

CONTENTS

Item	Details	Pages
Preface		ii
Inaugural Session		iii
Highlights	Technology Generated	iv
Technical Session-I	Discipline Wise Report	1
Technical Session-II	Breeder Seed Production	2
Technical Session-III	Formulation of Technical Programme	
	III. a Crop improvement	3
	III. b Crop production	4
	III. c Crop Protection	5
Technical Session-IV	Review of Center-Wise Activities	6
Technical Session-V	FTD & TSP Formulation	7
Technical Session-VI	PGR and IPR Issues	8
Special Meeting	Varietal Identification Committee meeting	9
Technical Session-VII	Plenary Session	10
<i>Annexure-I</i>	Discipline-wise Technical Programme	
	I.i Technical Programme of Forage Crop improvement Research	11
	I.ii Technical Programme of Forage Crop Production Research	19
	I.iii Technical Programme of Forage Crop Protection Research	32
<i>Annexure-II</i>	List of Participants	34
<i>Annexure-III</i>	Glimpses of Media Coverage	

PREFACE

The National Group Meet, *Rabi* 2013-14 of All India Coordinated Research Project on Forage Crops was organized to review the accomplishments of Technical programme executed during *Rabi* 2012-13 at different coordinating and cooperating centres, in-house research activities and Forage Technology Demonstrations (FTDs); and also to formulate technical programme for *Rabi* 2013-14 as well as to discuss future thrust areas for fodder research under 12th plan. The meeting was jointly organized by Indian Council of Agricultural Research and JNKVV, Jabalpur during September 7-8, 2013.

The meeting was attended by the scientists engaged in forage research working at coordinating and collaborating centres located at different SAUs, ICAR institutes and NGOs. Representatives of Milk Cooperative Federation, private seed companies also participated in the programme and being important stakeholders contributed in the development of programme and linkages. Electronic and print media also participated in the meet and gave wide coverage of the programme.

This compilation contains brief report of National Group Meet, *Rabi* 2013-14 covering highlights on forage crop improvement, forage production and plant protection trials, technologies generated, proceedings of different technical sessions and technical programme for the coming *Rabi* season 2013-14. The participants discussed and planned future strategies for improving the forage productivity and quality through development of the regional and national forage technologies. The finalized technical programme on forage crop improvement, forage crop production and forage crop protection for *Rabi* 2013-14 have been given in annexure(s).

The successful conductance of the programme is attributed to the joint efforts made by the participating scientists, authorities of JNKVV, Jabalpur and the ICAR, Project Coordinating Unit, and other staff. All India Coordinated Research Project on Forage Crops sincerely acknowledges their contribution in successful organization of the event. We sincerely thank authorities, staff and students of JNKVV, Jabalpur for their warm hospitality, excellent arrangements and professional conductance of the programme.

A. K. Roy
Project Coordinator

INAUGURAL SESSION

The inaugural session of the National Group Meet, *Rabi* 2013-14 of AICRP on forage crops was organized at JNKVV, Jabalpur during September 7-8, 2013. Dr. V. S. Tomar, Vice Chancellor, JNKVV, Jabalpur presided over the meeting. Dr. S. K. Datta, Deputy Director General (Crop Science), ICAR, New Delhi was chief guest. Dr. P. K. Ghosh, Director, IGFRI, Jhansi was guest of honour.

Dr. S. S. Tomar, Director Research Services, JNKVV, Jabalpur highlighted the research contribution of the university in various fields especially the forage crops. He extended welcome to the chief guest, dignitaries, participating scientists, team of NGM organizers, representative of press and media and farmers of the region.

Dr. A. K. Roy, Project Coordinator (Forage Crops) presented Coordinator's report for *Rabi* 2012-13. He highlighted the progress of research activities and the targets achieved as per the technical programme under the project. During *Rabi* 2012-13, the research activities were conducted at 30 centers located in five zones on aspect of forage crop improvement, forage crop production and plant protection. A total of 13 breeding trials of four annuals and two perennial forage species were conducted at 30 centers. Seventy forage crop production trials at 25 locations were undertaken to generate forage crop production technologies and improved forage crop varieties. Forage crop protection trials on pest occurrence, evaluation of breeding materials, and pest management were undertaken at 9 centers. He also presented the present scenario of forage resources and priorities for XIIth plan.

Dr. P. K. Ghosh, Director, IGFRI, highlighted the achievements of IGFRI in the forage development and its key role in bridging the gap of huge deficit of green fodder demand and supply. He highlighted the new initiatives by IGFRI proposed in XIIth plan including "National initiative on forage technology demonstration" for transfer of technology at farmer's field.

Dr. S. K. Datta, DDG (Crop Science), ICAR, New Delhi stressed upon the need of producing quality and nutritious fodder in sufficient quantity for getting better livestock production. He also highlighted the necessity of joint efforts of policy makers, scientist and farmers in coordinated and collaborative manner to meet challenges of increasing production of quality forages in eco-friendly manner. He emphasized upon the need of post harvest conservation and management of forages.

Prof. V. S. Tomar, Vice Chancellor, JNKVV, Jabalpur, highlighted the programmes undertaken for overall development of forage crop production in the state. He also extended the welcome and best wishes to all the participating scientists for successful and fruitful meeting.

The inaugural function ended with vote of thanks by Dr. A. K. Mehta, Organizing Secretary, to the dignitaries and participants for their valuable presence in inaugural session. He also extended gratitude to the PC Unit and other staff of the institute, different committees for their support in organization of NGM Meet of AICRP on Forage Crops.

Highlights: Technology Generated

A. Forage Crop Improvement

Entries identified for release as variety

1. **Tall Fescue Grass (*Festuca arundinacea*) entry HIMA 14:** The proposal was submitted by HPKVV, Palampur. The committee recommended its identification for release for hill zone of Himachal Pradesh, Uttarakhand, and Jammu and Kashmir for sub-temperate and temperate grasslands/ pastures and cultivation.
2. **Lucerne (*Medicago sativa*) entry Anand-23 (AL-4):** The proposal was submitted by AAU, Anand. The committee recommended its identification for release for north-west zone comprising states of Punjab, Rajasthan for cultivation as the perennial fodder.
3. **Oat (*Avena sativa*) entry OS-377:** The proposal was submitted by CCS HAU, Hisar. The committee recommended its identification for release for central zone under irrigated conditions in single cut system in Rabi season for the states of Uttar Pradesh, Maharashtra, Gujarat, Madhya Pradesh and Chhattisgarh.
4. **Oat (*Avena sativa*) entry JHO 2010-1:** The proposal was submitted by IGFR, Jhansi. The committee recommended its identification for release for the south zone under irrigated conditions in single cut system in rabi season for the states of Andhra Pradesh, Karnataka, Tamil Nadu.
5. **Pearl millet (*Pennisetum glaucum*) entry PAC 981:** The proposal was submitted by Advanta Limited, Hyderabad. The committee recommended its identification for release for cultivation in the irrigated/ rainfed condition in the state of Punjab, Haryana, Rajasthan in the NW zone and Gujarat, Madhya Pradesh, Maharashtra, Uttar Pradesh in the central zone.

B. Forage Production Technologies:

1. Intercropping of banana with bajra napier hybrid was found most remunerative system for Kerala.
2. Application of FYM (10 t/ha) + ZnSO₄ 20 kg/ha + Gypsum 5 q/ha along with RDF to fodder sorghum was found best treatment for increasing fodder productivity and remuneration under saline sodic soil at Mandya.
3. In south zone, growing of Para/BN hybrid under waste water supplemented with 100% RDF resulted in the highest GFY and monetary return.
4. In NEZ conventional tillage recorded higher GFY and net return of oat without affecting rice yield. Application of 100% Recommended dose of fertilizer + Biofertilizer (*Azotobacter* + PSB) resulted in higher fodder productivity and net returns.

Technical Session-1
(Discipline-wise report)

Chairman : Dr. P. K. Ghosh, Director, IGFRI, Jhansi
Co- Chairman : Dr. A. K. Singh Consultant JK Group, Raipur
Rapporteurs : Drs. S. M. Kumawat & D. I. Suma Bai

Crop Improvement: Dr. A. K. Mall, Senior Scientist (PB&G), AICRP FC coordinating unit, IGFRI, Jhansi presented the highlights of forage crop improvement trials conducted during *Rabi* 2012-13 at different Centers. A total of 13 trials were conducted at 30 locations on Berseem, Oat (Single, Multi cut, Dual and Seed), Rye Grass and Lathyrus (annuals) and Lucerne, Tall Fescue as perennials and success rate was 94.7 % (179/189). The entries promoted for advanced trials were pointed out.

Crop Production: Dr. S. R. Kantwa, Senior Scientist (Agronomy), AICRP FC coordinating unit, IGFRI, Jhansi presented the outcome of Forage Crop Production trials conducted during *rabi* 2012-13 at different locations. Total 17 experiments were conducted comprising of coordinated (8), location specific (7) and AVTs based (2) at 25 locations and success index was 95%. During this period, four production technologies were recommended.

Crop Protection: Dr. R. B. Bhaskar, Senior Scientist (Plant Pathology) presented the report on Plant protection trials conducted at 7 locations. The experiments aimed to study the occurrence and abundance of major diseases and pests in forages, screening of breeding materials and development of management technologies for the control of diseases and pests in Oat, lucerne and berseem. The most prevalent pest and diseases in *Rabi* forage crops was presented. During the period under report, stem rot and root rot of berseem, leaf blight and aphid infestation in oat, leaf spot, rust, downey mildew and aphid infestation were the major diseases and pests at various locations.

The session ended with vote of thanks to the chair.

Technical Session-II Breeder Seed Production

Chairman	: Dr. D. K. Mishra, Head, Dept of GPB, JNKVV, Jabalpur
Co- Chairman	: Dr. Dinesh Kumar, Principal Scientist, ICAR
Rapporteurs	: Drs. S. Bora Neog & H. P. Parmar
Finalization of BSP allocation	: Dr. A. K. Mall

At the outset, the chairman welcomed all the participants. Dr. A. K. Mall, Senior Scientist (PB&G), AICRP FC coordinating unit, IGFRI, Jhansi presented the status of Breeder Seed Production in forage crops for *Rabi* 2012-13.

In *Rabi* 2012-13, the indent for Breeder Seed Production was received from DAC, GOI for 28 varieties in four forage crops *viz.* oat (9), Berseem (10), Lucerne (4) and Gobhi-Sarson (5).

The actual production was 696.72 q that indicates the deficit of 217.4 q *i.e.*, 23.27%. The shortfall in the breeder seed production of different crops was as follows:

- Production in oats was 611.3 q against the indent of 837.5 q (deficit 226.2 q)
- Production in Berseem was 76.68 q against the indent of 69.1 q (Surplus 7.58q)
- Production in Lucerne was 6.6 q against the indent of 7.1 q (deficit 0.5 q)
- Production in Gobhi-Sarson was 2.14 q against indent of 0.42 q (Surplus 1.72 q)

Seed production was affected at some station due to drought and non availability of nucleus seeds.

Dr. A. K. Mall also presented *Rabi* 2013-14 Breeder Seed Production Programme. Seed production was allocated to different centers as per indent of DAC, Government of India. The allocation in different crop and varieties were accepted by the respective centres.

Many centres raised the issue of non-lifting of breeder seed by different organization in Oat crop.

The session ended with vote of thanks to the chair.

TECHNICAL SESSION III (CONCURRENT)
FORMULATION OF TECHNICAL PROGRAMME
FORAGE CROP IMPROVEMENT

Chairman	: Dr. D. K. Mishra, Head, Dept. of GPB, JNKVV, Jabalpur
Co- Chairman	: Dr. A. K. Roy, PC AICRP Forage Crops
Rapporteurs	: Dr. Rahul Kapoor & Dr. P. S. Takawale
Finalization of trials	: Dr. A. K. Mall

At the outset, the chairman welcomed the delegates. Dr. A. K. Mall, presented the breeding trial report of *Rabi* 2012-13 to the house for finalization of the technical programme for *Rabi* 2013-14. A total of seventeen breeding trials were decided by the house for *Rabi* 2012-13 in five different crops.

