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कार्यवृत्त

राष्ट्रीय समूह बैठक : रबी-2020-21

28 सितम्बर, 2020

PROCEEDINGS

National Group Meeting : *Rabi*-2020-21

28th September, 2020

अखिल भारतीय समन्वयित अनुसंधान परियोजना
चारा फसलें एवं उपयोगिता
(भारतीय कृषि अनुसंधान परिषद)

All India Coordinated Research Project on Forage Crops & Utilization
(Indian Council of Agricultural Research)

Project Coordinating Unit
ICAR-IGFRI, Jhansi-284 003, (U.P.)

http://www.aicrponforagecrops.res.in

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Proceedings of the National Group Meeting : *Rabi* 2020-21
Held on 28th September, 2020 (Online)

This document is meant for official use only for the AICRP (FC&U) Centres, Coordinating Unit, ICAR Headquarters and Forage Scientists.

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PREFACE

The National Group Meet, *Rabi* 2020-21 of 'All India Coordinated Research Project on Forage Crops and Utilization' was organized with the objectives to review the accomplishments of technical programme executed during *Rabi* 2019-20 at different Coordinating and Cooperating centres, In-house research activities, Breeder Seed Production, Forage Technology Demonstrations (FTDs), Tribal sub-plan (TSPs) and other activities carried out towards development and promotion of forage resources. The formulation and finalization of technical programme for *Rabi* 2020-21 was successfully done during the meet. The meeting was conducted online on 28th September, 2020.

The meeting was attended by the scientists and officials engaged in forage research and development working at Coordinating and Cooperating centres located at different SAUs, CAU, ICAR institutes, NGOs and other institutions. All the important stakeholders contributed in the development and refinement of programme, linkages and collaborations and deciding future course of action in view of the changing agricultural needs of the farmers, livestock keepers and other stakeholders.

This compilation contains concise report of the National Group Meet, *Rabi* 2020-21 covering highlights on forage crop improvement, forage crop production, forage crop protection and proceedings of different technical sessions. The National Group Meet members discussed and planned future strategies for improving the forage productivity, quality, and soil health to address the regional and national forage security with sustainability for increasing livestock population. The finalized technical programme on forage crop improvement, forage crop production and forage crop protection for *Rabi* 2020-21 have been given in annexure.

The successful conductance of the event is outcome of the joint efforts made by the ICAR/IGFRI authorities, participating scientists, staff of the Project Coordinating Unit, Principal Investigators and other staff of IGFRI, Jhansi. The team of All India Coordinating Research Project on Forage Crops & Utilization sincerely acknowledges their guidance, active involvement, suggestions and cooperation for successful organization of the meeting.

We sincerely thank authorities at ICAR, particularly Dr. T. Mohapatra, Director General, ICAR, Dr. T. R. Sharma, Deputy Director General (Crop Science), Dr. Y. P. Singh, Assistant Director General (FFC) and other unit members of Crop Science Division, ICAR for their constant guidance, support and encouragement as well as financial and administrative approval.

We are thankful to Dr. Vijay K. Yadav, Director, IGFRI and heads of divisions, scientists, administrative and finance personnel of IGFRI, Jhansi for their constant support.

A.K. Roy

Project Coordinator

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Major Recommendations

- Crop Improvement programme should be strengthened at individual coordinating centers with clear cut chalked out activities regarding enrichment of germplasm by exploration or introduction, pre-breeding programme, careful targeted selection of parents and crossing programme in detail along with sharing of progenies.
- A strong crop specific programme needs to be chalked out for which brain storming sessions on individual important crop basis may be planned to decide the future course of action. Well-structured and trait specific crossing programme should be planned and executed at each centre for better results in future.
- IGFRI, Jhansi should take up the scientifically and carefully designed crossing programme in different forage crops and furthermore the segregating material should be distributed to different AICRP centres for further selection and evaluation.
- For breeder seed production, a contingency plan should have in place to achieve the targeted Breeder seed production in case of failure in regular season/centers.
- IGFRI should developed seed quality standards for major & minor forage crops.
- Scientific study on relay cropping of Mustard – Berseem may be taken up for enhancing berseem seed production. It is a common farmers practice in Gwalior, Morena (MP) area.
- Forewarning modules for different diseases and insect-pests in forage crops should be made and disseminated.

Technologies developed

Varieties Identified

- **Berseem entry PC 91:** The proposal was submitted by PAU, Ludhiana. It was identified for release in the states of Tarai part of Uttarakhand, Punjab, Haryana, Rajasthan, West Bengal, Jharkhand, Bihar, Eastern UP, and Orissa.
- **Berseem entry JHB 17-1:** The proposal was submitted by ICAR-IGFRI, Jhansi. It was identified for release in the states of Tarai part of Uttarakhand, Punjab, Haryana, Rajasthan, West Bengal, Jharkhand, Bihar, Eastern UP, and Orissa.
- **Berseem entry JHB 17-2:** The proposal was submitted by ICAR-IGFRI, Jhansi. It was identified for release in the states of Tarai part of Uttarakhand, Punjab, Haryana, Rajasthan, West Bengal, Jharkhand, Bihar, Eastern UP, and Orissa
- **Multicut summer fodder Bajra entry ADV0061:** The proposal was submitted by Advanta Ltd. Hyderabad. It was identified for release in the states of Madhya Pradesh, Maharashtra and Gujarat.
- **Multicut summer fodder Bajra entry HTBH 4902:** The proposal was submitted by Hytech Seed Private Ltd, Hyderabad. It was identified for release in the states of Telangana, Andhra Pradesh, Karnataka and Kerala.
- **White clover entry PWC 25:** The proposal was submitted by CSK HPKV, Palampur. It was identified for release for sub-temperate and temperate regions of the states of Himachal Pradesh and Uttarakhand and UT of Jammu and Kashmir.
- **Fodder Oat single cut entry HFO -529:** The proposal was submitted by CCS HAU, Hisar. It was identified for release in the state of Himachal Pradesh and UT of Jammu and Kashmir.

- **Fodder Oat single cut entry OL 1896:** The proposal was submitted by PAU, Ludhiana. It was identified for release for the state of Rajasthan, Haryana, Punjab, Terai part of Uttarakhand.
- **Fodder Oat multicut entry OL 1874:** The proposal was submitted by PAU, Ludhiana. It was identified for release for the state of Rajasthan, Haryana, Punjab, and Terai part of Uttarakhnad.
- **Fodder Oat multi cut entry JO-05-30-4:** The proposal was submitted by JNKVV, Jabalpur. It was identified for release for the state of Uttar Pradesh, Madhya Pradesh, Maharashtra, and Gujarat.
- **Oat (dual purpose) entry HFO-611:** The proposal was submitted by CCS HAU, Hisar. It was identified for release for the state of Rajasthan, Haryana, Punjab, and Terai part of Uttarakhand.
- **Fodder Oat (dual purpose) entry OL-1876-2:** The proposal was submitted by PAU, Ludhiana. It was identified for release for the state of Assam, Odisha, Jharkhand and eastern UP.
- **Fodder Oat (dual purpose) JO-10-506:** The proposal was submitted by JNKVV, Jabalpur. It was identified for release for the state of Assam, Odisha, Jharkhand and eastern UP.

Fodder Production Technologies

- Tall fescue grass planted at 30 cm x 30 cm spacing with white clover @ 2 kg/ha is recommended for getting yield and net return in Wet temperate conditions in NW Himalayas.
- Mulberry tree based silvi-pastoral system involving Setaria grass is recommended for higher yield, economic returns and soil organic carbon improvement in Mid hill regions of NW Himalayas.
- Application of 75% RDF (90N:45P_2O_5:30K_2O kg/ha) + 25% N (30kgN/ha) through *Dhaincha* green manuring or 50% RDF (60N:30P_2O_5: 20K_2O kg/ha) + 50% N (60kg N/ha) through *Dhaincha* green manuring in rice crop continuously for 4 years is recommended for enhanced green forage productivity of oat and also improved soil properties in sodic soils of Uttar Pradesh.
- Perennial grass based cropping system, Bajra Napier hybrid grass in paired rows (60/120 cm) with *Sesbania grandiflora* is recommended for achieving higher yield, net return and total carbon sequestration in Southern Zone.
- Agase inter-cropping with BN Hybrid (2:1) or perennial fodder sorghum (2:6) has been recommended as sustainable and economical cropping system for higher yield and net returns in Southern Karnataka.
- Agase inter-cropping with *Setaria* grass (2:2) or BN Hybrid (2:1) found sustainable and economical *Agase* based cropping system for yield and net returns in Kerala.
- Sowing of oat variety JHO 822 at 45 cm row spacing and fertilized with 120 kg N/ha is recommended for superior seed yield (after one forage cut at 45 DAS) and better net economic return in Chhattisgarh.

Fodder Protection Technologies

- Seed treatment with carbendazim @ 2 g/kg seed followed by three foliar spray of hexaconazole @ 0.1 % is recommended for the management of clover rot and powdery mildew of red clover in Hill zone.

AICRP on Forage Crops and Utilization
National Group Meeting –Rabi 2019-20
28th September 2020

Inauguration Programme

Virtual National Group Meeting Rabi-2020-21 of All India Coordinated Research Project on Forage Crops and Utilization, Jhansi was organized on 28th September, 2020 using online platform.

Dr. Tilak Raj Sharma, Deputy Director General (Crop Sciences), ICAR inaugurated the programme and congratulated the scientists for entering into the Golden Jubilee Year of the project. He applauded scientists and staff for coordinating the establishment of the 'Golden Jubilee Forage Garden' at 33 SAUs/CAU/NGO/ICAR institutes across the country and desired that the garden should be maintained for years to come for sensitizing the visiting farmers, students, dignitaries and other stakeholders. He called for initiation of target oriented breeding programmes across the AICRP centres. He also emphasized to develop an action plan to minimize Berseem seed import. He stressed upon efforts to increase the varietal replacement rate and to increase fodder availability during the lean period.

Dr. A. K. Roy, Project Coordinator, presented the brief introduction of the project, salient achievements during last three year's period and summary of activities carried out during Rabi 2019-20 as well as new initiatives for future programme. He highlighted release of 52 forage varieties, 26 production and 6 protection technologies during the SFC period of 2017-20.

Nine publications including AICRP Annual Report Rabi 2019-20, Two books on "Database of Forage Crop Varieties:2020" and "Glimpses of Tribal Sub Plan Activities of AICRP on Forage Crops and Utilization"; one bulletin on "Technological Advances in Forage Crop Protection" and 4 farmers' friendly literature in regional /national languages were released.

More than 100 participants attended the meeting which included Dr. Y. P. Singh, ADG FFC; Dr. D. K. Yadava, ADG (Seed); Dr. A. K. Tyagi, ADG (Animal Nutrition); Dr. V. K. Yadav, Director, IGFRI, Jhansi, Dr. C. Tara Satyavathi, Project Coordinator Pearl Millet; Directors of Regional Fodder Station, Ministry of Animal Husbandry and Dairying; Dr Digvijay Singh, Sr Manager, NDDB, representatives of private and public sector, scientists of AICRP voluntary centers, coordinating centers and other ICAR institutes. Expert panel included Dr Bhag Mal, Dr. A. K.Tyagi, Dr Jagdish Kumar, Dr. D. R. Malaviya and Dr. M. P. Jain. A total of more than 120 scientists participated in the meeting.

Various technical sessions on crop improvement, crop production, crop protection, breeder seed production, FTD and TSP activities were held in which results of previous years were presented and technical programmes for coming Rabi season were discussed.

Plenary session was chaired by Dr. T. R. Sharma, Deputy Director General (Crop Sciences), ICAR. Rapporteurs of different sessions presented the salient recommendations. Chairman stressed upon need of more cohesive interaction among all stakeholders, evaluation of germplasm for various traits and careful selection of parents for breeding programme.

A total of 13 new varieties including 3 in Berseem, 1 in White clover, 2 in multicut fodder summer Bajra, 7 in fodder oats under different cutting management for different zones were identified for release in the Varietal Identification Committee Meeting, held under the chairmanship of Dr. Tilak Raj Sharma, Deputy Director General (Crops Science), ICAR.

TECHNICAL SESSION I
FORAGE CROP IMPROVEMENT
REPORT & TECHNICAL PROGRAMME FORMULATIONS

Chairman	**:**	Dr. T. R. Sharma, DDG (Crop Science), ICAR
Co-Chairman	**:**	Dr. Y.P. Singh, ADG (FFC), ICAR
Convener	**:**	Dr. A. K. Roy, Project Coordinator,
Report of Trials Rabi 2019-20 & Technical programme for Rabi 2020-21	**:**	Dr. Subhash Chand, IGFRI, Jhansi
Rapporteurs	**:**	Drs. Rahul Kapoor and T. Shashikala

At the outset, the chairman welcomed the delegates and Dr. Subhash Chand, presented the breeding trial report of *Rabi* 2019-20 to the house and then finalization technical programme for *Rabi* 2020-21 was presented. After thorough discussion, following breeding trials were formulated

- **IVTB:** four entries were proposed for promotion to AVT-1
- **AVTB-1:** five entries were proposed for promotion to AVTB-2
- **AVTB-2 and AVTB (seed):** trials were completed. 03 variety proposals submitted.
- **IVTO (SC):** four entries were proposed for promotion to AVT-1
- **AVTO-1 (SC):** seven entries were proposed for promotion AVTO-2
- **AVTO-1 (SC) and AVTO (seed):** trials were completed. Two variety proposals submitted
- **IVTO (MC):** six entries were proposed for promotion to AVT-1 based on superiority
- **AVTO-1 (MC):** two entries were proposed for promotion to AVT-1
- **AVTO-2 (MC) and AVT-2 (seed):** trials were completed. Two variety proposals submitted
- **IVTO (dual):** no entry was found markedly superior than the best check
- **AVTO-1 (dual):** no entry was found markedly superior than the best check
- **AVTO-2 (dual) and AVTO-2 (seed):** trials were completed. Three variety proposals submitted
- **IVT Lucerne:** two entries were proposed for promotion to AVT-1
- **IVT Bajra multicut summer:** two entries were proposed for promotion to AVT-1
- **AVT-1 Bajra multicut summer:** three entries were proposed for promotion to AVT-2
- **AVT-2 Bajra multicut summer and AVT-2 (seed):** trials were completed
- **IVT Lathyrus:** one entry was proposed for promotion to AVT-1
- Perennial trials on **red clover and white clover** completed. One variety proposal submitted

A total of twenty breeding trials were proposed to be conducted during *Rabi* 2020-21 in five different crops viz., Berseem (4), Oat (9), Lucerne (2), Summer multicut bajra (4) and Lathyrus (1). New IVT trials were constituted in Berseem, Oat (single cut, multi cut, Dual), multi cut Bajra, Lucerne. AVT-1 and AVT-2 in different crops were constituted with promoted entries.

Following were the suggestions and recommendations:

- Strengthening of Pre breeding programme at individual coordinating centers and steps to enrich germplasm diversity should be focused. Frequent review meetings with AICRP centres may be organized to monitor crop and trait wise pre-breeding activities.
- IGFRI, Jhansi should take up the scientifically and carefully designed crossing programme in different forage crops and the segregating material should be distributed to different AICRP centres for further selection and evaluation.
- NVTs (as being conducted in wheat and other crops) should be a regular part of AICRP-FCU for effective initial evaluation of large number of genotypes contributed from different AICRP centres.
- Well-structured and trait specific crossing programme in important crops should be planned and executed at respective centres for better results in future. Selection of superior parental lines to be involved in hybridization programme should be the main goal of the programme. Each AICRP centre should be given task of making a definite number of crosses followed by sharing of segregating material/derivatives in the mandate crop of their centre.
- A strong crop specific programme needs to be chalked out for which a brain storming session on an individual crop basis may be planned to decide the future course of action.

The session end with vote of thanks to chairman and co-chairman.

TECHNICAL SESSION- II
BREEDER SEED PRODUCTION

Chairman	**:**	Dr. Bhag Mal, Secretary TAAS ; Ex-Director IGFRI and Ex-Coordinator, Biodiversity International
BSP-IV report production Rabi 2019-20 & BSP -1 Allocation for Rabi 2020-21	**:**	Dr. Subhash Chand, Scientist AICRP FC&U
Rapporteurs	**:**	Dr. P. Mahadevu & Dr. Gayathri G

The indent for Breeder Seed Production was received from DAC, GOI for different varieties in three forage crops *viz*., Oat, Berseem, Lucerne. The quantity allocated was 409.15q. The production target was assigned to different Breeder Seed producing centers of the different SAUs/ NGO/ ICAR institutes. Among quantity indented for different forage crops, the maximum was for Oat followed by Berseem and Lucerne.

The final Breeder Seed Production Report (BSP-IV) received from different seed producing centers revealed that in all three crops Berseem, Oat & Lucerne, the overall breeder seed production was more than the allocated quantity. The overall production was 478.58 q which was 69.43 q (16.96%) higher than the indented target.
In Oat, 24 varieties were used for the production. There was surplus production than DAC indent. **In Berseem,** the production was 18.94 q against the indent of 29 q making a deficit of 10.26 q. **In Lucerne,** the target of (4.2 q) was allotted. The total production was 4.36 q which was 0.16 q or 3.81% higher than the indent.

DAC indent for Rabi, 2020-2021 (production year) breeder seed allocation of oat (373.80 q), berseem (33.16 q), Lucerne (4.32 q), and Rye grass (0.56 q) and finally grand total is 411.83 q. The indent was allocated to different centers and accepted by them

Following were the suggestions and recommendations:

- Contingency plan should be in place to achieve the targeted Breeder seed production in case of failure in regular season/centers.
- Use of pollinators to enhance seed set in tetraploid varieties of Berseem was suggested.
- Dr. Digvijay Singh, NDDB narrated the success story of Berseem variety BL-43, seed production with farmers with enhanced profitability as compared to wheat seed production He also requested to develop and popularize improved fodder varieties in Ryegrass, Chinese cabbage and Sugar beet.
- Experiments to address Cuscuta problem in Berseem and Lucerne was suggested.
- Seed quality standards for major & minor forage crops need to be established.
- Eco regional planning is required to fulfill the regional /national forage seed requirement of Breeder/Certified seed.

The session end with vote of thanks to chairman and co-chairman.

TECHNICAL SESSION-III:
Forage Crop Production
Report and Technical Programme Formulations

Chairman	**:**	**Dr M. P. Jain, Director Research RVSKVV, Gwalior**
Co-chairman	**:**	**Dr. Y. P. Singh, ADG (FFC), ICAR**
Report of Trials *Rabi 2019-20* & Technical programme for *Rabi 2020-21*	**:**	**Dr. Naveen Kumar**
Rapporteurs	**:**	**Dr. S. D. Sivakumar & Dr. S. K. Jha**

Discipline wise report and technical programme formulations –Forage crop production session began with introductory remarks of Chairman Dr M. P. Jain, Director Research RVSKVV, Gwalior and Co-chairman Dr. Y.P. Singh, ADG (FFC), ICAR. Dr. Naveen Kumar, OIC AICRP FC&U, CSKHPKV center presented the result of experiment conducted during *Rabi* 2019-20. Results of 17 trials including ten coordinated trials, four location specific and five AVT based trials were presented. He also presented the technical programme for the coming season.

Technology Recommendations for adoption

- In hill zone, wet temperate conditions in NW Himalayas plantation of tall fescue grass at 30 cm x 30 cm spacing with white clover @ 2 kg/ha is recommended for getting yield and net return.
- In hill zone, mid hill regions of NW Himalayas, Mulberry tree based silvi-pastoral system involving Setaria grass is recommended for higher yield, economic returns and soil organic carbon improvement.
- In Sodic soils of Uttar Pradesh, Application of 75% RDF (90N:45P_2O_5:30K_2O kg/ha) + 25% N (30kgN/ha) through *Dhaincha* green manuring or 50% RDF (60N:30P_2O_5: 20K_2O kg/ha) + 50% N (60kgN/ha) through *Dhaincha* green manuring in rice crop is recommended for enhancing green forage productivity of oat and improvement in soil properties.
- In southern states (Telangana, Karnataka and Kerala), perennial grass based cropping system, Bajra Napier hybrid grass in paired rows (60/120 cm) with *Sesbania grandiflora* is recommended for achieving higher yield, net return and total carbon sequestration.
- In Karnataka, Agase inter-cropping with BN Hybrid (2:1) or perennial fodder sorghum (2:6) is recommended higher fodder productivity, economic returns and sustainability.
- In Kerala, Agase inter-cropping with Setaria grass (2:2) or BN Hybrid (2:1) is recommended higher fodder productivity, economic returns and sustainability.
- In Chhattisgarh, oat variety JHO 822 at sown at 45 cm row spacing and supplemented with 120 kg N/ha is recommended for dual purpose as it produced higher fodder in first cut at 45 DAS as well as seed yield in subsequent cut and better net economic return.

Recommendation

- Dr M.P. Jain stated that study on relay cropping of Mustard – Berseem may be initiated for making self-sufficient in berseem seed production particularly in Morena (MP) area.

The session ended with vote of thanks to the Chair.

TECHNICAL SESSION IV
Forage Crop Protection
Report & Technical Programme Formulation

Chairman	**:**	Dr. Jagdish Kumar, Joint Director, ICAR-NIBSM, Raipur
Co-Chairman	**:**	Dr. Y.P. Singh, ADG (FFC), ICAR
Finalization of trials	**:**	Dr. N. R. Bhardwaj
Rapporteurs	**:**	Drs. Ashlesha and Sandip Langde

Discipline-wise report and technical programme formulation–Forage Crop Protection began with introductory remarks of Chairman, Dr. J. Kumar, Joint Director, ICAR-NIBSM, Raipur and Co-chairman Dr. Y.P. Singh, ADG (FFC), ICAR. Dr. N. R. Bhardwaj, P.I. (crop protection) presented the results of experiments conducted during Rabi 2019-20. He also presented the recommendations made by different centers on forage crop protection for different locations. Two new proposals on management of stem rot in Berseem and Assessment of yield losses due to diseases and insect-pests in Lucerne were proposed for Rabi 2020-21 and onwards. He emphasized on the integration of non chemical methods along with chemicals for disease and insect-pest management. He also emphasized to frame multilocation trials rather than location specific trials.

