which 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. one eyed stem cutting, two eyed stem cutting, one eyed root slip and two eyed root slips. The planting was done in the month of May 2016 with pre-monsoon showers with all the standard agronomic practices except the treatments. The first cutting was taken at 75 DAT while subsequent cuttings were taken at 60 (± 5) days coinciding with the peak vegetative growth. Observations of all the 6 cuttings were pooled and analyzed for all the parameters except the green fodder yield for which each cut wise data is presented here under.

The results revealed that weight of the vegetative propagules was lowest with the BNH var. CO(BN) 5 while the volume was lowest with the DHN 6. Among the vegetative propagules, the lowest weight and volume were recorded with the one eyed stem cutting, while the two 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 1 eyed stem cutting (K-15-AST-2L (a)). The BNH varieties did not show significant difference among themselves with regard to number of tillers/hill, plant height and weight of green and dry fodder per meter row length. The 2 eyed root slips recorded significantly higher values with regard to the above said parameters followed by 2 eyed stem cutting. The lowest values were observed in 1 eyed stem cutting. The cutting interval wise green fodder yield per hectare showed differential performance. The varieties differ significantly in the green fodder yield. The 2 eyed rooted slips recorded significantly higher green fodder yield followed by 2 eyed stem cutting in the first 2 cuttings, while the subsequent cuttings did not show any significant difference among the vegetative propagules. However the mean and the total green fodder yield showed that 2 eyed root slips followed 2 eyed stem were high green fodder yielder as compared to others. Further the dry fodder yield was not significantly affected either varieties or by vegetative propagules indicating the at par performance of different varieties and vegetative propagules. The crude protein content and yield too were on par among the varieties and the vegetative propagules. However, both of them were significantly higher with 2 eyed root slips followed by 2 eyed stem cuttings.

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	1103.74	169.25	87.90	96.627	100.00	31.59	182.16	1.264	0.293	210.72	48.96	13.60	6.55
CO(BN) 5	1034.37	191.34	83.93	94.841	100.00	31.09	190.78	1.237	0.286	206.19	47.77	13.48	6.60
IGFRI 7	1083.72	183.36	87.10	96.825	100.00	31.19	188.35	1.249	0.290	208.10	48.30	13.73	6.60
SEm±	5.24	2.45	0.61	0.897		0.41	2.15	0.017	0.004	2.81	0.65	0.28	0.04
CD (P=0.05)	20.50	9.60	2.37	3.509		1.61	NS	NS	NS	NS	NS	NS	NS
Planting material													
Stem cutting 1 eyed	654.33	72.82	72.75	92.857	100.00	26.47	176.41	1.188	0.277	198.00	46.20	6.51	6.30
Stem cutting 2 eyed	1120.58	125.84	94.18	97.090	100.00	32.15	189.11	1.251	0.289	208.55	48.32	6.60	6.39
Root slip 1 eyed	906.00	211.72	83.33	95.767	100.00	31.88	186.22	1.229	0.285	204.87	47.56	6.57	6.38
Root slip 2 eyed	1614.86	314.89	94.97	98.677	100.00	34.66	196.64	1.332	0.307	221.92	51.28	6.65	6.47
SEm±	5.25	2.42	0.59	0.588		0.34	1.33	0.019	0.004	3.11	0.70	0.02	0.02
CD (P=0.05)	15.60	7.20	1.75	1.747		1.02	3.95	0.056	0.013	9.25	2.08	0.07	0.05
CV (%)	1.69	4.63	2.36	2.119		3.82	2.46	5.17	5.057	5.18	5.03	1.16	3.89

K-15 AST-8-7 L: 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 two consecutive seasons of Rabi 2015-16 and 2016-17 at Faizabad centre to screen 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 and poor in fertility (pH-8.9, EC-0.71dSm⁻¹, ESP-16.9% , organic carbon- 0.23%, availableN-193.4 kg, P -16.4 kg and K -185.7 kg/ha), silty loam in texture and saline in reaction. The mean results indicated that among all the entries tested, NDO-951 was found superior in all parameters i.e., green fodder, dry matter and crude protein yields as well as per day productivity. This was closely followed by NDO-952.

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

S. N.	Genotype	Yield (q/ha)									Yield per day (q/ha/day)					
		Green fodder			Dry Matter			Crude protein			Green fodder			Dry Matter		
		2015-16	2016-17	Mean	2015-16	2016-17	Mean	2015-16	2016-17	Mean	2015-16	2016-17	Mean	2015-16	2016-17	Mean
1	NDO-952	512.4	520.7	516.5	120.9	121.8	121.4	9.9	10.0	9.9	4.58	4.60	4.59	1.08	1.08	1.08
2	NDO-1101	460.7	466.4	463.5	106.9	106.8	106.8	8.4	8.4	8.4	4.11	4.13	4.12	0.95	0.94	0.94
3	NDO-1709	430.4	427.6	429.0	98.1	98.7	98.4	7.6	7.8	7.7	3.84	3.78	3.81	0.88	0.87	0.87
4	NDO-951	556.6	582.3	574.4	136.6	140.9	138.7	11.6	12.0	11.8	5.06	5.15	5.10	1.22	1.24	1.23
5	NDO-911	416.8	420.5	418.6	93.4	97.9	95.6	7.5	7.8	7.6	3.75	3.72	3.73	0.83	0.87	0.85
6	NDO-726	401.5	395.7	398.6	93.1	90.6	91.8	7.2	7.3	7.2	3.58	3.50	3.54	0.83	0.80	0.82
7	NDO-1(check)	385.3	388.4	386.8	82.2	88.5	85.3	6.6	6.8	6.7	3.44	3.43	3.44	0.79	0.78	0.78
8	NDO-2(check)	378.2	375.8	377.0	85.5	86.4	85.9	6.5	6.7	6.6	3.38	3.32	3.35	0.76	0.76	0.76
	CD at 5%	65.8	72.5	69.2	18.6	18.1	18.4	1.52	1.32	1.43	-	-	-	-	-	-

K-16-AST-6: Organic nutrient management in sorghum-berseem cropping sequence for sustainable fodder production [Table Reference: K-16-AST-6 (a)- (b)]

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. For single-cut forage sorghum, date of sowing was 13.07.2016 and variety used was HJ-541 during *kharif*. For subsequent *Rabi* season, berseem crop was taken and variety used was HB-1. Sowing of berseem crop was done on 12.11.2016. Total five cuts were taken in the berseem crop in all the treatments. Experiment was laid out in randomized block design to

Results: Data presented in Table 1 reveal that during *kharif* 2016, highest green fodder and dry matter yield of sorghum were recorded with T₁ (451.2 q/ha and 168.1 q/ha, respectively) which were significantly superior over rest of the treatments. Data presented in Table 2 reveal that during *Rabi* 2016-17, highest green fodder and dry matter yield of berseem (total five cuts taken) were recorded with T₃ (1011.8 q/ha and 148.9 q/ha, respectively) which were significantly superior over T₄, T₆ and T₈ except rest of the treatments.

Microbial study:

Initial Population at the time of start of experiment was *Azotobacter*- 28.6x10⁴ cfu/g soil, *Rhizobium*- 11.5x10³ cfu/g soil, PSB- 46.5x10⁵ cfu/g soil. Initial microbial population was low in case of *Rhizobium*, however *Azotobacter* and PSB populations were average. Data presented in Table 3 reveal that there was positive effect of organic inputs on overall growth of beneficial microbes. The biofertilizers used in respective crop showed establishment as shown by the population at the harvest. Green manuring favours growth of *Rhizobium* in berseem. Overall after consecutive use of biofertilizers, the populations increases and may reflect in nutrient status in the coming years.

Treatments detail:

T ₁ : Recommended dose of fertilizers through inorganic source (75 kg N+15 kg P ₂ O ₅ /ha in sorghum and 25 kg N+70 kg P ₂ O ₅ /ha in berseem)
T ₂ : 20 t FYM/ha (15t in sorghum and 5t/ha in berseem)
T ₃ : 20 t FYM/ha (15t in sorghum + 5t in berseem) + biofertilizer (<i>Azotobacter</i> + PSB in sorghum and <i>Rhizobium</i> + PSB in berseem)
T ₄ : 20 t FYM/ha (15t in sorghum + 5t in berseem) + Green manuring (<i>Dhaincha</i>)
T ₅ : 20 t FYM/ha (15t in sorghum + 5t in berseem) + biofertilizer + Green manuring
T ₆ : 7.5 t vermicompost/ha (5t in sorghum + 2.5t in berseem)
T ₇ : 7.5 t vermicompost/ha (5t in sorghum + 2.5t in berseem) + biofertilizer
T ₈ : 7.5 t vermicompost/ha (5t in sorghum + 2.5t in berseem) + Green manuring
T ₉ : 7.5 t vermicompost/ha (5t in sorghum + 2.5t in berseem) + biofertilizer + Green manuring

Table K-16-AST-6 (a): Effect of organic nutrient management on growth and forage yield of forage sorghum during *Kharif* 2016 and *Rabi* 2016-17

Treatment	Kharif 2016						Rabi 2016-17				Total Yield (q/ha)	
	No. of Tillers/m	Plant height (cm)	Yield (q/ha)			Crude protein (%)	No. of Tillers/ft ²	Plant height (cm)	Total green fodder (q/ha)	Total dry matter yield (q/ha)	Green fodder	Dry matter
			Green fodder	Dry matter	Crude Protein							
T ₁	18.3	277.5	451.2	168.1	18.39	10.94	953.4	63.11	953.4	141.9	1404.6	310.0
T ₂	16.8	260.0	350.5	130.5	13.14	10.07	954.7	61.80	954.7	135.8	1305.2	266.3
T ₃	16.1	256.2	359.8	133.2	13.11	9.84	1011.8	64.67	1011.8	148.9	1371.6	282.1
T ₄	17.4	258.8	366.8	143.5	14.75	10.28	932.4	61.47	932.4	129.1	1299.2	272.6
T ₅	17.3	266.1	381.5	141.7	15.81	11.16	998.2	63.31	998.2	148.0	1379.7	289.7
T ₆	15.7	245.0	342.3	125.2	12.33	9.85	850.5	58.60	850.5	120.6	1192.8	245.8
T ₇	15.6	237.7	307.6	119.0	13.54	11.38	953.9	61.73	953.9	136.2	1261.5	255.2
T ₈	15.4	235.2	275.6	104.3	10.04	9.63	859.0	57.89	859.0	124.2	1134.6	228.5
T ₉	16.6	232.1	281.6	101.2	10.40	10.28	952.6	61.42	952.6	139.3	1234.2	240.5
SEm±	1.03	4.72	8.40	5.11	-	0.34	22.88	0.97	22.88	5.60		
CD (P=0.05)	NS	14.30	25.60	15.50	-	1.02	69.17	2.95	69.17	16.93		
CV %	10.70	3.50	4.20	6.80	-	5.62	4.21	2.74	4.21	7.13		

Table K-16-AST-6 (b): Economic analysis and microbial populations of sorghum-berseem cropping sequence under organic nutrient management

Treatment	Economic analysis				Microbial study					
	Cost of cultivation (Rs.)	Gross returns (Rs.)	Net returns (Rs.)	BC ratio	<i>Azotobacter</i> (cfu/g soil)	<i>Rhizobium</i> (cfu/g soil)	PSB (cfu/g soil)	<i>Azotobacter</i> (cfu/g soil)	<i>Rhizobium</i> (cfu/g soil)	PSB (cfu/g soil)
T ₁	96947	175569	78622	1.81	50.0x10 ⁴	20.5x10 ³	55.6x10 ⁵	44.5x10 ⁴	19.5x10 ⁴	57.3x10 ⁵
T ₂	98892	163149	64257	1.65	11.2x10 ⁵	19.5x10 ³	42.1x10 ⁶	18.5x10 ⁵	21.2x10 ⁴	48.5x10 ⁶
T ₃	99045	171446	72401	1.73	57.0x10 ⁵	25.5x10 ³	45.0x10 ⁶	58.0x10 ⁵	49.5x10 ⁵	49.5x10 ⁶
T ₄	105392	162402	57010	1.54	32.5x10 ⁵	22.5x10 ⁴	34.5x10 ⁶	41.5x10 ⁵	32.0x10 ⁴	36.9x10 ⁶
T ₅	105545	172462	66917	1.63	60.5x10 ⁵	25.2x10 ⁴	63.0x10 ⁶	63.0x10 ⁵	37.4x10 ⁵	61.5x10 ⁶
T ₆	123555	149101	25546	1.21	29.5x10 ⁵	15.5x10 ³	66.5x10 ⁶	33.2x10 ⁵	24.7x10 ⁴	67.2x10 ⁶
T ₇	123708	157689	33981	1.27	55.6x10 ⁵	18.5x10 ³	88.2x10 ⁶	59.0x10 ⁵	78.6x10 ⁵	89.0x10 ⁶
T ₈	130055	141828	11773	1.09	31.5x10 ⁵	25.5x10 ⁴	75.0x10 ⁶	38.2x10 ⁵	43.4x10 ⁴	74.5x10 ⁶
T ₉	130208	154280	24072	1.18	61.5x10 ⁵	26.0x10 ⁴	89.5x10 ⁶	64.3x10 ⁵	64.0x10 ⁵	80.5x10 ⁶

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 study the resource management in rice-oat cropping system under sodic soils. The treatments comprised of eight treatments viz.; control, RDF (120N:60P₂O₅:40K₂O kg/ha), combination of 75% RDF and 50% RDF with 25% N and 50% N substitution through pressmud, dhaincha 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%, Avai. N- 115.4 kg, P –15.6 kg and K-240.0 kg/ha), silty loam in texture and saline in reaction. The paddy variety Sarjoo-52 was transplanted on July 29, 2016 and fertilized as per treatment. Fodder oat sown after harvest of paddy during Rabi 2016-17 and was fertilized with recommended dose of fertilizers. The results revealed that the values of grain and straw yields of paddy were significantly higher with RDF and being *at par* with 75% RDF+25% N through pressmud. 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 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 pressmud under rice – oat cropping system during the year 2016-17. Observations recorded on physico-chemical properties of soil after harvest of the crop during first year of experimentation showed nonsignificant effect for available nitrogen, phosphorous and potash as well as for pH, EC, ESP and Organic Carbon percentage over its initial values.

Table K 16-AST-8 (a): Effect of integrated nutrient management on fodder production under rice-oat cropping system during 2016-17

Treatment	Rice yield (q/ha)		Harvest Index (%)	Oat forage equivalent Yield (q/ha)	Oat Yields (q/ha)			Total green forage
	Grain	Straw			GFY	DMY	CPY	
Control	19.37	28.13	40.78	149.66	481.5	96.6	7.7	631.16
RDF(120N:60P ₂ O ₅ : 40K ₂ O kg/ha)	40.45	53.76	42.94	310.03	491.3	101.5	8.1	801.33
75% RDF+25% N through pressmud	36.23	48.89	42.56	278.05	489.6	99.2	8	767.65
75% RDF+25% N through dhaincha	33.67	46.64	43.92	259.01	487.3	98.7	7.9	746.31
75% RDF+25% N through crop residue	32.13	45.95	41.15	247.88	484.7	97.4	7.8	732.58
50% RDF+50% N through pressmud	32.55	46.42	41.22	251.06	486.7	97.8	7.9	737.76
50% RDF+50% N through dhaincha	31.21	44.66	41.14	240.8	485.5	96.9	7.7	726.3
50% RDF+50% N through crop residue	29.75	43.43	40.65	229.87	482.6	95.8	7.6	712.57
SEm±	2.03	2.39	2.4	15.07	41.35	6.83	0.51	38.36
CD (P=0.05)	4.26	5.12	NS	32.33	NS	NS	NS	82.3
CV%	7.8	6.53	7.07	7.51	10.42	8.54	7.95	6.42

K 16-AST-8 (b): Monetary return as influenced by integrated nutrient management under rice-oat cropping system during 2016-17

S. N.	Treatment	Cost of cultivation (Rs.)			Gross return (Rs.)	Net return (Rs.)	BC Ratio
		Rice	Oat	Total			
1	Control	28639	18219	46858	94674	47816	2.02
2	RDF(120N:60P ₂ O ₅ : 40K ₂ O kg/ha)	35117	18219	53336	120200	66864	2.25
3	75% RDF+25% N through pressmud	38962	18219	57181	115148	57967	2.01
4	75% RDF+25% N through dhaincha	36347	18219	54566	111946	57380	2.05
5	75% RDF+25% N through crop residue	38597	18219	56816	109887	53071	1.93
6	50% RDF+50% N through pressmud	42869	18219	61088	110664	49576	1.81
7	50% RDF+50% N through dhaincha	37577	18219	55796	108945	53149	1.95
8	50% RDF+50% N through crop residue	42077	18219	60296	106886	46590	1.77

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 2016-17

S. N.	Treatment	Available nutrients (kg/ha)			pH value	EC dSm ⁻¹	Exchangeable sodium (%)	O. C. (%)
		N	P	K				
1	Control	118.3	15.9	244	9.1	0.96	31.7	0.32
2	RDF(120N:60P ₂ O ₅ :40K ₂ O kg/ha)	122.7	16.8	255	9.0	0.94	31.3	0.24
3	75% RDF+25% N through pressmud	127.4	17.0	260	8.9	0.93	30.4	0.26
4	75% RDF+25% N through dhaincha	124.8	16.7	257	9.0	0.92	31.2	0.24
5	75% RDF+25% N through crop residue	122.6	16.6	254	9.0	0.93	31.3	0.24
6	50% RDF+50% N through pressmud	125.7	16.8	258	8.9	0.92	30.2	0.25
7	50% RDF+50% N through dhaincha	123.3	16.6	252	9.0	0.92	30.9	0.24
8	50% RDF+50% N through crop residue	124.4	16.5	249	9.0	0.92	31.1	0.24
	Initial value	115.4	15.6	240	9.1	0.97	32.7	0.23
	SEm ±	4.83	0.64	9.11	-	-	-	-
	CD (P=0.05)	NS	NS	NS	-	-	-	-
	CV%	4.8	4.7	4.4	-	-	-	-

R-13-AST-1: Yield Potential of Cereals with Forage Legumes under Pure Stand and Mixtures

[Table Reference: R-13-AST-1 (a)-(c)]

Location: Srinagar

Three cereals viz. oats (*Avena sativa* L.), barley (*Hordeum vulgare*) and annual rye grass (*Lolium multiflorum*) were evaluated in pure stands as well as in mixtures of 50:50 ratios with common vetch (*Vicia sativa* L.) and field pea (*Pisum sativum*) under temperate conditions of Kashmir Valley to address the problem of nutritious green fodder for livestock. The crops were sown during third week of October in a randomized complete block design at Mountain Livestock Research Institute (MLRI), Manasbal of SKUAST-K, Srinagar. The experiment was initiated during *rabi* 2013-14 and after completion of three years of evaluation, data has been reported in the Table (R-13-AST-1 (a)-(c)) The results revealed that oats vetch mixture performed better in terms of green and dry matter yields. The mixture recorded, 398.60 quintals per hectare green fodder and 88.04 quintals per hectare dry matter yield which was 10.97 and 16.77 percent higher than oats pure stand, respectively. Similarly, it was calculated that overall oats-vetch mixture yielded 31.40 and 37.0 percent higher dry matter than barley-vetch and rye grass-vetch, respectively. In pure stands maximum green fodder yield was recorded in oats crop followed by barley, rye grass and vetch. Higher content of crude protein was observed in sole vetch (20.89%) and higher crude protein yield was obtained in oat + vetch (11.31kg/ha), which was closely followed by barley + vetch and the minimum was found in sole rye grass (3.61kg/ha), thus indicating that cereal legume intercropping had maximum crude protein yield compared to sole cropping of cereals. The highest net return was recorded in oat + vetch followed by sole oats. All the treatments except sole cereals showed positive balance of available nutrients that indicates the grass-legume association improves the soil health.

Table R-13-AST-1 (a):- Effect on growth and yield of cereals with different legume intercropping

Treatments	Plant height (cm)	L:S ratio	yield (q/ha)		
			Fresh Fodder	Dry Fodder	Crude protein
T ₁ - Sole Oat	120.52	0.46	359.20	75.39	5.89
T ₂ - Sole Barley	92.50	0.44	271.35	58.78	7.02
T ₃ - Sole Ryegrass	76.25	1.80	235.30	54.04	3.61
T ₄ - Sole Vetch	76.20	0.70	210.00	43.80	9.53
T ₅ - Sole Field pea	67.35	0.52	195.80	48.75	9.96
T ₆ - Oat + Vetch	139.30	0.64	398.60	88.04	11.31
T ₇ - Oat + Field pea	118.60	0.58	312.30	64.40	7.02
T ₈ - Barley + Vetch	98.30	0.48	298.00	67.00	10.03
T ₉ - Barley + Field pea	88.50	0.44	240.00	55.20	6.95
T ₁₀ - Ryegrass + Vetch	86.35	1.62	245.00	54.15	6.02
T ₁₁ - Ryegrass + Field pea	80.28	1.38	200.00	46.25	4.43
SEm±	2.25	0.01	3.71	1.22	0.24
CD (P=0.05)	6.58	0.04	10.85	3.58	0.72

Table R-13-AST-1 (b):- Effect on quality parameters and economics with different cereals and legume intercropping

Treatments	Crude protein content (%)	Nitrogen content (%)	Nitrogen uptake (kg/ha)	Net returns (Rs/ha)	B:C ratio
T ₁ - Sole Oat	7.9	1.26	94.26	75600	2.36
T ₂ - Sole Barley	11.23	1.8	112.28	60975	1.79
T ₃ - Sole Ryegrass	6.54	1.05	57.72	56400	2.01
T ₄ - Sole Vetch	20.89	3.34	152.38	50430	1.65
T ₅ - Sole Field pea	19.3	3.09	159.3	48750	1.59
T ₆ - Oat + Vetch	12.85	2.05	180.48	83580	2.38
T ₇ - Oat + Field pea	11.6	1.85	112.22	66150	1.89
T ₈ - Barley + Vetch	14.98	2.4	160.80	63176	1.80
T ₉ - Barley + Field pea	13.02	2.08	111.19	51600	1.49
T ₁₀ - Ryegrass + Vetch	11.12	1.78	85.02	52200	1.53
T ₁₁ - Ryegrass + Field pea	9.8	1.57	70.84	43620	1.28
SEm±	0.41	0.19	3.02	-	-
CD (P=0.05)	1.23	0.53	8.76	-	-

Table R-13-AST-1 (c):- Effect of treatments on soil properties

Treatment	Organic carbon (%)	pH	Available N (kg/ha)	Available P (kg/ha)	Available K (kg/ha)
T ₁ - Sole Oat	0.73	6.4	203.3	11.5	304.52
T ₂ - Sole Barley	0.75	7.1	208.5	13.4	318.50
T ₃ - Sole Ryegrass	0.75	6.8	208.3	13.6	312.25
T ₄ - Sole Vetch	0.76	6.8	227.4	15.2	328.20
T ₅ - Sole Field pea	0.78	6.9	234.5	15.8	331.20
T ₆ - Oat + Vetch	0.78	6.8	222.6	12.9	314.25
T ₇ - Oat + Field pea	0.74	6.9	214.5	15.0	312.50
T ₈ - Barley + Vetch	0.76	6.9	216.6	16.0	315.60
T ₉ - Barley + Field pea	0.78	6.5	219.6	15.6	318.20
T ₁₀ - Ryegrass + Vetch	0.79	6.7	221.3	14.8	310.6
T ₁₁ - Ryegrass + Field pea	0.78	6.7	219.5	15.3	312.5
Initial soil status	0.71	6.6	212.52	14.42	320.48

R-14-AST-2:- Effect of cutting and nutrient management on growth, yield and quality of oat

[Table Reference: R-14-AST-2 (a)]

Location: Imphal

This experiment was initiated during Rabi season of 2014-15 on location specific mode with a view to evaluate oat for different purpose, viz. grain, fodder and both grain and fodder, under varying nutrients and cutting management practices. Total twelve treatments comprising of T₁- No cutting (Seed) + RDF (NPK @ 60: 40:40), T₂- No cutting (Seed) + 75% RDF + 5 t FYM/ha, T₃- No cutting (Seed) + 50% RDF + 7.5t FYM/ha, T₄- No cutting (Seed) + 25% RDF + 10t FYM/ha, T₅- Single cut (60 DAS) +Seed + RDF, T₆- Single cut (60 DAS) + Seed + 75% RDF + 5 t FYM/ha, T₇- Single cut (60 DAS) +Seed+ 50% RDF + 7.5t FYM/ha, T₈- Single cut (60 DAS) + Seed + 25% RDF + 10t FYM/ha, T₉- Three cut (60, 90 & 120 DAS)+ RDF, T₁₀- Three cut (60, 90 & 120 DAS)+ 75% RDF + 5 t FYM/ha, T₁₁- Three cut (60, 90 & 120 DAS)+ 50% RDF + 7.5t FYM/ha, T₁₂- Three cut (60, 90 & 120 DAS)+ 25% RDF + 10t FYM/ha were laid out in FRBD and replicated thrice. The data presented in the Table R-14-AST-2 (a), 2 (a-1) & 2 (a-2) revealed that fodder oat variety JHO-822, grown for seed purpose only i.e. No cutting (seed) recorded higher seed yield (21.69 q/ha) followed by single cut + seed (20.06 q/ha). Fodder oat grown for green fodder i.e. three cut (60, 90 & 120 DAS) was found to be dominant in fodder yield (533.64 q/ha) and dry matter yield (99.04 q/ha). For dual purpose (green forage +seed yield), one cut @ 60 DAS and left for seed was found to be the best in terms of yield, quality and economics. With the increase in quantity of FYM from 5 t/ha to 7.5 t/ha and decrease in RDF from 100% to 50%, there is an increase in green fodder yield, seed yield, dry matter yield, crude protein yield, crude protein content and crude protein content respectively. From economics point of view, highest net monetary return and benefit cost ratio was recorded in oat grown for green forage + seed.

In terms of net monetary return, the combined effect of single cut @ 60 DAS + seed with 50% RDF + 7.5 t FYM/ha recorded highest net return (Rs. 96784/ ha) and benefit cost ratio.

Table R-14-AST-2 (a): Effect of cutting and nutrient management on growth, yield and quality of oat

Treatment	Yield (q/ha)				Crude protein (%)	Plant height (cm)	Leaf stem ratio	Return (Rs./ha)		Benefit cost ratio
	Green fodder	Seed	Dry matter	Crude protein				Gross return	Net return	
A. Cutting										
No cutting (Seed)	-	21.69	-	-	-	111.17	-	108464	65814	1.65
Single cut (60 DAS) + Seed	224.84	20.06	37.49	3.96	10.54	89.31	0.53	134012	84331	1.59
Three cut (60, 90 & 120 DAS)	533.64	-	99.04	10.06	10.14	86.86	0.62	80046	27927	2.87
SEm±	5.36	0.53	1.49	0.29	0.32	1.32	0.02	1989	1989	0.04
CD (P=0.05)	16.26	1.61	4.51	0.89	0.96	3.88	0.07	5832	5832	0.13
B. Nutrient										
RDF (N, P ₂ O ₅ & K ₂ O @ 80: 40:40)	355.92	19.61	65.24	6.03	9.50	96.93	0.56	100939	57064	1.77
75% NPK of RDF + 5 t FYM/ha	370.17	20.77	67.38	7.39	10.80	95.59	0.52	106218	56369	1.88
50% NPK of RDF + 7.5t FYM/ha	409.06	23.27	71.81	7.66	10.92	92.59	0.60	118475	68900	1.72
25% NPK of RDF + 10t FYM/ha	381.81	19.87	68.62	6.95	10.14	98.00	0.63	104396	55096	1.89
SEm±	3.79	0.38	1.05	0.21	0.22	1.14	0.02	1722	1722	0.04
CD (P=0.05)	11.50	1.14	3.19	0.63	0.68	3.36	0.05	5051	5051	0.11
C. Interaction: C X N										
SEm±	7.58	0.75	2.10	0.41	0.45	2.29	0.03	3444	3444	0.07
CD (P=0.05)	NS	NS	NS	NS	NS	6.94	NS	NS	NS	NS

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

Location: Jorhat

Crop diversification through food – forage cropping system aims at supplying food for human consumption at the same time production of nutritious green forage for animal component. Intercropping system also helps to intensify crop production both in time and space dimension. Besides, in order to further increase in productivity integrated nutrient management is a very good option. In view of above, the experiment on effect of oat + pea intercropping system under different INM practices were undertaken in Rabi 2016-17 to study the performance of the cropping system on productivity of both food and forage. 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. F₁= RDF (inorganic), F₂= 50% N of RDF+50% N through FYM and F₃= 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 (Table R-15-AST-2 (a)–(b) revealed that the highest GFEY of the system as a whole was found in pea sole (807.41 q/ha). However intercropping system oat+pea (3:3 ratio) recorded higher GFEY than oat+pea (3:2 ratio) being 745.61 and 664.99 q/ha. INM with 50% RDF + 50% N through vermicompost recorded the highest GFEY than other treatments. The highest LER was also recorded (2.10) 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).

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

Treatments	Green fodder yield (q/ha)			GFEY (Oat+ Pea +Pod) q/ha	Dry matter yield (q/ha)		
	Oat	Pea			Oat	Pea	Oat + Pea
		GFY	Green Pod				
A. Intercropping system							
C ₁ .Oat sole	368.00	-	-	368.00	77.34		77.34
C ₂ . Pea Sole		180.71	26.82	807.51	-	30.72	30.72
C ₃ . Oat+Pea (3:2)	259.53	83.79	13.99	664.99	54.50	15.08	259.53
C ₄ . Oat+Pea (3:3)	255.90	86.62	17.99	745.61	53.74	14.73	255.90
SEm ₊				4.882			
CD (P=0.05)				14.77			
B. Integrated Nutrient Management							
F ₁ = RDF (inorganic)	283.12	110.86	17.39	597.89	59.46	19.10	283.12
F ₂ = 50% N of RDF+50%N through FYM	297.48	118.86	20.14	658.99	62.47	20.50	297.48
F ₃ = 50% N of RDF+50%N through Vermicompost	303.11	121.41	21.27	682.92	63.65	20.94	303.11
SEm ₊				9.221			
CD (P=0.05)				27.90			
Interaction C x F							
SEm				15.97			
CD (P=0.05)				NS			

R-15-AST-2 (b): growth quality and monetary parameters of oat + pea intercropping system as influenced by integrated nutrient management

Treatments	Plant Height (cm)		Plant Population Per meter		CP (%)		CPY (q/ha)		LER	Gross Income (Rs/ha)	Net Return (Rs/ha)
	Oat	Pea	Oat	Pea	Oat	Pea	Oat	Pea			
A. Intercropping system											
C ₁ Oat sole	116.17		132.74		7.91		6.17		1.00	36828	31766
C ₂ Pea Sole		42.64		13.11		13.80		4.24	1.00	80751	74492
C ₃ Oat+Pea (3:2)	113.26	38.91	134.51	12.89	8.23	14.35	4.49	2.16	1.17	66499	61540
C ₄ Oat+Pea (3:3)	113.43	40.90	133.20	12.67	8.14	14.54	4.38	2.14	1.18	74561	69718
SEm±	0.351	0.552	0.552	0.192	0.053	0.065				488.17	576.75
CD (P=0.05)	1.107	1.742	1.742	1.183	0.169	0.206				1477.40	1745.50
B. Integrated Nutrient Management											
F ₁ RDF (inorganic)	106.97	35.40	126.68	12.89	8.01	13.94	4.74	2.63	1.09	59789	55176
F ₂ 50% N of RDF+50%N through FYM	114.73	41.45	133.39	13.22	8.15	14.34	5.09	2.92	1.08	65899	60263
F ₃ 50% N of RDF+50%N through Vermicompost	121.17	45.60	140.39	12.56	8.18	14.42	5.21	3.00	1.09	68292	62698
SEm±	1.061	0.345	1.885	0.229	0.077	0.167				922.11	1520.49
CD (P=0.05)	3.346	1.089	5.943	NS	NS	NS				2790.70	4601.66
Interaction C x F											
SEm±	1.838	0.598	3.264	0.396	0.094	0.280	0.172	0.113		1597.15	2633.57
CD (P=0.05)	NS	NS	10.479	1.683	NS	NS	0.731	0.481		NS	7970.30
CV (%)	14.23	6.33	4.12	5.17	15.02	3.08	4.22	02.21		15.62	22.29

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

Location: Imphal

The experiment was initiated during Rabi season of 2015-16 to study the effect of integrated nutrient management on productivity of oat - chickpea intercropping system. The data for the year 2016-17 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 second year of experimentation, the data revealed that all parameters except plant height of both the crops, stover and seed yield of chickpea were significantly higher under sole crop compared to its intercropping. Irrespective of nitrogen sources, intercropping system recorded LER above 1.0 which indicates 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.89145/ ha).

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

Treatment	Oat yield (q/ha)			Chickpea				Green forage equivalent yield	LER of Intercropping System	Gross return (Rs. ha)	Net return (Rs./ha)	Benefit cost ratio
	Green fodder	Dry matter	Plant height (cm)	Seed yield (q/ha)	Harvest index (%)	Stover yield (q/ha)	Plant height (cm)					
A. Intercropping System												
Sole Oat	531.67	120.95	118.81	-	-	-	-	531.67	1	79750	42068	2.15
Sole Chickpea	-	-	-	19.81	47.44	20.59	51.93	584.26	1	116853	80371	3.26
Oat + Chickpea (3:2)	399.85	84.54	110.55	13.64	45.89	15.74	49.63	802.29	1.50	140465	103183	3.84
Oat + Chickpea (3:3)	389.33	88.23	109.30	16.90	44.89	17.50	53.15	887.83	1.63	158099	121017	4.37
SEm+	4.80	2.73	1.69	0.42	0.56	0.62	1.09	10.66	0.04	2091	2091	0.05
CD (P=0.05)	18.83	10.70	6.64	1.63	NS	2.43	NS	36.90	NS	7233	7233	0.18
B. Nutrient												
RDF (N, P ₂ O ₅ & K ₂ O @ 60: 40:40)	422.27	87.82	112.96	16.11	45.69	18.13	52.18	673.19	1.66	118803	87651	3.82
50% N of RDF + 50% N through FYM	441.24	97.64	110.00	16.81	43.48	17.72	50.82	702.82	1.55	124017	89145	3.56
50% N of RDF + 50% N through Vermicompost	457.35	108.26	115.70	17.42	49.05	17.99	51.71	728.52	1.50	128555	83183	2.84
SEm+	5.96	4.43	2.26	0.72	0.42	0.61	1.49	14.84	0.03	2995	2995	0.08
CD (P=0.05)	18.36	13.64	NS	NS	1.29	NS	NS	NS	0.11	NS	NS	0.24

R-15 AST-3: Response of phosphogypsum to various cultivars of fodder oat in sodic soil.
[Table Reference: R-15-AST-3 (a)-(c)]

Location: Faizabad

The experiment was initiated during Rabi 2015-16 and continued in Rabi 2016-17 at Faizabad center to assess the effect of phosphogypsum on fodder productivity of cultivars of oat under sodic soils. The treatment comprised of twelve combinations viz; three oat cultivars (NDO-1, NDO-2 & NDO-711) and four phosphogypsum levels [control, 125 kg (20kg S), 250 kg (40kg S) and 375 kg (60kg S)/ha]. The treatments were laid out in factorial randomized block design and replicated thrice. The experimental field was fertilized with recommended dose (100kg N: 40kg P₂O₅/ha). The soil of experimental field was sodic and poor in fertility (pH-8.9, EC-0.73dsm⁻¹, ESP-17.8%, organic carbon -0.21%, available N-192.4kg, P₂O₅ -16.4 kg and K₂O -187.8 kg/ha), silty loam in texture and saline in reaction. The results indicated that oat cultivar NDO-711 was statistically superior in terms of GFY, DMY, CPY and per day productivity, closely followed by oat cultivar NDO-1. A consistent increase in GFY, DMY, CPY and per day productivity were recorded with an increase in phosphogypsum levels from zero to 375 kg (60kg S)/ha. However, the differences between 250 kg (40kg S)/ha and 375 kg (60kg S)/ha was non-significant. Oat cultivars and phosphogypsum levels did not exhibit significant effects on CP%, plant height, plant populations, leaf stem ratio, days to 50% flowering and initial available nitrogen, phosphorus and potash in soils of the experimental field.

After harvest of the crop, soil of the experimental field was analyzed as per treatments for available nitrogen, phosphorus and potash. Oat cultivar showed non significant effects on available nitrogen, phosphorus and potash however, an increase in phosphogypsum levels up to 375 kg (60kg S)/ha consistently enhanced the available nitrogen, phosphorus and potash in soil and these values were observed non significant between 250 kg (40kg S)/ha and 375 kg (60kg S)/ha. Interaction effect was found non significant for all the parameters taken in investigations. Based on the average data of two years, it is clear that an application of 375 kg phosphogypsum/ha to fodder oat cultivar NDO-711 gave maximum gross return, net return and return per rupee investment.

Table R-15 AST-3(a): Effect of phosphogypsum on fodder production of various cultivars of oat under sodic soils during Rabi-2016-17

Treatment	GFY (q/ha)	DMY (q/ha)	CPY (q/ha)	Plant height (cm)	Plant populati on/m ²	Leaf stem ratio	Days to 50% flowering	Per day productivity (q/ha/day)	
								GFY	DMY
A- Cultivar									
V ₁ -NDO-1	472.62	112.30	8.76	107.6	387	0.76	109	4.33	1.03
V ₂ -NDO-2	433.50	102.87	8.41	106.2	379	0.78	108	3.99	0.95
V ₃ -NDO-711	517.17	122.95	10.30	109.0	397	0.81	107	4.81	1.14
SEm ±	21.55	5.05	0.37	3.58	10.56	0.02	4.02	0.17	0.04
CD (P=0.05)	44.70	10.47	0.76	NS	NS	NS	NS	0.35	0.09
B-Phosphogypsum (kg/ha)									
P ₁ -Control	429.66	102.56	8.24	108.4	385	0.77	108	3.99	0.95
P ₂ -125	461.43	108.06	8.87	109.2	387	0.77	108	4.27	0.97
P ₃ -250	491.83	107.06	9.31	109.7	389	0.79	109	4.53	1.07
P ₄ 375	514.80	123.13	10.22	108.8	389	0.81	109	4.72	1.14
SEm±	24.89	5.82	0.42	4.14	12.19	0.2	4.65	0.19	0.05
CD (P=0.05)	51.62	12.08	0.88	NS	NS	NS	NS	0.40	0.11
C-Interaction cultivar x Phosphogypsum									
SE ±	43.11	10.09	0.74	7.7		0.04	8.05	0.34	0.09
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV%	11.13	10.97	9.86	8.17	6.67	5.81	9.13	9.46	10.53

R-15 AST-3(b): Physico-chemical properties of soil at initial stage & after harvest

Treatment	Initial available			After harvest of the crop available		
	N	P	K	N	P	K
A- Cultivar						
V ₁ -NDO-1	192.8	16.7	188.3	203.6	17.8	209.3
V ₂ -NDO-2	192.7	16.6	188.4	202.4	17.5	207.6
V ₃ -NDO-711	192.9	16.5	188.3	206.6	18.1	212.1
SEm ±	4.14	0.33	3.69	4.36	0.36	4.17
CD (P=0.05)	NS	NS	NS	NS	NS	NS
B-Phosphogypsum (kg/ha)						
P ₁ -Control	192.3	16.4	187.8	195.5	16.8	201.2
P ₂ -125	193.2	16.7	188.9	199.3	17.6	207.6
P ₃ -250	192.9	16.7	188.4	209.3	18.3	212.9
P ₄ 375	192.9	16.6	188.3	212.7	18.6	216.9
SEm ±	4.78	0.38	4.27	5.03	0.41	4.82
CD (P=0.05)	NS	NS	NS	10.44	0.86	10.0
C-Interaction cultivar x Phosphogypsum						
SEm ±	8.28	0.65	7.39	8.72	0.72	8.35
CD (P=0.05)	NS	NS	NS	NS	NS	NS
CV%	5.26	4.83	4.81	5.23	4.92	4.88

R-15 AST-3(c): Monetary return as influenced by application of phosphogypsum to various cultivars of oat (mean data of Rabi 2015-16 & 2016-17)

Treatment	Cost of cultivation	Gross return	Net return	Net return/ rupee investment
A- Cultivar				
V ₁ -NDO-1	19308	71036	51728	3.68
V ₂ -NDO-2	19308	65100	45724	3.37
V ₃ -NDO-711	19308	77423	58114	4.01
SEm ±				
CD (P=0.05)				
B-Phosphogypsum (kg/ha)				
P ₁ -Control	18219	64540	46321	3.54
P ₂ -125	19095	69115	50020	3.62
P ₃ -250	19651	73755	54104	3.75
P ₄ 375	20268	77335	56977	3.82

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 Agricultural Research Station, SKRAU, Bikaner on sandy soil during *rabi* season of 2016-17 to fulfil the objectives-(i) to find out optimum seed rate of oats/ sarson mixed cropping for long term stable green fodder availability, and (ii) to work out the economics of different treatments. Treatments comprising of 100 % Seed rate lucerne (30kg/ha) (T₁), 100 % Seed rate oats (100 kg/ha) (T₂), T₁+10 kg/ha oats (T₃), T₁+20 kg/ha oats (T₄), T₁+30 kg/ha oats (T₅), T₁+40 kg/ha oats (T₆), T₁+0.625 kg/ha Sarson (T₇), T₁+1.250 kg/ha Sarson (T₈), T₁+1.880 kg/ha Sarson (T₉) and T₁+2.500kg/ha Sarson (T₁₀) were laid out in randomised block design with three replications. Experimental field soil was sandy loam in texture with medium in fertility status having OC 0.25%, and 111, 27.5, 220 kg/ha available NPK, respectively and has alkaline in reaction (pH 8.28), and EC (0.09ds/m of 2:1 soil water suspension). Sowing was done on November 18, 2016 using recommended seed rate of lucerne, oat as sole and lucerne + mixed crop (oat/sarson) as per treatments. Fertilizers @ 20 kg N, 40 kg P₂O₅, 20 kg K₂O 12.5 kg ZnSO₄ as basal was drilled at sowing. Further 20 kg N in two equal splits at 30DAS and after first cut for green fodder was broadcasted. Total six cuts was harvested as green fodder starting first at 50-55 DAS and next cuts at 20-30 days interval while in oats only three cuts harvested as green fodder. The results (Table-1R-15-AST-4 (a) reveal that lucerne + oat/ sarson mix fodder production system at variable seed rates gave significantly higher GFY and DMY as compared to sole lucerne or oats. Further the highest GFY (606 q/ha), DMY (68.1q/ha) and CPY (10.3 q/ha) were recorded in lucerne+ oat mixed with 30 kg/ha (T₅) treatment. The maximum net return and B:C ratio was observed in lucerne+ oat mixed @30 kg/ha (T₅). However, oat sole crop gave three cuts and green fodder lasts up to March end while rest treatments harvested six cuts of green fodder and lasts up to end of May.

Table-R-15-AST-4 (a): Yield, quality and economics of lucerne+oat/sarson mixed fodder production system (2016-17)

Treatment	Plant height(cm)	L:S ratio	Yield (q/ha)			CP %	Net return (Rs/ha)	B:C ratio
			Green fodder	Dry Matter	Crude protein			
T ₁	64.33	1.01	470.80	44.60	6.89	15.42	66160	2.36
T ₂	60.00	1.58	307.00	43.36	5.49	12.66	35400	1.36
T ₃	62.00	1.31	553.50	57.26	8.61	15.03	81700	2.82
T ₄	60.58	1.21	551.53	59.05	9.11	15.43	80807	2.74
T ₅	58.42	1.46	605.97	68.10	10.27	15.08	91193	3.04
T ₆	58.83	1.30	547.53	66.73	10.03	15.03	79007	2.59
T ₇	62.75	1.01	590.90	60.77	8.93	14.69	89380	3.10
T ₈	58.92	1.15	544.80	59.13	8.62	14.58	79707	2.75
T ₉	59.42	1.06	540.03	58.80	8.06	13.72	78707	2.69
T ₁₀	60.58	1.12	555.83	61.33	7.35	11.83	85600	2.90
Sem±	1.20	0.09	27.11	2.17	0.44	0.42	5078	0.18
CD (P=0.05)	3.55	0.26	80.55	6.43	1.31	1.25	15087	0.53
CV%	3.42	12.18	8.91	6.48	9.15	5.08	11	11.63

R-15-AST-5: Effect of Zinc and Boron on seed production potentiality of oats under lateritic soil of West Bengal
[Table Reference: R-15-AST-5 (a)]

Location: Sriniketan, Bengal

A field experiment was conducted during *Rabi* 2016-17 at Agriculture Farm, Institute of Agriculture, Visva-Bharati University, Sriniketan, West Bengal to study the effect of zinc and boron on seed production potentiality of oats under lateritic soil. 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) leading to 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.

During this field experimentation, growth attributes (plant height, no. of tillers/plant, LAI, dry matter accumulation and crop growth rate), yield components (no. of panicles/m², no. of filled grains/panicle and test weight) in (R-15-AST-5 (a), seed yield, straw yield, biological yield, harvest index, economics and seed quality of oats were studied.

Combined application of ZnSO₄ @ 20 kg/ha and Borax @ 10 kg/ha produced the highest seed yield (3.33 t/ha), straw yield (7.07 t/ha) and biological yield (10.81 t/ha) of oats (Table 1). This was statistically at par with Zinc sulphate @ 20 kg/ha along with boron @ 15 kg/ha (3.22 t/ha) & significantly higher than Zinc sulphate @ 5 kg/ha combined with borax @ 10 kg/ha (3.01 t/ha). As regards to economics, Combined application of ZnSO₄ @20kg/ha along with Borax @ 10 kg/ha gave the highest gross return (Rs. 1, 37,400/ha), net return (Rs. 1, 01,082/ha) and return per rupee investment (Rs.3.78). These were followed by ZnSO₄ @ 20kg/ha along with borax @15 kg/ha. The highest crude protein yield was obtained with application of ZnSO₄ @ 20 kg/ha (475.37 kg/ha). This was significantly higher than application of ZnSO₄ @ 15 kg/ha (386.23 kg/ha). The highest percentage of seed germination of oats was obtained at 15 kg/ha borax application (95.5%). However, this was at par with borax @10 kg/ha (94.8%) and borax @ 5 kg/ha (94.2%).

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

Treatment	Grain yield (t/ha)	Straw yield (t/ha)	Biological yield (t/ha)	Harvest Index (%)	Number of panicles/m ²	Number of filled grains/panicle	Test weight (g)	Gross Return (Rs./ha)	Total Cost of Cultivation (Rs./ha)	Net Return (Rs./ha)	Return per Rupee Investment (Rs.)	Crude Protein yield (kg/ha)	Seed Germination (%)
Levels of Zinc(ZnSO₄ kg/ha)													
0	2.49	5.73	8.23	30.22	179.6	66.9	28.5	103438	35743	67695	2.89	336.9	91.2
15	2.78	6.28	9.06	30.69	185.1	72.3	28.9	114675	36118	78557	3.17	386.2	94.3
20	3.11	7.07	10.18	30.63	193.3	78.6	29.7	128688	36243	92445	3.55	475.4	96.0
25	2.94	7.05	10.00	29.53	194.4	73.2	29.3	123563	36368	87195	3.40	452.5	95.0
SEm(±)	0.05	0.14	0.14	0.63	2.00	1.32	0.62	1452.08		1452.08	0.04	7.78	0.48
CD (P=0.05)	0.14	0.42	0.41	1.83	5.77	3.83	1.80	4193.90		4193.90	0.12	22.46	1.39
Levels of Boron(Borax kg/ha)													
0	2.50	5.77	8.26	30.14	175.1	66.2	28.5	103700	35893	67807	2.89	341.4	92.0
5	2.75	6.25	9.00	30.59	184.2	70.5	28.6	113638	36043	77595	3.15	387.0	94.2
10	3.04	6.98	10.02	30.46	192.4	77.2	29.8	126200	36193	90007	3.49	450.2	94.8
15	3.04	7.14	10.18	29.87	200.7	77.1	29.6	126825	36343	90482	3.49	472.4	95.5
SEm(±)	0.05	0.14	0.14	0.63	2.00	1.32	0.62	1452.08		1452.08	0.04	7.78	0.48
CD (P=0.05)	0.14	0.42	0.41	1.83	5.77	3.83	1.80	4193.90		4193.90	0.12	22.46	1.39
Zn x B Interaction													
SEm(±)	0.09	0.29	0.28	1.27	4.00	2.65	1.25	2904.15		2904.15	0.08	15.55	0.96
CD (P=0.05)	0.27	NS	0.82	NS	NS	NS	NS	8387.80		8387.80	0.23	NS	NS
CV (%)	5.75	7.63	7.26	5.27	3.68	6.31	7.41	4.28		6.17	4.27	6.53	1.77

R-15-AST-7: Standardization of seed rate of berseem with rye grass under mixed cropping system

Location: Karnal

A field experiment was conducted during *Rabi* 2016-17 at NDRI, Karnal, Haryana, to study the effect of varying seed rates of berseem and ryegrass on growth, yield, quality and economics of berseem and rye grass production in mixed cropping system. The treatments comprised of nine treatment combinations of different seed rates of berseem with ryegrass (*Lolium perenne*) viz; T₁ Sole Berseem (seed rate@25 kg/ha), T₂ Sole Ryegrass (seed rate @8kg/ha), T₃ seed rate @ 50 % (B+RG), T₄ seed rate @ 100%+25% (B+RG), T₅ seed rate @ 75%+25% (B+RG), T₆ seed rate @ 50%+25% (B+RG), T₇ seed rate @ 100%+25% (RG+B) T₈ seed rate @ 75%+25% (RG+B)T₉ seed rate @ 50%+25% (RG+B). The treatments were replicated thrice in randomized block design.

The results presented in table R-15-AST-7 (a) revealed that highest yields were recorded by t₈ (115.80t green and 1.20 t dry matter /ha). The sole rye grass recorded lowest yields (95.90t green and 1.00t dry matter /ha). Lower Leaf Stem Ratio was noted in berseem. 100% seed rate of berseem +25% seed rate of rye grass recorded the maximum net return and BC ratio.