Following were the suggestions and recommendations:

- Four entries *viz*; JBSC-1, JBSC-2, JBSC-3 and JBSC-4 were promoted to AVT-1 berseem (SC) from IVT berseem (SC).
- From IVTO SC, nine entries *viz*; UPO-12-1, OS 405, JO-04-14, JHO-2012-1, OL 1760, SKO 190, JHO-2012-2, RSO-59 and RSO 60 were promoted to AVTOSC-1.
- Four entries *viz*; NDO 711, OS 403, UPO-06-1 and NDO 10 were promoted to AVTOSC-2 from AVTOSC-1.
- Six entries *viz*; JO-04-315, HFO 488, OL 1769, OL 1766, JHO-2012-3 and PLP 14 were promoted to AVTO-1(MC) from IVTO (MC).
- None of the entries were promoted IVTO-dual
- For IVT Lathyrus and AVT-2 Lathyrus location Karjat is dropped.
- Kanpur, Karjat, Pusa centres to be deleted for conduct of AVT-2 Lathyrus (seed).
- From IVT-Lathyrus five entries *viz*; JLJO-09-2, BK-12-2, RLS-3006-2, JHLS-2012-2 and JHLS-2012-1 were promoted to AVT-1 Lathyrus.
- Two entries *viz*; JHLS-2011-2 and JLJ-09-1 were promoted from AVT-1 Lathyrus to AVT-2 Lathyrus.
- It was decided that plant samples of the testing entries after 30 and 60 DAS in AVT2 of Lathyrus and seed samples of AVT 2 seed should be collected and send to IGFRI, Jhansi after drying and grinding for evaluation of antinutritional factor.
- Seven new trials were constituted in different crops like berseem (IVTB), oats (IVTO-SC, IVTO-MC and IVTO-dual) Lathyrus (IVT-Lathyrus), Ryegrass (IVT-Ryegrass) and Lucerne (VT –Perennial Lucerne).
- AVTO-2 (SC) trial conducted during Rabi 2011-12 will be repeated in Rabi 2013-14.
- Chairman and co-chairman emphasized on contribution of good material for IVTs by each centre.

All the centres were advised to give more emphasis on germplasm collection, procurement and adopt suitable breeding methodology to develop material and contribution to multilocation trials.

The session ended with vote of thanks to the chairman.

TECHNICAL SESSION – III (CONCURRENT)

FORMULATION OF TECHNICAL PROGRAMME

FORAGE CROP PRODUCTION

Chairman	: Dr. A. R. Sharma, Director, DWSR, Jabalpur
Co- Chairman	: Prof. Girish Jha, Head, Dept of Agronomy, JNKVV, Jabalpur
Rapporteurs	: Dr. K. K. Sharma and Mr. Birendra Kumar
Finalization of trials	: Dr. Naveen Kumar and Dr. S. R. Kantwa

At the outset, chairman emphasised on generation of research information on resource management for increasing forage productivity. He stressed upon need of detailed study in respect of each component technology for development of effective technology. New research programmes were discussed and finalised as follows.

- AST-4: Studies on the effect of irrigation levels on green forage yield and quality of different forage crops during lean period will be conducted one more year (Rabi 13-14).
- The trial on “Performance of perennial fodder sorghum (COFS 29) as influenced by planting geometry and cutting intervals under irrigated condition” was approved by the house for Dharwad, Bikaner and Raipur centres as coordinated trial.
- “Yield potential of cereals with forage legumes under pure stand and mixtures” approved as location specific trial for Srinagar.
- “Studies on intensive fodder cropping systems for yield maximization” approved as location specific trial for Raipur.
- Altogether 17 experiments were conducted at 25 locations. Two AVT based trials, two location specific trials and one coordinated trials will be started from *Rabi* 2013-14.

Four trials were concluded and recommendations are as follows:

- Intercropping of banana with bajra napier hybrid was found most remunerative system for Kerala.
- Application of FYM (10 t/ha) + ZnSO₄ 20kg/ha + Gypsum 5q/ha along with RDF to fodder sorghum was found best treatment for increasing fodder productivity and remuneration under saline sodic soil at Mandya.
- In south zone, growing of Para/BN hybrid under waste water supplemented with 100% RDF resulted in the highest GFY and monetary return.
- In NEZ conventional tillage recorded higher GFY and net return of oat with out affecting rice yield. Further application of 100% Recommended dose of fertilizer + Biofertilizer (*Azotobactor* + PSB) resulted in higher fodder productivity and net returns.

In chairman’s remark, Dr Sharma asked for identifying the research gap and chalk out programmes to get research information with utility for end user, *i. e.*, farming community. He also appealed to effectively conduct ‘on farm demonstration programme’ for proper dissemination of technology.

The session ended with vote of thanks to the chair.

TECHNICAL SESSION- III (CONCURRENT)
FORMULATION OF TECHNICAL PROGRAMME
FORAGE CROP PROTECTION

- Chairman** : **Dr. N. D. Sharma**, Ex-Prof. & Head, Dept. Plant Pathology, JNKVV, Jabalpur
- Co- Chairman** : **Dr. O.P. Veda**, Head, Deptt. of Entomology and
Dr. A. G. Nema, Head Deptt. of Plant Pathology, JNKVV, Jabalpur
- Rapporteurs** : Drs. Upasana Rani and A. B. Tambe
- Finalization of trials** : Drs. R. B. Bhaskar and Ritu Mawar

Forage Scientists of Plant Pathology and Entomology disciplines discussed in detail the achievements of the last *Rabi* season along with the ongoing technical programme. Dr. S.B. Dass, Professor of Entomology and Dr. S. P. Tiwari, Professor Nematology also participated in the discussion. The Chairman gave valuable suggestions for further improvement of the technical programme. Based on the discussion and suggestions made by the Chairman, the following recommendations emerged.

1. The trials PPT-1 and PPT-2: A & B will continue as they are of continuous nature.
2. PPT-12, PPT-17 and PPT-18 will also continue in the *Rabi* 13-14.
3. The chairman suggested that all the plant protection scientists should record the observations of insect-pests and diseases in agronomy (AVT) trials.
4. Rahuri centre should supply the seed samples to check the population of *Ditylenchus dipsaci* nematode to the Project In-charge, AICRP on Nematodes, Department of Plant Pathology, JNKVV, Jabalpur.

The meeting ended with vote of thanks to Chair.

TECHNICAL SESSION – IV

REVIEW OF RESEARCH ACTIVITIES: CENTRE WISE PRESENTATION

Chairman	:	Dr. A. K. Roy, PC, AICRP-FC
Co-Chairman	:	Dr. Dinesh Kumar, Principal Scientist, FFC section, ICAR
Rapporteur	:	Dr. J. K. Bisht & Dr. P. M. Patel

The Session started with introductory remarks by the Chairman. Twenty two centers from different zone have presented the reports.

- Palampur centre has a good collection of Fescue grass and attempts were made for generation of new genetic material in winter grasses.
- Srinagar center reported good progress on oat.
- Almora center reported dual purpose wheat varieties for fodder availability during lean (winter) season.
- Ranchi center is advised to strengthen the germplasm holding by exploration to different areas. They should start work on *Deenanath* grass.
- Jorhat centre have reported successful introduction of rice bean under rice fallow system.
- Rahuri centre was asked to share the material of poly-cross Lucerne nursery with Bikaner.
- Anand center reported good progress in breeding programme in Lucerne.
- Mandya centre have developed inbred line of maize, therefore they were advised to go for hybridization programme.

Some of the important recommendations emerged out after thread bear discussion

- It has been advised that the respective centres should give details of the germplasm status at their centre and should try to enrich the germplasm holding in mandated crops. They should also characterize the germplasm and identify superior lines and donors of desirable traits.
 - To strengthen the forage improvement programme, emphasis should be given to germplasm collection from different sources
 - All the centers were advised to respect the IPR issues. They are further advised not to use material from other sources without consent of concerned breeder/ institution.
 - All the germplasm available with different centers need to be characterized and IC numbers should be obtained from NBPGR.
 - It is advised that all the centers should concentrate on their allotted crops.
 - All the center should share their breeding materials with other centers having the same mandated crops.
 - All the germplasm exchange from foreign countries should be routed through NBPGR, New Delhi. It must be strictly followed.
 - Regarding placement of staff in AICRP coordinating units, it was pointed out that higher cadre persons should be posted against the sanctioned post of lower cadre.
 - AICRP centres were requested to supply the released varieties seed material for their conservation at NBPGR as only 58 released varieties have been conserved.
 - Any recognition / achievement by the centers regarding forage research should be communicated to AICRP FC coordinating unit for compilation in annual report.
- The session ended with the thanks to Chair.

Technical Session-V

FTD & TSP Formulation

Chairman : Dr. A. K. Roy
Rapporteurs : Drs. Amit Jha & Ritu Mawar

At the outset, the chairman welcomed all the participants. Dr. S. R. Kantwa (Senior Scientist) presented the status of FTD's allotted to AICRP (FC) centres for *Rabi* 2013-14.

A total of 598 FTD's were allotted to 23 AICRP centres for Rabi crops. It comprised of 150 FTDs to berseem, 95 to lucerne, 280 to oat, 15 to laythrus, 5 to tall fescue, 5 to rabi maize, 15 to cowpea, 3 to white clover and 20 to rye grass.

The following decisions were taken after the discussion.

- All the centres should send the results of the demonstrations along with details of beneficiaries (farmers).
- Farmers should not be repeated for the same crop and variety in subsequent years.
- As far as possible every year, the target villages and beneficiaries should be changed.
- The data regarding GFY and seed yield etc should be recorded and analyzed before reporting. The report along with good photograph should be send for compilation in annual report.
- The agronomist in the center will be responsible for FTD and TSP trials under the supervision of OIC center.
- TSP and FTD budget utilization should be mentioned separately in the AUC.
- In case of TSP, quarterly report should be submitted immediately after the end of every quarter for onward transmission to ICAR. (It is time bound activity).

The session ended with vote of thanks to the chair.

**Technical Session-VI
(PGR & IPR Issues)**

Chairman	Dr. S. S. Tomar, DRS, JNKVV, Jabalpur
Convener	Dr. A. K. Roy, Project Coordinator (FC)
Rapporteurs	Dr. A. K. Mall

At the outset, the chairman welcomed all the three speakers and expressed the views that three important topics being covered by eminent speakers will be beneficial for all. He appealed all the participants to pay attention to the lectures.

Dr Anjali Kak, Principal Scientist, NBPGR, New Delhi gave an extensive talk on 'Registration of Novel and Unique Germplasm'. She deliberated in detail about the scope and importance of germplasm registration and detailed the methodology of registration. She also gave a status report of forage crop germplasm conserved at NBPGR. She highlighted the need of constitution of the institute germplasm registration committee at all the centres. It was pointed out that unique and distinct material developed during the process of breeding varieties as well as unique germplasm collected/ identified can be registered at NBPGR.

Dr V. K. Yadav, Principal Scientist, IGFRI, Jhansi gave a talk on 'DUS testing guidelines'. He discussed in detail about the need of DUS testing guidelines and explained the various steps of on-going DUS testing guidelines development in oat, Cowpea and Guinea grass. He presented the details of characters and invited suggestion from the participants to improve upon them.

Dr. D. Khare, Professor, JNKVV, Jabalpur explained the various aspects of 'PPV & FRA'. He gave details of uniqueness, various rules and regulations of the act. He elucidated about the varietal registration process, application procedure, different types of varieties protected under this act.

At the end chairman and co chairman appreciated all the speakers for informative presentations and also suggested to all the participating centres to seek full advantage out of the vast knowledge provided by the speakers on different components of fodder genetic resources and Intellectual Property Right.

The session ended with vote of thanks to the chairman.

Proceeding of the Varietal Identification Committee

Varietal Identification Committee meeting was held on 7th September, 2013 during the National Group Meeting (Rabi 2012-13) of AICRP (Forage Crops) at JNKVV, Jabalpur under the chairmanship of Dr S. K. Datta, Deputy Director General (Crop Science) ICAR, New Delhi

A total of seven proposals of four forage crops *viz.*, Oat (3), Tall fescue (1), Bajra (2), Lucerne (1) were submitted by different institutes/ SAUs/ Pvt. Companies. The proposals were discussed thoroughly. The recommendations of the committee are as following:

Tall Fescue Grass (*Festuca arundinacea*) entry HIMA 14: The proposal was submitted by HPKVV, Palampur. The entry was found superior in GFY and DMY against the qualifying entry and all the checks. It was also having good quality and no problem of diseases and pest. The committee recommends its identification for release for hill zone of Himachal Pradesh, Uttarakhand, and Jammu and Kashmir for sub-temperate and temperate grasslands/ pastures and cultivation.

Lucerne (*Medicago sativa*) entry Anand – 23 (AL -4): The proposal was submitted by AAU, Anand. The entry was found superior against both the checks for GFY and DMY. It also showed superiority for per day productivity for both GFY and DMY. The entry is also having good quality (>21% Crude protein). The material was having a different genetic background being a local collection from north Gujarat (Kutch region of Gujarat). Hence, the entry was recommended for identification for release for north-west zone for the states of Punjab, Rajsthan for cultivation as the perennial fodder crop variety.