Based on the discussions and advices of the Chairman the following points emerged:

1. Chairman suggested that the disease severity or incidence values should be supported with reference rating scale/disease diagrams used.
2. The evaluation of breeding germplasm for disease resistance should be done under artificial epiphytotic conditions in order to confirm the disease reaction for a particular disease.
3. Chairman also suggested that previous survey and monitoring data of different diseases and insect-pests should be utilized for making forewarning modules for different diseases and insect-pests in forage crops.
4. The trials PPT-1, PPT-2, PPT-17, PPT-31 and PPT-34 will continue in *Rabi* 2020-21.
5. The trial PPT-26 (Biological management of oat aphid "*Rhopalosiphum padi*" on oats) and PPT-30 (Biological management of powdery mildew of oat caused by *Blumeria graminis* f. sp. *avenae*) will be validated on larger area.
6. Trials PPT-32 (Validation of best treatments of trial entitled "Management of soil borne and powdery mildew diseases in red clover seed crop") was validated on larger area and following recommendation emerged:

- Seed treatment with carbendazim @ 2 g/kg seed followed by three foliar spray of hexaconazole @ 0.1 % is recommended for the management of clover rot and powdery mildew of red clover in Hill zone.

7. Two new trials, PPT-35 (Non chemical management of stem rot of berseem caused by *Sclerotinia trifoliorum*) for Ludhiana centre and PPT-36 (Assessment of yield losses due to insect-pests and diseases in Lucerne) for Rahuri, Ludhiana and Jhansi were formulated and finalized.

The session ended with vote of thanks to the Chairman and Co-chairman.

TECHNICAL SESSION V
FTD & TSP FORMULATION

Chairman	**Dr. V. K. Yadav, Director IGFRI**
Co-chairman	Dr. Y.P.Singh, ADG (FFC), ICAR
Report Plan	Dr. N. R. Bhardwaj
Rapporteurs	Dr. Maninder Kaur, Dr. R. Katoch

At the outset, the chairman welcomed all the participants. Dr. N. R. Bhardwaj presented the status of FTD's allotted to AICRP (FC) centres for Rabi 2020-21. A total of 660 FTD's were proposed to be allotted to AICRP centres and co-operating centres during Rabi 2020-21 for the crops viz., Berseem, Lucerne, Oat, Lathyrus, Bajra Napier hybrid, Cowpea, summer Bajra, Moringa, Ryegrass etc. Out of 660 FTD's, 80 were allocated to Berseem, 55 to Lucerne, 420 to Oat, 10 cowpea, 30 to BN Hybrid, 10 to Lathyrus, 10 to ryegrass, 5 to Moringa, 5 to summer bajra and 5 to perennial sorghum.

The following decisions were taken after the discussion:

- All the centres should send result of the demonstrations along with beneficiaries' details.
- For effective dissemination of technologies, new villages and beneficiaries should be selected in subsequent years.
- The data regarding GFY and seed yield etc. should be recorded and analyzed before reporting.
- The report along with good photograph should be sent for compilation.

Crop-wise FTDs to be conducted during Rabi 2020-21

SN	Centre	Berseem	Lucerne	Oat (SC)	Oat (MC)	Other crops	Total
1.	AAU, Jorhat			20			20
2.	OUAT, Bhubaneswar			15			15
3.	BCKV, Kalyani	05		10		Lathyrus: 10	25
4.	BAU, Ranchi	10		20			30
5	NDUAT, Ayodhya			10		BxN Hybrid: 10	20
6.	JNKVV, Jabalpur	15		10			25
7.	AAU, Anand		10	10			20
8.	BAIF, Urulikanchan	10		10		Fodder summer bajra:5	25
9.	MPKV, Rahuri						nil
10.	SKRAU, Bikaner		10	15			25
11.	PAU, Ludhiana				160		160
12.	CCS HAU, Hisar	10		15	05		30
13.	GBPUAT, Pantnagar	20		20		Maize+cowpea=20	40
14.	TNAU, Coimbatore		05			Forage cowpea 05	10
15.	PJTSAU, Hyderabad		10	05		Hedge lucerne: 10	35
16.	ZRS, UAS (B), Mandya		10	10			20
17.	CSK HPKV, Palampur				20	Rye Grass:10	30
18.	KAU, Vellayani					Forage Cowpea 5, BN Hybrid: 20	25
19.	IGKV, Raipur	10		10	5	Moringa: 5; Perennial Sorghum: 5	30
20.	CAU, Imphal			10			10
21.	SKUA& T, Srinagar			30			30
22.	RPCAU, Pusa			10			10
Total		**80**	**45**	**310**	**110**	**115**	**660**

Tribal Sub Plan

Centre wise allotment under TSP for rabi season of 2020-21

Centre	Training	Demonstrations	Exposure visit	Beneficiaries
BAIF Urulikanchan	3	81	4	100
OUAT, Bhubaneswar	20	120	30	120
CAU, Imphal	4	60	0	200
AAU, Jorhat	4	40	4	40
CSKHPKV, Palampur	1	50	0	100
GBPUA&T, Pantnagar	12	120	2	400
MPKV, Rahuri	1	0	1	120
IGKV, Raipur	4	90	0	130
SKUAST, Srinagar	2	40	2	40
BAU, Ranchi	4	50	4	50
BCKV, Kalyani	6	120	4	160
Total	**61**	**771**	**51**	**1460**

The following decisions were taken after discussion

- TSP progress report should be submitted every quarter by the centres in the given proforma.
- Funds will be allocated as per availability from the council.

The session ended with vote of thanks to the chairman.

TECHNICAL SESSION-VI
PLENARY SESSION

Chairman	**Dr. T. R. Sharma, Deputy Director General (Crop Science), ICAR**
Co-Chairman	Dr. Y.P.Singh, ADG (FFC), ICAR
Convener	Dr. A. K. Roy, PC
Rapporteurs	Dr. R. K. Agrawal & Dr. Rahul Kapoor

Plenary session was chaired by Dr. T. R. Sharma, Deputy Director General (Crop Sciences), ICAR. Rapporteurs of different sessions presented the salient recommendations. Chairman stressed upon need of more cohesive interaction among all stakeholders, evaluation of germplasm for various traits and careful selection of parents for breeding programme. He also highlighted the need of providing seed and planting material of fodder crops especially perennial crops to tribals and poor farmers for enhancing fodder production of the country.

Following recommendations were finalized after detailed interaction and discussion

- Crop Improvement programme should be strengthened at individual coordinating centers with clear cut chalked out activities regarding enrichment of germplasm by exploration or introduction, pre-breeding programme, careful targeted selection of parents and crossing programme in detail along with sharing of progenies.
- A strong crop specific programme needs to be chalked out for which brain storming sessions on individual important crop basis may be planned to decide the future course of action. Well-structured and trait specific crossing programme should be planned and executed at each centre for better results in future.
- IGFRI, Jhansi should take up the scientifically and carefully designed crossing programme in different forage crops and furthermore the segregating material should be distributed to different AICRP centres for further selection and evaluation.
- NVTs (as being conducted in wheat and other crops) should be a regular part of AICRP-FCU for effective initial evaluation of large number of genotypes contributed from different AICRP centres.
- For breeder seed production, a contingency plan should have in place to achieve the targeted Breeder seed production in case of failure in regular season/centers.
- IGFRI should developed seed quality standards for major & minor forage crops.
- Scientific study on relay cropping of Mustard – Berseem may be taken up for enhancing berseem seed production. It is a common farmers practice in Gwalior, Morena (MP) area.
- Forewarning modules for different diseases and insect-pests in forage crops should be made and disseminated.

Proceedings of Varietal Identification Committee Meeting

The virtual meeting of Varietal Identification Committee of AICRP on Forage Crops and Utilization was held under the Chairmanship of Dr T. R. Sharma, Deputy Director General (Crop Science), ICAR, New Delhi on 28-09-2020.

Following members were present in the meeting.

1	**Dr. T. R. Sharma** Deputy Director General (Crop Science), ICAR	**Chairman**
2	**Dr. Y. P. Singh,** Assistant Director General (FFC), ICAR	Member
3	**Dr. D. K. Yadava,** Assistant Director General (Seed), ICAR	Member
4	**Dr A. N. Singh,** Director, ICAR-IISS, Mau	Member
5	**Dr. B. Singh,** Director RFS, Hyderabad, DADH, Govt of India	Member
6	**Dr. Bhag Mal,** Ex-Director IGFRI & Ex-coordinator Biodiversity International	Member
7	**Dr. D. R. Malaviya,** Ex- PS and Head, CI Division, IISR, Lucknow	Member
8	**Dr. M. P. Jain,** Director (Research), RVSKVV, Gwalior	Member
9	**Dr Digvijay Singh,** Sr Manager NDDB	Member
10.	**Dr A K Roy** Project coordinator AICRP (FCU)	Member Secretary

Dr. R K Agarwal, PI Agronomy, **Dr. N R Bhardwaj,** PI Plant protection, **Sri Subhash Chand,** PI Plant Breeding, AICRP coordinating unit were present in the meeting to assist the committee.

Thirteen proposals in four crops were presented before the committee and after deliberations and discussions following decisions were taken.

Berseem entry PC 91: The proposal was submitted by PAU, Ludhiana for North West and East/North East zone. The committee found that in NW zone, the entry has shown superiority over the national check for GFY (>14%), DMY (>14%), CPY (>10%), Seed yield (>30%). In NE zone also the variety outperformed national checks by a margin of more than 8% for GFY, DMY and CPY. It was also superior to zonal check in both the zones. The variety was moderately resistant against stem rot and leaf blight. It was also responsive to phosphate fertilizer. Therefore, it was identified for release in the states of Tarai part of Uttarakhand, Punjab, Haryana, Rajasthan, West Bengal, Jharkhand, Bihar, Eastern UP, and Orissa.

Berseem entry JHB 17-1: The proposal was submitted by ICAR-IGFRI, Jhansi for North West and East/north east zone. The committee considered the proposal and found that the entry has shown superiority over the national check by for GFY (>15%), DMY(>10%), seed yield (>24%) in NW zone. In case of NE zone it was superior over the national check by more than 10% for GFY, DMY and seed yield. It was also found superior over the zonal check. The variety was moderately resistant against stem rot and leaf blight. It was also responsive to phosphate fertilizer. Therefore, it was identified for release in the states of Tarai part of Uttarakhand, Punjab, Haryana, Rajasthan, West Bengal, Jharkhand, Bihar, Eastern UP, and Orissa.

Berseem entry JHB 17-2: The proposal was submitted by ICAR-IGFRI, Jhansi for North West and East/North East zone. The committee found that in NW zone, the entry has shown superiority over the national check for GFY (>19%), DMY (>19%), CPY (>17%), Seed yield (>24%). In NE zone also the variety outperformed national checks by a margin of more than 8% for GFY, DMY and CPY. It was also superior to zonal check in both the zones. The variety was moderately resistant against stem rot and leaf blight. It was also responsive to phosphate fertilizer. Therefore, it was identified for release in the states of Tarai part of Uttarakhand, Punjab, Haryana, Rajasthan, West Bengal, Jharkhand, Bihar, Eastern UP and Odisha.

Multicut summer fodder Bajra entry ADV0061: The proposal was submitted by Advanta Ltd. Hyderabad for central zone. It was observed that the entry has shown superiority over the national checks by a margin of more than 12% for GFY, DMY. It also showed superiority for CPY and seed yield. It was also responsive to nitrogenous fertilizers. Therefore, it was identified for release in the states of Madhya Pradesh, Maharashtra and Gujarat.

Multicut summer fodder Bajra entry HTBH 4902: The proposal was submitted by Hytech Seed Private Ltd, Hyderabad for south zone. It was also responsive to nitrogenous fertilizers. It was observed that the entry has shown superiority of over 11% against all the checks for GFY and DMY. Therefore, it was identified for release in the states of Telangana, Andhra Pradesh, Karnataka and Kerala.

White clover entry PWC 25: The proposal was submitted by CSK HPKV, Palampur for hill zone. The entry was found superior than the check for GFY, DMY, and CPY. It was also observed that the only released variety in this crop is Palampur Composite released in state of Himachal Pradesh in 1987. It was identified for release for sub-temperate and temperate regions of the states of Himachal Pradesh and Uttarakhand and UT of Jammu and Kashmir.

Fodder Oat single cut entry HFO - 529: The proposal was submitted by CCSHAU, Hisar for Hill zone. The entry showed superiority over the national and zonal checks for GFY and DMY. For CPY, it was superior by a margin of 17.5% and 13.6% against both national checks and 8.1% over zonal check. It was also superior for per day productivity over the checks. It was identified for release in the state of Himachal Pradesh and UT of Jammu and Kashmir.

Fodder Oat single cut entry OL 1896: The proposal was submitted by PAU, Ludhiana for North West and central zone. In North West Zone, the entry out performed both the national checks by margin of 15.6% and 12.9% for GFY and 10.5% and 3.1% for DMY. For CPY it was better than 30.7% and 23.4% over the national checks and 10.9% against the zonal check. It had better quality in terms of crude protein and dry matter digestibility against both national and zonal checks. It also showed moderately resistant to resistant reaction against leaf blight. For central zone the entry did not perform better than check for most of the traits. It was identified for release for the state of Rajasthan, Haryana, Punjab, Terai part of Uttarakhand.

Fodder Oat multicut entry OL 1874: The proposal was submitted by PAU, Ludhiana for North West Zone. The entry outperformed checks for GFY and DMY. It had better quality in terms of crude protein (14.7%) as compared to 13.6% and 13.4% of both checks. It had better dry matter digestibility also as compared to both national checks. The entry showed

moderately resistant reaction against leaf blight. It was identified for release for the state of Rajasthan, Haryana, Punjab and Terai part of Uttarakhand.

Fodder Oat multi cut entry JO-05-30-4: The proposal was submitted by JNKVV Jabalpur for central zone. It showed better dry matter yield (>7.5%) against both the national checks. It was identified for release for the state of Uttar Pradesh, Madhya Pradesh, Maharashtra and Gujarat.

Oat (dual purpose) entry HFO-611: The proposal was submitted by CCSHAU, Hisar for North West zone. It was observed that the variety has shown more than 7% superiority against all the two national checks for GFY (10.9% and 7%) and DMY (18.4% and 7%) and CPY (15.2% and 5.6%). It was also superior for Crude protein %, dry matter digestibility and per day green and dry matter productivity over both the checks. It was identified for release for the state of Rajasthan, Haryana, Punjab and Terai part of Uttarakhand.

Fodder Oat (dual purpose) entry OL-1876-2: The proposal was submitted by PAU, Ludhiana for North West zone, North East Zone and Central zone. The committee observed that in north east zone it was superior over both the checks for GFY (>9%), DMY (>6.5%). It was also superior for crude protein % and CPY. It was found resistant to leaf blight in North East Zone. It was observed that the entry was not significantly superior in NW zone and Central zone. Hence it was identified for release for the state of Assam, Odisha, Jharkhand and eastern UP.

Fodder Oat (dual purpose) JO -10-506: The proposal was submitted by JNKVV, Jabalpur for North East Zone. The committee observed that the entry has outperformed both the national check for GFY (>8%), DMY (>6.5%), CPY (>8%). It was also superior for per day productivity. The entry was moderately resistant to leaf blight. Hence it was identified for release for the state of Assam, Odisha, Jharkhand and eastern UP.

Annexure A

AICRP on Forage Crops and Utilization
Technical Programme Crop Improvement
Rabi 2020-21

1. IVTB: Forage Berseem (New)

Entries	:	5+ 1 (NC) + 1 (ZC)
Entries	:	1(PAU, Ludhiana); 1 (CCS HAU, Hisar); 1 (JNKVV, Jabalpur); 2 (IGFRI, Jhansi)
Checks	:	Wardan (NC),BL-22 (HZ), JB- 05-09 (NWZ), Bundel Berseem-2 (CZ), Bundel Berseem-3 (NEZ)
Design	:	RBD with 3 replications
Plot size	:	3 m x 3 m accommodating 3m long 10 rows at 30 cm
Seed rate	:	25 Kg/ha (23 g per plot)
Fertilizers	:	N-20 Kg, P_2O_5 80 Kg/ha
Seed	:	2.0 Kg/entry & NC;BL-22 (HZ) – 0.5 kg; JB-05-9 (NWZ)- 0.5 kg; Bundel Berseem-2 (CZ) -0.5kg; Bundel Berseem-3 (NEZ) – 0.5 kg
Locations (21)	:	**HZ-** Palampur, Srinagar, Rajouri, Almora **NWZ**- Pantnagar, Bikaner, Hisar, Ludhiana, Udaipur, Meerut **NEZ**- Kalyani, Ranchi, Faizabad, Bhubaneswar, Pusa, Sabour **CZ-** Jhansi, Rahuri, Jabalpur, Urulikanchan, Raipur

2. AVTB-1: Forage Berseem (HZ, NWZ,CZ and NEZ)

Entries	:	4 + 1 (NC) +1 (ZC)
Entries	:	**HFB-16-1, HFB-16-10**(HAU, Hisar); **JB-07-15**(JNKVV, Jabalpur);**BM-14** (PAU, Ludhiana)
Checks	:	Wardan (NC), BL-22 (HZ), BB-2 (NWZ,CZ), BB-3 (NEZ)
Design	:	RBD with 4 replications
Plot size	:	4 m x 3 m accommodating 4 m long 10 rows at 30 cm
Seed rate	:	25 Kg/ha (30 g per plot)
Fertilizers	:	N-20 Kg, P_2O_5 80 Kg/ha
Seed	:	2.5 Kg/entry & NC; BL-22 (0.5 kg), BB-2 (NWZ and CZ) -1.5 kg, BB-3 (NEZ)- 0.75 kg
Locations (20)	:	**HZ-** Palampur, Srinagar, Rajouri, Almora **NWZ**- Pantnagar, Bikaner, Hisar, Ludhiana, Udaipur, Meerut **NEZ**- Kalyani, Ranchi, Faizabad, Bhubaneswar, Pusa **CZ-** Jhansi, Rahuri, Jabalpur, Uralikanchan, Raipur

3. AVTB-2: Forage Berseem(HZ, NWZ and CZ)

Entries	:	5 + 1 (NC) +1 (ZC)
Entries	:	**JHB-18-1, JHB-18-2**(IGFRI, Jhansi); **BM-12**(PAU, Ludhiana); **HFB-15-5**(CCS HAU, Hisar); **JB-06-11** (JNKVV, Jabalpur)
Checks	:	Wardan (NC), BL- 22 (HZ), BB-2 (NWZ and CZ)
Design	:	RBD with 3 replications
Plot size	:	4 m x 3 m accommodating 4m long 10 rows at 30 cm
Seed rate	:	25 Kg/ha (30 g per plot)
Fertilizers	:	N-20 Kg, P_2O_5 80 Kg/ha
Seed	:	1.5 Kg/entry & NC; BL-22 (HZ)- 0.5 Kg;BB-2 (NWZ and CZ)- 1.5 kg
Locations (15)	:	**HZ-** Palampur, Srinagar, Rajouri **NWZ**-Pantnagar, Bikaner, Hisar, Ludhiana, Udaipur, Meerut, Jalore **CZ-** Jhansi, Rahuri, Jabalpur, Uralikanchan, Raipur

3A – AVT-2 Forage Berseem – Agronomy – Details under agronomy section

Entries	:	5 + 1 (NC) +1 (ZC)
Entries	:	**JHB-18-1,JHB-18-2**(IGFRI, Jhansi); **BM-12**(PAU, Ludhiana); **HFB-15-5**(CCS HAU, Hisar); **JB-06-11** (JNKVV, Jabalpur)
Checks	:	Wardan (NC), BL- 22 (HZ), BB-2 (NWZ and CZ)
Design	:	Split plot with 3 replications Total plots = 7x3x3 = 63 Main plot – entries -5 Sub- Plot P2)5 levels - 60, 80 and 100 Kg /ha
Plot size	:	4 m x 3 m accommodating 4m long 10 rows at 30 cm
Seed rate	:	25 Kg/ha (30 g per plot)
Fertilizers	:	N-20 Kg, as basl
Seed	:	3.0 Kg/entry & NC; BL-22 (HZ)- 1.2 Kg; BB-2 (NWZ and CZ)- 1.2 kg
Locations (8)	:	**HZ-** Palampur, Srinagar; **NWZ**- Pantnagar, Hisar, Ludhiana, **CZ-**, Rahuri, Jabalpur, Raipur

Note: 1st Cut has to be taken at 60 Days after sowings subsequent cut at 30 days interval

4. AVT-2 (Seed): Forage Berseem(HZ, NWZ and CZ)

Entries	:	5 + 1 (NC) +1 (ZC)
Entries	:	**18-1,JHB-18-2**(IGFRI, Jhansi); **BM-12**(PAU, Ludhiana); **HFB-15-5**(CCS HAU, Hisar); **JB-06-11** (JNKVV, Jabalpur)
Checks	:	Wardan (NC), BL- 22 (HZ), BB-2 (NWZ and CZ)
Design	:	RBD with 3 replications
Plot size	:	4 m x 3 m accommodating 4m long 10 rows at 30 cm
Seed rate	:	25 Kg/ha (30 g per plot)
Fertilizers	:	N-20 Kg, $P_2O_5$80 Kg/ha
Seed	:	1.0 Kg/entry & NC; BL-22 (HZ)- 0.25 Kg; BB-2 (NWZ and CZ)- 1.0 kg
Locations (10)	:	**HZ-** Palampur, Srinagar; **NWZ**- Pantnagar, Hisar, Ludhiana, **CZ-** Jhansi, Rahuri, Jabalpur, Uralikanchan, Raipur;

