

**Proceedings of 28th Annual Group Meeting of
All India Coordinated Research Project on Small Millets**

April 14 -15, 2017

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Executive summary

The 28th Annual Group Meeting of the All India Coordinated Research Project on Small Millets was held at University of Agricultural Sciences, Bengaluru on April 14-15, 2017. About 71 participants from various SAUs, voluntary centers, private companies and other collaborating institutes participated in the group meeting.

The group meeting was held in 6 sessions spanned over two days. First day started with Inaugural Session. The group meeting was formally inaugurated by Dr. A. Seetharam, Ex-Project Coordinator (Small Millets) under the chairmanship of Dr. H. Shivanna, Vice-Chancellor, University of Agricultural Sciences, Bengaluru. Dr. NR Gangadharappa, Director of Research, UAS, Bengaluru welcomed the delegates. Dr. Prabhakar, Project Coordinator (Small Millets), AICRP on Small Millets, ICAR, Bengaluru presented the research highlights of AICRP centers. Dr. VA Tonapi, Director, ICAR-IIMR, Hyderabad and Dr. TN Prakash, Chairman, Agriculture Price Commission, Government of Karnataka, Bengaluru were the Guests of Honor. Dr. T. Sheshadri, Associate Director of Research, UAS, Bengaluru proposed the vote of thanks.

In the afternoon, presentation of progress reports of various disciplines was made by respective Principal Investigators. Discipline-wise programme planning group meetings to review the results and finalization of 2017-18 technical programmes for the ensuing seasons. Second day was dedicated to presentation of lead topics by distinguished speakers, followed by scientific auditing of each center and the scientists working under the AICRP scheme so that the shortfalls could be identified and addressed effectively. The plenary session was presided over by Dr. DP Kumar, Director of Education, UAS, Bengaluru. Dr. NR Gangadharappa, Director of Research and Dr. MA Shankar, Ex-Director of Research, UAS, Bengaluru were the co-chairman. Dr. Prabhakar, Project Coordinator (Small Millets) proposed vote of thanks.

Dr. Prabhakar, Project Coordinator (Small Millets), Bangalore presented the research highlights of small millets for 2016-17, mentioning that all the six small millets are cultivated in all the states of India. Research work on small millets is going on in 13 AICRP and 21 co-operating centers. He presented the action taken report on recommendations of previous workshop. It was mentioned that web site of AICRP on Small millets (www.aicrpsm.res.in) has been launched on 24th Feb., 2017. Performance of AICRP breeding trial in 2016-17 and comparisons of 3 years were presented. He mentioned that Zonal concept was adopted for evaluation of entries only in finger millet along with national, zonal check and local checks. Accordingly, North zone and Southern zones were formulated on trial basis for 2016-17. Against a total allocation of 108 trials, comprising six millet crops, to various centres all over India, 92 trials were conducted and the overall success was 81.14 %.

Dr. Prabhakar highlighted the performance of all the entries in six crops of small millets. Performance of AICRP breeding trial in 2016-17 and comparisons of 3 years were presented. Agronomical recommendations, Front line demonstrations, TSP, drought tolerance accessions of finger millet superior to GPU 28 were presented. Banded leaf blight is becoming major threat in all the small millets and soil application of bio-agents is effective in managing the disease. Scenario of insect pests in small millets and promising varieties with multi pest resistance were highlighted. He mentioned that TSP was implemented in 6 centers covering 520.1 ha demonstrations and 28 lakhs were spent in the programme. During the year, the indent of 25.58 quintals of breeder seed was made by DAC for all the six crops. Accordingly, the total production of breeder seed was 105.90q and it is 206.99 % more than the allocation. The work of new programme started on popularization of small millets in 3 centers of North eastern hilly regions was presented. Progress on registration of genetic stock, DUST guide lines, publications made by the scientists in small millets and recognition received by the scientists were also highlighted.

Dr. V.A Tonapi, Director, IIMR, Hyderabad emphasized that though we have increased the productivity but is there any chance or opportunity or mechanization that could double the yield of small millets? He pointed that in the scenario where 10- 20 years old varieties are ruling, how can new varieties make their place? He mentioned that we have perhaps failed in not putting the mechanization in right time. He also brought attention towards that as millets

are climate resilient crops so why not all centres take all the crops for testing and evaluation. Real enthusiasm and zeal is required from each centre. He requested to the scientists to participate in the deliberations and concrete steps should be taken for the development of millets.

Dr. Tonapi emphasized that we need to think as policy makers, as markets and we really need to push the progressive farmers to go for these crops with one irrigation and productivity will get doubled. He figured out that the indents for seed production of small millets are very less; there is a need to popularize the small millets among the farming community so as to increase indents. Entire ranges of varieties in small millets evolved are from selection, only few are from recombination breeding. Seed supply system is also very poor and 90% farmers saved seeds are in use. Training of the farmers to produce quality seed is essential. There is about 40% deficit between demand and supply of small millets. Awareness, demand generation, better processing, better prices and interest of progressive farmers to grow small millets can increase the area. Karnataka, Tamil Nadu and A.P. government is doing better job for small millets.

Dr. T. N. Prakash, Chairman, KPAC welcomed on behalf of Karnataka government and emphasized that govt. of Karnataka is the first state to include finger millet and Jowar in PDS system. Government has procured 20 lakh quintal ragi @ Rs 2100 per quintal during last year in Karnataka and now promoting organic finger millet. Several NGOs are also working to promote the finger millet. He emphasized that there is enormous gap between trial yield and farmers yield. One protective irrigation can increase 10-15% grain yield of finger millet. Nearly 10 lakh ha area of finger millet has gone out due to shifting of cropping pattern in Karnataka. Reduction in cost of production, yield enhancement, procurement and timely repayment can sustain the area under finger millet. He mentioned that the interest, awareness and eagerness among consumers have been increasing across India, among health conscious people.

Dr. A. Seetharam, former Project Coordinator (Small millets), who developed first sunflower hybrid expressed his views and told that millets are passing challenging time. There is drastic reduction in area and production of small millets and shares less than 1% in regional food security. In the situation of high cost of cultivation and low production, farmers will not grow the millets. Lot of publicity in the urban area about nutritional security through small millets may be the future line of work. AICRP system is doing better job and IIMR is giving basic and strategic support. Uses of modern tools, their integration with conventional tools for yield improvement and diversity creation are important researchable issues. Generation of more variability especially in kodo millet and little millet through mutation breeding and biotechnological tools can help us. Grain size is an important factor to enhance 15-20% grain yield. Production system is important and more research is needed on mechanization system. Good raw material is needed for value and supply chain. Millets area may be conserved through proper linkages between productions to consumption.

Dr. H. Shivanna, Vice- Chancellor, UAS, Bengaluru, in his presidential address asked all the delegates to seriously think on the initiatives by which we can increase the productivity of small millets. He expressed his views on progress of research work carried out all over the country in different disciplines by AICRPs, programme of IIMR, programmes running in Karnataka and comments of Dr. Seetharam on kind of work in small millets and problem facing. He suggested that production level has to be increase. However, it is not a magic. A lot of cultivable area is still fallow in the country and 5-10% area is under encroachment. Land size is coming down and expectations are more. Government wants improvement in technology development, their transfer to farmers and socio-economic development. Dry land farmers always suffer a lot. Monsoon and market are important factors that largely fluctuate. It is suggested that small millets cannot be promoted without profit in the market and scientists working in the field will take the challenges. We will have to put our heart and soul to rightly design the future programmes to address these problems. He insisted that all the Breeders, Pathologists, Entomologist and Agronomists should work together and come out with a package in order to increase the productivity levels in millets systems.