Pearl millet (*Pennisetum glaucum*) entry RBB-1 (Raj Bajra -1): The proposal was submitted by SKRAU, Bikaner. The committee observed that the entry was significantly inferior in green fodder yield against the check Giant Bajra. Hence the committee did not recommend its identification.

Oat (*Avena sativa*) entry OS-377: The proposal was submitted by CCS HAU, Hisar for central zone. The entry was found superior against both the national checks and the zonal check for GFY and DMY. It was also superior against all the qualifying entries. It was also superior for per day productivity for both green fodder and dry matter. There was no major disease problem. The committee recommends its identification for release for central zone under irrigated conditions in single cut system in rabi season for the states of Uttar Pradesh, Maharashtra, Gujarat, Madhya Pradesh, Chhattisgarh.

Oat (*Avena sativa*) entry JHO 2010-1: The proposal was submitted by IGFRI, Jhansi. The committee observed its superiority for GFY and CPY against all the checks. It was also superior against all the checks and qualifying entries for DMY. The committee recommends its identification for release for the south zone under irrigated conditions in single cut system in *Rabi* season for the states of Andhra Pradesh, Karnataka, Tamil Nadu.

Oat (*Avena sativa*) entry UPO 09-1: The proposal was submitted by GBPUAT, Pantnagar. The committee observed that the entry had at par or slightly better / inferior performance against some of the checks and qualifying entries. Committee recommends that the full trial of AVT-2 should be repeated again for one year to observe the consistency and performance of all the entries.

Pearl millet (*Pennisetum glaucum*) entry PAC 981: The proposal was submitted by Advanta Limited, Hyderabad. The committee observed its superiority for GFY and DMY against all the checks and qualifying entries. It was also superior for per day productivity against the checks and qualifying entries for both green fodder and dry matter yield. The committee recommends its identification for release for cultivation in the irrigated/ rainfed condition in the state of Punjab, Haryana, Rajasthan in the NW zone and Gujarat, Madhya Pradesh, Maharashtra, Uttar Pradesh in the central zone.

TECHNICAL SESSION -VII
PLENARY SESSION

Chairman : Dr. V. S. Tomar, Vice-Chancellor, JNKVV, Jabalpur
Co-Chairman : Dr. P. K. Ghosh, Director, IGFRI, Jhansi
Convener : Dr. A. K. Roy, Project Coordinator (FC)
Rapporteurs : Drs. S. R. Kantwa and A. K. Mall

The rapporteurs of different technical sessions presented proceedings of respective sessions. The aspects and major issues related to *Rabi* 2013-14 programme in specific and forage research in general were discussed. The recommendation of technical session were discussed and accepted after approval of the house. The modifications suggested by the house were incorporated in the respective session proceedings.

Dr. V. S. Tomar, Vice-Chancellor, JNKVV, Jabalpur, appealed to all the scientists to work wholeheartedly for development of suitable technologies. He stressed upon the need of developing user-friendly and economically viable technologies which can be readily adapted by the farmers. He congratulated the scientists of the institutions whose varieties were identified for release.

Dr. P. K. Ghosh, Director, IGFRI, Jhansi highlighted the achievements and new initiatives in forage research. He thanked the authorities of JNKVV for excellent hospitality.

Dr A. K. Mehta, OIC, AICRP-FC, JNKVV, Jabalpur extended vote of thanks to the ICAR authorities, Project Coordinator and his team, participants, local team and media for successful conductance of National Group meet at the end of session.

Dr A. K. Roy, PC, AICRP Forage Crops congratulated all the participants for successful conductance of the programme. He thanked the Hon'ble Vice Chancellor, Director Research Services, Staff and students of JNKVV, Jabalpur for their warm hospitality, excellent boarding and lodging arrangements, facilities and conductance of the programme.

TECHNICAL PROGRAMME FOR RABI-2013-14 FORAGE CROP IMPROVEMENT (PLANT BREEDING)

1. IVT Berseem: Initial Varietal Trial in Berseem

Number of entries	4 + 2 NC + 1 ZC
Contributors	2: Hisar; 1: Jhansi; 1 Jabalpur
National checks	Wardan, Mescavi (2)
Zonal checks	BL-22 (HZ), Bundel Berseem-2 (CZ & NWZ), Bundel Berseem-3 (NEZ)
Design	RBD with 3 replications
Plot size	3.0 x 3.0 m
Spacing	Row to row-30 cm (each plot accommodating 10 rows of 3 m length)
Seed rate	22 g per plot (approx. 25 kg/ha)
Seed requirement	2.25 kg/entry from each contributor ; 1.0 Kg for each zonal check
Fertilizer	N-20 kg, P ₂ O ₅ 80 kg/ha
Locations (21)	HZ- Palampur, Srinagar, NWZ- Pantnagar, Bikaner, Hisar, Ludhiana, Jalore, Meerut & Udaipur, NEZ- Kalyani, Ranchi, Faizabad, Bhubaneswar, Pusa, CZ- Jhansi, Rahuri, Jabalpur, Urulikanchan, Palgarh, Kanpur, Raipur

2. AVT-1: First Advanced Varietal Trial in Berseem (SC)

Number of entries	4 + 2 NC + 1 ZC
Name of the entries	JBSC-1, JBSC-2, JBSC-3 & JBSC-4 (Jhansi)
National checks	Wardan, Mescavi
Zonal checks	Bundel Berseem-2 (CZ & NWZ)
Design	RBD with 3 replications
Plot size	4.0 x 3.0 m
Spacing	Row to row-30 cm (each plot accommodating 10 rows of 3 m length)
Seed rate	30 g per plot (approx. 25 kg/ha)
Seed requirement	1.25 kg/entry from contributor; 1.25 Kg for each national and zonal check
Fertilizer	N-20 kg, P ₂ O ₅ -80 kg/ha
Locations (8)	CZ- Jhansi, Rahuri, Jabalpur, Urulikanchan, Karjat, NWZ- Bikaner, Hisar, Ludhiana
Special note	Cut has to be taken at 60 Days after sowing

3. IVT Oat (SC): Initial Varietal Trial in Oat (Single cut)

Number of entries	13 + 2 NC + 1 ZC
Contributors	3: Srinagar; 1: Hisar; 3: Ludhiana; 2: Rahuri; 2: Jhansi; 1: Jabalpur; 1: Faizabad
National checks	Kent and OS-6
Zonal check	SKO-90 (HZ), OL-125 (NWZ), JHO-99-2 (NEZ), JHO-822 (CZ), JHO- 2000-4 (SZ)
Design	RBD with 3 replications
Plot size	3.0 x 3.0 m
Spacing	Row to row: 25 cm (each plot accommodating 12 rows of 3 m length)
Seed rate	90 g per plot (approx. 100 kg/ha)
Seed requirement	10.0 kg/entry from each contributor; 3.5 Kg for each zonal check
Fertilizer	N- 80 kg, P ₂ O ₅ -40 kg/ha
Locations (27)	HZ- Palampur, Srinagar NWZ- Bikaner, Jalore, Hisar, Ludhiana, Pantnagar, Udaipur, Meerut NEZ- Jorhat, Kalyani, Bhubaneswar, Ranchi, Pusa, Faizabad, CAU Imphal CZ- Jhansi, Rahuri, Urulikanchan, Palgarh, Kanpur, Anand, Jabalpur, Raipur SZ- Hyderabad, Mandya, Coimbatore (Ooty)

4. AVT Oat (SC)-1: First Advanced Varietal Trial in Oat (Single cut)

Number of entries:	9 + 2 NC +1 ZC
Name of entries:	UPO-12-1, OS-405, JO-04-14, JHO-2012-1, JHO-2012-2, OL-1760, SKO-190, RSO-59 & RSO-60
National checks:	Kent and OS-6
Zonal checks:	SKO-90 (HZ), OL-125 (NWZ), JHO-99-2 (NEZ), JHO-822 (CZ), JHO- 2000-4 (SZ)
Design:	RBD with 3 replications
Plot size:	4.0 x 3.0 m
Spacing:	Row to row-25 cm (each plot accommodating 12 rows of 4 m length)
Seed rate:	120 g per plot (approx. 100 kg/ha)
Seed requirement	11.5 kg/entry from each contributor; 4.0 kg for each zonal check
Fertilizer:	N- 80 kg, P ₂ O ₅ -40 kg/ha
Locations (27):	HZ- Palampur, Srinagar NWZ- Bikaner, Jalore, Hisar, Ludhiana, Pantnagar, Udaipur, Meerut NEZ- Jorhat, Kalyani, Bhubaneswar, Ranchi, Pusa, Faizabad, CAU Imphal CZ- Jhansi, Rahuri, Urulikanchan, Karjat, Kanpur, Anand, Jabalpur, Raipur SZ- Hyderabad, Mandya, Coimbatore (Ooty)

5. AVT Oat (SC)-2: Second Advanced Varietal Trial in Oat (Single cut)

Number of entries	4 + 2 NC +1 ZC
Name of entries	NDO-711, OS-403, UPO-06-1 and NDO-10
National checks	Kent and OS-6
Zonal checks	Palampur-1(HZ), OL-125 (NWZ), JHO-99-2 (NEZ), JHO-822 (CZ), JHO-2000-4 (SZ)
Design	RBD with 3 replications
Plot size	4.0 x 3.0 m
Spacing	Row to row- 25 cm (each plot accommodating 12 rows of 4 m length)
Seed rate	120 g per plot (approx. 100 kg/ha)
Seed requirement	11.5 kg/entry from each contributor; 4.0 kg for each zonal check
Fertilizer	N- 80 kg, P ₂ O ₅ - 40 kg/ha
Locations (27)	HZ- Palampur, Srinagar NWZ- Bikaner, Jalore, Hisar, Ludhiana, Pantnagar, Udaipur, Meerut NEZ- Jorhat, Kalyani, Bhubaneswar, Ranchi, Pusa, Faizabad, CAU Imphal CZ- Jhansi, Rahuri, Urulikanchan, Karjat, Kanpur, Anand, Jabalpur, Raipur SZ- Hyderabad, Mandya, Coimbatore (Ooty)

5A. AVT Oat (SC)-2 (Agronomy)

Number of entries	4+2+1
Name of entries	NDO-711, OS-403, UPO-06-1 and NDO-10
National checks	Kent and OS-6
Zonal checks:	Palampur-1(HZ), OL-125 (NWZ), JHO-99-2 (NEZ), JHO-822 (CZ), JHO- 2000-4 (SZ)
Seed requirement	12.00 kg from each contributor for entries and national check 4.00 kg for each zonal check
Locations (11)	HZ- Palampur, Srinagar NWZ- Hisar, Pantnagar, NEZ- Jorhat, Ranchi, Kalyani CZ- Jhansi, Jabalpur, SZ- Mandya, Coimbatore (Ooty)

6. AVT Oat (SC)-2 (Seed): Second Advanced Varietal Trial in Oats (Single cut) for seed

Number of entries	4 + 2 NC +1 ZC
Name of entries	NDO-711, OS-403, UPO-06-1 and NDO-10
National checks	Kent and OS-6
Zonal check	Palampur-1(HZ), OL-125 (NWZ), JHO-99-2 (NEZ), JHO-822 (CZ), JHO-2000-4 (SZ)
Design	RBD with 3 replications
Plot size	4.0 x 3.0 m
Spacing	Row to row- 25 cm (each plot accommodating 12 rows of 4 m length)
Seed rate	100 g per plot (approx. 80 kg/ha)
Seed requirement	4.0 kg/entry from each contributor; 1.25 kg for each zonal check
Fertilizer	N- 80 kg, P ₂ O ₅ -40 kg/ha
Locations (10)	HZ - Palampur, Srinagar, NWZ - Hisar, Pantnagar, NEZ - Jorhat, Ranchi CZ - Jhansi, Jabalpur, SZ - Mandya, Hyderabad

7. AVT Oat (SC)-2: Second Advanced Varietal Trial in Oat (Single cut) 2011-12 (Repeat)

Number of entries	8 + 2 NC +1 ZC
Name of entries	JHO-2009-1, JHO-2009-2, UPO-09-1, UPO-09-2, SKO-148, SKO-156, OS-363 & JO-03-95
National checks	Kent and OS-6
Zonal checks	Palampur-1(HZ), OL-125 (NWZ), JHO-99-2 (NEZ), JHO-822 (CZ), JHO-2000-4 (SZ)
Design	RBD with 3 replications
Plot size	4.0 x 3.0 m
Spacing	Row to row- 25 cm (each plot accommodating 12 rows of 4 m length)
Seed rate	120 g per plot (approx. 100 kg/ha)
Seed requirement	10.5 kg/entry from each contributor; 4.0 kg for each zonal check
Fertilizer	N- 80 kg, P ₂ O ₅ - 40 kg/ha
Locations (24)	HZ - Palampur, Srinagar NWZ - Bikaner, Jalore, Hisar, Ludhiana, Pantnagar & Meerut NEZ - Jorhat, Kalyani, Bhubaneswar, Ranchi, Pusa, Faizabad, CAU Imphal CZ - Jhansi, Rahuri, Urulikanchan, Kanpur, Anand, Jabalpur SZ - Hyderabad, Mandya, Coimbatore (Ooty)