Table R-15-AST-7 (a): Standardization of seed rate of berseem with rye grass under mixed cropping system

Treatments	GFY (t/ha)	DMY (t/ha)	CP (%)	Leaf Stem Ratio		Plant Height		Economics			
				Bersee m	Rye grass	Bersee m	Rye grass	Gross Return	Cost of Cultivation	Net Return	B:C ratio
T ₁ -Sole Berseem (B)	110.10	1.10	20.1	0.24	0.83	78.8	0.0	177124	63345	113779	2.80
T ₂ -Sole rye	95.90	1.00	18.4	0.19	0.95	0.0	60.4	130322	63118	67204	2.06
T ₃ -100%B+RG	109.90	1.10	18.5	0.27	0.91	79.6	68.4	163718	63930	99787	2.56
T ₄ -50%B+RG	107.10	1.00	19.4	0.27	0.90	81.2	66.9	156075	63232	92843	2.47
T ₅ -100%B+25%RG	110.30	1.10	18.3	0.25	0.90	80.4	66.5	165138	63492	101646	2.60
T ₆ -75%B+25%RG	112.90	1.20	22.8	0.26	0.82	80.8	62.9	165717	63288	102429	2.62
T ₇ -50%B+25%RG	113.50	1.20	19.2	0.30	0.81	82.7	67.9	168370	63085	105284	2.67
T ₈ -100%RG+25%B	115.80	1.20	21.2	0.22	0.80	84.5	69.2	171540	63321	108219	2.71
T ₉ -75%RG+25%B	108.00	1.10	20.4	0.28	0.81	81.9	63.4	157572	63175	94397	2.49
T ₁₀ -50%RG+25%B	106.90	1.00	17.7	0.27	0.77	79.9	62.9	155612	63028	92584	2.47
Total	109.00	1.10	19.6	0.24		73.0	58.8				

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

Location: Imphal

The trials could not be completed due to very less plant stand and heavy rain during February-March, 2017 crop was damaged as it was planted in low lying area where previous crop of rice was grown and the data could not be recorded.

R-16-AST-5: Seed yield maximization in Oat cv. RO-19 (Phule Harita)

[Table Reference: R-16-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; S₁- 0 (Control), S₂- 200, S₃- 300 and 400 Kg ha⁻¹ and Cutting management; C₁- No cutting, C₂- 45 and C₃ - 55 Days after sowing. The treatments were replicated thrice in randomized block design. The results indicated that application of silicon dioxide @ 400 kg ha⁻¹ recorded significantly higher plant height (113.0 cm). However, it was at par with silicon dioxide application @ 300kg ha⁻¹. Whereas, no cut recorded significantly higher plant height (110.7 cm), which was at par with cutting on 45 DAS. The application of silicon dioxide @ 400kg ha⁻¹ recorded significantly higher seed yield (15.12 q ha⁻¹), straw yield (109.36 q ha⁻¹). However, it was at par with silicon dioxide application @ 200kg ha⁻¹ and 300kg ha⁻¹. The cutting of oat at 45 DAS recorded significantly higher seed yield (15.89 q 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 (13.04 %) was significantly higher @ 400 kg ha⁻¹. Significantly higher lodging percentage was recorded with no cutting of crop (50%). Thus, application of silicon dioxide @ 400kg ha⁻¹ recorded significantly higher seed yield (15.12 q ha⁻¹), straw yield (109.36 q ha⁻¹). The cutting on 45 DAS produced higher seed yield (15.89 q ha⁻¹).

Table R-16-AST-5 (a): Seed yield maximization in Oat cv. RO-19 (Phule Harita)

Treatment	Plant population/ m row length	Plant height (cm)	Panicle length (cm)	Lodging (%)	Yield (q ha ⁻¹)		Lignin content in straw (%)	Seed germination (%)	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)	111.0	98.7	28.4	52.5 6	11.93	81.14	8.60	86	208.5	20.7	401.6
S ₂ - 200	108.0	103.4	30.0	46.6 7	13.90	103.92	10.48	86	198.5	19.5	384.2
S ₃ - 300	109.0	108.3	30.3	43.8 9	14.51	107.21	12.17	86	186.3	18.5	368.9
S ₄ - 400	106.0	113.0	30.6	42.4 4	15.12	109.36	13.04	86	177.8	17.9	347.6
SEm ±	2.78	2.22	0.47	1.51	0.44	4.53	0.18	0.72	5.80	0.42	6.73
CD 5 %	NS	6.40	1.34	4.36	1.27	13.04	0.53	NS	16.70	1.22	19.38
Cutting management (DAS)											
C ₁ - ^{No} cutting	110.0	110.7	30.6	50.0 0	12.13	107.12	10.37	85	203.4	20.1	389.3
C ₂ - 45	109.0	106.6	29.9	45.5 8	15.89	99.31	10.99	87	191.5	19.0	375.6
C ₃ - 55	107.0	100.3	29.0	43.5 8	13.58	94.79	11.86	86	183.4	18.4	361.8
SEm ±	2.41	1.93	0.40	1.31	0.38	3.92	0.16	0.62	5.02	0.37	5.83
CD 5 %	NS	5.55	1.16	3.77	1.10	NS	0.46	NS	14.46	1.06	16.78
Interaction S x C											
SEm ±	4.82	3.85	0.81	2.62	0.76	7.84	0.32	1.24	10.04	0.74	11.65
CD 5 %	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV (%)	7.70	6.30	4.68	9.78	9.51	13.52	4.99	2.50	9.02	6.66	5.37
Initial soil fertility status									185.3	18.6	385.0

R-14-AST-3: Studies on the effect of additives on silage quality of different grasses
[Table Reference: R-14-AST-3 (a)-(d)]

Location: Vellayani

The experiment was conducted at Vellayani to study the effect of additives on silage quality of different grasses in Rabi 2015 and Kharif 2016. The treatments consisted of two grasses *i.e.*, BN hybrid and guinea grass along with five silage additives namely Urea 1%, Urea 2%, Urea 1% + Jaggery 1%, Tapioca flour 1% and Jaggery 2%. The study was conducted in completely randomized design with three replications.

During Rabi 2015, highest dry matter and fresh silage/pit was recorded in guinea grass silage and the effect of additives were non significant. No significant difference was noticed in pH of silages prepared from the grasses using different additives. The pH of all the silages was in acceptable range. Total ash is the non combustible fraction of the feed, representing the total mineral content in the feed. Though the different additives tried in this experiment did not show any significant influence on the total ash content in silages, the impact of grasses on the total ash content of silage was significant. Lowest ash content (6.64) was recorded in the silage prepared from hybrid napier and highest total ash content (10.2) was recorded in guinea grass silage. Same trend was observed in acid insoluble ash content of silages, which indicates the silica present in the feed.

Significantly higher protein content was recorded in silage prepared from BN hybrid but additives couldn't influence the protein content of silage. Both the factors couldn't significantly influence the fibre content and nitrogen free extract (NFE) in silage, which indicates monosaccharides, disaccharides, trisaccharides and some of the soluble polysaccharides. But the impact was significant on ether extract (crude fat) percent which indicates the fat and fat-soluble components in the silage such as plant pigments (chlorophyll, xanthophylls, and carotene) and fat-soluble vitamins. Highest values of ether extract (2.198) was recorded in hybrid napier silage and among the different additives tested, urea 2% recorded highest value and was on par with all other additives.

Table R-14-AST-3 (a): Studies on the effect of additives on silage quality of different grasses (Rabi 2015)

Treatments	Fresh silage/pit	Dry Matter Content (%)	pH	Total ash	Acid insoluble ash	Crude protein	Crude fibre	Ether extract	Nitrogen free extract
A. Fodder crops									
Hybrid Napier	23.18	35.13	4.36	6.64	1.76	5.9	40.94	2.198	44.91
Guinea grass	28.29	44.13	4.18	10.2	2.14	3.03	39.94	1.513	46.83
SEm±	0.579	1.29	0.925	0.382	0.117	0.298	1.419	0.181	1.107
CD (P=0.05)	1.208	2.71	NS	0.799	0.245	0.621	NS	0.375	NS
B. Silage Additives									
Urea 1%	25.18	36.58	4.27	7.47	1.68	5.1	40.33	1.83	45.45
Urea 2%	27.42	43.65	4.2	8.15	1.87	4.65	39.17	2.72	46.05
Urea 1% + Jaggery 1%	26.12	38.58	4.38	8.2	2.31	3.93	42.12	1.42	46.68
Tapioca flour 1%	25.4	40.83	4.39	8.57	1.66	4.43	40.67	1.72	45.1
Jaggery 2%.	25.57	38.5	4.1	9.9	2.23	4.21	39.92	1.61	46.07
SEm±	0.916	2.04	0.146	0.605	0.185	0.471	4.679	0.284	1.751
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	0.593	NS

During Kharif 2016, highest dry matter and fresh silage/pit was recorded in guinea grass silage and the effect of additives were non significant. No significant difference was noticed in pH of silages prepared from the grasses using different additives. The pH of all the silages was in acceptable range. Total ash is the non combustible fraction of the feed, representing the total mineral content in the feed. Both additives and grass types had significant influence on the total ash content in silages. Lowest ash content (6.66) was recorded in the silage prepared from hybrid napier and highest total ash content (9.74) was recorded in guinea grass silage. Among the additives, jaggery 2% recorded highest ash and acid insoluble ash percentage and urea 1% had lowest values.

Significantly higher protein, fibre and ether extract percent content was recorded in silage prepared from BN hybrid but additives couldn't influence the protein and fibre content of silage. Significantly higher values of ether extract percent, which indicates the fat and fat-soluble components in the silage such as plant pigments (chlorophyll, xanthophylls, carotene) and fat-soluble vitamins, was estimated in silage prepared from BN hybrid with urea 2% as additive. Both the factors couldn't significantly influence nitrogen free extract (NFE) in silage, which indicates monosaccharides, disaccharides, trisaccharides and some of the soluble polysaccharides

Table R-14-AST-3 (b): Studies on the effect of additives on silage quality of different grasses (Kharif 2016)

Treatments	Fresh silage/pit	Dry Matter Content (%)	pH	Total ash	Acid insoluble ash	Crude protein	Crude fibre	Ether extract	Nitrogen free extract
A. Fodder crops									
Hybrid Napier	23.12	34.97	4.30	6.66	1.82	5.42	41.26	1.90	44.46
Guinea grass	27.98	44.39	4.15	9.74	1.985	2.97	39.33	1.32	44.02
SEm±	0.644	0.935	0.084	0.236	0.067	0.131	0.592	0.065	0.72
CD (P=0.05)	1.342	1.949	NS	0.493	NS	0.274	1.234	0.135	NS
B. Silage Additives									
Urea 1%	24.93	37.0	4.31	6.96	1.627	4.35	39.75	1.72	43.47
Urea 2%	28.03	42.43	4.14	7.83	1.692	4.42	39.59	2.22	45.36
Urea 1% + Jaggery 1%	25.05	38.54	4.38	8.45	2.12	3.67	41.71	1.197	43.70
Tapioca flour 1%	24.97	41.17	4.36	8.59	1.80	4.49	41.29	1.405	44.73
Jaggery 2%	24.77	39.33	4.01	9.22	2.30	4.06	39.15	1.52	43.94
SEm±	1.017	1.478	0.132	0.374	0.105	0.207	0.935	0.102	0.113
CD (P=0.05)	NS	NS	NS	0.779	0.219	NS	NS	0.213	NS

On the basis of two years study the mean data revealed that, the colour of the silages was slightly different according to the additives used for ensiling. Although there was slight difference in colour, the colour of all the silages were in acceptable range. Colour of silages with urea as additive had more greenish colour and the colour was yellowish green, while the silages with jaggery and tapioca flour as additive was pale green in colour. In the case of urea and jaggery mixed silage the colour was same as that of urea silage.

Pooled analysis of the data over two seasons was done and perusal of the data showed that seasons had no significant influence on quality parameters of silage. But grass type had significant influence on fresh silage/pit, dry matter content, total ash, crude protein and ether extract of silage. Highest value for fresh silage/pit, dry matter content and total ash was recorded in silage prepared from Guinea grass. Total ash is the non combustible fraction of the feed, representing the total mineral content in the feed. Sometimes the highest ash content in feed might cause some health problems in cattle. Highest crude protein and ether extract was recorded in silage prepared from BN hybrid.

Individual effect of additives was significant on total ash, acid insoluble ash and ether extract. Highest total ash and acid insoluble ash was estimated in silage prepared with Jaggery 2% as additive. Total ash content was on par with silage additives urea 1% + jaggery 1% and tapioca flour 1%. Acid insoluble ash was found to be on par with all other additives. Acid insoluble ash is directly related to the ash content and indicates the amount of silica present in the sample. This fraction of ash is unavailable to cattle and indicates poor quality of feed.

Ether extract was found to be significantly high in silage prepared with urea 2% as additive. It is the fraction of the feed which is obtained after continuous extraction with petroleum ether. It is the source of essential fatty acids that supplies energy to the animal.

Interaction effect of grass and additives was found to be significant on fresh silage/pit, pH, total ash, acid insoluble ash and crude protein content. Highest fresh silage/pit was recorded in Guinea grass + (urea 1% + jaggery 1%) and it was on par with all the other additive combinations with guinea grass. Highest silage pH was recorded in BN hybrid+ Jaggery 2% and it was on par with all other treatment combinations except silages prepared from BN hybrid+ urea 2%, Guinea grass+ urea 1% and Guinea grass + Jaggery 2%. Highest total ash and acid insoluble ash was recorded in the silage prepared from Guinea grass + Jaggery 2%.

Crude protein is the major quality parameter in silage and highest crude protein content was recorded in silage prepared from BN hybrid+ Jaggery 2% and it was on par with BN hybrid+ Urea 1% and BN hybrid+ Tapioca flour 1%.

Table R-14-AST-3 (c): Effect of season, grass and additives on quality parameters of silage (pooled data)

Treatments	Fresh silage/pit	Dry Matter Content (%)	pH	Total ash	Acid insoluble ash	Crude protein	Crude fibre	Ether extract	Nitrogen free extract
a) Season									
Rabi	25.75	39.63	4.27	8.46	1.79	4.46	40.44	1.86	45.87
Kharif	25.55	39.72	4.24	8.20	2.06	4.20	40.30	1.62	44.24
CD	NS	NS	NS	NS	NS	NS	NS	NS	NS
b) Fodder crops									
Hybrid Napier	23.16	35.09	4.35	6.65	1.79	5.66	41.11	2.05	44.69
Guinea grass	28.14	44.26	4.17	10.01	2.06	2.99	39.64	1.43	45.43
CD (P=0.05)	2.77	3.2	NS	1.44	NS	1.04	NS	0.606	NS
c) Silage Additives									
Urea 1%	25.06	36.79	4.29	7.21	1.66	4.72	40.04	1.80	44.46
Urea 2%	27.72	43.04	4.17	7.99	1.78	4.54	39.38	2.47	45.71
Urea 1% + Jaggery 1%	25.58	38.61	4.38	8.31	2.21	3.79	41.91	1.31	45.19
Tapioca flour 1%	25.18	41.0	4.38	8.58	1.73	4.46	40.98	1.56	44.92
Jaggery 2%.	24.69	38.91	4.05	9.56	2.26	4.14	39.54	1.56	45.00
CD (P=0.05)	NS	NS	NS	1.44	1.437	NS	NS	0.606	NS
S.Em(±)	3.5	3.8	2.83	5.23	6.99	7.28	3.68	4.08	2.83

Table R-14-AST-3 (d): Interaction effect of grasses and additives on quality parameters of silage (pooled data)

Treatment	Fresh silage/pit	Dry Matter Content (%)	pH	Total ash	Acid insoluble ash	Crude protein	Crude fibre	Ether extract	Nitrogen free extract	Cost of production Rs./t	B:C ratio
BN hybrid + Urea 1%	22.2	30.75	4.38	5.92	1.843	5.63	41.2	2.005	44.17	3723	2.14
BN hybrid + Urea 2%	27.72	36.95	4.04	6.12	1.52	5.22	41.44	2.91	45.17	3813	2.09
BN hybrid + Urea 1% + Jaggery 1%	22.70	33.73	4.29	7.27	1.96	5.07	40.45	1.99	45.13	4173	1.9
BN hybrid + Tapioca flour 1%	21.98	38.67	4.47	7.41	1.84	6.15	39.33	1.87	46.38	3833	2.08
BN hybrid + Jaggery 2%	21.20	35.33	4.54	6.5	1.81	6.24	43.68	1.48	42.58	4533	1.76
Guinea grass + Urea 1%	27.92	42.83	4.21	8.51	1.47	3.81	38.88	1.59	44.75	3723	2.14
Guinea grass + Urea 2%	27.73	49.13	4.30	9.82	2.04	3.85	37.31	2.03	46.24	3813	2.09
Guinea grass + Urea 1% + Jaggery 1%	28.47	43.5	4.48	9.35	2.46	2.52	43.37	1.63	45.26	4173	1.9
Guinea grass + Tapioca flour 1%	28.38	43.33	4.29	9.75	1.62	2.78	42.63	1.25	43.45	3833	2.08
Guinea grass + Jaggery 2%	28.18	42.5	3.57	12.62	2.72	2.03	35.99	1.64	47.42	4533	1.76
CD (P=0.05)	1.95	NS	0.28	1.07	0.305	0.733	NS	NS	NS		
S.Em(+)	3.5	3.8	2.83	5.23	6.99	7.28	3.68	4.08	2.83		

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

Location: Hyderabad

The trial was started with the objective to establish the suitability of different crops, ideal seed rate and cutting interval for quality biomass production and economic feasibility of fodder production under Hydroponics system. The trial could not be conducted at Vellayani, Mandya and Ludhiana. The treatments included three crops namely, C₁ Maize, C₂ Sorghum and C₃ Cowpea; three seed rates i.e., S₁ 200g, S₂ 300g and 400g g per square feet and four time interval for harvest i.e., D₁9 days, D₂11 days, D₃13 days and D₄ 15 days. the trial was laid out in CRD with three replications. The quality of water used in experiment was of neutral pH (7.8) and E.C of 1.6 dS/m.

Results:

Maize

The green fodder yield from one kg of seed was highest at seed density of 200 g/sft compared to other seed densities tested (4.73 kg GFY per kg seed). The green fodder yields harvested on 9th day, 11th day and 13th day were on par, hence, the ideal harvesting interval could be 9th day. However, significantly highest DM% of 11.0 % was observed when harvested on 9th day. Crude protein increased with delaying harvest from 9 to 15th day; highest was observed on 15th day (16.8%). There was no significant effect of densities on dry matter yields and crude protein content of hydroponic maize was observed. The root and shoot length increased steadily up to 13th day. There was no effect of densities on root or shoot lengths.

K-16-AST-1 (a): Green fodder, dry matter and crude protein content in hydroponic maize fodder

Interval	Green fodder (kg)			Dry matter content (%)			Crude protein content (%)		
	200 g/sft	300 g/sft	400 g/sft	200 g/sft	300 g/sft	400 g/sft	200 g/sft	300 g/sft	400 g/sft
9th day	4.79	4.20	4.47	11.33	11.33	10.33	9.9	9.6	10.5
11th day	4.84	4.43	3.99	9.33	8.33	8.33	11.7	13.7	14.6
13th day	4.76	4.04	3.81	7.67	7.67	7.33	16.6	14.9	14.1
15th day	4.55	2.67	2.89	7.17	8.00	7.33	14.1	19.4	16.8
		S.Em (±)	C.D. (0.05)	-	S.Em (±)	C.D. (0.05)		S.Em (±)	C.D. (0.05)
	Densities	0.19	0.56	Densities	0.33	NS	densities	0.724	NS
	Intervals	0.22	0.64	Intervals	0.382	1.119	intervals	0.84	2.47
	Interaction	0.38	NS	Interaction	0.661	NS	interaction	1.448	NS

K-16-AST-1 (b): Influence of seed densities and harvesting intervals on shoot length and root lengths of maize under Hydroponics

Seed Densities	9 th day		11 th day		13 th day		15 th day	
	Shoot length (cm)	Root Length (cm)	Shoot length (cm)	Root Length (cm)	Shoot length (cm)	Root Length (cm)	Shoot length (cm)	Root Length (cm)
200 g/sft	22.1	17.1	25.9	15.9	30.1	21.0	31.5	22.2
300 g/sft	24.3	15.3	30.5	20.5	34.1	20.9	29.4	18.9
400 g/sft	25.1	19.4	27.9	17.7	31.1	21.2	26.3	19.4
Mean	23.8	17.3	28.1	18.0	31.8	21.0	29.1	20.2
S.Em (+)	0.89	1.3	1.5	1.8	1.2	1.8	1.2	1.6
C.D. (0.05)	NS	NS	NS	NS	NS	NS	3.7	NS

K-16-AST-1 (c): Influence of seed densities and harvesting intervals on quality of maize under Hydroponics

Interval	Ash (%)				NDF (%)				Ether extract (%)			
	200	300	400	Mean	200	300	400	Mean	200	300	400	Mean
9th day	2.50	3.93	2.27	2.90	57.1	57.3	64.0	59.5	2.50	3.93	2.27	2.90
11th day	1.17	1.60	3.60	2.12	66.5	63.0	60.1	63.2	1.17	1.60	3.60	2.12
13th day	2.90	1.34	1.15	1.80	62.9	62.6	61.0	62.2	2.90	1.34	1.15	1.80
15th day	0.05	0.04	0.03	0.04	60.4	61.3	61.6	61.1	0.05	0.04	0.03	0.04
Mean	1.66	1.73	1.76		61.7	61.0	61.7		1.66	1.73	1.76	
	S.Em (+)	CD (0.05)				S.Em (+)	C.D. (0.05)			S.Em (+)	C.D. (0.05)	
	Densities	0.19	NS		Densities	0.6	NS		Densities	0.19	NS	
	Intervals	0.22	0.64		Intervals	0.7	2.04		Intervals	0.22	0.64	
	Interaction	0.38	1.31		Interaction	1.2	4.17		Interaction	0.38	1.31	

COWPEA

The green fodder yield from one kg of seed was highest at seed density of 300 g/sft compared to other seed densities tested (3.92 kg GFY per kg seed). The green fodder yields of crop harvested on 9th day was highest (4.34 kg) though on par with that of 11th day harvest. Dry matter was also highest at 400g/sft i.e., 10.68 % but on par with 300g/sft (10.38%). Crude protein was highest at 400g/sft seed density but there was no effect of harvesting intervals on CP%. The root and shoot length increased significantly with increasing seed density explaining effect of competition at higher seed densities.

K-16-AST-1 (d): Green fodder, dry matter and crude protein content in hydroponic cowpea fodder

Density	Green fodder (kg GFY/kg seed)			Dry matter content (%)			Crude protein content (%)		
	200	300	400	200	300	400	200	300	400
9th day	3.85	4.29	4.89	10.25	9.25	10.25	37.87	42.70	59.80
11th day	3.35	4.46	3.97	9.25	11.50	10.25	52.43	39.67	49.70
13th day	2.72	4.5	2.69	9.50	10.25	10.50	46.07	41.23	51.27
15th day	2.12	2.42	1.30	10.25	10.50	11.50	39.37	48.87	42.40
		S.Em (±)	C.D. (0.05)		S.Em (±)	C.D. (0.05)		S.Em(±)	C.D.(0.05)
	Densities	0.17	0.49	Densities	0.17	0.51	Densities	1.62	4.76
	Intervals	0.19	0.57	Intervals	0.20	0.59	Intervals	1.87	NS
	Interaction	0.33	1.15	Interaction	0.35	1.21	Interaction	3.24	11.23

K-16-AST-1 (e): Influence of seed densities (per sq ft) and harvesting intervals on shoot length and root lengths (cm) of cowpea under Hydroponics

Seed Densities	9 th day		11 th day		13 th day		15 th day	
	Shoot length	Root Length	Shoot length	Root Length	Shoot length	Root Length	Shoot length	Root Length
200 g/sft	11.6	3.25	15.1	5.1	12.6	2.9	12.6	3.7
300 g/sft	14.5	5.2	17.3	8.0	19.0	5.8	19.0	6.2
400 g/sft	18.9	7.4	16.3	6.4	17.7	5.1	17.3	4.3
Mean	15.0	5.3	16.2	6.5	16.4	4.6	16.3	4.7
S.Em (±)	0.5	0.63	0.7	0.7	0.6	0.6	0.4	0.5
C.D. (0.05)	1.49	1.88	NS	NS	1.7	1.8	1.3	1.5

K-16-AST-1 (f): Influence of seed densities (g/sq ft) and harvesting intervals on quality of cowpea under Hydroponics

	Ash (%)				NDF (%)				Ether extract (%)			
	200	300	400	Mean	200	300	400	Mean	200	300	400	Mean
9th day	7.37	8.11	8.00	7.83	37.2	38.6	37.7	37.8	1.67	1.70	1.43	1.60
11th day	8.38	8.00	5.37	7.25	37.6	38.0	42.9	39.5	1.53	1.43	1.17	1.38
13th day	7.00	8.25	7.37	7.54	35.3	40.9	37.4	37.9	1.40	1.67	1.70	1.59
15th day	6.75	6.38	6.25	6.46	33.9	37.3	31.3	34.2	1.47	1.20	1.23	1.30
Mean	7.37	7.69	6.75		36.0	38.7	37.3		1.52	1.50	1.38	
	S.Em(±)	CD (0.05)				S.Em(±)	C.D. (0.05)			S.Em(±)	C.D. (0.05)	
	Densities	0.11	0.32		Densities	0.36	1.06		densities	0.039	NS	
	Intervals	0.13	0.37		Intervals	0.42	1.22		intervals	0.045	0.133	
	Interaction	0.22	0.76		Interaction	0.72	2.50		interaction	0.078	0.272	

SORGHUM

In sorghum the seed multiplication ratio into GFY was very poor i.e., not crossing 3 kg at any harvesting interval. Hence hydroponics fodder production will not be advisable in sorghum. The dry matter content in sorghum hydroponics is higher than all the three crops tested i.e., varying between 13.0-14.3%. The crop growth was very poor and slow compared to other crops.

K-16-AST-1 (g): Green fodder, dry matter and crude protein content in sorghum hydroponic fodder

	Green fodder (kg GFY per kg seed)			Dry matter content (%)		
	200	300	400	200	300	400
9th day	2.14	1.97	1.82	12.0	14.0	13.0
11th day	2.46	1.94	1.85	12.5	13.0	14.0
13th day	2.59	2.14	2.09	12.5	15.0	15.5
15th day	2.56	2.74	2.29	12.7	14.6	13.8
		S.Em(±)	C.D.(0.05)		S.Em(±)	C.D.(0.05)
	Densities	0.022	0.063	Densities	0.32	0.953
	Intervals	0.025	0.073	Intervals	0.38	NS
	Interaction	0.043	0.149	Interaction	0.65	NS

K-16-AST-1 (h): Influence of seed densities (per sq ft) and harvesting intervals on shoot length and root lengths (cm) of sorghum under Hydroponics

Harvesting Interval	9 th day		11 th day		13 th day		15 th day	
	Shoot length	Root Length	Shoot length	Root Length	Shoot length	Root Length	Shoot length	Root Length
200 g/sft	22.1	17.1	25.9	15.9	30.1	21.0	31.5	22.2
300 g/sft	24.3	15.3	30.5	20.5	34.1	20.9	29.4	18.9
400 g/sft	25.1	19.4	27.9	17.7	31.1	21.2	26.3	19.4
Mean	23.8	17.3	28.1	18.0	31.8	21.0	29.1	20.2
S.Em(±)	0.89	1.3	1.5	1.8	1.2	1.8	1.2	1.6
C.D. (0.05)	NS	NS	NS	NS	NS	NS	3.7	NS

C. AVT-2 BASED AGRONOMY TRIALS

R-16-AST-6: Effect of nitrogen levels on forage yield of promising entries of oat (AVTO-2-SC)

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

Locations: **Hill zone:** Palampur, Srinagar
North West Zone: Ludhiana, Hisar, Pantnagar
Central Zone: Anand, Jabalpur, Raipur, Urulikanchan

In Oat (Single cut), eight entries (424, OL-1769-1, OL-1802, SKO-225, JO-04-19, UPO-10-3, OL-1766-1, OS-432) along with two national checks namely OS-6 and Kent and three zonal checks viz., SKO-90 (HZ), OL-125 (NWZ), JHO-822 (CZ), were evaluated at 9 locations across the three zones in the country.

In North West zone, for GFY and DMY, entry OL-1802 (710.2 and 130.83 q/ha, respectively) was superior to other entries as well as national checks. OL-1802 recorded 11.5, 24.5, 11.2 and 23.0 % higher green fodder yield over entry OL-1766-1, Kent (NC), OS-6 (NC) and OL-125 (ZC). Entry OL-1802 also recorded 31.9, 11.9 and 23.9 % higher dry matter than Kent (NC), OS-6 (NC) and OL-125 (ZC) respectively. Entry OL-1802 demonstrated highest CPY followed by OS-6 and SKO-225. The growth performance and yields of all the entries improved consistently with increase in level of nitrogen up to 120 kg/ha (622.3 q green and 114.97q dry matter /ha) which was 15.2 and 5.5 % higher over 40 and 80kg N/ha, respectively in terms of green fodder. The interaction effect for green fodder and dry matter yield was significant at Ludhiana.

In Hill zone, except entry UPO-10-3, all other entries recorded higher GFY and remained at par with each other. The entries were significantly superior over checks. In terms of DFY, SKO-225 (64.65) recorded superior yields over other entries and checks which was 11.0% and 4.5% higher over Kent and other best entry JO-19. In terms of curds protein yields entries OS-424, SKO-225, UPO-10-3 proved best and recorded higher yields than other entries and checks. The interaction effect for green fodder and dry matter yield was significant at Srinagar.

The growth performance and yields of all the entries improved consistently with increase in level of nitrogen up to 120 kg/ha (325.8 q green and 66.1 q dry matter /ha), which was 25.8 and 12.3 % 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.

In Central zone, for GFY and DFY, entry OL-1802, OL-1766-1 and OL-1769-1 (527.7& 106.6, 516.3q &102.5 q , 526.8 &104.9q GFY and DFY/ ha respectively) were superior over other entries. In terms of CPY entry OL-1802 was superior to other entries but was at par with national checks. The growth performance and yields of all the entries improved consistently with increase in level of nitrogen up to 120 kg/ha (531.1 q green and 108.7 q dry matter /ha), which was 29.10 and 8.8 % 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.

On all India mean basis, OL-1802 produced maximum GFY (533.3 q/ha) and DFY (104.01 q/ha). The entry also recorded highest CP yields as among all entries and national checks. It was followed by OL-1766-1 (503.3 q/ha) in terms of GFY as well as DFY. The growth performance and yields of all the entries improved consistently with increase in level of nitrogen up to 120 kg/ha (515.9 green and 100.85 q dry matter/ha).

Table- R-16-AST-6 (a): Effect of nitrogen levels on green fodder yield of promising entries of Oat (AVTO-2-SC)

Entries	Green fodder yield (q/ha)												Overall Mean
	Hill zone			North West zone				Central Zone					
	Palam-pur	Sri-nagar	Mean	His-ar	Pant-nagar	Ludh-iana	Mean	Anand	Jabalpur	Raipur	Urulik ancha n	Mean	
OL-1766-1	214.0	365.3	289.7	630.2	630.0	625.6	628.6	545.0	574.5	404.6	540.9	516.3	503.3
OL-1802	177.4	408.3	292.9	754.6	608.0	740.9	701.2	568.0	508.3	407.4	626.9	527.7	533.3
UPO-10-3	197.0	343.7	270.4	598.2	618.0	593.1	603.1	517.0	484.2	331.5	572.9	476.4	472.8
SKO-225	166.4	433.5	300.0	572.5	624.0	543.8	580.1	484.0	561.1	358.3	534.2	484.4	475.3
OL-1769-1	193.0	394.0	293.5	570.3	585.0	566.9	574.1	508.0	553.6	393.5	652.0	526.8	490.7
OS-424	203.9	391.4	297.7	529.4	631.0	596.3	585.6	490.0	440.3	343.5	653.5	481.8	475.5
OS-432	216.7	384.5	300.6	411.3	607.0	310.3	442.9	397.0	502.5	311.1	468.3	419.7	401.0
JO-04-19	201.2	399.3	300.3	539.6	636.0	569.0	581.5	399.0	458.1	397.2	648.0	475.6	471.9
Kent (NC)	197.5	348.3	272.9	564.6	598.0	527.0	563.2	412.0	558.5	350.0	596.7	479.3	461.4
OS-6 (NC)	162.8	377.3	270.1	639.9	599.0	651.5	630.1	451.0	530.9	305.6	652.5	485.0	485.6
SKO-90 (HZ)	175.6	375.6	275.6										
JHO-822 (CZ)								393.0	392.3	334.3	572.5	423.0	
OL-125 (NWZ)				520.6	617.0	572.5	570.0						
SEm±	10.30	8.05		36.81	7.2	13.25		17.6	20.6	11.01	24.9		
CD at 5%	24.81	23.60		109.36	20.0	39.1		52.0	60.6	32.72	73.8		
Nitrogen level (Kg/ha)													
40	137.8	360.6	249.2	526.0	604.0	490.4	540.1	430.0	434.6	289.4	531.7	421.4	422.7
80	192.8	382.8	287.8	585.6	617.0	583.1	595.2	489.0	527.3	363.1	588.4	492.0	481.0
120	243.7	407.9	325.8	615.2	621.0	630.7	622.3	490.0	555.6	421.2	657.6	531.1	515.9
SEm±	3.37	4.45		10.15	3.8	5.72		6.6	12.3	5.20	4.25		
C D at 5%	9.61	12.85		29.02	11.0	16.3		18.3	36.52	14.87	12.16		
Interaction: V X N levels													
SEm±		13.24				18.97		21.9	16.54		27.39		
CD at 5%	NS	38.4		NS	NS	54.0		60.8	48.63	NS	80.84		
CV (%)				10.13		5.74		8.1	15.12				

Table- R-16-AST-6 (a-1): Interaction effects of nitrogen levels and promising entries on green fodder yield (q/ha) of oat (AVTO-2 -SC)

Entries	Ludhiana				Srinagar			
	N levels (kg/ha)				N levels (kg/ha)			
	40	80	120	Mean	40	80	120	Mean
OL-1766-1	520.5	666.1	690.3	625.6	342.5	360.7	392.6	365.27
OL-1802	684.4	747.2	791.1	740.9	385.7	410.6	428.6	408.30
UPO-10-3	460.3	633.3	685.6	593.1	325.8	342.6	362.8	343.73
SKO-225	513.9	540.3	577.2	543.8	392.5	439.6	468.3	433.47
OL-1769-1	526.7	570.6	603.6	566.9	372.5	398.3	411.2	394.00
OS-424	456.1	642.2	690.6	596.3	368.5	389.2	416.5	391.40
OS-432	240.0	302.8	388.1	310.3	365.4	379.6	408.5	384.50
JO-04-19	482.2	570.6	654.2	569.0	376.5	398.8	422.6	399.30
Kent (NC)	493.1	517.8	570.3	527.0	325.80	342.6	376.5	348.30
OS-6 (NC)	556.7	685.3	712.5	651.5	358.7	372.6	400.6	377.30
SKO-90 (HZ)					352.7	375.6	398.5	375.60
OL-125 (NWZ)	482.2	601.4	633.9	572.5				
Mean	490.4	583.1	630.7		360.6	382.7	407.8	
	Entry	Nitrogen level	E x N		Entry	Nitrogen level	E x N	
	13.25	5.72	18.97	SEm±	8.05	4.45	13.24	
CD at 5%	39.1	16.3	54.0	CD at 5%	23.60	12.85	38.4	

Table- R-16-AST-6 (b): Effect of nitrogen levels on dry fodder yield of promising entries of Oat (AVTO-2-SC)

Entries	Dry Matter Yield (q/ha)												Over all Mean
	Hill zone			North West zone				Central Zone					
	Palam-pur	Sri-nagar	Mean	His-ar	Pant-nagar	Ludh-iana	Mean	Ana-nd	Jabal-pur	Rai-pur	Urulikan-ghan	Mean	
OL-1766-1	41.1	77.7	59.40	119.8	126.8	109.4	118.67	86.5	116.4	84.3	123.1	102.58	98.34
OL-1802	34.1	83.0	58.55	139.7	123.1	129.7	130.83	120.0	101.5	93.8	111.2	106.63	104.01
UPO-10-3	36.8	71.9	54.35	100.0	127.0	101.9	109.63	94.9	96.6	77.0	106.9	93.85	90.33
SKO-225	32.8	96.5	64.65	105.8	125.5	94.0	108.43	76.4	112.4	73.1	110.9	93.20	91.93
OL-1769-1	37.2	78.7	57.95	95.0	117.6	90.0	100.87	74.0	111.3	83.1	151.5	104.98	93.16
OS-424	39.1	83.2	61.15	100.6	127.5	106.1	111.40	74.7	86.2	74.2	153.0	97.03	93.84
OS-432	40.5	80.6	60.55	58.2	123.8	48.4	76.80	56.0	95.5	56.7	95.2	75.85	72.77
JO-04-19	38.8	84.92	61.86	97.4	130.0	97.3	108.23	80.5	90.7	81.9	150.3	100.85	94.65
Kent (NC)	39.0	77.5	58.25	95.7	119.0	82.9	99.20	91.0	112.0	70.1	144.3	104.35	92.39
OS-6 (NC)	31.3	80.3	55.80	117.7	120.5	112.6	116.93	66.8	104.8	58.5	161.4	97.88	94.88
SKO-90 (HZ)	33.8	81.03	57.42										
JHO-822 (CZ)								89.2	76.6	56.6	122.5	86.23	
OL-125 (NWZ)				91.4	125.6	99.9	105.63						
SEm±	1.91	2.49		5.14	1.74	2.57		3.1	7.31	2.54	5.50		
CD at 5%	4.62	7.32		15.25	4.92	7.58		9.3	21.63	7.56	16.34		
Nitrogen level (Kg/ha)													
40	26.2	78.73	52.47	90.0	116.7	83.7	96.80	74.1	84.7	55.5	119.4	83.43	81.00
80	37.3	80.24	58.77	104.7	125.3	100.9	110.30	88.8	105.4	72.8	128.7	98.93	93.79
120	46.8	85.23	66.02	111.0	126.1	107.8	114.97	85.3	111.0	92.4	142.0	107.68	100.85
SEm±	0.66	1.40		1.58	0.91	1.12		1.2	6.3	1.46	0.90		
C D at 5%	1.89	4.08		4.53	2.57	3.18		3.4	18.21	4.18	2.58		
Interaction: Entry X N levels													
SEm±		4.33				3.71		4.0	6.24		6.02		
CD at 5%	NS	12.52		NS	NS	10.56		11.1	18.54	NS	17.78		
CV (%)				8.93		6.59		8.4	10.31				

Table- R-16-AST-6 (b-1): Interaction effects of nitrogen levels and promising entries on dry matter yield (q/ha) of oat (AVTO-2 -SC)

Entries	Ludhiana				Srinagar			
	N levels (kg/ha)				N levels (kg/ha)			
	40	80	120	Mean	40	80	120	Mean
OL-1766-1	90.2	117.7	120.6	109.4	75.2	75.6	82.3	77.70
OL-1802	117.4	134.5	141.8	129.7	80.8	82.6	85.6	83.00
UPO-10-3	78.2	109.8	117.7	101.9	71.5	71.8	72.4	71.90
SKO-225	87.2	94.4	100.0	94.0	90.2	96.5	102.9	96.53
OL-1769-1	84.2	90.4	95.6	90.0	74.4	79.6	82.2	78.73
OS-424	82.9	113.5	122.0	106.1	80.6	81.6	87.5	83.23
OS-432	37.2	48.5	59.5	48.4	76.6	79.5	85.6	80.56
JO-04-19	81.2	96.9	113.4	97.3	82.7	83.5	88.6	84.92
Kent (NC)	79.0	80.2	89.3	82.9	74.6	75.2	82.7	77.50
OS-6 (NC)	99.3	117.7	121.1	112.6	78.6	78.1	84.3	80.33
SKO-90 (HZ)					80.9	78.7	83.5	81.03
OL-125 (NWZ)	83.6	106.2	109.9	99.9				
Mean	83.7	100.9	107.8		78.73	80.24	85.23	
	E	N	E x N			E	N	E x N
SEm±	2.57	1.12	3.71		SEm±	2.49	1.40	4.33
CD at 5%	7.58	3.18	10.56		CD at 5%	7.32	4.08	12.52

Table- R-16-AST-6 (c): Effect of nitrogen levels on crude protein yield of promising entries of Oat (AVTO-2 -SC)

Entries	Crude Protein Yield (q/ha)									Overall mean
	Hill zone			North West zone	Central zone					
	Palampur	Srinagar	Mean	Ludhiana	Anand	Jabalpur	Raipur	Urulikanchan	Mean	
OL-1766-1	8.9	8.96	8.93	7.54	6.68	8.10	6.59	9.74	7.78	8.07
OL-1802	9.5	10.20	9.85	8.99	8.37	7.70	7.93	9.40	8.35	8.87
UPO-10-3	9.4	10.66	10.03	7.00	7.40	8.33	6.00	8.52	7.56	8.19
SKO-225	9.4	10.70	10.05	7.69	6.82	9.03	5.72	8.77	7.59	8.30
OL-1769-1	8.9	9.90	9.40	7.18	5.72	6.87	5.97	11.22	7.45	7.97
OS-424	9.5	10.56	10.03	8.17	7.32	7.53	5.43	11.54	7.96	8.58
OS-432	9.4	9.10	9.25	4.78	5.81	7.20	4.23	7.29	6.13	6.83
JO-04-19	9.4	9.60	9.50	6.28	6.73	6.00	6.53	12.27	7.88	8.12
Kent (NC)	9.3	9.33	9.32	6.41	6.51	9.47	5.61	12.13	8.43	8.39
OS-6 (NC)	9.0	9.00	9.00	8.01	6.61	9.07	4.90	13.63	8.55	8.60
SKO-90 (HZ)	9.7	8.53	9.12							
JHO-822 (CZ)					6.46	8.0	4.32	9.68	7.12	
OL-125 (NWZ)				7.64						
SEm±	0.2	0.42		0.19	0.26	0.63	0.21	0.44		
CD at 5%	0.5	1.24		0.565	0.78	2.14	0.62	1.32		
Nitrogen level (Kg/ha)										
40	2.3	9.20	5.75	5.71	6.12	7.8	4.14	9.26	6.83	6.36
80	3.5	9.75	6.63	7.40	7.08	10.1	5.70	10.32	8.30	7.69
120	4.6	10.10	7.35	8.61	7.10	10.5	7.41	11.56	9.14	8.55
SEm±	0.1	0.23		0.08	0.09	0.63	0.01	0.07		
CD at 5%	0.2	0.63		0.23	0.26	1.85	0.31	0.21		
Interaction: Entry X N levels										
SEm±		0.78		0.27	0.37	0.61	0.36	0.49		
CD at 5%	NS	2.15		0.77	0.87	1.34	1.04	1.44		
CV (%)				6.48	8.04	3.64				

Table- R-16-AST-6 (d): Effect of nitrogen levels on crude protein content and number of tillers/m row length of promising entries of (AVTO-2 -SC)

Entries	Crude Protein (%)					Number of tillers/m row length						
	Sri-nagar	Pant-nagar	Ludh-iana	Rai-pur	Mean	Palam-pur	Ana-nd	Rai-pur	Ludh-iana	His-ar	Pant-nagar	Mean
OL-1766-1	6.98	9.72	6.83	7.8	7.83	98.0	63.3	56.4	69.3	102.3	113.0	83.72
OL-1802	8.47	10.01	6.92	8.4	8.45	80.0	76.3	59.9	67.8	111.9	116.0	85.32
UPO-10-3	7.66	9.82	6.81	7.8	8.02	87.0	69.9	49.6	60.4	105.9	116.0	81.47
SKO-225	10.34	9.43	8.14	7.8	8.93	92.0	59.7	54.1	67.5	106.6	123.0	83.82
OL-1769-1	7.79	9.91	7.96	7.2	8.22	110.0	62.1	54.3	67.7	102.3	118.0	85.73
OS-424	8.80	9.19	7.66	7.3	8.24	101.0	62.2	53.3	69.2	101.0	122.0	84.78
OS-432	7.34	9.62	9.74	7.4	8.53	127.0	73.4	56.1	77.8	88.4	107.0	88.28
JO-04-19	8.16	9.43	6.42	8.0	8.00	96.0	63.8	57.4	60.6	103.3	121.0	83.68
Kent (NC)	7.25	9.23	7.70	8.0	8.05	98.0	61.0	49.3	69.7	99.2	114.0	81.87
OS-6 (NC)	7.23	9.82	7.08	8.2	8.08	104.0	60.6	47.1	69.2	101.4	114.0	82.72
SKO-90 ZC (HZ)	6.92					76.0						
JHO-822 ZC (CZ)				7.6			60.7	46.0				
OL-125 ZC (NWZ)		9.62	7.58		8.60				59.8	96.1	117.0	90.97
SEm±	0.36	0.28	0.11	--		2.9	2.4	1.69	1.41	2.75	2.66	
CD at 5%	1.06	NS	0.33	--		7.2	7.0	5.02	4.17	8.18	08.00	
Nitrogen level (Kg/ha)												
40	7.25	9.45	6.93	7.6	7.81	86.0	65.3	46.0	65.9	90.9	116.0	78.35
80	7.84	9.54	7.51	7.8	8.17	93.0	66.2	52.7	67.4	103.0	117.0	83.22
120	8.62	9.86	8.15	7.9	8.63	112.0	62.9	60.5	68.3	111.1	117.0	88.63
SEm±	0.19	0.15	0.03	--		1.3	0.93	0.73	0.51	1.19	1.3	
CD at 5%	0.53	NS	0.08	--		3.6	2.58	2.11	1.45	3.40	NS	
Interaction: Entry X N levels												
SEm±	0.70		0.09				3.09		1.68			
CD at 5%	1.98		0.26				NS		NS			
CV (%)			2.07				8.25		4.34	6.71		

Table- R-16-AST-6 (e): Effect of nitrogen levels on plant height of promising entries of Oat (AVTO-2 -SC)

Entries	Plant height (cm)											
	Hill zone			North West zone				Central Zone				Overall Mean
	Palampur	Srinagar	Mean	Hisar	Pantnagar	Ludhiana	Mean	Anand	Jabalpur	Raipur	Mean	
OL-1766-1	106.1	81.4	93.75	156.6	167.0	141.2	154.93	152.2	166.9	164.6	161.23	142.0
OL-1802	97.4	117.4	107.40	164.2	153.0	137.9	151.70	178.0	163.9	163.9	168.60	147.0
UPO-10-3	95.6	92.4	94.00	148.2	161.0	134.0	147.73	167.2	149.0	149.0	155.07	137.1
SKO-225	92.3	110.6	101.45	151.3	162.0	140.3	151.20	139.2	149.0	149.7	145.97	136.8
OL-1769-1	34.6	100.2	67.40	160.6	161.0	129.6	150.40	127.5	159.9	161.3	149.57	129.3
OS-424	73.1	102.5	87.80	145.7	152.0	125.6	141.10	114.1	132.0	135.6	127.23	122.6
OS-432	104.0	101.8	102.90	91.3	173.0	80.5	114.93	126.5	125.7	123.4	125.20	115.8
JO-04-19	100.1	117.2	108.65	153.3	163.0	132.0	149.43	148.3	141.1	141.1	143.50	137.0
Kent (NC)	101.6	88.5	95.05	152.6	160.0	118.4	143.67	151.2	138.0	139.0	142.73	131.2
OS-6 (NC)	96.0	93.5	94.75	163.9	171.0	133.0	155.97	114.7	146.3	146.3	135.77	133.1
SKO-90 ZC (HZ)	67.7	86.5	77.10									
JHO-822 ZC (CZ)								149.3	139.1	139.0	142.47	
OL-125 ZC (NWZ)				152.9	160.0	127.7	146.87					
SEm±	2.7	2.11		3.33	0.33	2.87		3.22	1.46	2.40		
CD at 5%	6.6	6.21		9.90	01	8.48		9.50	3.54	7.13		
Nitrogen level (Kg/ha)												
40	70.18	93.6	81.89	142.7	161.0	118.1	140.60	142.5	138.5	138.0	139.67	125.6
80	89.27	100.1	94.69	149.7	163.0	128.9	147.20	142.3	145.8	146.7	144.93	133.2
120	105.28	104.1	104.69	155.1	163.0	134.8	150.97	142.9	155.1	155.9	151.30	139.5
SEm±	1.1	1.20		1.43	0.31	0.88		1.54	1.62	1.34		
CD at 5%	2.8	3.48		4.10	01	2.50		NS	4.5	3.85		
CV (%)				5.52								
Interaction: Entry X N levels												
SEm±		3.48				2.91		5.11	1.11			
CD at 5%		10.12				8.30		NS	3.12			
CV (%)						3.96		6.21	8.1			

Table- R-16-AST-6 (f): Effect of nitrogen levels on leaf stem ratio of promising entries of Oat (AVTO-2 -SC)

Entries	Leaf Stem ratio										
	Hill zone			North West zone			Central zone			Over all Mean	
	Palampur	Srinagar	Mean	Ludhiana	Pantnagar	Hisar	Mean	Jabalpur	Raipur		Mean
OL-1766-1	0.51	0.50		0.56	0.48	0.49	0.51	0.68	0.44	0.62	0.52
OL-1802	0.68	0.54	0.51	0.58	0.46	0.50	0.51	0.76	0.47	0.54	0.57
UPO-10-3	0.69	0.57	0.51	0.60	0.48	0.56	0.55	0.68	0.40	0.52	0.57
SKO-225	0.64	0.60	0.63	0.57	0.47	0.52	0.52	0.64	0.40	0.52	0.55
OL-1769-1	0.59	0.41	0.52	0.55	0.51	0.47	0.51	0.62	0.41	0.49	0.51
OS-424	0.55	0.52	0.62	0.56	0.49	0.49	0.51	0.62	0.35	0.49	0.51
OS-432	0.53	0.43	0.50	0.87	0.47	0.69	0.68	0.58	0.40	0.53	0.57
JO-04-19	0.63	0.41	0.54	0.67	0.48	0.53	0.56	0.61	0.44	0.46	0.54
Kent (NC)	8.0	4.32	9.68	0.46	0.50	0.45	0.47	0.71	0.39	0.56	0.50
OS-6 (NC)	0.56	0.47	0.61	0.58	0.51	0.41	0.50	0.68	0.35	0.52	0.51
SKO-90 ZC (HZ)	0.65	0.46	0.48								
JHO-822 ZC (CZ)								0.57	0.35	0.46	
OL-125 ZC (NWZ)				0.58	0.47	0.43	0.49				
SEm±	0.40	0.01	0.52	0.02	0.02			0.03	0.013		
CD at 5%	0.04	0.04	0.56	0.05	NS			0.08	0.040		
Nitrogen level (Kg/ha)											
40	0.44	0.47		0.58	0.48	0.46	0.51	0.59	0.35	0.52	0.48
80	0.59	0.50		0.59	0.48	0.51	0.53	0.66	0.38	0.58	0.53
120	0.76	0.51	0.46	0.61	0.49	0.54	0.55	0.68	0.48		0.58
SEm±	0.01	0.02		0.01	0.01			0.01	0.007		
CD at 5%	0.02	NS		NS	NS			0.03	0.020		
Interaction: Entry X N levels											
SEm±		0.03		0.03				0.01	0.023		
CD at 5%	Sig.	NS		NS	s			0.03	0.067		
CV (%)				10.01				4.2			

Table- R-16-AST-6 (g): Effect of nitrogen levels on Cost of cultivation, Gross return, Net return, B: C ratio of promising entries of Oat (AVTO-2 -SC) at Hisar

Entries	Cost of cultivation (Rs.)	Gross returns (Rs.)	Net returns (Rs.)	B:C ratio
OL-1766-1	28072	78773	50701	2.80
OL-1802	28072	94329	66257	3.36
UPO-10-3	28072	74780	46708	2.66
SKO-225	28072	71563	43491	2.55
OL-1769-1	28072	71285	43213	2.54
OS-424	28072	66169	38097	2.36
OS-432	28072	51412	23340	1.83
JO-04-19	28072	67454	39382	2.40
Kent (NC)	28072	70579	42507	2.51
OS-6 (NC)	28072	79988	51916	2.85
OL-125 ZC (NWZ)	28072	65081	37009	2.32
SEm±				
CD at 5%				
Nitrogen level (Kg/ha)				
40	27591	65748	38157	2.38
80	28072	73198	45126	2.61
120	28553	76894	48341	2.69
SEm±				
CD at 5%				

21. R-16-AST-7: Effect of P levels on forage yield of promising entries of Berseem (AVTB-2-MC)

[Table Reference: R-16-AST-7(a)-(f)]

Locations:

North West Zone: Bikaner, Hisar, Ludhiana

Central Zone: Rahuri, Jabalpur, Urulikanchan, Raipur

Two berseem entries (JB-04-23 and JB-04-21) along with two national checks (Wardan and Mescavi) and one zonal check (BB-2) were evaluated at 7 centers located in two zones. Both the testing entries remained below or at par with checks (Bundel Berseem-2 (CZ & NWZ) and Mescavi (NC) in terms of GFY and DFY. The application of graded level of phosphorus brought consistent improvement in GFY, DMY recording maximum with 100 kg P₂O₅ kg/ha (574.2 and 84.6 q/ha). The corresponding increase in GFY and DFY with 100 kg P₂O₅ was 20.0 and 23.44 % over 60 kg/ha and 6.7% & 8.16% over 80 kg/ha on national mean basis, respectively.