5. IVTO: Forage Oat (single cut) (New)

Entries	:	13+ 2 (NC) + 1 (ZC)
Entries	:	**1** (NDUAT, Ayodhya); **3**(PAU, Ludhiana); **1** (JNKVV, Jabalpur);**2** (BAU, Ranchi); **1** (GBPUAT, Pantnagar); 1 (IGFRI, Jhansi); 3 (CCS HAU), 1 (SKUAST-K)
Checks	:	Kent, OS-6 (NC); SKO-225 (HZ);OS-403 (NWZ, NEZ, SZ), RO-11-1 (CZ)
Design	:	RBD with 3 replications
Plot size	:	3 m x 3 m accommodating 3 m long 10 rows at 30 cm
Seed rate	:	100 Kg/ha (90 g per plot)
Fertilizers	:	N- 80 Kg, P_2O_5 -40 Kg/ha
Seed	:	8.5 Kg/entry & NC; SKO-225 (1.0 kg), RO-11-1 (2.50 kg), OS-403 (5.0 kg)
Locations (29)	:	**HZ**-Palampur, Srinagar, Rajouri; **NWZ**-Bikaner, Hisar, Ludhiana, Pantnagar, Udaipur, Meerut; **NEZ**-Jorhat, Kalyani, Bhubaneswar, Ranchi, Pusa, Faizabad, Imphal; **CZ**-Jhansi, Rahuri, Urulikanchan, Palgarh, Anand, Jabalpur, Raipur, Dhari; **SZ**-Hyderabad, Tirupati/ Guntur, Mandya, Coimbatore (Ooty), Mattupetty

6. AVTO-1 (single cut): Forage Oat (HZ, NWZ, NEZ, CZ& SZ)

Entries	:	4 + 2 (NC) + 1 (ZC)
Entries	:	**HFO-906, HFO-904**(CCS HAU, Hisar**); OL-1960**(PAU, Ludhiana); **JO-07-28,** (JNKVV, Jabalpur)
Checks	:	Kent, OS-6 (NC), OS-403 (NWZ, NEZ, SZ), SKO-96 (HZ), RO-11-1 (CZ)
Design	:	RBD with 3 replications
Plot size	:	4 m x 3 m accommodating 4 m long 12 rows at 25 cm
Seed rate	:	100 Kg/ha (120 g per plot)
Fertilizers	:	N- 80 Kg, $P_2O_5$40 Kg/ha
Seed	:	12 Kg/entry & NC; SKO-96 (1.5Kg), RO-11-1 (3.0Kg), OS-403 (7.0Kg)
Locations (29)	:	**HZ**-Palampur, Srinagar, Rajouri; **NWZ**-Bikaner, Hisar, Ludhiana, Pantnagar, Udaipur, Meerut; **NEZ**-Jorhat, Kalyani, Bhubaneswar, Ranchi, Pusa, Faizabad, Imphal; **CZ**-Jhansi, Rahuri, Urulikanchan, Palgarh, Anand, Jabalpur, Raipur, Dhari; **SZ**-Hyderabad, Tirupati/ Guntur, Mandya, Coimbatore (Ooty), Mattupetty

7. AVTO-2 (single cut):Forage Oat (HZ, CZ and SZ)

Entries	:	7 + 2 (NC) + 1 (ZC)
Entries	:	**RO-11-1-2, RO-11-1-3 (**MPKV, Rahuri); **OL-1876-1, OL-1874-1**(PAU, Ludhiana); **HFO-806 (**CCS HAU, Hisar); **JO-06-23**(JNKVV, Jabalpur); **SKO-241**(SKUAST-K, Srinagar)
Checks	:	Kent, OS-6 (NC); SKO-96 (HZ), RO-11-1(CZ), OS-403 (SZ),
Design	:	RBD with 3 replications
Plot size	:	4 m x 3 m accommodating 4 m long 12 rows at 25 cm
Seed rate	:	100 Kg/ha (120 g per plot)
Fertilizers	:	N- 80 Kg, P_2O_5 40 Kg/ha
Seed	:	6.0 Kg/entry & NC; SKO-96 (1.2 Kg), RO-11-1 (3.0 Kg), OS-403 (2.0 Kg)
Locations (15)	:	**HZ**-Palampur, Srinagar, Rajouri; **CZ**-Jhansi, Rahuri, Urulikanchan, Palgarh, Anand, Jabalpur, Raipur **SZ**-Hyderabad, Tirupati/ Guntur, Mandya, Coimbatore (Ooty), Mattupetty

7A – AVT-2 Forage Oat (single cut) – Agronomy- details under agronomy section

Entries	:	7 + 2 (NC) + 1 (ZC)
Entries	:	**RO-11-1-2, RO-11-1-3 (**MPKV, Rahuri); **OL-1876-1, OL-1874-1**(PAU, Ludhiana); **HFO-806 (**CCS HAU, Hisar); **JO-06-23**(JNKVV, Jabalpur); **SKO-241**(SKUAST-K, Srinagar)
Checks	:	Kent, OS-6 (NC); SKO-96 (HZ), RO-11-1(CZ), OS-403 (SZ),
Design	:	Split plot with 3 replications total plots = 10x3x3 = 90 **Main plot:** Total Entries (10) Sub-plot N = 3 [60, 90, and 120 kg N /ha (Split application of nitrogen- 60% as basal + 40 at 40 DAS)]
Plot size	:	4 m x 3 m accommodating 4 m long 12 rows at 25 cm
Seed rate	:	100 Kg/ha (120 g per plot)
Fertilizers	:	$P_2O_5$40 Kg/ha- basal
Seed	:	11.5 Kg/entry & NC; SKO-96 (3.0 Kg), RO-11-1 (4.2 Kg), JHO 2009-1 (4.2Kg)
Locations (8)	:	**HZ**-Palampur, Srinagar; **CZ**-Uralikanchan,, Anand, , Raipur **SZ**-Hyderabad, Mandya, Coimbatore (Ooty)

8. AVTO-2: (single cut) (Seed): Forage Oat (HZ, CZ and SZ)

Entries	:	7 + 2 (NC) + 1 (ZC)
Entries	:	**RO-11-1-2, RO-11-1-3 (**MPKV, Rahuri); **OL-1876-1, OL-1874-1**(PAU, Ludhiana); **HFO-806 (**CCS HAU, Hisar); **JO-06-23**(JNKVV, Jabalpur); **SKO-241**(SKUAST-K, Srinagar)
Checks	:	Kent, OS-6 (NC); SKO-96 (HZ), RO-11-1(CZ), OS-403 (SZ),
Design	:	RBD with 3 replications
Plot size	:	4 m x 3 m accommodating 4 m long 12 rows at 25 cm
Seed rate	:	100 Kg/ha (120 g per plot)
Fertilizers	:	N- 80 Kg, P_2O_5-40 Kg/ha
Seed	:	4.0 Kg/entry & NC; SKO-96 (1.0 Kg), RO-11-1 (2.0 Kg), OS-403 (1.2Kg)
Locations (10)	:	**HZ**-Palampur, Srinagar; **CZ**-Jhansi, Rahuri, Anand, Jabalpur, Raipur **SZ**-Hyderabad, Mandya, Coimbatore (Ooty)

9. IVTO (Multi cut): Forage Oat (New)

Entries	:	9+ 2 (NC)
Entries	:	**3**(PAU, Ludhiana);**1** (GBPUAT, Pantnagar); **1** (JNKVV, Jabalpur); **2** (CCS HAU, Hisar); **1** (CSK HPKV, Palampur); 1 (IGFRI, Jhansi)
Checks	:	**National checks:**UPO-212 and RO-19
Design	:	RBD with 3 replications
Plot size	:	3 m x 3 m accommodating 3 m long 12 rows at 25 cm
Seed rate	:	100 Kg/ha (90 g per plot)
Fertilizers	:	N-80 Kg, P_2O_5-40 Kg/ha
Seed	:	6.0 Kg/entry & national check
Locations (18)	:	**HZ:** Palampur, Srinagar, Almora **NWZ:** Pantnagar, Hisar, Jalore, Ludhiana **NEZ:** Ranchi, Pusa, Faizabad, Jorhat, Bhubaneswar, Imphal, **CZ:** Jhansi, Anand, Jabalpur, Rahuri, Uralikanchan

10. AVTO-1 (Multi cut): Forage Oat (HZ and CZ)

Entries	:	6 + 2 (NC)
Entries	:	**OL-1919, OL-1924** (PAU, Ludhiana); **HFO-921, HFO-918**(CCS HAU, Hisar); **PLP-24**(CSK HPKV, Palampur); **JO-07-310**(JNKVV, Jabalpur)
Checks	:	**National checks:**UPO-212 and RO-19
Design	:	RBD with 3 replications
Plot size	:	4 m x 3 m accommodating 3 m long 12 rows at 25 cm
Seed rate	:	100 Kg/ha (120 g per plot)
Fertilizers	:	N-80 Kg, $P_2O_5$40 Kg/ha
Seed	:	3.0 Kg/entry & national check
Locations (8)	:	**HZ:** Palampur, Srinagar, Almora **CZ:** Jhansi, Anand, Jabalpur, Rahuri, Uralikanchan

11. AVTO-2 (Multi cut): Forage Oat (NWZ)

Entries	:	**2** + 2 (NC)
Entries	:	**OL-1882**(PAU, Ludhiana);**HFO-707**(CCS HAU, Hisar)
Checks	:	**National Check:**UPO-212 and RO-19
Design	:	4 m x 3 m accommodating 4 m long 12 rows at 25 cm
Plot size	:	RBD with 5 replications
Seed rate	:	100 Kg/ha (90 g per plot)
Fertilizers	:	N-80 Kg, $P_2O_5$40 Kg/ha
Seed	:	2.0 Kg/entry & national check
Locations (4)	:	**NWZ:** Pantnagar, Hisar, Jalore, Ludhiana

11A – AVT-2 Forage Oat (multi cut) – Agronomy- details in agronomy section

Entries	:	**2** + 2 (NC)
Entries	:	**OL-1882**(PAU, Ludhiana); **HFO-707**(CCS HAU, Hisar)
Checks	:	**National Check:**UPO-212 and RO-19
Design	:	4 m x 3 m accommodating 4 m long 12 rows at 25 cm
Plot size	:	Split plot with 3 replications total plots 4x3x3 = 36 Main plot – Entries -4 Sub- plot – N level -04 [70,105 and 140 kg N /ha (Split application of nitrogen- 40% as basal + 20% at 40 DAS+20% after 1st cut +20% after 2nd cut)]
Seed rate	:	100 Kg/ha (90 g per plot)
Fertilizers	:	P_2O_5-40 Kg/ha as basal
Seed	:	4.5 Kg/entry & national check
Locations (3)	:	**NWZ:** Pantnagar, Hisar, Ludhiana

12. AVTO-2 (Multi cut) (Seed): Forage Oat (NWZ)

Entries	:	**2** + 2 (NC)
Entries	:	**OL-1882**(PAU, Ludhiana); **HFO-707**(CCS HAU, Hisar)
Checks	:	**National Check:**UPO-212 and RO-19
Design	:	4 m x 3 m accommodating 4 m long 12 rows at 25 cm
Plot size	:	RBD with 5 replications
Seed rate	:	100 Kg/ha (90 g per plot)
Fertilizers	:	N-80 Kg, P_2O_5-40 Kg/ha
Seed	:	2.0 Kg/entry & national check
Locations (4)	:	**NWZ:** Pantnagar, Hisar, Ludhiana

13. IVTO (Dual): Forage Oat (New)

Entries	:	8 + 2 (NC)
Entries	:	**3** (PAU, Ludhiana);**1** (JNKVV, Jabalpur); **2** (CCS HAU, Hisar); **1** (GBPUAT, Pantnagar); 1 (IGFRI, Jhansi)
Checks	:	**National Check:**UPO-212 and JHO-822
Design	:	3 m x 3 m accommodating 3 m long 12 rows at 25 cm
Plot size	:	RBD with 3 replications
Seed rate	:	100 Kg/ha (90 g per plot)
Fertilizers	:	N-80 Kg, $P_2O_5$40 Kg/ha
Seed	:	5.0 Kg/entry & national check
Locations (15)	:	**NWZ**- Bikaner, Hisar, Ludhiana, Pantnagar; **NEZ**-Jorhat, Bhubaneswar, Ranchi, Faizabad, Pusa; **CZ**-Jhansi, Rahuri, Uralikanchan, Anand, Jabalpur, Raipur

14. VT Lucerne: Perennial Lucerne (New)

Entries	:	3+ 2 NC
Entries	:	**1** (IGFRI RRS, Dharwad); **BAIF Lucerne-5**(BAIF, Uralikanchan); **1** (PAU, Ludhiana)
Checks	:	Anand-2, RL-88
Design	:	RBD with 4 replications
Plot size	:	4 m x 3 m accommodating 4 m long 10 rows at 30 cm
Seed rate	:	25 kg/ha (30.0 g per plot)
Fertilizers	:	N-20kg, P_2O_5-80 kg/ha)
Seed	:	1.50 kg/entry & national check
Locations (12)	:	**NWZ**- Ludhiana, Bikaner, Jalore, Udaipur; **CZ**- Rahuri, Urulikanchan, Raipur; **SZ**- Hyderabad, Coimbatore, Mandya, Tirupati, Dharwad

15. AVT Lucerne-1: Annual Lucerne (NWZ and SZ)

Entries	:	2+ 2 NC
Entries	:	**LLC-6**(PAU, Ludhiana), **AL-66**(AAU, Anand)
Checks	:	Anand-2, RL-88
Design	:	RBD with 5 replications
Plot size	:	4 m x 3 m accommodating 4 m long 10 rows at 30 cm
Seed rate	:	25 kg/ha (30.0 g per plot
Fertilizers	:	N-20kg, $P_2O_5$80 kg/ha)
Seed	:	1.50 kg/entry & national check
Locations (8)	:	**NWZ**- Ludhiana, Bikaner, Jalore, Udaipur; **SZ**- Hyderabad, Coimbatore, Mandya, Dharwad

16. IVT Summer Bajra: (New)

Entries	:	**3**+ 2 NC
Entries	:	**BAIF Bajra-8** (BAIF, Urulikanchan); NBFH 2020 **(Nuziveedu seeds);** ADV175020 **(Advanta),**
Checks	:	**National Check:**Giant bajra, Moti bajra, BAIF Bajra 1
Design	:	RBD with 4 replications
Plot size	:	4 m x 1.8 m accommodating 4 m long 6 rows at 30 cm
Seed rate	:	12 Kg/ha (10 g per plot)
Fertilizers	:	N-40 Kg, $P_2O_5$20 Kg/ha
Seed	:	400 g/entry and 400 g for each national check
Locations (7)	:	**CZ**- Rahuri, Uralikanchan, Anand, Jabalpur **SZ-**Hyderabad, Bangalore, Vellayani

17. AVT-1 Summer Bajra: (CZ and SZ)

Entries	:	2+ 3 (NC)
Entries	:	**16-ADVO111**(Advanta seed); **SBH-101**(RASI seed)
Checks	:	**National Check:**Giant bajra, Moti bajra,BAIF Bajra 1
Design	:	RBD with 4 replications
Plot size	:	4 m x 1.8 m accommodating 4 m long 6 rows at 30 cm
Seed rate	:	12 Kg/ha (10 g per plot)
Fertilizers	:	N-40 Kg, P_2O_5-20 Kg/ha
Seed	:	400 g/entry and 400 g for each national check
Locations (7)	:	**CZ**- Rahuri, Uralikanchan, Anand, Jabalpur **SZ-**Hyderabad, Bangalore, Vellayani

18. AVT-2: Summer Bajra (CZ)

Entries	:	**3** + 3 (NC)
Entries	:	**TSFB-18-1** (PJTSAU, Hyderabad);**BAIF Bajra-5, BAIF Bajra-6** (BAIF, Urulikanchan)
Checks	:	**National Check:**Giant Bajra, Moti Bajra, Raj Bajra
Design	:	RBD with 4 replications
Plot size	:	4 m x 1.8 m accommodating 4 m long 6 rows at 30 cm
Seed rate	:	12 Kg/ha (10 g per plot)
Fertilizers	:	N-40 Kg, P_2O_5-20 Kg/ha
Seed	:	300g/entry and 300 g for each national check
Locations (4)	:	**CZ**- Rahuri, Uralikanchan, Anand, Jabalpur

18A – AVT-2 Summer Bajra – Agronomy – details in agronomy section

Entries	:	**3** + 3 (NC)
Entries	:	**TSFB-18-1** (PJTSAU, Hyderabad);**BAIF Bajra-5, BAIF Bajra-6** (BAIF, Urulikanchan)
Checks	:	**National Check:**Giant Bajra, Moti Bajra, Raj Bajra
Design	:	Split plot with 3 replications total plots 6x4x3 = 72 Main plot – Entries -6 Sub- plot – N level -04 [0, 40, 80 and 120kg/ha N /ha (Split application of nitrogen- 40% as basal + 20% at 40 DAS+20% after 1st cut +20% after 2nd cut)]
Plot size	:	4 m x 1.8 m accommodating 4 m long 6 rows at 30 cm
Seed rate	:	12 Kg/ha (10 g per plot)
Fertilizers	:	N-40 Kg, P_2O_5 -20 Kg/ha
Seed	:	600g/entry and 600 g for each national check
Locations (4)	:	**CZ**- Rahuri, Uralikanchan, Anand, Jabalpur

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

Entries	:	**3** + 3 (NC)
Entries	:	**TSFB-18-1** (PJTSAU, Hyderabad);**BAIF Bajra-5, BAIF Bajra-6** (BAIF, Urulikanchan)
Checks	:	**National Check:**Giant Bajra, Moti Bajra, Raj Bajra
Design	:	RBD with 4 replications
Plot size	:	4 m x 1.8 m accommodating 4 m long 6 rows at 30 cm
Seed rate	:	12 Kg/ha (10 g per plot)
Fertilizers	:	N-40 Kg, P_2O_5 -20 Kg/ha
Seed	:	300g/entry and 300 g for each national check
Locations (4)	:	**CZ**- Rahuri, Uralikanchan, Anand, Jabalpur

20. AVT-1: Lathyrus (CZ and NEZ)

Entries	:	1 + 3 (NC)
Entries	:	**KL-5** (BCKV, Kalyani)
Checks	:	**National Check:** Ratan, Mahateora, Prateek
Design	:	RBD with 5 replications
Plot size	:	4 m x 3 m accommodating 4 m long 10 rows at 30 cm
Seed rate	:	40 Kg/ha (50 g per plot)
Fertilizers	:	N-20 Kg, P_2O_5 40 Kg/ha
Seed	:	2.0 Kg each entry & national check
Locations (7)	:	Jorhat, Kalyani, Ranchi, Pusa, Jhansi, Jabalpur, Raipur

Seed Requirement of the Check Varieties and entries for Rabi 2020-21 trials

S.N.	Crop & Variety	Quantity Required (in Kg)	Seed Source
1.	**Berseem**		
	Wardan	2.0 (IVT) + 2.5 (AVT-1) +1.5 (AVT-2) + seed-1.0 + 2.88 kg for agronomy = **10 Kg**	Dr. Vijay Yadav, Head Seed Tech Div., IGFRI, Jhansi
	Bundel Berseem-2	0.5 (IVT) +1.5 (AVT-1)+ 1.5 (AVT-2) + seed-1.0 + 1.1 kg for agronomy = **5.6 kg**	
	Bundel Berseem-3	0.50 (IVT) + 0.75 (AVT-1) = **1.25 kg**	
	BL-22	0.5 (IVT) + 0.5 (AVT-1) + 0.5 (AVT-2) + Seed- 0.25 + 0.75 (agron) = **2.5 kg**	Dr. Rahul Kapoor, PAU, Ludhiana
	JB-05-09	0.5 (IVT)= **0.5 kg**	Dr. AK Mehta, JNKVV, Jabalpur
	IVT entries	**2.0 kg**	Respective breeders
	AVT-1 entries	**2.5 kg**	Respective breeders
	AVT-2 entries	1.5 (breeding) + 1.0 (seed) + 3.0 (agronomy) **= 5.5Kg**	Respective breeders
2.	**Oat**		
	Kent	8.5 (IVT SC) + 12.0 (AVT SC-1) + 6.0 (AVT-SC-2) + 4.0 (AVT-SC-2 seed) +11.5 (agron) **= 42 kg**	Dr. Vijay Yadav, Head Seed tech Div, IGFRI, Jhansi
	JHO-822	5.0 (IVTO-D) = **5.0 kg**	
	OS-6	8.5 (IVTO SC) + 12.0 (AVT SC-1) + 6.0 (AVT-SC-2) + 4.0 (AVT2-SC-2 seed) +11.5 (agron) = **42 kg**	Dr. D. S. Phogat, CCS HAU, Hisar
	OS-403	5.0 (IVTO SC) + 7.0 (AVTO SC-1) + 2.0 (AVTOSC-2) + 1.2 (AVTOSC-2 seed) + 4.5 (agron) **= 20 kg**	
	SKO-96	1.5 (AVTO SC-1) + 1.2 (AVTO SC-2) + 1.0 (AVTO SC-2-seed)+ 3.0 (agron) **= 7 kg**	Dr. Salim Khuroo SKUAST, Srinagar
	SKO-225	1.0 (IVTOSC) = **1.0 Kg**	
	UPO-212	6.0 (IVT MC) + 3.0 (AVT-1 MC) + 2.0 (AVT-2 MC) + 2.0 (AVT-2 MC seed) + 4.5 (agron) + 5.0 (IVTO-D) **= 22.5 kg**	Dr. M S Pal/ Dr Birendra Prasad GBPUA&T, Pantnagar
	RO-19	6.0 (IVT MC) + 3.0 (AVT-1 MC) + 2.0 (AVT-2 MC) + 2.0 (AVT-2 MC seed) + 4.5 (agron) **= 17.5 kg**	Dr. P L Badhe , MPKV, Rahuri
	RO-11-1	2.5 (IVTO SC) + 3.0 (AVTO SC-1) + 3.0 (AVT-SC-2) + 2.0 (AVTO SC-2-seed) + 4.5 (agron) **= 15 kg**	
	IVT entries - SC	**8.5 kg**	Respective breeders
	AVT-1 entries-SC	**12.0kg**	Respective breeders
	AVT-2 entries-SC	6.0 (breeding) + 4.0 (seed) + 11.5 (agronomy) **= 21.5 Kg**	Respective breeders
	IVT entries - MC	**6.0 Kg**	Respective breeders
	AVT-1 entries - MC	**3.0Kg**	Respective breeders
	AVT-2 entries - MC	2.0 (breeding) + 2.0 (seed) + 4.5 (agronomy) **= 8.5 Kg**	Respective breeders
	IVT entries - Dual	**5.0Kg**	Respective breeders
3.	**Lucerne**		
	Anand-2	1.5 (IVT) + 1.5 (AVTL-1) **= 3.0 kg**	Dr. D. P. Gohil, AAU, Anand
	RL-88	1.5 (IVT) + 1.5 (AVTL-1) **= 3.0 kg**	Dr P L Badhe, MPKV, Rahuri
	IVT entries	1.5 (IVT) **= 1.5 kg**	Respective breeders
	AVT-1 entries	1.5 (AVTL-1)= **1.5 Kg**	Respective breeders
4.	**Summer Bajra It should be sent in the month of December 2020**		
	Giant bajra	0.4 (IVT)+ 0.4 (AVT-1) + 0.3 (AVT-2) + 0.3 (AVT-2 seed) + 0.6 (agronomy) **= 2 Kg**	
	Moti bajra	0.4 (IVT) + 0.4 (AVT-1) + 0.3 (AVT-2) + 0.3 (AVT-2 seed) + 0.6 (agronomy) **=2 Kg**	
	BAIF Bajra-1	0.4 (IVT) + 0.4 (AVT-1) = **0.8 Kg**	
	Raj Bajra-1 (RBB-1)	0.3 (AVT-2) + 0.3 (AVT-2 seed)) + 0.6 (agro) = **1.2 Kg**	
	IVT entries	**0.4 Kg**	
	AVT-1 entries	**0.4 Kg**	
	AVT-2 entries	0.3 (breeding) + 0.3 (seed)+ 0.6 (agronomy)= **1.2 Kg**	