8. AVT Oat (SC)-2 (Seed): Second Advanced Varietal Trial in Oat (Single cut) for Seed 2011-12 (Repeat)

Number of entries	8 + 2 NC +1 ZC
Name of entries:	JHO-2009-1, JHO-2009-2, UPO-09-1, UPO-09-2, SKO-148, SKO-156, OS-363 & JO-03-95
National checks:	Kent and OS-6
Zonal checks:	Palampur-1(HZ), OL-125 (NWZ), JHO-99-2 (NEZ), JHO-822 (CZ), JHO-2000-4 (SZ)
Design:	RBD with 3 replications
Plot size:	4.0 x 3.0 m
Spacing:	Row to row- 25 cm (each plot accommodating 12 rows of 4 m length)
Seed rate:	100 g per plot (approx. 80 kg/ha)
Seed requirement	4.0 kg/entry from each contributor; 1.25 kg for each zonal check
Fertilizer:	N- 80 kg, P ₂ O ₅ - 40 kg/ha
Locations (9):	HZ - Palampur, Srinagar NWZ - Hisar, Pantnagar NEZ - Jorhat, Ranchi CZ - Jhansi, Jabalpur SZ -Mandya

9. IVTO (MC): Initial Varietal Trial in Oat (Multi cut)

Number of entries	9 + 3 NC
Contributors	1: Jabalpur; 1: Rahuri; 2: Jhansi; 3: Ludhiana; 1: Hisar; 1: Palampur
National checks	Kent, UPO-212 and RO-19
Design	RBD with 3 replications
Plot size	3.0 x 3.0 m
Spacing	Row to row-25 cm (each plot having 12 rows of 3.0 m length)
Seed rate	90 g per plot (approx. 100 kg/ha)
Seed requirement	6.5 kg/entry from each contributor; 6.5 kg for each national check
Fertilizer	N-80 kg, P ₂ O ₅ -40 kg/ha
Locations (19)	HZ: Palampur, Srinagar, Almora NWZ: Pantnagar, Hisar, Jalore, Ludhiana, Udaipur NEZ: Ranchi, Pusa, Faizabad, Jorhat, Bhubanewar, Imphal CZ: Jhansi, Anand, Jabalpur, Rahuri, Urulikanchan,

10. AVTO-1 (MC): First Advanced Varietal Trial in Oat (Multi cut)

Number of entries	6 + 3 NC
Name of entries	JO-04-315, HFO-488, OL-1769, OL-1766, JHO-2012-3, PLP-14
National checks	Kent, UPO-212 and RO-19
Design	RBD with 3 replications
Plot size	4.0 x 3.0 m
Spacing	Row to row-25 cm (each plot having 12 rows of 3.0 m length)
Seed rate	120 g per plot (approx. 100 kg/ha)
Seed requirement	8.5 kg/entry from each contributor; 8.5 kg for each national check
Fertilizer	N-80 kg, P ₂ O ₅ -40 kg/ha
Locations (19)	HZ: Palampur, Srinagar, Almora NWZ: Pantnagar, Hisar, Jalore, Ludhiana, Udaipur NEZ: Ranchi, Pusa, Faizabad, Jorhat, Bhubanewar, Imphal CZ: Jhansi, Anand, Jabalpur, Rahuri, Urulikanchan,

11. IVT Oat (Dual): Initial Varietal Trial in Oat (Dual)

Number of entries	6 + 3 NC
Contributors	1: Jabalpur; 2: Jhansi; 1: Hisar; 2: Ludhiana
National checks	RO-19, UPO-212 and JHO-822
Design	RBD with 3 replications
Plot size	3.0 x 3.0 m
Spacing	Row to row : 25 cm (each plot accommodating 12 rows of 3 m length)
Seed rate	90 g per plot (approx. 100 kg/ha)
Seed requirement	7.0 kg/entry from each contributor & 7.0 kg for each national check
Fertilizer	N- 80 kg, P ₂ O ₅ -40 kg/ha
Locations (19)	HZ- Palampur, Srinagar NWZ- Bikaner, Jalore, Hisar, Ludhiana, Pantnagar, Udaipur, NEZ- Jorhat, Bhubaneswar, Ranchi, Faizabad, CZ- Jhansi, Rahuri, Urulikanchan, Karjat, Anand, Jabalpur, Raipur

12. IVT Lathyrus: Initial Varietal Trial in Lathyrus

Number of entries	3 + 3 NC
Contributors	1: Kalyani; JHLS-2013-1 and JHLS-2013-2
National checks	Nirmal, Mahateora, Prateek
Design	RBD with 4 replications
Plot size	3.0 x 3.0 m
Spacing	Row to row: 30 cm (each plot accommodating 10 rows of 3.0 m length)
Seed rate	36.0 g per plot (Approx. 40 kg/ha)
Seed requirement	1.75 kg/entry from each contributor; 1.75 kg for each national check
Fertilizer	N-20kg, P ₂ O ₅ -40 kg/ha
Locations (9)	Jorhat, Kalyani, Bhubneshwar, Ranchi, Pusa, Jhansi, Jabalpur, Kanpur & Raipur

13. AVT Lathyrus-1: First Advanced Varietal Trial in Lathyrus

Number of entries	5 + 3 NC
Name of entries	JLJO-09-2, BK-12-2, RLS-3006-2, JHLS-2012-2 & JHLS-2012-1
National checks	Nirmal, Mahateora, Prateek
Design	RBD with 3 replications
Plot size	4.0 x 3.0 m
Spacing	Row to row: 30 cm (each plot accommodating 10 rows of 4.0 m length)
Seed rate	48.0 g per plot (Approx. 40 kg/ha)
Seed requirement	2.0 kg/entry from each contributor; 2.0 kg for each national check
Fertilizer	N-20kg, P ₂ O ₅ -40 kg/ha
Locations (9)	Jorhat, Kalyani, Bhubneshwar, Ranchi, Pusa, Jhansi, Jabalpur, Kanpur & Raipur

14. AVT Lathyrus-2: Second Advanced Varietal Trial in Lathyrus

Number of entries	2 + 3 NC
Name of entries	JHLS-2011-2 & JLJ-09-1
National checks	Nirmal, Mahateora, Prateek
Design	RBD with 4 replications
Plot size	4.0 x 3.0 m
Spacing	Row to row: 30 cm (each plot accommodating 10 rows of 4.0 m length)
Seed rate	48.0 g per plot (Approx. 40 kg/ha)
Seed requirement	2.5 kg/entry from each contributor; 2.5 kg for each national check
Fertilizer	N-20kg, P ₂ O ₅ -40 kg/ha
Locations (8)	Jorhat, Kalyani, Bhubneshwar, Ranchi, Pusa, Jhansi, Jabalpur & Kanpur

14 A. AVT Lathyrus-2 (Agronomy)

Number of entries	2 + 3 NC
Name of entries	JHLS-2011-2 & JLJ-09-1
National checks	Nirmal, Mahateora, Prateek
Seed requirement	3.5 kg/entry from each contributor; 3.5 kg for each national check
Locations (7)	NEZ-Jorhat, Kalyani, Bhubaneswar, Ranchi CZ-Jhansi, Jabalpur & Raipur

15. AVT Lathyrus-2: Second Advanced Varietal Trial in Lathyrus for seed

Number of entries	2 + 3 NC
Name of entries	JHLS-2011-2 & JLJ-09-1
National checks	Nirmal, Mahateora, Prateek
Design	RBD with 4 replications
Plot size	4.0 x 3.0 m
Spacing	Row to row: 30 cm (each plot accommodating 10 rows of 4.0 m length)
Seed rate	48.0 g per plot (Approx. 40 kg/ha)
Seed requirement	2.5 kg/entry from each contributor; 2.5 kg for each national check
Fertilizer	N-20kg, P ₂ O ₅ -40 kg/ha
Locations (6)	Jorhat, Kalyani, Bhubneshwar, Ranchi, Jhansi & Jabalpur

16. VT Lucerne (P)-2011: Varietal Trial in Lucerne (Perennial)-3rd year

Number of entries	6 + 2 NC
Contributors	Anand-1, Urulikanchan-1, Dharwad-1, Rahuri-1, Coimbatore-1, Bikaner-1
Being perennial in nature, trial will be continued in Rabi 2013-14	

17. VT Lucerne (P)-2013: Varietal Trial in Lucerne (Perennial)-1st year

Number of entries	5 + 2 NC
Contributors	1: Urulikanchan; 1: Coimbatore; 2: Anand; 1: Rahuri
National checks	Anand-2, RL-88
Design	RBD with 3 replications
Plot size	4.0 x 3.0 m
Spacing	Row to row : 30 cm (each plot accommodating 10 rows of 4.0 m length)
Seed rate	30.0 g per plot (Approx. 25 kg/ha)
Seed requirement	1.75 kg/entry from each contributor; 1.75 kg for each national check
Fertilizer	N-20kg, P ₂ O ₅ -80 kg/ha
Locations (12)	NWZ- Ludhiana, Hisar, Bikaner, Jalore, Udaipur CZ- Rahuri, Urulikanchan, Anand, Raipur SZ- Hyderabad, Coimbatore, Mandya

Abbreviations: HZ-Hill zone, NWZ-North-west zone, NEZ-North-east zone, CZ-Central zone, SZ-South zone

DATA TO BE RECORDED ON BREEDING TRIALS

- GFY (q/ha), DMY(q/ha), per day productivity for green forage and dry matter yield (q/ha/day).
- Ancillary characters, like plant height, leafiness (Leaf / Stem ratio).
- Seed and stover yield in case of Seed trial.
- In IVT trials, only CP (%) and CP yield in all the cuts.
- In AVT trials, CP (%), CP yield, NDF (%), ADF (%) and IVDMD (%) in all the cuts.
- In Oat (SC), cut for fodder at the time of 50% flowering..
- In Oat (MC), two cut for fodder has to be taken, first cut after 55-60 days of sowing and second cut at 50% flowering
- In Oat (Dual), cut for fodder after 55-60 days of sowing and then left for grain harvesting. In this trial, biological yield has to be recorded.
- In Berseem (SC), cut has to be taken at 60 days after sowing.

Note: In case of Single cut, data are to be recorded at 50% flowering stage. In case of multi-cut, data are to be recorded cut wise.

$$\text{Yield Conversion Factor: } \text{Yield (q/ha)} = \frac{\text{Yield (kg. /plot)}}{\text{Net plot size (m}^2\text{)}} \times 100$$

WORKING SCHEDULE FOR RABI 2013-14

- Seed of checks and entries to be supplied by contributors to AICRP (FC) unit, Jhansi by 30.9. 2013.
- Seed for trials will be dispatched by AICRP (FC) unit, Jhansi to the testing locations/centers by 10.10. 2013.
- Trial sowing report to PC (FC): within 7 days of sowing.
- Information on trials failure, etc. is communicated immediately to PC (FC) through the Director of Research/Director ICAR institute.
- Rabi trial's data are to be submitted by testing centres to PC (FC) Jhansi up to May 10, 2014. In case of seed yield and quality traits up to 20 May, 2014.
- Reporting of Breeder seed (BSP-IV): May 20, 2014.

Important & Urgent

For Breeding and Agronomy (AVT-2) trials, seed of the check varieties are to be supplied by the concerned scientist to PC (FC) by September 30, 2013.