Discipline-wise research highlights

Breeding

- Applied researches dealt with multi-location yield trials. Basic and strategic researches focused on various aspects including development of high yielding varieties of all six millets with tolerance to diseases and insect-pests, etc.
- Zonal concept was adopted for evaluation of entries only in finger millet along with national, zonal check and local checks. Accordingly, North zone and Southern zones were formulated on trial basis for 2016-17.
- Against a total allocation of 108 trials, comprising six millet crops, to various centres all over India, 92 trials were conducted and the overall success was 81.14 %.
- In Finger millet Initial varietal Trial- South zone, in the early maturity group, the entries BR 14-3 and VL-503 were inferior to grain and fodder yield against check VL-352. But, entry BR 14-3 was superior by 33.70 % over the check VR-708. In medium maturity group, the entry PR 10-35 was significantly superior to GPU-45 and gave 22.92% more grain and 2.48% more fodder yield than the best check GPU-45. In long duration group, the entry KOPN-942 gave 12.62% more grain yield than the check VR-936, but gave less grain and fodder yield over best check GPU-67.
- In Finger millet Initial Varietal Trial- North zone, the variety DHFM 78-33 ranked first in the trial and it was on par with the best check VR -708 and was significantly superior to check GPU-67. The entries DHFM 78-33, KOPN-942 and BR-14-3 exhibited more than 20% grain yield over checks VR-936, GPU-67, VL-352, PR-202 and GPU-45.
- In Finger millet Advanced Varietal Trial- Early and Medium duration: South zone, the entries VL-386 and VL-379 gave more than 10% less fodder yield than the best check GPU-45. The varietal performance of varieties over three years of testing indicated that VL-379 was 10.5% superior in grain yield over the best check, but it was on par with the check in fodder yield.
- In Finger millet Advanced Varietal Trial- Early and Medium duration : North zone, the varieties VL-379 and VL-386 were significantly superior to the checks GPU-45 and VR-708.
- In Foxtail millet advanced varietal Trial, none of the entries were significantly superior to the best check SiA 3156. For grain yield, the entries SiA 3164, DHFTMV-2-5, DHFT 5-6, DGHT 77-3 and SiA 3179 were superior from 5.70 to 16.12%. The varietal performance of foxtail varieties over 3 years of testing indicated that the variety DHFTMV 2-5 gave 11.39% more fodder yield than the best check SiA 326.
- In Kodo Millet Advanced Varietal Trial, three Kodo millet varieties namely BK-48, TNPSC-176 and BK -36 gave more than 20% yield and were significantly superior to all the 3 checks (TNAU-86, GPUK-3 and RK-390- 25) for grain yield. Three varieties TNPSC-176, BK-48 and DPS-118 were superior by 8.55 to 17.41% for fodder yield.
- In Little millet Advanced Varietal Trial, None of the varieties were significantly superior to checks and gave less fodder yield than check OLM-203. The entries, DHLT 28-4, TNPSU 171, KOPLM 53, WV 126 and DLM 95 were on par with the check BL-6 for grain yield and were superior by 5.98 to 15.77% over OLM-203 and from 19.27 to 30.28% over JK-8.
- In Barnyard millet Advanced Varietal Trial, the entry DHB 23-3 was superior by 13.51% over VL-172 and 14.80% over VL-207 for grain yield and it gave 22.85% more fodder yield than the best check VL-207. The varietal performance of barnyard millet varieties over 3 and 2 years of testing indicated that the entry DHB 23-3 was superior to checks for both grain and fodder yields. It was superior by 9.16% for grain yield and 24.67 % for fodder yield.
- In Proso millet Advanced Varietal Trial, the entry TNPM-238 was superior by 4.25 to 14.06% over checks for grain yield and it gave 6.88% more fodder yield than the best check GPU-21, where as the entry DHP 2181 gave 1.81 to 11.39% more grain yield over checks and 13.78% more fodder yield than the best check. The varietal performance of Proso millet varieties over three years of testing indicated that the entry DHP 2181 was 9.95% more superior to the check GPUP-21, but none of the entries were superior to checks over three years for fodder yield.

- Breeder seed production: During the year, the indent of 25.58 quintals of breeder seed was made by DAC, Government of India for all the six crops of small millets. Accordingly, the total production of breeder seed was 105.90q and it is 206.99 % more than the allocation.

Agronomy

- Evaluation of pre-released genotypes to fertility levels revealed that 100 per cent recommended dose of fertilizer was optimum to get higher yields in Finger millet, Foxtail millet and Proso millet, whereas 125 per cent RDF for Little millet.
- Test varieties of VL 379 (Finger millet), BL 150 (little millet), SiA 3163 (Foxtail millet) and TNPM 228 (Proso millet) were superior to local or national checks which gave 24.16 %, 49.49 %, 15.23 % and 28.13 % increase in grain yield respectively.
- The study on Nutrient management in small millets indicated that Seed treatment with biofertilizers and micro nutrients along with RDF application was superior to raise the Finger millet production both under rainfed and irrigated condition. Inclusion of sunhemp as green manure in rice fallows and 75% RDF enhanced the productivity and profitability of succeeding finger millet in irrigated condition.
- Assessing the performance of small millets to different sowing windows indicated that Need based agronomic management practices are necessary to tackle mid and late season drought to increase yield level and for moisture conservation.
- Experiment on Weed management for small millets revealed that cultural practices like two inter cultivation along with one hand weeding improve the yield level in finger millet, kodo millet and little millet crops.
- Summer ploughing was a best practice for moisture conservation under rainfed conditions for cultivation of minor millets under conservation agriculture in small millets.
- Millet based cropping systems for sustainable productivity inferred that Production of millets through inter/sequence cropping with legumes improve the soil health and productivity

Pathology

- Head blast pressure was low to moderate in Andhra Pradesh, Chattisgarh, Karnataka, Odisha and Tamil Nadu, whereas high blast prevailed on local varieties in Jharkhand and Uttarakhand. Brown spot and foot rot were low to moderate in Odisha and Tamil Nadu while cercospora leaf spot remained high in Uttarakhand. On foxtail millet blast, rust and downy mildew occurrence was low in Andhra Pradesh, whereas in Uttarakhand grain smut was low to high, but sheath blight was low on barnyard millet. In little millet grain smut and banded blight ranged from low to high; in kodo millet head smut, banded blight and *Striga* occurrence was of low to moderate intensity in Madhya Pradesh.
- Among the germplasm, finger millet line VR-13-14 was immune to both neck and finger blasts at Almora, whereas at Mandya varieties GN 4, GN 5 and Dapoli 1 were not only immune to head blast, but were highly resistant to foot rot. At Almora ten IEC lines of barnyard millet were immune to grain smut. Out of the 1034 *Setaria* lines screened at Nandyal, though many were resistant, a total of 775 lines were free from both downy mildew and blast.
- In finger millet IVT, BR 14-3 for blast and PR 10-35 for banded blight were highly promising, whereas in AVT I & II while no entry was superior for banded blight and CLS, VL 379 showed moderate resistance to neck blast. Five LAVT lines viz., KOPLM 53, GPUL 2, WV 126, DLM 95 and DHLT 28-4 were free from grain smut; KAVT entry DPS 118 was highly resistant to head smut whereas BAVT line DHBM 18-6 was resistant to grain smut. FAVT entries, SiA 3164 for brown spot and rust, DHFT 5-6 for rust and blast, H-4-6 for rust and downy mildew were resistant.
- In correlation studies at Ranichauri, with increase in average temperature, the CLS severity decreased. Incidence of foxtail millet blast was negatively correlated with maximum temperature, but was positively correlated with minimum temperature, relative humidity (morning and evening) and rainfall, but, rust incidence was positively correlated with maximum temperature and relative humidity (morning and evening); at the same time it was negatively correlated with minimum temperature and rainfall.

- In the eco-friendly management of banded/ sheath blight over locations and amongst different small millets, soil application of value added *P.f.+T.v.+B.s.* not only minimized disease, but also enhanced grain and fodder yields.