National checks: (2): & Zonal check (1):

Table- R-16-AST-7(a): Effect of P levels on green fodder yield of promising entries of Berseem (AVTB-2-MC)

Green fodder yield (q/ha)										
Entries	North West zone				Central Zone				Mean	Overall mean
	* Bika-ner	His-ar	Ludh-iana	Mean	Rah-uri	Jabal-pur	*Urulikan-chan	Rai-pur		
JB-04-23	116.2	648.1	637.8	643.0	311.8	838.7	132.6	468.0	437.78	506.2
JB-04-21	148.8	711.9	658.1	685.0	259.8	824.0	218.4	489.0	447.80	526.9
ardan (NC)	153.2	595.3	713.7	654.5	331.1	909.1	127.5	472.0	459.93	524.8
Mescavi (NC)	139.1	689.7	703.2	696.5	305.2	848.0	242.4	478.0	468.40	544.4
Bundel Berseem-2 ZC(CZ & NWZ)	144.9	708.3	658.8	683.6	327.9	921.5	154.0	522.0	481.35	548.8
SEm±	1.7	24.60	9.97		9.86	54.0	7.12	9.56		
CD at 5%	5.6	81.48	32.5		32.16	150.78	20.73	31.68		
P levels (kg P₂O₅/ha)										
60	141.0	603.1	584.7	593.9	284.0	763.8	167.9	468.0	420.93	478.6
80	143.7	674.1	679.3	676.7	313.1	900.2	172.8	489.0	468.78	538.1
100	136.7	734.8	758.9	746.9	324.4	940.7	184.3	502.0	487.85	574.2
SEm±	2.6	7.38	3.92		8.15	30.0	5.51	7.62		
C D at 5%	7.6	21.92	11.6		24.04	90.6	N.S.	22.64		
Interaction: V X P levels										
SEm±			8.78		18.22	22.5	12.33			
CD at 5%			25.9		NS	66.8	N.S.	NS		
CV (%)	7.1	4.26	2.25		10.27					

- Due to very low yield , data of Bikaner and Urulikanchan centres not included in mean

Table- R-16-AST-7(a-1): Interaction effect of P levels on green fodder yield of promising entries of Berseem (AVTB-2-MC)

Green fodder yield (q/ha)												
Entries	Raipur				Ludhiana				Jabalpur			
	60	80	100	Mean	60	80	100	Mean	60	80	100	Mean
JB-04-23	456.7	466.3	481.7	468.0	533.9	656.4	723.1	637.8	770.0	863.3	882.7	838.7
JB-04-21	466.7	502.3	498.3	489.0	576.1	676.9	721.4	658.1	714.8	863.3	893.8	824.0
Wardan (NC)	454.0	458.3	505.0	472.0	613.6	700.6	826.9	713.7	807.8	939.6	979.9	909.1
Mescavi (NC)	459.3	481.7	493.0	478.0	628.6	698.3	782.8	703.2	737	867.5	939.6	848.0
Bundel Berseem-2 ZC (CZ - NWZ)	501.0	535.7	530.0	522.0	571.4	664.4	740.6	658.8	789.4	967.4	1007.6	921.5
Mean of P	468.0	489.0	502.0		584.7	679.3	758.9		763.8	900.22	940.72	
Factor		SEM	CD	Factor	C.D.	SE(m)			V	P	VXP	
E		9.567	31.685	E	32.5	9.97		SEm±	54.0	30.0	22.5	
P		7.622	22.642	P	11.6	3.92		CD	150.78	90.6	66.8	
Phosphorus at same level of Entries		16.571	N/A	Interaction	25.9	8.78						
Entries at same level of Phosphorus		16.887	N/A									

Table- R-16-AST-7(b): Effect of P levels on Dry matter yield of promising entries of Berseem (AVTB-2-MC)

Entries	Dry Matter Yield (q/ha)										
	North West zone				Central Zone					Mean	Overall mean
	Bika- ner	His- ar	Ludh- iana	Mean	Rah- uri	Jabal- pur	Urulikan- chan	Rai- pur			
JB-04-23	23.8	89.1	73.5	81.3	55.5	129.0	21.1	71.3	69.23	73.3	
JB-04-21	25.2	99.8	77.0	88.4	44.0	125.9	34.2	76.4	70.13	76.2	
Wardan (NC)	28.0	85.1	83.1	84.1	62.2	140.1	20.3	73.5	74.03	77.4	
Mescavi (NC)	22.1	93.0	82.1	87.6	53.8	129.6	35.0	74.4	73.20	78.0	
Bundel Berseem-2 ZC (CZ -NWZ)	26.3	100.5	77.1	88.8	60.1	142.1	23.9	81.3	76.85	80.8	
SEm±	0.7	3.05	1.56		2.15	5.6	1.14	1.88			
CD at 5%	2.2	10.09	5.09		7.02	15.7	3.32	6.23			
P levels (kg P₂O₅/ha)											
60	25.7	81.8	68.1	75.0	48.3	115.9	26.1	71.0	65.33	68.5	
80	25.2	93.7	78.9	86.3	55.5	138.9	26.4	75.9	74.18	78.2	
100	24.4	105.0	88.5	96.8	61.5	145.2	28.2	79.2	78.53	84.6	
SEm±	0.4	1.54	0.47		2.31	4.3	0.88	1.20			
C D at 5%	1.2	4.57	1.39		6.81	12.8	N.S.	3.57			
Interaction: V X P levels											
SEm±			1.06		5.16	3.3	1.97				
CD at 5%			3.12		NS	10.12	N.S.				
CV (%)	6.2	6.37	2.33		16.22	13.9					

Due to very low yield , data of Bikaner and Urulikanchan centres not included in mean

Table- R-16-AST-7(b-1): Interaction effect of P levels on dry fodder yield of promising entries of Berseem (AVTB-2-MC)

Entries	Dry fodder yield (q/ha)											
	Raipur				Ludhiana				Jabalpur			
	60	80	100	Mean	60	80	100	Mean	60	80	100	Mean
JB-04-23	66.8	71.8	75.3	71.3	62.3	74.1	84.0	73.5	117.5	133.3	136.3	129.0
JB-04-21	74.3	76.8	78.1	76.4	67.8	79.8	83.4	77.0	108.1	132.4	137.1	125.9
Wardan (NC)	68.0	70.8	81.7	73.5	71.3	81.3	96.6	83.1	123.2	145.4	151.7	140.1
Mescavi (NC)	68.8	76.0	78.3	74.4	73.4	81.9	90.8	82.1	111.7	132.9	144.2	129.6
Bundel Berseem-2 ZC (CZ-NWZ)	77.1	84.2	82.5	81.3	65.9	77.7	87.6	77.1	119.2	150.3	156.7	142.1
Mean of P	71.0	75.9	79.2		68.1	78.9	88.5		115.94	138.86	145.2	
Factor		SEm	CD		Factor	C.D.	SE(m)			V	P	VXP
E		1.884	6.239		E	5.09	1.56		SEm±	5.6	4.3	3.3
P		1.203	3.574		P	1.39	0.47		CD +	15.7	12.8	10.12
Phosphorus at same level of Entries		3.263	NS		Interaction	3.12	1.06		CV (%)	13.9		
Entries at same level of Phosphorus		2.893	NS									

Table- R-16-AST-7(c): Effect of P levels on Crude protein yield and crude protein (%) of promising entries of Berseem (AVTB-2-MC)

Entries	Crude protein yield (q/ha)									Crude protein (%)				Mean
	North West zone			Central Zone					Overall mean	North West zone			Central Zone	
	Bika-ner	Ludh-iana	Mea-n	Rah-uri	Jabal-pur	Urulika-nchan	Rai-pur	Mean		Ludh-iana	Bika-ner	Mean	Rah-uri	
JB-04-23	4.21	14.17	9.19	9.62	19.40	3.85	11.92	11.20	11.79	19.23	17.66	18.45	17.30	18.06
JB-04-21	4.14	15.20	9.67	7.70	19.03	6.26	13.21	11.55	12.28	19.70	16.42	18.06	17.52	17.93
Wardan (NC)	4.95	15.35	10.15	11.67	21.17	3.63	12.07	12.14	12.78	18.38	17.63	18.01	18.71	18.24
Mescavi (NC)	3.47	14.98	9.23	9.55	19.27	6.36	12.78	11.99	12.59	18.23	15.70	16.97	17.71	17.21
Bundel Berseem-2 ZC (CZ & NWZ)	4.67	14.22	9.45	11.38	20.80	4.35	14.19	12.68	12.99	18.40	17.74	18.07	18.83	18.32
SEm ⁺	0.13	0.32		0.47	0.89	0.20	0.312			0.10	0.21		0.24	
CD at 5%	0.42	NS		1.55	2.24	0.60	1.035			0.31	0.68		0.77	
P levels (kg P₂O₅/ha)														
60	4.37	12.34	8.36	8.33	17.40	4.73	12.00	10.62	10.96	18.13	17.00	17.57	17.23	17.45
80	4.24	14.85	9.55	9.90	20.62	4.79	12.93	12.06	12.62	18.82	16.76	17.79	17.79	17.79
100	4.25	17.16	10.71	11.73	21.78	5.16	13.57	13.06	13.88	19.40	17.33	18.37	19.02	18.58
SEm ⁺	0.11	0.09		0.39	0.79	0.16	0.20			0.04	0.26		0.28	
C D at 5%	0.34	0.27		1.14	2.21	N.S.	0.59			0.12	0.78		0.83	
Interaction: V X P levels														
SEm ⁺		0.20		0.87	0.68	0.36				0.09			0.63	
CD at 5%		0.60		NS	1.18	N.S.				0.28			NS	
CV (%)	10.38	2.37		15.04	12.67					0.87	6.03		6.03	

Table- R-16-AST-7(d): Effect of P levels on Plant height, Leaf stem ratio, plant population, No. of tillers/m² of promising entries of Berseem (AVTB-2-MC)

Entries	Plant height (cm)								Overall mean
	North West zone				Central Zone				
	Bika- ner	His- ar	Ludh- iana	Mean	Rah- uri	Jabal- pur	Rai- pur	Mean	
JB-04-23	45.1	62.34	40.7	49.38	69.3	54.10	49.1	57.50	57.50
JB-04-21	48.9	65.31	40.3	51.50	65.6	55.93	50.9	57.48	57.48
Wardan (NC)	49.3	58.50	42.0	49.93	74.4	53.66	48.7	58.92	58.92
Mescavi (NC)	45.4	62.70	39.5	49.20	67.8	52.93	47.9	56.21	56.21
Bundel Berseem-2 ZC (CZ -NWZ)	45.6	64.04	40.7	50.11	71.9	54.42	49.4	58.57	58.57
SEm±	0.84	1.18	0.32		1.84	0.04	0.36		
CD at 5%	2.74	3.90	1.04		NS	0.12	1.20		
P levels (kg P₂O₅/ha)									
60	46.2	58.73	39.3	48.08	66.6	53.23	48.2	56.01	56.01
80	47.4	63.04	40.9	50.45	70.2	54.26	49.3	57.92	57.92
100	47.0	65.96	41.8	51.59	72.5	55.13	50.1	59.24	59.24
SEm±	0.42	0.68	0.26		1.18	0.05	0.31		
C D at 5%	1.25	2.02	0.77		3.47	0.15	0.93		
Interaction: V X P levels									
SEm±			0.58		2.63	0.03	0.68		
CD at 5%			NS		NS	0.09	2.08		
CV (%)	3.50	4.20	2.49		6.53	8.4			

Table- R-16-AST-7(e): Effect of P levels on Leaf stem ratio, plant population, No. of tillers/m² of promising entries of Berseem (AVTB-2-MC)

Entries	Leaf : stem ratio							Plant Population		No. of Tillers/m ²			
	North West zone			Central Zone				Rai- pur	Rah- uri	His- ar	Bika- ner	Ludh- iana	Mean
	Ludh- iana	Bika- ner	Mean	Rai- pur	Rah- uri	Jabal- pur	Mean						
JB-04-23	0.48	0.83	0.65	0.54	0.64	0.54	0.57	65.7	221.0	70.35	35.9	91.2	65.82
JB-04-21	0.53	0.83	0.68	0.56	0.55	0.56	0.56	73.4	223.0	76.50	38.0	88.2	67.57
Wardan (NC)	0.50	0.83	0.66	0.54	0.68	0.54	0.59	65.8	233.0	63.46	38.6	90.4	64.15
Mescavi (NC)	0.52	0.85	0.69	0.54	0.61	0.54	0.56	71.5	231.0	74.53	38.0	87.9	66.81
Bundel Berseem-2 ZC(CZ - NWZ)	0.47	0.81	0.64	0.58	0.65	0.58	0.60	74.3	226.0	75.34	37.6	89.2	67.38
SEm _±	0.016	0.04		0.006	0.015	0.025		1.00	8.35	1.92	0.8	0.46	
CD at 5%	NS	0.12		0.021	0.051	0.075		3.33	NS	6.37	2.5	1.51	
P levels (kg P₂O₅/ha)									0.51				
60	0.49	0.85	0.67	0.51	0.52	0.51	0.57	62.5	218.0	65.05	37.7	88.4	63.72
80	0.50	0.79	0.64	0.54	0.63	0.54	0.64	70.9	232.0	72.71	37.6	89.5	66.60
100	0.51	0.85	0.68	0.60	0.73	0.60	0.57	77.06	231.0	78.34	37.5	90.2	68.68
SEm _±	0.011	0.04		0.009	0.012	0.01		0.85	5.36	0.65	0.4	0.52	
C D at 5%	NS	0.11		0.026	0.034	0.03		2.54	NS	1.93	NS	NS	
Interaction: V X P levels													
SEm _±	0.026				0.026	0.01			12.00			1.16	
CD at 5%	NS				0.077	0.03			NS			NS	
CV (%)	9.10	12.00			7.19	10.9			9.15	3.49	4.1	2.24	

Table- R-16-AST-7(f): Economics of P levels on of promising entries of Berseem (AVTB-2-MC) at Hisar

Entries	Cost of cultivation (Rs.)	Gross returns (Rs.)	Net returns (Rs.)	B: C ratio
JB-04-23	56447	81019	24571	1.43
JB-04-21	56447	88984	32537	1.58
Wardan (NC)	56447	74418	17971	1.32
Mescavi (NC)	56447	86210	29762	1.53
Bundel Berseem-2 ZC (CZ - NWZ)	56447	88535	32088	1.57
P levels (kg P₂O₅/ha)				
60	55568	75381	19813	1.36
80	56376	84268	27892	1.49
100	57398	91849	34451	1.60

FORAGE CROP PROTECTION

PPT – 1: Survey of pathogens, insect pests and nematodes associated with Berseem and 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, 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 and presented in Table Ludhiana PPT1a.

STEM ROT OF BERSEEM: First appearance of disease was observed in the last week of December, 2016 on variety BL-42. Disease progressed first slowly and then at faster rate till 2nd fortnight of March, 2017 with maximum disease incidence of 61.4 percent due to favourable weather parameters (Table Ludhiana PPT1a). During this period, 5.2-40.4 mm rainfall with moderate temperature of 6.6-22.5°C and mean relative humidity of 41-96% was observed which increased the disease incidence (Figure Ludhiana PPT1a).

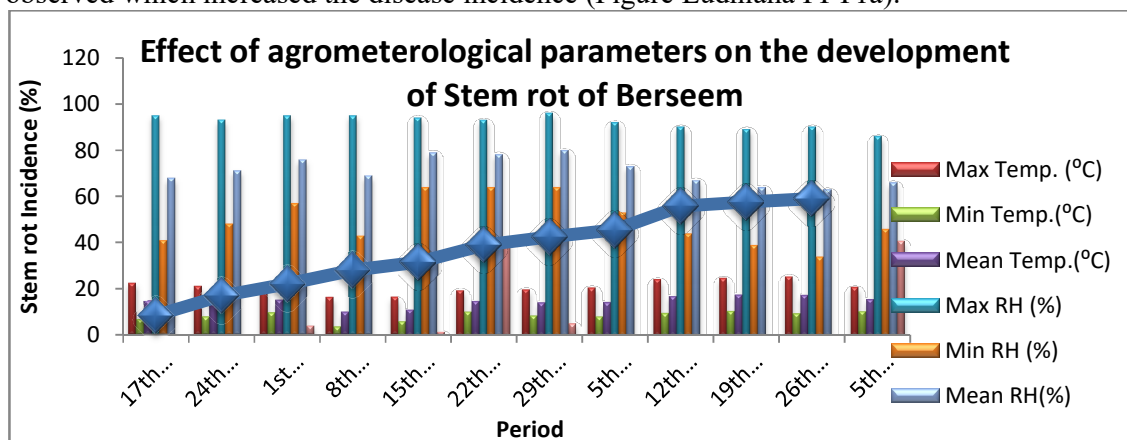


Fig Ludhiana PPT1a: Effect of weather parameters on stem rot of berseem

LEAF BLIGHT OF OAT: The disease appeared on OL-10 variety in the 1st week of January, 2017. Disease development was slow till first week of February and thereafter, it increased at alarming rate till first week of March with favourable temperature between 6.2-30.4°C, percent relative humidity of 43-96 which increased the disease severity upto 56.7 percent (Figure Ludhiana PPT1b). Afterwards it became static and developed slowly (Table Ludhiana PPT1a). Maximum disease severity was 58.9 percent.

DOWNY MILDEW OF LUCERNE: The disease on variety LLC 5 was observed in the 3rd week of January, 2017. Disease progressed at faster rate till 3rd week of March with disease severity of 52.4 percent and then it progressed at steady pace till first week of April with maximum downy mildew severity of 58.3 percent (Table Ludhiana PPT1a). During this period, low temperature range of 6.2-25.5°C, high relative humidity (64-96%) and high rainfall favoured the disease development (Figure Ludhiana PPT1c).

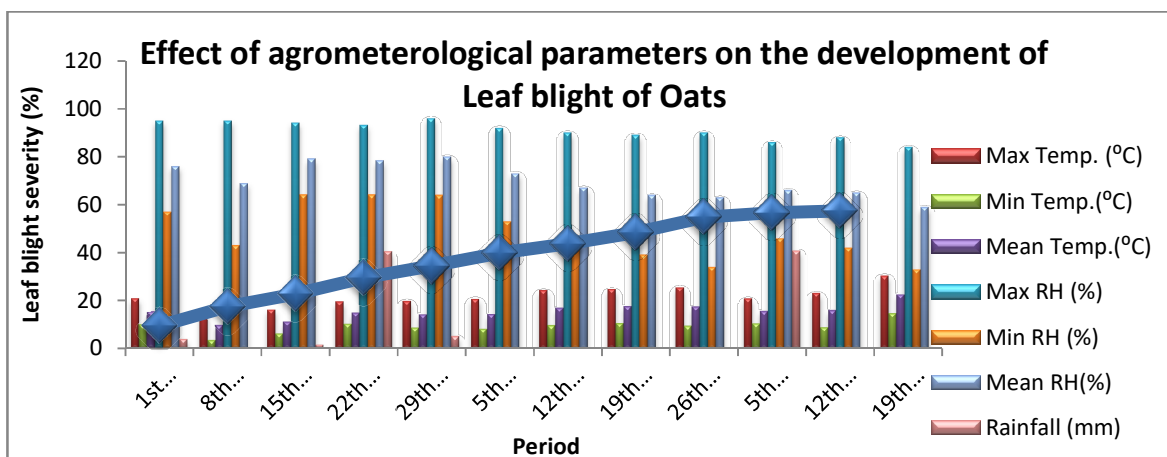


Fig Ludhiana PPT1b: Effect of weather parameters on leaf blight of oats

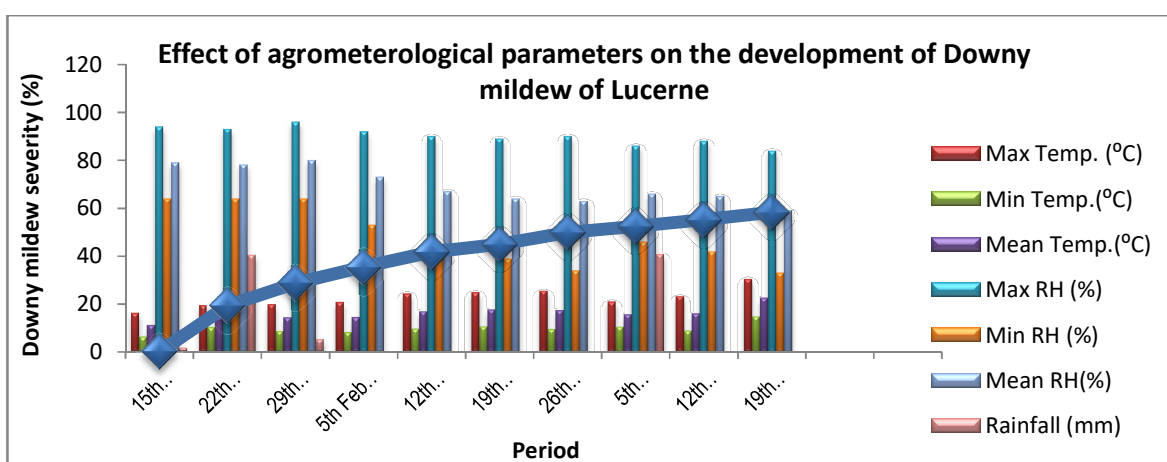


Fig Ludhiana PPT1c: Effect of weather parameters on lucerne downy mildew

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

Crop/ variety	disease	Percent Disease Incidence / Severity DOO (Date of observation)													
		22/12 /16	29/12 /16	05/1 /17	12/1 /17	19/1 /17	26/1 /17	02/2 /17	09/2 /17	16/2 /17	23/2 /17	02/3 /17	09/3 /17	16/3 /17	23/3 /17
Berseem (BL-42)	Stem Rot	8.5*	17.0	22.0	28.0	31.5	39.0	42.5	45.5	55.8	57.6	59.0	61.4		
Oat (OL-10)	Leaf Blight			9.3*	17.3	22.7	29.4	34.5	39.8	43.7	48.3	54.8	56.7	57.4	58.9
Lucerne (LLC 5)	Downy Mildew					8.9*	19.2	28.7	35.4	41.7	44.8	49.9	52.4	55.1	58.3

*DOA: Date of appearance

Entomological observations: At Ludhiana, population dynamics of major lepidopteran as well as sucking insect pests was studied throughout the cropping season on different *rabi* forages during 2016-17. Three varieties of berseem (vars. BL-10 and BL-42 and PC 75), oats (vars. Kent and OL-10) and one of lucerne (var. LLC-5) were sown in unreplicated plots (5m x 3m each).

The population of lepidopteran insect pests green semilooper, *Trichoplusia orichalcea* and gram caterpillar, *Helicoverpa armigera* and *S. 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 I week of April till IV week of May 2017) 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 starting from February till mid March 2017. Observations on number of Lucerne weevils and aphids per plant and *H. armigera* larvae per m row length were also recorded at weekly intervals in the months of March and April 2017. The data were pooled and presented in Tables 1a-c

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 end of April to first week of May. The population of *H. armigera* appeared on berseem crop in 3rd week of April and lasted till the IV week of May, with its highest peak during last week of April 2016 to first week of May. Lucerne var. LLC-5 was also infested with lucerne weevil from I week of February till mid March 2016 during which its highest peak was observed in the 3rd week of march. The population of oat aphid was comparatively higher as compared to previous year. Maximum population of oat aphid appeared during the last week of March to first week of April and starting to decrease from month of march onward (Tables Ludhiana PPT1b-1d).

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

S N	Variety	No. of <i>T. orichalcea</i> larvae per m row length								Mean
		03.04.17	10.04.17	17.04.17	24.04.17	1.5.17	08.05.17	15.05.17	22.05.17	
1.	BL-10	1.67	2.33	5.67	5.0	4.0	4.0	3.33	2.0	3.5
2.	BL-42	2.0	2.0	3.33	4.67	4.33	3.67	3.33	1.33	3.0
3	PC 75	1.67	3.0	4.67	5	5.33	6.67	3.0	1.67	3.8
No. of <i>H. armigera</i> larvae per m row length										
1.	BL-10	3.67	5.33	9.0	14.33	15.67	16.33	10.33	5.67	10.04
2.	BL-42	4.0	5.67	9.0	12.33	14.67	15.0	11	6.66	9.79
3	PC 75	3.0	5.0	6.67	9.33	10.67	10	9.67	7.0	7.6
No. of <i>Spodoptera exigua</i> larvae										
1	BL-10	3.67	3.0	3.67	4.33	5.67	6.67	6.33	3.0	4.5
2	BL-42	3.33	3.0	5.33	5.0	6.0	6.0	5.0	2.67	4.5
3	PC 75	1.0	3.33	2.0	3.33	4.0	5.0	5.67	4.0	3.5

Table Ludhiana PPT1b. Incidence of insect pests in Lucerne var. LLC-5

Variety	No. of weevils per plant								Mean	
	6.03.17	13.03.17	20.03.17	27.03.17	03.04.17	10.04.17	17.04.17	24.04.17		
Lucerne LLC-5	10.3	14.3	12.3	9.67	8.3	5.6	5.6	3.3	8.67	
No. of <i>H. armigera</i> larvae per m row length										
	3.33	4.33	4.67	5.33	5.67	5.67	3.67	2.0	4.33	

Table Ludhiana PPT1c. Incidence of oat aphid in different varieties of oats

S. N.	Variety	No. of aphids per tiller								Mean
		06.02.17	13.02.17	20.02.17	27.02.17	07.03.17	14.03.17	21.03.17	28.03.17	
1.	OL-10	50	65	65	79	89	54	54	31	60.0
2.	Kent	55	52	53	51	52	68	69	30	53.0

RAHURI

Lucerne Aphids: At Rahuri, the population of pea aphid (*Acyrtosiphon pisum*) was noticed on lucerne during last week of December 2017 (10.67 aphids/tiller) and increased steadily at its peak level up to the 3rd week of January, 2017 (42.67 aphids/tiller). Thereafter the decreasing trend of pea aphid population was noticed up to 1st week of February, 2017 (4.33 aphids/ tiller). Afterwards pea aphid population disappeared from the crop. Pea aphid appeared again on Lucerne during 2nd week of March 2017 (15.67 aphids/tiller) and reached at its peak during last week of March 2017 with 24.00 aphids/tiller. Then after decreasing trend of aphid population was observed which ended on 4th week of April, 2017. During the aphid infestation, population of predatory lady bird beetles was moderate to high level. (1.00 to 3.67 grubs/tiller).

Lucerne Lepidopteran pests: At Rahuri, the *Spodoptera litura* become a major and regular pest on Lucerne during summer season. Larval population was noticed during 2nd week of February, 2017 with 1.00 larva/m². Then after, population increased steadily and reached to its peak population (11.33 larvae/m²) during 1st week of May, 2017. After that the population of *S. litura* declined and recorded nil during 3rd week of May, 2017.

The population of *H. armigera* was noticed on lucerne seed crop during 3rd week of February, 2017 (1.00 larva/m²) and showed increasing trend up to 3rd week of April 2017 with highest population of 13.00 larvae/m². After that population declined and showed minimum population during 3rd week of May 2017 (2.00 larvae/m²).

Table Rahuri PPT1 a Population dynamics of insect pests associated with rabi forages:
Incidence of insect pests in different varieties of Lucerne

Date	No. aphids/tiller				Lady bird beetle grubs/tiller	No. of larvae/m ²	
	Pea aphid	Cowpea aphid	Spotted aphid	Total		<i>S. litura</i>	<i>H. armigera</i>
12/12/2016	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19/12/2016	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26/12/2016	10.67	0.00	0.00	10.67	0.00	0.00	0.00
02/01/2017	13.33	0.00	0.00	13.33	0.00	0.00	0.00
09/01/2017	20.00	0.00	0.00	20.00	0.00	0.00	0.00
16/01/2017	42.67	0.00	0.00	42.67	2.00	0.00	0.00
23/01/2017	16.33	0.00	0.00	16.33	3.00	0.00	0.00
30/01/2017	8.00	0.00	0.00	8.00	3.00	0.00	0.00
06/02/2017	4.33	0.00	0.00	4.33	3.00	0.00	0.00
13/02/2017	0.00	0.00	0.00	0.00	3.00	1.00	0.00
20/02/2017	0.00	0.00	0.00	0.00	0.00	2.00	1.00
27/02/2017	0.00	0.00	0.00	0.00	0.00	3.00	2.00
06/03/2017	0.00	0.00	0.00	0.00	1.00	3.00	3.00
13/03/2017	15.67	0.00	0.00	15.67	3.67	3.67	3.00
20/03/2017	20.33	0.00	0.00	20.33	2.33	4.00	4.00
27/03/2017	24.00	0.00	0.00	24.00	2.00	6.00	4.33
03/04/2017	17.67	0.00	0.00	17.67	2.67	6.33	8.00
10/04/2017	10.00	0.00	0.00	10.00	2.00	7.00	12.00
17/04/2017	6.33	0.00	0.00	6.33	1.00	8.00	13.00
24/04/2017	0.00	0.00	0.00	0.00	1.00	10.67	12.00
01/05/2017	0.00	0.00	0.00	0.00	0.00	11.33	10.00
08/05/2017	0.00	0.00	0.00	0.00	0.00	8.00	5.00
15/05/2017	0.00	0.00	0.00	0.00	0.00	3.00	2.00
22/05/2017	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Berseem: At Rahuri, In berseem, aphid *R. maydis* was noticed during 1st week of January 2017 and disappeared after last week of January 2017. Its population was very low in the range of 3.67 to 9.67.

Table Rahuri PPT1 b Population dynamics of insect pests associated with rabi forages: Incidence of insect pests in Berseem

Date	No. aphids/tiller	Natural enemies/tiller		
		<i>C. carnea</i>	Lady Bird Beetle grubs	Syrphid fly larvae
12/12/2016	0.00	0.00	0.00	0.00
19/12/2016	0.00	0.00	0.00	0.00
26/12/2016	0.00	0.00	0.00	0.00
02/01/2017	7.33	0.00	0.00	0.00
09/01/2017	9.67	0.00	0.00	0.00
16/01/2017	6.33	0.00	1.00	0.00
23/01/2017	4.33	0.00	1.33	0.00
30/01/2017	3.67	0.00	1.00	0.00
06/02/2017	0.00	0.00	0.00	0.00

Oat Aphid: At Rahuri, Periodic abundance of oat aphid (*Rhopalosiphum padi* L.) was observed during the investigation. The data on average number of aphids per tiller recorded from 1st week of October, 2016 to last week of March, 2017 is given in table Rahuri PPT1 c.

It is seen from the table that, population of oat aphid was noticed (13.90/tiller) during 3rd week of December 2016 (51 SMW). During this week, average maximum and minimum temperatures, morning and evening relative humidity and rainfall recorded were 29.4^oC and 14.7^oC and 65.1 and 41.1 per cent and 0.0 mm, respectively. The population increased at faster rate and reached its peak (93.20 aphids/tiller) during the 1st week of February, 2017 (7th SMW). During this period, average maximum and minimum temperatures, morning and evening relative humidity and rainfall recorded were 29.8^oC and 11.6^oC and 59.0 and 32.7 per cent and 0.0 mm, respectively. Then it started declining in 3rd week of February, 2017 (8th SMW). It was minimum in 1st week of March, 2017 (10th SMW) with the population of 12.50 aphids/tiller. During this period, average maximum and minimum temperatures, morning and evening relative humidity and rainfall recorded were 31.1^oC and 12.3^oC and 55.56 and 29.31 per cent and 0.0 mm, respectively. Thereafter no aphid population was noticed.

Natural enemies

Coccinellid predators: At Rahuri, At the time of first observation in 1st week of October (40th SMW), the population of Coccinellid grubs, was nil. The initial population of LBB grub was recorded during last week of December, 2016 (52nd SMW) with 1.00 grub/tiller. The population of the grubs increased very slowly up to the 1st week of February, 2017 (6th SMW) with its maximum (3.40 grubs/tiller) level. The mean maximum and minimum temperatures, morning and evening relative humidity, during this period were 28.7^oC and 11.3^oC, 59.41 and 33.00 per cent, respectively. The population of the grubs started decreasing (3.00 grubs/tiller) from 2nd week of February, 2017 (7th SMW) and disappeared from 2nd of March, 2017 (11th SMW). The aphid population during the period was also showed in decreasing trend.

Chrysoperla carnea: At Rahuri, The population of *C. carnea* noticed (0.50 grub/tiller) at the 4th week of January, 2017 (4th SMW). During this period, oat aphids were observed to be well established on oat. The average maximum and minimum temperatures, morning and evening relative humidity during this period were 28.5^oC and 10.3^oC, 60.4 and 34.7 per cent, respectively. The highest population of *C. carnea* grub (2.00/tiller) was noticed in last week of February 2017 (9th SMW). It started decreasing (1.00 grub/tiller) from 1st week of March, 2017 (10 SMW) and disappeared in 2nd week of March, 2017 (11th MW). During this period decreasing trend of aphid population was also noticed.

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

Table Rahuri PPT1 c Population dynamics of insect pests associated with *rabi* forages: Incidence of insect pests in different varieties of Oat

Met. Week	Date	Aphids/tiller	Coccinellid predators	C. <i>carnea</i> grubs /tiller	Abiotic factors				
					Temp. Max.	Temp. Min.	R.H. (%) Morn.	R.H. (%) Even.	Rain fall (mm)
40 (2016)	03.10.16	0.00	0.00	0.00	28.1	22.65	85.93	77.50	0
41	10.10.16	0.00	0.00	0.00	28.98	21.65	85.93	69.83	0
42	17.10.16	0.00	0.00	0.00	30.15	20.7	83.02	61.08	0
43	24.10.16	0.00	0.00	0.00	30.55	19.6	79.06	54.88	0
44	31.10.16	0.00	0.00	0.00	30.60	18.57	74.88	51.77	0
45	07.11.16	0.00	0.00	0.00	30.42	17.69	70.98	48.92	0
46	14.11.16	0.00	0.00	0.00	30.3	16.70	69.00	45.77	0
47	21.11.16	0.00	0.00	0.00	30.45	16.30	68.41	44.83	0
48	28.11.16	0.00	0.00	0.00	30.09	15.62	66.93	43.65	0
49	05.12.16	0.00	0.00	0.00	30.15	15.26	66.93	42.05	0
50	12.12.16	0.00	0.00	0.00	30.00	14.74	65.03	40.99	0
51	19.12.16	13.90	0.00	0.00	29.39	14.67	65.08	41.05	0
52	26.12.16	17.30	1.00	0.00	30.38	14.26	64.22	40.17	0
1 (2017)	02.01.17	22.40	1.00	0.00	30.8	10.90	67.00	31.00	0
2	09.01.17	28.80	2.00	0.00	29.10	9.38	65.87	32.62	0
3	16.01.17	30.10	2.50	0.00	27.94	9.42	56.72	34.50	0
4	23.01.17	42.80	2.70	0.50	28.51	10.34	60.39	34.73	0
5	30.01.17	69.30	3.10	1.00	28.88	10.85	59.89	34.37	0
6	06.02.17	88.70	3.40	1.00	28.66	11.26	59.41	33.00	0
7	13.02.17	93.20	3.00	1.40	29.79	11.56	59.00	32.72	0
8	20.02.17	58.60	3.00	1.60	30.19	11.88	58.10	30.53	0
9	27.02.17	25.30	2.40	2.00	30.64	12.00	56.00	30.53	0
10	06.03.17	12.50	1.00	1.00	31.08	12.26	55.56	29.31	0
11	13.03.17	0.00	0.00	0.00	31.18	12.33	52.82	28.61	0
12	20.03.17	0.00	0.00	0.00	31.43	12.55	52.82	27.73	0
13	27.03.17	0.00	0.00	0.00	31.80	12.92	51.88	27.77	0

Palampur

At Palampur, during *Rabi* 2016-17 season, oat crop was severely affected by powdery mildew (95% severity), followed by leaf blights (15%), loose smut (3%) and sucking pest (16%). In berseem low incidence of root rot (5%) and moderate intensity of leaf spot (12%) and defoliating beetles (20%) was observed. Defoliating beetles (45%) and leaf spot (18%) 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)								
		3.3.17	10.3.17	24.3.17	31.3.17	7.4.17	17.4.17	21.4.17	28.4.17	5.5.17
Oats	Powdery mildew	20	30	45	75	90	95	-	-	-
	Leaf blights	1	2	3	5	5	10	12	15	-
	Loose smut	-	-	-	-	-	2	3	3	3
	Aphids & Thrips	5	10	15	16	-	-	-	-	-
Berseem	Root rot	3	5	5	-	-	-	-	-	-
	Leaf spot	-	-	2	5	7	10	12	12	12
	Defoliating beetles	-	-	-	3	5	10	15	18	20
Lucerne	Leaf spot	-	-	-	5	7	10	15	15	18
	Defoliating beetles	-	-	-	2	5	7	10	15	20

Dharwad

At Dharwad, In Lucerne, insect and disease incidence at 15 days interval revealed that aphid population started building from January months onwards and reached peak during second fortnight of February (130 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 30% of disease severity was seen during first fortnight of March. Disease intensity was almost nil during May.

Table Dharwad PPT 1. Monitoring of insect- pests and diseases associated with Lucerne ecosystem at IGFRI Dharwad during *rabi* 2016-17

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	0	0
II Fortnight of January	10	15
I Fortnight of February	100	20
II Fortnight of February	130	25
I Fortnight of March	100	30
II Fortnight of March	35	20
I Fortnight of April	25	10
II Fortnight of April	10	5
I Fortnight of May	5	0
II Fortnight of May	0	0

Bhubaneswar

At Bhubaneswar, observations were recorded on oat cv Kent and Berseem cv Mescavi. The crop was sown between 25.11.201 to 3.12.2016. The diseases started appearing on 50th meteorological week and the peak was observed at 5th meteorological week. In oat, leaf blight caused by *Helminthosporium sp.* and root rot caused by *Sclerotium sp.* was observed. Nematode population was found to increase before sowing and after harvest.

Table Bhubaneswar PPT1: Incidence of insect pest and disease on Berseem and Oat at Bhubaneswar

Diseases / Insects	01.12. 16	08.12. 16	15.12. 16	22.12. 16	29.12. 16	05.01. 17	12.01. 17	19.01. 17	26.01. 17
OAT(KENT)									
Leaf blight (1-5 grade) (<i>Helminthosporium sp.</i>)	-	1.5	2.0	2.0	2.5	3.2	3.5	3.6	3.8
Root rot (%) <i>Sclerotium sp.</i>	-	3.2	5	7	8.4	9.4	--	-	-
Leaf defoliators (No/10 Plants)		2.0	2.2	3.2	4.4	4.6	4.6	4.8	4.8
BERSEEM (Mescavi)									
Leaf spot and blight (1-5 grade)	-	-	1.5	1.5	1.8	2.0	2.2	2.8	3.2
Root rot (Fungal) (%)			3.2	3.6	4.6	5.8	6.6	7.2	8.4
Leaf defoliators (No/10 Plants)			2.0	2.2	3.4	3.6	4.0	4.8	5.2
NEMATODE									
Nematode (Count/250 g soil)	Before sowing				At harvest				
<i>Helicotylenchus dihystrera</i>	148				235				
<i>Hoplolaimus indicus</i>	44				72				
<i>Caloosia exilis</i>	21				32				
<i>Total</i>	213				339				

Hyderabad

At Hyderabad, incidence of thrips in Berseem and Lucerne started in 2nd SMW (8-14 January, 2017) and continued up to 5th SMW. The crop was sown on 25-11-2006. In Lucerne, appearance of Aphids and leaf webber started in 2nd and 3rd SMW respectively and continued till 5th SMW.

Hyderabad		Lucerne			Berseem
Std wk		No. of thrips/ tiller	No. Aphids/ tiller	No. of leaf webber damaged tillers/ sq. m	No. of Thrips/ tillers
47	9-25 Nov, 2016	-	-	-	-
48	26-2 Dec, 2016	-	-	-	-
49	3-9 Dec, 2016	-	-	-	-
50	10-16 Dec, 2016	-	-	-	-
51	17-23 Dec, 2016	-	-	-	-
52	24-31 Dec, 2016	-	-	-	-
1	1-7 Jan, 2017	-	-	-	-
2	8-14 Jan, 2017	3.8	-	1.2	1.4
3	15-21 Jan, 2017	5.0	2.0	1.6	2.0
4	22-28 Jan, 2017	5.8	2.8	1.6	2.5
5	29 Jan-4 Feb, 2017	6.2	3.4	1.4	3.1
6	5-11 Feb, 2017	-	-	-	-
7	12-18 Feb, 2017	-	-	-	-
8	19-25 Feb, 2017	-	-	-	-

PPT-2: FIELD SCREENING OF RABI-BREEDING TRIALS FOR RESISTANCE TO DISEASES AND INSECT- PESTS.

IVTB: INITIAL VARIETAL TRIAL IN BERSEEM

In Berseem IVTB, At Ludhiana, all the entries showed moderately susceptible disease reaction to stem rot of berseem except HFB-13-1, JHB-16-01, JB -05-10 which were moderately resistant. All the entries showed moderate population of lepidopteran caterpillars with non significant differences. **At Rahuri**, all 5 test entries as well as national check was Resistant (Aphids below 15/tiller); whereas JHB 146 (Bundel Berseem -2 zonal check) was moderately resistant (aphids above 15 below 20 per tiller). **At Palampur**, for root rot, entries JHB-16-01, JB -05-10 and national check Wardan were resistant whereas others were moderately resistant. **At Bhubaneswar**, For leaf spot and leaf blight, HFB-13-1 and BB 3 ZC were susceptible whereas JHB-16-01 and JB -05-10 were moderately resistant, other entries were resistant. For leaf defoliators, JHB-16-01, national check Wardan and BB 3 ZC were moderately resistant whereas other entries were resistant.

S. N.	Entries	Ludhiana (stem rot)		Palampur (root rot)			Rahuri	Bhubaneswar		Ludhiana		
		Incidence (%)	Reaction	% incidence	Rating	Reaction	No. of Aphids/tiller	Leaf spot & Blight	Leaf defoliators	<i>Trichoplusia</i> / m row length	<i>H. armigera</i> / m row length	<i>S. exigua</i> / m row length
1	BL-205	38.33	MS	10	3	MR	5.20	1.67	1.70	3.3	8.4	4.0
2	HFB-13-1	28.67	MR	15	3	MR	10.07	3.00	1.40	3.6	6.7	3.6
3	HFB-13-10	42.00	MS	15	3	MR	12.00	1.83	1.27	4.0	6.7	3.7
4	JHB-16-01	13.00	MR	5	2	R	6.13	2.17	2.10	4.0	7.3	4.0
5	JB -05-10	24.00	MR	7	2	R	4.97	2.50	1.47	3.3	7.0	3.6
6	Wardan	35.67	MS	10	2	R	8.93	1.83	2.50	3.0	7.3	3.6
7	JHB 146	37.67	MS				16.27			3.0	6.6	3.0
7	BB 3 ZC							3.17	2.47			
7	BL-22 ZC			12	3	MR						
	Wardan (LC)						4.67					
	SE (m) ⁺						0.75	0.20	0.14			
	CD 0.05	5.204					2.27	0.61	0.41	NS	NS	NS
	CV (%)							15.06	12.73			

AVTB-1: FIRST ADVANCED VARIETAL TRIAL IN BERSEEM

In AVT-I Berseem, At Ludhiana, all the entries were moderately resistant to stem rot except PC-82 which showed moderately susceptible disease reaction. All the entries showed moderate population of lepidopteran caterpillars with non significant differences. At Rahuri, All the entries recorded less than 10 aphids/tiller (Resistant). At Palampur, all the entries were resistant to root rot.

S. No.	Entries	Ludhiana (stem rot)		Palampur (root rot)			Rahuri	Ludhiana (entomology)		
		Stem Rot Incidence (%)	Disease Reaction	% incidence	Disease Rating	Disease Reaction	No. of Aphids/tiller	<i>Trichoplusia</i> / m row length	<i>H. armigera</i> / m row length	<i>S. exigua</i> / m row length
1	BL-22 (ZC)			7	2	R				
1	JHB 146 (ZC)	26.67	MR				9.73	4.0	5.0	5.0
2	JB-05-9	17.00	MR	5	2	R	4.60	4.3	6.7	3.7
3	HFB-12-4	15.00	MR	7	2	R	5.00	5.0	7.3	4.0
4	HFB-12-9	23.67	MR	9	2	R	3.80	4.3	7.0	3.6
5	Mescavi (NC)	23.00	MR	5	2	R	4.33	5.0	7.3	3.6
6	Wardan (NC)	13.33	MR	5	2	R	2.87	3.67	6.6	3.0
7	PC-82	31.00	MS	5	2	R	5.50	4.3	3.67	3.0
8	Wardan (LC)						5.20			
	SE \pm						0.44			
	CD (0.05)	3.95					1.32	NS	NS	NS

AVTB-2: SECOND ADVANCED VARIETAL TRIAL IN BERSEEM

Berseem- AVT-2, At Ludhiana, Entries BB2 and Wardan (zonal and national checks) were moderately resistant to stem rot of berseem and rest entries were moderately susceptible. BB 2 zonal check also recorded non significant differences of lepidopteran caterpillars. **At Rahuri**, all the entries showed less than 10 aphids per tiller except national check Wardan (10.20) and Wardan (13.60) (Resistant)

S. N.	Entries	Ludhiana		Rahuri	Ludhiana		
		Stem Rot Incidence (%)	Disease Reaction	No. of Aphids/ tiller	<i>Trichoplusia</i> / m row length	<i>H. armigera</i> / m row length	<i>S. exigua</i> / m row length
1	JB-04-23	35.00	MS	3.50	4.0	6.7	3.7
2	BB 2 (ZC)	25.67	MR	4.98	4.0	7.3	4.0
3	Wardan (NC)	16.00	MR	10.20	3.3	7.3	3.6
4	JB-04-21	46.67	MS	5.43	3.3	8.4	4.0
5	Mescavi (NC)	37.67	MS	4.85	3.6	6.7	3.67
6	Wardan (LC)			13.60			
	SE±			0.71			
	CD at 5%	7.27		2.13	NS	NS	NS

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

Berseem – AVT-2 (Seed): At Ludhiana, all entries were moderately susceptible to stem rot of berseem. All entries recorded non significant differences for lepidopteran caterpillar population. **At Rahuri**, all the entries showed less than 10 aphids per tiller (Resistant).

S. N.	Entries	Ludhiana		Rahuri	Ludhiana		
		Stem Rot Incidence (%)	Disease Reaction	No. of Aphids/ tiller	<i>Trichoplusia</i> / m row length	<i>H. armigera</i> / m row length	<i>S. exigua</i> / m row length
1	JB-04-23	40.67	MS	3.65	4.0	5.0	5.6
2	BB 2 (ZC)	35.43	MS	3.50	4.3	6.7	5.6
3	Wardan (NC)	35.62	MS	2.00	5.0	7.3	4.6
4	JB-04-21	39.38	MS	8.90	4.3	7.0	4.3
5	Mescavi (NC)	46.74	MS	3.90	5.0	5.6	5.67
	Wardan (LC)			4.65			
	SE±			0.33			
	CD at 5%	3.74		0.99	NS	NS	NS

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

Oats – IVTO SC: At Ludhiana, UPO-16-4 was found resistant to leaf blight. All the entries showed moderately resistant disease reaction except HFO 607 which was moderately susceptible. The aphid population in the test genotypes varied non-significantly from 20.3-29.3 aphids per tiller being higher population of aphid in OL-1862 and lowest in OL-1861. The other entries showed the aphid population with non significant variations amongst them. **At Rahuri**, National check Kent was moderately Resistant; other entries including local check RO-19 were resistant. **At Palampur**, all entries were susceptible to Powdery mildew.

Entries	Bhubaneswar			Ludhiana		Palampur			Rahuri	Ludhiana
	Alternaria Leaf blight *	Sclerotium Root rot (%)	Leaf Defoliators (No/10 Plants)	Leaf Blight Severity (%)	Disease Reaction	% Disease severity	Disease Rating	Disease Reaction	No. of Aphids/ tiller	No. of Aphids/ tiller
OL-1861	3.83	7.13	3.10	13.67	MR	34	4	S	10.40	22.00
NDO-1102	2.83	5.60	2.60	17.67	MR	35	4	S	10.67	20.33
UPO-16-4	2.67	4.20	3.23	9.33	R	40	4	S	18.13	21.13
SKO-90 (ZC-HZ)						35	4	S		
OL-125 (ZC-NWZ)				11.33	MR					21.97
JHO-99-2 (ZC-NEZ)	3.00	5.43	2.93							
OS-377 (ZC-CZ)									11.33	
HFO 525	2.33	4.27	2.47	22.67	MR	55	5	HS	7.87	26.20
OL-1862	4.00	6.97	4.43	27.00	MR	45	4	S	10.57	29.30
HFO 607	1.83	3.57	1.73	32.00	MS	35	4	S	13.93	22.37
OS-6	2.17	2.00	1.47	25.67	MR	45	4	S	6.27	21.30
JO-05-7	3.17	6.90	3.03	25.33	MR	30	4	S	6.07	27.00
OL-1869-1	2.67	6.00	2.50	13.00	MR	45	4	S	13.47	29.33
Kent	3.17	7.33	4.20	18.33	MR	45	4	S	22.07	25.53
IVTOSC-12	1.67	1.77	1.63	11.33	MR	37	4	S	12.20	27.20
RO-19									16.93	
OL10										24.77
OL 9										24.97
SE (m)±	0.18	0.20	0.14						1.20	
CD (0.05)	0.55	0.60	0.43	4.29					3.50	NA
CV (%)	11.26	6.73	8.94							12.52

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

Oats - AVTOSC-1: At Ludhiana, HFO-529 showed resistant disease reaction to leaf blight of oats whereas rest of entries was found moderately resistant to leaf blight. The aphid population in the test genotypes varied non-significantly from 15.67-25.33, being highest population of aphid in HFO-427 and lowest in OS-6. The other entries showed the aphid population with non significant variations. **At Palampur**, entry 5 was highly susceptible, whereas other entries fall into susceptible category for Powdery mildew. **At Bhubaneswar**, for Alternaria leaf blight, entries JO-04-22 and OS-6 were moderately susceptible, whereas entries SKO-227 and HFO-529 were resistant. All other entries were moderately resistant. For sclerotium root rot, entries JO-04-22, JHO-99-2 (ZC-NEZ), JHO-15-1 were highly susceptible, whereas entry HFO-529 was resistant. Entries HFO-427, SKO-227, Kent (NC) were moderately resistant rest of the entries were moderately susceptible.