S.N.	Crop & Variety	Quantity Required	Seed Source
1.	Berseem		
	Wardan	3.5 Kg	Dr. D. R. Malaviya, Head, Division of Seed Technology, IGFRI, Jhansi
	Bundel Berseem-2	3.5 Kg	
	Bundel Berseem-3	1.25 Kg	
	Mescavi	4.0 Kg	Dr. Yogesh Jindal, CCS HAU, Hisar
BL-22	1.25 Kg	Dr. R. K. Bajaj, Senior Breeder, PAU, Ludhiana	
2.	Oat		
	Kent	80.0 Kg	Dr. D. R. Malviya, Head, Division of Seed Technology, IGFRI, Jhansi
	JHO-99-2	23.5 Kg	
	JHO-822	30.0 Kg	
	JHO-2000-4	22.0 Kg	
	OS-6	64.0 Kg	Dr. Yogesh Jindal, CCS HAU, Hisar
	SKO-90	7.5 Kg	Dr. Gul Zaffar, Sr. Scientist (PB), SKUAST, Srinagar
	OL-125	22.0 Kg	Dr. R. K. Bajaj, Senior Breeder, PAU, Ludhiana
	Palampur-1	16.0 Kg	Dr. Naveen Kumar, Sr. Agronomist & OIC, CSK HPKV, Palampur
	UPO-212	22.0 Kg	Dr. J. S. Verma, Professor (PBG), GBPUA&T, Pantnagar
	RO-19	22.0 Kg	Dr. A. H. Sonane, Forage Breeder & OIC, MPKV, Rahuri
3.	Lathyrus		
	Nirmal	12.5 Kg	Dr. C. K. Kundu, Agronomist & OIC BCKV, Kalyani
	Mahateora Prateek	12.5 Kg 12.5 Kg	Dr. Nitish Tiwari, Scientist (Agronomy), IGKV, Raipur
4.	Lucerne		
	Anand-2	1.75 Kg	Dr. H. P. Parmar, Research Scientist (FC), AAU, Anand
	RL-88	1.75 Kg	Dr. A. H. Sonane, Forage Breeder & OIC, MPKV, Rahuri

(B) FORAGE CROP PRODUCTION (AGRONOMY) RABI-2013-14**(A) ON-GOING COORDINATED TRIALS:****AST 1: RESOURCE CONSERVATION THROUGH FORAGES****Objectives:**

- To study the effect of resource conservation techniques (RCT) on forage yield of the system
- To study the effect of resource conservation through forages (RCT) on physico - chemical status of soil.
- To study the economics of the system.

Year of start : Kharif 2009 (Establishment)**Duration:** Five years**Methodology :****Phase I: (2009)**

- Studies on initial physico-chemical status of the soil i.e., WHC, Infiltration rate, pH, OC (%), available N, P & K and microbial population.
- Formulation of zone specific RCT through forage crops in pilot trial mode.

Phase II: (2010-2011 to 2012-13)

- Execution of the experiments as per the technical programme in the respective zone
- Observation recording on growth, yield and quality in different seasons of system in each year
- Recording observation on soil fertility status after end of the in each year.

Phase III: (2013-14)

- Recording final physico-chemical soil status after completion of the study
- Computation of data and analysis and preparation of the report

Observation to be recorded:**A. Crop growth:**i- Plant / shoot population at harvest (per m²) ii- Plant height at harvest iii- Leaf : Stem ratio**B. Yield (q/ha):**

i- Green fodder ii- Dry matter iii- Grain yield iv- Straw yield v- Forage equivalent yield

C. Quality:

i- Crude protein content (%) ii- Crude protein yield (q/ha)

D. Economics:

i- Cost of cultivation (Rs./ha) ii- Gross monetary return (Rs./ha)

iii- Net monetary return (Rs./ha) iv- Benefit : cost ratio

E. Soil studies:

- Soil fertility status viz., pH, OC (%), EC, available NPK and microbial population before and after completion of the experiment.

Soil moisture conservation studies: Soil moisture data from 0-15 and 15-30 cm depth at initial, 15 days after germination and later on every 30 days interval.**NOTE:** Specific observations will be recorded as per experimental need.**1. Hill Zone:****Subtitle: Effect of vegetative cover barriers and improved forage species on conservation of degraded grassland****Design:** Split**Replication (s):** Three**Treatments:****A. Vegetative barriers**1. No vegetative barrier 2. Napier Bajra Hybrid (NB-37) 3. *Setaria anceps***B. Planting of improved species**1. Local grass 2. *Setaria anceps* (PSS-1) 3. *Stylosanthes hamata* 4. *Setaria anceps* + *Stylosanthes hamata***Location :** Palampur

2. North-West Zone

Subtitle: Effect of different tillage practices on productivity of forage crop in the prevalent crop sequence (Irrigated conditions)

Design: RBD

Replication(s) : Three

Treatments: T₁-Conventional tillage (1 Disc harrow + 2 Cultivator), T₂-2 Cultivation (1 Disc harrow + 1 Cultivator), T₃-2 cultivation (Rotavator) T₄-1 cultivation (Disc harrow) T₅-1 cultivation (Rotavator), T₆-Broadcasting of seed before T-3 , T₇-Broadcasting of seed before T-5, T₈-No cultivation (zero tillage)

Locations (3): Ludhiana, Hisar and Pantnagar

3. Central Zone:

Sub title: Effect of planting methods and forage crop combinations on fodder productivity through moisture conservation

Design: RBD

Replication(s): Three

Treatments:

A. Moisture conservation techniques (main plot)

1. Ridge and furrow
2. Flat bed

B. Combination of grasses and legumes

- *Cenchrus ciliaris* + *Desmanthus virgatus*
- *C. ciliaris* + *Stylosanthes seabrana*
- *Dichanthium annulatum* + *Desmanthus virgatus*
- *Dichanthium annulatum* + *S. seabrana*

Locations (4): Rahuri, Jabalpur, Anand, Urulikanchan

4. North East Zone:

Sub title: Effect of moisture conservation practices on production of perennial grasses

Design: RBD

Replication(s): Three

Treatments:

A. Perennial grasses

1. *Brachiaria ruziziensis*
2. Guinea grass (Hamil)/Hybrid Napier
3. *Setaria* grass (Nandi variety)

B. Moisture conservation

1. Control (Without mulch)
2. Soil mulch
3. Inter cropping with legume (Cowpea/Rice bean - Berseem/Rice bean-Cowpea)

Locations (6): Jorhat, Faizabad, Ranchi, Bhubaneswar and Kalyani

5. South Zone:

(a) Sub title: Intensive forage production through silvipasture system under rainfed ecosystem

Design: RBD

Replication(s): Three

Treatments : 8

T₁ – Subabool + *Cenchrus ciliaris*

T₂ –Subabool + *Stylosanthes scabra*

T₃ –Subabool + *Desmanthus virgatus*

T₄ –Subabool + *C. ciliaris* + *Stylosanthes* (3:1)

T₅ – Subabool + *C. ciliaris* + *Desmanthus* (3:1), T₆ - Subabool + Sorghum + Horse gram (2:1)

T₇ – Subabool + Pearl millet + horse gram (2:1), T₈- Subabool (*Leucaena diversifolia*) (Sole)

Note: Spacing of Subabool – 3 m x 2 m

Location (3): Hyderabad, Coimbatore and Mandya

(b) Sub title: Cassava based sustainable alley farming system for rain fed areas of the humid tropics

Design: RBD **Replication:** 3
Treatments: 12 Cassava variety: Vellayani Hraswa
A. Grasses: 1. BN Hybrid (Sugna variety) 2. *Brachiaria brizantha* 3. No grass
B. Legumes: 1. Fodder cowpea (EC 4216) 2. No fodder legume
C. Biofertilizer: 1. VAM (*Glomus fasciculatum*) 2. No biofertilizer
Location: Vellayani

AST-2 (AST-2): EFFECT OF TILLAGE AND NUTRIENT MANAGEMENT ON PRODUCTIVITY OF RICE-OAT CROPPING SYSTEM

Objective:

- To study the effect of tillage and nutrient management in oats on the productivity of the system

Duration : Three year **Design** : Split plot
Replication : 3 **Plot size** : 4m x 3m
Year of start : *Kharif 2010* (Raipur and Jabalpur - Kharif 2011)

Treatment: 12

Main plot – Tillage practices (3)

S₁- Zero tillage S₂. Minimal tillage S₃. Conventional tillage

Sub Plot - nutrient management (4)

M₁ – 75 % Recommended Dose of NPK (RD) M₂ – 75 % RD + Biofertilizers (*Azotobactor* + PSB)
M₃ – 100 % RD M₄ – 100 % RD + Biofertilizers (*Azotobactor* + PSB)

Observations:

- Initial and final status of soil fertility and microbial population
- Yield of grain and straw for rice Yield of green and dry matter of oat
- Weed studies CP% and CP yield of oat and Economics.

Note: Tillage and nutrient management will be done in oat crop and residual effect of the treatments will be studied on *Kharif* rice. Data will be reported in Rabi.

Locations (2): Raipur and Jabalpur

AST - 3 (AST-4): Studies on the effect of irrigation levels on green forage yield and quality of different forage crops during lean period

Objectives:

- To study the performance of forage crops under varied moisture regimes
- To identify suitable and most remunerative crop for existing situation / under limited irrigations

Year of start: Rabi -2011-12 **Duration:** Three years
Design: Split plot **Replication:** Three
Treatments: 12 **Plot size:** 4.0m x 3.6m

Treatment details:

Main plot (Irrigation levels-3)

I₁- IW/CPE—0.6 I₂- IW/CPE—0.8 I₃- IW/CPE—1.0

Sub plot (Crops – 4)

C1-Fodder maize C2-Fodder sorghum C3-Fodder pearl millet C4- Baby corn

Observation to be recorded:

- Plant height (cm)
- L: S ratio
- Green and DFY (q/ha)
- CP content (%)
- WUE (kg/ha/cm)
- Gross and net returns (Rs./ha)
- Benefit-cost ratio
- crude protein yield (q/ha)

Data reporting: Rabi

Locations: **Mandya, Hyderabad and Dharwad**

AST- 4 (AST-5): Effect of stubble management and INM on forage productivity in Rice-Oat cropping system

Objectives:

- To study the effect of different cutting height of rice stubble on crop establishment and forage productivity of oat
- To evaluate the relative performance of different stubble management and INM treatment on Productivity of Rice -Oat cropping system.

Treatments: 12

Main Plot- Rice Stubble management

S1- Cutting of rice stubble at ground level

S2- Cutting of rice stubble at 30cm height

S3- Normal cultivation

Sub Plot- INM treatment

M1- 100% NPK (Inorganic fertilizer)

M2-50% N through FYM+50%NPK through inorganic fertilizer

M3-25% N through FYM+Green manure+50% NPK through inorganic fertilizer+Biofertilizer

M4 -50% N through FYM +GM+ PSB+ Biofertilizers

Design: Split Plot Design

Replication: 3

Plot size: 4mx3m

Year of Start:

Kharif 2012

- INM treatment will be given to Rice crops
- 50% RDF will be given to oat crop
- In stubble management practices except normal cultivation system oat will be sown behind the plough

Observation:

- Initial and final fertility status of soil
- Yield of component crop.
- Equivalent yield
- Economics
- Soil fertility before and after harvesting of crop cycle.

Locations: Jorhat and Bhubaneswar

(Data reporting: Rabi)

AST-5 (AST-6): Performance of dual purpose forage crops under different cutting management system

Objectives: To study effect of cutting management on forage and seed production potential of forage crops

Technical details:

Treatment (12)

(a) Main plot (Crops-3) Oats

Barley

Wheat

(b) Sub plots (Cutting management -4)

(For Hill Zone)

No cutting

Cutting of fodder at 70 days after sowing

Cutting of fodder at 80 days after sowing

Cutting of fodder at 90 days after sowing

(For NWZ, NEZ and Central Zone)

No cutting

Cutting of fodder at 50 days after sowing

Cutting of fodder at 60 days after sowing

Cutting of fodder at 70 days after sowing

(Second cut will be taken for seed)

Design: Split plot design

Replications: 3

Plot Size: 4 m x 3 m

Duration: Three years

Year of start: Rabi -2012-13

Observations to be recorded

- Tiller No. / m row length
- Plant height (cm)
- Leaf: Stem ratio
- Green and dry fodder yields (qha⁻¹)
- Grain/seed and straw yields (qha⁻¹)
- CP content (%) and CPY (q/ha)
- Gross and net returns (Rs. ha⁻¹)
- Benefit: Cost ratio.
- EGY (of wheat, barley and oat)
- Quality analysis of grain by biochemists
- Soil fertility status before and after crop season

Locations (13): HZ-Palampur, Srinagar, Almora; NWZ- Ludhiana, Hisar, Bikaner,;NEZ- Jorhat and Bhubaneswar; CZ- Jabalpur, Raipur, Rauri, Anand, Urulikanchan **(Data reporting: Rabi)**

(NB: The recommended varieties of the crops for a particular location for the purpose will be used and crops will be grown with recommended package of practices).

Seed availability: Testing centers will make their own arrangement of seed

AST- 6 (AST-7): EFFECT OF WEED MANAGEMENT ON FORAGE AND SEED YIELD OF BERSEEM (*Trifolium alexandrinum* L.)