Entomology

Pest scenario in small millets:

- In finger millet, the grasshopper is a major biotic constraint followed by the Pink stem borer (*Sesamia inferens*), Aphids (leaf aphid and panicle aphid), *Myloccerus* weevil and ear head caterpillar, etc.
- The low population of grass hopper (2.3/m²) and moderate damage by grasshopper 0 to 40 per cent recorded at Berhampur. Aphid incidence was high on leaf ranges from 0 to 40 % compared to panicle aphid 20-30 %.
- *Myloccerus* weevil noticed very low incidence 0 to 2/m². Dead heart caused by stem borer ranged from 0 to 2%. At Ranchi, grasshopper population was 2.0 to 7.0/m² and moderate damage by grasshopper 2.3 to 10.2 per cent.
- Aphid incidence was high on leaf ranges from 0 to 4.0 % compared to panicle aphid 0 -2.0 %. *Myloccerus* weevil noticed very low incidence 0 to 6.0/m².
- Earhead web worm (0 -3%) and earhead caterpillar (20-30 %) was recorded at Bangalore.
- Shoot fly was the major pest on other millets (viz., kodo, little, proso, foxtail and baryard millet) at four different centres.

Management of shoot fly in small millets

- In little millet, all India average was recorded highest yield 804 kg/ha in treatment spraying of 1500 ppm azadirachtin at 15 DAS followed by 796 kg/ha in NSKE 5 % at 15 DAS, 1.5 times recommended seed rate (734 kg/ha) and sprayed with NSKE 5 % at 7 DAS (703 kg/ha) treatments are significantly different from control.
- In proso millet, the highest yield 385 kg/ha recorded in treatment spraying of 1500 ppm azadirachtin at 15 DAS followed by 370 kg/ha in NSKE 5 % at 15 DAS, 1500 ppm azadirachtin at 25 DAS (358.6 kg/ha), early sowing (7 days before normal sowing) (334.4 kg/ha) and 1.5 times recommended seed rate (325.9 %) treatments are significantly differ compared to control.

Frontline demonstrations

- During *Kharif 2016-17*, 300 frontline demonstrations (FLDs) on small millets were organized in nine districts across country viz., Andhra Pradesh, Chattisgarh, Gujarath, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Tamil Nadu and Uttarakhand on farmer's fields.
- The demonstrated varieties of finger millet, foxtail millet, kodo millet, little millet, barnyard millet and proso millet gave 52.63 %, 81.19%, 17.31 %, 169.50%, 110%, 136.34%, 77.36%, 83.61%, 29.14%, 33%, 41.57% and 13.68% higher grain and fodder yields respectively than the local checks.

Physiology

- A few germplasm accessions for high yield potential and drought tolerance through physiological traits have been identified.
- Application of zinc either through soil or foliar application did not result in significant increase in grain yield.

Tribal Sub Plan:

- The TSP programme was carried out in six centres viz., Jagdalpur, Athiyandal, Dindori, Mandya, Vizianagaram and P.C unit (Palakkad, Kerala) and the amount of Rs. 29.50 lakhs was released to different centres.
- At Mandya, there was 45 % improvement in yield in farmer's fields with improved practice as compared to local practice in finger millet..
- At Dindori, the demonstrations in farmers field in 20.0 ha area in kodo millet indicated that there was an increase of 89.72% in improved practice over farmers practice. Demonstrations in farmers field in 10.0 ha area in little millet indicated that there was an increase of 102.16% increase in grain yield in improved practice over farmers practice.
- At Vizianagaram, the demonstrations in farmer's field in finger millet indicated that there was an increase of 79.30% increase in grain yield in improved practice against farmers practice.

Popularization of small millets in NEH Region

- As of now, few varieties of millets are sporadically grown by the tribal farmers and consumed in parts of Assam and adjoining the North-Eastern states in limited quantity. The popularization of small millets in this region is important to uplift the economic level of the farmers.
- A total of Rs. 31.08 lakhs has been allocated three centres, viz. Gossaigaon in Assam, Agartala in Tripura and Namthumg, Sikkim to popularise the small millets in NEH region by way of conducting demonstration in farmers fields in Summer and kharif 2017.
- Besides, implements like thresher and de-husker have been provided to all the three centres.

Recommendations

1. As small millets are climate resilient crops, the centres were advised to take up more crops other than the mandate crops for testing and evaluation in order to expand the area of small millet crops.
2. The breeding materials should be shared among centres in all crops and breeders are requested to contribute the segregating generation materials for evaluation across locations.
3. In order to generate new breeding materials, a national hybridisation programme should be devised and breeders were asked to contribute the parent for specific traits.
4. At present, the entries in coordinated trials are tested under the centres codes and it has been suggested to give project codes for all the entries in all six crops from this year onwards.
5. As the DUS guidelines are finalized for finger millet and foxtail millet, the AVT entries in these crops are to be characterized as per DUS guidelines.
6. The germplasm available with the centres should be sent to PC Unit with passport data. Efforts should be made for getting IC numbers from NBPGR, New Delhi.
7. For analyzing nutritional parameters, scientists are requested to collaborate with concerned universities, ICAR-IIMR, Hyderabad and NIN, Hyderabad.
8. The training for hybridisation in small millets was conducted last year. Project Coordinating Unit at Bengaluru should organise the training programme this year also for the benefit of all the newly joined breeders.
9. Pre sowing irrigation followed by irrigation at 20-25 days after sowing is sufficient enough to give 33 % increased foxtail millet yield under limited water supply condition at Nandyal area of Andhra Pradesh.
10. Kodo millet/little millet based inter cropping system (Kodo /little millet + Pigeon pea 8:2) was the most profitable system in Dindori, Rewa and Athiyandal.
11. Inclusion of sunhemp as green manure crop in rice fallows followed finger millet with 75% RDF enhanced the productivity and profitability of succeeding finger millet under irrigated condition.
12. Two inter cultivations along with one hand weeding improved the grain yield in finger millet (80%), Kodo millet (36%) and little millet (42%) at Athiyandal, Dindori, Rewa and Jagdalpur.
13. Soil application of value added *P.f.+T.v.+B.s.* not only minimized banded/ sheath blight, but also enhanced grain and fodder yields on all the small millets across locations. Being an eco-friendly strategy, pathologists were suggested to push the technology for package of their respective universities to encash.
14. There is a need to identify the tolerant and susceptible checks in all crops (based on literature or previous work). Screening for shoot fly should be initiated in the nursery itself.
15. All insect pests of finger millet and other small millets should be recorded in percentage only.
16. Collected specimens of all insect pests of small millets should be sent to main centre for identification. (Predators/parasitoids/ spiders to be identified from taxonomists).
17. Weather parameters should be correlated with insect pests of different crops in different centers. Hence, all centers should record weekly observations of weather parameters during the cropping season.
18. Ten years data should be compiled to know the susceptible and resistant varieties/germplasms for screening of all the small millets.

Part A: Proceedings of technical sessions

Session I: Inaugural session

Chief Guest:	Dr. A. Seetharam, Ex-Project Coordinator (Small Millets)
Chairman:	Dr H. Shivanna, Vice- Chancellor, UAS, Bengaluru
Guest of Honors:	Dr. V. A. Tonapi, Director, IIMR, Hyderabad Dr. T.N. Prakash, Chairman, Karnataka Agriculture Price Commission, Bengaluru
Rapporteurs	Dr. A. K. Jain, Principal Scientist (Pl. Path.), Rewa (M.P.) Dr. Laxmi Rawat, Pathologist, Ranichauri (UK)

Inaugural Session started with the Vandana made by P.G Students of University of Agricultural Sciences, GKVK Campus, Bengaluru. Dignitaries inaugurated the event by lightening the ceremonial lamp. First of all, Director Research of the University was invited for welcome address

Dr. N. R. Gangadharappa, Hon'ble Director Research of the University gave welcome speech and he welcomed all the dignitaries and delegates. He expressed his thanks for choosing the University as venue for holding the 28th Annual Group meeting of AICRP on Small Millets.

- He made a special mention that UAS, Bengaluru has been ranked as number one university as per the ranking of ICAR. He on behalf of Programme Coordinator of Small Millets and on behalf of the university welcomed all the dignitaries, delegates and respective scientists. He briefed about the advanced facilities available at University of Agricultural Sciences, GKVK Campus, Bengaluru and also the technologies and different varieties developed at UAS, Bengaluru.
- Later on, he mentioned that the area under millets have come down terribly including the production. There is need to address issues of climate change with respect to these crops. It's time to recognize the importance of millets and how they can be popularized. He said that the small millets will definitely play a key role in nutritional point of view and also with changing climatic conditions.