S. N.	Entries	Ludhiana		Bhubaneswar			Ludhiana	Palampur (Powdery mildew)		
		Leaf Blight Severity (%)	Disease Reaction	Alternaria Leaf blight *	Sclerotium Root rot (%)	Leaf Defoliators (No/10 Plants)	No. of Aphids per tiller	% Disease severity	Disease Rating	Disease Reaction
1	HFO-427	17.33	MR	3.17	2.27	1.73	25.33	25	4	S
2	SKO-227	16.33	MR	2.67	2.20	1.60	23.67	40	4	S
3	VOS-15-24	24.00	MR	3.17	3.77	3.20	23.33	43	4	S
4	OL-1844	10.67	MR	3.67	3.80	3.40	22.00	30	4	S
5	HFO-529	6.33	R	2.50	1.77	1.27	20.00	50	5	HS
6	JO-04-22	29.33	MR	4.00	4.43	3.53	22.00	25	4	S
7	SKO-90 (ZC-HZ)							27	4	S
7	OL-125 (ZC-NWZ)	18.00	MR				22.33			
7	JHO-99-2 (ZC - NEZ)			3.33	4.03	3.20				
8	JHO-15-1	19.67	MR	3.00	4.93	3.27	23.00	36	4	S
9	OS-6 (NC)	14.00	MR	4.00	3.93	4.07	15.67	45	4	S
10	Kent (NC)	12.67	MR	3.33	2.87	3.47	19.33	40	4	S
	OL-10 (LC)						16.00			
	OL-9 (LC)						21.67			
	SE (m)±			0.18	0.16	0.17				
	CD (0.05)	4.93		0.55	0.49	0.51	NS			
	CV (%)			9.59	8.36	10.21	13.08			

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

Oats- AVTOSC-2: At Ludhiana, Kent (NC) and OL-1802-1 showed resistant disease reaction to leaf blight. OL-1766-1, UPO-10-3, OL-1769-1, OS-424, JO-04-19 were moderately resistant and rest entries which were moderately susceptible except SKO-225 which was susceptible. The aphid population in the test genotypes varied non-significantly from 11.67-18.97, being highest population of aphid per tiller in OL-125 (ZC-NWZ) and lowest in SKO-225. There was no statistical difference with respect to aphid population per tiller amongst different entries in the experiment. **At Palampur,** Kent (NC) was resistant entries OL-1766-1, SKO-225, OL-1769-1, OS-432 were moderately resistant whereas all other entries were susceptible. **At Rahuri,** Resistant entries were UPO-10-3, OS-432, JO-04-19, JHO-822 (ZC-CZ) and RO-19, whereas moderately resistant entries were OL-1766-1, SKO-225, OL-1769-1. Susceptible entries were OL-1802-1, OS-6 (NC) and highly susceptible were Kent (NC), OS-424

S N	Entries	Palampur (Powdery mildew)			Ludhiana (Leaf blight)		Ludhiana	Rahuri
		% Disease severity	Disease Rating	Disease Reaction	Severity (%)	Disease Reaction	No. of Aphids/ tiller	No. of Aphids/ tiller
1	Kent (NC)	10	2	R	6.33	R	18.97	61.63
2	OL-1766-1	20	3	MR	16.33	MR	13.33	22.67
3	OL-1802-1	28	4	S	4.67	R	17.63	46.37
4	UPO-10-3	20	4	S	27.33	MR	13.00	10.40
5	OS-6 (NC)	30	4	S	31.00	MS	16.87	27.80
6	SKO-225	20	3	MR	52.00	S	11.67	15.20
7	OL-1769-1	15	3	MR	21.33	MR	14.43	20.93
8	OS-424	40	4	S	27.00	MR	15.07	65.28
9	OS-432	15	3	MR	31.00	MS	17.07	9.67
10	JO-04-19	35	4	S	21.67	MR	12.07	10.53
11	OL-125 (ZC-NWZ)				30.33	MS	18.97	
11	JHO-822 (ZC-CZ)							10.53
11	SKO-90 (ZC-HZ)	25	4	S				
	RO-19 (LC)							9.07
	OL-10 (LC)						14.30	
	SE±							2.05
	CD (p = 0.05)				3.51			6.00

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

AVTO (SC)-2 (SEED): At Rahuri, resistant entries were Kent (NC), SKO-225, OL-1769-1, OS-424, OS-432, JO-4-19, JHO-822 (ZC-CZ) and RO-19 (Local check) . Moderately resistant entry was OL-1766-1 whereas entries OL-1802, UPO-10-3, OS-6 (NC) were susceptible. **At Palampur for Powdery mildew**, SKO-90 (ZC-HZ) was moderately resistant whereas all other entries were susceptible.

S. N.	Entries	Palampur (Powdery Mildew)			Rahuri
		% Disease severity	Disease Rating	Disease Reaction	No. of Aphids/ tiller
1	Kent (NC)	25	4	S	11.13
2	OL-1766-1	35	4	S	20.13
3	OL-1802	32	4	S	32.07
4	UPO-10-3	33	4	S	27.80
5	OS-6 (NC)	30	4	S	35.67
6	SKO-225	35	4	S	13.80
7	OL-1769-1	27	4	S	11.67
8	OS-424	36	4	S	9.77
9	OS-432	35	4	S	13.07
10	JO-04-19	25	4	S	9.87
11	SKO-90 (ZC-HZ)	14	2	MR	
11	JHO-822 (ZC-CZ)				12.27
	RO-19 (LC)				9.20
	SE				1.25
	CD				3.68

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

Oats – IVTOMC: At Ludhiana, OL-1869 showed resistant reaction to leaf blight and other entries showed moderately resistant reaction except PLP-18 which was moderately susceptible and HFO-609 was susceptible. The aphid population varied significantly from 48.30-13.0 being highest in OL-1873 (48.30 aphids per tiller) and lowest in UPO-212 (NC). **At Palampur**, all the entries were susceptible to highly susceptible for Powdery mildew. **At Bhubaneswar**, entry JO-05-301 was highly susceptible, entries RO-19 (NC) and HFO-611 were resistant, entries OL-1876, Kent (NC) were moderately resistant. All other entries were susceptible for Alternaria leaf blight. For sclerotium root rot, entries RO-19 (NC) and HFO-611 were moderately resistant whereas other entries fall into susceptible to highly susceptible categories. For leaf defoliators, minimum incidence was recorded at RO-19 (NC) and HFO-611 and maximum in JO-05-301. **At Rahuri**, Resistant entries were JO-05-301, OL-1869, OL-1873, UPO-212 (NC), RO-19 (NC), PLP-18, HFO-609 and RO-19(LC); moderately resistant entries were OL-1876, Kent (NC), and HFO-611.

S N	Entries	Bhubaneswar			Ludhiana (Leaf Blight)		Palampur			Ludhi ana	Rahur i
		<i>Alterna ria</i> Leaf blight *	<i>Scler otium</i> Root rot (%)	Leaf Defoliato rs (No/10 Plants)	Sever ity (%)	Disea se React ion	% Disea se severit y	Dis ease Rati ng	Dise ase React ion	Aphid popula tion/til ler	No. of Aphid s/tiller
1	JO-05-301	4.17	4.67	3.73	10.67	MR	50	5	HS	47.33	7.33
2	OL-1869	3.33	4.50	2.60	8.33	R	40	4	S	18.67	14.07
3	OL-1873	3.17	5.13	3.00	24.33	MR	45	4	S	48.30	10.33
4	UPO-212 (NC)	3.50	4.13	2.87	20.00	MR	48	4	S	13.00	12.80
5	RO-19 (NC)	1.67	2.33	1.40	27.33	MR	60	5	HS	37.57	8.27
6	OL-1876	2.33	3.40	2.20	30.67	MR	65	5	HS	30.47	19.20
7	Kent (NC)	2.17	4.53	3.33	27.67	MR	50	5	HS	19.33	15.80
8	PLP-18	3.83	5.53	3.33	38.67	MS	40	4	S	20.33	11.73
9	HFO-609	4.00	3.53	2.47	61.33	S	65	5	HS	41.67	10.07
10	HFO-611	1.50	2.47	1.93	18.33	MR	45	4	S	42.67	18.73
	OL-10				45.00	MS				36.67	
	RO-19										8.53
	SE (m)±	0.14	0.25	0.11							1.14
	CD (0.05)	0.42	0.76	0.34	4.06					6.58	3.35
	CV (%)	8.14	10.79	7.22						11.85	

AVTO-1 (MC): FIRST ADVANCED VARIETAL TRIAL IN OAT (MULTI CUT)

At **Rahuri**, moderately resistant entries were OL-1842, UPO-212 whereas all other entries including local check RO-19 (LC) were resistant. At **Palampur**, all the entries were susceptible to highly susceptible for Powdery mildew

S.No.	Entries	Palampur Powdery Mildew			Rahuri
		% Disease severity	Disease Rating	Disease Reaction	No. of Aphids/ tiller
1	OL-1842	48	4	S	23.33
2	JO-4-321	35	4	S	10.40
3	RO-19 (NC)	55	5	HS	9.33
4	OL-1866	40	4	S	13.93
5	UPO-212 (NC)	33	4	S	24.20
6	Kent (NC)	35	4	S	8.67
7	HFO-514	45	4	HS	8.87
8	HFO-417	57	5	HS	11.20
	RO-19				13.47
	SE±				0.87
	CD at 5%				2.60

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

IVTO-Dual: At **Bhubaneswar**, for Alternaria leaf blight, entries HFO-610, JHO-822 (NC), RO-11-1, HFO-619 were highly susceptible, whereas entries OL-1804-1, RSO -8, UPO-212 (NC), RSO -60 were moderately resistant. All other entries were susceptible. For sclerotium root rot, entries HFO-610, JHO-822 (NC), RO -11-1, HFO-619, JO-10-501 were highly susceptible, whereas entry RSO -60 was resistant. Entries OL-1804-1, RSO -8, UPO-212 (NC) were moderately resistant rest of the entries were moderately susceptible. At **Ludhiana** IVTO-1 and IVTO-6 were resistant to leaf blight and IVTO-10 was susceptible. Rest of entries were moderately resistant except IVTO-8 and IVTO-9 which showed moderately susceptible disease reaction to leaf blight. The aphid population in the test genotypes varied significantly from 18.0-38.0, being highest in IVTO 4 and lowest in IVTO-8. At **Palampur**, all the entries were susceptible to highly susceptible for Powdery mildew. At **Rahuri**, Moderately resistant entries were UPO-212 (NC), RSO-60, HFO-619, whereas all other entries including local check RO-19 were resistant.

S N	Entries	Bhubaneswar			Ludhiana		Palampur (Powdery mildew)			Rahuri	Ludhiana
		<i>Alternaria</i> Leaf blight *	<i>Sclerotium</i> Root rot (%)	Leaf Defoliators (No/10 Plants)	Leaf Blight Severity (%)	Disease Reaction	% Disease severity	Disease Rating	Disease Reaction	No. of Aphids /tiller	Aphid population/ tiller
1	OL-1769	3.33	3.20	2.93	8.00	R	45	4	S	8.27	24.33
2	OL-1804-1	2.67	2.13	2.23	19.00	MR	40	4	S	9.67	31.66
3	RSO -8	3.00	2.93	2.53	15.33	MR	45	4	S	5.27	30.10
4	OL-1871	3.83	3.80	4.37	11.00	MR	40	4	S	13.33	38.0
5	UPO-212 (NC)	2.83	2.50	2.47	20.67	MR	45	4	S	17.93	26.66
6	HFO-610	4.17	4.67	4.73	8.67	R	37	4	S	13.07	33.8
7	JHO-822 (NC)	4.00	5.00	4.73	24.00	MR	48	4	S	9.87	31.1
8	RSO -60	2.33	1.80	1.67	38.67	MS	45	4	S	18.47	22.33
9	RO -11-1	4.17	5.13	4.70	33.00	MS	55	5	HS	8.93	26.66
10	HFO-619	4.00	5.20	4.83	57.33	S	50	5	HS	23.60	26.33
11	JO-10-501	3.83	4.40	4.43			35	4	S	13.00	
	OL-10				45.00	MS					18.0
	RO-19									9.00	
	SE (m)±	0.14	0.21	0.26						0.66	
	CD (0.05)	0.43	0.64	0.77	5.17					1.94	9.88
	CV (%)	7.14	9.93	12.33							20.50

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

AVTO -1 (Dual): At Bhubaneswar, for *Alternaria* leaf blight, entries OL-1802, JHO-822 (NC), UPO-212 (NC) were resistant, whereas entry NDO-11-01 was moderately resistant. Entry RO-19 (NC) was susceptible, entry OL-1760-1 was highly susceptible. For sclerotium root rot, entry OL-1760-1 was highly susceptible, whereas entry OL-1802, RO-19 (NC) was susceptible. Entries JHO-822 (NC), NDO-11-01, UPO-212 (NC) were moderately resistant. For leaf defoliators, Minimum incidence was recorded on entry UPO-212 (NC) and maximum for entry OL-1760-1.

Bhubaneswar				
SN	entry	<i>Alternaria</i> Leaf blight *	<i>Sclerotium</i> Root rot (%)	Leaf Defoliators (No/10 Plants)
1	OL-1802	1.67	3.27	2.27
2	OL-1760-1	4.17	4.27	3.13
3	JHO-822 (NC)	1.83	2.73	1.73
4	NDO-11-01	2.17	2.93	2.07
5	UPO-212 (NC)	1.67	2.33	1.53
6	RO-19 (NC)	3.50	3.40	2.87
	SE (m)±	0.15	0.18	0.12
	CD (0.05)	0.44	0.53	0.36
	CV (%)	9.38	9.73	9.25

VT Lucerne (P) -2016: VARIETAL TRIAL IN LUCERNE (Perennial) - 2016 – 1ST YEAR

Lucerne – VTL- 2016: At Ludhiana, VTL-1-9, 10, 11 and VTL-1-13 showed moderately resistant disease reaction to downy mildew. Rest entries were moderately susceptible. All entries showed non-significant variation for Lucerne weevil and *H. armigera* population.

At Rahuri, Resistant entries were VTLu-1, VTLu-2, VTLu-3, VTLu-4, VTLu-6, VTLu-7, VTLu-8, VTLu-9, VTLu-10, VTLu- 11, VTLu-12, and VTLu-13. All entries were found resistant

S. N.	Entry	Rahuri	Ludhiana			
		No. of Aphids/ tiller	Lucerne weevil/ plant	<i>H. armigera</i>	Downy mildew severity (%)	Disease Reaction
1	VTLu-2016-1	10.00	4.3	3.0	43.67	MS
2	VTLu-2016-2	7.80	4.67	3.0	50.33	MS
3	VTLu-2016-3	11.93	5.0	5.0	42.38	MS
4	VTLu-2016-4	13.20	4.3	5.0	37.00	MS
5	VTLu-2016-6	9.40	5.0	3.66	35.00	MS
6	VTLu-2016-7	7.60	3.7	5.67	38.69	MS
7	VTLu-2016-8	9.77	4.3	4.3	32.56	MS
8	VTLu-2016-9	10.67	4.3	4.3	23.44	MR
9	VTLu-2016-10	12.20	5.0	5.0	22.00	MR
10	VTLu-2016-11	12.53	4.67	3.67	28.72	MR
11	VTLu-2016-12	12.13	4.6	4.0	39.00	MS
12	VTLu-2016-13	10.00	5.0	5.0	23.00	MR
13	RL-88	10.27				
	SE±	0.8				
	CD at 5%	2.34	NS	NS	3.06	

IVT VICIA (P): VARIETAL TRIALS IN VICIA (PERENNIAL) -1ST YEAR

At **Rahuri**, Insect-pests and diseases were not observed on Vicia crop

IVT LOLIUM (P): VARIETAL TRIALS IN RYE GRASS (ANNUAL)

At **Palampur**, Disease pressure was low and all the entries of rye grass were resistant for powdery mildew.

S. No.	Entries	Palampur (Powdery mildew)		
		% Disease incidence	Disease Rating	Disease Reaction
1	Palam rye grass -2	7	2	R
2	Palam rye grass -1	6	2	R
3	PBRG-2	6	2	R
4	Advanta RG-1	9	2	R
5	PBRG -1 (NC)	3	2	R
6	Advanta RG -2	2	2	R

VT- LUCERNE (P) REPEAT: VARIETAL TRIAL IN LUCERNE (P)-2013 REPEAT

S. N	Entries	Hyderabad				
		DOA 22-01-2017	DOA 02-02-2017	DOA 02-02-2017	DOA 03-02-2017	
		Thrips/ tiller		Aphids / tiller	% Rust incidence (PDI)	Scale
1	TNLC-14	6 (2.58)	8.1 (3.02)	1.8 (1.67)	31.11 (33.6)	3.0
2	Anand -25	6 (2.64)	7.7 (2.95)	1.4 (1.53)	33.48 (35.31)	3.0
3	Anand -26	4 (2.16)	7.6 (2.93)	1.0 (1.40)	39.70 (39.03)	3.0
4	RL-10-2	10 (3.36)	8.1 (3.01)	1.5 (1.57)	33.33 (35.1)	3.0
5	ALP-1-1	5 (2.44)	8.0 (2.99)	0.9 (1.38)	15.85 (23.32)	2.0
6	Anand -2	9 (3.10)	7.9 (2.98)	1.6 (1.60)	37.78 (37.81)	3.0
7	RL-88	10 (3.36)	8.8 (3.12)	1.7 (1.63)	30.52 (33.12)	3.0
	C.D.	0.270	N/S	0.17	NS	
	SE(m)	0.087	0.04	0.05	3.06	
	C.V.	5.352	2.5	6.21	15.6	

VT- LUCERNE (P) REPEAT: VARIETAL TRIAL IN LUCERNE (P)-2013 REPEAT

entries	Coimbatore		Mandya		Hyderabad	
	Av. No. of aphids/tiller	Rust intensity (Score values)	Av. No. of aphids/tiller	Rust intensity (Score values)	Aphids / tiller	Rust intensity (Score values)
TNLC-14	6.27 (R) [2.59]	1.67 (R)	0.00 (R)	1.00 (R)	1.8 [1.67]	4.00 (S)
Anand -25	7.07 (R) [2.74]	1.33(R)	0.00 (R)	1.00 (R)	1.4 [1.53]	4.00 (S)
Anand -26	6.33 (R) [2.61]	2.00(R)	0.00 (R)	1.00 (R)	1.0 [1.40]	4.00 (S)
RL-10-2	6.87 (R) [2.71]	1.33(R)	0.00 (R)	1.00 (R)	1.5 [1.57]	4.00 (S)
ALP-1-1	7.80 (R) [2.87]	1.00(R)	0.00 (R)	1.00 (R)	0.9 [1.38]	3.00 (MR)
Anand -2	7.47 (R) [2.81]	1.67(R)	0.00 (R)	1.00 (R)	1.6 [1.60]	4.00 (S)
RL-88	6.53 (R) [2.65]	1.67(R)	0.00 (R)	1.00 (R)	1.7 [1.63]	4.00 (S)
SE	0.09				0.05	
CD 5%	N.S.				N.S.	

For Aphid	For Leaf Disease
R= Less than 10 aphids/tiller	1= No Symptoms
MR= 11-25 aphids/tiller	2= R (Upto 10 %intensity)
MS= 26-40 aphids/tiller	3=MR (11-25 % intensity)
S= 41-60 aphids/tiller	4= S (26-50 % intensity)
HS= above 60 aphids/tiller	5= HS (Beyond 50 % intensity)
R= Resistant, MR= Moderately resistant, MS=Moderately susceptible, S= Susceptible and HS= Highly susceptible	

AVTO (SC)-2: SECOND ADVANCED VARIETAL TRIAL IN OAT (SINGLE CUT) REPEAT 14-15

At Hyderabad, no incidence of leaf blight was recorded. All the entries were highly resistant. Data were recorded on 22-01-2017 and 02-02-2017. At Coimbatore and Mandya also no leaf blight incidence was recorded.

Entries	Coimbatore	Mandya	Hyderabad
	Leaf blight	Leaf blight	Leaf blight
	Score	Score	Score
SKO-190	1.00	1.00	1.00
JHO -2012-2	1.00	1.00	1.00
RSO-59	1.00	1.00	1.00
RSO-60	1.00	1.00	1.00
OS-405	1.00	1.00	1.00
JHO-2012-1	1.00	1.00	1.00
JHO-2000-4	3.00	1.00	1.00
OS-6	1.00	1.00	1.00
Kent	1.00	1.00	1.00
OL-1760	1.00	1.00	1.00
SE			
CD 5%			

For Leaf Disease

- 1= No Symptoms
- 2= R (Upto 10 %intensity)
- 3=MR (11-25 % intensity)
- 4= S (26-50 % intensity)
- 5= HS (Beyond 50 % intensity)

PPT 17: To study the pathogenic variability of *Blumeria graminis* f. sp. *avenae* on oat

Location: Palampur

During 2016-17 season, eleven isolates of powdery mildew i.e. Palampur, KVK Kangra, Bir, Utarala, Kholi 53 mile (Dist. Kangra), Bara (Hamirpur), Lad-Bharol, Tikkan, Shanaan (Mandi) and Udaipur, Jhalma (Lahaul and Spiti) were collected and maintained under controlled conditions (Green House). The reaction of these isolates will be studied on selected differential set to find out the pathogenic variability. The reaction of these isolates will be recorded on detached leaf method under *in vitro* as infection types i.e. 0-4 under stereo zoom microscope on 10 differential line of Oat. The detached leaf methods for evaluation of oat germplasm under *in vitro* and scale for the recording of infection types was standardized for pea powdery mildew (Banyal, 1995) will be used.

Table: The description of infection types (Banyal, 1995) is as below:

Infection type	Description
0	No mycelium growth
1	Sparse mycelium growth with very little sporulation
2	Slight growth of mycelium is evident microscopically
3	Moderate growth of mycelium is evident macroscopically & formation of clear colonies
4	Abundant growth of mycelium is evident macroscopically & colonies get mixed with each other leading to thr formation of mycelia.

The above infection types were employed for studying the pathogenic variability. In designating the pathotypes, only two disease reaction categories were used *viz.* Resistant (R) including 0,1 and 2 infection types, and susceptible (S) including 3 and 4 infection types. The infection type and reaction type of all the isolates will be recorded.

Refinement of Differential set: The previous selected differential set will be refined and for refinement 347 lines of oat were evaluated at Palampur *in vivo* for powdery mildew under natural epiphytotic conditions. Disease level was very high reaching up to 80 per cent severity in susceptible checks. From these, 75 lines were selected for the refinement of differential lines which were formed during 2013-2014 and will be evaluated under greenhouse conditions (Detached leaf method), with the collected isolates.

Study of inheritance of Powdery mildew in oat: To study of inheritance of powdery mildew resistance, three resistant lines (OL-1847, OG-77 and AVTO-SC-2-Seed-9) were selected and crossed with HJ-8 (Susceptible check) in field and F1 seeds was harvested for further studies.

PPT 19: Management of soil borne diseases in clover (Egyptian clover) seed crop

Location: Ludhiana

Design: RBD

Replication: 3

Plot size: 3.5x3m²

At Ludhiana, The experiment was conducted for the management of soil borne diseases in clover. The results presented in table PPT 19 showed that the spray with Carbendazim @ 1.0 kg/ha exhibited least disease incidence (14.38%)

of stem rot having 55.20 percent disease control with 38.98 percent increase in green fodder yield followed by application of neem seed powder @ 50 kg/ha (17.43%) with 35.25 percent in green fodder yield and spray of NSKE @ 5% before disease appearance with disease incidence of 18.62 percent followed by Soil application of *Trichoderma* @ 5kg/ha with incidence of 19.07 percent as compare to control (32.09%) under natural conditions. Percent incidence was statistically at par in all the treatments.

Table PPT 19: Effect of soil, seed treatment and foliar spray on disease incidence and GFY on clover seed crop

Treatments		Stem rot Incidence (%)	Disease Control (%)	GFY (q/ha)	Percent Increase	Seed Yield (q/ha)
T ₁	Soil application of <i>Trichoderma</i> @ 5kg/ha	19.07	40.57	592.83	19.05	3.77
T ₂	Soil application of <i>Pseudomonas fluorescens</i> @ 5kg/ha	21.58	32.74	557.83	12.02	3.31
T ₃	Seed treatment with Carbendazim @ 2g/kg seed	20.49	36.14	573.98	15.26	3.43
T ₄	Apply FYM @ 60 kg/ha to the plots	22.18	30.89	521.41	4.70	3.20
T ₅	Apply neem seed powder @ 50 kg/ha	17.43	45.69	673.52	35.25	3.89
T ₆	Spray of NSKE @ 5% before disease appearance	18.62	41.99	597.34	19.95	3.89
T ₇	Spray of Carbendazim @ 1.0 kg/ha	14.38	55.20	692.08	38.98	4.23
T ₈	Untreated control	32.09	-	497.98	-	2.40
CD (P=0.05)		2.85		5.87		4.57
CV		7.88		6.45		7.44

PPT-20: Management of soil borne and powdery mildew diseases in red clover seed crop

Location: Palampur

The experiment was conducted to manage the powdery mildew and soil borne diseases in the seed crop of red clover. It was observed that integrated management i.e. seed treatment with carbendazim @ 2 g/kg seed followed by three foliar spray of hexaconazole @ 0.1 % gave best management of powdery mildew having 3.8 percent disease severity and 93.9 per cent disease control with 45.7 per cent increase in yield as compared to control. Seed treatment with carbendazim @ 2 g/kg seed followed by and one spray each of *Trichoderma*, wettable sulphur and hexaconazole provided best management of soil borne diseases (2.2 % severity and 86.7 % disease control) and good control of powdery mildew (6.0 % severity and 90.4 % disease control) with 62.9 per cent increase in yield over check.

Table: Palampur PPT-20: Management of soil borne and powdery mildew diseases in red clover seed crop

Treatment	% Severity or incidence				Yield	
	Powdery mildew	% control	Soil borne disease	% control	(q/ha)	% increase
T ₁ : Seed treatment with <i>Trichoderma</i> @ 5g/kg seed	62.6 (52.3)	-	8.3	50.0	0.80	14.3
T ₂ : Seed treatment with carbendazim @ 2 g/kg seed	53.7 (47.1)	14.4	4.4	73.5	0.84	20.0
T ₃ : T ₁ + Three foliar spray of <i>Trichoderma</i> @ 0.5%	40.4 (39.7)	35.6	7.1	57.2	0.86	22.9
T ₄ : T ₂ + Three foliar spray of <i>Trichoderma</i> @ 0.5%	38.4 (38.3)	38.8	4.2	74.7	0.93	32.9
T ₅ : T ₁ + Three foliar spray of wettable sulphur @ 0.3%	12.7 (20.9)	79.7	6.6	60.2	0.98	40.0
T ₆ : T ₂ + Three foliar spray of wettable sulphur @ 0.3%	11.6 (19.9)	81.5	3.9	76.5	0.94	34.3
T ₇ : T ₁ + Three foliar spray of hexaconazole @ 0.1 %	7.0 (15.4)	88.8	6.9	58.4	0.91	30.0
T ₈ : T ₂ + Three foliar spray of hexaconazole @ 0.1 %	3.8 (11.2)	93.9	3.8	77.1	1.02	45.7
T ₉ : T ₁ + One spray each of <i>Trichoderma</i> , wettable sulphur and hexaconazole	5.3 (13.3)	91.5	6.6	60.2	1.00	42.9
T ₁₀ : T ₂ + One spray each of <i>Trichoderma</i> , wettable sulphur and hexaconazole	6.0 (14.2)	90.4	2.2	86.7	1.14	62.9
T ₁₁ = Control	62.7 (52.3)	-	16.6	-	0.70	-
CD (5%)	1.90		1.27		0.11	

PPT 21: Management of foliar diseases of oat

Location: Ludhiana and Bhubaneswar

Objective: To manage the foliar diseases of oat through seed treatment and foliar application of fungicides and bioagents

At Ludhiana, the experiment was conducted for the management of foliar diseases of oats in RBD with 3 replications in plot size 3x2.5 m² (Table PPT 21). 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 (15.33%) of leaf blight with 50.01 percent control of disease and 211.43 q/ha of green fodder and 15.62 q/ha of seed yield followed by seed treatment with *Trichoderma viride* (CFU 10⁶/gm of formulation) @ 5g/kg of seed + foliar application of Propiconazole 25 EC @ 1ml/lit after 21 DAS that is 16.17 percent severity with 47.29 percent disease control and 14.37 percent increase in green fodder yield was observed. Seed treatment with Carbendazim 50WP @ 2g/kg seed + foliar application of Carbendazim 12% + Mancozeb 63% WP @ 1g/lit after 21 DAS showed 37.51 percent disease control as compare to untreated check (30.67%).

At Bhubaneswar, Seed treatment with carbendazim 50WP @ 2g/kg seed + foliar application of Propiconazole 25EC @ 1ml/lit after 21DAS showed minimum diseases severity of leaf blight in oats (26.66%) followed by seed treatment with *Trichoderma viride* (CFU 10⁶/gm of formulation) @ 5g/kg of seed + foliar application of Propiconazole 25 EC @1ml/lit after 21 DAS (32.33 percent) and seed treatment with carbendazim 50 WP @ 2g/kg seed+ foliar application of Carbendazim 12% + Mancozeb 63% WP @ 1g/lit after 21 DAS (36.66%) as compared to check (percent leaf blight severity of 61.33%).The fodder yield was also observed in treatments T6 and T7 333q/ha and 308q/ha respectively. Other treatments were statistically at par with each other. (Table PPT 21)

Table PPT 21: Effect of foliar spray and seed treatment on leaf blight and GFY of Oats

Treatments	Ludhiana				Bhubaneswar		
	Leaf Blight Severity (%)	Disease control (%)	GFY (q/ha)	Percent Increase	Seed Yield (q/ha)	Leaf Blight severity (%)	GFY (q/ha)
T ₁	21.53	29.79	191.24	10.94	12.00	41.33	280
T ₂	28.83	5.99	179.05	3.87	9.90	46.33	272
T ₃	26.83	12.51	186.67	8.29	10.29	44.66	285
T ₄	19.17	37.51	196.19	13.81	12.57	36.66	291
T ₅	24.40	20.44	188.57	9.39	11.05	43.66	287
T ₆	15.33	50.01	211.43	22.65	15.62	26.66	333
T ₇	16.17	47.29	197.14	14.37	14.29	32.33	308
T ₈	30.67	-	172.38	-	9.52	61.33	252.67
CD (P=0.05)	7.170		4.062		2.05	1.85	14.76
CV	17.734		13.145		7.68	2.66	2.95

T₁ - Seed treatment with carbendazim 50WP @ 2g/kg seed

T₂ - Seed treatment with *Trichoderma viride* (CFU 10⁶/gm of formulation)@ 5g/kg of seed

T₃ - T₂ + foliar spray of *T. viride* @ 0.5% at 21 DAS

T₄ - T₁ + foliar application of Carbendazim 12% + Mancozeb 63%WP @ 1g/lit at 21 DAS

T₅ - T₂+ foliar application of Carbendazim 12% + Mancozeb 63%WP @ 1g/lit at 21 DAS

T₆ - T₁ + foliar application of Propiconazole 25EC @ 1ml/lit after 21DAS

T₇ - T₂ + foliar application of Propiconazole 25EC @ 1ml/lit after 21DAS

T₈ -Untreated control

PPT 22: Studies on biological management of *Spodoptera litura* in relation with different time of application on Lucerne under field condition

Location: Rahuri, Dharwad and Hyderabad

At Rahuri, during Pre count, the interaction effect among the treatments in respect of survival population of larvae/m² before spray treatment was non-significant. The range of survival larval population/m² was from 7.85 to 10.50 larvae/m² (Table Rahuri PPT22.1)

At Rahuri, after 5 DAS, statistically lower survival population/m² was observed in treatment with mixture of *B. bassiana*, *N. rileyi* and SINPV (1.76 larvae/m²) at 8 pm spraying time. However, it was at par with mixture of mixture of *B. bassiana* and SINPV recording 1.76 larvae/m² at 8 pm spraying treatment, respectively. Among the time of application, lower survival population of larvae/m² was observed at 8 pm recording 3.52 larvae/m² which is significantly superior over the other time of application such as 8 am and 4 pm.

However, the treatments, mixture of *B. bassiana*, *N. rileyi* and SINPV was found significantly superior over all the treatments recording 3.57 larvae/m². Nevertheless, it was at par with mixture of *B. bassiana* and SINPV and mixture of *N. rileyi* and SINPV recording 3.74 and 3.80 larvae/m².

At Rahuri, after 7 DAS, Foliar application of *B. bassiana* + *N. rileyi* + SINPV, *B. bassiana* + SINPV and *N. rileyi* + SINPV at 8 pm recorded 0.00, 0.00 and 0.00 survival larva/m², respectively at 7 DAS which were significantly at par with each other and showed their superiority as compared to other time of application. Among the treatments, lower survival population of larvae was observed with mixture of *B. bassiana*, *N. rileyi* and SINPV recording 1.56 larvae/m². Among the time of application, statically lower survival population was observed at 8 pm, recording 2.64 larvae/m²

Table Rahuri PPT 22.1: Survival larval population of *S. litura* / m² before spray treatment

S. N.	Precount				5 days after spray				7 days after spray			
	8am (C1)	4pm (C2)	8pm (C3)	Mean	8am (C1)	4pm (C2)	8pm (C3)	Mean	8am (C1)	4pm (C2)	8pm (C3)	Mean
T1	8.49 3.00	8.15 2.94	10.05 3.25	8.90 3.06	5.73 2.50	6.65 2.67	3.42 1.98	5.27 2.38	2.55 1.75	5.83 2.52	1.55 1.43	3.31 1.90
T2	8.34 2.97	8.00 2.91	9.90 3.22	8.75 3.04	5.57 2.46	6.18 2.58	2.13 1.62	4.63 2.22	2.53 1.74	5.81 2.51	1.94 1.56	3.43 1.94
T3	8.60 3.02	8.26 2.96	10.17 3.27	9.01 3.08	5.76 2.50	6.65 2.67	2.11 1.61	4.84 2.26	2.14 1.62	5.42 2.43	1.55 1.43	3.04 1.83
T4	8.50 3.00	8.16 2.94	10.07 3.25	8.91 3.06	4.47 2.22	5.00 2.35	1.76 1.49	3.74 2.02	1.26 1.32	4.54 2.24	0.00 0.71	1.93 1.42
T5	8.54 3.01	8.20 2.95	10.10 3.26	8.95 3.07	4.44 2.22	4.86 2.31	2.11 1.61	3.80 2.05	1.16 1.26	4.43 2.22	0.00 0.71	1.86 1.40
T6	8.67 3.03	8.16 2.94	10.24 3.27	9.02 3.08	4.10 2.14	4.85 2.31	1.76 1.49	3.57 1.98	0.71 1.09	3.98 2.12	0.00 0.71	1.56 1.31
T7	8.45 2.99	7.85 2.89	9.82 3.21	8.71 3.03	10.40 3.30	10.95 3.38	11.33 3.44	10.89 3.37	12.10 3.55	11.90 3.52	13.47 3.74	12.49 3.60
Mean	8.51 3.00	8.11 2.93	10.50 3.32	8.89 3.06	5.78 2.48	6.45 2.61	3.52 1.89	5.25 2.33	3.21 1.76	5.99 2.51	2.64 1.47	3.95 1.91
	T	C	T x C		T	C	T x C		T	C	T x C	
SE±	0.026	0.017	0.040		0.027	0.022	0.050		0.033	0.023	0.052	
CD at 5%	NS	NS	NS		0.080	0.065	0.149		0.099	0.065	0.153	

* Bold Figures indicate $\sqrt{n} + 0.5$ transformation

At Rahuri, the higher green forage yield (98.69 q/ha) of lucerne was obtained from the treatment combination of *B. bassiana*, *N. rileyi* and SINPV sprayed during 8 pm on lucerne and it was significantly higher than the other treatments and other time of applications. However, it was at par with mixture of *N. rileyi*, SINPV @ 1x10⁸ cfu/g + 250 LE/ ha, mixture of *B. bassiana*, SINPV @ 1x10⁸ cfu/g + 250 LE/ ha, SINPV alone @ 250 LE/ha, *N. rileyi* alone @ 1x10⁸ cfu/ml recording 95.93, 95.21, 93.83 and 94.47 q/ha, respectively. Among the treatments, highest green forage yield was obtained with mixture of *B. bassiana*, *N. rileyi* and SINPV recording 87.65 q/ha. However, it was at par with mixture of *N. rileyi*, + SINPV, mixture of *B. bassiana*, + SINPV and SINPV alone recording 86.03, 84.53 and 84.37 q/ha, respectively. Among the time of application, higher green forage was obtained at 8 pm, recording 91.16q/ha which is significantly superior over other time of application.

At Rahuri, Maximum ICBR (1:2.83) due to individual treatment of *N. rileyi* alone. However, among the different time of application 8 PM showed highest (1:4.41) ICBR than the other time of application. Application of biopesticides at 8 PM is suitable time for the highest return

Table Rahuri PPT 22.2: Interaction effect of time of application of biopesticidal treatments on green forage yield and Incremental cost benefit ratio (ICBR) of lucerne

Treatments	Green forage yield (q/ha)				Incremental cost benefit ratio (ICBR)			
	8 am (C1)	4 pm (C2)	8 pm (C3)	Mean (T)	8 am (C1)	4 pm (C2)	8 pm(C3)	Mean (T)
T1	81.69	68.47	91.53	80.56	1:1.54	1:-0.14	1:4.92	1:2.20
T2	82.42	69.41	94.47	82.10	1:1.73	1:0.10	1:5.67	1:2.50
T3	85.03	74.25	93.83	84.37	1:2.19	1:1.20	1:5.10	1:2.83
T4	85.42	72.97	95.21	84.53	1:1.41	1:0.39	1:3.73	1:1.84
T5	85.58	76.58	95.93	86.03	1:1.44	1:1.03	1:3.85	1:2.10
T6	87.53	76.74	98.69	87.65	1:1.20	1:0.62	1:3.22	1:1.68
T7	71.77	65.11	68.46	68.45				
Mean C	82.78	71.93	91.16		1:1.58	1:0.58	1:4.41	
	(T)	(C)	(TxC)					
SE±	1.20	1.75	2.20					
CD at 5%	3.60	5.11	6.50					

T1 - Foliar application of *B. bassiana* @ 1x10⁸ CFU/g (5 g/lit)

T2 - Foliar application of *N. rileyi* @ 1x10⁸ CFU/g (5 g/lit)

T3 - Foliar application of SINPV @ 250 LE/ ha (1ml/lit)

T4 - T₁+T₃ (*B. bassiana* @ 1x10⁸ CFU/g (5 g/lit) + SINPV @ 1ml/lit)

T5 - T₂+T₃ (*N. rileyi* @ 1x10⁸ CFU/g (5 g/lit) + SINPV @ 1ml/lit)

T6 - T₁+T₂+T₃ ((*B. bassiana* @ 1x10⁸ CFU/g (5 g/lit) + *N. rileyi* @ 1x10⁸ CFU/g (5 g/lit) + SINPV @ 1ml/lit)

T7 - Untreated control

At Dharwad, as incidence of *Spodoptera litura* was not observed in the season and hence observations were not recorded.

At Hyderabad, *S. Litura* infestation was not observed

PPT-23: Biological control of *Helicoverpa armigera* on Berseem / Lucerne seed crop.

Location: Ludhiana, Dharwad, Rahuri and Hyderabad

Objectives: To find out the effectiveness of different entomopathogenic fungi in combination with *HaNPV* against *H. armigera* on berseem / Lucerne seed crop

At Ludhiana, In Berseem var. BL-42 seed crop, formulations of three (3) biopesticides viz. *Beauveria bassiana*, *Nomuraea rileyi* and *HaNPV* supplied by Rahuri centre, were evaluated at three individual doses along with different combinations, and untreated control for their bioefficacy against *Helicoverpa armigera*. The trial was laid out in randomized block design with three replications with date of spray on 03.05.2017. Incidence of *H. armigera* was recorded at the time of flowering by counting the number of larvae per meter row length, before spray, 5 and 7 days after spray (DAS) from three randomly selected spots per replication. The data was recorded as and when pest appears. Activity of honeybees was also monitored in all the plots after 12 hrs of spray treatment. Seed yield was also recorded at the time of harvest and converted to hectare basis. The pooled statistically analyzed data are presented in table Ludhiana PPT23.

The results revealed that the number of *H. armigera* larvae before spray varied non-significantly in all the treatments. Among the biopesticides evaluated, the treatment effect was significantly evident as compared with control after 5 and 7 days after spray. Within treatment statistical differences were evident as T4 and T6 recorded lower mean number of *H. armigera* larvae per m row length at 5 and 7 days after spray (DAS). And amongst all the treatments T6 emerged as statistically superior treatment. 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 6.90-10.

Table Ludhiana PPT 23. Bioefficacy of microbial biopesticides against *H. armigera* on berseem seed crop at Ludhiana

Treatment	Number of <i>H. armigera</i> larvae per m row length			Number of honeybees per plot		Seed yield (kg/ha)
	Before spray	5 DAS	7 DAS	Before spray	12h after spray	
T ₁	11.33	9.33(3.21)	6.33(2.71)	11.10	7.50	209
T ₂	8.67	7.33(2.89)	5.67(2.56)	9.60	6.90	205
T ₃	10.67	6.33(2.68)	5.33(2.51)	12.10	6.70	210
T ₄	10.33	5.67(2.58)	3.67(2.16)	10.10	7.5	207
T ₅	12.33	6.67(2.76)	4.33(2.31)	10.80	7.33	208
T ₆	12.00	4.33(2.29)	2.00(1.72)	7.90	7.33	216
T ₇	12.67	18.33(4.40)	22.00(4.79)	12.0	10.0	158
CD (5%)	NS	0.48	0.46	NS	NS	4.14
CV	16.34	12.10	9.82	15.0	16.0	11.4

Figures in parenthesis are square root transformed value

At Dharwad, Experiment was carried out on Lucerne variety RL-88, in RBD with 3 replications in plot size 3x4 m² Among all the treatments, combination of foliar application of *B. bassiana* @ 1x10⁸ CFU/g (5g/lit)+ *N. rileyi* @ 1x10⁸ CFU/g (5 g/lit)+ *HaNPV* @ 1ml/lit proved superior over all the treatments in reducing the larval population of *H.armigera* than other treatments and registered the highest seed yield of 2.94 q/ha. Combination of either of entomopathogen *B. bassiana* and *N.rileyi* with NPV were superior than sole treatments. Among sole treatment of entomopathogens, NPV and *N.rileyi* were superior over *B. bassiana*. However, all the treatments were untreated check in reducing the *H.armigera* and obtaining higher seed yield. All the entomopathogens are safe to honeybees after 12 hours of spray.

Table Dharwad PPT23. Evaluation of entomopathogenic fungi in combination with *Ha* NPV against *H.armigera* on lucerne seed crop at Dharwad

Treatment	Number of <i>H. armigera</i> larvae per m row length			Number of honeybees per plot	
	Pre count	5 DAS	7 DAS	12 hours after spray	Seed yield (q/ha)
T ₁	4.2	3.8	3.0	2.2	2.28
T ₂	4.4	3.0	2.2	2.0	2.32
T ₃	4.6	3.2	2.2	2.2	2.36
T ₄	4.8	2.0	1.0	2.0	2.54
T ₅	4.2	2.2	1.0	2.0	2.62
T ₆	4.0	1.2	0.0	2.2	2.94
T ₇	4.8	4.6	4.0	2.0	2.10
CV	-	7.52	6.40	-	6.90
CD at 5%	NS	0.62	0.54	NS	0.14
SEM±	-	2.48	2.12	-	2.34

* DAS= Days After Treatment

At Rahuri, At 5 days after spraying treatment combinations of *B. bassiana*, *N. rileyi* and HaNPV gave excellent control of *H. armigera* (2.58 larvae/m²), however, treatment combinations of *N. rileyi* and HaNPV and combination of *B. bassiana* and HaNPV, were statistically at par with each other for reducing the larval population of *H. armigera* and recorded 2.76 and 3.13 larvae/m² at 5 DAS. At seven days after treatment, combination of *B. bassiana*, *N. rileyi* and HaNPV and combination of *N. rileyi* and HaNPV were statistically at par with each other recording 1.00 and 1.26 larvae/m², respectively.

Honey bee activities: There were non-significant differences among the treatments in respect of bee visits and average number of bees/plot/min at 2nd days after treatment. However, the range of bee visits /plot/min. at 11 a.m. was 19.33 to 23.33 at 2nd days after spraying. As regards average number of bees/plot/min., it was ranged from 3.00 to 4.00 at 11 a.m. 2nd days after spraying.

Seed yield: The treatment combinations of *B. bassiana*, *N. rileyi* and HaNPV recorded highest seed yield (2.55 q/ha) of lucerne and it was significantly higher than the remaining treatments. However, treatment combinations of *N. rileyi* and HaNPV, *B. bassiana* + HaNPV and HaNPV alone were at par with it. These treatments were recorded 2.43, 2.34 and 2.32 q/ha seed yield, respectively.

Table Rahuri 23: Effect of entomopathogenic fungi and HaNPV on survival larval population of *H. armigera*, honey bee activities and seed yield of lucerne (Mean table)

Treatment	Precount (Av. No. larvae/m ²)	Survival larval population / m ² days after spray		Av. No. of bee visits and bees/ plot/minute at 11 AM 2 nd DAS spraying		Seed Yield (q/ha)
		5 DAS	7DAS	Visits	No. of bees	
T ₁	5.92 (2.53)	4.10 (2.14)	2.71 (1.79)	23.33	4.00	2.11
T ₂	5.87(2.52)	4.03 (2.13)	2.79 (1.81)	20.00	3.00	2.19
T ₃	6.18(2.58)	4.27 (2.18)	2.45(1.72)	20.33	3.33	2.32
T ₄	6.23(2.59)	3.13 (1.90)	1.72 (1.49)	19.33	3.33	2.34
T ₅	5.92(2.53)	2.76 (1.80)	1.26 (1.32)	19.67	3.33	2.43
T ₆	6.22(2.59)	2.58 (1.75)	1.00 (1.22)	23.00	3.67	2.55
T ₇	9.40 (3.15)	11.53(3.47)	12.27 (3.57)	21.33	3.67	1.03
SE±	0.07	0.05	0.06	0.80	0.50	0.08
CD 5%	N.S.	0.15	0.18	N.S.	N.S.	0.24

Bold figures in parenthesis indicating the values of square root n+0.5

T1 - Foliar application of *B. bassiana* @ 1x10⁸ CFU/g (5 g/lit)

T2 - Foliar application of *N. rileyi* @ 1x10⁸ CFU/g (5 g/lit)

T3 - Foliar application of HaNPV @ 1ml/lit

T4 - T₁+T₃ (*B. bassiana* @ 1x10⁸ CFU/g (5 g/lit) + HaNPV @ 1ml/lit)

T5 - T₂+T₃ (*N. rileyi* @ 1x10⁸ CFU/g (5 g/lit) + HaNPV @ 1ml/lit)

T6 - T₁+T₂+T₃ ((*B. bassiana* @ 1x10⁸ CFU/g (5 g/lit) + *N. rileyi* @ 1x10⁸ CFU/g (5 g/lit) + HaNPV @ 1ml/lit)

T7 - Untreated control

At Hyderabad, experiment was carried out in Lucerne crop, *H. armigera* infestation was not observed

PPT-26: Biological management of oat aphid *Rhopalosiphum padi* on oats

Location: Rahuri, Ludhiana and Dharwad

Objectives To find out the effectiveness of different entomopathogenic fungi and neem formulations against *R. padi* on oats

At Rahuri, Precount was non-significant, there was non-significant differences among the aphid population. At 5 DAS *L. lecanii* @ 7.5 g/lit recorded significantly lower number of aphids (25.30) per tiller. However, *M. anisopliae* @ 7.5g/lit (25.38) and *L. lecanii* @ 5g/lit (28.83) were found at par with it. At 7 DAS *L. lecanii* @ 7.5 g/lit and *M. anisopliae* @ 7.5g/lit maintained their superiority against oat aphid and recorded 9.90 and 11.31 aphids/tiller which were significantly lower than the other treatments.

At Rahuri, all the treatments were found non-significant differences of coccinellid predators among the treatments. Biopesticides did not affected the activities of coccinellid predators 5 and 7 days after spray.

Table Rahuri PPT 26. Effect of biopesticides on insect-pests

SN	Treatments	Dose (%)	survival population of oat aphids (Av. of 2 sprays)			survival population of Coccinellid predators (Av. of 2 sprays)		
			Precount	5 DAT	7 DAT	Precount	5 DAT	7 DAT
1	<i>L. lecanii</i> 1.5 % WP	5 gm/lit.	50.51	28.83	11.35	1.50	2.20	2.25
			7.08	5.39	3.46	1.49	1.70	1.72
2	<i>L. lecanii</i> 1.5 % WP	7.5 gm/lit.	52.36	25.30	9.90	1.43	2.22	2.27
			7.19	5.05	3.24	1.46	1.70	1.73
3	<i>Metarrhizium anisopiliae</i> 1.5 % WP	5 gm/lit.	49.61	31.86	15.06	1.50	2.27	2.29
			7.03	5.67	3.96	1.49	1.72	1.73
4	<i>Metarrhizium anisopiliae</i> 1.5 % WP	7.5 gm/lit.	50.64	26.38	11.31	1.57	2.25	2.20
			7.08	5.15	3.45	1.51	1.72	1.71
5	Azadirachtin 10000 ppm	2ml /lit	51.41	29.95	22.02	1.57	2.23	2.18
			7.14	5.49	4.76	1.51	1.71	1.70
6	Neem Seed extract (NSE)	5 %	52.66	28.71	19.83	1.43	2.22	2.19
			7.21	5.38	4.53	1.47	1.71	1.70
7	Untreated control		51.87	58.65	65.43	1.63	2.27	2.33
			7.15	7.55	7.99	1.53	1.72	1.74
	SEm ±		0.16	0.12	0.14	0.05	0.03	0.02
	CD at 5%		N.S.	0.36	0.40	N.S.	N.S.	N.S.