Objectives

- To assess the effect of weed management treatments on forage and seed yield of berseem
- To study the efficacy of herbicides in controlling weed in berseem

Technical details:

Treatment details (10)

T₁ – Weedy check (Control)

T₂ – Pendimethalin @ 0.3 kg a.i.ha⁻¹

T₃ – Pendimethalin @ 0.4 kg a.i.ha⁻¹

T₄ – Pendimethalin @ 0.5 kg a.i.ha⁻¹

T₅ – Oxyflourfen @ 0.100 kg a.i.ha⁻¹

T₆ – Imazethapyr @ 0.100 kg a.i. ha⁻¹ (Immediate after harvest of Ist and IInd cut)

T₇ – Oxyflourfen @ 0.100 kg a.i.ha⁻¹ + Imazethapyr @ 0.100 kg a.i.ha⁻¹ (Immediate after harvest of Ist cut)

T₈ – Pendimethalin @ 0.300 kg a.i.ha⁻¹ + Imazethapyr @ 0.100 kg a.i.ha⁻¹ (Immediate after Ist cut)

T₉ – Pendimethalin @ 0.400 kg a.i.ha⁻¹ + Imazethapyr @ 0.100 kg a.i.ha⁻¹ (Immediate after Ist cut)

T₁₀ – Pendimethalin @ 0.500 kg a.i.ha⁻¹ + Imazethapyr @ 0.100 kg a.i.ha⁻¹ (Immediate after Ist cut)

Design: RBD

Replications: Three

Plot size: Gross: 4x3 m²

Net plot: 3.40 x 2.40 m²

Seed rate: 30 kg/ha

Year of start: Rabi 2012-13

Duration: 3 years

Crop & Variety: Berseem (Wardan)

Observations to be recorded:

A) Weed studies :

Species wise weed count /m²

Weed dry matter /m²

Weed control efficiency (%)

Weed Index

B) Crop studies

Plant population/ m row length

Plant height (cm) at harvest.

Leaf: Stem ratio

Green and dry fodder yields (qha⁻¹)

Seed and straw yield (qha⁻¹)

CP content (%) and CP yield (qha⁻¹)

C) Economics:

- Gross and Net monetary returns (Rs. ha⁻¹)

Benefit: Cost ratio.

D) Soil studies:

- Soil fertility status (OC, NPK and microbial population) before and after crop season

Locations (7): CZ: Rahuri, Jabalpur, Raipur Urulikanchan; **NEZ:** Ranchi; **NWZ:** Ludhiana, Pantnagar

(NB: Crop will be left for seed production after two-three forage cut)

AST-7 (18): EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON YIELD AND QUALITY OF OAT

Objectives: To assess the effect of INM on yield and quality of oat

Design: RBD

Plot Size: 4 mx3 m

Spacing: 25cm (R-R)

Variety: JHO 822/851

Treatments

T₁- RDF

T₂- N @ 60kg/ha + 5t FYM/ha

T₃- N @ 60kg/ha + 7.5t FYM/ha

T₄- N @ 60kg/ha + 10t FYM/ha

T₅- N @ 100kg/ha + 5t FYM/ha

T₆- N @ 100kg/ha + 7.5t FYM/ha

T₇- N @ 100kg/ha + 10t FYM/ha

T₈- N @ 120kg/ha + 5t FYM/ha

T₉- N @ 120kg/ha + 7.5t FYM/ha

T₁₀- N @ 1200kg/ha + 10t FYM/ha

Observation to be recorded:

- Soil studies initial, after each season, final
- Plant height (cm)
- L: S ratio
- Plant population/m row length
- GFY, DMY (q/ha)
- CP% & CPY (q/ha)
- Economics

Location (2): Imphal & Kalyani

(Data will be reported in Rabi)

AST-8 (AST-6 -NT): STUDY ON DIFFERENT MODELS FOR YEAR ROUND GREEN FODDER PRODUCTION UNDER IRRIGATED CONDITION

Objectives

1. To study the different combinations of perennial and seasonal fodder crops for productivity and identify suitable crop combination
2. To study economics of different models
3. To study effect of different models on soil chemical properties

Treatments: Crop combinations-models

- T1 - Maize+cowpea – oat+berseem – bajra+cowpea
- T2 – Sorghum+cowpea – maize+berseem – bajra+cowpea
- T3 – Hybrid napier+cowpea - hybrid napier+berseem - hybrid napier+cowpea
- T4 – Hybrid napier + lucerne
- T5 – Hybrid napier + *Desmanthus*

Design: RBD **Replications:** 4 **Plot size:** 6 x 5 m

Duration: 3 years (Starting from Kharif 2013)

Observations to be recorded:

Growth: Plant height, Leaf stem ratio, Plant population per m row length

Yield and quality: Green fodder yield, Dry matter yield, Crude protein yield, CP (%), CF (%)

Economics: Net monetary returns, benefit cost ratio

Soil studies: Initial soil status and after completion of sequence for pH, EC, OC, N, P & K

Note: Recommended package of practices will be followed for each crop.

The ratio of cereal to legume will be 2:1 for seasonal crops. In hybrid napier + lucerne and hybrid napier + *Desmanthus*: Two rows of hybrid napier spaced at 4.8 meter (60 cm from boarder) and in between two lines of hybrid napier 12 lines of legumes at 30 cm spacing.

Locations: (4): Urulikanchan, Anand, Rahuri, and Bikaner **(Data reporting: Rabi)**

B- ONGOING LOCATION SPECIFIC TRIALS

AST -9 (AST-8): OPTIMIZATION OF NITROGEN FOR MAIZE IN DIFFERENT FORAGE BASED CROPPING SYSTEMS

Year of start: Rabi 2011-12 **Duration:** Three years **Design:** Split plot

Replications: Three **Plot size:** 5m x 4m **Treatments:** 4x4=16

(a) Cropping System (4)

1. Oat – Maize – Cowpea
2. Oat – Maize – Rice bean
3. Barley – Maize – Cowpea
4. Barley – Maize – Rice bean

(b) Nitrogen Levels (4)

1. 50% of Recommended dose of N
2. 75% of recommended dose of N
3. 100% of Recommended dose of N
4. 125% of recommended dose of N

Note: N level treatments will be applied to maize. Other crops of the sequence will be grown with recommended NPK doses and other packages.

Observations to be recorded

A. Crop Growth

Plant Population/m² Growth parameters (Plant height and leaf stem ratio)
Green fodder and dry matter Forage equivalent and crude protein yield (q/ha)

B. Economics (Rs./ha/year)

Cost of cultivation Gross monetary returns
Net monetary returns Benefit: Cost ratio

C. Nutrient Studies

Nitrogen uptake by each crop and entire system Nitrogen use efficiency
Soil fertility status before and after completion of sequence

Location: Shillong **(Data reporting: Kharif)**

AST- 10 (AST 9): EFFECT OF SOIL AMENDMENTS ON PRODUCTIVITY OF RICE- BERSEEM AND CHANGES IN SOIL PROPERTIES OF SODIC SOIL

Year of start : Kharif 2009 **Duration** : Five years
Plot size : 4m x 3m **Design** : RBD **Replication** : 3

Treatments: GR = Gypsum Requirement

T1 = RDF (Control) T6 = RDF + Press mud @ 50 % GR
T2 = RDF + FYM 10 t/ha T7 = RDF + Gypsum @ 75 % GR + FYM 10 t/ha
T3 = RDF + Gypsum @ 75 % (GR) T8 = RDF + Gypsum @ 50 % GR + FYM 10 t/ha
T4 = RDF + Gypsum @ 50 % GR T9 = RDF + Pressmud @ 75 % GR + FYM 10 t/ha
T5 = RDF + Press mud @ 75 % GR T10 = RDF+ Pressmud @ 50 % GR + FYM 10 t/ha

Note:

- All the soil amendment treatments will be applied to rice only. Hence, berseem crop will be grown with recommended fertilizer dose.
- Calculation of doses of soil amendments will be based on gypsum requirement.

Observations to be recorded:

- Plant /shoot population at harvest (per m²) , Plant height at harvest, grain and straw yield and Harvest index (Rice).
- GFY, DMY, Forage equivalent yield, CP % and CPY (Berseem)
- Net monetary return (Rs/ha/yr)
- Uptake of N, P and K (kg/ha) by each crop and entire system
- Initial soil fertility status viz., pH, EC, Exch. Na, OC and available NPK
- Soil fertility status after completion of sequence i.e. pH, EC, OC, available NPK and exchangeable sodium percentage

Location: Faizabad

(Data reporting: Rabi)

AST-11 (AST 11): PRODUCTION POTENTIAL OF FORAGE CROPS IN RICE FALLOWS UNDER VARIED NITROGEN LEVELS

Objectives:

- To identify suitable crops in rice fallow
- To identify optimum dose of nitrogen for sustained yield

Technical Details:

Design : Split Plot **Replication** : 4
Year of start : Rabi 2011-12 **Plot size** : 3.0 m x 3.6 m

Treatments (9):

A. Main plot (Crops- 3)

C1- Sorghum+ cowpea (3: 1) C2- Maize + Cowpea (3:1) C3- Pearl millet + Cowpea (3:1)

B. Sub plot (Nitrogen levels – 3)

N1: 50% RDN N2: 75% RDN N3: 100% RDN

- FYM 10 ton / ha common in all treatment
- P&K as per recommended dose

Observation to be recorded

- Plant height
- Leaf:stem ratio
- Green fodder yield
- Dry matter yield
- Soil pH, OC%. and NPK status before and after experimentation
- Economics (Gross Returns, Net Returns and BC Ratio)
- Crude protein yield
- Soil pH, OC % and NPK status before and after experimentation
- Economics (Gross returns, NMR and BC ratio)

Location: Mandya

(Data reporting: Rabi)

AST-12 (AST 13): EFFECT OF SOURCES OF NITROGEN ON OAT AND RESIDUAL EFFECT ON SUCCEEDING CROPS

Objectives

- To find out the most feasible cropping sequence with respect to quality fodder production.
- To find out the best source of nitrogen and
- To work out the relative economics of the cropping sequences.

Technical details:

Design : Split Plot Design **Replication** : Three (3)
Year of start : Rabi-2011-12 **Duration** : Three years

Treatment details (10)

Main Plot (Cropping sequences-2)

C1= Oat-Maize-Turnip C2=Oat- Maize+ Cowpea-Turnip

Sub Plot (Source of Nitrogen-5)

F1= 100% N through Urea
F2= 75% N through urea + 25% N through FYM
F3= 50% N through urea + 50% N through FYM
F4= 75% N through urea + 25% N through sheep manure
F5= 50% N through urea + 50% N through sheep manure

Observations to be recorded:

- Plant height and Leaf stem ratio at 50% flowering
- Green fodder yield and Dry fodder yield (q/ha) at 50% flowering
- CP content and CP yield
- Cost of cultivation
- Gross monetary return
- Net monetary return
- Benefit-cost ratio
- N content and uptake by each crop and entire system
- Soil fertility status before and after completion of sequence

Note: N sources will be applied to Oats. Other crops of the sequence will be grown with recommended package (instead of 100 % RDF, 75 % RDF will be applied to succeeding crops)
Location: SKAUST, Srinagar.

AST-13 (AST-14): PERFORMANCE OF BAJRA NAPIER HYBRID GRASS AS INFLUENCED BY MICRONUTRIENTS UNDER IRRIGATED CONDITIONS

Objectives:

- To study the effect of conjoint application of organic manure, inorganic fertilizers and micronutrients on forage yield, economics of production and soil properties.

Technical detail:

Treatments details: (9)

T₁- NPK alone
T₂ - NPK + FeSO₄ @50 kg/ha
T₃ - NPK + FeSO₄ @100 kg/ha
T₄ - NPK + ZnSO₄ @25 kg/ha
T₅ - NPK + ZnSO₄ @50 kg/ha
T₆ - NPK + FeSO₄ @50 kg/ha + ZnSO₄ @25 kg/ha
T₇ - NPK + FeSO₄ @100 kg/ha + ZnSO₄ @25 kg/ha
T₈ - NPK + FeSO₄ @50 kg/ha + ZnSO₄ @ 50kg/ha
T₉- NPK + FeSO₄ @ 100kg/ha + ZnSO₄ @ 50 kg/ha

AST-15 (AST-19): Effect of residual effect of P applied to wheat on the succeeding summer fodders in sorghum-wheat-summer fodders cropping system

Objectives:

- (1) To identify suitable summer fodder crop in sorghum-wheat-summer fodder cropping systems and
- (2) To study the residual effect of phosphorus applied to wheat on succeeding summer fodder crops

Technical details:

Year of start: Kharif 2013;

Design: FRBD

Replications: 3;

Variety: PSC 1

Seed rate: 37.5 kg/ha

Row spacing: 30 cm

Treatments

(A) Summer fodder crops (3): Cowpea, maize and bajra

(B) P - levels to summer fodder crops (5): 0, 25, 50, 75 and 100 % of recommended fertilizers: 100 kg N + 20 kg P₂O₅/ha

Observations to be recorded:

- **Crop growth:** Plant population, Plant height, L:S
- **Yield (q/ha):** Green fodder, Dry matter
- **Quality:** Crude protein content & yield
- **Economics:** Cost of cultivation, Gross monetary return, Net returns, Benefit : cost ratio
- N and P uptake
- **Soil studies:** Soil fertility status before and after completion of the sequence, i.e., pH, OC (%), EC, available NPK.