Dr. Prabhakar, Project Coordinator (Small millets), Bangalore presented the research highlights of small millets for 2016-17, mentioning that all the six small millets are cultivated in all the states of India. Research work on small millets is going on in 13 AICRP and 21 co-operating centers. He presented the action taken report on recommendations of previous workshop. It was mentioned that web site of AICRP on Small millets (www.aicrpsm.res.in) has been launched on 24th Feb., 2017. Performance of AICRP breeding trial in 2016-17 and comparisons of 3 years were presented. The work of new programme started on popularization of small millets in 3 centers of North eastern hilly regions was presented. Progress on registration of genetic stock, DUST guide lines, publications made by the scientists in small millets and recognition received by the scientists were also highlighted. The highlights are as follows

- Zonal concept was adopted for evaluation of entries only in finger millet along with national, zonal check and local checks. Accordingly, North zone and Southern zones were formulated on trial basis for 2016-17.
- Against a total allocation of 108 trials, comprising six millet crops, to various centres all over India, 92 trials were conducted and the overall success was 81.14 %.
- In Finger millet Advanced Varietal Trial- Early and Medium duration: South zone: The entries VL-386 and VL-379 gave more than 10% less fodder yield than the best check GPU-45.

- In Finger millet Advanced Varietal Trial- Early and Medium: North zone: The varieties VL-379 and VL-386 were significantly superior to the checks GPU-45 and VR-708.
- In Foxtail millet advanced varietal Trial: The varietal performance of foxtail varieties over 3 years of testing indicated that the variety DHFTMV 2-5 gave 11.39% more fodder yield than the best check SiA 326.
- In Kodo Millet Advanced Varietal Trial, 3 varieties TNPSC-176, BK-48 and DPS-118 were superior by 8.55 to 17.41% for fodder yield.
- In Little millet Advanced Varietal Trial (LAVT): The entries, DHLT 28-4, TNPSU 171, KOPLM 53, WV 126 and DLM 95 were on par with the check BL-6 for grain yield and were superior by 5.98 to 15.77% over OLM-203 and from 19.27 to 30.28% over JK-8.
- In Barnyard millet Advanced Varietal Trial (BAVT): The entry DHB 23-3 was superior to checks for both grain and fodder yields over 3 years.. It was superior by 9.16% for grain yield and 24.67 % for fodder yield.
- In Proso millet Advanced Varietal Trial (PAVT): The entry DHP 2181 was 9.95% more superior to the check GPUP-21 over 3 years.
- During the year, the indent of 25.58 quintals of breeder seed was made by DAC for all the six crops. Accordingly, the total production of breeder seed was 105.90q and it is 206.99 % more than the allocation. A surplus breeder seed of 80.32q has been produced.
- In evaluation of pre- released genotypes to fertility levels indicated that 100 per cent recommended dose of fertilizer was optimum to get higher yields in Finger millet, Foxtail millet and Proso millet, whereas 125 per cent RDF for Little millet.
- On Nutrient management in small millets showed that seed treatment with biofertilizers and micro nutrients along with RDF application was superior to raise the Finger millet production both under rainfed and irrigated condition.
- Need based agronomic management practices are necessary to tackle mid and late season drought to increase yield level and for moisture conservation.
- Cultural practices like two inter cultivation along with one hand weeding improve the yield level in finger millet, kodo millet and little millet crops.
- Production of millets through inter/sequence cropping with legumes improve the soil health and productivity
- Head blast pressure was low to moderate in Andhra Pradesh, Chattisgarh, Karnataka, Odisha and Tamil Nadu, whereas high blast prevailed on local varieties in Jharkhand and Uttarakhand. Brown spot and foot rot were low to moderate in Odisha and Tamil Nadu while cercospora leaf spot remained high in Uttarakhand.
- On foxtail millet blast, rust and downy mildew occurrence was low in Andhra Pradesh, whereas in Uttarakhand grain smut was low to high, but sheath blight was low on barnyard millet. In little millet grain smut and banded blight ranged from low to high; in kodo millet head smut, banded blight.
- In the eco-friendly management of banded/ sheath blight over locations and amongst different small millets, soil application of value added *P.f.+T.v.+B.s.* not only minimized disease, but also enhanced grain and fodder yields.
- In finger millet, the grasshopper is a major biotic constraint followed by the Pink stem borer (*Sesamia inferens*), Aphids (leaf aphid and panicle aphid), *Myloccerus* weevil and ear head caterpillar, *Helicoverpa armigera* etc.
- Shoot fly was the major pest on other millets (viz., kodo, little, proso, foxtail and baryard millet) at four different centres.
- 300 frontline demonstrations (FLDs) on small millets were organized in nine districts across country. The demonstrated varieties of finger millet, foxtail millet, kodo millet, little millet, barnyard millet and proso millet gave 52.63 %, 81.19%, 17.31 %, 169.50%, 110%, 136.34%, 77.36%, 83.61%, 29.14%, 33%, 41.57% and 13.68% higher grain and fodder yields respectively than the local checks.
- The TSP programme was carried out in six centres viz., Jagdalpur, Athiyandal, Dindori, Mandya, Vizianagaram and P.C unit (Palakkad, Kerala) and the amount of Rs. 29.50 lakhs was released to different centres.

- Popularization of small millets in NEH Region was carried out to uplift the economic level of the farmers. A total of Rs. 31.08 lakhs has been allocated three centres, viz. Gossaigaon in Assam, Agartala in Tripura and Namthung, Sikkim to popularise the small millets in NEH region.

Thereafter, 13 publications from different centres were released related to small millets on the occasion.

Dr. V.A Tonapi, Director, ICAR-IIMR, Hyderabad, addressed the gathering. The salient points were as below.

- While speaking on the occasion, first of all he conveyed best wishes of DDG (Crop Science) and ADG (FFC), to all participants as they could not made to attend the workshop.
- He emphasized that though we have increased the productivity but is there any chance or opportunity or mechanization that could double the yield of small millets?
- He pointed that in the scenario where 10- 20 years old varieties are ruling, how can new varieties make their place? He mentioned that we have perhaps failed in not putting the mechanization in right time.
- He also brought attention that as millets are climate resilient crops so why not all centres take all the crops for testing and evaluation. Real enthusiasm and zeal is required from each centre. He requested to the scientists to participate in deliberations and concrete steps should be taken for the development of millets.
- He also mentioned the difficulties in addressing the breeding programme in small millets as florets are small and handling them is difficult and flowering behavior occur in odd time.
- He emphasized that we need to think as policy makers, as markets and we really need to push the progressive farmers to go for these crops with one irrigation and productivity will get doubled. He said these are the issues we need to think about.
- He figured out that the indents for seed production of small millets are very less; there is a need to popularize the small millets among the farming community so as to increase indents.
- Entire ranges of varieties in small millets evolved are from selection, only few are from recombination breeding. Seed supply system is also very poor and 90% farmers saved seeds are in use.
- Training of the farmers to produce quality seed is essential. There is about 40% deficit between demand and supply of small millets.
- Awareness, demand generation, better processing, better prices and interest of progressive farmers to grow small millets can increase the area. Karnataka, Tamil Nadu and A.P. government is doing better job for small millets

Dr. T. N. Prakash, Chairman, KPAC welcomed on behalf of Karnataka government and emphasized that govt. of Karnataka is the first state to include finger millet and Jowar in PDS system. Government has procured 20 lakh quintal ragi @ Rs 2100 per quintal during last year in Karnataka and now promoting organic finger millet. Several NGOs are also working to promote the finger millet. He emphasized that there is enormous gap between trial yield and farmers yield. One protective irrigation can increase 10-15% grain yield of finger millet. Nearly 10 lakh ha area of finger millet has gone out due to shifting of cropping pattern in Karnataka. Reduction in cost of production, yield enhancement, procurement and timely repayment can sustain the area under finger millet. He mentioned that the interest, awareness and eagerness among consumers have been increasing across India, among health conscious people.