Bold Figures indicating $\sqrt{n+1}$

DAT: Days after treatment

At Ludhiana, formulations of two biopesticides viz. *L. Lecani*, *M. anisopliae* were supplied by Rahuri centre, and evaluated at two doses along with neem formulations and untreated control for their bioefficacy against oat aphid on oats variety Kent during *rabi* 2016-17. The trial was laid out in randomized block design with three replications. Spray was done on 21.02.2017. Incidence of aphid was recorded at peak activity period by counting the number of aphid population/ tiller from 3 randomly selected plants, before spray, 5 and 7 days after spray (DAS) from three randomly selected spots per replication. Activity of coccinellid predators was also monitored in all the plots after 12 hrs of spray treatment. Green fodder yield was recorded at the time of harvest and converted to hectare basis. The data were pooled, statistically analyzed and presented in Table Ludhiana PPT26

The results revealed that the number of *R. padi* before spray varied non-significantly in all the treatments. Among the biopesticides evaluated, the treatment effect was significantly evident as compared with control after 5 and 7 days after spray. Amongst different treatments T5 recorded lower mean number of *aphids* at 7 days after spray (DAS). The number of predators varied non significantly after 12h of treatment. The green fodder yield was also recorded to be highest in T5.

Table Ludhiana PPT 26: Biological management of oat aphid *R. padi* on oats var. Kent

S. N.	Treatment	Aphid population per tiller			Natural enemy per 5 plants		Green fodder yield (q/ha)
		Before spray	5 DAS	7 DAS	Before spray	12h after spray	
T ₁ .	<i>L Lecani</i> @ 1 X 10 ⁸ CFU/g (5g/lt)	20.63	16.33	10.33	5.3	3.33	496
T ₂ .	<i>L Lecani</i> @ 1 X 10 ⁸ CFU/g (7.5 g/lt)	19.63	13.66	7.66	6.67	4.33	506
T ₃ .	<i>M .anisopliae</i> @ 1 X 10 ⁸ CFU/g (5g/lt)	24.10	17.33	13.0	6.67	4.33	492
T ₄ .	<i>M .anisopliae</i> @ 1 X 10 ⁸ CFU/g (5g/lt)	19.97	14.33	8.66	5.33	3.67	509
T ₅ .	Neemazal @ 2ml/lt	15.30	13.33	6.66	4.67	4.33	512
T ₆ .	NSE @ 5%	23.00	17.66	8.66	5.33	3.0	501
T ₇ .	Untreated control	17.67	17	16.66	6.67	4.0	485
	CD	NS	2.59	3.07	NS	NS	14.58
	CV	18.49	9.22	16.69	12.10	15.30	10.50

At Dharwad, crop was established and treatments were not imposed due to non-occurrence of the aphid *Rhopalosiphum padi* on oat.

Forage Crops Breeder Seed Production

[Indent year Rabi 2017-18]
[Production year Rabi 2016-17]
(Table Reference: Tables BSP 1 & BSP 2)

The indent for Breeder Seed Production was received from DAC, GOI for 25 varieties in four forage crops *viz.*, Oat (12), Berseem (9), Lucerne (3) and Gobhi Sarson (1). The quantity allocated was 491.15q which was 20% higher than previous year indent of 409.13q. The production target was assigned to eleven Breeder Seed producing centres of the different SAUs/ NGO/ ICAR institutes. Among quantity indented for different forage crops, the maximum was for Oat (445 q) followed by Berseem (41.73 q) and Lucerne (4.30 q) and minimum for Gobhi Sarson (0.12 q).

The final Breeder Seed Production Report (BSP-IV) received from different seed producing centres revealed that in Berseem and Gobhi Sarson, the overall breeder seed production was more than the allocated quantity. However, there was marginal shortfall in Oat. In Lucerne, the target was achieved. The overall production was 456.98 q which was 34.17 q (6.95%) less than the indented target.

In Berseem, the production was 46.35 q (4.62 q surplus) against the allocated quantity of 41.73 q. Center wise scenario indicates that PAU, Ludhiana; IGFRI, Jhansi were net surplus producers whereas HAU, Hisar and JNKVV, Jabalpur were net deficit producers in Berseem. **In Oat**, the production was 406.16 q (38.84 q deficit) against the allocation of 445 q.; IGFRI, Jhansi; SKUAST-K, Srinagar were net surplus producers whereas GBPUAT, Pantnagar; HAU, Hisar, PAU, Ludhiana, NDUAT, Faizabad; BAIF, Urulikanchan; were net deficit producers in oat. **In Lucerne**, the target of (4.3 q) was achieved. **In Gobhi Sarson**, the production was 0.17 q against the allocation of 0.12 q (0.05 q surplus) and as indent was for only one variety, HPKV, Palampur was net surplus producer. The overall breeder seed production was 456.98 q against the indent of 491.15 q (Table BSP 1 & 2). There was surplus breeder seed available in many centers (Table BSP 3)

Table BSP 1: Centre wise Breeder Seed Production (q) during Rabi 2016-17

[Indent Rabi 2017-18]
[Production year Rabi 2016-17]

Berseem

S. N.	Producing centre	Variety	Allocation as per DAC	Allocation BSP-I	Production	Surplus/ Deficit
1.	Punjab					
	PAU, Ludhiana	BL-42	8.28	8.28	9.00	(+) 0.72
		BL-180	0.8	0.8	2.0	(+) 1.2
		BL-10	14.25	14.25	15.00	(+) 0.75
		BL-1	4.0	4.0	4.50	(+) 0.50
2.	Uttar Pradesh					
	IGFRI, Jhansi	BB-2 (JHB 146)	0.20	0.20	2.0	(+)1.80
		Wardan	8.05	8.05	9.00	(+) 0.95
3.	Haryana	H. Berseem-1	0.75	0.75	3.0	(+) 2.25
	CCS HAU, Hisar	Mescavi	4.4	4.4	1.0	(-) 3.4*
4.	Madhya Pradesh					
	JNKVV, Jabalpur	JB-5	1.0	1.0	0.85	(-) 0.15
	Grand Total		41.73	41.73	46.35	(+) 4.62

Oat

S. N.	Producing centre	Variety	Allocation as per DAC	Allocation BSP-I	Production	Surplus/ Deficit
1	Punjab					
	PAU, Ludhiana	OL-9	2.25	2.25	3.00	(+) 0.75
		OL-10	6.0	6.0	20.00	(+) 14.00
		Kent	326.6	177.1	102.00	(-) 75.1
2.	Maharashtra					
	BAIF, Urulikanchan	Kent	326.6	30	28.5	(-) 1.5
	MPKV, Rahuri	RO-19	5.0	5.0	5.0	-
3.	Gujarat					
	AAU, Anand	Kent	326.6	60	60.0	-
4.	Uttarakhand					
	GBPUAT, Pantnagar	UPO-212	21.0	21.0	20.0	(-)1.0
5.	Uttar Pradesh					
	IGFRI, Jhansi	JHO-2000-4	32.5	32.5	19.00	(-) 13.5*
		JHO-99-2	2.4	2.4	3.6	(+)1.2
		JHO-99-1	2.5	2.5	3.11	(+)0.61
		JHO-882	15.0	15.0	25.0	(+) 10.0
		JHO-851	10.0	10.0	13.00	(+) 3.0
		Kent	326.6	59.5	80	(+) 20.5**
	NDUA&T, Faizabad	NDO-1	4.0	4.0	0.45	(-)3.55
6.	Haryana					
	CCS HAU, Hisar	OS-6	10.0	10.0	5.0	(-) 5.0
7.	Jammu & Kashmir					
	SKUAST, Srinagar	Shalimar Oat-1 (SKO -20)	10.0	10.0	12.5	(+) 2.5

*At IGFRI, Jhansi, The target could not be fulfilled due to sudden surge (6 times higher than usual) in BS demand of JHO 2000-4 this year. Sufficient NS/BS was not available for sowing due to sudden surge.

At HAU, Hisar, Oats OS 6 seed less produced due to problem in germination.

At HAU, Hisar, Mescavi seed plot got poor seed set.

Lucerne

S. N.	Producing centre	Variety	Allocation as per DAC	Allocation BSP-I	Production	Surplus/ Deficit
1.	Maharashtra					
	MPKV, Rahuri	RL-88	0.30	0.30	0.30	-
2.	Gujarat					
	AAU, Anand	Anand-3	0.60	0.60	0.60	-
		Anand-2	3.40	3.40	3.40	-

Gobhi Sarson

S. N.	Producing centre	Variety	Allocation BSP-I	Allocation as per DAC	Production	Surplus/ Deficit
1	Himachal Pradesh					
	CSK HPKV, Palampur	Him Sarson-1	0.12	0.12	0.17	(+) 0.05

Table BSP 2: Variety wise breeder seed production (q) during Rabi 2016-17

[Indent Rabi 2017-18]

[Production year Rabi 2016-17]

Crop	S N	Variety	Produced by	Year of Notification	Allocation as per DAC	Allocation BSP-1	Production	Surplus (+) / Deficit (-)	
Berseem	1	BL-42	PAU, Ludhiana	2007	8.28	8.28	9.00	(+) 0.72	
	2	BL-180	PAU, Ludhiana	2006	0.8	0.8	2.0	(+) 1.2	
	3	BL-10	PAU, Ludhiana	1985	14.25	14.25	15.00	(+) 0.75	
	4	BL-1	PAU, Ludhiana	1978	4.0	4.0	4.50	(+) 0.50	
	5	BB-2	IGFRI, Jhansi	1997	0.20	0.20	2.0	(+)1.80	
	6	Wardan	IGFRI, Jhansi	1982	8.05	8.05	9.00	(+) 0.95	
	7	H. Berseem-1	CCS HAU, Hisar	2006	0.75	0.75	3.0	(+) 2.25	
	8	Mescavi	CCS HAU, Hisar	1975	4.4	4.4	1.0	(-) 3.4	
	9	JB-5	JNKVV, Jabalpur	2005	1.0	1.0	0.85	(-) 0.15	
		Total			41.73	41.73	46.35	(+) 4.62	
Oat	1	OL-10	PAU, Ludhiana	2014	6.0	6.0	20.00	(+) 14.00	
	2	Kent	PAU, Ludhiana	1975	326.6	177.1	102.00	(-) 75.1	
	2	Kent	BAIF, Urulikanchan	1975		30	28.5	(-) 1.5	
	2	Kent	IGFRI, Jhansi	1975		59.5	80	(+) 20.5	
	2	Kent	AAU, Anand	1975		60	60.0	-	
	2	Kent	MPKV, Rahuri	1975		0	9.0	(+) 9.0	
	3	RO-19	MPKV, Rahuri	2007	5.0	5.0	5.0	-	
	4	UPO-212	GBPUAT, Pantnagar	1990	21.0	21.0	20.0	(-)1.0	
	5	JHO-2000-4	IGFRI, Jhansi	2006	32.5	32.5	19.00	(-) 13.5*	
	6	JHO-99-2	IGFRI, Jhansi	2005	2.4	2.4	3.6	(+)1.2	
	7	JHO-99-1	IGFRI, Jhansi	2007	2.5	2.5	3.11	(+)0.61	
	8	JHO-882	IGFRI, Jhansi	1989	15.0	15.0	25.0	(+) 10.0	
	9	JHO-851	IGFRI, Jhansi	1998	10.0	10.0	13.00	(+) 3.0	
	10	OS-6	CCS HAU, Hisar	1982	10.0	10.0	5.0	(-) 5.0	
	11	Shalimar Oat-1	SKUAST-K, Srinagar	2013	10.0	10.0	12.5	(+) 2.5	
12	NDO-1	NDUA&T, Faizabad	2010	4.0	4.0	0.45	(-)3.55		
		Total			445	445	406.16	(-) 38.84	
Lucerne	1	RL-88	MPKV, Rahuri	1996	0.30	0.30	0.30	-	
	2	Anand-3	AAU, Anand	1995	0.6	0.6	0.6	-	
	3	Anand-2	AAU, Anand	1984	3.4	3.4	3.4	-	
			Total		4.3	4.3	4.3	-	
Gobhi Sarson	1	Him Sarson-1	CSK HPKV, Palampur	2009	0.12	0.12	0.17	(+) 0.05	
			Total		0.12	0.12	0.17	(+) 0.05	
Grand Total						491.15	491.15	456.98	(-) 34.17

Table BSP -3: Surplus breeder seed produced in 2016-17 or not lifted in 2015-16

S. N.	Producing center	Crop	Variety	DAC Indent	Actual production (BSP IV) (q)
1	JNKVV, Jabalpur	Berseem	JB-1	0	2.98
2	JNKVV, Jabalpur	Oat	JO-1	0	0.7
3	JNKVV, Jabalpur	Oat	Kent	0	8.0
4	IGFRI, Jhansi	Berseem	BB-3	0	1.00
5	IGFRI, Jhansi	Oat	Kent	0	16.00 (2015-16 produce)
6	PAU, Ludhiana	Metha	M 150	0	0.60
7	PAU, Ludhiana	Rye Grass	PBRG 1	0	0.30
8	HAU, Hisar	Berseem	HB-2	0	2.5
9	MPKV, Rahuri	Oat	Kent	0	9.0
10	MPKV, Rahuri	Oat	RO-11-1	0	9.0

FORAGE TECHNOLOGY DEMONSTRATIONS

A total of 595 FTD's were allotted to 23 AICRP centres / voluntary for Rabi crops. It comprised of 112 FTDs to berseem, 60 to lucerne, 160 to oat (Single cut), 88 to oat (Multi cut), 25 to cowpea, 25 to laythrus, and to other crops.

Crop-wise FTDs allocated to different centers for conductance during Rabi 2016-17

S.N.	Centre name	Berseem	Lucerne	Oat (SC)	Oat (MC)	Cowpea	Maize	Other crops	Total
1.	AAU, Jorhat			20					20
2.	OUAT, Bhubaneshwar	10		15					25
3.	BCKV, Kalyani	5		15				Lathyrus-15	35
4.	BAU, Ranchi	10		15	15			Lathyrus-10	50
5.	NDUAT, Faizabad			10					10
6.	JNKVV, Jabalpur	10			5				15
7.	AAU, Anand		5	5					10
8.	BAIF Urulikanchan	5		10					15
9.	MPKV, Rahuri	7			3				10
10.	SKRAU, Bikaner		10	15					25
11.	PAU, Ludhiana	10			20			Rye grass-10	40
12.	CCSHAU, Hisar	20		15	5				40
13.	GBPUAT, Pantnagar	20		10			20		50
14.	TANU, Coimbatore		5			5		Guinea -10	20
15.	PJTSAU, Hyderabad		10	10				Desmenthus-15	35
16.	UAS ZARS, Mandya		30			10	30		70
17.	HPKV, Palampur				10			Tall fescue-5	15
18.	KAU, Vellayani					5		BNH-20	25
19.	IGKV, Raipur	10			10				20
20.	CAU, Imphal				20				20
21.	SKUAST-K, Srinagar			20					20
22.	PJNA&RI, Karaikal					5			5
23.	Angarau, Guntur	5					5	BNH-5, Desmenthus-5	20
Total		112	60	160	88	25	55	95	595

Monitoring Details of Rabi 2016-17 of AICRP (FC&U) Trials

S.N.	Name of Centre	Monitoring Team	Date of Monitoring
1	AAU, Jorhat	Drs. Naveen Kumar, V.K. Sood	1 st Feb., 2017
2	CAU, Imphal	Drs. Naveen Kumar, V.K. Sood	3 rd Feb, 2017
3	OUAT, Bhubaneswar	Drs. R. Joseph Koireng, Seuji B. Neog	13 th Feb., 2017
4	BCKV, Kalyani	Drs. R. Joseph Koireng, Seuji B. Neog	16 th Feb., 2017
5	BAU, Ranchi	Drs. R. Joseph Koireng, Seuji B. Neog	14 th Feb., 2017
6	NDUAT, Faizabad	Drs. Yogesh Jindal, M. S. Pal	23 rd Jan., 2017
7	JNKVV, Jabalpur	Drs. P. S. Takawale, Santosh Patil	2 nd Feb., 2017
8	AAU, Anand	Drs. S. K. Jha, A. K. Mehta	18-19 Jan., 2017
9	BAIF, Urulikanchan	Drs. Mareen Abraham, Usha C. Thomas	13-15 Feb., 2017
10	MPKV, Rahuri	Drs. Mareen Abraham, Usha C. Thomas	13-15 Feb., 2017
11	PAU, Ludhiana	Drs. P. Mahadevu, B. G. Shekara	21 Feb, 2017
12	CCSHAU, Hisar	Drs. P. Mahadevu, U. S. Tiwana	23 Feb, 2017
13	GBPUA&T, Pantnagar	Dr. Ramesh Singh Yadav	28 th Jan., 2017
14	TNAU, Coimbatore	Drs. A. B. Tambe, T. Shashikala	6-7 Feb, 2017
15	PJTSAU, Hyderabad	Drs. A. B. Tambe, Pravasini Behera, T. Shashikala	23-24 Jan., 2017
16	UAS B (ZRS, Mandya)	Drs. A. B. Tambe, T. Shashikala	8-9 Feb., 2017
17	CSK HPKV, Palampur	Drs. A. K. Roy & R. K. Agrawal	17 th April., 2017
18	KAU, Vellayani	Drs. A. H. Sonone, S. D. Sivakumar	31 st Jan., 2017
19	IGKV, Raipur	Drs. P. S. Takawale, Santosh Patil	1 st Feb., 2017
20	SKUAS&T-K, Srinagar	Drs. U.S. Tiwana, V.K. Sood	22-23 June, 2017

Forage In-house Breeding Activities, Rabi 2016-17

AICRP on Forage Crops & Utilization, AAU, Anand, Gujarat

Lucerne

Germplasm maintenance: 246 Lines

New Germplasm collection: 41

Crop	Number	Source
Lucerne	35	32 from Chhittorgarh, Rajasthan; 3 from North Gujarat
Sorghum	3	North Gujarat
Forage Bajra	3	North Gujarat

Segregating materials

Crop	Cross advanced	IPS	Bulk
Lucerne	5 F ₁	--	--
	12 F ₂	31	--
	28 F ₄	62	--
	20 F ₅	45	1
	21 F ₆	17	15

Polycross programme: Thirty one plants were selected based on GFY, plant height, tillers and leafiness out of seventy one selected plants evaluated

Maize

Maize x Teosinte: Seeds from African Tall x TL-1 were obtained.

Development of Maize Composite: Development of forage composite maize variety is in progress. During Rabi-2016 seed multiplication was done of selected plants.

Composite Programme

A	B	C	D
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

AICRP on Forage Crops & Utilization, IGKV, Raipur, Chhattisgarh

Maintenance of Oat germplasm lines: 42 germplasm lines were sown on 24-11-2016 for maintenance

Generation of F₂ from F₁ seed of elite Lathyrus crosses: F₁ seeds of six parents used (Mahateora, Pusa-24, Ratan, BK-5, Nirmal, BK-20-5) were sown on 30-11-2016 for advancing generation

Lathyrus germplasm evaluation and identification for forage type: Total 1940 number of germplasm available in IGKV, Raipur which was taken as source for the evaluation of forage type. Three groups viz., low ODAP < 0.19 %, days to 50 % flowering < 70-76 days (late type) and larger leaf size (width and breadth) were separated as core group for the evaluation. The first group containing low ODAP accessions includes 93 entries in which RLK 700, RLK 1392, 1446,382 having the forage type characteristics. In the second group late flowering entries namely RLK 88, 1363, 1961, 1923, 1962, 345 showing better forage type characteristics, among 41 core germplasm for late flowering. Among the third group of leaf size core accessions from 28 entries better performing entries 552, 652, 1638 and 75 were identified. Low ODAP Group – 93 entries; Late Flowering Group – 41 entries; Broad Leaf Group – 28 entries.

AICRP on Forage Crops & Utilization, JNKVV, Jabalpur, M. P.

Germplasm holding: Oat (121 germplasm), Berseem (113germplasm) are being maintained.

Berseem

- Poly cross nursery programme has been started taking five diverse parents viz., Wardan, BL42, Mescavi, UPB110, and JB1. Tripping has been done 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 M₂ generation.
- In Wardan, seven 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 third filial generation.

- 39 advanced lines were evaluated for different fodder traits.
- No. of crosses made - 11
- Segregating material advanced/ handled - 29 (F₂ onwards)
- Advance breeding lines - 57

AICRP on Forage Crops & Utilization, AAU, Jorhat, Assam

Maize

- **Development of composite forage maize:** 27 maize germplasm lines were selfed and progenies will be evaluated with check varieties in next season.
- **Evaluation of maize germplasm:** 27 maize germplasm were evaluated with African Tall and J-1006. Promising entries were identified.

Ricebean

- **Ricebean germplasm evaluation for rabi season:** Suitable entries selected for *rabi* season were grown and evaluated for their fodder yield and quality.

Lathyrus

- **Evaluation of germplasm:** Ten selected entries were evaluated for yield and quality.
- **Hybridization programme:** A diallel cross was made among four selected germplasm lines and test entries Nirmal, Prateek, Ratan and Madhuri without reciprocals to develop forage lathyrus lines with high biomass yield, quality, disease resistance and low BOAA content.
- **Mutation breeding programme:** M₂ progenies were evaluated.

AICRP on Forage Crops & Utilization, BAU, Ranchi, Jharkhand

Lathyrus

- Local germplasm were collected from different villages of Jharkhand.
- 5 germplasm were maintained
- Evaluation of Lathyrus Germplasm.

Oat

- 15 Oat Germplasm were maintained
- Eight different fresh crosses were made in Oat.
- Evaluation of oat F₄ generation

Station Trial

- Seven entries of oat were evaluated against two checks.
- Seven entries of lathyrus were evaluated against two checks.

AICRP on Forage Crops & Utilization, TNAU, Coimbatore, Tamil Nadu

Lucerne

- **Poly cross breeding programme:** Poly-cross breeding programme in Lucerne has been initiated during *rabi* 2011-12. This programme is being continued as per technical programme finalized during the NGM *rabi* 2011-12. From the selected progenies, most promising individual plants (41) were identified, tagged and numbered and allowed for seed production during summer 2014. The OP seed of selected promising plants (41) were harvested individually and were sown on 09.02.2015 in a single row of 3 m length spaced at 30 cm for progeny test. The most promising 20 lines selected based on GFY were allowed for seed production during summer 2016 and the seeds collected from them were sown on 25.02.2017 for further studies.
- **Future plan of work:** The mother plants of those selected progenies will be vegetatively propagated meanwhile in pro-trays. The selected clones will be planted in isolation and allowed to random mate for development of synthetic population during summer 2017. The new synthetic population so developed at each location will be evaluated against National and zonal checks in Perennial Varietal Trial under the aegis of All India Coordinated Research Project on Forage Crops and Utilization during *rabi* 2017-18.
- **Seed multiplication in Lucerne:** Seed multiplication of five promising entries identified from previous Poly cross breeding programme have been taken up during summer 2017 further promotion.

AICRP on Forage Crops & Utilization, NDU&T, Faizabad U. P.

Germplasm collection

Crop	New collections	Source	Total collections
Oat	10	Barabanki , Ghazipur, Raebareli & Sultanpur Distt.	172
Berseem	05	Barabanki , Ghazipur, Raebareli & Sultanpur Distt	32

Hybridization in oat: Twelve new crosses were made during Rabi 2016-17

S. N.	Cross combinations	S.N.	Cross combinations
1	NDO1101 x <i>Avena sterilis</i>	7	NDO 711x <i>Avena sterilis</i>
2	NDO1101 x LC-6	8	NDO 711 x LC-6
3	NDO1101 x LC-7	9	NDO 711 x LC-7
4	NDO1102 x <i>Avena sterilis</i>	10	NDO1710 x <i>Avena sterilis</i>
5	NDO1102 x LC-6	11	NDO 1710 x LC-6
6	NDO1102 x LC-7	12	NDO 1710x LC-7

Segregating generations

F₁-12; F₂- 16; F₃- 16; F₄-11; F₅-10; F₆- 05; Advance lines - 12

Station Trial: Fourteen genotypes were tested against two checks viz., NDO-1 and NDO-2 in VT Station trial on Forage oat.

AICRP on Forage Crops & Utilization, PJTSAU, Hyderabad, Telengana

Varieties released at state and central level

S. N.	Crop	State/Central
1	Fodder cowpea	Vijaya (State notified)
2	Fodder bajra (multicut)	Moti bajra(State notified)
3	Fodder bajra (single cut)	APFB 09-1(Central Notified)

Germplasm Holding

S. N.	Crop	Collections	Source
1.	Fodder Cowpea (<i>Vigna unguiculata</i>)	52	1. NBPGR, Regional Station, Hyderabad 2. RARS, ANGRAU, Tirupathi 3. Local collections
2.	Fodder Maize (<i>Zea mays</i>)	45	1. Winter Nursery, DMR, Hyderabad 2. NBPGR, New Delhi
3.	Fodder Bajra <i>Pennisetum glaucum</i> <i>Pennisetum orientale</i>	56 48 8	ICRISAT, Hyderabad.
4.	Napier (<i>Pennisetum purpureum</i>)	15	TNAU, Coimbatore.
5	Lucerne (<i>Medicago sativa</i>)	10	Gujarat and Maharashtra
6	Hedge Lucerne	6	Local Collections
7	Perennial Sorghum	4	Local collection
8	Para grass	3	<i>Bracharia mutica</i> , <i>B. brizantha</i> , <i>B. ruzvicensis</i>

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 2016-17. 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. The culture is promoted for testing in AVT 1 & 2 trial during Kharif 2017.
- Seed multiplication of Promising Maize population **TSFM -15-5** developed from G1 group (African tall) of polycross population was taken up during Rabi 2016-17. 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 promoted for testing in AVT 1 & 2 trial during Kharif 2017.

Forage cowpea

- Seed multiplication of promising entry TSFC 11-6 (CO4 X UPC 625) was taken up during Rabi 2016-17. The entry was found to be promising with 7.6% increasing green fodder yield over the best check variety BL-1. Promoted to test in AVTC-1, Kharif 2017.
- Seed of the promising entry TSFC 12-15 that was promoted for testing in AVTC-2, Kharif 2017 was multiplied during Rabi 2016-17.

Bajra Napier Hybrids

Following six fresh crosses were established in the nursery during Rabi 2016-17

SN	Bajra Napier Hybrids	SN	Bajra Napier Hybrids
1	RBC-2x FD 433	2	Giant Bajra x FD 433
3	Baif Bajra x FD 441	4	Giant Bajra x FD 441
5	Rijko Bajra x FD 438	6	Giant Bajra x FD 438

Fodder bajra

- Seed of the promising entries viz., TSFB 10-5, TSFB 13-12 and TSFB14-10 which were promoted for testing in AVTPM-2, Kharif 2017 were multiplied during Rabi 2016-17.

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Germplasm collected

Crop	No. of collections	Location
Cowpea	74	Channarayapattana Local, Goa Local, Patrehalli AICRP Arid Legumes, GKVK, Bengaluru.
Maize	10	AICRP(Maize), ZARS, V.C.Farm Mandya
Horse gram	135	AICRP on Arid Legumes, GKVK, Bengaluru
Field Bean (Fodder types)	64	AICRP on Pigeonpea, GKVK, Bengaluru and Farmers field of Karnataka, Tamilnadu and Andhra Pradesh
Perennial grasses	13	IGFRI Jhansi, western Ghats exploration from KAU Vellayani

COWPEA

- **Advancing of F₈ generation** - Advanced breeding lines of forage cowpea for seed multiplication of stabilised and promising genotypes
- **No of stabilised lines sown: 16** **Date of sowing: 22-11-2016**

Stabilized lines, Multiplication of Elite lines & Quantity seed produced: More than 50 kg seeds of 20 lines were produced. MFC-09-15, MFC-09-21 and MFC-09-23 stabilised lines were selected in F₇ generation for station varietal trial. Two of them were also nominated for IVT during kharif 2016. These lines are selected for high green forage yield and seed yield.

Advanced F₄ generation to F₅ generation. The following cross combinations found promising and selected for high foliage & biomass in F₅ generation.

S. No.	Selected Genotypes	Character
1	MFC-09-6 X EC-170578-1-1 (Sl. 17)	Late flowering and more branches
2	MFC-09-6 X EC-170578-1-1 (Sl. 20)	Tall type, compact branches and high leaf stem ratio
3	MFC-09-13 IC-1071(Sl. 41)	Purple pod , More branches stay green and more forage
4	MFC-09-9 X IC-1071(Sl. 61)	High biomass Tolerant rust
5	MFC-09-10 X IC-1071 (Sl. 28)	More branches, High biomass
6	MFC-09-10 X IC-1071 (Sl. 29)	More branches, High biomass
7	MFC-09-10 X IC-1071 (Sl. 30)	More branches, High biomass
8	MFC-09-9 X IC-1071 (Sl. 38)	More branches, High biomass
9	MFC-09-13 X IC-1071 (Sl. 40)	More branches, High biomass
10	MFC-09-13 X IC-1071 (Sl. 41)	More branches, High biomass
11	MFC-09-13 X IC-1071 (Sl. 42)	More branches, High biomass
12	MFC-09-9 X IC-1071 (Sl 51)	More branches, High biomass
13	MFC-09-10 X NBC-2(Sl 65)	More branches, High biomass

Identification of promising and stabilized lines from the advanced generation (F₆)

1. MFC-09-9 X IC-1071 – F₆ generation (MFC-16-1)
2. MFC-09-9 X NBC-2 – F₆ generation (MFC-16-3)
3. MFC-09-9 X EC-170578-1-1 – F₆ generation (MFC-16-2)
4. MFC-09-9 X NBC-2 (MFC-16-4)

Identification of new parental lines for hybridization

1. EC-170578-1-1 (2) - Very good biomass and stay green
2. Patrehalli local - Bold Seeded, high biomass & broad leaves.
3. KBC-5 - Bushy growth, more leaves ((High Leaf: Stem ratio)
4. Goa local - High biomass & bold seeded.
5. Channarayapattana Local - High leaf stem ratio, small seeded

MAIZE

Generation of stabilized population (by sibbing)

- 1-42-4 (Light orange)
- 1-27-2 (Orange)

- 1-41-1 (Orange)
- African tall X (SKV-50x AT) (Orange)
- J-1006x AT white
- (African tall x Sujay 267-1)-42-4 is tolerant to SDM & TLB

DOS: 08.08.2016 **Genotypes:** 76 **Generation:** F8 **Selected populations:** 64

HORSEGRAM

Horse gram germplasm screening for identification of good fodder types with high biomass: 101 genotypes were evaluated in augmented design in 2 rows. DOS: 29-12-2016

Promising fodder type identified in Horsegram:

1. IC-71743- More biomass & viny
2. IC-202781- More biomass & late
3. IC-264704- High biomass & YMV- tolerant
4. IC-123033- Bushy & more biomass
5. TCR-1549- High biomass
6. TCR-1700- High biomass
7. TCR-1675- Viny & determinate
8. IC-71814- Very good biomass & disease free
9. TCR-1789- Very good biomass & disease free

BREEDER SEED PRODUCTION

Crop	Variety	Quantity produced (q)
Fodder Cowpea	MFC-08-14	0.30
Fodder Cowpea	MFC-09-1	0.50

Screening of Parental lines & Promising Genotypes in Cowpea for important diseases

Dos: 22-11-2016

S. N.	Genotypes	Powdery mildew (%)	Rust (%)	Macrophomina blight (%)
1.	UPC5286	-	10	2.0
2.	EC-170578-1-1	-	0.0	0.0
3.	NBC-2	-	40	2.0
4.	IC-1071	-	10	0.0
5.	EC-458489	-	15	1.5
6.	C-157	-	0.0	2.0
7.	Local patrehalli	-	0.0	0.0
8.	C-157	-	0.0	1.0
9.	Goa Local	1.0	15	2.0
10.	IC97767	4.5	25	2.5
11.	KBC-5	0.0	30	4.0
12.	KBC-6	-	20	0.0
13.	IC402154	0.0	0.0	0.0
14.	IC1071	6.0	10	0.0
15.	KBC-2	0.0	40	3.0
16.	V578	3.0	25	3.5
17.	27 (PMV & BLB)	2.5	0.0	3.0
18.	21-2(CPV & BLB)	2.5	35.0	0.0
19.	120P-1-1 (PMV)	3.0	50	1.0
20.	EC-458505XNBC-2-16-1	3.5	25	0.0
21.	MFC-09-9XEC170578-1-1	2.0	10	1.0
22.	MFC-09-9XNBC-2 30-1	2.0	10	0.0
23.	EC-458505XNBC-2	0.0	45	0.0
24.	KBC-2	0.0	20	2.0
25.	EC4216	0.0	40	5.0

26.	Cowpea local	-	50	-
27.	PFC-40	-	-	2.0
28.	C-215	-	-	-
29.	UPC 1601	-	30	-
30.	Bundel Lobia-1	-	-	4.0
31.	UPC- 5286(NC)	-	30	-
32.	MFC-08-14(c)	-	-	1.0
33.	PFC-39	-	-	1.5
34.	TSFC-11-6	-	-	-
35.	MFC-09-15	-	-	-
36.	MFC-09-23	-	-	-
37.	MFC-09-3	-	-	-
38.	TSFC-12-15	-	-	1.0
39.	MFC-09-13	-	-	1.5
40.	UPC-1501	-	-	1.0
41.	MFC-09-4	-	-	2.0
42.	Vellayani-1	-	-	1.5

Cowpea

- All the available and new collections (Total 74 Nos.) were evaluated in preliminary during Rabi 2016-17 (Date of sowing: 22-11-2016). Out of them, the following were selected based on desirable traits to be used as parents for hybridization programme.
- Screened all the germplasm for resistance against rust, PM and CYMV under natural condition during summer and late kharif conditions.

Oats

- Based the consistency of results over 3 years the following entries were selected for multilocation evaluation during Rabi 2017. RO-11-1, JHO 2012-2, JHO-2000-4, OS-405 along with other promising & check entries.

RO-11-1

- Oats (Single cut) variety from Rahuri, Maharashtra
- Identified for release in North East, North West central and south zone during Rabi season under single cut situation
- This variety superior for GFY, DMY, CPY, Per day GF & DM productivity with good leaf stem ratio
- Moderately resistant to leaf blight, resistant to root rot and less susceptible to aphid
- It responded well with different 'N' levels in the agronomy trials.

➤ Significant characters of Oats Variety OS-6 & RO 11-1

Characters	OS-6	RO 11-1
Leaf sheath color	Light green	Dark green
Leaf length	48-50 cm	39-42 cm
Leaf width	1.50-1.60 cm	2.10 -2.40 cm
Growth habit	Erect	Erect
Early vigor	More	More
Plant height (cm)	105.1 cm	95-98 cm
Tillers per clump	3-5	4-6
Leaf: Stem ratio	0.43	0.55
Days to 50 % Flowering	70-72	80-85
Ligules	Non Pubescent	Non pubescent
Glumes	White	Partial glumy
Lemma	Comparatively long, no hairs on lemma, yellowish white	yellow
Palea	Wide, yellowish white	yellowish white
Seeds	Seeds relatively smaller than kent	Bigger seeds

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Germplasm collected/procured during the period

Crop	Source of collection	Number
Oat	JNKVV Jabalpur; PAU, Ludhiana	202

Germplasm Holding

Crop	No. of collections
Tall Fescue Grass (<i>Festuca arundinacea</i>)	58
Rye Grass (<i>Lolium perenne</i>)	8
Red Clover (<i>Trifolium pratense</i>)	9
White Clover (<i>Trifolium repens</i>)	58
Oat (<i>Avena</i> spp.)	337
Total	470

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. Genotypes ADG-96, JPO-35, OL-9, EC-528896 and EC-528895 were found resistant to powdery mildew as well as superior for forage yield and related traits. Crosses have been attempted to study the inheritance of powdery mildew resistance.
- Forty five Triple Test cross progenies were evaluated for various agromorphological, fodder and seed yield related traits so as to identify superior cross combinations for further advancement. Ten 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 three promising entries have been multiplied for inclusion in Coordinated trials.
- 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.

Tall Fescue Grass

- Mean performance of 32 elite genotypes against checks revealed that genotypes Hima-3 and EC-178181 were superior for most of the traits. 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 D² statistic, RAPD and SSR were multiplied to be used as parents in polycross breeding programme for development of synthetics in Tall Fescue grass.

Lolium x Festuca hybridisation

- Four perennial rye grass (*Lolium perenne*) parents were crossed with three Tall fescue grass (*Festuca arundinacea*) parents to develop F₁ hybrids. Hybrids will be backcrossed to both the parents so as to introgress drought tolerance from *Festuca* to *Lolium* and quality traits from *Lolium* to *Festuca*.

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 on Forage Crops & Utilization, PAU, Ludhiana, Punjab

Varieties released at Central or State level (in last 5 years): (06)

Crop	Variety	Year of release	State/Central release
Oats	OL 10	2014	State
	OL 1802	2016	Central Zone
	OL 1804	2016	North East Zone
Sorghum	PSC 4	2015	State
Bajra Napier Hybrid	PBN 346	2016	State
	PBN 342	2017	Punjab, Haryana, Rajasthan, Odisha, Assam, Tamilnadu, Karnataka

OATS

Conduct of station and Multi location Trials: A total of seven evaluation trials (5 station and 2 multi location) were conducted. Promising entries identified on yield basis are given below

Description of the Trial	Promising entries
Multilocation Fodder Trial in oats-multicut	OL 1876, OL 1869, OL 1873, OL 1842, OL 1866
Multilocation Fodder Trial in oats—Single cut	OL 1766-1, OL 1769-1 OL 1802, OL 1861, OL 1862, OL 1869-1
Station trial- Dual purpose	OL 1804-1, OL 1871, OL 1802, OL 1760-1
Large Scale fodder trial Oats-multicut	OL 1874, OL 1882, OL 1897
Large Scale fodder trial Oats-Single cut	OL 1893, OL 1898, OL 1896
Small Scale fodder trial Oats-Single cut	OL 1910, OL 1907, OL 1908, OL 1906
Germplasm evaluation Trial-dual purpose	Data is being analysed

Germplasm Collection, Maintenance and Evaluation

- A total of 520 germplasm lines were maintained following standard breeding procedures.

Hybridization

- A total of Two hundred crosses have been attempted involving promising genotypes and exotic germplasm accessions.
- Attempts were made to develop inter-generic hybrids between oat and maize (8000 florets were hand emasculated and hand pollinated using maize pollen) along with the further standardization of the embryo culture protocol to develop plants through embryo rescue/ovary culture under the project entitled “Introgression in oat by developing oat-maize addition (OMA) lines” which was sanctioned by UGC, New Delhi during 2013.

Breeding material handled Total 1320

Generation	No. of progenies handled	Generation	No. of progenies handled
F ₁	120	F ₂	110
F ₃	90	F ₄	470
F ₅	500	F ₆	30

Berseem

- A total of two evaluation trials (1 station and 1 multilocation) were conducted.

S. N.	Description of the Trial	Promising entries
1.	Berseem multilocation trial	PC 75, PC 82, BL 205
2.	Local Fodder Trial-Berseem	PC 75, PC 82, BL 205

- A total of 75 polycross progenies were maintained and evaluated against the best check.
- M₃ population of gamma rays irradiated BL 42 was grown and single plant selections were made.
- Forty poly cross progenies in berseem were handled during the season as per the standard breeding procedure

Ryegrass

- One local trial comprising nine entries was conducted, out of these, PBRG 2 appeared to be promising for lateness, green fodder yield and its quality.
- M2 populations of gamma rays irradiated PBRG1, Makhan grass and two local varieties were grown and single plant selection were made

PGR status (evaluated/maintained) of different forage crops at PAU

- Germplasm maintained/ handled (680)

Crops	Germplasm	Crops	Germplasm
Oats	520	Berseem	100
Lucerne	08	Ryegrass	52 mutant progenies

Entries contributed in AICRP (FCU) breeding Trials during Rabi 2016-17

S. N.	Crop	Name of entry	proposed in Trial/Trial No.
1.	Oats	OL 1861	IVTO SC/4
2.		OL 1862	IVTO SC/4
3.		OL 1869-1	IVTO SC/4
4.		OL 1844	AVTO-1-SC/5
5.		OL 1769-1	AVTO-2-SC/6
6.		OL 1802	AVTO-2-SC/6
7.		OL 1766-1	AVTO-2-SC/6
8.		OL 1869	IVTO MC/8
9.		OL 1873	IVTO MC/8
10.		OL 1876	IVTO MC/8
11.		OL 1842	AVTO-1-MC/9
12.		OL 1866	AVTO-1-MC/9
13.		OL 1769	IVTO-Dual/10
14.		OL 1804-1	IVTO-Dual/10
15.		OL 1871	IVTO-Dual/10
16.		OL 1802	AVTO-1-Dual/11
17.		OL 1760-1	AVTO-1-Dual/11
18.	Berseem	PC 82	AVT-1 Berseem/2
19.		BL 205	IVT Berseem/1
20.	Rye grass	PBRG 2	IVT-Lolium

Seed Production

Crop	Variety	Nucleus seed (q)	Breeder seed (q)	Foundation seed (q)
Oats	Kent	0.50	102.0	
	OL 9	0.50	-	
	OL 10	0.80	20.0	
	OL 1760	0.50	-	
Berseem	BL 10	0.50	15.0	
	BL 42	0.50	9.00	3.0q
	BL 1	0.10	4.50	
	BL 22	0.10	-	
	BL 180	0.40	2.0	
Ryegrass	PBRG1	0.50	0.30	
Metha	ML 150		0.60	

Besides the recommended varieties, seed of advanced lines and selected elite material was also produced in oats, berseem and lucerne.

AICRP on Forage Crops & Utilization, BCKV, Kalyani, West Bengal

Lathyrus germplasm: Three (3) local germplasm of lathyrus were collected from Taaldangra block area of Bankura district under red and lateritic zone of West Bengal and maintained during *rabi* season of 2016-17. Five (5) germplasm lines of lathyrus were evaluated against two checks *viz.*, Nirmal and Ratan as Large Scale Trial (LST) on production of green forage cum grain production as dual purpose.

Germplasm maintained

Crop	Total number of lines
Rice bean	250
Coix	3
Lathyrus	5

Breeder seed production:

- Rice bean (Bidhan Rice bean 1) - 32 kg
- Rice bean (Bidhan Rice bean 2) - 113 kg
- Coix (Bidhan Coix 1) - 25 kg

Nucleus Seed production programme:

- Ricebean (Bidhan Ricebean-1) - 4.6 kg
- Ricebean (Bidhan Ricebean-2) - 3.2
- Job's Tear/ Coix - (Bidhan Coix-1) - 1.1

TFL seed production

- Oat (cv. Kent) – 51 kg
- Lathyrus (cv. Nirmal) – 55 kg
- Lathyrus (cv. Ratan) – 45 kg
- Berseem (cv. Mescavi) – Very good vegetative growth as green forage

Management of BN hybrid during *rabi*, 2016-17

- BN hybrid (CO-3) : 3500 cuttings (Approx.) [Nos.]
- BN hybrid (CO-4) : 4500 cuttings (Approx.) [Nos.]

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Lucerne

- **Polycross Programme:** New cycle of polycross was established in *Rabi* 2015-16 involving eight genotypes namely BAL 08-1, RLG 08-1, ALS-11, BAL 08-6, RLG 08-10, ALS-2, BAIF lucerne-1 and Alamdar-51. Equal number of seeds of each genotype was mixed together and seed sowing was done at 10 cm distance in lines spaced at 25 cm from each other. Eight cut were taken for fodder and during the period the poor performing individual plants were uprooted. All the remaining individual plants were left for crossing.
- **Evaluation of Germplasm:** The studies were initiated in *Rabi* 2014-15 and forty five accessions of Lucerne collected from Lucerne dominated areas of Maharashtra & Gujarat states are being evaluated for growth parameters, forage yield, quality and perenniality. The data for twenty one cut was generated for yield, quality and growth characters.

Maize

- **Germplasm evaluation & maintenance:** The total germplasm holding of maize at the center is 197 which was collected since 2001. In order to maintain the germplasm, it needs to be grown in field for once in 2-3 years. During this season, 176 accessions were grown in paired row at 30 cm distance. Off type plants from each accession are rouged out before flowering and both plant to plant as well as bulk sib pollination was performed. Pollinated cobs are harvested individually.

AICRP on Forage Crops & Utilization, CCS HAU, Hisar, Haryana

Varieties released and notified

- **Berseem Variety HB 2** has been released and notified by CVRC for Haryana state vide SO 1146 (E) dated 24.4.2014. It is a Long duration variety with light green foliage, big head size, higher leaf: stem ratio, better regeneration, resistant to stem rot disease (<10% disease incidence) a major problem in berseem growing areas of Haryana. GFY – 750-800q/ha.
- **Oat variety OS 377** has been released and notified by CVRC for Central Zone (Uttar Pradesh, Maharashtra, Gujarat, Chhattisgarh, 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, 122q/ha of dry matter with better nutritional qualities and 25q/ha of seed. It gave about 12.0% more green fodder yield than the national checks Kent and OS 6. It is Moderately Resistant to Leaf Blight disease and has bold seeds.

Varieties Identified

- **CENTRAL OAT OS 403:** Fodder Oats variety “CENTRAL OAT OS 403” has been identified for release for timely sown, irrigated and single cut system in the North West Zone (Haryana, Punjab, Uttrakhand and Rajasthan). Average GFY 534 q/ha (10.0-12.0% more than national checks Kent and OS 6). It gives dry matter of 108 q/ha with better nutritional qualities and is moderately resistant to Leaf Blight disease. It is also bold seeded and is capable of giving 18-20q/ha of seed. The variety was earlier identified for 11 states of India viz. North East (Assam, Manipur, Odhisha, West Bengal, Eastern UP, Bihar, Jharkhand) and South zone (Telengana, Andhra Pradesh, Karnataka and Tamil Nadu). Thus, Central Oat OS 403 is identified for release in 3 different agro-climatic zones of India covering 15 states **CENTRAL OAT OS 405:** Single cut forage oats Variety “CENTRAL OATS OS 405” has been identified for release for timely sown, irrigated and single cut system. for Central Zone of India comprising of States of Uttar Pradesh, Maharashtra, Gujarat, Chhattisgarh, Madhya Pradesh and Central U.P. Average GFY 513.0 q/ha (10 -11.0% more than the checks) DMY (114.73 q/ha) out yielded the best national checks Kent (103.2q/ha) by 11.1% and OS 6 (103.0 q/ha) by 11.3%. It also has better nutritional qualities. The variety is resistant to moderately resistant *Helminthosporium* leaf blight. Bold seeded with seed yield of 16.7q/ha.

Externally funded Projects Sanctioned for two years i.e. 2015-2017

Project	Scientists	Funding agency
Farmers’ trainings on scientific cultivation of forage crops to ensure quality seed production	PI: Dr. S.K. Pahuja Co-PI: Dr Y. Jindal Dr. R.S. Sheoran	RKVY

New Project Applied

Title of the project	Investigators	Budget	Funding Agency	Status
Development of oat (<i>Avena sp.</i>) genotypes with higher yield and nutritive value	Yogesh Jindal & Jayanti Tokas	10.00 Lakhs	Gap-Filling Ad-Hoc Research Scheme under DOR, CCS HAU, Hisar	Presentation done. Result awaited.

Research Activity

- A total of **20 experiments** consisting of **36 trials** on **9 crops** were conducted during the year 2016-17
- Conducted **12 experiments** during *Kharif* 2016 consisting of **16 trials on 7 crops** viz. Cowpea, Pearl millet, Teosinte, Maize, Bajra Napier Hybrid, *Cenchrus ciliaris* and *Pennisetum*.
- Conducted **8 experiments** during *Rabi* 2016-17 consisting of **20 trials on 2 crops** Berseem and Oats.

BERSEEM

Experiment # 1: Collection, maintenance and evaluation of germplasm (State plan): The berseem germplasm contains 225 lines of indigenous sources and 27 of exotic origin. This year half of the germplasm was grown for maintenance purpose.

Experiment # 2: Evaluation of varietal trials for fodder yield and its components (State plan): Three station trials viz., LST, SST and PRT on berseem were conducted.

- **Large Scale Trial (LST):** 8 genotypes were evaluated for fodder yield against four checks viz., Wardan, Mescavi, HB 1 and HB 2.

- **Small Scale Trial (SST):** 8 genotypes were evaluated for fodder yield against four checks viz., Wardan, Mescavi, HB 1 and HB 2.
- **Progeny Row Trial (PRT):** 16 genotypes were tested against four checks viz., Wardan, Mescavi, HB 1 and HB 2.

Experiment # 3: Mutation breeding in berseem - creation of genetic variability for morphological characters in berseem using chemical mutagen i.e. EMS (State plan).

- **M1 generation :** In this experiment, 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 M₁ generation.
- **Selection of superior plant progenies in different generations:** On the basis of their evaluation against checks (on three cut basis) 15 superior progenies were selected from M₂ generation of different treatments which will be grown in M₃ for evaluated for fodder yield in next year.

Experiment # 4: Evaluation of promising Berseem genotypes for fodder yield (AICRP-FCU).

- Initial Varietal Trial (IVTB)
- Advance Varietal Trial -1 (AVTB-1)
- Advance Varietal Trial -2 (AVTB-2)
- Advance Varietal Trial -2-Seed (AVTB-2-seed)

OATS

Experiment # 5: Collection, maintenance and evaluation of Oats germplasm (State plan):

- The oats germplasm contains 580 lines were grown for maintenance and evaluation of yield and some ancillary characters.

Experiment # 6: Development of breeding material through hybridization in oat (State plan):

- Fresh crosses were attempted between desirable and diverse parents. Breeding material in different filial generations were advanced and single plants selected.

Experiment # 7: Evaluation of varietal trials for fodder yield and its components (State plan).

- Following seven trials were conducted during *Rabi* 2016-17
- | | |
|--|--|
| 1. LST (Single Cut) : 9+3 checks; | 2. LST (Multi Cut): 12+4 checks; |
| 3. LST (Dual) : 8+4 checks; | 4. SST (Single Cut): 9+3 checks; |
| 5. SST (Multi Cut) : 12+4 checks; | 6. PRT (Single Cut): 18+3 checks; |
| 7. PRT (Multi Cut) : 8+3 checks; | |

Experiment # 8: Evaluation of promising Oats genotypes for fodder yield (AICRP-FCU)

- A total of six trials under All India Co-ordinated breeding trials on Oats were conducted during *Rabi* 2016-17

Genotypes contributed/promoted in AICRP (FC) trials during *rabi* 2016-17

Crop/Variety	Name of Trial	Crop/Variety	Name of Trial
Berseem		Oat (single cut)	
HFB 12-4	AVT-1	HFO 525	IVT-SC
HFB 12-9	AVT-1	HFO 607	IVT-SC
HFB 13-1	IVT	HFO 529	AVT-1-SC
HFB 13-10	IVT	HFO 427	AVT-1-SC
Oat Multicut		HFO 424	AVT-2-SC
HFO 609	IVT-MC	HFO 424	AVT-2-SC-SEED
HFO 611	IVT-MC	HFO 432	AVT-2-SC
HFO 514	AVT-1-MC	HFO 432	AVT-2-SC-SEED
HFO 417	AVT-1-MC		
Oat Dual			
HFO 610	IVT-D		
HFO 619	IVT-D		

Nucleus and TFL Seed Production: Sufficient quantity of Mescavi, HB 1 and HB 2 seed was produced alongwith 60 Kgs. of nucleus seed of these three varieties.