Location: Ludhiana

(Data reporting: Kharif)

C: AVT – 2 BASED AGRONOMY TRIALS

AST-16: EFFECT OF P LEVELS ON FORAGE YIELD OF PROMISING ENTRIES OF LATHYRUS (AVT-2)

Objective: To see the effect of phosphorus levels and promising entries on yield and quality of lathyrus.

Year : Rabi 2013-14

Duration : One season

Design : RBD

Replications : 3

Plot Size : 4 x 3 m

Spacing: Row to Row: 30 cm (each plot accommodating 10 rows of 4.0 m length)

Fertilizer: 20 KgN/ha as basal Seed rate: 50.0 g per plot (Approx. 40 kg/ha)

Treatments: 15

(A) Entries (5) = 2+3 (JHLS-2011-2, JLJ-09-1, Nirmal (NC), Mahateora (NC), Prateek (NC))

(B) P₂O₅-levels: 3 = (20, 40 and 60 Kg P₂O₅ /ha)

Observations to be recorded

- Plant population/ m row length
- Growth parameters (Plant height and Leaf : stem ratio)
- Green fodder, dry matter and crude protein yield (q/ha)

Seed requirement 3.50 kg/entry from each contributor

Locations (7): NEZ- Jorhat, Kalyani, Bhubneshwar, Ranchi CZ- Jhansi, Jabalpur and Raipur

(Data reporting: Rabi)

AST 17: EFFECT OF NITROGEN LEVELS ON FORAGE YIELD OF PROMISING ENTRIES OF OAT (AVT- 2 SC)

Objective: To study the effect of nitrogen levels and promising entries on yield and quality of oat

Year	: Rabi 2013-14	Design	: Split plot
Replications	: Three	Plot size	: 4 m x 3 m
Seed rate	: 100 g/plot (80 kg/ha)	Spacing	: R x R-25 cm
Treatments	: Combinations: 7 x 3=21		

Treatment details:

Main plot:

(A) Entries : 4+2+1 (Entries-4, NC (2) and ZC (1))

Entries (4) : NDO-711, OS-403, UPO-06-1 and NDO-10

National checks (2): Kent, OS-6

Zonal checks (1): Palampur-1 (HZ), OL-125 (NWZ), JHO-99-2 (NEZ), JHO-822 (CZ), JHO-2000-4 (SZ)

Sub-plot: (B) N- levels: 3 (40, 80, and 120 kg N /ha) (Split application of nitrogen)

Observations to be recorded:

- Tiller number /m row length at harvest
- Growth parameters (Plant height (cm) and leaf: stem ratio)
- Green fodder, dry fodder yields (q/ha)
- Crude protein content (%) and CP yield (q/ha)

Seed requirement: Testing entry/national check : **12.00 kg**, Zonal check : **4.00 kg**

Locations (11): **HZ**-Palampur, Srinagar; **NWZ**-Hisar, Pantnagar; **NEZ**-Jorhat , Ranchi, Kalyani
CZ- Jhansi, Jabalpur; **SZ**- Mandya, Coimbatore

D: NEW RESEARCH TRIALS

(1) Coordinated trial

AST-18 (NT): PERFORMANCE OF PERENNIAL FODDER SORGHUM (*Sorghum bicolor* Cv. COFS 29) AS INFLUENCED BY PLANTING GEOMETRY AND CUTTING INTERVALS UNDER IRRIGATED CONDITIONS)

Objectives:

- To study the effect of planting geometry on growth and yield
- To study the effect of cutting intervals on growth and yield
- To study the interactive effect of planting geometry and cutting intervals on growth and yield

Year	: Rabi 2013-14	Design	: FRBD
Replications	: Three	Plot size	: 4.0 m x 3.6 m
Seed rate	: 10 kg/ha	Spacing	: As per treatment

Treatments:

A. Planting geometry: 30 cm inter-row spacing, 2. 45 cm inter-row spacing, 3. 60 cm inter-row spacing

B. Cutting interval: 45 days, 2. 60 days, 3. 75 days, 4. 90 days

Observations to be recorded: All observations will be recorded at each cut

Plant height,	Number of tillers/m row length,
Leaf: stem ratio	Dry matter /m row length,
Green fodder yield/ha	DFY/ha
Crude protein (%),	Crude fibre (%),
HCN content at each harvest	

Location (3): Dharwad, Raipur and Bikaner

(Data will be reported in Rabi)

(2) Location specific trials:

AST-19 (NT): YIELD POTENTIAL OF CEREALS WITH FORAGE LEGUMES UNDER PURE STAND AND MIXTURES

Objective: To evaluate fodder yield potential and quality of cereals and legumes in mono as well as in mixed cropping.

Year : Rabi 2013-14 **Design** : RBD
Replications : Three **Plot size** : 4.0 m x 3.0 m
Duration : Three years

Treatments:-

T1 - Sole Oat	T2 - Sole Barley	T3 - Sole ryegrass
T4 – Sole Vetch (<i>Vicia sativa</i>)	T5 – Sole Field pea	T6 – Oat+ Vetch (1:1)
T7 - Oat + Field pea (1:1)	T8 – Barley +Vetch (1:1)	T9 – Barley +Field pea (1:1)
T10 –Ryegrass +Vetch (1:1)	T11- Ryegrass + Field pea (1:1)	

Observation to be recorded:-

Crop Growth: Plant population at harvest/m², Plant height at harvest, Leaf stem ratio

Yield (q/ha): Fresh weight at harvest, Dry weight at harvest, Forage equivalent yield, Land equivalent ratio

Quality Parameters: Crude protein content (%), Crude protein yield (q/ha)

Nutrient studies: Nitrogen content and uptake by each crop, Soil fertility status before and after harvest.

Note: **Nutrient management: N: P₂O₅ : K₂O kg/ha**

Vetch (*Vicia sativa*) and field pea = 30:60:40

Oat/Barley/Wheat = 120:60:40

The fertilizers will be applied as per recommended package for sole crops however, in case of intercropping the fertilizers will be applied as per row proportion

Location: Srinagar (Data will be reported in Rabi)

AST-20 (NT): STUDIES ON INTENSIVE FODDER CROPPING SYSTEMS FOR YIELD MAXIMIZATION

Objectives:

- To find out the appropriate cropping system for maximum fodder production
- To study the effect of cropping systems on soil fertility, nutrient use and water use efficiency

Year: Summer/Kharif 2014 **Design** : RBD
Replications: Three **Plot size (Gross):** 6.0 m x 5.0 m
Duration: Three years

Treatments:

1. BN Hybrid + Lucerne
2. Setaria + Lucerne
3. BN Hybrid + Cowpea (summer) / Lucerne (winter)
4. Setaria + Cowpea (summer)/ Lucerne (winter)
5. BN Hybrid + Berseem (winter)
6. Setaria + Berseem (winter)
7. BN Hybrid + Cowpea (summer)/ Berseem (winter)
8. Setaria + Cowpea (summer)/ Berseem (winter)

Observations to be recorded:

1. **Growth attributes:** Plant height, Leaf: stem ratio
2. **Yield:** GFY, DMY and CPY
3. **Economics:** Cost of cultivation, Net returns and BC ratio
4. **System productivity:** Equivalent yields
5. **Other yearly observations:** WUE, NUE, soil fertility after crop cycle

Location: Raipur (Data reporting in Rabi)

GENERAL SUGGESTIONS

- The technical programme must not be changed without prior approval of the Project Coordinator (FC). The data are to be recorded as per technical programme and reported to the Project Coordinator (FC) accordingly well in time scheduled. A soft copy of the data (in CD) and also through E-mail must be provided to the Project Coordinator (FC) in MS WORD and MS EXCEL. In case of location – specific trials, the text of the trial should also be supplied by the Centre concerned.
- Data must be analyzed factor-wise statistically (with two-way tables) having Sem±, CD at 5% and CV %. In case of interaction, two-way tables must be reported.
- Following (statistically analyzed) data with yield data must be reported for comparisons and making valid conclusions.
- Net monetary return (Rs./ha/yr) of the complete sequence (Crop sequences trial).
- Component-wise and total green fodder and dry matter yield (q/ha), net monetary return (Rs./ha/yr) and Land Equivalent Ratio (LER) (Intercropping trial)
- Component-wise and total crude protein yield (q/ha) as well as crude protein (%)
- Initial and final fertility status of the soil, i.e., after completion of trial which should essentially include pH, EC, OC (%), available N, P & K (Crop sequences and fertility trials).
- In trials on problematic soils, initial and final fertility status of the soil, i.e., after completion of trial and uptake of NPK by the crop(s) in each season is to be provided.
- In multi-cut crop(s)/variety(s), data on growth and quality parameters (i.e., plant population/m row length, L:S ratio, No. of tillers/m row length, No. of branches/plant and crude protein content (%)) are to be recorded as per schedule given below :
- In Cereals and grasses, growth observations, in general, are to be recorded for first and last harvest. However, in cutting management trials or in trials with split application of N, the observations are to be taken for each cut.
- Data on dry matter estimation and crude protein analysis are to be recorded for each cut
- Centres/Locations are advised to send complete information on soil characteristics, variety (ies), agronomic recommendations, No. of cuts, etc., for the experiments in the prescribed format.
- In case of net monetary return, current market price (Rs./q) must be indicated.
- Centres/Locations are advised to provide trials at a glance in one sheet mentioning trials allotted, trials conducted, data reported (character-wise-analyzed) and trials not conducted (with valid reasons) while supplying data to the Project Coordinator (FC). The format is attached herewith.
- **Meteorological data of Rabi 2013-14 from 40th SMW to 21st SMW will be needed for inclusion.**
- **The data of Rabi season should be send to PC Unit before 20th June.**

Yield (kg/plot)

Yield Conversion Factor: Yield (q/ha) = ----- X 100

Net plot size (m²)

AICRP ON FORAGE CROPS AGRONOMY TRIALS AT A GLANCE

Year: Rabi 2013-14 Centre/Location:

Trials Allocated (No. & Name)	Trials conducted No. & Name	Trials not conducted/failed, also give reason for not conducting the trial/failure (No. & name)

(C) FORAGE CROP PROTECTION COORDINATED TRIALS FOR RABI-2013-14

PPT. 1: MONITORING OF PATHOGEN AND INSECT-PEST ASSOCIATED WITH BERSEEM, LUCERNE AND OAT ECOSYSTEM

Location: Anand, Hisar, Jhansi, Hyderabad, Ludhiana, Bhubaneswar, Rahuri, Dharwad and Palampur

Observation:

- Occurrence and severity of pathogens, insect pests at 15 days interval.

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

Location: Anand, Hisar, Jhansi, Bhubaneswar, Rahuri, Hyderabad, Palampur, Dharwad and Ludhiana

PPT-2.B.: EVALUATION OF BERSEEM ENTRIES FOR RESISTANCE TO ROOT AND STEM ROT DISEASE UNDER SICK PLOT

Location: Jhansi and Ludhiana

PPT-12: DISEASE MANAGEMENT IN WHITE CLOVER

Location: Palampur

Design: RBD

Replication: 3

Plot size: 2 x 2 m²

Treatments:

T₁ = Seed treatment with carbendazim @ 2 g/kg seed

T₂ = Seed treatment with *T. viride* @ 5g/kg

T₃ = T₁ + Foliar spray of carbendazim @ 0.1 %

T₄ = T₂ + Foliar spray of carbendazim @ 0.1 %

T₅ = T₁ + Foliar spray of hexaconazole @ 0.05 %

T₆ = T₂ + Foliar spray of hexaconazole @ 0.05 %

T₇ = T₁ + Foliar spray of carbendazim @ 0.1 % + Foliar spray of hexaconazole @ 0.05 %

T₈ = T₂ + Foliar spray of carbendazim @ 0.1 % + Foliar spray of hexaconazole @ 0.05 %

T₉ = T₁ + T₂ + Foliar spray of carbendazim @ 0.1 % + Foliar spray of hexaconazole @ 0.05 %

T₁₀ = Control

Observations:

1. Disease severity of powdery mildew
2. Disease incidence of clover rot
3. Seed yield (q/ha)

PPT 17: TO STUDY THE PATHOGENIC VARIABILITY OF

A. *Erysiphe graminis* f. sp. *avenae* on oat

Location: Palampur

2nd year: (i) Standardization of differentials for variability

3rd year: (i) Characterization of pathogenic virulence.