Dr. A. Seetharam, former Project Coordinator (Small millets), who developed first sunflower hybrid expressed his views and told that millets are passing challenging time. There is drastic reduction in area and production of small millets and shares less than 1% in regional food security. In the situation of high cost of cultivation and low production, farmers will not grow the millets. Lot of publicity in the urban area about nutritional security through small millets may be the future line of work. AICRP system is doing better job and IIMR is giving basic and strategic support. Uses of modern tools, their integration with conventional tools for yield improvement and diversity creation are important researchable issues. Generation of more variability especially in kodo millet and little millet through mutation breeding and biotechnological tools can help us. Grain size is an important factor to enhance 15-20% grain yield. Production system is important and more research is needed on mechanization system. Good raw material is

needed for value and supply chain. Millets area may be conserved through proper linkages between productions to consumption.

Dr. H. Shivanna, Vice- Chancellor, UAS, Bengaluru, in his presidential address asked all the delegates to seriously think on the initiatives by which we can increase the productivity of small millets. He expressed his views on progress of research work carried out all over the country in different disciplines by AICRPs, programme of IIMR, programmes running in Karnataka and comments of Dr. Seetharam on kind of work in small millets and problem facing. He suggested that production level has to be increase. However, it is not a magic. A lot of cultivable area is still fallow in the country and 5-10% area is under encroachment. Land size is coming down and expectations are more. Government wants improvement in technology development, their transfer to farmers and socio-economic development. Dry land farmers always suffer a lot. Monsoon and market are important factors that largely fluctuate. It is suggested that small millets cannot be promoted without profit in the market and scientists working in the field will take the challenges. We will have to put our heart and soul to rightly design the future programmes to address these problems. He insisted that all the Breeders, Pathologists, Entomologist and Agronomists should work together and come out with a package in order to increase the productivity levels in millets systems.

At the end, Dr. T. Sheshadri, Associate Director of Research proposed vote of thanks.

Session II: Presentation of Progress Report: 2016-17

Chairman : Dr NR Gangadharappa, Director of Research, UAS, Bengaluru

Co-chairman : Dr V.A.Tonapi, Director , ICAR-IIMR, Hyderabad

Rapporteurs : Dr P.Munirathnam, Pr.Scientist (Agro), RARS, Nandyal

Dr TSSK Patro, Sr.Scientist (PI.Path) & Head, ARS, Vizianagaram

At the outset, the Chairman and Co-chairman welcomed all the delegates and invited the Principal Investigators of the project for presentation of research highlights. The research highlights were presented by Dr. CR Ravishankar (PI-Breeding), Dr B Boraiah (PI-Agronomy and FLDs), Dr. A Nagaraja (PI-Plant Pathology), Dr Prabhu C. Ganiger (PI-Entomology), Dr Nanja Reddy (PI-Plant Physiology) and Sri Munirajappa (TSP and NEH).

Dr Ravishankar presented the research highlights of breeding as below

- Applied researches dealt with multi-location yield trials. Basic and strategic researches focused on various aspects including development of high yielding varieties of all six millets with tolerance to diseases and insect-pests, etc.
- Zonal concept was adopted for evaluation of entries only in finger millet along with national, zonal check and local checks. Accordingly, North zone and Southern zones were formulated on trial basis for 2016-17.
- Against a total allocation of 108 trials, comprising six millet crops, to various centres all over India, 92 trials were conducted and the overall success was 81.14 %.
- In Finger millet Initial varietal Trial- South zone, in the early maturity group, the entries BR 14-3 and VL-503 were inferior to grain and fodder yield against check VL-352. But, entry BR 14-3 was superior by 33.70 % over the check VR-708. In medium maturity group, the entry PR 10-35 was significantly superior to GPU-45 and gave 22.92% more grain and 2.48% more fodder yield than the best check GPU-45. In long duration group, the entry KOPN-942 gave 12.62% more grain yield than the check VR-936, but gave less grain and fodder yield over best check GPU-67.
- In Finger millet Initial Varietal Trial- North zone, the variety DHFM 78-33 ranked first in the trial and it was on par with the best check VR -708 and was significantly superior to check GPU-67. The entries DHFM 78-33, KOPN-942 and BR-14-3 exhibited more than 20% grain yield over checks VR-936, GPU-67, VL-352, PR-202 and GPU-45.
- In Finger millet Advanced Varietal Trial- Early and Medium duration: South zone, the entries VL-386 and VL-379 gave more than 10% less fodder yield than the best check GPU-45. The varietal performance of varieties over three years of testing indicated that VL-379 was 10.5% superior in grain yield over the best check, but it was on par with the check in fodder yield.
- In Finger millet Advanced Varietal Trial- Early and Medium duration : North zone, the varieties VL-379 and VL-386 were significantly superior to the checks GPU-45 and VR-708.
- In Foxtail millet advanced varietal Trial, none of the entries were significantly superior to the best check SiA 3156. For grain yield, the entries SiA 3164, DHFTMV-2-5, DHFT 5-6, DGHT 77-3 and SiA 3179 were superior from 5.70 to 16.12%. The varietal performance of foxtail varieties over 3 years of testing indicated that the variety DHFTMV 2-5 gave 11.39% more fodder yield than the best check SiA 326.
- In Kodo Millet Advanced Varietal Trial, three Kodo millet varieties namely BK-48, TNPSC-176 and BK -36 gave more than 20% yield and were significantly superior to all the 3 checks (TNAU-86, GPUK-3 and RK-390- 25) for grain yield. Three varieties TNPSC-176, BK-48 and DPS-118 were superior by 8.55 to 17.41% for fodder yield.
- In Little millet Advanced Varietal Trial, None of the varieties were significantly superior to checks and gave less fodder yield than check OLM-203. The entries, DHLT 28-4, TNPSU 171, KOPLM 53, WV 126 and DLM

95 were on par with the check BL-6 for grain yield and were superior by 5.98 to 15.77% over OLM-203 and from 19.27 to 30.28% over JK-8.

- In Barnyard millet Advanced Varietal Trial, the entry DHB 23-3 was superior by 13.51% over VL-172 and 14.80% over VL-207 for grain yield and it gave 22.85% more fodder yield than the best check VL-207. The varietal performance of barnyard millet varieties over 3 and 2 years of testing indicated that the entry DHB 23-3 was superior to checks for both grain and fodder yields. It was superior by 9.16% for grain yield and 24.67 % for fodder yield.
- In Proso millet Advanced Varietal Trial, the entry TNPM-238 was superior by 4.25 to 14.06% over checks for grain yield and it gave 6.88% more fodder yield than the best check GPU-21, where as the entry DHP 2181 gave 1.81 to 11.39% more grain yield over checks and 13.78% more fodder yield than the best check. The varietal performance of Proso millet varieties over three years of testing indicated that the entry DHP 2181 was 9.95% more superior to the check GPUP-21, but none of the entries were superior to checks over three years for fodder yield.
- Breeder seed production: During the year, the indent of 25.58 quintals of breeder seed was made by DAC, Government of India for all the six crops of small millets. Accordingly, the total production of breeder seed was 105.90q and it is 206.99 % more than the allocation.

When some centres told that the indented seed was not lifted, the PC informed that alternate arrangements would be made to lift the seed in case the seed is not lifted in any centre. Dr Tonapi made a point that the number of locations for conducting trials in each state may be increased to good average.

Dr .B. Boraiah, while presenting the research highlights of Agronomy, informed the house that 32 trials were conducted in small millets across the country. The highlights are as below.