5.	**Lathyrus**		
	Ratan	2.0 (AVT-1) = **2.0 Kg**	Dr S K Jha, IGKV, Raipur
	Mahateora	2.0 (AVT-1) = **2.0 Kg**	
	Prateek	2.0 (AVT-1) = **2.0 Kg**	
	AVT-1 entries	2.0 (AVT-1) = **2.0 Kg**	Respective breeder

Abbreviations: HZ-Hill zone, **NWZ**-North-west zone, **NEZ**-North-east zone, **CZ**-Central zone, **SZ**-South zone; **NC-** National check, **ZC-** Zonal check

Annexure B

Technical Programme– Forage Crop Production
Rabi: 2020-21

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

Locations : Imphal, (location specific)	**Data reporting:** Rabi
Year of Start and duration: Rabi 2018-19 (Three years)	**Concluding Year:** 2020-21

Objectives:

1. To study the effect of stubble management practices on fodder productivity and quality of oat
2. To find out the optimum seed rate of oat for higher productivity and quality
3. To find out the economics of the system

Treatment details:

T_1S_1	Rice stubble at 10 cm above ground level + 80 kg/ha seed rate of oat
T_1S_2	Rice stubble at 10 cm above ground level + 100 kg/ha seed rate of oat
T_1S_3	Rice stubble at 10 cm above ground level + 120 kg/ha seed rate of oat
T_2S_1	Rice stubble at 25 cm above ground level + 80 kg/ha seed rate of oat
T_2S_2	Rice stubble at 25 cm above ground level + 100 kg/ha seed rate of oat
T_2S_3	Rice stubble at 25 cm above ground level + 120 kg/ha seed rate of oat
T_3S_1	Rice stubble at 40 cm above ground level + 80 kg/ha seed rate of oat
T_3S_2	Rice stubble at 40 cm above ground level + 100 kg/ha seed rate of oat
T_3S_3	Rice stubble at 40 cm above ground level + 120 kg/ha seed rate of oat
T_4S_1	Bending of rice stubble (without cutting) + 80 kg/ha seed rate of oat
T_4S_2	Bending of rice stubble (without cutting) + 100 kg/ha seed rate of oat
T_4S_3	Bending of rice stubble (without cutting) + 120 kg/ha seed rate of oat

Experimental details

- **Plot Size**: 4x3 m^2
- **Design**: SPD
- **Replications**: 3

Observations to be recorded:

- **Growth and yield attributes:** Plant height, No. of plants or tillers/m^2 GFY, DMY
- **Quality parameters:** Crude protein yield, Crude protein content
- **Economic analysis:** Cost of cultivation, Gross returns, Net returns and B: C ratio
- **Soil Properties:** Physico- Chemical properties at sowing and at harvest of the crop

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

Locations: Hisar	**Data Reporting:** Rabi
Year of Start: 2016, 5 years	**Concluding year:** Rabi 2021

Objectives

- To study the effect of organic sources of fertilizers on yield and quality of fodder in sorghum-berseem cropping system
- To study the influence of organic sources of nutrients on soil fertility
- To work out the economics

Treatments

T_1	Recommended dose of fertilizers through inorganic source (75 kg N+15 kg P_2O_5/ha in sorghum and 25 kg N+70 kg P_2O_5/ha in berseem)
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 (*Azotobacter* + PSB in sorghum and *Rhizobium* + PSB in berseem)
T_4	20 t FYM/ha (15t in sorghum + 5t in berseem) + Green manuring (*Dhaincha*)
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

Experimental details

Design RBD
Replications Three
Crop sequence Sorghum (single cut) – Berseem (multi cut)
Variety Sorghum: HJ 541 and berseem: HB 1
Gross plot size 12 m x 8 m = 96 m^2

Observations

Growth: Plant height, No. of plants or tillers/m^2, days to 50% flowering

Yield and quality: Green fodder yield, dry matter yield, crude protein content and crude protein yield

Soil studies: Physico-chemical properties of soil before sowing and after harvest, microbial population before sowing and after harvest

Economics: Net monetary returns and benefit: cost ratio

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

Locations (2): Hyderabad and Dharwad	**Data reporting:** Rabi
Year of Start: Rabi 2019	**Concluding Year:** Rabi 2020

Treatments details:
Zinc and Iron levels:

T_1	0 kg $ZnSO_4$ /ha
T_2	10 kg $ZnSO_4$ /ha –as basal + 1% $ZnSO_4$ foliar spray at 45 DAS
T_3	10 kg $FeSO_4$ /ha –as basal + 1% $FeSO_4$ foliar spray at 45 DAS
T_4	10 kg $ZnSO_4$ +10 kg $FeSO_4$ /ha –as basal + 1% $ZnSO_4$ 1 % $FeSO_4$ as foliar spray at 45 DAS
T_5	20 kg $ZnSO_4$ /ha –as basal + 1% $ZnSO_4$ foliar spray at 45 DAS
T_6	20 kg $FeSO_4$ /ha –as basal + 1% $FeSO_4$ foliar spray at 45 DAS
T_7	20 kg $ZnSO_4$ +20 kg $FeSO_4$ /ha –as basal + 1 % $ZnSO_4$ 1% $FeSO_4$ as foliar spray at 45 DAS

Fodders Crops:

1. Rabi Maize (var. African tall)
2. Rabi Sorghum (var. SSV 74)

Experimental details:

Fertilizers	90:40:40 kg NPK/ha
Spacing	30 X 10 cm
Plot size	4 m x 3.6 m
Design	Factorial RBD
Replication	Three
Treatments combinations	2 x 7= 14

Observations to be recorded:

- **Growth and Yield:** Plant height, biomass/plant and green fodder yield (q/ha), Number of days for harvesting (50% flowering)
- **Quality:** CP, CF, Zn and Fe content in plant at harvest,
- **Soil studies:** N, P, K, Zn and Fe content in soil before and after harvest of fodder crops
- **Economics:** Net monetary returns and benefit: cost ratio

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

Locations : Kalyani, Jorhat**,** Imphal**,** Faizabad, Jabalpur, Anand	**Data reporting:** Rabi
Year of Start and duration: Rabi 2018-19 (Three years)	**Concluding Year:** 2020-21

Objectives:

1. To find out the effect of nutrient management on green forage quality and grain yield in dual purpose oats
2. To study the effect of nutrient management on physic-chemical properties of soil after harvesting
3. To study the production economics of dual purpose oats

Treatment details:

T_1	Control
T_2	RDF (N:P2O5: K2O = 80:40:40 kg/ha)
T_3	75% of RDN + Vermicompost @ 2t/ha
T_4	T3 + PSB (Soil) @ 1.5 kg/ha
T_5	T4 + Seed treatment with Azotobacter @ 10g/kg seed
T_6	T5 + ZnSO4 @ 20 kg/ha (soil application as basal)
T_7	T5 + ZnSO4 @ 15 kg/ha (soil application as basal)
T_8	T6 + Foliar spray of ZnSO4 @ 0.5% at just before flowering
T_9	T7 + Foliar spray of ZnSO4 @ 0.5% at just before flowering

Experimental Details

Crop	Oats (dual purpose)
Spacing	25 cm X 5 cm
Seed rate	80 kg/ha
Replications	Three
Design	RBD
Treatments combinations	27

Observations to be recorded:

- **Growth and yield:** Plant height (cm): 55 DAS (first cut) at seed harvest, Green forage and dry matter yield at first cut
- **Seed yield and attributes:** Panicle length, Panicle weight, Grains /panicle, test weight (1000 seed wt. in g), Grain yield, Straw yield,
- **Forage quality:** Crude protein content and crude protein yield
- **Straw quality:** Crude protein content and Crude protein yield
- **Economics:** Gross return, net return, B:C ratio
- **Soil:**Initial nutrient status (including Zn) of soil, Final nutrient status (including Zn) of soil after harvesting

Note: First cut for fodder at 60 DAS then leave for seed

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

Locations : Pantnagar and Ranchi	**Data reporting:** Rabi
Year of Start and duration: Rabi 18-19, 3 years	**Concluding Year:** Rabi 20-21

Objectives

1. To study the production potential of berseem varieties
2. To find out the ideal time of last cut of berseem for higher seed production in Tarai region of Uttarakhand**.**

Treatments: 08

Varieties (02)		**Cutting management (Last cut) (04)**	
	BL -42		15th February (2 cutting)*
	BB-3		02 March (3 cutting)
			17 March (3 cutting)
			1 April (3 cutting)

*** Note: Date of last cut and crop will be left for seed production**.

Detail of cutting management

No. of Cutting	**Date of Last Cut**				**Remark**	**Total days after sowing**
	15 Feb	**2 March**	**17 March**	**1 April**		
I	15 Jan	15 Jan	15 Jan	15 Jan	30 days interval	60 days
II	15 Feb	15 Feb	15 Feb	15 Feb	30 days interval	90 days
III	X*	02 March	x	x	15 days interval	105 days
iv	x	x	17 March	x	30 days interval	120 days
v	x	x	x	01 April	45 days interval	135 days
No. of total Cutting	**02**	**03**	**03**	**04**		

Note: x*: No cut.

1. 1st cut will be taken after 60 days of sowing. The cutting days i.e. 60, 90, 105, 120 and 135 days after sowing are mentioned for different dates of last cut. The crop will be left for seed production after last cut.
2. The cutting shall be taken as per the date of last cut. Therefore the 3rd and 5th cut will be taken after 15 days interval of previous cut only at the last cut date of 2 March and 1 April, respectively.
3. The 2% solution of KNO_3 will be sprayed in all treatments at flowering time (as a common spray).

Experimental Details

Seed rate	25 kg/ha
Plot size	3m x4m
Sowing Date	15November
Replications	Three
Design	RBD

Observations

- **Growth:** Plant height, Germination count, Plant population per m row length**,** No. of plants or tillers/m^2, days to 50% flowering, No. flowers /m^2
- **Yield and quality:** Green fodder yield, dry matter yield, crude protein content and crude protein yield, Seed yield, Seed yield per plant
- **Soil studies:** Physico-chemical properties of soil before sowing and after harvest, microbial population before sowing and after harvest
- **Economics:** Net monetary returns and benefit: cost ratio

K-19-AST-1: Studies on organic source of nutrient on green forage yield and quality of Cowpea-Fodder maize under irrigated situation.

Locations (4): Mandya, Coimbatore, Vellayani and Hyderabad	**Data reporting:** Rabi
Year of Start: Kharif 2019	**Concluding Year:** Kharif 2022

Objectives

1. Study the effect of organic nutrient sources on green forage yield and quality.
2. Study the physico-chemical and biological properties of soil.
3. To compare the economics of organic with inorganic sources.

Treatment details

T_1	100% RDN through inorganic fertilizers
T_2	100% RDN through FYM
T_3	75% RDN through FYM+ 25% RDN through vermicompost
T_4	75% N through FYM+ 25% RDN through Bio-compost
T_5	50% RDN through FYM+ 50% RDN through vermicompost
T_6	50% RDN through FYM+ 50% RDN through Bio-compost
T_7	75% of T2 (both sources)
T_8	75% of T3 (both sources)
T_9	75% of T4 (both sources)
T_{10}	75% of T5 (both sources)
T_{11}	75% of T6 (both sources)
T_{12}	50% N through FYM+ 25% RDN through vermicompost + 25% RDN through bio compost.

Note

- Organic manures will be applied based on N equivalent considering soil test values.
- Nutrient requirement - Cowpea 20:60 kg N:P_2O_5/ha Maize 90:60:40 kg N:$P_2O_5K_2O$/ha, (adjust the doses based on soil test values)
- Calculate requirement of both crops; apply organic nutrients equivalent to 55 kg N/ha to cowpea and equivalent to 55 kg N/ha maize before sowing allowing sufficient time for decomposition.
- In treatment T1, (RDN through inorganic fertilizers) 20 kg nitrogen application will be applied to cowpea and 90 kg to maize. In treatments T2 to T12 (RDN through organic sources), 55 kg N/ha or 75% of it, as per treatment will be applied to cowpea and 55 kg N/ha or 75% of it as per treatment will be applied to Maize.
- The study will be in fixed plots to account for the direct, residual and cumulative effects of the treatments.

Experimental details

Crop Cowpea- Fodder maize (winter)
Variety BL-2, African tall
Spacing 30 X 10 cm
Plot size 4 m x 5 m
Replications 3
Design RBD

Observations to be recorded

Growth and yield parameters: Plant height, leaf: stem ratio, GFY, DMY, CPY, ash, carbohydrates and fibre content

Soil properties: Organic carbon, EC, available N, P, K, microbial biomass carbon content in soil at initial and after harvest of the oat.

Economics: Gross returns, net returns, B: C ratio

K-19-AST-2: Studies on organic source of nutrients on forage yield and quality of rice bean-oat system under irrigated situation

Locations (5): Jorhat, Imphal, Kalyani Ranchi, Pusa	**Data reporting:** Rabi
Year of start and duration: Rabi 2019-20, four years	**Concluding year:** Rabi 2022-23

Preamble

Due to improved purchasing power and health consciousness, organic milk is becoming more popular and fetching higher price. This has potential to improve the economic condition of rural poor. Organic green forage is the base for organically produced milk and other livestock products. Organic manure also improves soil fertility in terms of organic carbon and microbial count. Ricebean is a drought tolerant forage-cum-pulse crop, also serves as a good cover crop. Hence, study on low-cost organic nutrient management is proposed for rice bean-oat system under irrigated condition.

Objectives

- To compare the effect of nutrient sources on yield, quality and economics of fodder production system.
- To assess the changes in physico-chemical and biological properties of soil under different nutrient sources.

Treatment details

T_1	100% RDN through inorganic fertilizers
T_2	100% RDN through FYM
T_3	75% RDN through FYM+ 25% RDN through vermicompost
T_4	75% RDN through FYM + 25% RDN through bio-compost
T_5	50% RDN through FYM + 50% RDN through vermicompost
T_6	50% RDN through FYM + 50% RDN through bio-compost
T_7	75% RDN of T_2 (through FYM only)
T_8	75% RDN of T_3 (56% through FYM + 19% through vermicompost)
T_9	75% RDN of T_4 (56% through FYM + 19% through bio-compost)
T_{10}	75% of T_5 (37.5% through FYM + 37.5% through vermicompost))
T_{11}	75% of T_6 (37.5% through FYM + 37.5% through vermicompost))
T_{12}	50% RDN through FYM+ 25% RDN through vermicompost + 25% RDN through poultry manure at 30 DAS

Note

- Organic manures will be applied based on N equivalent considering soil test values.
- Nutrient requirement - oat 90:60:40 kg N:$P_2O_5K_2O$/ha, rice bean 20:60 kg N:P_2O_5/ha (adjust the doses based on soil test values)
- Calculate requirement of both crops; apply organic nutrients equivalent to 55 kg N/ha to rice bean and equivalent to 55 kg N/ha oats before sowing allowing sufficient time for decomposition.
- In treatment T1, (RDN through inorganic fertilizers) 20 kg nitrogen application will be applied to rice bean and 90 kg to oat. In treatments T2 to T12 (RDN through organic sources), 55 kg N/ha or 75% of it, as per treatment will be applied to rice bean and 55 kg N/ha or 75% of it as per treatment will be applied to Oat.
- The study will be in fixed plots to account for the direct, residual and cumulative effects of the treatments.

Experimental details

Crop	Rice bean - oat	**Variety**	Bidhan rice bean- 2 & JHO-822
Spacing	30 cm x 10 cm- for both the crops	**Plot size**	4 m x 5 m
Design	RBD	**Replications**	Three

Observations to be recorded

- **Growth and yield parameters:** Plant height, leaf: stem ratio, GFY, DMY, CPY, ash, carbohydrates and fibre content
- **Soil properties:** Organic carbon, EC, available N, P, K, microbial biomass carbon content in soil at initial and after harvest of the oat.
- **Economics:** Gross returns, net returns, B: C ratio

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

Locations (3): Raipur, Ranchi, Ayodhya and Pantnagar	**Data Reporting:** Rabi
Year of Start and duration: Rabi 2019-20	**Concluding Year:** 2020-21

Objective

1. To study the effect of splitting of nitrogen dose and cutting management on fodder yield and quality of oat varieties.
2. To study the interaction effect on oat varieties and splitting of nitrogen, cutting management on fodder oat.
3. To work out the economics of different treatments.

Treatment details:

Main plot: Variety	Sub plot: Cutting management & Splitting of nitrogen doses
V_1: RO-19	Two cut + 60% Basal+40% at 1st cut
V_2: JHO-851	Two cut + 50% Basal+50% at 1st cut
V_3: UPO-212	Three cut + 50% Basal+25% at 1st cut+25% at 2nd cut Three cut + 40% Basal+30% at 1st cut+30% at 2nd cut

Two cut-1st cut at 50DAS +2nd cut at 50% flowering
Three cut-1st cut 50DAS+2nd cut 35 days after 1st cut+3rd cut 50% flowering

Experimental details

Treatment	12
Design	Split
Plot size	4x3m
Replications	Three
Fertilizer Details	140 N: 60 P_2O_5 and 40 K_2O kg ha^{-1}
Cutting (Stubble) height	10 cm from ground level

Observations to be recorded:

- **Growth and yield parameters:** Number of shoots (tiller) before cutting (per m row length), No. of leaves before cutting (per m row length) ,Days to 50% flowering, Leaf : stem ratio at each cut Plant height, leaf: stem ratio, GFY, DMY, CPY, ash, carbohydrates and fibre content
- **Soil properties:** Organic carbon, EC, available N, P, K, microbial biomass carbon content in soil at initial and after harvest of the oat.
- **Economics**: Cost of cultivation ,Net monitory returns, B:C ratio

R-19 AST 2: Effect of different potassic fertilizer sources on green fodder production and quality of fodder maize

Locations (2): Anand and Hyderabad	**Data reporting:** *Rabi*
Year of Start and duration:*Rabi* 2019-20	**Concluding Year:** 2021

Objective

- To study the effect of *schonite as* potassic fertilizer on green fodder yield and quality of fodder maize

Treatments

T_1	Control (Only N and P applied)
T_2	1% schoenite foliar spray (at 30 and 45 DAS)
T_3	100 % RDK through KCL
T_4	100 % RDK through KCL + 1 % schoenite foliar spray (at 30 and 45 DAS)
T_5	75 % RDK through KCL + 1 % schoenite foliar spray (at 30 and 45 DAS)
T_6	100 % RDK through K_2SO_4
T_7	100 % RDK through K_2SO_4 +1 % schoenite foliar spray (at 30 and 45 DAS)
T_8	75 % RDK through K_2SO_4 +1 % schoenite foliar spray (at 30 and 45 DAS)
T_9	100 % RDK through potassium schoenite
T_{10}	100 % RDK through potassium schoenite +1% schoenite foliar spray (at 30 and 45 DAS)
T_{11}	75 % RDK through potassium schoenite + 1 % schoenite foliar spray (at 30 and 45 DAS)

Note:

- Foliar application: 100g schoenite/ dissolved in 10 l of water applied at 30 and 45 DAS.
- Soil application: 124.0 kg schoeniteper ha.
- Remaining nutrients except potassium will be applied as per recommendation

Experimental details:

Recommended Fertilizers dose 90:40:40 kg NPK /ha
Plot size 4.20 m X 6.00 m
Spacing 30 cm X 10 cm
Seed rate 75 kg ha^{-1}
Replication 4
Design RBD
Crop and variety Maize *African tall*

Observations to be recorded:

- **Growth and yield parameters:** Plant population in meter row length, Periodical plant height (at 30, 45 DAS and at harvest), No of leaves per plant (at 30, 45 DAS and at harvest), Green fodder yield (q/ha), CP, CF and DM in plant at harvest, K content and uptake in plant at harvest
- **Soil properties:** Organic carbon, EC, available N, P, K, microbial biomass carbon content in soil at initial and after harvest.
- **Economics**: Cost of cultivation, Net monitory returns, B:C ratio

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

Locations (5): Ranchi, Hyderabad, Mandya and Dharwad	**Data reporting:** *Rabi*
Year of Start and duration: *Rabi* 2019-20, Three years	**Concluding Year:** 2021-22

Preamble

Moringa (*Moringa oleifera* L.) also called drumstick is a popular multipurpose shrub grown in many parts of the country. It is grown for tender pods, leaves and flowers as well as perennial multi-cut fodder fodder. Moringa can be grown in versatile conditions including hot, humid, dry tropical and sub-tropical regions except water logged conditions. Moringa fodder is a rich source of nutrients, protein and minerals. Moringa fodder contains approximately 16% dry matter, 16% Crude Protein, 35 % crude fiber, 7.6% total ash and other minerals. It can be planted for cut and carry system to meet the fodder requirements of livestock during the fodder deficit periods. The biomass production of moringa is affected by climatic condition, spacing, cutting height, planting pattern, geometry and cutting frequencies. This research project is proposed to identify ideal planting geometry, nutrient management and cutting frequency.