AICRP on Forage Crops & Utilization, MPKV, Rahuri, Maharashtra

POLYCROSS PROGRAMME OF LUCERNE: The new polycross programme was initiated from Rabi-2011-12 onwards with following parental lines

Center Code	Center	Entry Code	Name of the entry
A	AAU, Anand	A	Anand-24
A	AAU, Anand	L	AL-3
B	BAIF, Urlikanchan	B	BAIF- Lucerne-1
C	TNAU, Coimbatore	C	TNFD-118
R	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 programme 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.

GERMPLASM EVALUATION IN LUCERNE:

Experiment	: Evaluation of Lucerne Germplasm
Objective	: To identify promising strains of Lucerne (P)
Experimental details	: AICRP on FC, Rahuri, Augmented Block Design, 33+1, 3.00 x 1.20 m, 3.00 x 1.20 m, 30 cm, 20:80:00 NPK kg/ha, 12.12.2014 (Cuts on:- 05.01.16, 30.01.16, 24.02.16, 18.03.16, 26.04.16, 18.05.16, 08.06.16, 07.07.16, 12.08.16, 03.09.16, 13.10.16, 16.11.16 & 23.12.16
Results	: The mean forage yield (q/ha) of 13 cuts is given below

Mean forage Yield (q/ha) of Lucerne Germplasm (2014) (Cuts-13): The entries RLG-2014-10 (679.42 q/ha), RLG-2014-30 (671.05 q/ha), RLG- 2014-9 (659.75 q/ha), RLG- 2014-8 (659.25 q/ha), RLG-2014-29 (653.61 q/ha), RLG-2014-12 (637.92 q/ha) and RLG-2014-3 (632.75 q/ha) recorded numerically higher GFY over check RL-88 (624.13 q/ha).

Oat:

Generation	Cross	Activity
F3	Kent x JHO-2010-4	45 IPS
	Kent x JO-03-309	46 IPS

Germplasm of different grasses maintained during 2016-17

S.N	Name of grass	Nos.
1.	Napier (<i>Pennisetum purpureum</i> L)	33
2.	Guinea grass (<i>Panicum maximum</i> L)	11
3.	Marvel (<i>Dichanthium spp.</i>)	48
4.	Madras Anjan (<i>Cenchrus spp.</i>)	44
5.	Dongari (<i>Crysopogon fulvus</i>)	13
6.	Stylo (<i>Stylosanthes spp.</i>) <i>S. seabrana</i> : 35; . <i>S. scabra</i> :5; <i>S. vscos</i> -1; <i>S.seca</i> :1 ; <i>S. hamata</i> :2	44
7.	Gokarn/Butterfly pea (<i>Clitoria ternatae</i>)	25
8.	Rhodes grass (<i>Choris gayana</i>)	7
9.	Dinanath (<i>Pennisetum pediselatum</i>)	5
10.	Moshi (<i>Iseilema wighttii</i>)	3
11.	Ber (<i>Ischiemum aristanum</i>)	3
Total		236

AICRP on Forage Crops & Utilization, SKRAU, Bikaner, Rajasthan

Lucerne

- **Variety development:** One lucerne variety RRB-07-1 (Krishna) developed from Bikaner centre has been released and notified for North West zone in 2016.
- **Breeding work:** Seeds obtained from polycrosses made during Rabi-2015-16 were evaluated during Rabi-2016-17. 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-2017-18. Selection of superior plants was also done from the seed material generated from crosses made in previous years.
- **Lucerne germplasm:** 25
- **Seed multiplication:** Seed of newly developed variety Krishna of lucerne from Bikaner centre was further multiplied on a large isolated area.

AICRP on Forage Crops & Utilization, KAU, Vellayani, Kerala

Evaluation of Guinea grass cultures for yield and forage quality: From the germplasm collection maintained at Vellayani centre, four superior cultures were identified and compared for their performance. The data was presented in the ZREAC workshop 2016, two cultures (Culture 1 & 2) were accepted for farm trial and farm trial is ongoing in five different zones of Kerala

Evaluation of BN hybrid cultures for yield and forage quality: Fifty one bajra-napier hybrids received from IGFR, Jhansi during Kharif 2010, were evaluated during Kharif 2011. Out of the 51 hybrids sown, 20 hybrids have germinated and they were multiplied. Evaluation of 20 hybrids was done during Kharif 2012. Five hybrids with superior fodder attributes were selected for yield trials. The five cultures were compared with the local check (Suguna). The data was presented in the ZREAC workshop 2016 and one culture (Culture 1) was accepted for farm trial. Farm trial is ongoing in five different zones of Kerala.

Induced mutagenesis for delayed flowering and high tillering in guinea grass (*Panicum maximum* Jacq.): Work is in progress to develop high yielding guinea grass types with delayed flowering and high tillering through induced mutagenesis.

Genetic analysis of yield and quality in fodder cowpea (*Vigna unguiculata* Walp.): Genetic analysis of fodder yield and quality in fodder cowpea and evaluation of F₂ progenies to identify superior recombinants in 32 accessions is in progress.

AICRP on Forage Crops & Utilization, GPU&T, Pantnagar, Uttarakhand

OAT

Germlasm maintenance: A total of 309 oat germplasm lines comprising indigenous, exotic and improved genetic stocks have been maintained and evaluated during the season.

Crossing nursery: Based on growth habit, leafiness, tillering, days to heading, growth rate, maturity and seed yielding ability certain genetic donors for different desirable traits / trait combinations have been identified for their use in the crossing nursery. Ten new crosses were attempted during the season. However, the F₁ seed from only six new cross combinations could be obtained due to strong desiccating winds and high temperature during the crossing programme.

New F₁ Crosses

- (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// PI 295932) // UPO 201)
- (Fulgham / No. 2672) x (Wright / UPO 265) -11-1-1

F₂ Populations: The following ten F₂ populations were planted and 25- 30 single plant selections from each population were made.

1. Otter x (UPO 201 x UPO 247)-1-5
2. (Portal/Kent//UPO 212) -20-1-1 x (Ox 795)-5-1
3. Otter x EC 246122
4. UPO 276 x EC 246197
5. (Cockor-72-27 x Swan)-11 x UPO 275
6. New -5 x (Portal/Kent//UPO 212) -20-1-1
7. EC 246187 x EC 246190
8. UPO -04-4 x New -5
9. Lang x EC – 246122
10. EC 246207 x EC 246190

Breeding Materials: Oat Breeding materials of early segregating generations comprising F₃ (145), F₄ (477), F₅ (144) ; and advanced generations of F₆ (103), F₇ (94) F₈ (45) & F₉(34) progenies were grown and within / between line, single panicle or single plant selections were made following the pedigree breeding.

Coordinated Varietal Trials: All the eight Coordinated Varietal Trials including 6 on oats and two on berseem allotted to the Centre were successfully conducted. However, in IVTO-Dual trial the seed could not be harvested due to heavy damage by wild animals.

Multiplication of Promising Lines: Thirteen 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 material.

Nucleus and Breeder Seed Production: Nucleus seed production of our released oat varieties UPO 212 and UPO 94 was undertaken during the season. Breeder seed of UPO 212 (20.0 q) was produced during *Rabi* 2016-17 season.

Other Activities Rabi-2016-17

AICRP on Forage Crops & Utilization, TNAU, Coimbatore, Tamil Nadu

Awards and Honours: ‘Best AICRP FC&U Centre award’ for the year 2016-17 from ADG (FFC), ICAR, New Delhi during the National Group Meet-*Kharif* 2017 held at HPKV, Palampur.

Publications

Research articles

Babu C, Iyanar K, Vijayakumar G, Kalamani A, Velayudham K, Velayutham A, Anandakumar CR and Ganesamurthy K (2016). A high yielding fodder cowpea CO-9. *Electron J Plant Breed*, 7(4): 888-894.

Sathiya Bama K and Babu C (2016). Perennial forages as a tool for sequestering atmospheric Carbon by best management practices for better soil quality and environmental safety. *Forage Res*, 42 (3): 149-157

Book chapter (with ISBN)

Babu C, Revathi S and Pavithra N (2016) Advances in seed production techniques in forage crops. In: ICAR–Winter School on “Recent trends in seed production, post harvest handling and value addition techniques for effective seed supply chain” Seed Centre, TNAU, Coimbatore, pp. 202-208 (ISBN: 978 - 93 - 84 - 234- 744).

Babu C, Iyanar K and Kalamani A (2016). Tree fodder production and management technology. In: Forestry Technologies-A complete value chain approach, vol-I, Scientific Publishers. pp. 341-361 (ISBN: 978-93-86102-60-7).

Seminar/Symposia papers

Nithya S, Sivakumar SD and Babu C (2017). Study on influence of planting material in Bajra Napier hybrid grass on plant population, growth and yield. National symposium on “*New Directions in Managing Forage Resources and Livestock Productivity in 21st Century: Challenges and Opportunities*” P1-09: p14.

Nithya S, Sivakumar SD and Babu C (2017). Effect of planting materials on plant nutrient dynamics and quality of Bajra Napier hybrid grass CO (BN) 5. National symposium on “*New Directions in Managing Forage Resources and Livestock Productivity in 21st Century: Challenges and Opportunities*” P1-10: p15.

Nithya S, Sivakumar SD and Babu C (2017). Study on biochemical differences in sett material of Bajra Napier grass and its influence on sprouting and establishment. National symposium on “*New Directions in Managing Forage Resources and Livestock Productivity in 21st Century: Challenges and Opportunities*” P2-37: p81.

Sriram VR, Sivakumar SD and Babu C (2017). Effect of age and portion of planting material in plant population and growth of Bajra Napier hybrid grass. National symposium on “*New Directions in Managing Forage Resources and Livestock Productivity in 21st Century: Challenges and Opportunities*” P1-17: p22.

Sriram VR, Sivakumar SD and Babu C (2017). Effect of age and portion on biochemical differences in planting material of Bajra Napier grass and its influence on sprouting and establishment. National symposium on “*New Directions in Managing Forage Resources and Livestock Productivity in 21st Century: Challenges and Opportunities*” P1-18: p23.

Important persons visit: Dr. Tony Butler, Tasmania, Australia

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 ‘Forage seed production techniques and vermicomposting’ imparted to **120 Veterinary Assistant Surgeons** funded by State Fodder Development Scheme (2016-17) Department of Animal Husbandry, Tamil Nadu with a budget outlay of Rs.3.20 lakhs

Title of training	No. of trainees	Date	Districts
Forage seed production techniques and Vermi composting funded by State Fodder Development Scheme (2016-17)	I batch (40)	10.01.2017 & 11.01.2017	Ariyalur, Coimbatore, Cuddalore, Dharmapuri, Dindigul, Erode, Karur, Krishnagiri, Kancheepuram and Madurai
	II batch (40)	24.01.2017 & 25.01.2017	Chennai, Kanyakumari, Nagapattinam, Namakkal, Nilgiris, Perambalur, Pudukottai, Ramanathapuram, Salem, Sivagangai, Thanjavur and Theni
	III batch (40)	02.02.2017 & 03.02.2017	Thiruvallur, Thiruvarur, Thoothukudi, Tirunelveli, Tirupur, Tiruvannamalai, Trichy, Vellore, Villupuram and Virudhunagar
Total	120		

Quantity of seeds/ planting material produced and supplied (2016-17)

S. N.	Crop/ variety	Class of seeds	Quantity produced (kg)	Quantity supplied (kg)	Expected production (2017-18) (kg)	Total quantity (kg)
I	SEEDS					
1.	Multicut Fodder sorghum CO (FS) 29	BS	200.0	200.0	280.0	280.0
		TFL	454.6	454.6	1000.0	1000.0
2.	Fodder sorghum CO 31	TFL	152.2	152.2	1500.0	1500.0
3.	Maize African tall	TFL	642.0	642.0	2500.0	2500.0
4.	Fodder cowpea CO 9	BS	-	-	300.0	300.0
		TFL	55.6	55.6	1000.0	1000.0
5.	Lucerne CO 2	TFL	0.5	0.5	150.0	150.0
6.	<i>Desmanthus</i>	TFL	523.7	523.7	1500.0	1500.0
7.	Puthiya soundal	TFL	24.8	24.8	100.0	100.0
8.	Agathi	TFL	-	-	300.0	300.0
II	PLANTING MATERIAL					
1.	BN hybrid CO (CN) 4 stem cuttings		20,435	20,435	50,000	75,000
2.	BN hybrid CO (BN) 5 stem cuttings		19,29,439	19,29,439	30,00,000	30,50,000
3.	Guinea grass CO (GG) 3 rooted slips		14,905	14,905	1,00,000	1,10,000

Externally funded project: 1

Title of the Scheme	Sponsors	Duration	Outlay
Development of pearl millet forage hybrids and pearl millet – napier (PN) hybrids for high biomass and quality suited for different agro climatic zones of India.	CGIAR- Dry land Cereals – Competitive Grants 2015	2015-16	50,000 USD

AICRP on Forage Crops & Utilization, UAS, ZARS Mandya, Karnataka

Publications

Extended Abstracts

Shekara BG, Lohithaswa HC, Chikkarugi NM and Manasa N (2017). Studies on Scheduling of Irrigation on green forage yield and quality of different forage crops during lean season. XIII Agricultural Science Congress- 21-24 February-2017.

Shekara BG, Mahadevu P, Chikkarugi NM and Manasa N (2017). Enhancing the production potential of various forage crops in coconut garden through nutrient management. XIII Agricultural Science Congress- 21-24 February-2017.

Shekara BG, Mahadevu P, Chikkarugi NM and Manasa N (2017). Studies on response of Promising pearl millet genotypes to (*Pennisetum glaucum*) to nitrogen levels. XIII Agricultural Science Congress- 21-24 February-2017.

Kannada Folders

Shekara BG, Mahadevu P, Chikkarugi NM and Manasa N (2017) Vividha Mevin Belegala Sudharit Utpadana Tantrikategalu. ZREP, 6th-7th 2017.

Shekara BG, Mahadevu P, Chikkarugi NM and Manasa N (2017) Misratali Hasuvinnalli Aghik Halin iluvarigagi samatolan ahar. ZREP, 6th-7th 2017.

Shekara BG, Mahadevu P, Chikkarugi NM and Manasa N (2017) Niravariyalli Ekadala Mevin Belegalu. ZREP, 6th-7th 2017.

Shekara BG, Mahadevu P, Chikkarugi NM and Manasa N (2017) Paustik Dayak Dwidala Mevin Belegalu. ZREP, 6th-7th 2017.

Important persons visit

- Monitoring team visited during 8th to 10th February, 2017 to ZARS, VC Farm, Mandya Dr. A. B. Tambe, Sr. Scientist Entomology, MPKV Rahuri, Maharashtra, Dr. Shusheela, Sr. Scientist Agronomy, PJTSAU, Hyderabad.
- Project Co-ordinator, AICRP- Forage Crops & Utilization, Jhansi

Meetings / Workshop/Winter School attended

- Rabi National Group Meeting on Forage crops & Utilization, held at KAU, Vellayani, Kerala on 05th & 06th of September 2016.
- Agronomist Technical meeting at RIOF, GKVK, UAS, Bengaluru 06th to 08th, March, 2017.
- Breeders Technical meeting at UAS, GKVK, Bengaluru on 2nd, 3rd and 4th March, 2017.
- Mr. Nagesh Chikkarugi, Technical Assistant, undergone one year Post Graduate Diploma in Agricultural Extension Management (PGDAEM), MANAGE, Hyderabad.

Student(s) guided: Ph.D. (Agri.) in Agronomy- 1

No. of FTDs conducted: 46

Training conducted: 3-Training programme & 9-Field days

TV/ Radio talk: 25

Seed/ planting material sold

S. No.	Crops	Root Slips Sold (In Lakhs)
1.	Napier Bajra Hybrid (Co-3)	0.30
2	Guinea grass (JHGG-08-1)	0.20
3	Rhodes grass (Selection)	0.10
4	Signal grass(Selection)	0.10

Externally funded projects: 3

GOK projects: Maintenance breeding of Fodder cowpea varieties (KBC-2, MFC-08-14, MFC-09-1).

RKVY projects

- ✓ Augmenting Fodder Production and establishing fodder seed bank at UAS, Bangalore (2013-14) -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 on Forage Crops & Utilization, BAIF, Urulikanchan, Maharashtra

Awards and Honours: P. S. Takawale, Forage Breeder & OIC, acknowledged and honoured as valued reviewer of International Journal of Agricultural Sciences and awarded the **Membership Certificate** (Id: E8FA036384) by Bioinfo Publications.

Publications

Kauthale VK, Takawale PS and Patil SD (2016) Weed management in Berseem. *Indian Journal of Weed Science* 48 (3): 300-303

Important persons visit

- Dr. Sudhir M. Bobde, Principal Secretary, AHDD and Fisheries, Govt. of U.P.
- Mr. Saurabh K. Singh, President, ICICI Foundation
- Mr. P. N. Pokale, Joint Director (Planning), Agriculture Dept. Govt. of Maharashtra
- Mr. Bishnupada Sethi, Commissioner & Secretary, F & ARD Dept. Govt. of Odisha
- Dr. O. P. Chaudhary, Joint Secretary (ANLM) DADF, Govt. of India
- Dr. A. K. Roy, Project Coordinator, AICRP on Forage Crops & Utilisation, Jhansi
- Dr. N. Vijaya Lakshmi Secretary, Animal & Fish Resources Dept. Govt. of Bihar
- Dr. O. P. Dhanda, Former ADG (AS), ICAR, New Delhi

FTDs conducted: Fifteen demonstrations of Oat & Berseem were established at farmer's field in seven villages of Haveli block to make aware the farmers about new fodder varieties and their production technologies.

TSP activities: The activities were implemented in three villages of Nandurbar district of Maharashtra. The activity wise achievements are as under.

Activities	No. of Participants	Type of assets/activities achieved
Demonstration of fodder cultivation technologies in non traditional area during winter	30 from five groups in three villages	Covered 12 ha area under maize and berseem crops at 30 farmer's field
Goat improvement programme through distribution of bucks, first aid kit etc.		5 bucks of Osmanabadi breed & 5 first aid kit received to 5 groups of farmers
Water resource development for irrigation facilities		Diesel pump sets, PVC pipes and other materials received to 5 user groups. Water available for irrigation to 30 farmer's field

Training conducted for farmers/ NGO/ Govt. officials: Trainings on "Livestock Management and Fodder Development" were conducted by BAIF at Urulikanchan during the period. In all 460 trainee participants from different institutions of Govt., NGOs, Dairy Cooperatives and individuals from Maharashtra, Chhattisgarh, Tamilnadu, M. P. and Odisha were joined in the training programme and in all 31 trainings were conducted. Lectures on Fodder Production and Utilisation Technologies were delivered by the Scientists working in AICRP on Forage Crops.

HRD for the AICRP-FC staff: Dr. S. D. Patil, Scientist (Agronomy) attended training on "Forage Resource Management for Sustainable and Economic Livestock Production" organised at S. K. Rajasthan Agricultural University, Bikaner (Rajasthan) during Nov. 29 to Dec. 08, 2016.

TV/Radio talk delivered by AICRP-FC staff/ extension activities: Member of Agricultural Advisory Committee for Krishi darshan Programme of Doordarshan Kendra, Pune

AICRP on Forage Crops & Utilization, MPKV, Rahuri, Maharashtra

Publications

- Tamboli ND, Patil CS and Tambe AB (2016). Persistent toxicity of synthetic insecticides to pea aphid, *Acyrtosiphon pisum* (Harris) on Lucerne, *Medicago sativa* (Linnaeus), *Advances in life Science* 5 (12) : 5914-5916
- Andhale RP, Amolic VL, Sinare BT, Dhadge SM and Bharud RW (2016). Response of summer groundnut (*Arachis Hypogaea* L.) to Water soluble foliar fertilizers. *Indian Journal of Ecology*. 43(Special issue-1) : 458-460
- Sinare BT, Andhale RP, Pardeshi HP and Tambe AD (2016). Effect of different land configurations, irrigation regimes and potassium levels on consumptive use, water use efficiency and yield of summer groundnut (*Arachis hypogaea* L.). *Indian Journal of Ecology*. 43(Special issue-2): 615-618.

In souvenirs

- Tambe AB, Pardeshi HP and Sonone AH (2016). Use of plant products in storage. Souvenir published at AICRP- Forage Crops NGM- Rabi-2016 organized by ICAR, New Delhi and Kerala Agricultural University Thiruvananthapuram, during 5-6, Sept., 2016: pp.-88-90.
- Tambe AB, Pardeshi HP and Sonone AH. (2016). Role of bio-agents in management of stored grain pests. Souvenir of 3rd National Meet of Entomologists 2016 held at ICAR-Indian Institute of Horticulture Research, Hessarghatta, Bengaluru, Karnataka on 7-8 Oct., 2016 pp. 65
- Jadhav Jyotiram, Tambe AB, Kulkarni SR and Saindane YS (2016). Effect of application time of biopesticides against *Spodoptera litura* (Fab.) in lucerne crop. Souvenir of 3rd National Meet of Entomologists 2016 held at ICAR-Indian Institute of Horticulture Research, Hessarghatta, Bengaluru, Karnataka on 7-8 Oct., 2016 pp. 75.
- Tambe AB, Jadhav Jyotiram and Kulkarni SR (2016). Efficacy of different biopesticides against *Helicoverpa armigera* (Hubner) on lucerne seed crop. Souvenir of 3rd National Meet of Entomologists 2016 held at ICAR-Indian Institute of Horticulture Research, Hessarghatta, Bengaluru, Karnataka on 7-8 Oct., 2016 pp. 65.

Abstracts

- Tamboli ND, Tambe AB and Kharbade SB (2017). Evaluation of entomopathogenes and virus and its combination against *Spodoptera litura* (Fabricius) infesting lucerne, *Medicago sativa* (Linnaeus). Book of Abstract of 5th National Conference on Biological Control: Integrating Recent Advances in Pest and Disease Management held at Bengaluru on 9-11 February 2017.

Technical Publications

- Sinare BT, Gavit MG, Pardeshi HP and Sonone AH (2016). Performance of dual purpose forage crops under different cutting management system. Proceedings of the Indian Ecological society: International conference on Natural Resource Management Ecological Perspectives held at SKUAST, Jammu on 18-20 February, 2016. PP 159-160.
- Sinare BT, Andhale RP and Pardeshi HP (2016). Consumptive use, water use efficiency and yield of summer groundnut (*Arachis hypogaea* L.) under different land configurations, irrigation regimes and potassium levels. Proceedings of the Indian Ecological society: International conference on Natural Resource Management Ecological Perspectives held at SKUAST, Jammu on 18-20 February, 2016. PP 29-30.
- Sonawane CJ, Bharud RW, Sinare BT and Andhale RP (2016). Growth performance of different tree species in silviculture system. Proceedings of the Indian Ecological society: International conference on Natural Resource Management Ecological Perspectives held at SKUAST, Jammu on 18-20 February, 2016. PP 474-475.
- Andhale RP, Amolic VL, Sinare BT, Dhadge SM and Bharud RW (2016). Response of summer groundnut (*Arachis hypogaea* L.) to water soluble foliar fertilizers. Proceedings of the Indian Ecological society: International conference on Natural Resource Management Ecological Perspectives held at SKUAST, Jammu on 18-20 February, 2016. PP 669-670.

Andhale RP, Sinare BT, Ugale NS, Dhadge SM and Bharud RW (2016). Effect of integrated nutrient management on growth, yield and quality of summer groundnut (*Arachis hypogaea* L.). Proceedings of the Indian Ecological society: International conference on Natural Resource Management Ecological Perspectives held at SKUAST, Jammu on 18-20 February, 2016. PP 615-616.

Tambe AD, Sinare BT and Pawar VR (2016). Sweet corn (*Zea mays* var. *saccharata*) production with different organic sources. Proceedings of the Indian Ecological society: International conference on Natural Resource Management Ecological Perspectives held at SKUAST, Jammu on 18-20 February, 2016. Vol.(2) : 650.

Book/Manual

Andhale RP, Shaikh AA, Sinare BT and Dhonde MB (2016) Practical Manual AGRON-505 Agrometeorology and crop weather forecasting. Publication No./MPKV/ DEE/ EXTN /PUB /132 /2016

Popular articles: 03

Student Guide

M.Sc. (Agri.)

- Prof. A. H. Sonone (Plant Breeding) : 01
- Dr. A. B. Tambe (Entomology) : 02
- Dr. S. V. Damame (Biochemistry) : 01
- Dr. B. T. Sinare (Agronomy) : 02

Course taught

- Dr. A. H. Sonone: GPB 501 (M.Sc. Agril. Plant Breeding)

FTDs conducted: 10 - Berseem (Wardan) -07 and Oat (RO-19) -03

HRD for the AICRP-FC staff: Dr. B. T. Sinare attended short term training programme on “Forage Resource Management for Sustainable and Economic Livestock Production” held w.e.f. 29th November to 8th December, 2016 at Directorate of Human Resource Development, SKRAU, Bikaner.

TV/Radio talk/ Lectures

- Radio talk :01
- Lectures to farmers in training programme: 16 [Dr. A.H. Sonone - 04; Dr. A.B. Tambe- 08; Dr. S.V. Damame- 04]

Seed Production (*Rabi-16-17*)

S. N.	Crop	Nucleus	Breeder	TFL
1.	Lucerne/RL88	1.20	-	0.03
2.	Berseem /Wardan	-	-	1.80
3.	Oat / Phule Harita (RO-19)	-	1.30	5.00
	Oat/ Kent	-	8.0	-
	Oat/ Phule Surabhi (RO-11-1)	-	10.0	-
4	Maize/African Tall	0.40	-	-

Visits of farmers and Govt. Staff of Agril. Department of Maharashtra State

- No. of Farmers visited to farm during Rabi 16-17 : 500
- No. of Govt. officers/staff visited to farm during Rabi 16-17: 30

AICRP on Forage Crops & Utilization, PAU, Ludhiana, Punjab

Awards and Honours

- **Best Research Paper award (2016):** Kaur R, Goyal M and Tiwana US 2016 Influence of seasonal variation on oxalate accumulation in Napier Bajra hybrid under different nitrogen nutrition. *Range Mgmt. & Agroforestry*. 37(1): 62-68 by Range Management Society of India, Jhansi during National Symposium at RVSRVV, Gwalior on 3-4th March 2017.
- **Fellow Award 2016:** Dr. U.S. Tiwana awarded with Fellow Award 2016 by Range Management Society of India in National Symposium held at Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalyaya, Gwalior on 3 March, 2017.

Publications

Research papers

- Gill PK, Tiwana US and Kaur Simarjit (2016). Crop-weed competition in Napier Bajra hybrid (*Pennisetum purpureum* x *Pennisetum glaucum* L.) under different planting sources. *Indian J Agron* 61(4): 47-52
- Goyal M and Tiwana US (2016) Ensiling legume with cereal fodder influences quality of silage mixture. *Indian J. Anim. Nutr.* 33(2): 228-232
- Kapoor Rahul (2017) Variability and character association studies in fodder maize (*Zea mays* L.) hybrids. *Forage Res.* (Accepted)
- Kapoor Rahul and Singh Gagandeep (2017) Estimation of heterosis and combining ability in oats (*Avena sativa* L.) for green fodder yield and attributing traits using line x tester design. *Int. J Pure App Biosc* (Accepted).
- Kaur G and Goyal M (2016) Effect of nitrogen application on proximate and fibre components of oats (*Avena sativa* L.) grain at two stages of development. *Indian J. Anim. Nutr.* (accepted)
- Kaur G and Goyal M (2017) Nitrogen assimilation potential in relation to nitrate-N toxicity at different growth stages and N inputs in oats (*Avena sativa* L.) *IJBB* (accepted).
- Kaur G and Goyal M (2017). Effect of growth stages and fertility levels on growth, yield and quality of fodder oats (*Avena sativa* L.). *Journal of Applied and Natural Science*. 9 (3) (in press).
- Kaur G, Goyal M 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). (in press)
- Kaur R, Goyal M and Tiwana US (2016). Influence of seasonal variation on oxalate accumulation in Napier Bajra hybrid under different nitrogen environment. *Range Management and Agroforestry* (in press)
- Kaur Rajvir and Kapoor Rahul (2017) Accessing genetic diversity in oats based on morpho-agronomic traits. *Forage Res.* 42(4): 271-273.
- Malik EA, Bhardwaj R, Goyal M and Kaur J (2017). Morphological diversity to evaluate dry summer adaptability of Pearl millet. *Agricultural Research*. DOI: 10.1007/s40003-017-02454-x.
- Sandhu SK, Sarao NK, Goyal M, Uppal SK, Singh PP, Kaur S and Kaur J (2016) Profiling of sugar beet genotypes for agronomical, sugar quality and forage traits and their genetic diversity analysis using SSR markers. *Electronic Journal of Plant Breeding*. 7:253-267
- Sharma PK, Kalra VP and Tiwana US (2016). Effect of farm yard manure and nitrogen levels on growth, quality and fodder yield of summer maize (*Zea mays* L.). *Agric Res J* 53 (3): 355-59.
- Singh Simranjit, Upasana Rani, Asmita Sirari and Tiwana US (2016). Identification of the pathogen associated with the wilt of guar (*Cyamopsis tetragonoloba*). *Pl. Dis. Res.* 31: 6-9.

Papers presented in Symposia/Workshops

- Tiwana US, Harpreet Kaur Oberoi, Kumar R and Goyal M (2016). Hydroponic fodder: Boon for ranchers. In: National Conference on “Innovative and current advances in agriculture and allied sciences” held at PJTSAU, Rajendranagar, Hyderabad (Telengana) 10-11 December, 2016.

- Kaur H and Goyal M (2017) Effect of salicylic acid on biochemical metabolites in berseem (*Trifolium alexandrinum L*) under cold stress. In: National symposium on “New directions in managing forage resources and livestock productivity in 21st century: challenges and opportunities.” Paper ID P2-38 pp 82 March 3-4, Gwalior.
- Kaur H and Goyal M (2017) Study of total phenol, tannin, flavonoid and saponin content of different cowpea genotypes. In: National symposium on “New directions in managing forage resources and livestock productivity in 21st century: challenges and opportunities.” Paper ID P2-08 pp 52 March 3-4, Gwalior.
- Tiwana US and Singh Sukhpreet (2016) Forage yield and quality of berseem (*Trifolium alexandrinum*) genotypes as influenced by phosphorus levels under Punjab conditions. In: National Conference on “Innovative and current advances in agriculture and allied sciences” held at PJTSAU, Rajendranagar, Hyderabad (Telangana) 10-11 December, 2016 pp. 15-16.
- Kumar, Ravinder and Tiwana US (2016). Control efficacy of seed dressing insecticides against sorghum shoot fly (*Alternaria socata*) in forage sorghum (*Sorghum bicolor* (L.) Moench). In: National Conference on “Innovative and current advances in agriculture and allied sciences” held at PJTSAU, Rajendranagar, Hyderabad (Telangana) 10-11 December, 2016 pp. 38-39.
- Tiwana US and Singh Sukhpreet (2017). Performance of dual purpose forage crops under different cutting management. In: National Symposium on “New Directions in Managing Forage Resources and Livestock Productivity in 21st Century: Challenges and Opportunities” (March 3-4, 2017) at RVSKVV, Gwalior (Abstract no. 01-02).
- Kumar, Ravinder, Tiwana US and Singh Devinder Pal (2017). Effect of differential seed rate on stem borer *Chilo partellus* inflicted damage and yield advantage in fodder maize. In: National Symposium on “New Directions in Managing Forage Resources and Livestock Productivity in 21st Century: Challenges and Opportunities” (March 3-4, 2017) at RVSKVV, Gwalior (Abstract no. P4-12).

Souvenir Articles

- Goyal M, Kaur H and Tiwana US (2017) Oxalate in forage crops. In: Souvenir of 52nd Annual Group Meet of All India Coordinated Research Project on Pearl Millet held at Punjab Agricultural University on April 28-30, 2017, pp 97-99.
- Kumar Ravinder, Singla Ashesha and Twana Udham Singh. 2016. Eco-friendly pest management approach for different lepidopteran pests in berseem (*Trifolium alexandrinum L.*). *Souvenir: National Group Meet, Rabi 2016-17* of All India Coordinated Research Project on Forage Crops and Utilization, September 5-6, 2016 held at KAU, Vellayani (pp 84-87).
- Oberoi HK, Tiwana US, Goyal M, Singh DP, Kumar R and Singla A (2017) In: Souvenir of 52nd Annual Group Meet of All India Coordinated Research Project on Pearl Millet held at Punjab Agricultural University on April 28-30, 2017, pp 100-107.
- Singla Ashesha, Kumar Ravinder and Tiwana Udham Singh. 2016. Biological control as promising alternative against diseases of fodder crops. *Souvenir: National Group Meet, Rabi 2016-17* of All India Coordinated Research Project on Forage Crops and Utilization, September 5-6, 2016 held at KAU, Vellayani (pp 79-83).

Extension publications

- Singh D, Goyal M and Tiwana US (2017) J1006: the most suitable maize variety for silage making. *Progressive farming* 53 (04): 24-25.
- Singh D, Goyal M and Tiwana US (2017) Hare chare da aachar banaun lai makki di dhukavi kissam J-1006. *Changi Kheti* 53 (04): 24-25.
- Singh, D, Goyal M and Tiwana US (2017) Saaunii vitch gunvatta bharpur chare lai ravah di kashat karo. *Uttam Kheti* April-June 2017 (17): 35-36.
- Singh, D, Goyal M and Tiwana US (2016) Importance of lucerne among *rabi* fodders and its improved cultivation practices. *Advisor* January 2016 pp 24.
- Singh, D, Goyal M and Tiwana US (2017) Hari vitch gunvatta bharpur chare lai raye ghaa di kashat. *Modern Kheti*, November 2016 pp 44

Students guided: M. Sc.:4; Ph.D.: 3
FTDs conducted: 20 -Oats (OL 10): 20

Training conducted: Lectures delivered -25; Trainings organized-01

TV/Radio talks: TV: 1

HRD: 01 (Dr. Rahul Kapoor attended 21 days winter school at IASRI, New Delhi)

External funded Projects

S.N.	Name of Project	Funding Agency	Amount	PI
1.	Alien genes introgression in oat by developing oat maize addition lines	UGC	9.31 Lacs	Dr. Rahul Kapoor

Seed/Planting material sold

Crop	Variety	TL (q)	F/S (q)	B/S (q)
Berseem	BL 10	23.65	--	18.16
	BL 42	62.90	5.76	9.68
	BL 180	--	--	0.22
Oats	OL 10	21.0	--	9.60
	Kent	62.0	--	26.0
Rye grass	PBRG 1	2.10	--	--
	Total	171.65	5.76	63.66

AICRP on Forage Crops & Utilization, NDU&T, Faizabad

Publication

Yadav RS, Singh Bhagwan, Singh SP, Singh AK and Kumar R (2017). Resource management in rice-oat cropping system under sodic soils. Paper presented in National Seminar on “Recent trends and future prospects in Sustainable Agriculture with reference to Climate Change” organized by Deptt. of Agronomy. Janta College, Bakewar, Etawah (U.P.) held on March 18-19, 2017 p. 43-44.

Kumar R, Nand V, Singh MP and Yadav RS (2017). Evaluation of barley varieties for weed competitiveness. Paper presented in National Seminar on “Recent trends and future prospects in Sustainable Agriculture with reference to Climate Change” organized by Deptt. of Agronomy. Janta College, Bakewar, Etawah (U.P.) held on March 18-19, 2017 p. 63.

Yadav RS, Singh Bhagwan, Singh SP, Singh AK and Singh RK (2017). Response of soil amendments on productivity of rice – Berseem cropping system and changes in soil properties of sodic soil. Paper presented in International conference on “Advances in Agricultural and Applied Sciences for Promoting Food Security (AAPFS-2017)” organized by Society for Agriculture Innovation and Development, Ranchi (Jharkhand) at Hotel Mirage Lord Inn, Baltishputli, Kathmandu, Nepal held on May 13-15, 2017 p. 195-196.

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 624 (Ph. D.) –Management of saline and alkali soils

Guided student:

- Mr. Mohan Singh MSc.(Ag.) I.D.No. A 9488/2016

FTD conducted: Forage oat-NDO-1 -10

Radio Talks - 01

AICRP on Forage Crops & Utilization, AAU, Jorhat, Assam

Research Papers

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

Krishna Abhishek, Ahmed Shahid, Pandey HC, Kumar Vikas, Rai SK, Sharma KK and Kumar Ashok (2016). Assessment of genetic characteristics in different lines of Oat (*Avena sativa* L.). *Agricultural Science Research Journal*. 6(6): 145-151

Extension leaflet

- Cultivation of forage crops in Assam (in Assamese)
- Feeding nutritious forage crops (in Assamese)

Important persons visit

- Dr. I. S. Solanki, ADG (FFC), ICAR, New Delhi

Student(s) guided: M.Sc. (Agri.) 3 in PBG and 3 in Agronomy; Ph. D. in Agronomy- 2

No. of FTDs conducted: 40

TSP activities: Adopted 7 villages in two TSP districts viz. Dhemaji and Karbi Anglong

Training conducted for farmers/ NGO/ Govt. officials: 8

TV/ Radio talk delivered by AICRP-FC staff/ extension activities: 2

Details of seed/ planting material sold

S.N.	Forage crops	Total quantity (kg)		
		Total Slips(No)	Foundation seed	TFL seed
1.	Hybrid Napier CO-3,CO-4	1.3 lakh		
2.	Setaria Kazungula, PSS-1	1.2 lakh	-	
3.	Rice bean Var. Shyamalima		30 kg	
4.	Oat Var. Kent and JHO 822			4.00 q
	Grand Total	2.5 lakh	30.00 Kg	4.00 q

New Variety Identified

Varieties	Year	Breeding methods	State	Specific features
Madhuri	2016	Pure line selection	Assam	High green and dry matter yields, high quality characters and tolerant to insect pest and diseases in rice fallow both as relay and sole crop. Tolerant to drought and cold

AICRP on Forage Crops & Utilization, BCKV, Kalyani, West Bengal

Research articles in journals

Roy DC and Jana K (2016). Biomass production and quality of berseem fodder (*Trifolium alexandrinum* L.) as influenced by application of phosphorus and phosphate solubilizing bacteria. *Advances in Life Sciences* (ISSN 2278-3849), 5 (4), 2016: 1225-1229.

In Souvenirs

Jana K, Kundu CK, Puste AM, Biswas S and Bandyopadhyay P (2016). Job's tear (*Coix* spp.): An important forage crop grown in marshy areas. Souvenir, National Group Meet, *Kharif*, 2016, AICRP on Forage Crops and Utilization held at SKUAT, Shalimar, Srinagar, May 16-17, 2016: 94-103.

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 (2016). Ricebean: Nutritionally rich grain legume and grown under diverse cropping system in drought prone areas of Indian sub-continent to maintain food security. Souvenir, National Group Meet, *Rabi*, 2016-17, AICRP on Forage Crops and Utilization held at KAU, Vellayani, September 5-6, 2016: 50-59.

Student(s) guided

- M. Sc. (Ag.) in Agronomy - 4
- Ph. D. in Agronomy- 1

Courses taught: Course No. 509, Agronomy of fodder and forage crops and other courses

No. of FTDs conducted: 36 units [Berseem (cv. Warden and Mescavi) - 5 units, Oat (SC) (cv. OS-6 and Kent) – 16 units and Lathyrus (cv. Nirmal and Ratan) – 15 units, respectively].

TSP activities: 168 tribal families of Gram Panchayet: Arrah at Chhatna block and Gram Panchayet: Mankanali at Bankura-II block & Gram Panchayet: Bivarda at Taaldangra block of Bankura district and Gram Panchayet: Rautari of Chakdaha block & Gram Panchayet: Fatepur of Haringhata block of Nadia district of West Bengal has been identified for forage demonstration under TSP programme, 2016-17. Distribution of seeds of hybrid maize seed (cv. Nisha 3503), Planting materials of Bajra-Napier hybrid (cv. CO 3 & CO 4), grass pea (cv. Nirmal & Ratan) and Toria (cv. B-54) seeds, fertilizers, *Rhizobium* culture, plant protection chemicals (viz. insecticides and fungicides) etc. were done among tribal families for improving their livelihoods. Forage crops condition was very good under TSP programme.

Seed production

Crop	Variety	Nucleus seed	Breeder seed
Ricebean	Bidhan Ricebean-1	4.6 kg	32 kg
	Bidhan Ricebean-2	3.2 kg	113 kg
Job's Tear/ Coix	Bidhan Coix-1	1.1 kg	25 kg

TFL seed production

Lathyrus (cv. Nirmal) – 55 kg

Lathyrus (cv. Ratan) – 45 kg

Oat (cv. Kent) – 51 kg

Meeting cum Training conducted for Tribal farmers during *rabi*, 2016-17: 3 (Three)

Three tribal farmers' training programmes were organized in selected tribal villages *i.e.*

Kalikapur, Rautari and Panch Kahania.

Management of BN hybrid

- BN hybrid (CO-3) : 3500 cuttings (Approx.)
- BN hybrid (CO-4) : 4500 cuttings (Approx.)

Externally Funded Project: 1 (Private Company)

Participated in seminar/farmers' meeting etc:

- Farmers Meet & training on forage production technology with tribal farmers as well distribution of inputs at Kalikapur (Taldangra block, Bankura district), Rautari (Chakdaha block, Nadia district) and at Panch Kahania (Haringhata block, Nadia district).
- Participated in 'Annadata' programme of E-TV Bangla on 'Forage production programme'.
- Participation in International symposium on 'Eco-efficiency in agriculture & allied research' organized by CWSS, BCKV at FACC, BCKV, Kalyani, Nadia during January 20-23, 2017.
- Participation in National symposium on 'Agriculture and food production today and tomorrow' organized by The Agricultural Society of India at Institute of Agricultural Science, University of Calcutta on February 22-23, 2017.
- Participation in National seminar on 'Maximizing fertilizer use efficiency and environmental health for posterity' organized by The Society for Fertilizers and environment at Ramakrishna Mission Vivekananda University, Narendrapur on March 8, 2017.
- Participated as resource person in 6th KRISHI MELA at Ramakrishna Mission, Kamarpukur, Dist.- Hooghly on 8th February, 2017.
- Participated in Workshop cum Training Programme on "Statistical Tool for Research Data Analysis (Series II)" organizing by SASAA, Department of Agricultural Statistics, BCKV from 29.05.2017 to 09.06.2017 (for two weeks).

Awareness development on 'seed production' of forage crops: Seed production of oat (cv. OS-6 & Kent) and lathyrus (cv. Nirmal & Ratan) by farmers for their own uses.

Transfer of technology

- For popularizing as an under canopy legume crop for nutrient enrichment and fodder production in the litchi, mango, banana and guava orchards, distributed seeds of berseem (cv. Wardan & Mescavi) and lathyrus (cv. Nirmal & Ratan) to the resource poor farmers
- Introduced berseem and oat as green forage crop and lathyrus as 'paira' crop in Taldangra block area in jangal mahal area of Bankura district under red and laterite zone of WB.
- Given trainings to the farmers, SHGs of different districts of West Bengal.
- Participated in Agricultural Fair (*Krishi Mela*) conducted by KVK (Nadia) at Gayeshpur and KVK (Hooghly) at Chinsurah under BCKV.
- Dissemination of forage technology by distributions of leaflets among the farmers
- Distributed the planting material (cuttings) of BN hybrid (Variety: CO 3 & CO 4) to the resource poor farmers in different districts, like Bankura, Purulia, Paschim Medinipur (West Midnapur) districts in Western Part of West Bengal and Nadia, North-24 PGS, Cooch Behar, Hooghly and Burdwan districts etc.
- popularizing maize as baby corn cum green forage/ green cob cum green forage as well as grain cum stover production by distributing hybrid maize seed (cv. Nisha 3503) to the resource poor tribal farmers

Popular articles: 1 (in bengali)

AICRP on Forage Crops & Utilization, CCS HAU, Hisar, Haryana

Research Articles

- Jindal Y, Phogat DS, Joshi UN and Mall AK (2016). Forage maize genotypes performance for fodder yield and its attributes with quality parameters at Hisar and all-India level. *Forage Res.*, 41 (4): pp. 208-211.
- Jindal Y, Arora RN, Phogat DS, Pahuja SK, Midha LK, Gandhi SK and Joshi UN (2016). OS 377– A new forage single-cut oat variety for the central zone of India. *Forage Res.*, 41 (4): pp. 242-245.
- Godara AS, Satpal, Joshi UN and Jindal Y (2016). Response of berseem (*Trifolium alexandrinum* L.) genotypes to different phosphorous levels. *Forage Res.*, 42 (1): pp. 40- 43.

Paper presented in seminar/symposia etc.

- 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. 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

Souvenirs

- Jindal Y and UN (2016). Sustainable utilization of forage resources for animal and human nutritional security” in Haryana. Paper published in Souvenir during “National Group Meet” (*Kharif* 2015) of AICRP (Forage Crops) at SKUAST, Srinagar held from 16-18th May, 2016 pp 76-88.

Booklets

- Pahuja SK, Khatri RS, Phogat DS, Sheoran RS, Jindal Yogesh, Arya, Satyawan, Kumari, Pummy, Satpal, Panchta, Ravish and Tokas Jayanti (2016). *Chara faslon ki unnat prodyogiki* (Package of Practice on different forage crops). Forage Section, Department of Genetics and Plant Breeding, CCS Haryana Agricultural University, Hisar (p-36).
- Pahuja, SK, Khatri RS, Phogat DS, Sheoran RS, Jindal Yogesh, Arya Satyawan, Kumari Pummy, Satpal and Panchta Ravish (2016). *Chara faslon ki unnat kismain*. Forage Section, Department of Genetics and Plant Breeding, CCS Haryana Agricultural University, Hisar (p-32).
- Pannu RK, Walia RK and Jindal Y (2015). Significant Achievements – COA for the year 2014-15. Published by College of Agriculture, CCS HAU, Hisar (p-108).

Technical Bulletins

- Phogat DS, Jindal Yogesh, Panchta Ravish and Pahuja SK (2016). *Lobia - grmi ke mausam ka hara sona* Tech. Bull. TB/2015-16/FC/04. Forage Section, CCS HAU, Hisar.
- Jindal Yogesh, Phogat DS, Sheoran RS and Pahuja SK (2016). *Berseem - sardiyo ka behtareen hara chara* Tech. Bull. TB/2015-16/FC/05. Forage Section, CCS HAU, Hisar.
- Phogat DS, Jindal Yogesh, Sheoran RS and Pahuja SK (2016). *Jai - sardiyo ka badia hara chara* Tech. Bull. TB/2015-16/FC/06. Forage Section, CCS HAU, Hisar.
- Sheoran, RS, Sajjan Sihag, Pummy Kumari, Satpal and S.K. Pahuja (2016). *Hare chare se silage evam hay banana*. Tech. Bull. TB/2015-16/FC/07. Forage Section, CCS HAU, Hisar.
- Sheoran, R.S., Satpal, Pummy Kumari and S.K. Pahuja (2016). *Pashuon ko poora saal hara chara uplabdh karwane hetu fasal chakar*. Tech. Bull. TB/2015-16/FC/03. Forage Section, CCS HAU, Hisar.

Popular Articles

- Sheoran RS, Satpal and Jindal Yogesh (2016): Makchhari: der tk hara chara dene wali fasal (मकचरी: देर तक हरा चारा देने वाली फसल) in Haryana Kheti: 49 (5): 29
- Jindal Yogesh and Pahuja SK (2016): Shushk evm ardh shushk kshetro ke liye – Anjan Ghaas (शुष्क एवं अर्ध शुष्क क्षेत्रों के लिए - अंजन घास) in Haryana Kheti: 49 (5): 30
- Jindal Yogesh and Pahuja SK (2016): Napier Bajra sankar ghaas (नेपियर बाजरा संकर घास) in Haryana Kheti: 49 (5): 32

Sheoran RS and Satpal (2016): *Hare chare ke liye makka ki kheti. Haryana Kheti*: 49 (5): 30.
 Satpal, Pahuja SK, Sheoran RS (2016) *Garmiyon va kharif mein hara chara utpadan. Haryana Kheti* 49 (5): 4.
 Satpal, Sheoran RS and Kathwal R (2015). *Rabi ki chara faslon ka prabandhan. Haryana kheti* 48(12) : 9-10.

Pamphlets (in Hindi) were published which were distributed to the farmers:

- *Berseem - sardiyo ka behtareen hara chara*
- *Jai - sardiyo ka badia hara chara*
- *Jowar ki unnat kismo ki smagra sifarishe*
- *Lobia - grmi ke mausam ka hara sona*
- *Guar - barani kheti ka sona*
- *Hare chare se silage evm Hay banana*
- *Pashuon ko pura saal hara chara uplabdh krvane hetu fasal chakra*

Booklets published and distributed to the farmers:

- *Chara faslon ki unnat prodyogiki (Package of Practice) on different forage crops*
- *hara faslon ki unnat kismain*

Extension Activities

- Interacted with farmers and dignitaries during “Krishi Mela” in Sept. 2016
- 1st Haryana Agri. Conclave and Expo held on March 22-23, 2017.
- Interacted with state officials during AO’s workshop in Oct. 2016 and April 2017
- Delivered lectures during “Monthly T & V” schedules.
- Delivered a lecture on “**Rabi Fodder Crops**” to a group of farmers from Vrindavan organized by RSFPD, Govt. of India, Hisar on 28.3.2017.

Fodder Technology Demonstrations (FTDs): Sixteen FTD’s on Berseem varieties HB1 and HB 2

RKVY Project: “Farmers’ trainings on scientific cultivation of forage crops to ensure quality seed production” for 2 years (2015-16 and 2016-17).

- During 2015-16 & 2016-17, twenty farmers trainings each year were imparted to 2400 farmers (1200 each year) in twenty districts of Haryana.
- Farmers were provided with pamphlets on cultivation of different forage crops. Farmers took keen interest in the deliberations and they were given improved technology for seed production in different forage crops.
- Farmers were also provided the seed of improved varieties.

Additional Duties of Dr. Y. Jindal

- Incharge, 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.

Courses under teaching:

Course No.	Course title	Name of the teacher
PB 201	Principles of Plant Breeding	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	Dr. R.S. Sheoran

List of students Guided

Ph.D. /M.Sc. Students being supervised

S. N.	Name of student	Major adviser	Degree
1.	Parbhat Kumar	Dr DS Phogat & Dr Y Jindal	Ph.D.
2.	Arpit Gaur	Dr Y Jindal	Ph.D.