- Evaluation of pre- released genotypes to fertility levels revealed that 100 per cent recommended dose of fertilizer was optimum to get higher yields in Finger millet, Foxtail millet and Proso millet, whereas 125 per cent RDF for Little millet.
- Test varieties of VL 379 (Finger millet), BL 150 (little millet), SiA 3163 (Foxtail millet) and TNPM 228 (Proso millet) were superior to local or national checks which gave 24.16 %, 49.49 %, 15.23 % and 28.13 % increase in grain yield respectively.
- The study on Nutrient management in small millets indicated that Seed treatment with biofertilizers and micro nutrients along with RDF application was superior to raise the Finger millet production both under rainfed and irrigated condition. Inclusion of sunhemp as green manure in rice fallows and 75% RDF enhanced the productivity and profitability of succeeding finger millet in irrigated condition.
- Assessing the performance of small millets to different sowing windows indicated that Need based agronomic management practices are necessary to tackle mid and late season drought to increase yield level and for moisture conservation.
- Experiment on Weed management for small millets revealed that cultural practices like two inter cultivation along with one hand weeding improve the yield level in finger millet, kodo millet and little millet crops.
- Summer ploughing was a best practice for moisture conservation under rainfed conditions for cultivation of minor millets under conservation agriculture in small millets.
- Millet based cropping systems for sustainable productivity inferred that Production of millets through inter/sequence cropping with legumes improve the soil health and productivity

Dr NirmalaKumari, told that due to less number of locations in testing the pre release entries yields are not properly representing which is becoming constraint for release of the variety. Therefore, some arrangements are to be made to solve this problem. Dr Tonapi advised that in addition to net returns and B:C ration, Agronomic efficiency is to be worked out for effective presentation. Dr Krishne Gowda, Ex PC told that for nutrient management experiments soil fertility status (initial and final) should be given invariably for drawing meaningful conclusions.

Dr. A. Nagaraja presented the highlights of Plant Pathology. The brief research highlights are as below

- Head blast pressure was low to moderate in Andhra Pradesh, Chattisgarh, Karnataka, Odisha and Tamil Nadu, whereas high blast prevailed on local varieties in Jharkhand and Uttarakhand. Brown spot and foot rot were low to moderate in Odisha and Tamil Nadu while cercospora leaf spot remained high in Uttarakhand. On foxtail millet blast, rust and downy mildew occurrence was low in Andhra Pradesh, whereas in Uttarakhand grain smut was low to high, but sheath blight was low on barnyard millet. In little millet grain smut and banded blight ranged from low to high; in kodo millet head smut, banded blight and *Striga* occurrence was of low to moderate intensity in Madhya Pradesh.
- Among the germplasm, finger millet line VR-13-14 was immune to both neck and finger blasts at Almora, whereas at Mandya varieties GN 4, GN 5 and Dapoli 1 were not only immune to head blast, but were highly resistant to foot rot. At Almora ten IEC lines of barnyard millet were immune to grain smut. Out of the 1034 *Setaria* lines screened at Nandyal, though many were resistant, a total of 775 lines were free from both downy mildew and blast.
- In finger millet IVT, BR 14-3 for blast and PR 10-35 for banded blight were highly promising, whereas in AVT I & II while no entry was superior for banded blight and CLS, VL 379 showed moderate resistance to neck blast. Five LAVT lines viz., KOPLM 53, GPUL 2, WV 126, DLM 95 and DHLT 28-4 were free from grain smut; KAVT entry DPS 118 was highly resistant to head smut whereas BAVT line DHBM 18-6 was resistant to grain smut. FAVT entries, SiA 3164 for brown spot and rust, DHFT 5-6 for rust and blast, H-4-6 for rust and downy mildew were resistant.
- In correlation studies at Ranichauri, with increase in average temperature, the CLS severity decreased. Incidence of foxtail millet blast was negatively correlated with maximum temperature, but was positively correlated with minimum temperature, relative humidity (morning and evening) and rainfall, but, rust incidence was positively correlated with maximum temperature and relative humidity (morning and evening); at the same time it was negatively correlated with minimum temperature and rainfall.
- In the eco-friendly management of banded/ sheath blight over locations and amongst different small millets, soil application of value added *P.f.+T.v.+B.s.* not only minimized disease, but also enhanced grain and fodder yields.

Dr.Prabhu C. Ganiger presented research highlights of Entomology. Highlights are as below

Pest scenario in small millets:

- In finger millet, the grasshopper is a major biotic constraint followed by the Pink stem borer (*Sesamia inferens*), Aphids (leaf aphid and panicle aphid), *Myloccerus* weevil and ear head caterpillar, etc.
- The low population of grass hopper (2.3/m²) and moderate damage by grasshopper 0 to 40 per cent recorded at Berhampur. Aphid incidence was high on leaf ranges from 0 to 40 % compared to panicle aphid 20-30 %.
- *Myloccerus* weevil noticed very low incidence 0 to 2/m². Dead heart caused by stem borer ranged from 0 to 2%. At Ranchi, grasshopper population was 2.0 to 7.0/m² and moderate damage by grasshopper 2.3 to 10.2 per cent.
- Aphid incidence was high on leaf ranges from 0 to 4.0 % compared to panicle aphid 0 -2.0 %. *Myloccerus* weevil noticed very low incidence 0 to 6.0/m².
- Earhead web worm (0 -3%) and earhead caterpillar (20-30 %) was recorded at Bangalore.
- Shoot fly was the major pest on other millets (viz., kodo, little, proso, foxtail and baryard millet) at four different centres.

Management of shoot fly in small millets

- In little millet, all India average was recorded highest yield 804 kg/ha in treatment spraying of 1500 ppm azadirachtin at 15 DAS followed by 796 kg/ha in NSKE 5 % at 15 DAS, 1.5 times recommended seed rate (734 kg/ha) and sprayed with NSKE 5 % at 7 DAS (703 kg/ha) treatments are significantly different from control.

- In proso millet, the highest yield 385 kg/ha recorded in treatment spraying of 1500 ppm azadirachtin at 15 DAS followed by 370 kg/ha in NSKE 5 % at 15 DAS, 1500 ppm azadirachtin at 25 DAS (358.6 kg/ha), early sowing (7 days before normal sowing) (334.4 kg/ha) and 1.5 times recommended seed rate (325.9 %) treatments are significantly differ compared to control.

While answering to a query, Dr Prabhu informed the house that the screening was done under natural conditions only. The house suggested that it is better to collect the dead hearts for better representation of the incidence rather than fish meal bait. Dr Seetharam Ex PC suggested that after repeated screening of the entries for 2-3 years it should be advanced to further generations and then handed over to breeder for further utilization in crossing programme. Dr Gangadharappa, Director of Research advised that the conclusion may be drawn and present the inference in 2-3 lines for effective presentation. Dr Tonapi informed the house that shoot pest nursery is being maintained at ICAR IIMR which can be better utilized for screening purpose in a collaborative manner.

Dr Nanja Reddy presented the research highlights of Plant physiology and told that there were four trials conducted at PC unit, Bengaluru.

- Physiological studies are focused on identification of physiological traits associated with yield potential under normal and moisture stress conditions in germplasm accessions and mapping population.
- A few germplasm accessions for high yield potential and drought tolerance through physiological traits have been identified.
- Application of zinc either through soil or foliar application did not result in significant increase in grain yield.

He informed that for ideal plant type of finger millet the plant should be of medium duration (110-115 days), medium plant height (110-115 cm) with 120 tillers/m² and LAI of 2.34 for getting higher yield. He also told that when stress was imposed for 28 days during anthesis, the yield reduction was up to 25%. Dr Haider suggested that in addition to bio fortification through soil or foliar application, it is better to identify the entries which can mine the zinc very effectively from the soil and utilize them.

Dr Boraiah presented the results pertaining to FLDs and he informed the house that totally 300 FLDs were conducted in small millets throughout the country.

- During *Kharif 2016-17*, 300 frontline demonstrations (FLDs) on small millets were organized in nine districts across country viz., Andhra Pradesh, Chattisgarh, Gujarath, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Tamil Nadu and Uttarakhand on farmer's fields.
- The demonstrated varieties of finger millet, foxtail millet, kodo millet, little millet, barnyard millet and proso millet gave 52.63 %, 81.19%, 17.31 %, 169.50%, 110%, 136.34%, 77.36%, 83.61%, 29.14%, 33%, 41.57% and 13.68% higher grain and fodder yields respectively than the local checks.