Treatment details:

Planting geometry	Nitrogen doses	Cutting regimes
i. 22.5 cm x 15 cm	**i.** 100 kg N/ha/annum	**i.** 45 days interval
ii. 30 cm x 30 cm	**ii.** 150 kg/ha/annum	**ii.** 60 days interval
iii. 45 cm x 30 cm		**iii.** 75 days interval

Experimental details:

Design: Factorial RBD
Plot size: 4 m x 3.6 m
Total no. plots: 54 plots

Notes:

- Raise saplings in the polythene packets and 1 month old saplings may be transplanted as per the geometry in the experimental field
- An uniform dose of 10 t/ha of FYM to be given to the experimental field along with final land preparation before layout
- A basal dose of 20% N as per doses and 100% phosphorus (75 kg P_2O_5)+100 potassium (50 kg K_2O) may be applied at the time of transplanting
- A general cut in all the geometries to be given at 45 days after transplanting for uniformity at 60 cm height and thereafter the cutting regimes to be followed at 60 cm height
- The remaining dose of 80% N as per the doses may be given in equal splits after each cut in all the cutting regimes

Observations to be recorded:

- **Growth and yield parameters:** Height of the fresh grown plant above 60 cm (uniform basal cut height), Green fodder yield (q/ha), CP, CF and DM in plant at harvest, K content and uptake in plant at harvest
- **Soil properties:** Initial status of organic carbon content, available N, P and K in soil Status of organic carbon content, available N, P and K after each year in soil.
- **Economics**: Cost of cultivation, Net monitory returns, B:C ratio

R-19 AST 4: Screening of herbicides for control of *Cuscuta* in Lucerne crop.

Locations (5): Bikaner	**Data reporting:** *Rabi*
Year of Start and duration: *Rabi* 2019 -20, Two years	**Concluding Year:** 2020-21

Objectives:

- To screen effective herbicide for control of cuscuta in lucerne crop.
- To find out effect of herbicides on crops.
- To see the effect of herbicides on other weeds.

Treatment details:

T_1	Pendimethalin 0.75 kg ha^{-1} (Pre-emergence)
T_2	Diclosulam 20 g ha^{-1} (Pre-emergence)
T_3	Diclosulam 30 g ha^{-1} (Pre-emergence)
T_4	Diclosulam 30 g ha^{-1} (Post emergence After each cut)
T_5	Fenoxaprop 50g ha^{-1} (Post emergence at 40-45 DAS)
T_6	Imazethapyr 50 g ha^{-1} (Post emergence at 25 DAS)
T_7	Imazethapyr 100 g ha^{-1} (Post emergence After each cut)
T_8	Imazethapyr + pendimethalin (Ready mixer) 0.70 kg ha^{-1} (Pre-emergence)
T_9	Imazethapyr + pendimethalin (Ready mixer) 0.90 kg ha^{-1} (Pre-emergence)
T_{10}	Imazethapyr + Imazamox75 g ha^{-1} (Post emergence at 40-45 DAS)
T_{11}	Paraquat100 g ha^{-1} (Post emergence After each cut)
T_{12}	Weed free
T_{13}	Weedy check

Experimental details:

Plot size 3.0 m x 3.0 m (9.0 m^2)
Cutting management: one cut at 50-55 DAS, 2nd cut at 30 days after first cut and harvest.
Replications Three
Design RBD

Observations to be recorded

- **Growth and yield parameters:** Fresh and dry weight of Cuscuta and other weeds at 40, 80,120 DAS and at harvest, Days to germination of Cuscuta after sowing of crop, Plant height at each cut and harvest of Lucerne, Fresh and dry weight of Lucerne at 1st cut and at harvest of Lucerne (kg ha^{-1}), Green fodder yield (q/ha), CP, CF and DMY
- **Soil properties:** Initial status of organic carbon content, available N, P and K in soil Status of organic carbon content, available N, P and K after each year in soil.
- **Economics**: Cost of cultivation, Net monitory returns, B:C ratio

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

Location (1): Vellayani	**Data reporting:** *Rabi*
Year of Start and duration:*Rabi* 2019 -20 , Three years	**Concluding Year : 2022**

Preamble

Study conducted by Kerala State Planning Board pointed out the widespread deficiency of Mg in Kerala. Deficiency of Mg may be due to the imbalanced application of primary nutrients, leaching due to heavy rainfall, crop removal, acidic condition of the soil and high levels of Ca and K. Hence it is appropriate to study the role of Mg in the nutrition and production of hybrid napier to supplement it in the fertilizer schedule with the aim to increase its productivity. A study conducted on Magnesium nutrition in Bajra x napier hybrid , recommended that for higher fodder yield and quality, 80 kg $MgSO_4$ may be applied along with RDF (200: 50:50 kg NPK and 25 t/ha of FYM) to bajra x napier hybrid. Compared to single application, split application of MgSO4 may have significant effect on yield and economics as the entire dose of Mg given as basal may not be properly utilized due to the high mobility of Mg in soil. With this background, the present investigation is proposed to study the optimum dose and time of application of MgSO4 for growth and yield enhancement in Bajra x napier hybrid.

Objective:

To assess the impact of varying doses and frequency of application of $MgSO_4$ on the growth, yield and quality attributes of hybrid Napier**.**

Treatment details:

$MgSO_4$ levels (M)- 3	**Frequency of Application (F)-3**
M_1- 80 kg/ha	F_1- 2 (once in 6 months)
M_2- 100 kg/ha	F_2- 3 (once in 4 months)
M_3- 120 kg/ha	F_3- 4 (once in 3 months)

The crop will be raised as per the POP recommendations of KAU, Vellayani (25 t/ha FYM and 200:50:50 kg/ha NPK split in 7 each applied after cut- 7)

Experimental details:

Crop	Bajra Napier hybrid
Variety	Suguna
Plot size	4 x 4m
Replications	3
Design	Factorial RBD

Observations to be recorded

- **Growth and yield parameters:** Plant height at each harvest (cm), Leaf: stem ratio at each harvest, Number of tillers per hill at each harvest, Green fodder yield (q/ha), CP, CF and DMY
- **Soil properties:** Soil analysis:- pH, EC, Organic carbon, Mg, Initial status of organic carbon content, available N, P and K in soil Status of organic carbon content, available N, P and K after each year in soil.
- **Economics**: Cost of cultivation, Net monitory returns, B:C ratio

K-20-AST-1: studies on efficacy of micronutrient and plant growth regulators

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

Location (6): Uralikanchan, Srinagar, Pusa, Raipur, Hisar, Ranchi, Durgapura	**Data reporting:** *Rabi*
Year of Start and duration: 2020-21, Three years	**Concluding Year :** 2022-23

Preamble

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

Objectives

- To find out effect of different plant growth regulators on forage yield and quality of maize and oat
- To assess the economic feasibility of plant growth regulators

Treatments

T_1	Triacontanol @ 10 ppm
T_2	Triacontanol @ 20 ppm
T_3	Mepiquat chloride @ 200 ppm
T_4	Mepiquat chloride @ 300 ppm
T_5	Salicylic acid 100 ppm
T_6	Salicylic acid 200 ppm
T_7	NAA @ 20 ppm
T_8	Whip Super 4 g a.i./ha
T_9	GA_3 200 ppm
T_{10}	GA_3 400 ppm
T_{11}	Control- spray of water

Experimental details:

Cropping System: Maize–Oat (JHO-822) **Replications:** Three
Design Randomized Block Design **Gross plot:** 4 m x 3 m
Fertilizer Dose: Recommended dose (considering suitable correction in low or high nutrient availability soils)

Note:

- The spray of growth promoter be made at 30 DAS
- The crops should be grown under standard package of practice. The RDF should be adjusted as per soil test values.
- The treatments T1-T11 will be applied to both the crops
- This study to be conducted in a cropping system mode. Results to be reported in Rabi report)
- It a fixed plot study

Observation

- **Growth and yield parameters:** Plant height, number of leaves and L:S ratio at 30 DAS and at harvest, Green fodder yield (q/ha), CP, NDF, ADF content CF and DMY
- **Soil properties:** Initial status of organic carbon content, available N, P and K in soil Status of organic carbon content, available N, P and K after each year in soil.
- **Economics**: Cost of cultivation, Net monitory returns, B:C ratio

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

Locations(1)	Palampur
Year of start & duration	Kharif 2020, 5 years
Concluding year & Season	2020-2025

Preamble

Forage-based cropping systems are high-input demanding and mainly grown under inorganic nutrition conditions. However, high cost of fertilizers and concern about soil exhaustion, environmental deterioration and nutritional imbalance arising from continuous use of inorganic fertilizers, necessitate the research on other sources of nutrition. Organic nutrient management can help in arresting the decline in productivity through correction of deficiency of secondary and micro nutrients and improving the physical and biological health of the soil as well. Recently, a concept of "Natural Farming" embedding farming *with* nature and *without* chemicals has been promoted. In this system, soil is supplemented with the inoculums like *Beejamrut* and *Jeevamrut*to accelerate the propagation of existing soil micro flora. The information on the comparative performance of organic and natural farming systems nutrient on the productivity of forage-based cropping system is not available; therefore, the present study is being proposed.

Objectives

- To study the effect of organic systems of nutrition on forage yield and quality constituents.
- To study the effect of treatments on soil properties and economics of production.

Cropping system:

- Sorghum hybrid + Pearl millet hybrid - Annual rye grass (with two rows of Setaria grass on both sides of field boundaries)

Treatments:

Organic nutrient sources

T_1	FYM @10 t/ha (in each season)
T_2	Natural farming with mulch (5 t fresh –locally available material)
T_3	Natural farming without mulch
T_4	FYM @ 5 t/ha basal + natural farming (T_2)
T_5	FYM @ 5 t/ha basal + natural farming (T_3)
T_6	FYM @ 5 t/ha + foliar application of compost tea
T_7	Control

- **Natural farming:** *Beejamrit* (seed treatment with *beejamrit*); basal application of *Ghana jeevamrit* @500 kg/ha; mulching @10 t/ha; Foliar application of 10% *Jeevamrit*4 weeks after sowing and after each cut i.e. 10 days after cut in Kharif and 15 days after cut in rabi crops.
- Foliar application of compost tea 4 weeks after sowing and after each cut i.e. 10 days after cut in Kharif and 15 days after cut in rabi crops.
- All the treatments will be imposed during as per technical programme

Note: Trial should be conducted in organic block. It is a fixed plot study.

- NPK content of Jeevamrit, Ghanamrit and mulch should be done prior to application

Experimental details:

Design: Randomized block design **Replications**: 3

Observations:

- **Growth:** Plant height, No. of plants or tillers/m^2, days to 50% flowering
- **Yield and quality:** GFY,DMY, crude protein content, ADF, NDF content and crude protein yield.
- **Soil studies:** Physico-chemical properties of soil before sowing and after harvest, microbial population before sowing and after harvest.
- **Economics:** Net monetary returns and benefit: cost ratio

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

Locations	**Ayodhya**
Year of start & duration	Kharif 2020, 5 years
Concluding year & Season	2020-2025

Preamble

Forage-based cropping systems are high-input demanding and mainly grown under inorganic nutrition conditions. However, high cost of fertilizers and concern about soil exhaustion, environmental deterioration and nutritional imbalance arising from continuous use of inorganic fertilizers, necessitate the research on other sources of nutrition. Organic nutrient management can help in arresting the decline in productivity through correction of deficiency of secondary and micro nutrients and improving the physical and biological health of the soil as well. Recently, a concept of "Natural Farming" embedding farming *with* nature and *without* chemicals has been promoted. In this system, soil is supplemented with the inoculums like *Beejamrut* and *Jeevamrut*to accelerate the propagation of existing soil micro flora. The information on the comparative performance of organic and natural farming systems nutrient on the productivity of forage-based cropping system is not available; therefore, the present study is being proposed.

Objectives

- To study the effect of organic systems of nutrition on forage yield and quality constituents.
- To study the effect of treatments on soil properties and economics of production.

Treatments:

Organic nutrient sources

T_1	FYM @10 t/ha (in each season)
T_2	Natural farming with mulch (5 t fresh –locally available material)
T_3	Natural farming without mulch
T_4	FYM @ 5 t/ha basal + natural farming (T_2)
T_5	FYM @ 5 t/ha basal + natural farming (T_3)
T_6	FYM @ 5 t/ha + foliar application of compost tea
T_7	Control

Experimental details:

Cropping system: Sorghum-oat **Design:** Randomized block design **Replications**: Three

- **Natural farming:** *Beejamrit* (seed treatment with *beejamrit*); basal application of *Ghana jeevamrit* @500 kg/ha; mulching @10 t/ha; Foliar application of 10% *Jeevamrit*4 weeks after sowing and after each cut i.e. 10 days after cut in Kharif and 15 days after cut in rabi crops.
- Foliar application of compost tea 4 weeks after sowing and after each cut i.e. 10 days after cut in Kharif and 15 days after cut in rabi crops.
- All the treatments will be imposed during as per technical programme

Note:

- Trial should be conducted in organic block. It is a fixed plot study.
- NPK content of Jeevamrit, Ghanamrit and mulch should be done prior to application

Observations:

- **Growth:** Plant height, No. of plants or tillers/m^2, days to 50% flowering
- **Yield and quality:** GFY, DMY, crude protein content, ADF, NDF content and crude protein yield
- **Soil studies:** Physico-chemical properties of soil before sowing and after harvest, microbial population before sowing and after harvest
- **Economics:** Net monetary returns and benefit: cost ratio

K-20-AST-4d: Optimizing production technology for sustainable organic fodder production and soil health

Locations	Pantnagar
Year of Start & Duration	Kharif 2020, 4 years
Concluding year & Season	2024

Preamble

The significance of organic fodder has gained importance due to chemical farming and its high residue content in the final product. It is suggested that organic products are safe, tasty, full of essential amino acids and even economical. It has also been reported that traditional organic farming either of *Rishi krishi*, biodynamic, natural farming, *panchgavya krishi* or modern organic farming are equally good or even better than chemical farming. Keeping this in view, it is proposed to develop technologies for sustainable organic fodder production and soil health.

Objectives:

- To find out the effect of different components of organic cultivation on forage yield and quality.
- To assess the economic feasibility and sustainability of different organic farming systems.

Treatments:

Cropping systems (3)

C_1	Sorghum – berseem - maize+ cowpea
C_2	B N hybrid + (cowpea - berseem –ricebean)
C_3	Maize (sweet corn) – berseem + mustard – maize (sweet corn)

Organic production systems (4)

OP_1	Organic farming: Vermicompost @ 5 t/ha
OP_2	Zero budget natural farming : '*Bijamruta'* (seed treatment) '*Jivamruta'* (soil treatment) and foliar spray
OP_3	Panchgavya Krishi: Bio enhencer i.e.*'Panchgavya'*@ 4% foliar spray
OP_4	Rishi krishi: '*Amritpani'* and 'virgin soil'

Experimental details:

Plot size:	4.2 m x 5.0 m	**Treatments**:	12
Replication:	Three	**Design :**	RBD
Spacing:	70 cm x 40 cm BN Hybrid and 30 cm x10 cm seasonal crops		

Note:

- The experiment shall be carried out at organic block at Crop Research Centre, Pantnagar
- **OP_1: Organic farming:** NPK through vermicompost (2.2%N, 1.2% P_2O_5 and 0.6% K_2O) shall be used @ 5 t/ha for sorghum and maize and 1.5 t/ha for berseem. Vermicompost shall be applied to meet out the N requirement of the crop.
- **OP_2: Zero budget Natural farming:** '*Bijamruta'* (seed treatment) '*Jivamruta'* (soil treatment as basal and foliar spray @ 10% at 30 DAS in seasonal crops and after each cut in BN hybrid)
- **OP_3: Panchgavya Krishi:** Use of bio enhancer i.e.*'Panchgavya* @ 4% foliar spray
- **OP_4: Rishi krishi:** '*Amritpani'* and 'virgin soil'(37.5 kg of virgin rhizosperic soil collected from beneath of Banyan tree (*Ficus benghalensis*) should be spread over one hectare and the soil is enriched with 500 lit Amritpani. 200 lit Amritpani is prepared by mixing 250 g ghee with 10 kg of cow dung followed by 500 g honey and diluted with 200 lit of water)

Refer the following for detailed methodology

Organic Agriculture (Concept, Scenario, Principals and Practices). National Centre of Organic Farming, Department of Agriculture and Cooperation, Govt. of India, Ghaziabad, Uttar Pradesh)

Observations:

- **Growth:** Plant height, No. of plants or tillers/m^2, days to 50% flowering
- **Yield and quality:** GFY, DMY, crude protein content, ADF, NDF content and crude protein yield
- **Soil studies:** Physico-chemical properties of soil & microbial population before sowing and after harvest,
- **Economics:** Net monetary returns and benefit: cost ratio

AVT Based trials

R-20 AST-1: Effect of P levels on forage yield of promising entries of Berseem (AVTB2-MC)

Location (8): HZ- Palampur, Srinagar NWZ- Pantnagar, Hisar, Ludhiana, CZ- Rahuri, Jabalpur, Raipur	Data reporting: *Rabi*
Year of Start and duration:*Rabi* 20	Concluding Year: Rabi 2020-21

Objective:
To study the response of phosphorus levels on yield and quality of promising entries of Berseem

Treatments:

Main plot: Entries (5)	JHB-18-1, JHB-18-2 (IGFRI, Jhansi); BM-12 (PAU, Ludhiana); HFB-15-5 (CCS HAU, Hisar); JB-06-11 (JNKVV, Jabalpur)
Sub plot: P_2O_5-levels (4)	60, 80 and 100 Kg /ha

Entries No.	:	5 + 1 (NC) +1 (ZC)
Entries Name	:	JHB-18-1, JHB-18-2 (IGFRI, Jhansi); BM-12 (PAU, Ludhiana); HFB-15-5 (CCS HAU, Hisar); JB-06-11 (JNKVV, Jabalpur)
Checks	:	National Checks: Wardan (NC) Zonal Checks: BL- 22 (HZ), BB-2 (NWZ and CZ)
Design	:	Split plot
Replications	:	Three
Plot size	:	4 m x 3 m
Seed rate	:	30 g per plot (approx. 25 Kg/ha)
Spacing	:	Row to row-30
Treatment Combinations	:	7x 3=21
Total plots	:	7x 3x3=63
Fertilizer	:	20 Kg N/ha as basal
Seed requirement	:	270g/entry/location
Entry/ National check	:	2.88 Kg/entry from each contributor
Zonal checks BL- 22 (HZ),	:	720 g /ZC
BB-2 (NWZ and CZ)		1.1 each

Note: 1st Cut has to be taken at 60 Days after sowings subsequent cut at 30 days interval

Observations
Growth: Plant height, No. of plants or tillers/m^2, days to 50% flowering Plant population/ m row length, Growth parameters (Plant height and Leaf: stem ratio),
Yield and quality: Green fodder yield, Per day productivity (Green fodder, dry fodder), dry matter yield, crude protein content, ADF, NDF content and crude protein yield
Soil studies: Physico-chemical properties of soil before sowing and after harvest, microbial population before sowing and after harvest
Economics: Net monetary returns and benefit: cost ratio

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

Location (8): HZ- Palampur, Srinagar CZ- Urulikanchan, Anand, Raipur SZ- Hyderabad, Mandya, Coimbatore (Ooty)	**Data reporting:** *Rabi*
Year of Start and duration: *Rabi* 20	**Concluding Year:** Rabi 2020-21

Objective: To study the response of nitrogen fertilizer on yield and quality of promising entries of oat under single cut system.

Treatment details:

Main plot: Total Entries (10)	**7** + 2 (NC) + 1 (ZC)
Sub plot: N- levels: 4	60, 90, and 120 kg N /ha (Split application of nitrogen- 60% as basal + 40 at 40 DAS)

Entries No.	:	**7** + 2 (NC) + 1 (ZC)
Entries Name	:	RO-11-1-2, RO-11-1-3 (MPKV, Rahuri); OL-1876-1, OL-1874-1 (PAU, Ludhiana); HFO-806 (CCS HAU, Hisar); JO-06-23 (JNKVV, Jabalpur); SKO-241 (SKUAST-K, Srinagar)
Checks	:	Kent, OS-6 (NC); SKO-96 (HZ), RO-11-1(CZ), OS-403 (SZ)
Design & Replications	:	Split plot
Plot size:	:	4m x 3 m
Seed rate:	:	120 g/plot (100 kg/ha)
Treatments Combinations	:	10x 3=30
Total plots	:	10x3x3=90
Fertilizer	:	P_2O_5-40 Kg/ha basal
Spacing		R x R-25 cm
Cut		at 50% Flowering
Seed requirement		1.44 kg/entry/location
Entry/ National check		11.5 Kg/entry from each contributor
Zonal checks : SKO-96 (HZ)		3.0 kg Kg/ZC
Zonal checks : JHO-2009-1 (CZ), RO-11-1 (NWZ))		4.20 kg /ZC

Observations

Growth: Plant height, No. of plants or tillers/m^2, days to 50% flowering Plant population/ m row length, Growth parameters (Plant height and Leaf: stem ratio),

Yield and quality: Green fodder yield, Per day productivity (Green fodder, dry fodder), dry matter yield, crude protein content, ADF, NDF content and crude protein yield

Soil studies: Physico-chemical properties of soil before sowing and after harvest, microbial population before sowing and after harvest

Economics: Net monetary returns and benefit: cost ratio

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

Location (3): **NWZ: Pantnagar, Hisar, Ludhiana**	**Data reporting:** *Rabi*
Year of Start and duration:*Rabi* 20	**Concluding Year:** Rabi 20-21

Objective: To study the response of nitrogen fertilizer on yield and quality of promising entries of oat under multi cut system.