AICRP on Forage Crops & Utilization, CSK HPKV Palampur, H.P.

Research articles

- Banyal DK, Sood VK, Singh Amar and Mawar Ritu. 2016. Integrated management of oat diseases in north-western Himalaya. *Range Management & Agroforestry* 37 (1) : 84-87
- Chaudhary Jaya and Banyal DK 2016 Study of Inheritance of resistance to powdery mildew of pea using different isolates of *Erysiphe pisi*. *Indian Phytopathology*. 69 (4s) : 116-120
- Chaudhary Jaya and Banyal DK 2016. Study of slow mildewing components of powdery mildew of pea caused by *Erysiphe pisi*. *Plant Disease Research*. 31 (2): 138-141
- Chaudhary Jaya and Banyal DK 2017. Evaluation of pea genotypes for resistance against powdery mildew caused by *Erysiphe pisi*. *Indian Phytopathology*. 70 (1): 69-74
- Guleria Gunjan and Naveen Kumar. 2017. 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* (ISA/2016(05)/107)
- Katoch Rajan and Naveen Kumar. 2017. Effect of Seasonal Variation in biochemical composition of fodder trees prevalent in the mid-hill region of Himachal Pradesh. In *Range Management and Agroforestry* (Accepted).
- Katoch Rajan and S K Singh. 2016. Biotechnological interventions for improvement of plant nutritional value: From mechanism to application. In *Phytonutritional improvement of Crops*, Nouredine Benkeblia eds. Wiley press, Southern Gate, Chichester, West Sussex.
- Sharma Sanjay, Ankita, SS Rana and Naveen Kumar. 2017. Evaluation of multi-nutrient extractants for determination of available P, K and micronutrient cations in soil. *Journal of Plant Nutrition*. (Accepted)
- Sood V. K., Dhiman Rishu, Pathania Anju, Bhandari J.C and Chaudhary H. K. 2016 Genetic diversity based on multivariate analyses for breeding strategies in *Trifolium*. *Range Management and Agroforestry* 37 (2) 175 - 180

Paper in Souvenir

- Banyal DK, Katoch Rajan, Sood VK and Kumar Naveen. 2017. Diseases of important forage crops and their management. Souvenir, National group meet – Kharif 2017 held at CSK HPKV Palampur on 18-19 April, 2017 p 87-96
- Katoch Rajan, Kumar Naveen, Sood VK and Banyal DK. 2017. Major antinutrients in tree fodder of Himalayan region. Souvenir, National group meet – Kharif 2017 held at CSK HPKV Palampur on 18-19 April, 2017 p 97-102
- Kumar Naveen, Sood VK, Banyal DK and Katoch Rajan. 2016. Pasture and grassland in Indian Himalayas- present status, improvement strategies, constraints and future prospects. Souvenir, National group meet - Rabi 2016 held at TNU COA Vellayani, Kerala on 5-6th September, 2016 p 74-78
- Kumar Naveen, Sood VK, Banyal DK and Katoch Rajan. 2017. Farming in North Western Indian Himalaya. Souvenir, National group meet – Kharif 2017 held at CSK HPKV Palampur on 18-19 April, 2017 p 1-9
- Sood VK, Kumar Naveen, Katoch Rajan Banyal DK Ankita and Devi Rajni. 2017. Improvement of Setaria: current status and future prospects. Souvenir, National group *Sharma* meet – Kharif 2017 held at CSK HPKV Palampur on 18-19 April, 2017 p 10-19

Pamphlets: 3

Radio talk: 1

Association in Adhoc Projects

- Scientists are associated in 5 Ad hoc projects
- One new project proposal has been submitted

Recognitions & Awards

Dr. Naveen Kumar received

- Fellow Award 2016- Range Management Society of India
- Reviewer Excellence Award 2016 -Indian Journal of Agricultural Research & Legume Research-An International Journal
- Reviewer Excellence Award 2016 -Indian Journal of Animal Research & Asian Journal of Dairy and Food Research

Courses Taught

Course No	Course Title	Cr. Hr.
Agron 510	Agroforestry and Agrostology	2+1
Biochem.602	Advanced Mol. Biology	2+0=2
Biochem.621	Genomics, Proteomics & Metabolomics	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 121	Livestock production and Management	1+1
PI Path 511	Chemicals in Plant Disease Management	2+1=3

Seminar/ Workshop/ Group meeting/ Training

- Organized National Group Meet of All India Coordinated Research Project on Forage Crops & Utilization from 18-19 April, 2017 at CSKHPKV, Palampur.
- Drs. Naveen Kumar, V K Sood, D K Banyal and Rajan Katoch. Attended seminar on “Application of radioisotopes and radiation technology in food, agriculture, environment, healthcare and industry” organized by GCNEP, DAE (GOI) and CSK HPKV, 29-30 May 2017

Students guidance: M Sc. - 7 , Ph. D. 6- (as major advisor) ; 22 (Member advisory committee)

Forage technology consultations: 8

Lectures delivers to farmers and development officers: 3

Tribal Sub plan: Fifty families in Gont village (Nanahar) in Baijnath block of Kangra District have been supplied with inputs like UMM Bricks, mineral mixture for livestock; and implements like sickle. Planting material of Lemon and mulberry has also been procured.

Linkage with NGOs:

- CORD–“Chinmaya Organisation of Rural Development”, Tapovan, Dharamshala
- Society for Environmental & Rural Awakening (ERA), Khudian, Distt Kangra

Project Monitoring: AICRP (FC) of Rabi 2016-17 at AAU Jorhat, CAU Manipur

Linkage with other programmes and institutes:

- IVRI Regional Research Station Palampur
- AICRP (IFS)
- AICRP (Agroforestry)

Resource generation (Mega Seed Project): Rs. 4, 92,904/- (FY 2016-17)

AICRP on Forage Crops & Utilization, SKRAU, Bikaner

Publications

Journals

Kumawat SM, Arif M, Shekhawat SS and Kantwa SR (2016) Effect of nitrogen and cutting management on growth, yield and quality of fodder pearl millet (*Pennisetum glaucum* L.) cultivars. *Range Mgmt. & Agroforestry*, **37** (2): 207-213.

Books/ book chapters/ Souvenirs

Shekhawat SS and Kumawat SM (2017). Rabi me jai avam rijka se hara chara utpadan. Centre for Forage management, ARS, SKRAU, Bikaner.

Shekhawat SS and Kumawat SM (2017). Improved pasture establishment technology in arid region of Rajasthan. In: Souvenir, edited by Naveen Kumar, V. K. Sood, D. K. Banyal and Rajan Katoch, CSK HPKV, Palampur (H.P.); pp: 65-67.

Shekhawat SS (2017). New varieties of forage crops and grasses for North West zone of India and Rajasthan state. In: Souvenir, edited by Naveen Kumar, V. K. Sood, D. K. Banyal and Rajan Katoch, CSK HPKV, Palampur (H.P.); pp: 23-24.

Seminar/ Symposium

Dr. S. M. Kumawat participated in one National Conference held at Gwalior (MP), organised by RMSI, IGFRI, Jhansi and RMVSAU, Gwalior during March 3-4, 2017.

Student (s) guided and teaching work

- Dr. S. S. Shekhawat - one M. Sc. (Ag.) and two Ph.D. students as Major Adviser, . two Ph. D. students member of Advisory Committee
- Dr. S. M. Kumawat: Ph.D (01) in progress;

FTDs conducted

- 15 fodder demonstrations which included lucerne and oat.
- Demonstration of forage technology to farmers in Western Regional Agricultural Fair of ICAR, New Delhi held at SKRAU, Bikaner during February 18-20, 2017.

Training conducted for farmers/ NGO/Govt. Officials

1. Farmers were given training for green fodder production in Rabi season in November, 2016
2. Farmers' training for quality seed production organised with collaboration of Department of Plant Breeding and Genetics, Bikaner on March 23, 2017.

Details of seed/ planting material sold: Green fodder sale: 96 quintals = Rs. 19200/-

Other activities of Dr. S. S. Shekhawat

- University Head of Department of Plant Breeding and Genetics, SKRAU, Bikaner.
- Member of Academic Council of SKRAU, Bikaner.
- Breeder Incharge of seed production at KVK, Abusar, Jhunjhunu.
- Member of Board of Studies of Faculty of Agriculture of SKRAU, Bikaner.
- Member of Advisory Committee for RAWE (Rural Agricultural Work Experience) at College of Agriculture, SKRAU, Bikaner.
- Plan has been made and meeting was arranged with a Gaushala Samiti at Sardarsahar, (Churu district) to develop pasture on 500 bigha land. Sewan grass seed will be provided free from Agricultural Research Station, Bikaner for this purpose

AICRP on Forage Crops & Utilization, CAU, Imphal (Manipur)

Publications:

- **Research papers** : 2
- **Bulletins**: 1
- **Popular articles** : 1

Leaflets

- CAU recommended Perennial fodder Signal grass for the state of Manipur and similar situation of North East Hill Region” prepared by AICRP -FC CAU, Imphal centre.
- CAU recommended Perennial Napier Hybrid variety Co-4 for the state of Manipur and similar situation of North East Hill Region” prepared by AICRP -FC CAU, Imphal centre.

Radio/ TV talks: 2

FTDs conducted

Season	Year	Crop (variety)	No. of FTDs conducted	Yield farmers practice	Improved (range) yield
<i>Kharif</i>	2016-17	Rice bean var. Bidhan-I & Napier (CO-4)	20	345q/ha	385 q/ha
<i>Rabi</i>		Oat var. JHO-822	20	395q/ha	420 q/ha

TSP conducted: 180 beneficiaries Inputs provided Seeds, fertilizers, knapsack sprayers, PP chemicals etc.

M. Sc /Ph. D students guided: Ph. D. (Agri.) as Co-guide -01; M. Sc. (Agri.) as Major Guide -01

Courses taught

Course B. Sc. (Agri.)/ M. Sc. (Agri.)/ Ph. D. (Agri.)	Number of topics
Fodder crops, Weed Management, Organic farming, Dryland agriculture.	35

Revenue generated: Selling of Napier cutting & signal grass **Rupees 40, 000**

Linkage setup

- Collaborating with KVKs, Department of Veterinary & Animal Husbandry, Govt. of Manipur, Department of Agriculture, Govt. of Mizoram, All Manipur Milk producers Co-operative Union Ltd and Manipur Milk producing NGOs.

Transfer of Technology

- Interaction programme with farmers on “Production of fodder perennial grass, legumes, cereals crops under rainfed conditions of Manipur” and production of fodder Oat was organized regularly during *kharif* and Rabi season.
- Regularly attended as Resource person in training organized on Management practices & cultivation of green fodder to enhance dairy Farmer. Organized by Directorate of Extension Education, CAU, Imphal and ICAR NEH Region.
- Regular interaction with the Manipur dairy and Milk Producers Co-operative Union Ltd, NGOs, KVKs, govt. staff of Department of Animal Husbandry.
- Resource Person for delivering lecture on Crop Production Technology in Ground organized by DOR, CAU, Imphal.
- Resource person in Interaction programme with YUV (NGO) dairy farmers of Manipur.
- Regularly participated in NE Agri fare organized by CAU, Imphal.
- Regularly organized Farmers field day.
- Programme on transferring of fodder technology through local TV and news paper
-

Inputs supplied

- Inputs like seed, weedicide, knapsack sprayer, Napier hybrid cutting, urea; SSP, MOP, Plant protection chemical etc were supplied to TSP beneficiaries.
- Fodder Oat seed, Rice bean seed, Maize seed, Napier hybrid cutting, Signal grass, chemical fertilizers etc were supply to FTDs beneficiaries.
- Any type of fodder seed (seasonal, perennial, perennial cutting etc) are made available

Success story developed

Round the year green fodder production: Many farmers have adopted improved fodder production technologies developed by AICRP-FC&U, CAU, Imphal and has benefited dairy farmers in improving their economy. During 2015, Shri Rameswor, aged 39, graduate in arts from Kwakta of Bishnupur district decided to start dairy farming as an enterprise and consulted AICRP on Forage Crops & Utilization, Directorate of research, Central Agricultural University, Imphal for technical know-how on fodder cultivation. Scientist and Staffs of the centre visited his farm to take the stock of resources available in his farm, such as type of soil, irrigation source, land topography, labour availability and daily fodder requirement. Hence, fodder plan was prepared by incorporating high yielding annual and perennial fodder crops as per the availability of area and soil conditions.

High yielding Napier hybrids (Co-3 and Co-4) were recommended to plant with a spacing of 60 X 60 cm in fertile part of his land and Guinea grass and signal grass was recommended for moderately fertile part. Seasonal and high yielding fodder variety were also recommended according to the season and requirement. Planting of rooted slips and seed were demonstrated to his farm by the scientists with close supervision of the planting activity as it is the most important step for maintaining persistence and good yield in perennial crops. He was guided about time of planting, dose and timely fertilizer application and inter-cultivation aspects of the crops. Technical know-how on cutting management to ensure green fodder throughout the year was given. With this, he is now able to harvest on an average 3 q green fodder yield daily. As a legume component, he was advised to take up rice bean along the field boundary. He started with 5 dairy cattle and gradually increased the herd size. He has now constructed new animal shed to accommodate about 40 animals.

“I am now confident in managing dairy farm, due to availability of green fodder round the year and I am planning to further increase my herd size” he adds.

AICRP on Forage Crops & Utilization, Vellayani

Publications

Thomas Usha C, Abraham Mareen and Ganesh Dhanya (2017). Impact of additives on silage quality of fodder grasses. *Trends in biosciences*. 10(2): ISSN 0974-8431,664-667

Thomas Usha C and Ishrath PK (2017). Agase- Nutritious fodder crop. *Karshakan* .pp 74-76 (Malayalam)

Student(s) guidance

M.Sc. (Agri.) in Plant Breeding and Genetics – 2;

Ph.D in Plant Breeding and Genetics – 3,

M.Sc. (Agri.) in Agronomy-2

Teaching- Courses Dr. Mareen Abraham

BSc (Ag) courses - Principles of seed technology (1+1)

PG courses - Breeding of major crops (3+0); **Genetics** in crop improvement (2+1);

Genomics and proteomics (2+1)

Dr. Usha C Thomas

BSc (Ag) courses- Irrigation and water management (1+1); Field crops II (1+1)

Trainings/ workshops organized-

- Dr. Usha C. Thomas - course coordinator of two month MANAGE Agro clinic and Agri-business Training during Jan 30- March 31, 2017 at College of Agriculture, Vellayani
- One day training was conducted on forage cultivation and preservation techniques for the Manage- ACABC trainees on March 3, 2017. Number of trainees- 16

AICRP on Forage Crops & Utilization, IGKV, Raipur

Externally funded projects: Viswavidhyalaya fund

Projects	Title	PI	Budget
AGRON -35	Round the year fodder availability cropping modules for 19 KVK's	S. K. Jha	0.50 lakh
AGRON-42	Hydroponics fodder production, evaluation, standardization and demonstration under Chhattisgarh condition.	S.K. Jha	1.00 lakh
GPB- 85	Exploration, Maintenance, evaluation and storage of forage germplasm of Chhattisgarh	Mayuri Sahu	0.40 lakh
AGRON -33	Evaluation of ago-techniques for cassia tora production in up and waste land	S. K. Jha	0.20 lakh

Research Guidance

Subject	No of student registered
Agronomy (Dr S. K. Jha)	3 (Major advisor) 2 (Co-advisor)
Plant Breeding (Dr. Mayuri Sahu)	2 (Major advisor) 1Ph.D(Co-advisor)

Teaching

UG/PG/Ph.D courses		
1.	PG (Dr S. K. Jha)	Agronomy of major cereals and pulse crop
2.	PG (Dr S. K. Jha)	Practical Crop Production II
3.	UG (Dr. Mayuri Sahu)	Seed production technology
4.	PG (Dr. Mayuri Sahu)	Biotechnology for Crop Improvement

FTD's

- Total 23 FTD conducted during *Rabi* 2016-17. 12 FTD on oat and 11 FTD on berseem were conducted in Arang and Dhamdha block of Raipur and Durg districts.

TSP activities

- In *Rabi* 2016-17 total 30 demonstrations are conducted out of which 15 on Oat and 15 on Berseem were carried out to demonstrate the fodder production technology among the tribal farmers of Kanker, Garyband and Koriya districts of Chhattisgarh.
- Small implement like hand hoe (105) and improved sickle (105) are procured and it will be distributed to small and marginal farmers of Kanker, Gariyaband, Narayanpur districts of Chhattisgarh.
- Extension bulletin on चारा फसल उत्पादन की उन्नत तकनीक published for the distribution of tribal farmers

Seed production

- Perennial sorghum COFS-29 -30 kg TL

Radio Talk

- “*Khari fine* Chara Phasalo Ki Kheti” Programme “Naya daur Nayi batein” Recording date 15-07-2016 Broadcast date : 11-07-2016

Capacity building

- Dr. S. K. Jha participated in training programme on “ **Participatory Training Management Skills**” organized by Extension Education Institute Anand (Gujarat) during from 2nd -4th February.2017 at IGKV, Raipur

Rashtriya Kishan Mela Chhattisgarh -2017

- AICRP on FC & U participated in **Rashtriya Kishan Mela Chhattisgarh -2017** held at IGKV, Raipur during 27-31 January,2017

Important visitors

- Agriculture Production Commissioner, Chhattisgarh Government
- Hon'ble V.C. IGKV, Raipur along with Directors, Deans, PC, SMS and scientist

AICRP on Forage Crops & Utilization, PJTSAU, Hyderabad

Research papers

- 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.
- Susheela R, Shanti M, Shashikala T, Chandrika V and Anuradha M (2016) Growth and yield of fodder pearl millet (*Pennisetum glaucum* L.) genotypes as influenced by nitrogen levels under rainfed condition. *J of research PJTSAU* 44 (1&2):57-59
- Sunita Devi KB, Balaji Naik R, Shanti M and Soumya B (2016) Relative performance of different food and forage based cropping systems in semi-arid tropics. *Progressive Agriculture* 16(2):156-161
- Srinivas B, Shanti M and Satish Kumar T (2016) Effect of sewage waters on production and quality of various forage crops under different nitrogen levels. *Green Farming* 1(1): 63-68

Popular articles

- Susheela R, Shanti M, Anuradha M and Shashikala T. (2017) Hedge Lucerne cultivation *Vyavasayam* April 2017 issue
- Susheela R, Shanti M, Anuradha M and Shashikala T (2017) Perennial fodder jowar *Vyavasayam* May 2017 issue

Conferences attended

- Susheela R, Chandrika V, Shanti M, Anuradha M, Loka Reddy K (2016) Fodder yield and quality of different forage crops as influenced by irrigation levels during lean period. 4th International Agronomy Congress, 22-26 Nov. 2016, New Delhi, India held during 22-26 Nov. 2016
- Shanti M, Susheela R, Anuradha M and Shashikala T (2016) Studies on effect of varied nitrogen levels on yield and quality of sweet sorghum genotypes. 81st ISSS Annual Convention at Rajmata Vijayaraje Scindia Krishi Viswavidyalaya, Gwalior, M.P. 19th to 26th, October 2016
- Susheela R, Chandrika V, Shanti M, T Shashikala, Balazzii Naaiik RVT, Anuradha M (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. held on 2nd May, 2017
- Shanti M, Susheela R, Anuradha M and Shashikala T (2017). Evaluation of sorghum genotypes for Fodder yields and quality In: National conference on 'Agronomic approaches for climate resilience in agriculture' at RARS, Nandhyal, A.P. 2nd May, 2017
- Shanti M, Susheela R, Anuradha M and Shashikala T (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. 3 & 4th, March, 2017

Meetings attended

- Dr. T. Shashikala - Pre-ZREAC meeting at RARS, Palem in Plant Breeding on 22.3.17
- Dr. M. Shanti and Dr. R. Susheela - Pre-ZREAC meeting at RARS, Palem in Agronomy, Soil Science, Engineering on 25-3-17 & 27-3-17
- All scientists of this centre participated in review meeting conducted by our Hon'ble Vice-Chancellor Dr.V.Praveen Rao garu to review all the activities of the centre on 18.02.17

Scientists visit to other centres

- 6th - 7th February 2017: Monitoring of trials at Coimbatore centre by Dr T. Shashikala
- 8th -10th February 2017: Monitoring of trials at Mandya centre by Dr. R. Susheela

Radio talks

Name	Title of talk/ programme	Date of broadcast	From
Dr. T. Shashikala	Vesaviki anuvyna pasugraasaalu	25.1.17	AIR, Hyd
Dr. M. Shanti	"Choudu nelalalo pasugraasala pantala saagu"	27.1.17.	AIR, HYD
Dr. R. Susheela	Bahu varshika jona-COFS-29 sagu	26.5.17	AIR, HYD

TV Programmes

Scientist	Title of programme	Channel	Telecast Date
Dr.T.Shashaikala	Moti Bajra	DD	25.5.17
Dr.T.Shashaikala	Pasugrasala saagu	Express TV	20.5.17
Dr.R.Susheela	Vesavilo pasugrasa utpatti	TV 5-live	7.4.17
Dr.T.Shashaikala	Pasugrasala saagu	DD yadagiri	2.3.17
Dr.M.Shanti	Gorrelaku meta earpatlu	DD yadagiri	27.6.17
Dr.M.Shanti	Vesaviki pasugrasala saagu	DD Yadagiri, live-in	29.3.17
R.Susheela	Fodder production for summer	Electronic wing Recording (EWR)	30.3.17
R.Susheela	Summer Bajra cultivation	EWR	29.3.17
Dr.T.Shashaikala	Moti bajra	EWR	29.3.17
Dr.M.Shanti	Chetla pasugrasalu	EWR	28.3.17
Dr.M.Shanti	Bajra napier hybridlu	HMTV recording	20.9.16

FTDs: Total 40 [Lucerne – 10; Hedge lucerne -10; Oats - 20]

Tribal Sub Plan: Organized two field days with 10 beneficiaries. Training was imparted on Perennial fodder establishment, Sheep distribution in Budidagattu Thanda Nalgonda Dist

Important persons visit

- Dr.A.V.Ramana Associate Director of Research, STZ, on technical inspection.

Student Guidance/Teaching

S.No	Major advisor	Minor advisor	Courses taught
Dr. T. Shashikala	1	-	-
Dr. M. Shanti	-	2	1
Dr. R. Susheela	2	-	-

Guest lecturers: 8 lectures to various training courses

AICRP on Forage Crops & Utilization, AAU, Anand, Gujarat

In Souvenirs

Parmar HP, Saiyad MR and Padheria DR (2017). Lucerne breeding : Problems and prospects. Published in Souvenir during NGM *Kharif*-2017 held at Palampur. Page 15-18.

Parmar HP, Saiyad MR and Padheria DR (2017). Emasculation and pollination technique in Forage crops. Published in Souvenir during NGM *Kharif*-2017 held at Palampur.

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: Total 10 - Lucerne (Anand-2) – 5; Oat (Kent)- 5

Externally funded project: Two

- Development of pearl millet forage hybrid and pearl millet napier (PN) hybrid for high biomass and quality suited for different agro climatic zones of India (CGIAR – Dry land cereals) (Rs.1.74 Lakh).
- "Quality Seed Production in Fodder Crops" under Fodder Development Programme-RKVY (Rs.10.00 Lakh)

Extension activities

- "Krushhi Mahotsav-2017" at Nadiad, Bavlia, Chhotauaipur, Dahod and Godhra.
- Delivered lectures in training programme of women organized by R.B.R.U., AAU, Anand.
- Lectures in *Rabi* Pre-seasonal training under T & V programme.

Attended Workshop / Training/ Meeting

- Dr. H.P. Parmar attended 45th Regional Coordination Committee Meeting on Fodder Crops held at Dhamrod (Surat) on 22/05/2017.

AICRP on Forage Crops & Utilization, GBPUA&T, Pantnagar

Publications

Journals

- Ramu N, Pal MS and Nain AS 2016. Estimation of current fallow using remote sensing technology in Udham Singh Nagar of Uttarakhand. *International Journal of Basic & Applied Agricultural Research* 14(3): 257-260.
- Pal MS and Jain SK 2017. Effect of bio-fertilizers on productivity and profitability of berseem (*Trifolium alexandrinum*) in Tarai region of Western Himalaya. *Indian Journal of Plant & Soil* 4(1): 5-8.
- Panday Geeta, Prasad R, Prasad Birendra and Chauhan P. 2015. Coefficient of variation, heritability, genetic advance and variability for Rice bean (*Vigna umbellata* (thumb)) genotypes under mid hill condition of Uttarakhand. *J of Applied and Natural Sciences*, 7(2):794-798.
- Kushwaha UKS, Indra Deo, Jaiswal JP and Prasad Birendra 2017. Role of Bioinformatics in crop improvement. *Global Journal* 17(1):12-23
- Ruwali Y and Verma JS. 2016. Comparative suitability of phenotypic expressions and microsatellite markers in classifying Oat (*Avena sativa* L.) genotypes. *Range Mgt. & Agroforestry*. 37 : (2) : 167-174
- Prasad Shambhoo and Verma JS. 2016. Genetic analysis of morpho-metric traits in cowpea varieties. *Jr. Hill Agric.* 7(2) : 191-194.
- 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

Books/ Book Chapters

- Birendra Prasad and Kumar Udit. 2016. Innovative Agriculture Techniques and Practices. BioTech Books, New Delhi, pp 417, ISBN 978-81-7622-382-9.

Conferences/Symposia etc.

- Pal MS. 2017. Diversification of agriculture through different cropping systems. In: National Conference on Diversification of Agriculture for Food & Nutritional Security on 27 & 28 Feb 2017 at ITM University, Gwalior (MP),
- Pal MS. 2017. Resource Efficient Agriculture Production Systems. In: National Conference on Farmers' Centric Agri-Innovations for Sustainable Development, held on 24 & 25th March 2017 at CSAUAT, Kanpur.

ICAR/ University sponsored Training:

- Pal MS (2016). Precision resource management for enhancing crop productivity and quality In: Efficiency Centric Agro-management for Food and Nutritional Security" w.e.f. 28.09.2016 to 18.10.2016 (dated 30-5-16). Department of agronomy, GBPUAT, Pantnagar.
- Pal MS (2017) Resource Efficient Agriculture Production Systems. In: Ecology for Sustainable Agriculture w.e.f. 9 Feb to 1 March 2017, Department of Agronomy, GBPUAT, Pantnagar.

Popular Articles

- Pal MS (2016) Cultivation of Oat (*Avena sativa* L.) (Hindi). *Kisan Bharti* 48 (3); 29-34
- Pal MS and Jain SK (2016). Increase milk production from green fodder of berseem. *Kisan Bharti* 49 (1): 38-41.
- Pal MS. (2017) How to grow bajra for green fodder (हरे चारे हेतु बाजरा का अधिक उत्पादन कैसे लें). *Kisan Bharti* 48(8):18-21.
- Prasad Birendra and Kumar Amarjeet (2017) Seed Production Technology of forage Cowpea. *Indian Farmers Digest*, June 2017, 50(6):19-20.
- Verma JS and Shambhoo Prasad. 2016. Forage cowpeas for quality green fodder. *Indian Farmers' Digest* 49 (5) : 42-45

Forage Technology Demonstrations: 65 FTDs on berseem, oat and berseem+oat were conducted during Rabi-2016-17 at villages Khatola (Gadarpur block), Rampur-Tongia (Kotabagh block) and Shantipur (Kichcha block) of U S Nagar (Uttarakhand) during rabi season of 2016-17. The seed and improved fodder technologies were given to the farmers. The outcome of the fodder production was very good and farmers were very happy with seed and production.

TSP activities: Total 130 tribal families were selected under TSP activities in tribe dominated villages i.e. Kanpura, Kaithulia, Matiha, Bichua-Tukri (Sitarganj block) and Khatola (Rudrapur block) of U S Nagar (Uttarakhand). Total 201 field demonstrations were conducted during *Rabi/Summer-2016-17*.

S. N.	Name of villages	Number of demonstrations		
		Berseem	Oat	Maize (Sumer)
1	Kanpura	26	-	12
2	Matiha	36	-	25
3	Kaithulia	20	-	15
5	Tukri	19	20	-
6	Khatola	25	13	-
	Total	126	23	52

Radio Talks =08

- Dr Mahendra Singh Pal = 07 Dr B Prasad = 01

Course Taught

Dr Mahendra Singh Pal

- Agronomy of Rabi crops (APA 605)
- Soil Conservation and Watershed Management (APA 615)

Dr J S Verma

- Hybrid Seed Production (AGP/AST-701) 2(1-0-3)
- Advances in Seed Science Research (AST-705) 1(1-0-0)

Dr B Prasad

- Seed production, plant breeders' and Farmers Right (AGP 356-3(1-0-2))
- RAWE (AGP 390)
- PG-Hybrid Seed Production (AST-701)
- PG-Advances in Seed Science Research (AST-705)
- PG-Breeding Field Crops II(AGP-530)
- PG-Thesis Research (AGP-690)

P.G. Student Guided

- Ph. D. (SST/GPB) : 1 M. Sc. (GPB) : 2 By Dr. J. S. Verma

Lectures delivered

- The lectures were delivered on 'Forage Production' in farmers' training program organized by Directorate of Extension = 07

Courses developed: 02 (Dr B Prasad)

- Soil, plant, water and seed testing
- Principles of Seed Testing

Important Visitors

- Dr P. S Negi, Scientist, DRDO, Pithoragarh,
- Dr. Harish Guleria, Officer In charge, Haldwaini Range, WWF,
- Co. M K Bhatnagar, Officer In charge, NCC, GBPUAT, Pantnagar,
- Dr R S Yadav, Scientist (Agronomy)-FCU (UP)
- Team from Forest department, Govt of Uttarakhand

AICRP on Forage Crops & Utilization, JNKVV, Jabalpur, M.P.

Publications

Basha MH and Mehta AK (2016) Screening of oat (*Avena sativa* L.) mutant lines for drought tolerance using polyethylene glycol-6000 at seedling stage *Progressive Research* 11 (Special-VIII): 5561-5569

Extended Abstracts

Kujur MJ, Mehta AK and Bilaiya SK (2017) Study on character association among component of green fodder yield in Rice bean [*Vigna umbellata* (Thumb.) Ohwi and Ohashi] ; New Directions in Managing Forage Resources and livestock Productivity in 21st Century : Challenges and Opportunities *In: National Symposium held at Gwalior (Paper P2-17)*

Kujur MJ, Mehta AK and Bilaiya SK (2017) Genetic divergence in Rice bean [*Vigna umbellata* (Thumb.) Ohwi and Ohashi] ; New Directions in Managing Forage Resources and live stock Productivity in 21st Century : Challenges and Opportunities *In: National Symposium held at Gwalior (Paper P2-18)*

Important Persons visit

- Board Members of Vishwa Vidyalaya.
- Dr. P. M. Gaur International Scientist, ICRISAT Hyderabad.
- Dr. P. S. Takawale and Dr. S. D. Patil (BAIF)
- Dr. Raj Gupta, Director, BISA
- Dr. R. B. Singh, Chancellor CAU, Imphal
- Dr. Hanchinal, Chairman PPVFRA authority.
- Dr. Ashok Kumar, Scientist NBPGR, New Delhi

Students guided: M. Sc. - 1

FTDs conducted: 15

- Berseem JB1, JB5 = 10
- Oat JO1, Kent = 5

TSP activity: 33 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

WEATHER REPORT

The weather report of the AICRP-FCU Coordinating centers, Voluntary centers and Headquarter across the different zones during *Rabi* 2016-17 have been presented in this section. The weather parameters prevalent during 40th Standard Meteorological Week (SMW) (October 01-07, 2016) to 21st SMW (May 21-27, 2017) were taken into consideration, which covers the *Rabi* season, 2016-17 for all the testing/ experimenting locations for trial conduction (tables M1 to M13). 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^oC during 52nd SMW. Maximum temperature was recorded at Almora (32.1^oC) during 16th SMW. The average minimum temperature over the season was recorded lowest at Srinagar (2.5^oC). In North-East zone, Imphal recorded the lowest minimum temperature (1.9^oC) during 52nd SMW, whereas, maximum temperature was recorded at Kalyani (41.4^oC) during 10th SMW. In North-West zone, Ludhiana recorded lowest minimum temperature (3.5^oC) during 2nd SMW, whereas, maximum temperature was recorded at Bikaner (44.4^oC) during 16th SMW. In Central zone, Raipur recorded the lowest minimum temperature (4.2^oC) during 4th SMW whereas the maximum temperature was recorded at Anand (43.3^oC) during 20th SMW. In South zone, the lowest minimum and maximum temperature was recorded at Hyderabad (9.7^oC during 1st SMW and 40.9^oC during 16th SMW, respectively). The mean maximum and minimum temperature was also recorded at Hyderabad (33.1 and 16.5^oC, respectively) during 17th SMW. 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, Srinagar received higher rainfall (684.3 mm) as compared to Palampur (380.8 mm). In North-East zone, Jorhat received highest rainfall (1526.2 mm in 100 rainy days) followed by Imphal (836.0 mm) and lowest being with Ranchi (31.4 mm). In North-West zone, Ludhiana received highest rainfall (110.4 mm) in 7 rainy days followed by Bikaner (69.4mm) and Pantnagar received lowest rainfall (15.0mm) in 4 rainy days. In Central zone, maximum rainfall and maximum number of rainy days (249.3.3 mm, 19 days) was recorded at Rahuri followed by Raipur (109.5 mm) and lowest being with Faizabad (20.3 mm, 5 days). In South zone, Vellayani received maximum rainfall (249.6 mm) in 17 rainy days followed by Coimbatore (244.5 mm in 14 days).

Relative Humidity

In Hill zone, the morning, higher afternoon and average RH was recorded higher at Srinagar as compared to Palampur or Almora and it indicated that Srinagar is more humid than Palampur. In North-East zone, maximum average RH of 96.1 % was recorded at Jorhat

during morning hours followed by 92.1 % at Kalyani. The average minimum RH during afternoon hours was recorded at Bhubaneswar (45.6 %) and Kalyani (46.5 %) respectively.

In North-West zone, higher average RH of the season was recorded at Ludhiana, Pantnagar and Hisar in morning hours and in afternoon higher RH was recorded at Bikaner and Pantnagar. The lowest RH during evening hours was recorded at Bikaner (39.1%). In Central zone, maximum RH in morning (86.8 %) and evening hours (35.5 & 36.5%) was recorded at Jabalpur and Raipur. In South zone, maximum average RH of the season in morning and evening hours (90.6 and 74.6%) was recorded at Vellayani. The lowest average RH (79.2 & 31.9 %) 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 (7.60) followed by Palampur (7.10). 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 Bikaner (8.40) followed by Hisar (6.98). Lowest average sunshine hours were recorded at Pantnagar (6.66). In North-East zone, maximum average sunshine hours were recorded at Ranchi (8.8) followed by Bhubaneswar (7.3) and lowest at Jorhat (5.3). In Central zone, maximum average sunshine hours were recorded at Anand (9.35) followed by Jabalpur (8.0) and lowest at Raipur (7.5). In South zone, maximum average sunshine hours were recorded at Vellayani (8.8) and lowest at Coimbatore (7.4).

Std. Week No.	Period	Std. Week No.	Period
40	01-07 Oct, 2016	05	29-04 Feb, 2017
41	08-14 Oct, 2016	06	05-11 Feb, 2017
42	15-21 Oct, 2016	07	12-18 Feb, 2017
43	22-28 Oct, 2016	08	19-25 Feb, 2017
44	29-04 Nov, 2016	09	26-04 March, 2017
45	05-11 Nov, 2016	10	05-11 March, 2017
46	12-18 Nov, 2016	11	12-18 March, 2017
47	19-25 Nov, 2016	12	19-25 March, 2017
48	26-02 Dec, 2016	13	26-01 April, 2017
49	03-09 Dec, 2016	14	02-08 April, 2017
50	10-16 Dec, 2016	15	09-15 April, 2017
51	17-23 Dec, 2016	16	16-22 April, 2017
52	24-31 Dec, 2016	17	23-29 April, 2017
01	01-06 Jan, 2017	18	30-06 May, 2017
02	07-14 Jan, 2017	19	07-13 May, 2017
03	15-21 Jan, 2017	20	14-20 May, 2017
04	22-28 Jan, 2017	21	21-27 May, 2017

Table M 1: Meteorological data in Hill zone during crop growth period of Rabi 2016-17

Std. Week No.	PALAMPUR						ALMORA						
	Temperature (C)		Humidity (%)		Rainfall (mm)	Sunshine hrs	Temperature (C)		Humidity (%)		Rainfall (mm)	No. of Rainy days	Sunshine hrs
	Max.	Min.	RH1	RH2			Max.	Min.	RH1	RH2			
40	27.3	16.5	86.0	76.7	3.2	5.9	29.6	18.1	85.3	64.7	0.0	0	5.1
41	26.2	13.2	84.7	62.1	0.0	9.5	29.7	11.0	78.9	59.6	0.0	0	8.5
42	25.8	12.2	89.1	71.9	0.0	9.6	28.6	8.9	79.1	44.0	0.0	0	8.8
43	25.3	11.5	85.0	73.0	0.0	10.0	27.3	6.1	91.2	37.9	0.0	0	8.8
44	23.5	9.9	80.4	57.2	0.0	8.4	26.7	5.1	84.9	45.3	0.0	0	8.1
45	23.6	8.2	86.4	88.7	0.0	8.5	26.0	3.0	73.9	40.1	0.0	0	9.0
46	22.1	7.8	86.5	85.7	0.0	8.6	24.9	1.3	79.1	36.0	0.0	0	8.4
47	22.0	7.7	87.4	76.9	0.0	6.4	25.9	2.4	79.6	40.7	0.0	0	2.2
48	20.8	6.6	73.0	50.1	0.0	7.9	24.6	2.1	88.0	38.3	0.0	0	7.6
49	17.5	6.9	73.0	50.0	0.0	8.0	24.4	1.5	89.7	35.3	0.0	0	8.3
50	20.0	6.3	76.9	54.1	0.0	6.9	22.6	-0.9	84.6	49.6	0.0	0	8.2
51	21.8	6.1	53.1	39.1	0.0	7.6	23.2	-1.0	82.3	30.1	0.0	0	7.9
52	18.3	5.4	70.7	56.0	7.2	7.3	20.8	0.4	90.9	37.9	13.0	0	6.2
1	17.3	6.2	75.9	60.0	54.2	4.9	19.2	-0.4	94.3	56.9	0.0	1	5.5
2	11.6	1.7	78.4	51.5	17.6	5.9	15.8	-1.6	92.3	41.7	0.0	0	6.6
3	14.6	4.0	69.8	48.9	31.2	4.6	18.7	0.7	85.5	39.0	12.0	0	6.3
4	16.2	7.4	76.0	67.7	78.6	2.3	20.3	0.9	83.8	45.7	0.0	1	6.1
5	17.5	6.9	76.6	59.9	1.0	4.1	21.6	2.0	88.5	38.7	0.0	0	6.5
6	17.1	6.3	72.8	48.8	17.0	4.7	21.2	1.6	85.9	46.5	0.0	0	7.0
7	21.0	9.3	62.4	42.0	0.0	7.7	23.8	2.9	88.7	41.6	1.5	0	8.3
8	19.1	8.1	70.5	50.8	26.4	5.2	22.9	3.5	90.4	49.0	3.0	1	6.9
9	20.2	7.3	61.7	35.8	2.4	7.1	24.7	3.0	82.3	41.7	16.4	1	8.8
10	16.8	6.2	73.5	64.0	46.2	5.2	19.5	4.3	81.3	55.1	9.3	4	5.6
11	16.6	5.6	64.7	49.0	3.2	5.5	22.1	2.0	85.9	51.3	0.0	2	8.7
12	24.0	11.8	58.8	35.8	0.0	6.8	27.4	5.1	77.7	26.9	0.0	0	8.9
13	28.7	15.1	54.0	30.7	0.0	8.9	31.2	10.0	65.6	24.7	17.3	0	9.7
14	26.5	13.3	58.5	41.1	51.2	6.0	26.9	9.8	74.0	54.9	0.0	3	8.6
15	26.4	12.2	64.5	31.0	0.0	10.6	30.6	8.4	79.1	22.0	0.0	0	9.6
16	31.8	18.9	62.8	40.4	3.6	10.2	32.1	13.6	69.7	38.0	0.0	0	9.0
17	27.4	15.0	53.2	33.4	2.4	6.5	31.1	11.6	49.4	30.0	2.0	0	8.8
18	28.1	15.3	51.5	33.7	9.2	7.1	31.1	10.9	48.9	32.9		1	8.1
19	32.0	18.2	48.8	42.8	19.4	8.7						0	
20	30.4	17.7	54.1	38.1	4.5	7.9							
21	30.4	18.7	57.7	51.7	2.3	7.1							
Mean/ Total	22.6	10.1	70.0	52.9	380.8	7.1	25.0	4.7	81.0	41.8	74.5	14.0	7.6

Table M 2: Meteorological data in North East zone during crop growth period of Rabi 2016-17

Std. Week No.	Srinagar					
	Temperature (C)		Humidity (%)		Rainfall (mm)	Sunshine hrs
	Max.	Min.	RH1	RH2		
40	26.2	10.6	90.5	50.2	0.0	7.4
41	24.0	6.7	90.2	61.4	0.0	6.6
42	20.3	6.3	93.1	68.2	5.6	5.3
43	18.9	6.1	92.7	74.4	0.0	4.9
44	16.6	4.3	84.3	70.3	0.4	4.0
45	11.2	2.2	90.3	70.2	0.0	3.6
46	11.3	-1.5	90.4	58.3	0.0	4.1
47	10.3	-2.3	91.2	74.3	0.0	2.2
48	10.9	-0.4	90.1	79.0	0.0	0.4
49	9.2	-3.2	91.0	72.1	0.0	0.4
50	8.0	-4.7	87.1	54.2	0.0	2.4
51	8.7	-4.6	90.3	60.6	0.0	1.1
52	7.2	-5.8	94.3	62.9	0.0	3.2
1	7.5	-2.6	87.2	60.1	0.0	3.9
2	8.1	-3.4	89.9	46.4	3.0	3.3
3	9.5	-3.6	90.2	52.3	0.0	5.1
4	10.1	-1.9	88.3	58.1	0.0	3.1
5	9.2	-0.6	90.1	68.2	60.9	2.8
6	10.2	-1.1	88.5	56.0	16.2	5.5
7	11.3	1.2	89.9	59.4	12.5	3.4
8	9.5	2.5	92.2	76.6	0.0	0.2
9	9.5	0.3	90.3	75.2	134.0	2.3
10	9.9	-0.3	91.3	68.1	112.9	2.2
11	10.8	0.6	88.4	69.0	113.2	2.9
12	12.9	3.3	86.3	42.0	0.0	8.6
13	14.9	5.5	90.0	72.6	69.8	3.3
14	15.3	6.0	87.1	57.4	32.2	3.6
15	16.1	7.2	69.6	37.3	62.5	6.9
16	19.6	8.3	84.1	63.6	3.5	6.3
17	16.9	8.3	78.0	42.8	32.6	7.4
18	18.2	9.6	69.0	46.0	18.6	9.5
19	20.7	10.3	76.7	64.2	2.6	5.4
20	20.3	10.4	87.7	62.7	3.8	7.0
21	22.3	11.3	76.0	49.8	0.0	9.7
Mean/ Total	13.7	2.5	87.2	61.3	684.3	4.4

Table M 3: Meteorological data in North West zone during crop growth period of Rabi 2016-17

Std. Week No.	HISAR							BIKANER						
	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	35.0	24.5	91.0	56.0	1	12.0	5.4	36.3	23.5	84.7	47.9	1	24.2	6.6
41	35.2	19.4	82.0	35.0	0.0	0.0	8.8	37.1	21.2	69.3	41.7	1	4.2	9.8
42	35.1	16.2	79.0	34.0	0.0	0.0	9.4	36.3	19.7	69.0	26.1	0.0	0.0	9.9
43	33.7	15.8	85.0	41.0	0.0	0.0	8.1	35.3	19.3	68.0	26.4	0.0	0.0	9.8
44	30.8	13.2	92.0	51.0	0.0	0.0	3.5	34.9	16.3	71.0	30.9	0.0	0.0	8.5
45	30.1	10.7	94.0	43.0	0.0	0.0	3.6	33.6	14.0	63.4	23.7	0.0	0.0	7.9
46	28.7	11.0	91.0	48.0	0.0	0.0	6.3	29.2	10.8	78.7	31.9	0.0	0.0	6.7
47	29.1	9.9	89.0	48.0	0.0	0.0	8.0	31.8	10.2	76.1	29.0	0.0	0.0	9.1
48	28.3	9.1	91.0	47.0	0.0	0.0	7.8	31.7	10.0	83.0	32.7	0.0	0.0	9.0
49	26.2	7.4	95.0	51.0	0.0	0.0	7.3	31.2	9.4	72.6	26.7	0.0	0.0	9.2
50	24.7	9.2	98.0	54.0	0.0	0.0	5.8	29.0	10.3	90.3	35.1	0.0	0.0	6.9
51	23.7	5.3	98.0	51.0	0.0	0.0	7.4	28.9	8.6	88.0	32.6	0.0	0.0	9.0
52	21.9	7.7	99.0	70.0	0.0	0.0	4.5	27.3	7.9	84.9	39.0	0.0	0.0	8.4
01	20.1	9.9	100.0	80.0	1	5.8	2.9	20.1	7.9	90.4	78.7	0.0	0.0	2.7
02	17.6	3.2	99.0	60.0	0	0.0	6.0	19.3	4.1	86.0	47.6	0.0	0.0	6.5
03	16.9	3.9	96.0	66.0	0	0.8	4.3	19.1	4.9	83.9	43.4	0.0	0.0	6.6
04	20.0	10.4	99.0	81.0	3	34.6	3.1	22.0	8.1	90.1	56.7	0.0	2.2	3.9
05	20.6	7.8	98.0	64.0	0.0	0.0	5.6	26.4	8.5	91.3	32.9	0.0	0.0	8.4
06	21.6	7.0	93.0	53.0	0.0	0.0	6.9	26.3	5.8	87	30.3	0.0	0.0	8.7
07	24.5	7.4	90.0	45.0	0.0	0.0	7.8	30.0	10.0	71.7	23.3	0.0	0.0	9.6
08	26.8	9.1	90.0	37.0	0.0	0.0	8.4	30.2	10.6	63.9	18.6	0.0	0.0	9.9
09	26.9	8.3	92.0	37.0	0.0	0.0	8.6	30.6	13.0	68.3	21.7	0.0	0.0	8.6
10	25.6	9.7	89.0	45.0	1	7.5	7.6	30.0	11.9	66.3	19.3	0.0	0.8	7.6
11	25.1	7.4	90.0	40.0	0.0	0.0	8.3	30.7	12.4	63.0	23.0	0.0	0.0	8.1
12	32.0	13.6	90.0	34.0	0.0	0.0	9.2	36.3	18.4	57.6	21.9	0.0	0.0	8.6
13	36.3	16.7	85.0	30.0	0.0	0.0	9.6	41.1	22.5	41.1	18.0	0.0	0.0	9.5
14	35.7	17.5	68.0	27.0	1	3.1	6.9	37.9	20.6	50.1	15.9	0.0	0.0	7.8
15	37.2	14.0	59.0	16.0	0.0	0.0	10.3	40.9	19.1	40.4	28.6	0.0	0.0	10.3
16	42.9	22.8	45.0	19.0	0.0	0.0	9.9	44.4	27.1	75.9	49.1	0.0	0.0	10.9
17	38.5	20.7	54.0	24.0	0.0	1.0	7.9	39.4	24.5	66.1	27.1	1	18.8	10.3
18	38.9	24.5	54.0	25.0	0.0	0.0	7.2	41.8	24.4	41.9	15.9	0.0	0.0	9.9
19								44.4	28.4	64.4	39.9	0.0	0.0	10.0
20								42.0	25.8	54.3	22.6	1	10.6	11.0
21								42.4	26.8	52.4	28.1	2	8.6	10.2
Mean/ Total	28.7	12.0	86.3	45.5	7.0	64.8	6.98	32.3	14.5	71.8	32.4	6.0	69.4	8.4

Table M 4: Meteorological data in North West zone during crop growth period of Rabi 2016-17

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	34.0	24.8	91.0	55.0	0	0.0	3.3	32.7	24.9	88.0	65.4	0	0	3.9
41	33.3	19.7	89.0	35.0	0	0.0	9.1	32.2	19.9	88.7	61.6	0	0	5.9
42	33.4	17.2	85.0	31.0	0	0.0	8.1	31.6	17.2	80.0	48.7	0	0	7.7
43	31.6	16.1	89.0	29.0	0	0.0	6.2	31.2	13.8	90.1	38.4	0	0	7.7
44	29.2	14.7	90.0	39.0	0	0.0	0.9	30.4	13.5	84.9	38.6	0	0	7.9
45	28.7	12.3	92.0	29.0	0	0.0	4.3	29.0	11.4	90.3	36.9	0	0	7.9
46	26.7	11.9	86.0	30.0	0	2.0	7.3	28.3	10.6	90.9	36.9	0	0	8.1
47	27.6	11.6	87.0	31.0	0	0.0	6.8	26.6	9.8	93.4	38.1	0	0	7.3
48	26.5	10.1	89.0	35.0	0	1.6	6.0	26.1	11.3	92.6	46.6	0	0	4.2
49	24.5	9.5	95.0	48.0	0	0.0	4.2	23.4	11.5	83.2	54.9	0	0	4.1
50	20.0	10.1	97.0	63.0	0	0.0	2.8	20.0	9.9	94.4	66.4	0	0	2.2
51	22.5	6.6	95.0	41.0	0	0.0	7.1	23.1	6.5	94.6	48.7	0	0	6.1
52	21.1	7.9	93.0	48.0	0	0.0	5.1	22.5	8.7	93.4	55.3	1	11.2	5.9
1	20.9	9.7	95.0	57.0	1	4.0	3.3	22.6	9.3	92.1	52.9	0	0	6.3
2	16.3	3.5	95.0	43.0	0	0.0	6.5	18.2	4.3	92.7	52.1	0	0	6.2
3	16.2	6.2	94.0	64.0	0	1.6	4.5	19.2	7.0	95.3	58.6	0	0	4.5
4	19.5	10.3	93.0	64.0	2	40.4	3.6	22.6	8.5	92.3	55.3	0	0	5.3
5	19.8	8.7	96.0	64.0	1	5.2	4.5	21.2	9.4	93.0	59.7	0	0	5.3
6	20.7	8.2	92.0	53.0	0	0.0	6.0	23.2	8.5	92.1	46.6	0	0	5.9
7	24.3	9.7	90.0	44.0	0	0.0	8.1	25.2	9.3	90.6	48.7	0	0	7.1
8	24.8	10.6	89.0	39.0	0	0.0	8.8	26.9	10.4	91.6	44.6	0	0	7.2
9	25.5	9.5	90.0	34.0	0	0.0	9.6	27.4	9.5	87.1	39.0	0	0	8.0
10	20.9	10.5	86.0	46.0	1	40.8	7.3	25.9	10.0	86.1	50.0	1	2.8	7.8
11	23.2	8.9	88.0	42.0	0	0.0	8.3	25.6	7.9	88.0	35.6	0	0	8.4
12	30.4	14.8	84.0	33.0	0	0.0	9.8	30.5	13.9	82.3	38.3	0	0	8.3
13	34.9	18.5	85.0	31.0	0	0.0	10.9	34.6	16.9	81.6	33.7	0	0	9.1
14	32.9	19.3	66.0	29.0	1	6.2	7.1	35.5	17.6	72.3	27.7	1	1	7.3
15	36.6	15.1	56.0	13.0	0	0.0	11.8	35.3	15.1	66.1	20.7	0	0	9.5
16	41.7	23.6	51.0	23.0	0	0.0	10.0	36.7	24.5	56.7	40.3	0	0	7.9
17	36.9	21.5	54.0	23.0	1	8.6	10.0							
18	37.0	22.2	46.0	22.0	0	0.0								
19	40.9	26.1	42.0	21.0	0	0.0								
20														
21														
Mean/ Total	27.6	13.4	83.4	39.3	7.0	110.4	6.71	27.2	12.1	87.0	46.2	3.0	15.0	6.66