Dr Krishne Gowda, Ex PC suggested that the results obtained from different location may be grouped state wise for analysis and identify the gaps between FLDs and farmers practice. Dr Gangadharappa, Director of Research advised to increase the number of FLDs and proposals may be submitted to DMD so as to extend the area with new varieties or technologies.

Dr Munirajappa presented the results of TSP and programmes conducted in North Eastern Hill region. He informed that 520 ha was covered under TSP programme and for the first time the TSP was implemented in NEH covering Sikkim, Assam and Tripura. The Chairman and co chairman advised that it is better to have an impact assessment survey and documentation of the impact of TSP.

Tribal Sub Plan:

- The TSP programme was carried out in six centres viz., Jagdalpur, Athiyandal, Dindori, Mandya, Vizianagaram and P.C unit (Palakkad, Kerala) and the amount of Rs. 29.50 lakhs was released to different centres.
- At Mandya, there was 45 % improvement in yield in farmer's fields with improved practice as compared to local practice in finger millet..
- At Dindori, the demonstrations in farmers field in 20.0 ha area in kodo millet indicated that there was an increase of 89.72% in improved practice over farmers practice. Demonstrations in farmers field in 10.0 ha area in little millet indicated that there was an increase of 102.16% increase in grain yield in improved practice over farmers practice.
- At Vizianagaram, the demonstrations in farmer's field in finger millet indicated that there was an increase of 79.30% increase in grain yield in improved practice against farmers practice.

Popularization of small millets in NEH Region

- As of now, few varieties of millets are sporadically grown by the tribal farmers and consumed in parts of Assam and adjoining the North-Eastern states in limited quantity. The popularization of small millets in this region is important to uplift the economic level of the farmers.
- A total of Rs. 31.08 lakhs has been allocated three centres, viz. Gossaigaon in Assam, Agartala in Tripura and Namthumg, Sikkim to popularise the small millets in NEH region by way of conducting demonstration in farmer's fields in Summer and kharif 2017.
- Besides, implements like thresher and de-husker have been provided to all the three centres.

Session – III: Review of research: Scientific audit of AICRP centres

Chairman:	Dr. T Sheshadri, ADR, UAS, Bengaluru
Co-Chairman:	Dr. Prabhakar, Project Coordinator (SM)
Rapporteurs:	Drs. RK Khulbe and LN Yogeesh

Chairman welcomed the delegates and the officer In-charge of the centres were asked to present research highlights of all the disciplines of their centre during the year. Accordingly, presentations were made by the concerned Officer In-charge's of the centres within the stipulated time.

1. Athiyandal Centre: Dr. Nirmala Kumari presented the research highlights
 - One barnyard millet variety MDU 1 was released for Tamilnadu state.
 - Centre is maintaining about 3990 accessions of various small millets.

The centre has a strong breeding programme with promising segregating materials for specific traits on all small millets which received appreciation from the Chairman. The centre was advised to share these accessions with other centres working on these crops to strengthen their breeding programmes

2. Berhampur: Dr Pavitra Mohan presented the research highlights
 - One finger millet variety OEB 526 (Arjuna) was released at national level and another variety OEB 532 (Kalua) was released for Orissa state. They are being registered at PPV @&FRA.

The centre was advised to contribute entries for AICRP trials every year and generate breeding material in finger millet and little millet. Also, the centre was advised to take up seed production of recently released varieties in large scale and popularize them in the state.

3. Dindori: Dr. OP Dubey presented the research highlights
 - Proposal of one little millet variety DLM 103 has been submitted to SVRC
 - The centre has initiated mutation breeding kodo millet and has identified some promising material in M₂ generation.

It was suggested to give more attention and properly conduct the trials in all disciplines at the centre.

4. Dholi: Dr SK Singh presented the research highlights
 - One foxtail millet variety Rajendra Kauni 1 has been released and notified
 - About 500 accessions of finger millet, foxtail millet and proso millet were evaluated and maintained.

Breeder was advised to strengthen centre's breeding programme by using elite material available with other centres. The germplasm should be submitted to PC Unit, Bengaluru with passport data.

5. Jagdalpur: Dr. Ashwani Thakur presented the research highlights
 - One little millet variety Chattisgarh Kutki 2 (BL 4) has been notified for the state.

About 200 accessions of finger millet, kodo millet and little millet were maintained at the centre and breeder was asked to take up hybridization programme in little millet also. The centre was asked to give report on the performance of finger millet on their experimentation this year. The chairman appreciated the efforts of the centre to get a University project on processing and value addition of small millets.

6. Kolhapur: Dr. Ram Nigade presented the research highlights

- One barnyard millet variety Phule Bati (KOPBM 46) recommended for release for Maharashtra state.

About 250 accessions of different small millets were evaluated and maintained. The centre was asked to popularize the latest released varieties in finger millet, little millet and Barnyard millet and submit the available germplasm to PC Unit, Bengaluru with passport data.

7. Mandya: Dr Ravi Shankar presented the research highlights

- One white finger millet variety KMR 340 released for Zone V and Zone VI.
- About 2050 finger millet accessions are being maintained at the centre
- Soil application of 500 g P.f. + 500 T.v. kg talc powder with 25-30 kg of compost incubated for one week and applied over one acre recommended for management of foot rot disease of finger millet under irrigated condition
- Application of 75% RDF through briquettes found to give higher grain and fodder yield and B:C ratio in finger millet
- SRI method of planting in finger millet found superior over other methods of establishment
- Three crosses (PR 202 X 1409, I 5 X 1409 and I 5 x 2712) identified as sources of resistance (neck and finger blast < 1 per cent).

The centre has generated a lot of breeding material in finger millet for all the desirable traits, which was appreciated by the Chairman. The centre was asked to share the breeding material among centres.

8. Nandyal: Dr. Muniratnam presented the research highlights

- Pre-release varieties SiA 3222 AND SiA 3223 of foxtail millet are under minikt testing in the state
- Foxtail millet-Bengal gram system fetched 35 per cent higher returns compared to the prevalent Fallow-Bengal gram system

The centre produced about 210 q seed of different foxtail varieties and the centre was asked to popularize the foxtail millet before chick pea. Breeder was asked to contribute and share the promising segregating materials among centres.

9. Ranichauri : Dr Laxmi Rawat presented the research highlights

- Out of over 2000 finger millet accessions screened against Cercospora Leaf Spot, more than 200 were found resistant
- Correlation of CLS development with weather data revealed that disease development was high with high temperature and low rainfall
- Soil application of vermicompost impregnated with *Pseudomonas* isolate UUHF Psf 1 was identified as the best treatment for controlling grain smut and brown smut in barnyard millet.

The centre was requested to pursue the posting of Breeder as the breeding programme and seed production programme is handicapped.

10. Ranchi: : Dr ZA Haider presented the research highlights

- One finger millet variety Birsa Marua 3 released for Jharkhand state.
- About 161 accessions of finger millet were evaluated and BBM 10 and GE 320 were found promising both for yield and neck & finger blast
- Application of 100 per cent RDF along with Zinc (12.5 kg/ha), Boron (5 kg/ha), FYM (2.5 t/ha) and seed dressing with biofertilizers (3g/kg seed) was found the best option for yield maximization in poor soils.
- SRI method of transplanting was found to be the best method of crop establishment in transplanted finger millet
- Intercropping of little millet and pigeonpea (4:2) was found to be the best cropping sequence

- ITK: placing of little millet straw at the entry point of irrigation water in rice field to reduce incidence of rice case worm and spray of 5% well rotten bamboo spouts to check shoot fly incidence in little millet.

The centre was asked to initiate breeding programme and evaluate the shared breeding material by other centres.

11. Vizianagaram: Dr Samuel Patro presented the research highlights
- One finger millet variety VR 900 proposed for release at state level
 - One thousand accessions of finger millet were evaluated. A total of 3265 finger millet accessions are being maintained at the centre
 - About 210 q nucleus and breeder seed of finger millet produced.
 - Characterization of a new virus (Bacilliform double stranded DNA virus) on a local variety – a world first
 - Soil and foliar application of $ZnSO_4$ (12.5 kg/ha) recorded significant increase in grain and yield.