Treatment details:

Main plot: Entries (4)	**2 + 2 (NC)**
Sub plot: N- levels (3)	70,105 and 140 kg N /ha (Split application of nitrogen- 40% as basal + 20% at 40 DAS+20% after 1st cut +20% after 2nd cut)

Entries No.	:	2+2 (NC)
Entries Name	:	OL-1882 (PAU, Ludhiana); HFO-707 (CCS HAU, Hisar)
Checks	:	National Check:UPO-212 and RO-19
Design	:	Split plot
Replications	:	Three
Plot size	:	4 m x 3 m
Seed rate	:	120 g/plot (100 kg/ha)
Treatments	:	Combinations: 4X 3=12
Total plots	:	4X3X3=36
Fertilizer	:	P_2O_5-40 Kg/ha basal
Spacing	:	R x R-25 cm
Cutting management		1st at 55 DAS, 2nd at 85 DAS, 3rd at 50% Flowering
Seed Requirement	:	1.44 kg/entry/location
Entry & National check	:	4.5 Kg/entry or check

Observations

Growth: Plant height, No. of plants or tillers/m^2, days to 50% flowering Plant population/ m row length, Growth parameters (Plant height and Leaf: stem ratio),

Yield and quality: Green fodder yield, Per day productivity (Green fodder, dry fodder), dry matter yield, crude protein content, ADF, NDF content and crude protein yield

Soil studies: Physico-chemical properties of soil before sowing and after harvest, microbial population before sowing and after harvest

Economics: Net monetary returns and benefit: cost ratio

R-20 AST-4: Second Advanced Varietal Trial in Forage Pearl millet (AVTPM-2 Agronomy)

Objective: To study the response of nitrogen fertilizer on yield and quality of promising entries of forage pearl millet under summer sown multi cut system.

Locations (3) CZ- Urulikanchan, Anand, Jabalpur	**Data Reporting :** Summer 2021
Year of Start and duration: 2020 (1 year)	**Concluding Year**: Summer 2021

Treatment details:

Main plot: Entries (6)	3+ 3 (NC)
Sub plot: N- levels (4)	0, 40, 80 and 120kg/ha N /ha (Split application of nitrogen- 40% as basal + 20% at 40 DAS+20% after 1st cut +20% after 2nd cut)

Total Entries No. (6)	:	3+ 3 (NC)
Entries Name	:	TSFB-18-1 (PJTSAU, Hyderabad), BAIF Bajra-5, BAIF Bajra-6 (BAIF, Urulikanchan)
Checks	:	Giant Bajra, MotiBajra, Raj Bajra
N Levels		Four (0, 40, 80, 120kg/ha)
Design	:	Split plot with 3 replications
Plot size	:	4 m x 3 m accommodating 4 m long 10 rows at 30 cm
Cutting management		**(Three) first at 55DAS, 2nd 85 DAS, 3rd 115 DAS**
Seed rate	:	12 kg/ha (15g/plot)
Fertilizers	:	40:40 kg/ha (P:K) basal
Total plots	:	6x4x3 = 72
Seed requirement /Centre	:	180g /location
Seed requirement	**:**	540 g for entry and NC both

Observations

- Plant height, No. of plants or tillers/m^2, days to 50% flowering Plant population/ m row length, Growth parameters (Plant height and Leaf: stem ratio),
- GFY, Per day productivity (Green fodder, dry fodder), DMY, crude protein content, ADF, NDF content and CPY
- Physico-chemical properties of soil and microbial population before sowing and after harvest.
- Net monetary returns and benefit: cost ratio

Technical Programme
Kharif 2020

K-17-AST-1: Studies on performance of top feeds under varied planting geometry with and without intercrop

Locations (3): Mandya, Coimbatore and Vellayani	**Data reporting:** Kharif
Year of start and duration: Kharif 2017, Three years	**Concluding year:** 2021

Preamble

In southern parts of the country, the population of small ruminants is comparatively higher, particularly in rainfed pockets. In these regions, it is difficult for farmers to feed green fodder for maintenance and survival of the small ruminant enterprises. Sheep and goat require less feeds and fodder and have more affinity towards top feeds which are rich in crude protein, ash and other minerals. The farmers are cultivating top feeds on farm bunds without practicing proper management causing low productivity as well as high mortality of shrub species. Hence, present investigation was undertaken to standardize planting geometry and cropping system for sustainable and intensive fodder production of different top feeds.

Objectives

- To standardize optimum plant population for higher green forage yield and quality.
- To study the performance of different plant species as top feed under sole and intercropping system.

Treatment details:

Main plot: Cropping system x Top feeds (6)		**Subplot: Planting geometry (3)**
Cropping system (2)	**Top feeds (3)**	2 m x 1 m
Sole crop	Agase (*Sesbania grandiflora*)	2 m x 0.5m
Intercrop (Napier Bajra Hybrid)	Erythrina (*Erythrina indica*)	Paired system (between pairs - 2m, within pairs -1 m)
	Drumstick (*Moringa oleifera*)	

Plot size: 6 m x 4 m **Treatments:** 18
Replication: Three **Design** : Split plot

Note: Top feed species should be harvested at 75 cm height.

Observations

- Plant height, No. of plants or tillers/m^2, days to 50% flowering Plant population/ m row length, Growth parameters (Plant height and Leaf: stem ratio),
- GFY, Per day productivity (Green fodder, dry fodder), DMY, crude protein, ADF, NDF content and CPY
- Physico-chemical properties of soil & microbial population before sowing and after harvest
- Net monetary returns and benefit: cost ratio

K-18-AST-3: Bio-fortification of annual cereal fodder crops for enhancing zinc and iron content

Locations (5): Bikaner, Ludhiana, Anand, Hisar, Ayodhya and Pantnagar	**Data reporting:** Kharif
Year of Start and duration: Kharif 2019, Two years	**Concluding year:** 2020

Preamble

More than two billion of global population is malnourished particularly in India. Micronutrients deficiency among the people of every age is very common. Agronomic bio-fortification is a feasible and cost-effective means of delivering micronutrients to people who have limited access to diverse diets and other micronutrient interventions. Bio-fortification of crops can increase the levels of micronutrients in final product through application of micronutrients as foliar, soil application, seed priming and seed coating. Hence, the study on bio-fortification of fodder through agronomical manipulation is proposed.

Objectives

- To study the effect of micronutrient application on growth, yield and quality of fodder of annual cereal crops.
- To assess the effect of micronutrient application on soil health and economics.

Treatment details:

Fodders crops (2)	
C_1	Maize (var. African Tall)
C_2	Sorghum (var. SSV 74)
$ZnSO_4$ / $FeSO_4$ levels (7)	
T_1	0 kg $ZnSO_4$ /ha (only rec. NPK dose)
T_2	10 kg $ZnSO_4$ /ha –as basal + 1% $ZnSO_4$ foliar spray at 45 DAS
T_3	10 kg $FeSO_4$ /ha –as basal + 0.5% $FeSO_4$ foliar spray at 45 DAS
T_4	10 kg $ZnSO_4$ +10 kg $FeSO_4$ /ha –as basal + 1% $ZnSO_4$ +0.5 % $FeSO_4$ as foliar spray at 45 DAS
T_5	20 kg $ZnSO_4$ /ha –as basal + 1% $ZnSO_4$ foliar spray at 45 DAS
T_6	20 kg $FeSO_4$ /ha –as basal + 0.5% $FeSO_4$ foliar spray at 45 DAS
T_7	20 kg $ZnSO_4$ +20 kg $FeSO_4$ /ha –as basal + 1% $ZnSO_4$ +0.5% $FeSO_4$ as foliar spray at 45 DAS

Experimental details

Fertilizers	90:40:40 kg N:P_2O_5;K_2O /ha *	**Spacing**	30 x 10 cm
Plot size	4.0 m x 3.6 m	**Treatment combinations**	2 x 7= 14
Replication	Three	**Design**	RBD

Note

- 29 kg gypsum/ha to be applied in the control treatment (only rec. NPK dose) to balance the sulphur supplementation in other treatment plots.
- Composite samples of soil and plant in coded form to be analyzed for Zn and Fe at PAU, Ludhiana. PI of trial at centres will ensure to send proper samples timely to Ludhiana centre.
- *In low or high nutrient content soils, the RDF should be adjusted using 25% higher or lower dose of concerned nutrient.
- A uniform dose of NPK as per the soil-test values will be applied in all treatments.

Observations

- Plant height, No. of plants or tillers/m^2, days to 50% flowering Plant population/ m row length, Growth parameters (Plant height and Leaf: stem ratio),
- GFY, Zn and Fe content in soil before and after harvest, Zn and Fe content in plant at harvest, Per day productivity (Green fodder, dry fodder), DMY, crude protein content, ADF, NDF content and CPY
- Physico-chemical properties of soil and microbial population before sowing and after harvest
- **Economics:** Net monetary returns and benefit: cost ratio

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

Locations (2): Hyderabad and Dharwad	**Data reporting:** Rabi
Year of Start: Rabi 2019	**Concluding Year:** Rabi 2020

Treatment details:

Fodders crops (2)	
C_1	Rabi Maize (var. African tall)
C_2	Rabi Sorghum (var. SSV 74)
Zinc and Iron levels	
T_1	0 kg ZnSO4 /ha
T_2	10 kg ZnSO4 /ha –as basal + 1% ZnSO4 foliar spray at 45 DAS
T_3	10 kg FeSO4 /ha –as basal + 1% FeSO4 foliar spray at 45 DAS
T_4	10 kg ZnSO4 +10 kg FeSO4 /ha –as basal + 1% ZnSO4 1 % FeSO4 as foliar spray at 45 DAS
T_5	20 kg ZnSO4 /ha –as basal + 1% ZnSO4 foliar spray at 45 DAS
T_6	20 kg FeSO4 /ha –as basal + 1% FeSO4 foliar spray at 45 DAS
T_7	20 kg ZnSO4 +20 kg FeSO4 /ha –as basal + 1 % ZnSO4 1% FeSO4 as foliar spray at 45 DAS

Experimental details

Fertilizers 90:40:40 kg NPK /ha
Spacing 30 X 10 cm
Plot size 4 m x 3.6 m
Treatments combinations 2 x 7= 14
Replication Three
Design RBD

Note

- 29 kg gypsum/ha to be applied in the control treatment (only rec. NPK dose) to balance the sulphur supplementation in other treatment plots.
- Composite samples of soil and plant in coded form to be analyzed for Zn and Fe at PAU, Ludhiana. PI of trial at centres will ensure to send proper samples timely to Ludhiana centre.
- *In low or high nutrient content soils, the RDF should be adjusted using 25% higher or lower dose of concerned nutrient.
- A uniform dose of NPK as per the soil-test values will be applied in all treatments.

Observations

- Plant height, No. of plants or tillers/m^2, days to 50% flowering Plant population/ m row length, Growth parameters (Plant height and Leaf: stem ratio),
- GFY, Zn and Fe content in soil before and after harvest, Zn and Fe content in plant at harvest, Per day productivity (Green fodder, dry fodder), DMY, crude protein content, ADF, NDF content and crude protein yield
- Physico-chemical properties of soil and microbial population before sowing and after harvest,
- Net monetary returns and benefit: cost ratio

K-20-AST-1a: Response of fodder crops to micronutrient management

Locations	Rahuri, Bikaner, Imphal, Ranchi and BUAT, Banda
Year of start & duration	*Kharif* 2020, 3 years
Concluding year & season	2023

Preamble

Low productivity of livestock is mainly due to the poor feed and fodder availability. There is acute deficiency of micronutrients in different soils of various regions, which causes not only low yields but also poor quality of the fodder. Production potential of fodder crops can be enhanced with micronutrient management. Adequate supply of micronutrients is essential for higher yield and quality of fodder crops. Hence, the study on agronomic biofortification of fodder is proposed.

Objectives

- To study the effect of micro nutrient management on growth, yield and quality of forage.
- To assess the economics of forage production as influenced by micro nutrient management.

Treatments

Maize (Rahuri)

T_1	Absolute control (no fertilizer application)
T_2	RDF (100:50:50 N:P_2O_5:K_2O kg ha^{-1}) (based on soil test)
T_3	GRDF (100:50:50 N:P_2O_5:K_2O kg ha^{-1} + FYM 5 t ha^{-1})
T_4	GRDF + soil application of government notified multi-micronutrient grade I @ 25 kg ha^{-1}
T_5	GRDF + two foliar sprays of government notified multi-micronutrient grade II @ 1% at 30 and 45 DAS.
T_6	GRDF + soil application of government notified multi-micronutrient grade I @ 25 kg ha^{-1} + two foliar sprays of grade II @ 1% at 30 and 45 DAS.

BN hybrid- (Bikaner, Imphal, Ranchi) Cutting at 45 day interval

T_1	Absolute control (no fertilizer application)
T_2	RDF (100:50:50 N:P_2O_5:K_2O kg ha^{-1}) (based on soil test)
T_3	GRDF (100:50:50 N:P_2O_5:K_2O kg ha^{-1} + FYM 5 t ha^{-1})
T_4	GRDF + soil application of government notified multi-micronutrient grade I @ 25 kg ha^{-1} in Kharif and Rabi
T_5	GRDF + foliar spray of government notified multi-micronutrient grade II @ 1% at 25 days after cutting.
T_6	GRDF + soil application of government notified multi-micronutrient grade I @ 25 kg ha^{-1} in Kharif and Rabi + foliar spray of government notified multi-micronutrient grade II @ 1% at 25 days after cutting.

Experimental details

Plot size 4.0 m x 5.0 m **Replication** Three **Design** RBD

Spacing 75 cm x 50 cm BN Hybrid and 30 cm x10 cm for maize

Observations:

- Plant population 15 DAS, Plant height, number of leaves, stem girth, No. of plants or tillers/m^2, days to 50% flowering Plant population/ m row length, Growth parameters (Plant height and Leaf: stem ratio),
- GFY, Zn and Fe content in soil before and after harvest, Zn and Fe content in plant at harvest, Per day productivity (Green fodder, dry fodder), DMY, crude protein content, , IVDMD, ADF, NDF content and CPY
- Physico-chemical properties of soil before sowing and after harvest, microbial population before sowing and after harvest Nutrient status in soil (macro & micro) Initial and after harvest
- Net monetary returns and benefit: cost ratio

Composition of Government notified multi-micronutrient mixture Grade I and Grade II

	Multi-micronutrient mixture Grade I		**Multi-micronutrient mixture Grade II**	
Sr. No.	**Micronutrient**	**Content (%)**	**Micronutrient**	**Content (%)**
1	Zink (Zn)	3.0	Zink (Zn)	5.0
2	Iron (Fe)	2.5	Iron (Fe)	2.0
3	Manganese (Mn)	1.0	Manganese (Mn)	1.0
4	Boron (B)	1.0	Boron (B)	1.0
5	Copper (Cu)	0.5	Copper (Cu)	0.5
6	Molybdenum (Mo)	0.1		

K-20-AST-1b: Yield enhancement and bio-fortification of *kharif* forages with PGRs and micronutrients

Locations	Palampur, Srinagar, Mandya and Ayodhya	
Year of start & duration	Kharif 2020, 3 years	**Concluding year & season:** 2023

Preamble

About 43% and 18% of Indian soils have been reported to be deficient in Zn and B status, respectively spread in pockets in different states of the country. Zinc is known to improve the metabolism of the plant and yield; whereas boron is improves the productivity by triggering source and sink relationship. Boron deficiency affects vegetative and reproductive growth of plants, resulting in inhibition of cell expansion and death of meristem. Plant growth regulators and micronutrients in minute quantities play an important role in enhancing growth and development of plants. PGRs like salicylic acid and tricontonal are easily available in the market and are in use with other crops. Therefore, it is proposed to assess the effect PGRs and micronutrients (Zinc and boron) on productivity of forages.

Objectives

1. To assess the effect of PGRs and micronutrients on herbage yield and quality of produce
2. to study the effect of treatments on soil properties and economics of production

Treatments

T_1	Tricontanol 10 ppm at 30 DAS (foliar spray)
T_2	Salicylic acid 100 ppm at 30 DAS (foliar spray)
T_3	5 kg Zn/ha soil application
T_4	2 kg B/ha soil application
T_5	5 kg Zn + 2 kg B/ha soil application
T_6	5 kg Zn/ha soil application + triacontanol 10 ppm at 30 DAS foliar spray
T_7	5 kg Zn/ha soil application + salicylic acid 100 ppm at 30 DAS foliar spray
T_8	2 kg B/ha soil application + triacontanol 10 ppm at 30 DAS foliar spray
T_9	2 kg B/ha soil application + salicylic acid 100 ppm at 30 DAS foliar spray
T_{10}	5 kg Zn + 2 kg B/ha soil application + triacontanol 10 ppm at 30 DAS foliar spray
T_{11}	5 kg Zn + 2 kg B/ha soil application + salicylic acid 100 ppm at 30 DAS foliar spray
T_{12}	Water spray at the time of PGR application (PGR are also to be applied 15 days after cut in multicut crops; Zn and B to be applied at the time of sowing; Crop will be raised with recommended package of practices)

*****In treatments, where zinc is not applied equal amount of sulphur (sulphate given with 5 kg Zn) to be compensated through gypsum

Cropping System

Palampur: Forage sorghum hybrid **Srinagar, Ayodhya:** Forage sorghum **Mandya:** Maize

Experimental details

Spacing 30 cm x 10 cm **Replications** Three **Design** RBD

Observation:

- **Growth:** Plant height at 45 DAS ,Plant population 15 DAS, number of leaves, stem girth, Plant height, No. of plants or tillers/m^2, days to 50% flowering Plant population/ m row length, Growth parameters (Plant height and Leaf: stem ratio),
- **Yield and quality:** GFY, Zn and Fe content in soil before and after harvest, Zn and Fe content in plant at harvest, Per day productivity (Green fodder, dry fodder), DMY, crude protein content, ADF, NDF content and CPY
- **Soil studies:** Physico-chemical properties of soil before sowing and after harvest, pH, NPK, Zn and B contents (before and after experimentation) microbial population before sowing and after harvest Nutrient status in soil (macro & micro) Initial and after harvest
- **Economics:** Net monetary returns and benefit: cost ratio

K-20-AST-2: Precision water management in Bajra Napier hybrid to improve water use efficiency

Locations	Coimbatore and Varanasi
Year of start & duration	Kharif 2020, 3 Years
Concluding year & season	2022

Preamble: Bajra Napier hybrid grass has been acclaimed as the highest forage yielder with high water demand (1800-2000 mm). Decline in soil moisture status cause a negative effect on the growth and green fodder yield of this crop. Average annual per capita availability of water is expected to decline to about 1,341 m^3 by 2025 and 1,140 m^3 by 2050. This is likely to aggravate the availability of water for fodder production as well. Hence, precision irrigation management is essential for enhancing water use efficiency in high water demanding crops like Bajra x napier hybrid.

Objectives:

- To identify suitable irrigation method and nitrogen level to obtain higher green fodder yield of Bajra x napier hybrid
- To work out the saving in water and nitrogen use and economics.

Treatment details

Main plot: Method of irrigation (4)	
M_1	Surface drip irrigation
M_2	Sub-surface drip irrigation
M_3	Surge irrigation at 5 cm depth
M_4	Flood irrigation at 5 cm depth (Convention)
Subplot: N levels (3)	
S_1	50% RDN
S_2	75% RDN
S_3	100% RDN

Experimental details

Crop & variety NB Hybrid- CO (BN) 5 **Treatments** 15 **Plot size** 20 m^2
Design Strip plot **Replication** Three
RDN/ha Basal:150:50:50 kg N:P_2O_5:K_2O/ha + 75 kg N / ha per cut

Note:

- The irrigation to be applied equal to 125% PE in M_1 and M_2, in rest treatments as per quantity mentioned
- Irrigation interval: M_1 and M_2 - 3 days, M_3 - M_5- 10 days in winter, 7 days in summer
- Measurement of irrigation water through water metre in M_3 - M_5 and calculation based on discharge rate and time taken in irrigation in M_1 and M_2 treatments
- In all treatments urea to be source of nitrogen
- Cutting interval 55 days

Observation:

Growth: Plant height at 45 DAS ,Plant population 15 DAS, number of leaves, stem girth, Plant height, No. of plants or tillers/m^2, days to 50% flowering Plant population/ m row length, Growth parameters (Plant height and Leaf: stem ratio),

Yield and quality: GFY, Zn and Fe content in soil before and after harvest, Zn and Fe content in plant at harvest, Per day productivity (Green fodder, dry fodder), DMY, crude protein content, ADF, NDF, Water requirement, Water economy and water use efficiency Nitrogen uptake and nitrogen use efficiency content and crude protein yield

Soil studies: Physico-chemical properties of soil before sowing and after harvest, pH, NPK, Zn and B contents (before and after experimentation) microbial population before sowing and after harvest Nutrient status in soil (macro & micro) Initial and after harvest

Economics: Net monetary returns and benefit: cost ratio

K-20-AST-3: Optimizing the feedstuffs for air evacuating method of silage production in polybags

Locations	Coimbatore and Jorhat
Year of Start & Duration	Kharif 2020, 2 years
Concluding year & Season	2020- 2022

Preamble

Low productivity of livestock can be attributed to chronic shortage of quality feed and fodders especially during lean season and period of monsoon failures. Though good quantity green fodders are available during the monsoon season but these are not utilized properly due to low shelf-life (2-3 days), insufficient storage infrastructure and inadequate technical knowhow. Polybag ensiling has proved to be state of the art technology due to its ease, low cost, and low or no aerobic spoilage during storing period. Hence, the study on optimizing the feedstuffs for air evacuating method of silage production in polybags is proposed.