Table M 5: Meteorological data in Central zone during crop growth period of Rabi 2016-17

Std. Week No.	URULIKANCHAN					JHANSI					
	Temperature (C)		Humidity (%)	No. of Rainy	Rainfall	Temperature (C)		Humidity (%)		No. of Rainy	Rainfall
	Max.	Min.	RH1	days	(mm)	Max.	Min.	RH1	RH2	days	(mm)
40	32.7	25.4	74.3	-	1.6	34.5	24.6	90.0	60.0	1	3
41	35.7	25.8	65.9	1	3.6	34.9	21.1	86.0	46.0	0	0
42	35.7	24.0	59.2	-	0.0	35.0	16.3	78.0	43.0	0	0
43	34.9	22.7	59.2	-	0.0	34.4	16.5	78.0	46.0	0	0
44	32.1	18.8	57.0	-	0.0	31.5	13.1	79.0	42.0	0	0
45	30.7	16.0	51.9	-	0.0	31.0	12.6	81.0	40.0	0	3
46	30.3	18.2	59.4	-	0.0	30.0	11.6	84.0	43.0	0	0
47	30.6	15.2	53.2	-	0.0	30.0	11.5	87.0	40.0	0	0
48	32.1	15.8	54.5	-	0.0	29.0	11.8	87.0	50.0	0	0.0
49	30.1	16.0	54.2	-	0.0	23.8	9.6	92.0	56.0	0	0
50	29.6	17.4	60.2	-	0.0	26.7	8.9	86.0	46.0	0	0
51	30.8	15.5	52.2	-	0.0	25.8	7.4	87.0	52.0	0	0
52	30.5	15.1	51.3	-	0.0	25.5	8.0	88.0	62.0	0	0
1	29.6	14.4	51.5	-	0.0	21.0	7.8	91.0	69.0		0
2	28.5	13.8	54.5	-	0.0	19.7	6.0	91.0	77.0		0
3	28.8	17.0	55.8	-	0.0	20.6	6.4	90.0	58.0		0.0
4	31.2	17.2	50.2	-	0.0	24.4	9.5	89.0	53.0	1	3.6
5	31.9	17.7	48.3	-	0.0	23.3	10.0	91.0	57.0		0.0
6	32.2	18.4	48.1	-	0.0	24.4	8.7	89.0	54.0	1	22.2
7	31.9	18.5	41.1	-	0.0	25.5	9.6	87.0	46.0		0.0
8	35.5	19.1	32.5	-	0.0	30.0	10.6	81.0	41.0		25.8
9	35.0	19.0	30.5	-	0.0	29.7	11.5	80.0	43.0		0.0
10	33.4	18.2	37.6	-	0.0	28.1	10.9	76.0	44.0		0.0
11	33.1	18.5	36.2	-	0.0	28.7	10.5	80.0	35.0		0.0
12	36.3	21.4	33.7	-	0.0	33.8	16.1	80.0	37.0		0.0
13	39.2	24.7	41.6	-	0.0	38.7	18.8	69.0	31.0		0.0
14	37.2	22.0	31.9	-	0.0	39.9	19.6	64.0	32.0		0.0
15	39.5	23.5	32.6	-	0.0	38.2	17.2	66.0	29.0		0.0
16	39.1	24.1	33.1	-	0.0	42.8	23.6	56.0	28.0		0.0
17	36.6	23.0	39.9	-	0.0						
18	38.9	25.0	39.9	1	68.0						
19	39.0	24.8	41.4	-	0.4						
20	36.7	24.4	49.6	-	0.0						
21	37.3	25.0	50.3	-	0.0						
Mean/ Total	33.7	19.9	41.1	2.0	73.6	29.7	12.8	82.2	46.9	3.0	57.6

Table M 6: Meteorological data in Central zone during crop growth period of Rabi 2016-17

Std. Week No.	ANAND							RAHURI					
	Temperature (C)		Humidity (%)		No. of Rainy days	Rainfall (mm)	Sunshine hrs	Temperature (C)		Humidity (%)		No. of Rainy days	Rainfall (mm)
	Max.	Min.	RH1	RH2				Max.	Min.	RH1	RH2		
40	32.1	24.0	98.3	79.9	4	44.2	3.6	28.6	21.5	87.0	71.0	3	110.6
41	32.6	23.5	95.0	61.4	0	0.0	5.3	31.6	20.6	80.0	53.0	-	0.0
42	35.0	19.6	102.3	35.4	0	0.0	9.0	31.7	17.2	66.0	37.0	-	0.0
43	34.1	18.9	76.4	35.0	0	0.0	9.3	31.3	16.4	66.0	35.0	-	0.0
44	34.4	15.1	89.3	28.3	0	0.0	9.3	30.1	13.4	51.0	40.0	-	0.0
45	33.9	13.0	96.4	27.4	0	0.0	8.9	29.6	11.6	52.0	25.0	-	0.0
46	32.6	13.2	89.6	30.6	0	0.0	9.4	29.4	12.6	64.0	41.0	-	0.0
47	33.3	12.7	92.7	27.9	0	0.0	9.5	29.1	10.1	56.0	27.0	-	0.0
48	33.0	12.8	87.4	29.7	0	0.0	9.8	30.9	10.5	62.0	26.0	-	0.0
49	30.8	12.8	87.4	37.7	0	0.0	9.5	28.9	11.2	64.0	34.0	-	0.0
50	31.3	11.5	92.6	36.1	0	0.0	9.6	28.6	11.7	52.0	37.0	-	0.0
51	30.0	10.9	94.6	36.4	0	0.0	9.4	29.2	10.2	54.0	34.0	-	0.0
52	30.0	10.4	93.1	33.9	0	0.0	9.0	29.4	8.6	56.0	28.0	-	0.0
1	10.4	20.2	96.0	41.0	0	0.0	8.7	29.2	9.3	57.0	34.0	-	0.0
2	9.3	17.7	90.0	38.0	0	0.0	8.5	26.5	8.9	60.0	34.0	-	0.0
3	12.0	19.4	81.0	45.0	0	0.0	8.0	28.8	13.4	68.0	39.0	-	0.0
4	13.5	22.3	93.0	39.0	0	0.0	8.9	31.0	13.0	62.0	30.0	-	0.0
5	11.1	21.3	90.0	37.0	0	0.0	9.9	31.3	12.8	59.0	28.0	-	0.0
6	10.2	19.5	81.0	30.0	0	0.0	9.6	31.7	13.6	59.0	32.0	-	0.0
7	16.1	24.2	76.0	39.0	0	0.0	9.4	32.3	13.9	52.0	26.0	-	0.0
8	13.8	23.6	81.0	27.0	0	0.0	10.1	34.6	13.8	45.0	20.0	-	0.0
9	14.1	25.1	77.0	23.0	0	0.0	10.3	34.0	14.0	41.0	15.0	-	0.0
10	15.8	24.7	71.0	27.0	0	0.0	9.6	32.8	13.9	47.0	22.0	-	0.0
11	12.6	23.2	69.0	20.0	0	0.0	9.9	33.0	13.6	33.0	16.0	-	0.0
12	18.8	28.0	71.0	26.0	0	0.0	9.9	36.1	17.2	28.0	15.0	-	0.0
13	20.8	30.8	64.0	20.0	0	0.0	10.0	39.9	21.0	40.0	14.0	-	0.0
14	20.6	28.9	88.0	29.0	0	0.0	10.0	38.5	17.4	38.0	14.0	-	0.0
15	18.8	30.0	49.0	9.0	0	0.0	10.4	39.5	18.0	31.0	11.0	-	0.0
16	22.8	31.6	72.0	22.0	0	0.0	10.6	41.3	20.6	36.0	11.0	-	0.0
17	21.7	29.6	78.0	31.0	0	0.0	10.6	38.6	18.5	44.0	13.0	-	0.0
18	22.9	31.7	73.0	25.0	0	0.0	10.4	34.2	19.6	36.0	13.0	-	0.0
19								40.5	23.3	50.0	19.0	1	2.8
20								39.6	23.6	58.0	23.0	-	0.0
21								40.1	23.2	53.0	23.0	1	7.4
Mean/ Total	22.9	21.0	83.7	33.2	4.0	44.2	9.2	33.0	15.2	53.1	27.6	5.0	120.8

Table M 7: Meteorological data in Central zone during crop growth period of Rabi 2016-17

Std. Week No.	JABALPUR							RAIPUR						
	Temperature (C)		Humidity (%)		No. of Rainy days	Rainfall (mm)	Sunshine hrs	Temperature (C)		Humidity (%)		No. of Rainy days	Rainfall (mm)	Sunshine hrs
	Max.	Min.	RH1	RH2				Max.	Min.	RH1	RH2			
40	31.9	23.9	93.0	64.0	2	24.2	7.3	26.5	24.8	95.0	72.0	5	48.2	4.5
41	31.5	21.3	88.0	51.0	0	0	8.0	31.5	22.9	94.0	50.0	1	9.2	5.6
42	31.5	15.4	91.0	32.0	0	0	9.3	31.6	19.0	90.0	35.0	0	0.0	10.0
43	31.7	15.6	82.0	29.0	0	0	8.8	31.5	18.1	89.0	36.0	0	0.0	9.5
44	29.7	12.3	87.0	34.0	0	0	8.7	30.6	19.8	85.0	51.0	0	0.0	8.0
45	29.7	10.6	91.0	24.0	0	0	8.1	30.2	15.7	88.0	29.0	0	0.0	8.5
46	28.3	8.1	88.0	24.0	0	0	8.1	29.0	14.4	89.0	35.0	0	0.0	7.8
47	28.8	8.4	87.0	22.0	0	0	8.3	30.0	11.3	89.0	25.0	0	0.0	8.5
48	28.8	8.7	89.0	27.0	0	0	8.7	30.7	13.0	88.0	27.0	0	0.0	8.5
49	25.1	7.9	93.0	43.0	0	0	6.2	28.9	14.3	90.0	39.0	0	0.0	7.4
50	26.1	7.3	91.0	28.0	0	0	7.8	28.8	11.9	83.0	29.0	0	0.0	8.1
51	24.7	5.5	91.0	30.0	0	0	7.4	27.5	8.6	87.0	24.0	0	0.0	8.5
52	25.7	5.6	88.0	29.0	0	0	8.6	28.2	9.9	86.0	26.0	0	0.0	7.4
1	23.9	9.1	90.0	48.0	0	0	6.5	28.6	12.2	90.0	32.0	0	0.0	6.4
2	21.7	6.6	86.0	42.0	0	0.2	7.2	27.2	11.9	85.0	35.0	1	5.6	6.5
3	24.1	9.2	89.0	47.0	0	0	6.4	28.9	11.8	85.0	27.0	0	0.0	8.0
4	25.7	10.1	97.0	45.0	1	3.2	6.5	29.9	14.3	83.0	29.0	0	0.0	7.7
5	25.4	7.5	92.0	38.0	0	0	9.6	30.4	12.0	80.0	26.0	0	0.0	9.4
6	27.2	9.8	84.0	42.0	0	0	9.0	32.2	14.1	81.0	26.0	0	0.0	9.3
7	26.4	10.6	95.0	42.0	1	13.2	8.4	31.0	15.8	80.0	31.0	0	0.0	6.8
8	29.7	10.0	83.0	26.0	0	0	10.3	34.1	15.5	68.0	17.0	0	0.0	10.1
9	31.2	11.1	80.0	26.0	0	0	10.2	34.3	15.8	73.0	15.0	0	0.0	9.7
10	30.3	12.5	72.0	24.0	0	0	9.6	33.0	19.2	69.0	36.0	1	5.5	6.7
11	29.3	9.8	74.0	16.0	0	0	10.1	32.9	17.0	58.0	18.0	0	0.0	8.9
12	33.9	14.4	75.0	19.0	1	2.8	10.0	36.5	19.7	63.0	15.0	0	0.0	9.2
13	38.6	15.9	69.0	15.0	0	0	10.3	35.9	23.0	58.0	13.0	0	0.0	8.9
14	39.3	20.6	41.0	15.0	0	0	10.0	41.4	26.6	45.0	17.0	0	0.0	8.3
15	38.1	14.4	54.0	9.0	0	0	10.2	40.7	22.0	36.0	9.0	0	0.0	9.4
16	41.6	21.6	39.0	11.0	0	0	10.1	42.6	26.7	41.0	10.0	0	0.0	9.5
17	39.1	21.8	44.0	18.0	0	0	10.6	42.3	24.9	37.0	8.0	0	0.0	10.3
18	40.3	20.3	52.0	17.0	0	0	9.3	42.0	27.6	39.0	14.0	0	0.0	9.2
19								41.4	27.6	49.0	22.0	0	0.8	8.7
20								44.5	30.1	37.0	13.0	0	0.0	9.7
21														
30.3	12.4	79.8	30.2	5.0	43.6	8.7	33.2	17.9	73.0	27.0	8.0	69.3	8.3	30.3

Table M 8: Meteorological data in North East zone during crop growth period of Rabi 2016-17

Std. Week No.	JORHAT							RANCHI						
	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	23.7	97.0	79.0	4	75.0	1.1	30.0	20.7	83.7	69.4	0.0	0.0	57.8
41	32.6	21.8	96.0	69.0	0	0.0	6.2	28.7	19.0	82.4	70.7	2.0	19.3	47.3
42	30.6	20.6	95.0	68.0	0	1.2	3.8	28.2	14.6	85.4	59.4	0.0	0.0	65.5
43	31.3	19.5	96.0	62.0	0	0.0	5.9	28.6	14.5	87.3	46.9	0.0	0.0	63.2
44	27.9	19.8	98.0	79.0	3	16.5	2.5	28.1	14.6	85.9	58.1	0.0	0.0	60.9
45	30.2	18.0	96.0	66.0	0	0.0	3.3	26.9	12.1	86.4	59.0	0.0	0.0	56.7
46	27.5	12.3	98.0	63.0	0	0.0	8.8	27.0	10.9	87.1	49.0	0.0	0.0	60.5
47	27.7	13.8	95.0	62.0	0	0.0	8.2	25.1	6.9	87.3	56.7	0.0	0.0	67.5
48	27.6	11.8	99.0	61.0	0	0.0	8.0	25.0	7.3	87.0	57.1	0.0	0.0	60.1
49	26.5	9.7	100.0	58.0	0	0.0	8.8	26.1	9.7	87.9	54.0	0.0	0.0	57.2
50	26.0	12.6	99.0	62.0	0	0.0	5.8	24.3	5.2	86.7	63.0	0.0	0.0	60.6
51	25.0	12.6	99.0	66.0	2	43.5	5.8	24.3	3.5	85.1	47.0	0.0	0.0	62.3
52	34.3	25.7	97.0	71.0	1	2.3	4.5	24.6	4.8	86.1	55.3	0.0	0.0	62.0
1	25.9	10.7	99.0	56.0	0	0.1	8.2	24.8	4.8	83.9	57.6	0.0	0.0	48.5
2	24.0	9.3	98.0	61.0	0	0.0	6.6	22.9	5.0	84.4	60.7	0.0	0.0	50.5
3	24.3	8.0	99.0	57.0	0	0.0	8.1	23.4	5.8	85.3	63.6	0.0	0.0	61.4
4	26.8	9.1	96.0	51.0	0	0.0	7.6	26.7	8.3	85.4	59.1	0.0	0.0	59.9
5	25.5	11.3	97.0	59.0	0	2.0	7.3	24.6	6.3	84.3	57.1	0.0	0.0	68.8
6	27.4	12.6	93.0	55.0	0	0.0	4.3	27.5	10.3	88.0	61.1	0.0	0.0	70.3
7	27.9	11.0	94.0	44.0	0	0.0	7.1	27.3	11.1	86.9	71.0	0.0	0.0	58.8
8	25.6	15.0	96.0	66.0	3	37.4	4.5	29.8	12.7	86.7	51.7	0.0	0.0	69.4
9	25.9	15.0	94.0	60.0	0	0.0	3.2	29.5	11.1	85.4	69.1	0.0	0.0	62.7
10	26.3	14.6	91.0	62.0	2	19.2	5.0	13.9	14.4	86.9	68.7	1.0	6.0	44.7
11	26.8	14.3	91.0	53.0	1	10.6	6.7	11.1	15.9	73.7	44.6	0.0	0.0	69.1
12	26.3	15.2	95.0	61.0	2	26	4.9	14.3	17.4	83.4	69.4	0.0	0.0	63.0
13	26.6	19.3	97.0	77.0	6	115.9	1.9	16.4	20.7	83.9	64.1	0.0	0.0	68.2
14	25.9	19.4	96.0	79.0	5	99.9	2.6	35.6	19.1	82.7	66.0	0.0	0.0	70.0
15	31.1	19.7	90.0	59.0	1	4.3	7.4	36.0	17.8	86.3	68.9	0.0	0.0	69.6
16	28.1	20.3	94.0	75.0	4	36.8	3.0	38.5	20.8	83.9	67.9	0.0	3.1	65.4
17	28.8	21.2	97.0	77.0	3	33.6	4.6	40.5	22.0	81.3	66.9	0.0	0.0	67.0
18	28.6	20.4	96.0	73.0	5	46.3	4.3	38.8	22.1	85.1	68.4	0.0	1.0	60.9
19	27.9	20.6	97.0	76.0	4	24.1	4.2	39.5	22.5	85.7	68.9	0.0	0.0	65.1
20	28.2	20.1	96.0	74.0	3	13.2	4.1	40.0	22.1	84.0	69.6	0.0	0.0	70.6
21	28.1	21.1	97.0	75.0	0	0	3.4	38.4	22.1	84.4	70.0	0.0	2.0	56.1
Mean/ Total	27.74	16.18	96.12	65.18	100.00	1526.20	5.34	27.8	13.4	85.0	61.5	3.0	31.4	8.8

Table M 9: Meteorological data in North East zone during crop growth period of Rabi 2016-17

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	31.4	23.1	90.0	68.9	2.2	1	7.3	34.6	25.9	95.6	73.9	2	26.0	7.0
41	26.9	22.4	89.7	80.9	109.6	6	2.7	32.1	25.0	98.7	85.4	5	61.0	5.0
42	26.8	21.4	77.0	79.1	11.1	2	5.8	33.7	22.5	94.7	56.0	--	0.0	9.7
43	28.9	16.5	88.3	64.1	0.0	0	8.4	32.5	22.4	94.6	61.9	1	11.2	6.8
44	26.0	15.5	89.6	69.4	14.4	2	5.1	32.1	24.0	95.7	69.6	1	3.0	6.5
45	26.5	14.1	91.3	56.0	0.0	0	8.1	28.7	19.0	96.3	70.3	3	16.6	5.8
46	26.5	11.8	86.6	50.7	0.0	0	8.5	30.2	17.4	92.9	51.1	--	0.0	7.9
47	24.9	10.9	89.0	62.4	0.0	0	6.6	29.3	14.9	90.9	51.4	--	0.0	7.0
48	25.0	8.4	88.6	48.9	0.0	0	8.7	29.4	16.4	93.1	58.6	--	0.0	4.9
49	23.0	9.6	92.6	58.6	0.4	1	4.7	28.3	15.6	93.3	55.0	--	0.0	7.4
50	21.4	8.3	92.3	64.4	0.0	0	3.2	25.3	11.4	94.3	56.3	--	0.0	7.4
51	21.6	5.5	90.7	55.3	0.0	0	6.5	25.9	11.5	92.7	55.9	--	0.0	5.1
52	21.2	1.9	88.3	47.7	0.0	0	7.0	26.1	17.6	95.0	66.3	--	0.0	2.4
1	22.4	4.8	92.0	52.3	4.4	1	6.9	25.7	12.4	94.9	57.1	0	--	5.5
2	21.5	4.0	91.4	46.7	5.5	1	6.5	24.1	10.6	91.0	70.3	0	--	5.9
3	22.6	5.4	92.1	48.4	0.2	1	6.2	26.3	8.8	90.0	43.3	0	--	7.7
4	21.8	3.9	88.9	43.4	0.0	0	7.2	27.7	11.8	90.0	50.4	0	--	6.6
5	22.9	7.2	91.3	45.6	0.2	1	4.8	26.9	11.8	91.7	43.0	0	--	7.1
6	23.3	8.8	91.3	56.1	12.8	4	5.2	29.6	13.4	89.6	41.4	0	--	8.4
7	26.3	9.1	86.4	42.4	0.0	0	6.6	30.5	15.7	89.9	44.4	0	--	4.7
8	26.2	13.1	83.4	55.4	22.8	3	6.2	31.9	20.0	88.6	44.3	0	--	5.9
9	27.5	9.9	90.3	40.1	2.4	2	7.9	33.4	16.5	91.3	47.0	0	--	8.8
10	27.6	13.0	91.1	47.7	18.6	2	7.2	41.4	19.3	95.1	60.9	1	3.0	4.6
11	26.8	11.9	81.3	48.6	1.4	1	7.1	32.2	16.7	86.7	34.1	0	--	9.4
12	28.6	13.7	89.6	49.0	16.7	3	6.7	33.8	21.3	92.6	44.9	1	5.7	7.9
13	27.4	13.3	88.0	58.1	41.9	6	4.9	35.7	25.9	92.1	55.0	0	--	7.3
14	27.4	16.3	87.1	60.3	40.4	4	4.2	35.0	26.3	90.4	59.6	1	0.2	4.8
15	29.7	17.1	87.4	55.4	30.0	4	8.2	37.2	25.5	91.6	37.9	0	--	9.0
16	27.4	17.8	85.1	79.4	47.2	5	2.7	15.3	25.9	85.4	57.3	0	--	5.7
17	29.2	18.9	82.7	66.0	83.6	4	8.0	37.4	25.8	90.4	53.6	1	8.2	7.5
18	29.2	19.3	88.0	62.1	39.6	3	5.1	36.1	25.2	90.4	56.7	2	24.0	8.9
19	31.1	21.6	86.0	59.6	37.6	2	6.8	36.3	25.0	89.6	55.0	2	48.6	9.2
20	27.0	20.7	93.1	85.6	194.2	7	2.2	35.8	25.2	90.9	63.0	3	28.8	7.5
21	30.0	22.5	92.4	73.4	98.8	5	5.9							
Mean/ Total	26.1	13.0	88.6	58.3	836.0	71.0	6.2	30.9	19.0	92.1	55.5	23.0	236.3	6.8

Table M 10: Meteorological data in North East zone during crop growth period of Rabi 2016-17

Std. Week No.	Bhubaneswar						
	Temperature (C)		Humidity (%)		Rainy days	Rainfall (mm)	Sunshine hrs
	Max.	Min.	RH1	RH2			
40	32.1	24.9	94.0	75.0	5	39.8	5.9
41	31.6	23.9	92.0	68.0	4	76.2	5.0
42	32.8	21.3	84.0	65.0	0	0.0	8.3
43	32.4	20.4	87.0	64.0	2	16.8	5.1
44	32.2	22.6	88.0	66.0	1	8.6	7.3
45	29.7	17.0	92.0	46.0	1	11.7	5.6
46	30.7	18.3	89.0	45.0	0	0.0	6.8
47	31.3	15.2	92.0	38.0	0	0.0	8.7
48	31.3	16.6	92.0	43.0	0	0.0	7.1
49	30.6	16.2	78.0	35.0	0	0.0	8.0
50	30.5	15.8	79.0	35.0	0	0.0	8.1
51	29.8	12.6	90.0	33.0	0	0.0	8.0
52	29.5	14.6	94.0	43.0	0	0.0	5.5
1	29.2	16.0	96.0	46.0	0	0.0	3.7
2	29.5	14.6	83.0	38.0	0	0.0	6.5
3	29.2	12.7	86.0	33.0	0	0.0	8.0
4	30.7	14.1	91.0	36.0	0	0.0	6.6
5	31.3	17.6	95.0	40.0	0	0.0	7.0
6	33.3	17.2	94.0	32.0	0	0.0	8.2
7	33.6	17.4	92.0	36.0	0	0.0	8.3
8	35.1	22.4	92.0	42.0	0	0.0	7.8
9	35.7	20.6	94.0	35.0	0	0.0	8.1
10	33.2	22.8	93.0	54.0	5	45.4	5.0
11	33.1	21.6	92.0	40.0	0	0.0	7.1
12	35.9	22.7	89.0	37.0	0	0.0	8.0
13	35.6	25.3	88.0	44.0	0	0.0	7.8
14	35.6	26.0	88.0	48.0	0	0.0	6.6
15	37.8	26.0	86.0	43.0	0	0.0	7.4
16	36.0	25.9	88.0	58.0	1	29.2	8.2
17	38.3	27.1	88.0	49.0	0	0.0	7.9
18	38.0	26.8	83.0	47.0	0	0.0	8.3
19	37.9	22.3	85.0	45.0	1	27.5	8.5
20	39.4	28.1	83.0	46.0	0	0.0	8.9
21	39.2	27.8	80.0	45.0	0	0.0	9.7
Mean/ Total	33.3	20.4	88.7	45.6	20.0	255.2	7.3

Table M 11: Meteorological data in North East zone during crop growth period of Rabi 2016-17

Std. Week No.	FAIZABAD						
	Temperature (C)		Humidity (%)		Rainy days	Rainfall (mm)	Sunshine hrs
	Max.	Min.	RH1	RH2			
40	34.0	25.7	89.8	63.4	1	9.8	5.1
41	32.7	21.8	92.2	56.8	1	25.3	5.1
42	32.8	17.9	93.1	43.1	0	0.0	5.9
43	32.4	16.3	92.0	37.8	0	0.0	3.0
44	31.0	14.3	96.4	34.5	0	0.0	2.6
45	29.7	12.7	95.1	39.4	0	0.0	1.5
46	29.0	11.8	94.8	40.1	0	0.0	1.8
47	27.3	11.1	92.4	42.4	0	0.0	2.4
48	25.8	12.2	96.4	63.5	0	0.0	1.1
49	19.2	11.7	96.2	77.1	0	0.0	1.7
50	19.5	9.0	99.1	74.7	0	0.0	1.5
51	23.2	7.5	95.1	53.0	0	0.0	2.3
52	20.1	10.6	96.2	72.0	0	0.0	1.5
01	18.0	10.2	98.4	78.0	0	0.0	1.0
02	20.1	4.9	89.1	43.5	0	0.0	2.2
03	22.4	5.9	93.5	42.5	0	0.0	2.5
04	23.7	9.1	95.0	57.0	2	16.8	2.0
05	21.9	8.2	98.5	62.0	0	0.0	2.7
06	24.5	8.4	93.4	45.2	0	0.0	5.2
07	25.7	9.9	94.4	46.2	0	0.0	5.5
08	27.9	11.1	90.8	37.1	0	0.0	5.3
09	28.8	11.5	82.1	3.5	0	0.0	6.4
10	27.8	12.3	82.4	42.5	0	0.0	4.4
11	29.4	10.0	79.4	34.1	0	0.0	7.9
12	33.4	15.5	73.7	28.2	0	0.0	8.4
13	37.8	18.8	74.5	29.5	0	0.0	9.5
14	37.7	20.0	77.0	38.0	0	0.0	8.4
15	37.7	18.8	67.8	35.0	0	0.0	9.1
16	37.5	25.3	74.7	42.2	0	0.0	8.8
17	39.0	22.5	59.7	32.0	0	0.0	8.6
18							
19							
20							
21							
Mean/ Total	28.3	13.5	88.4	46.5	4.0	51.9	4.4

Table M 12: Meteorological data in South zone during crop growth period of Rabi 2016-17

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	21.9	90.3	65.9	1	4.4	5.7	31.7	24.3	90.9	74.1	-	-	9.7
41	29.9	20.8	94.4	50.9	3	27.8	5.3	31.6	24.3	90.3	76.3	-	-	9.7
42	30.6	14.6	92.7	34.1	0	0.0	9.2	32.1	24.3	88.0	74.0	1	12.0	9.0
43	30.2	15.1	91.9	38.3	0	0.0	8.8	31.5	24.1	91.4	75.7	-	-	8.5
44	30.9	19.9	84.0	47.1	0	0.0	7.0	31.9	24.4	92.4	80.4	2	30.0	7.7
45	30.1	12.3	88.0	28.7	0	0.0	8.5	32.0	24.2	91.7	76.7	-	-	7.6
46	29.8	15.7	88.7	44.9	0	0.0	6.5	31.7	24.0	92.1	77.6	-	2.0	6.7
47	29.7	9.8	89.7	28.1	0	0.0	8.7	32.2	24.2	94.9	82.6	2	10.2	6.9
48	30.8	10.0	90.9	31.4	0	0.0	8.3	32.0	23.4	92.1	79.3	1	24.0	8.0
49	29.1	14.0	92.6	42.3	0	0.0	7.4	31.5	23.8	94.4	78.3	2.0	7.8	8.2
50	27.9	13.1	86.3	51.3	0	2.0	6.7	31.6	23.1	92.1	75.3	-	2.0	8.6
51	29.4	9.5	88.3	24.0	0	0.0	9.1	32.5	23.9	94.4	74.1	-	-	9.2
52	29.4	8.9	91.4	31.0	0	0.0	9.0	33.6	23.7	93.3	75.4	1	18.8	9.3
01	29.1	9.7	89.6	29.7	0	0.0	8.8	32.7	22.5	93.6	73.1	-	-	8.9
02	29.3	13.2	84.0	38.0	0	0.0	7.6	32.8	22.8	94.6	74.7	-	-	8.9
03	28.2	11.4	89.1	31.7	0	0.0	7.7	32.3	21.8	92.9	72.7	-	-	9.1
04	29.9	14.7	85.9	38.4	0	0.0	7.6	32.7	23.4	91.7	72.7	1	6.0	8.1
05	31.3	12.7	86.3	27.7	0	0.0	9.0	31.9	22.0	94.4	72.3	1	10.0	9.3
06	31.9	13.6	78.0	28.4	0	0.0	9.3	31.9	20.7	94.1	71.9	-	-	9.4
07	30.8	13.8	87.4	32.7	0	0.0	9.4	32.7	20.9	86.4	66.1	-	-	9.3
08	35.4	13.8	70.7	20.4	0	0.0	10.3	33.3	22.7	88.9	71.9	-	-	9.4
09	29.2	11.1	61.3	15.0	0	0.0	8.3	33.3	24.1	84.3	73.0	-	-	9.2
10	35.0	19.8	84.9	29.9	0	0.0	7.9	32.8	24.6	89.6	75.6	-	-	8.4
11	33.9	18.4	73.3	30.6	1	5.6	8.0	33.3	24.3	89.3	77.0	-	1.6	9.3
12	35.8	16.9	68.4	20.4	0	0.0	9.0	33.3	24.3	89.3	74.7	-	-	8.8
13	39.0	20.0	69.7	21.4	0	0.0	8.4	34.0	24.5	86.0	72.9	-	-	9.6
14	39.7	23.1	72.6	27.9	1	2.6	8.0	34.2	25.8	90.0	71.9	-	-	9.5
15	39.2	19.2	68.9	18.7	0	0.0	8.5	34.2	25.7	89.0	72.0	-	-	9.2
16	40.9	22.6	58.1	21.0	0	0.0	10.1	33.8	26.2	89.3	74.0	-	-	9.4
17	40.0	22.9	44.9	22.0	0	0.0	9.8	34.5	26.1	87.4	72.6	-	-	9.7
18	38.7	22.3	63.0	25.3	0	1.6	9.5	34.4	25.7	88.3	72.7	1	20.0	9.6
19	38.5	22.9	67.4	32.6	1	60.0	8.9	33.7	25.6	87.1	75.7	1	8.7	8.9
20	39.9	25.2	58.3	29.7	0	0.0	9.5	34.1	25.8	90.3	73.4	2	76.5	9.2
21	41.4	26.8	60.7	25.3	0	0.0	9.9	33.8	25.8	86.0	74.0	2	20.0	8.0
Mean/ Total	33.1	16.5	79.2	31.9	7.0	104.0	8.4	32.8	24.0	90.6	74.6	17.0	249.6	8.8

Table M 13: Meteorological data in South Zone during crop growth period of Rabi 2016-17

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	21.5	33.4		-	86.0	9.9	33.5	18.3	91.0	52.0	0	0	7.3
41	22.3	32.1	1	19.5	87.0	7.8	33.3	19.0	90.0	61.0	2	2	4.9
42	23.3	31.9		-	89.0	4.3	36.5	16.6	79.0	50.0	0	0	6.0
43	22.8	31.9		1	89.0	4.6	34.7	15.2	91.0	53.0	0	0	7.9
44	22.9	31.3	2	67.7	88.0	5.7	33.9	18.8	77.0	53.0	1	1	8.2
45	21.9	31.3		-	86.0	6.6	32.5	15.8	91.0	42.0	0	0	9.2
46	23.9	31.2		1.4	87.0	4.5	31.4	18.5	88.0	49.0	0	0	8.9
47	20.6	31.4		-	85.0	6.7	32.1	14.2	92.0	37.0	0	0	9.7
48	18.5	31.4	1	7.4	84.0	6.0	30.5	11.4	93.0	41.0	1	1	6.2
49	21.1	28.8	2	28.5	89.0	5.5	30.9	12.5	95.0	51.0	1	1	8.2
50	20.0	29.3	2	9.1	88.0	3.1	29.8	14.7	93.0	40.0	2	2	5.2
51	20.8	30.6			88.0	7.2	30.8	12.6	93.0	37.0	0	0	9.3
52	19.7	31.2			87.0	7.8	30.8	9.3	87.0	30.0	0	0	9.8
1	18.2	31.3			85.0	8.5	31.3	11.5	92.0	42.0	0	0	9.6
2	20.4	30.9			83.0	7.2	31.3	13.9	91.0	39.0	0	0	8.9
3	19.9	30.5			84.0	8.2	32.3	12.8	86.0	49.0	0	0.1	8.6
4	21.3	30.0	1	6.4	82.0	4.9	31.0	16.3	91.0	47.0	1	6.4	6.4
5	20.8	30.2	1	20	84.0	8.0	31.4	13.4	91.0	50.0	0	0	9.2
6	18.4	31.9			80.0	9.9	32.9	11.0	77.0	61.0	0	0	8.6
7	20.1	31.0			75.0	9.0	32.9	10.6	78.0	66.0	0	0	7.9
8	19.2	34.6			84.0	9.6	34.6	11.1	49.0	63.0	0	0	6.0
9	21.6	33.2			81.0	6.7	34.5	12.4	80.0	40.0	0	0	7.7
10	23.8	34.2	1	51.3	88.0	7.2	35.0	20.4	84.0	40.0	0	0	7.3
11	23.0	33.9	1	7	87.0	7.2	34.4	19.6	87.0	38.0	1	8.4	7.5
12	23.7	34.5	1	4.7	87.0	8.3	35.5	19.4	85.0	32.0	0	0	8.1
13	22.2	35.9			83.0	10.0	36.7	17.6	84.0	42.0	0	0	8.6
14	23.2	36.5		1.8	87.0	9.4	36.8	22.2	90.0	34.0	1	6.6	7.4
15	24.1	36.5	1	15.5	88.0	7.9	36.9	22.1	90.0	38.0	1	11	6.1
16	25.3	36.0			84.0	8.7	35.4	21.7	89.0	45.0	3	67.1	7.1
17	24.7	36.5		3.2	85.0	9.4	36.6	21.8	89.0	33.0	0	0.8	8.7
18	25.2	36.5			85.0	9.2	36.3	19.4	89.0	61.0	0	0	9.4
19	25.3	36.4			84.0	9.3	35.7	18.4	87.0	54.0	0	0	9.6
20							35.7	17.4	92.0	72.0	0	0	9.8
21							35.2	18.5	93.0	86.0	0	0	8.9
Mean/ Total	32.7	21.9	14.0	244.5	85.3	7.4	33.6	16.1	86.9	47.9	14.0	107.4	8.0

APPENDIX-IV: FORAGE CROPS BREEDING TRIALS AT A GLANCE: (RABI-2016-17)

Zone	Location	Tr.-1	Tr.-2	Tr.-3	Tr.-4	Tr.-5	Tr.-6	Tr.-7	Tr.-8	Tr.-9	Tr.-10	Tr.-11	Tr.-12	Tr.-13	Tr.-14	Tr.-15	Tr.-16	Tr.-17	Tr.-18	Tr.-19	Total
		IVTB	AVTB-1	AVTB-2	AVT-2 B (Seed)	IVTO (SC)	AVT Oat (SC-1)	AVTO (SC-2)	AVTO (SC-2) (Seed)	IVTO (MC)	AVTO-1 (MC)	IVT Oat (Dual)	AVT-1 Oat (Dual)	VT Lucerne (P)-2016 1 st Year	IVT- Vicia	VT Rye Grass Lolium-2016 Annual	VT Red Clover-2016 Perennial (1 st Year)	VT White Clover-2016 Perennial (1 st Year)	Rept. AVT Oat (SC)-2 Repeat 14-15	VT Rept. Lucerne (P) 2013-1 st Year	
1 (HZ)	Palampur	DR	DR			DR	DR	DR	DR	DR	DR	DR				DR					10/10
2	Srinagar	DR	DR			DR	DR	DR	DR	DR	DR	DR				DR					10/10
3	Almora										DR	DR									3/3
4	Rajouri	DR	DR			DR	DR	DR													5/5
5	Bajoura (Kullu)															DR					1/1
6 (NWZ)	Bikaner	DR	DR	DR	TF	DR	DR	DR				DR				DR					8/9
7	Jalore	DR	DR	DR		DR	DR	DR		DR						DR					8/8
8	Hisar	DR	DR	DR	DR	DR	DR	DR	DR	DR		DR									10/10
9	Ludhiana	DR	DR	DR	DR	DR	DR	DR	DR	DR		DR			DR		DR				11/11
10	Pantnagar	DR		DR		DR	DR	DR	DR	DR		DR									8/8
11	Udaipur	DR	DR	DR		DR	DR	DR				DR				DR					8/8
12	Meerut	DR	DR	DR		DR															4/4
13 (CZ)	Jhansi	DR	DR	DR	DR	DR		DR	DR	DR	DR	DR				DNR					10/11
14	Rahuri	DR	DR	DR	DR	DR		DR	DR	DR	DR	DR			DR	DR					12/12
15	Urulikanchan	DR	DR	DR	DR	DR		DR		DR	DR	DR			DR						10/10
16	Kanpur					DR															1/1
17	Anand					DR		DR		DR	DR	DR			DR						6/6
18	Jabalpur	DR	DR	DR	DR	DR		DR	DR	DR	DR	DR				DR					11/11
19	Raipur	DR	DR	DR		DR		DR				DR			DR	DR					8/8
20	Palghar	DR	DR			DR		DR													4/4
21 (NEZ)	Jorhat					DR	DR			DR		DR	DR								5/5
22	Kalyani	DR				DR	DR														3/3
23	Bhubaneswar	DR				DR	DR			DR		DR	DR								6/6
24	Ranchi	DR				DR	DR	DR		DR		DR	DR								6/6
25	Pusa	DR				DR	DR			DR											4/4
26	Faizabad	DR				DR	DR			DR		DR	DR								6/6
27	CAU Imphal					DR	DR			DR											3/3
28 (SZ)	Hyderabad					DR	DR								DR				DR	DR	5/5
29	Mandya					DR	DR								DR				DR	DR	5/5
30	Coimbatore					DR	DR								DR				DR	DR	5/5
31	Karaikal						DNR														0/1
32	Mattupetty					DR	DR														2/2
33	Tirupati/Guntur					DR						DR			DR						3/3
34	Dharwad														DR						1/1
Total Location		21/21	15/15	12/12	6/7	30/30	20/21	16/16	7/7	18/18	8/8	18/18	4/4	13/13	3/4	5/5	EST	EST	3/3	3/3	199/202

DR=Data Reported, DNR=Data not reported, TF-Trial Failed, Data Report (%) =98.5%

APPENDIX-V: FORAGE CROP PRODUCTION TRIALS AT A GLANCE: (RABI-2016-17)

Location	PS-13-AST-2	K-14-AST-3	K-15-AST-9C	K-15-AST-11C	R-15-AST-1	PS-14-AST-2	CS-14-AST-1	CS-14-AST-2	K-15-AST-1L	K-15-AST-2L	K-15-AST-8-7L	K-16-AST-6	K-16-AST-8	R-13-AST-1	R-14-AST-2	R-14-AST-3	R-15-AST-2	R-15-AST-2(A)	R-15-AST-3	R-15-AST-4	R-15-AST-5	R-15-AST-7	R-16-AST-4	R-16-AST-5	K-16-AST-1	R-16-AST-1	R-16-AST-7	Total	
Hill Zone																													
Palampur																											DR		1/1
Srinagar															DR												DR		2/2
North West zone																													
Hisar												DR															DR	DR	3/3
Pantnagar			DR																								DR		2/2
Bikaner	DR																			DR								DR	3/3
Ludhiana																											DR	DR	2/2
Karnal																						DR							1/1
Faizabad										DR		DR							DR										3/3
Ranchi		DR	DR	DR	DR																								4/4
Kalyani			DR		DR																								2/2
Bhubaneswar					DR																								1/1
Jorhat																	DR												1/1
Imphal															DR			DR									DNR		2/3
Pusa																													
Sri Niketan																					DR								1/1
Central Zone																													
Jabalpur			DR	DR																							DR	DR	4/4
Rahuri																									DR			DR	2/2
Urulikanchan																											DR	DR	2/2
Anand				DR																							DR		2/2
Raipur	DR	DR					DR	DR																			DR	DR	6/6
South Zone																													
Hyderabad				DR																									2/2
Coimbatore				DR																						DR			1/1
Mandya									DR																				1/1
Vellayani				DR		DR										DR													3/3
Dharwad	DR	DR								DR																			3/3
Total (DR & TC)	3/3	2/2	4/4	6/6	3/3	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	1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	9/9	7/7	53/54

DR- Data reported; DNR-Data not reported; Success (%) of data reporting/trial conducted – 53/54=96.3%

APPENDIX –VI: FORAGE CROP PROTECTION TRIALS AT A GLANCE (RABI- 2016-17)

Locations/Trials	PPT-1	PPT-2	PPT-17	PPT-19	PPT-20	PPT-21	PPT-22	PPT-23	PPT-26	Total
Palampur (HZ)	A DR	A DR	A DR	-	A DR	-	-	-	-	4
Ludhiana (NWZ)	A DR	A DR	-	A DR	-	A DR	-	A DR	A DR	6
Bhubaneswar (NEZ)	A DR	A DR	-	-	-	A DR	-	-	-	3
Rahuri (CZ)	A DR	A DR	-	-	-	-	A DR	A DR	A DR	5
Hyderabad (SZ)	A DR	A DR	-	-	-	-	A DR	A DR	-	4
Dharwad	A DR		-		-	-	A DR	A DR	A DR	4
Total	6/6	5/5	1/1	1/1	1/1	2/2	3/3	4/4	3/3	26/26

Abbreviations: DR = Data Reported; DNR =Data not reported; Data Reporting (%) = 100%

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. H. P. Parmar	Research Scientist (FC)	02692-264179/ 225861	09879196905	02692- 261520/ 261526	rsfcanand@yahoo.com forageanand@gmail.com
Dr. Jagruti C. Shroff	Associate Research Scientist (Agronomy)	02692-264179	08511186683		shroff1jagruti@yahoo.com jagrutishroff@gmail.com
Dr. M. R. Saiyed	Associate Research Scientist (PB)	02692-264179	09374175387		mahiyuddinr_saiyed@yahoo.com
Dr. K. B. 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	takawalep@gmail.com
Dr. S. D. Patil	Scientist (Agronomy)	07447304882 020-26926448 020-26926265	08888414856 09421108349	020 - 26926347	santosh86patil@gmail.com
Dr. A. B. Pande	Sr. Vice President, Animal Genetics & Breeding	020-26926248 020-26926265	09325010213	020-26926347	abpande@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. S. Pal	Director of Research	033-25828407	09433777734	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	Asstt. Biochemist	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. Satpal	Assistant Agronomist	01662255270	08901057255		satpal.jpj@gmail.com
Dr. D. S. Phogat	Assistant Scientist (PB)	01662-255270	09254437796		forages@hau.ernet.in
Dr. S. S. Siwach	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		aicrforagecauimphal@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 (Uttarakhand)					
Dr. Mahendra Singh Pal	Professor Agronomy	05944-234448 7579177380	05944233279	05944 233473	drmspal1@gmail.com
Dr. Birendra Prasad	Senior Research Officer (PB)		09411398516		prasadbst@gmail.com
Dr. J. S. Verma	Professor, GPB		05944234407	05944-233473	jsverma21@yahoo.in
Prof. J. P. Singh	Director Research	05944-233363	07500241418	05944-233257 05944-233473	drshankar54@gmail.com 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. S. K. Rao	Director (Research)	0761-2681200 0761-2681074	0761-2681614	0761-2681074	drslnkv@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. Sajan Kurien	Prof. & Director of Research	0487-2438101	9446071917		dr@kau.in
Mahatma Phule Krishi Vidyapeeth, Rahuri-413722 (Maharashtra)					
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. B. T. Sinare	Scientist (Agronomy)	09404115448	09423732876	02426-243223	sinarebt69@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 Pradesh)					
Dr. Ramesh Singh Yadav	Jr. Scientist (Agronomy)	05270-262051	09415890200	05270-262051	dr.ramesh1959@gmail.com
Dr. Bhagwan Singh	Director (Research)	05270-262072	05270-262031 09415380448	05270-262097	director_research07@yahoo.co.in

Name	Designation & Discipline	Tel. Office	Tel. Residence	Fax	E-mail
Orissa University of Agriculture & Technology, Bhubaneswar-751003 (Odisha)					
Mrs. Pravasini Behera	Jr. Pathologist		09437937079		pravasinibehera.pp@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		rahulkapoor@pau.edu
Dr. Ashlesha Singla	Asstt. Plant Pathologist	-do-	09872874383		ashlesha-atr@pau.edu
Dr. Meenakshi Goyal	Asstt. Biochemist	-do-	09216176800		meenakshigoyal@pau.edu
Dr. A. K. Khokhar	Asstt. Agronomist	01885- 241601	09478842947		anilkhokhar@pau.edu
	Director of 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
Dr. D. Raji Reddy	Director of Research	040-24015078	09989625220	040-24017453	dr.pjtsau@yahoo.com
Dr. M. V. Ramana	Associate Director of Research	08008311779	09440019029	08540-221177	adrpalem@gmail.com
Rajendra Agricultural University, Pusa, Samastipur, 848 125 (Bihar)					
Dr. S. K. Choudhary	Sr. Scientist (Agronomy)	09431834082	06274-2430394	06274-240255	skcrau@gmail.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. Mehfuza Habib	Assoc. Prof. (PB)	09419904358	09419904358	-	Mehfuza_habib@yahoo.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. M. Maheswaran	Director of Research	0422-6611447	094890 33000	0422-6611454	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. C. R. Ravishankar	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	mpajora1@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 Acting	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	milletts.icar@nic.in director.milletts@icar.gov.in
ICAR- Indian Institute of Farming Systems Research, Modipuram, Meerut-250110					
Dr. A. S. Panwar	Director	0121-2888711		0121-2888546	directoriiifsr@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.ernet.in
ICAR Research Complex for NEH Region, Umroi Road (Umiam) Barapni-793 103 (Meghalaya)					
Dr. S. B. Ngchan	Director	0364-2570257	0364-2570302	0364-2570288/ 2570501/	director@icarneh.ernet.in
National Dairy Development Board, Anand-388 001 (Gujarat)					
Dr. A. K. Garg	Sr. Manager (PS-AH)	02692-226246 (O)	02692-226517(R)	09426389619	akgarg@nddb.coop
Agriculture Research Station, Mahim Road, Palghar, District- Palghar (Maharashtra)-401 404					
Dr. Umesh S. Kudtarkar	Jr. Agrostologist	02525-241048	08390982994		umeshb4u59@rediffmail.com
Dr. U. V. Mahadkar	Director Research				dorbskkv@rediffmail.com
Chandra Shakhazad 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		akbarikpsvb@rediffmail.com
Grassland Research Station Junagadh Agricultural University, Dhari (Distt. Amreli), Gujarat					
Dr. G. S. Vala	Assoc. Research Scientist,	02797-221117	09427242452		dragsvala@gmail.com
Mr. V. V. Ansodariya	Assistant Research Scientist (PI.Br.)	02797-221117	09824156656		grsdhari@jau.in
Main Agricultural Research Station, University of Agricultural Sciences, P. B. No. 24, Raichur-548 101 (Karnataka)					
Dr. S. A. Biradar	Scientist (Agronomy) In-charge Forage Section	08532-220193	09241743148	08532-220193	sabiradar1@rediffmail.com
M P U A & T, - Dryland Farming Research Station, Arjia, Bhilwara- 311 001 Rajasthan					
Dr. Sunil K. Dadhich,	Assistant Professor		09414385915		
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 (Puduchery)					
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, Karijat, Raigad-410 201 (Maharashtra)					
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. Vinod Gupta	Sr. Scientist (Agril. Extension)		09419139407		gupta.ng1@gmail.com rarsrajouri@gmail.com
ICAR- Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora 263 601 (Uttarakhand)					
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. P. K. Ghosh	Director	0510-2730666	0510-2730333	0510-2730833	igfri.director@gmail.com
Dr. B. G. Shivakumar	Principal Scientist & OIC IGFR-I-SRRS, Dharwad - 580005,	0836-2447150	0836-2776551 09731924228	0836-2743459	bgs Kumar@yahoo.com
Dr. Pradeep Saxena	Pr. Scientist (Plant Pathology) & I/C Head CI Division	0510-2730029	09415506157 (M)	0510-2730029	pradeepsax@yahoo.com
Dr. S. S. Meena	Pr. Sci & OIC, IGFR I RRS, Avikanagar		09461642052 (M)		ssmeena123@yahoo.com
ICAR- AICRP on Forage Crops and Utilization, Project Coordinating Unit, IGFR I, 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
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. I. S. Solanki	Asstt. Director General (FFC)	011-23381753		011-23381753	solanki255@rediffmail.com