4th year: (i) Characterization of pathogenic virulence.

B. *Helminthosporium avenae* on oat

Location: Ludhiana, Bhubneshwar and Jhansi

2nd year: Pathogenicity, re-isolation and characterization of *Helminthosporium* cultures

3rd year: Collection and maintenance of germplasm

4th year: Evaluation of germplasm against different isolates of *Helminthosporium* and resistant/tolerant entries will be identified and used in breeding programme.

* The leaf blight samples will be supplied by centres having leaf blight problem in oats

PPT 18: EVALUATIONS OF ENTAMOPATHOGENIC FUNGI ON INSECT PESTS OF LUCERNE

Design: RBD

Replication: 3

Plot size: 3 x 4 m²

Location: Rahuri, Hyderabad, Jhansi and Dharwad

Treatments

- T1 -Foliar application of *V. lecani* @ 4x10⁶ cfu/ml (2g/l)
- T2 -Foliar application of *B. bassiana* @ 4x10⁶ cfu/ml (2g/l)
- T3 -Foliar application of *M. anisopliae* 4x10⁶ cfu/ml (2g/l)
- T4 -Foliar application of *N. releyi* 4x10⁶ cfu/ml (2g/l)
- T5 - T1 + T2
- T6 -T1 + T3
- T7 -T1 + T4
- T8 -T2 + T3
- T9 -T2 + T4
- T10 -T3 + T4
- T11 -Untreated control

Observations:

1. Pre count and post treatment count of insect pests, natural enemies and pollinators at 7 DAS
2. GFY and DMY (q/ha)
3. Seed yield (q/ha)

List of participants
AICRP on Forage Crops, NGM Rabi 2013-14,
September 7-8, 2013, JNKVV, Jabalpur-482 004

S N	Name	Details
1	Dr S K Datta	Deputy Director General (Crop Science), ICAR, New Delhi
2	Dr Dinesh Kumar	Principal Scientist, ADG (FFC) Cell, ICAR, New Delhi
3	Dr Uma Raghunathan	Technical Officer, ADG (FFC) Cell, ICAR, New Delhi
4	Dr P K Ghosh	Director, IGFRI, Jhansi
5	Dr R B Bhaskar	Sr. Scientist, IGFRI Jhansi
6	Dr M G Gupta	Pr. Scientist, IGFRI Jhansi
7	Dr V K Yadav	Pr. Scientist, IGFRI Jhansi
8	Dr D Vijay	Sr. Scientist, IGFRI, Jhansi
9	Dr B G Shivkumar	Pr Scientist & OIC ,IGFRI RRS Dharwad
10	Dr N S Kulkarni	Sr. Scientist, IGFRI RRS, Dharwad
11	Dr A K Roy	PC (Forage Crops), AICRP FC, IGFRI Jhansi
12	Dr S R Kantwa	Sr Scientist and PI (Agron), AICRP FC, IGFRI Jhansi
13	Dr Ritu Mawar	Sr Scientist, AICRP FC, IGFRI Jhansi
14	Dr A K Mall	Sr Scientist, AICRP FC, IGFRI Jhansi
15	Dr Y K Jindal	Plant Breeder, Forage Section, CCS HAU, Hisar
16	Dr D S Phogat	Scientist, CCS HAU, Hisar
17	Dr Ramesh Yadav	Agronomist, NDU&T, Faizabad
18	Birendra Kumar	Breeder & OIC, BAU, Ranchi
19	Ashisan Tuti	Jr Agronomist, BAU, Ranchi
20	Dr Naveen Kumar	Sr. Agronomist & OIC, HPKV, Palampur
21	Dr V K Sood	Plant Breeder, HPKV, Palampur
22	Dr D K Banyal	Plant Pathologist, HPKV, Palampur
23	Dr Rajan Katoch	Biochemist, HPKV, Palampur
24	Dr A K Mehta	Sr Forage Breeder, JNKVV, Jabalpur
25	Dr Amit Jha	Jr Scientist, JNKVV, Jabalpur
26	Dr S Biliaya	Forage Breeder, JNKVV, Jabalpur
27	Dr K Loka Reddy	Pr. Scientist & OIC, ANGRAU, Hyderabad
28	Dr M Shanti	Scientist (Biochemistry), ANGRAU, Hyderabad
29	Dr T Shashikala	Senior scientist (PB), ANGRAU, Hyderabad
30	Dr R Susheela	Scientist (Agronomy), ANGRAU, Hyderabad
31	Dr D I Sumabai	Professor, KAU, Vellayani
32	Dr M R Krishnappa	Sr Scientist, UAS, Bangalore
33	Dr B G Shekara	Sr Scientist, UAS, Bangalore
34	Dr A H Sonone	Sr forage Breeder, MPKV, Rahuri
35	Dr A B Tambe	Scientist (Entomology) , MPKV, Rahuri
36	Dr S H Pathan	Scientist (Agronomy) , MPKV, Rahuri
37	Dr S V Damame	Asstt. Research Scientist, MPKV, Rahuri
38	Dr H P Parmar	Research Scientist, AAU, Anand
39	Dr P M Patel	Asstt Res Scientist, AAU, Anand
40	Dr D H Desai	Scientist, AAU, Anand
41	Dr Meenakshi Goyal	Asstt. Biochemist, PAU, Ludhiana
42	Dr Upasana Rani	Astt pathologist, PAU, Ludhiana
43	Dr Rahul Kapoor	Sr Forage Breeder, PAU, Ludhiana
44	Dr A Velayutham	Professor (Agronomy), TNAU, Coimbatore
45	Dr C Babu	Professor (PBG) , TNAU, Coimbatore
46	Dr G B Dash	Sr Breeder, OUAT, Bhubaneswar
47	Dr (Mrs) Suchsmita Tripathy	Sr Agronomist, OUAT, Bhubaneswar
48	Dr Durga Prasad Awasthi	Pathologist, OUAT, Bhubaneswar
49	Dr Champam Kundu	Scientist & OIC, BCKV, Kalyani
50	Mr P S Takawale	Forage Breeder & OIC, BAIF, Urulikanchan

51	Mr V K Kauthale	Scientist, BAIF, Urulikanchan
52	Dr Ansar- Ul -Haq	Agronomist, SKUAST, Srinagar
53	Dr N Sdeem Khan	Scientist (PB), SKUAST, Srinagar
54	Dr Nitish Tiwari	Agronomist, IGKV, Raipur
55	Dr J S Verma	Professor, GBPUAT, Pantnagar
56	Dr Surendra S Shekhawat	Assoc. Prof. (PBG) & OIC, RAU, Bikaner
57	Dr S M Kumawat	Assoc. Prof. (Agronomy), RAU, Bikaner
58	Dr K K Sharma	Pr. Scientist & OIC. AAU, Jorhat
59	Dr S Bora Neog	Pr. Scientist, AAU, Jorhat
60	Dr J K Bisht	VPKAS, Almora
61	Mr Ram Prakash Yadav	VPKAS, Almora
62	Dr M Gawai	RAR, Karjat, Raigarh, Maharashtra
63	Dr S K Choudhary	RAU, Pusa, Samastipur, Bihar
64	Dr Anjali Kak	Pr. Scientist, NBPGR, New Delhi
65	Dr A K Singh	Advisor, JK Trust, Gram Vikash Yojana, Raipur
66	Shri Radhamohan	NSC, Regional Office Bhopal
67	Mr G Prabhakar Babu	DGM, UPL Advanta India Ltd, Hyderabad
68	Dr Narayan Kolekar	UPL Advanta India Ltd, Hyderabad
69	Dr S A Faruqui	Advisor, UPL Advanta India Ltd
70	M. Semual	Pelican Equipments, Chennai
71	Dr P A Dubay	MAHYCO, Maharashtra
72	Mr H K Singh	MAHYCO, Maharashtra
73	Mr V K Khare	Sanchi Milk Federation, Jabalpur

PARTICIPANTS FROM JNKVV, JABALPUR

SN	Name	Details
1	Dr V S Tomar	Vice Chancellor, JNKVV, Jabalpur
2	Dr S S Tomar	Director of Research , JNKVV, Jabalpur
3	Dr S K Rao	Dean faculty, JNKVV, Jabalpur
4	Dr P K Mishra	DI , DES, JNKVV, Jabalpur
5	Dr N N Pathak	DF, JNKVV, Jabalpur
6	Dr R S Kampariya	Dean Agri College. , JNKVV, Jabalpur
7	Dr T K Bhattacharya	Dean Agri. Engg. , JNKVV, Jabalpur
8	Dr P K Bisen	DSW , Student Welfare, JNKVV, Jabalpur
9	Dr Girish Jha	Head, Dept of Agronomy, JNKVV, Jabalpur
10	Dr A K Rawat	Head, Dept of SSAC , JNKVV, Jabalpur
11	Dr D K Mishra	Head, Dept of PBG, JNKVV, Jabalpur
12	Dr (Smt) S Rao	Head, Dept of Crop Physiology, JNKVV, Jabalpur
13	Dr P K Jain	Head, Dept of Horticulture, JNKVV, Jabalpur
14	Dr S Tiwari	Head, Dept of Biotechnology, JNKVV, Jabalpur
15	Dr N K Raghuvanshi	Head, Dept of AEFM, JNKVV, Jabalpur
16	Dr A G Nema	Head, Dept of Plant Pathology, JNKVV, Jabalpur
17	Dr N K Khare	Head, Dept of Agril Extn Education, JNKVV, Jabalpur
18	Dr O P Veda	Head, Dept of Agril Entomology JNKVV, Jabalpur
19	Dr Suman Kumar	Head, Dept of FST, JNKVV, Jabalpur
20	Dr A K Mehta	Professor, JNKVV, Jabalpur
21	Dr M L Kewat	Assoc. Prof, Dept of Agronomy, JNKVV, Jabalpur
22	Dr K K Agrawal	Professor, JNKVV, Jabalpur
23	Dr V K Shukla	Professor, JNKVV, Jabalpur
24	Dr S K Vishwakarma	Scientist , JNKVV, Jabalpur
25	Shri N S Raghuvanshi	Scientist, JNKVV, Jabalpur
26	Dr J K Sharma	Scientist, JNKVV, Jabalpur
27	Smt Arti Shrivastava	Scientist, JNKVV, Jabalpur
28	Smt Nisha Mehra	Scientist, JNKVV, Jabalpur

29	Dr N.K. Khampariya	Scientist, JNKVV, Jabalpur
30	Dr A N Shrivastava	Pr. Scientist, JNKVV, Jabalpur
31	Dr P K Moitra	Pr. Scientist, JNKVV, Jabalpur
32	Dr V K Gour	Sr. Scientist, JNKVV, Jabalpur
33	Dr R S Shukla	Sr. Scientist, JNKVV, Jabalpur
34	Dr M S Bhale	Sr. Scientist, JNKVV, Jabalpur
35	Dr G K Koutu	Sr. Scientist, JNKVV, Jabalpur
36	Dr Dharendra Khare	Sr. Scientist, JNKVV, Jabalpur
37	Dr K R Naik	Sr. Scientist, JNKVV, Jabalpur
38	Dr A K Naidu	Sr. Scientist, JNKVV, Jabalpur
39	Dr (Smt) Usha Bhale	Sr. Scientist, JNKVV, Jabalpur
40	Dr A K Nigam	Sr. Scientist, JNKVV, Jabalpur
41	Dr S K Pandey	Sr. Scientist, JNKVV, Jabalpur
42	Dr B R Pandey	Sr. Scientist, JNKVV, Jabalpur
43	Dr S K Sengupta	Sr. Scientist, JNKVV, Jabalpur
44	Dr (Smt) S Shrivastava	Sr. Scientist, JNKVV, Jabalpur
45	Dr S B Das	Assoc. Prof., JNKVV, Jabalpur
46	Dr A K Saxena	Assoc. Prof., JNKVV, Jabalpur
47	Dr U K Khare	Pr. Scientist, JNKVV, Jabalpur
48	Dr S P Tiwari	Pr. Scientist, JNKVV, Jabalpur
49	Dr Jayant Bhatt	Sr. Scientist, JNKVV, Jabalpur