Objectives

- To identify suitable fodder crops and additives for air evacuating method of silage production in polybags.
- To study the effect of different feedstuffs and additives on quality of silage.

Treatments

Fodder crops (4)	
T_1	BN hybrid grass (CO BN- 5)
T_2	Fodder maize (African Tall)
T_3	Perennial fodder sorghum (CO-31)
T_4	Guinea grass (CO GG-3)
Method and additives (4)	
F_1	Air evacuation method without additives
F_2	Air evacuation method with additives (molasses 1%)
F_3	Manual compaction method without additives
F_4	Manual compaction method with additives (molasses 1%)

***Air evacuation method: Removal of air in poly bags using vacuum machines**

Experimental details

Design: RBD **Treatments**: 16 **Replication**: Three

Polybag capacity: 20 kg **Polybag thickness**: 450 micron

Note:

- Use standard protocol for silage preparation
- Apply additive on fresh weight basis
- Analyses to be done immediately after opening the bag by collecting samples from different layers of bag

Observations:

- **Growth:** Fresh silage yield, dry matter content, temperature, moisture content (before and after storage) Plant height at 45 DAS, Plant population 15 DAS, number of leaves, stem girth, Plant height, No. of Growth parameters (Plant height and Leaf: stem ratio),
- **Yield and quality:** pH, crude protein content, crude fibre content, Ash, acetic acid, lactic acid, propionic acid, butyric acid, Palatability, IVDMD and degradability analysis digestible dry matter, dry matter intake after ensiling, Per day productivity (Green fodder, dry fodder), dry matter yield, crude protein content, ADF, NDF, Water requirement, Water economy and water use efficiency Nitrogen uptake and nitrogen use efficiency content and crude protein yield
- **Soil studies:** Physico-chemical properties of soil before sowing and after harvest, pH, NPK, Zn and B contents (before and after experimentation) microbial population before sowing and after harvest Nutrient status in soil (macro & micro) Initial and after harvest
- **Economics:** Net monetary returns and benefit: cost ratio

K-20-AST-4: Organic fodder production for sustainable yields, quality and soil health

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

Locations	Jorhat
Year of start & duration	Kharif 2020, 5 years
Concluding year & Season	2020-2025

Preamble

Forage-based cropping systems are high-input demanding and mainly grown under inorganic nutrition conditions. However, high cost of fertilizers and concern about soil exhaustion, environmental deterioration and nutritional imbalance arising from continuous use of inorganic fertilizers, necessitate the research on other sources of nutrition. Organic nutrient management can help in arresting the decline in productivity through correction of deficiency of secondary and micro nutrients and improving the physical and biological health of the soil as well. Recently, a concept of "Natural Farming" embedding farming *with* nature and *without* chemicals has been promoted. In this system, soil is supplemented with the inoculums like *Beejamrut* and *Jeevamrut*to accelerate the propagation of existing soil micro flora. The information on the comparative performance of organic and natural farming systems nutrient on the productivity of forage-based cropping system is not available; therefore, the present study is being proposed.

Objectives

- To study the effect of organic systems of nutrition on forage yield and quality constituents.
- To study the effect of treatments on soil properties and economics of production.

Treatments:

Cropping system: JorhatBN Hybrid and Congo signal grass

Organic nutrient sources	
T_1	FYM @10 t/ha
T_2	Natural farming with mulch
T_3	Natural farming without mulch
T_4	FYM @ 5 t/ha basal + natural farming (T_2)
T_5	FYM @ 5 t/ha basal + natural farming (T_3)
T_6	FYM @ 5 t/ha + foliar application of compost tea
T_7	Control

- **Natural farming:** *Beejamrit* (seed treatment with *beejamrit*); basal application of *Ghana jeevamrit* @500 kg/ha; mulching @10 t/ha; Foliar application of 10% *Jeevamrit*4 weeks after sowing and after each cut i.e. 10 days after cut in Kharif and 15 days after cut in rabi crops.
- Foliar application of compost tea 4 weeks after sowing and after each cut i.e. 10 days after cut in Kharif and 15 days after cut in rabi crops.
- All the treatments will be imposed as per plan.

Experimental details

- **Design:** Randomized block design **Replications**: 3

Note: Trial should be conducted in organic block. It is a fixed plot study.

Observation:

- **Growth:** Plant height at 45 DAS ,Plant population 15 DAS, number of leaves, stem girth, Plant height, No. of plants or tillers/m^2, days to 50% flowering Plant population/ m row length, Growth parameters (Plant height, Leaf: stem ratio),
- **Yield and quality:** GFY, Zn and Fe content in soil before and after harvest, Zn and Fe content in plant at harvest, Per day productivity (Green fodder, dry fodder), DMY, crude protein content, ADF, NDF, Water requirement, Water economy and water use efficiency Nitrogen uptake and nitrogen use efficiency content and crude protein yield
- **Soil studies:** Physico-chemical properties of soil before sowing and after harvest, pH, NPK, Zn and B contents (before and after experimentation) microbial population before sowing and after harvest.
- **Economics:** Net monetary returns and benefit: cost ratio.

K-20-AST-5: Evaluation of promising fodder grass varieties under shade conditions

Locations	Vellayani
Year of Start & Duration	Kharif 2020, 3 years
Concluding year & Season	2023

Preamble

In Kerala, the most viable option to expand the area under fodder cultivation is to grow high-yielding fodder crops that fit well with existing homestead or tree-based farming systems by adopting the best management practices. It is a known fact that reduced light penetration affects the growth and quality of crops. The extent of reduction in yield and quality depends on the amount of shade and the degree of shade adaptation of the plant species. Hybrid Napier and guinea grass are the popular fodder grasses among small farmers of Kerala because of the high yield potential and nutritive quality. Most cultivars of fodder grasses express high yield potential when grown under open conditions with irrigation. In this context, this study is proposed to assess the influence of different shade levels on the growth, quality and yield of promising fodder grass varieties.

Objectives

To assess the influence of different shade levels on the growth, quality and yield of promising fodder grass varieties

Treatments

Main plot: Shade levels (3)	
S_1	0% (Open)
S_2	25% shade
S_3	50% shade
Subplot: Varieties (5)	
V_1	Suguna (BN hybrid)
V_2	Susthira (BN hybrid)
V_3	CO-3 (BN hybrid)
V_4	CO-5 (BN hybrid)
V_5	CO GG-3(guinea grass)

25 and 50 % shade will be established used shade nets.

Experimental details

Design: Split plot **Treatments**: 15 **Replication**: 3
Plot size: 3 m x 3 m **Spacing**: 60 cm x 60 cm

Observations:

- **Growth:** Plant height, leaf area, number of tillers, leaf : stem ratio, leaf chlorophyll content at each harvest , Light intensity at the top, middle and bottom of the canopy at harvest, number of leaves, stem girth, Plant height, No. of plants or tillers/m^2, days to 50% flowering Plant population/ m row length, Growth parameters (Plant height and Leaf: stem ratio),
- **Yield and quality:** Green fodder yield, Per day productivity (Green fodder, dry fodder), dry matter yield, crude protein content, and crude protein yield
- **Soil studies:** pH, EC, OC, available N, P and K before and after the experiment (in 2020 and 2023) microbial population before sowing and after harvest.
- **Economics:** Net monetary returns and benefit: cost ratio.

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

Locations	Dharwad, Srinagar and Mandya
Year of start & duration	Rabi 2020, 2 years
Concluding year	2022

Preamble

Fodder grasses are highly responsive to nitrogen application in terms of growth, quality and yield. Fertilizer nitrogen is a common input used by farmers in different agro-climatic conditions in India with varied use efficiency (30-50%). Nitrogen exhibits high synergistic effect in combination with water and other inputs. Application of inadequate dose of nitrogen results in yield reduction and application in excess leads to increased cost of cultivation and environmental pollution. Hence, the present study on precision management of nitrogen for efficient management and increasing NUE is proposed.

Objectives

- To estimate the effect of applied nitrogen using precision tools on crop growth and fodder
- To develop basis for fertilizer recommendation using the precision tools
- To work out the economics of different nitrogen management treatments

Treatments

T_1	No N
T_2	50 kg N/ha (40% N basal) + remaining based on SPAD meter critical value of 40
T_3	50 kg N/ha (40% N basal) + remaining based on SPAD meter critical value of 50
T_4	50 kg N/ha (40% N basal) + remaining based on LCC 4
T_5	50 kg N/ha (40% N basal) + remaining based on LCC 5
T_6	100 kg N/ha (40% N basal) + remaining based on SPAD meter critical value of 40
T_7	100 kg N/ha (40% N basal) + remaining based on SPAD meter critical value of 50
T_8	100 kg N/ha (40% N basal) + remaining based on LCC 4
T_9	100 kg N/ha (40% N basal) + remaining based on LCC 5
T_{10}	150 kg N/ha (40% N basal) + remaining based on SPAD meter critical value of 40
T_{11}	150 kg N/ha (40% N basal) + remaining based on SPAD meter critical value of 50
T_{12}	150 kg N/ha (40% N basal) + remaining based on LCC 4
T_{13}	150 kg N/ha (40% N basal) +remaining based on LCC 5
T_{14}	As per recommended package of practices (50% N as basal, remaining 50% at 30 days after sowing)

Cropping system:

Palampur: Forage sorghum hybrid **Srinagar, Dharwad and Mandya:** Maize

Note

- P & K are common for all treatment as per recommendation.
- In SPAD and LCC, the nitrogen will be applied after taking SPAD reading or matching with leaf colour chart at 30 & 60 DAS
- SDAD meter or LCC reading to be taken before 9.00 AM on healthy on flag leaf (topmost fully open leaf) free from insect /disease
- At each application 30 kg N to be applied

Experimental details

Plot size: 4 m x 3.6 m **Spacing:** 30 cm x 10 cm

Replication: Three **Design:** Randomized block design

- **Growth:** Plant height (cm), number of leaves / plant, leaf : stem ratio, fresh &dry weight of plant at cut; green fodder and dry matter yield
- **Yield and quality:** Green fodder yield, Per day productivity (Green fodder, dry fodder), dry matter yield, crude protein content, and crude protein yield, Nitrogen content in plant; nitrogen uptake;nitrogen use efficiency;
- **Soil studies:** pH, EC, OC, available N, P and K before and after the experiment microbial population before sowing and after harvest.
- **Economics:** Net monetary returns and benefit: cost ratio.

K-20-AST-7: Effect of nitrogen and cutting management on performance of forage pearl millet varieties

Locations	Hyderabad, Raipur, Pusa, Ludhiana and Jabalpur, BHU, Varanasi
Year of start & duration	Kharif 2020, 2 years
Concluding year	2022

Preamble

In *Kharif* season farmers cultivate maize, bajra or sorghum as annual forage crop, as single cut harvested between 65 and 75 days, leaving land vacant for rest of the season or beyond. At that time, soil is moist and it is not possible to prepare field for second crop. Harvest from single cut crop is obtained in bulk, which may pose storage issue before the farmer. But, multicut crop/ variety occupies land and extends the forage availability for longer period. Majority of recommended fodder pearl millet varieties have been released based on their single cut performance, but now the farmers are preferring 3-4 cuts in according to their need. Nitrogen plays an important role in increasing all the growth and growth attributing characters which finally leads to increased green fodder yield. Therefore, nitrogen enhances the photosynthesis, biomass accumulations as well as quick regeneration.

Objectives

- To explore the possibility of prolonging quality fodder availability period
- To study the effect of nitrogen and cutting management on yield and economics of new pearl millet varieties

Treatment

Main plot: Varieties of fodder Bajra (4)	
C_1	TSFB 15-4
C_2	TSFB 15-8
C_3	Moti Bajra
C_4	BAIF Bajra-1
Subplot: Nitrogen levels (2)	
L1	80 kg/ha
L2	120 kg/ha
Cutting management (2)	
Three cuts	1st at 50 DAS, 2nd cut at 30 days after 1st cut, 3rd cut at 50% flowering
Four cuts	1st at 50 DAS, 2nd, 3rd and 4th cuts with 30 days interval
Nitrogen management	
Three cut	40% basal + 30% after 1st cut + 30% after 2st cut
Four cut	40% basal + 20% after 1st cut + 20% after 2st cut+20% after 3st cut

Experimental details

Spacing	30 cm	**Gross Plot size**	4 m x 3 m
Design	Split Plot	**Replication**	Three

Growth: Plant height (cm), number of shoots/tillers, number of leaves / plant, leaf : stem ratio, fresh &dry weight of plant at cut; green fodder and dry matter yield

Yield and quality: Green fodder yield, Per day productivity (Green fodder, dry fodder), dry matter yield, crude protein content, and crude protein yield.

Soil studies: pH, EC, OC, available N, P and K before and after the experiment microbial population before sowing and after harvest. Soil fertility status (before and after completion of trial)

Economics: Net monetary returns and benefit: cost ratio.

AVT-2 Trials

K-20-AST-8: Second Advanced Varietal Trial in Forage Pearl millet (AVTPM-2-1Agronomy)

Locations South Zone -Coimbatore, Hyderabad and Mandya	**Data Reporting** : *Kharif*
Year of Start: 2020 (1 year)	**Concluding Year**:*Kharif* 2020

Entries No.	:	3+ 1 (NC) + 1 (ZC)
Entries Name	:	**K-25** (Kanchan Ganga Seeds); **ADV 160061** (Advanta Seeds ltd); **TSFB-17-7 (**PJTSAU, Hyderabad)
Checks	:	Giant Bajra (NC), Moti Bajra (SZ)
N Levels		Four (0, 30, 60, 90 kg/ha)
Design & Replications	:	RBD with 3 replications
Plot size	:	4 m x 3 m accommodating 4 m long 10 rows at 30 cm
Seed rate	:	12 Kg/ha (15g/Plot)
Fertilizers	:	40:40 kg/ha (P:K) basal
Total plots		60
Seed requirement/entry /Centre		180g/ centre
Seed requirement/entry/all Centre		for entry and NC = 540 g for 3 centres

Observations:

- **Growth:** Plant population/m^2, Plant height and Leaf: stem ratio, Plant height (cm), number of shoots/tillers, number of leaves / plant, fresh &dry weight of plant at cut; green fodder and dry matter yield
- **Yield and quality:** Green fodder yield, Per day productivity (Green fodder, dry fodder), Agronomic Optima and Agronomic Maxima, dry matter yield, crude protein content, and crude protein yield.
- **Soil studies:** pH, EC, OC, available N, P and K before and after the experiment microbial population before sowing and after harvest. Soil fertility status (before and after completion of trial)
- **Economics:** Net monetary returns and benefit: cost ratio.

K-20-AST-9: Second Advanced Varietal Trial in Cowpea (AVTC-2 Agronomy)

Locations NEZ- Faizabad, Kalyani, Imphal, Pusa;	Data Reporting :*Kharif*
Concluding Year:*Kharif* ,2020	Year of Start: 2020

Entries No.	:	1 + 2 (NC) + 1 (ZC) = 4
Entries Name	:	**RFC-2 (RCC-48)** (IGKV, Raipur)
Checks	:	Bundel Lobia-1, UPC-5286; **Zonal checks:** UPC-628 (NEZ)
P Levels		Three (30, 60 & 90 kg/ha)
Design	:	RBD with 3 replications
Plot size	:	4 m x 3 m accommodating 4 m long 10 rows at 30 cm
Seed rate	:	35 kg/ha (42g/plot)
Fertilizers	:	20:40 kg/ha (N:K) basal
Seed requirement	:	42 g/plot
Total plots		81
Seed requirement		378 g/ entry /Centre
Seed requirement/entry/all Centre		1.5 kg (each entry/ check)

Observations:
Growth: Plant population/m^2, Plant height and Leaf: stem ratio, Plant height (cm), number of shoots/tillers, number of leaves / plant, fresh &dry weight of plant at cut; green fodder and dry matter yield
Yield and quality: Green fodder yield, Per day productivity (Green fodder, dry fodder), Agronomic Optima and Agronomic Maxima, dry matter yield, crude protein content, and crude protein yield.
Soil studies: pH, EC, OC, available N, P and K before and after the experiment microbial population before sowing and after harvest.Soil fertility status (before and after completion of trial)
Economics: Net monetary returns and benefit: cost ratio.

Important points to be considered in execution of technical programme:

- Basic soil parameters should be given at the bottom of the table to understand the soil type and response expected.
- Fertilizer levels in all nutrient management experiments should be based on soil-test values, not just the vague / blanket recommendation.
- As estimation of quality parameters including the content of micronutrients for all centres to be done at a single location only. It is the responsibility of the concerned scientist to prepare the sample and send to analysing centre in time
- Data recording needs to be more precise.

Annexure C

AICRP on Forage Crops and Utilization
Technical Programme Crop Protection
Rabi 2020-21

PPT-1: Monitoring of diseases and insect pests in *Rabi* forage crops

Locations: Bhubaneswar, Jhansi, Palampur, Rahuri and Ludhiana

Location	Crops to be evaluated
Ludhiana	Oat, Berseem, Lucerne
Palampur	Oat, Berseem, Lucerne
Jhansi	Oat, Berseem, Lucerne
Rahuri	Oat, Berseem, Lucerne
Bhubaneswar	Oat, Berseem

Plot size: 4x4 m^2 per crop **Replication:** 4 per crop

Methodology

Disease/insect-pest progression on Rabi forages starting from date of appearance till crop maturity at weekly interval on 10 randomly selected plants/replication/crop using standard rating scale and calculation of disease severity/incidence/insect damage. Observation should be recorded in each plot and mean value should be provided.

PPT-2: Evaluation of Rabi forage crops breeding materials for prevalent diseases and insect pests under natural conditions

Locations: Bhubaneswar, Palampur, Rahuri, Jhansi and Ludhiana

Crops: Oat, Berseem, Lucerne and perennial grasses

Methodology

In this trial, screening of various contributed entries along with national and zonal checks for their reaction to diseases and insect pests under natural conditions using standard disease/insect-pest rating scales will be done. Data must be recorded from breeding trials planted at different locations. Details of the crops and diseases/insect-pest to be evaluated in a particular crop at each centre are given below:

Location	Disease and insect-pests to be evaluated in different crops			
	Oat	Berseem	Lucerne	Perennial grasses
Ludhiana	Leaf blight	Stem rot	Downy mildew, Weevil	Leaf spots and blight
Palampur	Leaf blight, Powdery mildew	Root rot, Leaf blight	Leaf spot	Leaf spot, blight, powdery mildew
Bhubaneswar	Leaf blight, Root rot	Root rot, Leaf blight	-	Leaf spot and blight
Rahuri	Leaf blight, Aphids	Aphids, Defoliators	Aphids, Rust, Weevil, Lepidopteran defoliators	leaf spot and blight
Jhansi	Leaf blight	Stem rot	Rust, weevil, Lepidopteran defoliators	leaf spot and blight

PPT-17: To study the pathogenic variability of *Bulmeria graminis* f. sp. *avenae* on oat

Location: Palampur

(i) Analysis of pathogenic and molecular variability of *Blumeria graminis* f. sp. *avenae*
(ii) Inheritance of powdery mildew in oat

PPT-26: Validation of best treatment of trial entitled "Biological management of Oat aphid *Rhopalosiphum padi* on Oat"

Locations: Rahuri, Ludhiana
Plot size: 10 x 10 m^2 **Replication:** 7
Design: Paired plot design **Variety:** Kent

Treatments:
T1: Foliar application of *L. lecanii* @ 1 x 10^8 CFU/g (7.5 g/lit)
T2: Foliar application of *M. anisopliae* @ 1 x 10^8 CFU/g (7.5 g/lit)
T3: control

Observations:
1. Precount and post treatment count of larvae at 5 and 7 days after spray.
2. Natural enemy count.
3. Green fodder yield (q/ha).
4. Economics.

PPT-30: Validation of best treatment of trial entitled "Biological management of powdery mildew of oats caused by *Blumeria graminis* f. sp. *avenae*"

Location: Palampur
Plot size: 10 x 10 m^2 **Replication:** 7
Design: Paired plot design **Variety:** Kent

Treatments:
T1: Three foliar sprays of Trichoderma viride @ 0.5%
T2: Three foliar sprays of Vitex @ 0.1%
T3: Control
Note: Foliar sprays will be given at 10 days interval starting from disease onset.

Observations:
1. Powdery mildew severity (%)
2. Seed yield (q/ha)
3. Economics

PPT-31: Eco-friendly pest management techniques in berseem ecosystem

Location: Ludhiana and Rahuri
Design: RBD **Replication:** 3 **Plot size:** 5x5 m^2
Treatments:

T1:	Seed treatment of *Trichoderma viride* @ 5g/Kg + foliar spray of NSKE @ 5%
T2:	Soil application of *Trichoderma viride*@ 1kg/25kg FYM/acre + foliar spray of NSKE @ 5%
T3:	T1+Chickpea as trap crop on border row + Bird perches
T4:	T2+Chickpea as trap crop on border row + Bird perches
T5:	T1+Sunflower as trap crop on border row + Bird perches
T6:	T2+Sunflower as trap crop on border row + Bird perches
T7:	Farmer's Practice (Spray of Carbendazim on fodder as well as seed crop + Malathion on fodder crop and Chlorantraniliprole 18.5 SC on seed crop)
T8:	Control

Observations:

- Number of larvae (*H. armigera* or other lepidopteran larvae) per meter row length on berseem crop.
- Number of larvae/ plant on trap crop.
- Activity of natural enemies on trap as well as berseem crop.
- Disease severity.
- Green fodder yield and seed yield.

PPT-34: Integrated disease management in berseem

Location: Jhansi, Ludhiana, Bhubaneswar, Palampur
Design: RBD **Replication:** 3
Plot size: 3x2 m^2 **Variety:** Wardan

Treatments:
T1: Seed treatment with Chitosan @ 0.05 %
T2: Seed treatment with *Trichoderma* @ 0.5 %
T3: Seed treatment with carbendazim @ 0.2 %
T4: Seed treatment with Chitosan @ 0.05 % + *Trichoderma* @ 0.5%
T5: Seed treatment with Chitosan @ 0.05 % + carbendazim @ 0.1%
T6: T1 + foliar spray of Chitosan @ 0.05%
T7: T2+ foliar spray of Chitosan @ 0.05 %
T8: T3 +foliar spray of Chitosan @ 0.05 %
T9: T3 + foliar spray of carbendazim @ 0.1 %
T10: Control
Target disease: root rot, stem rot, leaf blight

Observations:

- Severity/incidence of diseases.
- Green fodder yield and seed yield.

PPT-35: Non chemical management of stem rot of berseem caused by *Sclerotinia trifoliorum*

Location: Ludhiana **Duration:** 4 years

Botanicals to be tested:
Ocimum tenuiflorum, *Ricinus communis*, *Curcuma longa*, *Nicotiana tabacum*, *Murraya koenigii*, *Melia azedarach*, *Azadirachta indica*, *Calotropis gigantean*, *Aegle marmelos*, *Cymbopogan citrates* and *Datura stramonium*

Organic inputs to be tested:
Panchgavya, compost tea, NSKE

Methodology:

- Collection, isolation, identification and maintenance of stem rot pathogen (*Sclerotinia trifoliorum*)
- Collection, preservation and preparation of aqueous extracts of botanicals and organic inputs
- Screening of plant extracts and organic inputs against stem rot pathogen under *in vitro* conditions
- Evaluation of antifungal extracts and organic inputs against test pathogens in pot experiments
- Field evaluation of most effective antagonistic plant extracts and organic inputs against stem rot disease

Work plan for Year 2020-21:

- **Collection, isolation, identification and maintenance of stem rot pathogen (*Sclerotinia trifoliorum*)**
  Berseem plants showing symptoms of stem rot will be collected from the fields of Department of Plant Breeding and Genetics, Punjab Agricultural University (PAU), Ludhiana, Punjab, India. The pathogen will be isolated by following standard method. The pathogen will be identified based on its morphology, mycelial growth and sclerotia formation. Further, the pathogenecity of pathogen will also be proved by following the *Koch's* postulates.

- **Collection, preservation and preparation of aqueous extracts of botanicals and organic inputs**
  Eleven plants namely *Ocimum tenuiflorum, Ricinus communis, Curcuma longa, Nicotiana tabacum, Murraya koenigii, Melia azedarach, Azadirachta indica, Calotropis gigantean, Aegle marmelos, Cymbopogan citrates* and *Datura stramonium* will be collected and air dried. The fine dry powder was prepared by grounding plant material in a blender. The aqueous extracts will be prepared from overnight soaked fine powder, filtered and stored in flasks at 28±2°C for further use.

- **Screening of plant extracts and organic inputs against stem rot pathogen under *in vitro* conditions**
  The plant extracts and organic inputs will be evaluated under *in vitro* conditions at different concentrations by following the poisoned food technique and percent inhibition in mycelial growth over control (I) was calculated using the following formula.

$$I(\%) = \frac{\text{Mycelial growth in control - Mycelial growth in treatment}}{\text{Mycelial growth in control}} \times 100$$

PPT-36: Assessment of yield losses due to insect-pests and diseases in Lucerne

Target Diseases: Crown rot, Rust, Downy mildew
Target insect-pest: Aphids, Weevil, *Spodoptera litura*, *Helicoverpa armigera*
Location: Rahuri, Jhansi, Ludhiana

Treatments: 10 **Replications:** 3 **Design:** RBD
Duration: 2 years **Plot size:** 4x3 m^2 **Variety:** RL-88

Treatments	Details
T1:	Seed treatment with thiram @ 1g/kg of seed
T2:	T1+ spray at 30, 55, 85, 115, 145 days after emergence (DAE)
T3:	T1+ spray at 55, 85, 115, 145 DAE
T4:	T1+ spray at 30, 85, 115, 145 DAE
T5:	T1+ spray at 30, 55, 115, 145 DAE
T6:	T1+ spray at 30, 55, 85, 145 DAE
T7:	T1+ spray at 30, 55, 85, 115 DAE
T8:	T1+ spray at 30, 55, 85 DAE
T9:	Spray at 30, 55, 85, 115, 145 DAE
T10 :	Control

Treatment information:

- Seed treatment with thiram @1gm/kg seed for management of crown rot
- Spray at 30 DAE of imidacloprid 17.8 SL @ 0.3ml/lit of water for management of aphids
- Spray at 55 DAE of Propiconazole @ 1g /lit of water + Ridomil MZ @ 2.5 g/lit of water for management of rust and downy mildew
- Spray at 85 DAE of Quinalphos 25 EC @ 2 ml /lit of water for management of weevil
- Spray at 115 DAE of *SlNPV* 500 LE, 1000 million POBs/ml @1 ml / lit. of water for management of *Spodoptera litura*
- Spray at 145 DAE of *HaNPV* 500 LE, 1000 million POBs/ml @1 ml / lit. of water for management of *Helicoverpa armigera*

Observations:

- **Crown rot:** Disease incidence in 10 randomly selected plants/replication at weekly interval.
- **Aphids:** No. of aphids per tiller on 10 randomly selected tillers starting from pest emergence till pest presence on weekly interval.
- **Weevil:** No. of grubs and adult weevils per tiller on 10 randomly selected tillers starting from pest emergence till pest presence on weekly interval.
- **Diseases (Rust and downy mildew):** Disease severity in 10 randomly selected plants/replication at weekly interval starting from disease appearance till its presence.
- **Defoliators (*Helicoverpa armigera*, *Spodoptera litura*):** No. of larvae per tiller on 10 randomly selected tillers starting from pest emergence till pest presence on weekly interval.
- Green fodder yield (q/ha) in different treatments.
- Percent Yield loss in different treatments due to different diseases and insect-pests.

Annexure D

ICAR- ALL INDIA COORDINATED RESEARCH PROJECT ON FORAGE CROPS & UTILIZATION
(Indian Council of Agricultural Research)
NATIONAL GROUP MEET: *Rabi 2020-21*

Date: 28th September, 2020 **Venue:** On line Zoom platform

TENTATIVE PROGRAMME

SN	Event	Speaker	Time
1	Welcome address & PC report	Dr. A.K. Roy, Project coordinator	10:30-10:45 am
2	Remarks	Dr. V.K. Yadav, Director, IGFRI	10:45-10:50 am
3	Remarks	Dr. Y.P. Singh, ADG (FFC), ICAR	10:50-10:55 am
4	Release of publications	Dignitaries	10:55-11:00 am
5	Chairman remarks	Dr. T.R. Sharma, DDG (CS), ICAR	11:00-11:15 am
6	Vote of thanks	Dr. R.K. Agrawal	11:45-11:50 am

11:50-12:30 TECHNICAL SESSION-I: DISCIPLINE-WISE REPORT & Technical Programme Formulations – Forage Crop Improvement	
Chairman	**Dr. T. R. Sharma, Deputy Director General (Crop Science), ICAR**
Co-chairman	Dr. Y.P. Singh, ADG (FFC), ICAR
Convener	Dr. A. K. Roy, Project Coordinator
Report of Trials Rabi 2019-20	Dr. Subhash Chand
Technical programme for Rabi 2020-21	Dr. Subhash Chand
Rapporteurs	Dr. Rahul Kapoor & Dr. T. Sashikala

12:30-12:50 TECHNICAL SESSION-II: BREEDER SEED PRODUCTION	
Chairman	**Dr. Bhag Mal, Consultant, TAAS**
BSP-IV report production Rabi 2019-20	Dr. Subhash Chand, Scientist AICRP FC&U
BSP -1 Allocation for Rabi 2020-21	Dr. Subhash Chand, Scientist AICRP FC&U
Rapporteurs	Dr. P. Mahadevu & Dr. Gayathri G

12:50-13:30 TECHNICAL SESSION-III: DISCIPLINE-WISE REPORT & Technical Programme Formulations –Forage Crop Production	
Chairman	**Dr. M. P. Jain, Director Research RVSKVV, Gwalior**
Co-chairman	Dr. Y.P. Singh, ADG (FFC), ICAR
Convenor	Dr. A. K. Roy, Project Coordinator
Report of Trials Rabi 2019-20	Dr. R. K. Agrawal
Technical programme for Rabi 2020-21	Dr. R. K. Agrawal
Rapporteurs	Dr. S D Kumar & Dr S K Jha

13:30-14:15	**LUNCH**

14:15-14:45 TECHNICAL SESSION-IV: DISCIPLINE-WISE REPORT & Technical Programme Formulations –Forage Crop Protection	
Chairman	**Dr. Jagdish Kumar, Joint Director, ICAR-NIBSM, Raipur**
Co-chairman	Dr. Y.P. Singh, ADG (FFC), ICAR
Convenor	Dr. A. K. Roy, Project Coordinator
Report of Trials Rabi 2019-20	Dr. N. R. Bhardwaj
Technical programme for Rabi 2020-21	Dr. N. R. Bhardwaj
Rapporteurs	Dr Ashlesha & Dr. Sandip Langde

14:45-15:00	**TECHNICAL SESSION- V: FTD & TSP FORMULATION**
Chairman	**Dr. V. K. Yadav, Director IGFRI**
Co-chairman	Dr. Y.P.Singh, ADG (FFC), ICAR
Report Plan	Dr. N. R. Bhardwaj
Rapporteurs	Dr. Maninder Kaur, Dr. R. Katoch

15:00-16:00	TECHNICAL SESSION-VI : PLENARY SESSION
Chairman	**Dr. T. R. Sharma, Deputy Director General (Crop Science), ICAR**
Co-Chairman	Dr. Y.P.Singh, ADG (FFC), ICAR
Convener	Dr. A. K. Roy, PC
Rapporteurs	Dr. R. K. Agrawal & Dr. Rahul Kapoor
Presentation of the recommendations by respective Rapporteurs	
Remarks	Dr. Y. P. Singh, ADG (FFC), ICAR
Remarks	Dr. V. K. Yadav, Director, IGFRI ,Jhansi
Chairman's Remarks	Dr. T. R. Sharma, DDG (CS), ICAR
Vote of Thanks	Dr. A. K Roy

16:00-17:00	Varietal Identification Committee Meeting

Progress Review and Monitoring Committee (PMRC)

1. Dr. Bhag Mal , Ex Director IGFRI and coordinator Biodiversity International coordinator for SE Asia.
2. Dr. A. K. Tyagi , Asstt. Director General, Animal Nutrition, ICAR, New Delhi
3. Dr. Jagdish Kumar, Joint Director, ICAR- NIBSM, Raipur
4. Dr. D. R. Malaviya, Ex- Principal Scientist and Head, CI Division
5. Dr. M. P. Jain, Director (Research), RVSKVV, Gwalior

Annexure E

ALL INDIA COORDINATED RESEARCH PROJECT ON FORAGE CROPS AND UTILIZATION	
(INDIAN COUNCIL OF AGRICULTURAL RESEARCH)	
NATIONAL GROUP MEET– *Rabi 2020-21*	
Date: 28th September, 2020	Venue: On line video conference on Zoom Platform
List of invitees	
A. **Indian Council of Agricultural Research, Krishi Bhavan, New Delhi- 110 001**	
2.	Dr. T. R. Sharma, DDG (Crop Science), I.C.A.R.
3.	Dr. Y. P. Singh, ADG (FFC), I.C.A.R.
4.	Dr. D. K. Yadava, ADG (Seeds), I.C.A.R.
5.	Dr. A. K. Tyagi, ADG (Animal Nutrition), ICAR
B. Dept. of Animal Husbandry, Dairying & Fisheries, Ministry of Animal Husbandry, Dairying and Fisheries, Krishi Bhavan, New Delhi-110 001	
6	Joint Secretary (ANLM), DAHD & F, Ministry of Animal Husbandry, Dairying and Fisheries, Krishi Bhavan, New Delhi 110 001
7	Director, RFS, P.O. Cattle Farm Avadi, Alamadhi, PO Edapalayam, Via Red Hills, Chennai 600 052
8	Director, Regional Fodder Station, Post Textile Mills, Near HMT, Hisar 125 002
9	Director, Regional Fodder Station, Post-Ravirala, Via-Ragannaguda "X" Road, Mandal-Maheshwaram, District-Rangareddy-501510, Telangana
10	Director, Regional Fodder Station, P.O. Netaji Subhash Sanatorium, Kalyani, Distt. Nadia (W.B.)-741251
11	Director, Regional Fodder Station, Dhamrod, Campus CCBF, Ankaleshwar, Gujarat.
12	Director, Regional Fodder Station, Camp Office, 618/A, Gandhinagar, Jammu 180 004 (J&K)
13	Director, CFSPF, Regional Fodder Station Hessarghatta, Bangalore North Bangalore 560 088
14	Director, Regional Fodder Station, Suratgarh-335 804 Suratgarh- Sriganganagar Road, (Rajasthan)
D. AICRP on Forage Crops & Utilization centres	
CCS Haryana Agricultural University, Hisar 125 004 (Haryana)	
15	Dr. D. S. Phogat, Scientist, (Plant Breeding) , Head Forage Section
16	Dr. Naveen Kamboj, Asstt. Scientist (Agronomy)
17	Dr. Meenakshi, Asstt. Scientist (Plant Breeding)
Rajasthan Agricultural University, Bikaner 334 002 (Rajasthan)	
18	Dr. A. S. Godara OIC, AICRP-FC&U
19	Dr. R. C. Bairwa, Asstt. Prof. (Agro.)
N.D. University of Agriculture & Technology, Kumarganj, Ayodhya 224 001 (Uttar Pradesh)	
20	Dr. Ramesh Yadav, Agronomist & OIC, AICRP-FC
G.B. Pant University of Agriculture & Technology, Pantnagar 263 145 (Uttaranchal)	
21	Dr. M. S. Pal, Prof. Agronomy & OIC, AICRP-FC
22	Dr. Birendra Prasad , Plant Breeding
23.	Dr. Mohan Singh, Agronomist
Birsa Agricultural University, Kanke, Ranchi 834 007 (Jharkhand)	
24	Dr. Yogendra Prasad, Jr. Scientist, Plant Breeding
25	Dr. Birendra Kumar, Jr. Scientist (Agronomy)
Assam Agricultural University, Jorhat 785 013 (Assam)	
26	Dr. K. K. Sharma, Pr. Scientist (Agronomy) & OIC, AICRP-FC
27	Dr. S. Bora Neog, Pr. Sci. (Plant Breeding)
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28	Dr. Naveen Kumar, Sr. Agronomist & OIC, AICRP-FC
29	Dr. V. K. Sood, Sr. Forage Breeder

30	Dr. R. Katoch, Sci. (Biochemistry)
31	Dr. D. K. Banyal, Sr. Sci. (Plant Pathology)
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32	Dr. A. K. Mehta, Sr. Forage Breeder & OIC, AICRP-FC
33	Dr S K Billaiya , Prof. Plant Breeding
34	Dr. Amit Jha, Jr. Scientist (Agronomy)
Professor Jayashankar Telangana State Agricultural University, Hyderabad 500 030 (Telangana)	
35	Dr. T. Sashikala, Sr. Scientist (Plant Breeding) & OIC, AICRP -FC
36	Dr. B. Murali, Scientist (Agronomy)
37	Dr. K. Shailaja, Scientist (Biochemistry)
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42	Dr. P. L. Badhe, Plant Breeder
43	Dr. P.P.Surana, Sr. Forage Breeder & OIC AICRP –FC
44	Dr Sandip Langde, Entomologist
45	Dr. S.V. Damame, Scientist (Bio Chemistry)
46	Dr. Niteen Janardan Danawale, Scientist (Agronomy)
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47	Dr. D. P. Gohil, Research Scientist & OIC, AICRP-FC
48	Dr. Hiren kumar Kantilal Patel, Assistant Research Scientist
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50	Dr. R. S. Sohu, Principal Forage Breeder
51	Dr. Rahul Kapoor, Sr. Forage Breeder
52	Dr. Meenakashi Goyal, Asstt. Biochemist
53	Dr. Ashesha Dhingra, Astt. Plant Pathology
54	Dr Maninder Kaur, Agronomist
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55	Dr. C. Babu, Assoc. Prof (PB) & OIC AICRP -FC
56	Dr. K.A. Ganeshan, Prof PB & OIC AICRP -FC
57	Dr. S. D. Sivakumar, Asstt. Prof. (Agronomy)
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58	Dr. Kalyan Jana, Agronomist & OIC AICRP -FC
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60	Mr. P.S. Takawale, Forage Breeder & OIC, AICRP -FC
61	Mr. R. V. Kale, Scientist (Agronomy)
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62	Dr. Noor Saleem Khuroo, Sr. Scientist (PB)
63	Dr Zahida Scientist (Agronomy)
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64	Dr. S.K. Jha (Agronomy) & OIC, AICRP-FC
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66	Dr Mayuri Sahu , Scientist Plant Breeding
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70	Dr. Arabinda Dhal, Jr. Pathologist & OIC, AICRP-FC

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78	Mr. V. V. Ansodariya, Assistant Research Scientist (Pl.Br.)
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79	Dr. AjithKumar K., Scientist (Pathology) In-charge Forage Section
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80	Dr. N. S. Solanki, Prof. (Agrometeorology)
81	Dr. R. B. Dubey, Assistant Professor (GPB)
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82	Dr. S. K. Sachan, Director Extension & Head Entomology
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83	Dr. Ramdev Sutaliya, Zonal Director Research
S. K. University of Agril. Sciences & Technology, Regional Research Station, Rajouri B.P.O. Tandwal 185 131 (Jammu)	
84	Dr. Deepak Kumar, Sr. Scientist (Agril. Extension)
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85	Dr. Tankeswar Gohain, Assistant Professor
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86	Dr. S. Mala, Prof. (Agronomy)
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87	SK Gupta, Senior Scientist (Pearl millet Breeding)
F. Inter-related Institute(s) & AICRP(s) / Universities/ KVKs/ Fodder farms etc.	
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88	Dr. J. K. Bisht, PS (Agronomy)
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89	Dr Anjali Kak, Principal Scientist
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90	Dr. M. P. Rajora, Principal Scientist (PB)
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91	Dr. Sujoy Rakshit, Project Director

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92	Dr. Vilas A Tonapi, Director
93	Dr Venkatesh Bhat , Principal Scientist
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94	Dr. Tara C Satyavathi , Project Coordinator
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95	Dr. Digvijay Singh, Manager (PE)
G. Private companies/ NGO	
96	Dr. Aditya Sharma, Advanta India Limited, Unicorn House, Plot No.-3, Balaji Enclave, Secunderabad 500 009 (Telengana)
97	Dr Bhuvan Parihar, JK Agri. Genetics Limited 1-10-117, 4th Floor, Varun Towers, Begumpet, Hyderabad 500 016 (Telengana)
98	Dr Rajan Gupta, Rasi Seeds Pvt. Ltd, Bengaluru
99	Ch. Mahanand, Kanchan Ganga Seeds,
100	Dr ASN Reddy, SIRA Seeds, Krithika Layout opp. Image garden, Bengaluru
101	Dr. Ravindra babu, Principal Breeder-Maize, Nuziveedu Seeds Ltd, Kandlakoya, Hyderabad
102	M/S Alamdar Seed Company, Kutchh, Gujarat
103-105	**+ 3 more pvt companies as per need**
H. Forage Experts	
106	**Dr. Bhag Mal,** Ex Director IGFRI, *Trust for Advancement of Agricultural Sciences (TAAS)*
107	**Dr. D. R. Malaviya,** Principal Scientist and Head, CI Division, IISR, Lucknow.
108	**Dr Jagdish Kumar,** Joint Director, ICAR- NIBSM, Raipur
109	**Dr. A. K. Tyagi,** Asstt. Director General, Animal Nutrition, ICAR, New Delhi
110	**Dr M. P. Jain,** Director Research, RVSKVV, Gwalior
I. ICAR- Indian Grassland and Fodder Research Institute, Jhansi 284003 (U.P.)	
111	Dr. V. K. Yadav, Director
112	Dr. R V Kumar Head, Grassland and Silvi-pasture Management Division
113	Dr S. Ahmad Head, Crop Improvement Division
114	Dr A K Mishra Head, Plant Animal Relationship Division
115	Dr Sunil Kumar Head, Crop Production Division
116-126	+ 11 other Participants from IGFRI, Jhansi, Avikanagar, Dharwad, and Srinagar
AICRP on Forage Crops & Utilization, Project Coordinating Unit, IGFRI, Jhansi	
127	Dr. A. K. Roy, Project Coordinator
128	Dr. R. K. Agrawal, Principal Scientist (Agronomy)
129	Dr. Nitish Rattan Bhardwaj, Scientist (Pl. Pathology)
130	Dr. Subhash Chand, Scientist (Plant Breeding)

Experts for Progress Monitoring and Review Committee (PMRC) of forage crops

1	**Dr. Bhag Mal,** Secretary,*TAAS &* Ex Director IGFRI & Ex- Coordinator Biodiversity International
2	**Dr. D. R. Malaviya**, Ex- Principal Scientist and Head, CI Division, IISR, Lucknow.
3	**Dr. A. K. Tyagi,** Asstt. Director General, Animal Nutrition, ICAR, New Delhi
4	**Dr Jagdish Kumar,** Joint Director, ICAR- NIBSM, Raipur
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Glimpses of Media Coverage