Officer In-charge was asked to look into the purity of breeder seed produced. The programmes conducted under Tribal Sub Plan were appreciated by the chairman.

12. Waghai: Dr. Harshal Patil presented the research highlights
- One variety of white finger millet (Gujarat Navsari Nagli 7), one of little millet (Gujarat Navsari Vari 3) and one of kodo millet (Gujarat Kodra 3) released
 - One thousand accessions of finger millet were evaluated. A total of 3265 finger millet accessions are being maintained at the centre

The centre was asked to take up intensive research on little millet also. The chairman appreciated the cooperation of scientists of the university in evaluating breeding materials for agronomical superiority, insect-pests and diseases.

13. Rewa: Dr. AK Jain presented the research highlights
- One variety of kodo millet namely JK 137 has been released and notified for rainfed areas of M.P. (102(E)13.1.2016 SR) and another variety of little millet namely JK 4 has been released and notified for rainfed areas of M.P. (Recommended for notification in 75th CVRC (Sl. No. 153)

Many donors for sheath blight of Kodo millet, little millet and foxtail millet are identified and they should be utilized by breeders.

The session ended with vote of thanks to the chair.

Session V: Presentation of lead topics

Chairman: Dr.A Seetharam, Ex. Project Coordinator (Small millets),
Co-Chairman: Dr. Prabhakar, Project Coordinator (Small Millets),
Rapporteurs: Dr. Brij Mohan pandey, ICAR-VPKAS, Almora
Mr. Raveendra, H.R., ZARS, Mandya

At the outset the Chairman welcomed the gathering and introduced with the speakers of the session. In total six presentations were made on different topics viz., two each on Millet Improvement, Millet Production and Processing and value addition.

The first presentation was given by Dr. N. Devkumar, Professor and Head, Centre of Organic Farming, UAS, Bengaluru on "Guli method of cultivation in ragi." He expressed that the Guli method is very popular among farming community of Tamil Nadu, Andhra Pradesh and Chhattisgarh states. The method is similar to System of Rice Intensification and gives more grain as well as straw yield than the normal practice followed entire the country. He opined that the centre is not convincing the farmer for the technology but validating the farmer practice.

Another lecture was delivered by Dr. M. Elangovan, Principal Scientist, ICAR-IIMR, Hyderabad on "Digitalization of millets genetic resources management". He informed the house that the work has been carried out under the dream project of Hon'ble Prime Minister for Digital India. He made acquainted the house with the complete procedure of using the mobile application for data entry in the form of Field Book.

The third presentation was made on "Hybrids in finger millet: Fantasy or possibility" by Dr. M.V Channabyre Gowda, Ex. Project Coordinator (Small Millets). He informed the house about the work carried out for Hybridization by using partial male sterility in finger millet with a back ground of high yielding blast resistant variety GPU 28. He emphasized on essential requirement to develop hybrids in finger millet like presence of hybrid vigour, elimination of fertile pollen and the adequate pollination by male parent. The Chairman hoped that the whole finger millet group will make sincere effort for developing a finger millet hybrid.

Dr. K.T. Krishne Gowda, Ex. Project Coordinator (Small millets) gave a presentation on "Role of small millets in enhancing system productivity in sustainable agriculture". He emphasized upon the soil factor and choice of variety for different millet crops for mitigating the challenges of Climate Change. He said that there is need to work more on mechanization for reducing the cost of cultivation, and transfer of technology among millet farmers. He informed the gathering that the millet crops are having very good water use efficiency and being a C4 plant, are most suitable for rainfed situation.

At last, the presentations were made by Dr. N.G. Malleshi, Retd. Scientist, CFTRI, Mysore and Dr. H.B. Shivaleela, University Head, Department of Food and Nutrition, UAS, Bengaluru on "Recent advances in processing and value addition in small millets" and "Nutrition and value added products in small millets", respectively. Dr. Malleshi informed the scientists that after huge effort of nine organizations we are still waiting for a millet mill having 100 per-cent recovery of dehulled grain. He gave a note on various characteristics of a machine for the milling of different millet crops. He emphasized on breeding of millet varieties for the specific use and constitution of Millet Processor Association and planning of giving subsidy or interest free loan to them. He also gave information about the various private sector organization involved in millet products.

Considering millet as wonder seed, Dr. Shivaleela informed the gathering about the benefits of millets and their value added products for Happy Farmer and Healthy Earth. She gave a brief note on the work being carried out by UAS, Bengaluru on popularization of the value added millet products. She quoted the importance of millet for safety, security and sustainability in climate change scenario. The session ended with vote of thanks to the chair.

Session VI: Plenary Session

- Chairman** : Dr DP Kumar, Director of Extension, UAS, Bengaluru
- Co-chairman** : Dr M.A.Shankar, Ex-Director of Research, UAS, Bengaluru
: Dr. NR Gangadharappa, Director of Research, UAS, Bengaluru
- Rapporteurs** : Dr CV Chandra Mohan Reddy, Scientist (GPB), RARS, Nandyal
Dr Harshal Patil, Associate Scientist (GPB) & Head, NAU, Waghai

At the outset, the Chairman and Co-chairman welcomed all the delegates and asked all the Principal Investigators of the project to make a brief presentation of session-wise recommendation and technical programme for the year 2017-18 as finalized in the discipline-wise technical group meetings held on the first day.

Dr. Ravishankar presented the salient recommendations and briefed the technical programme of breeding. He informed that naming of trials is restructured and checks are updated in all six small millet crops. The new entries are to be submitted before 30th April 2017 for including in the trials. He mentioned that from this year the entries were retained and promoted based on the new selection criteria adopted in the technical group meeting. All breeders need to essentially adopt hybridization techniques in their concern crops to broaden genetic variability and use in breeding programme. The sharing of breeding materials among the centres has been given priority. On the suggestions of the house, in south zone, the name of the centre Behrampur, was replaced by Igatpuri for evaluation of finger millet entries and similarly, Guntur was added for testing 2 or more crops. As there were no other specific issues, the technical programme for the year 2017-18 was accepted as such for implementation.

Dr Boraiah presented the recommendations and briefed the technical programme of Agronomy. He informed the house that 23 trials were concluded, the remaining 20 trials will be continued in addition to 4 new trials. Dr Nirmala Kumari, told that due to less number of locations in testing, the yield of pre release entries are not properly representing which is becoming constraint for release of the variety. Therefore, some arrangements are to be made to solve this problem. Naming is suggested for System Finger Millet Intensification (SFMI) in place of SRI and it was adopted. As there were no other specific issues, the technical programme for the year 2017-18 was accepted in-toto for implementation.

While presenting the recommendations and technical programme of Plant Pathology, Dr. Nagaraja informed that in ragi, blast pressure was low to moderate in AP, Chattisgarh, Karnataka, Odisha and Tamilnadu whereas high disease prevailed on local varieties of Jharkhand and Uttarkhand, whereas cercospora leaf spot remained high in Uttarakhand. Banded blight trial of finger millet and little millet are constituted for VPKAS, Almora centre also. As there were no other specific issues, the technical programme for the year 2017-18 was accepted for implementation.

The recommendations and technical programme of Entomology were presented by Dr.Prabhu C.Ganiger. While answering to a query Dr Prabhu informed the house that the screening was done under natural conditions only. The house suggested that it is better to collect the dead hearts for better representation of the incidence rather than fish meal bait. On the request of Ranchi entomologist, Barnyard millet trial was deleted from Ranchi centre. As there were no other specific issues, the technical programme for the year 2017-18 was accepted as such for implementation.

Dr Nanja Reddy presented the recommendations and technical programme of Plant physiology and informed that there were four trials conducted at PC unit, Bengaluru. He informed that for ideal plant type of finger millet the plant should be of medium duration (110-115 days), medium plant height (110-115 cm) with 120 tillers/m² and LAI of 2.34 for getting higher yield. As there were no other specific issues, the technical programme for the year 2017-18 was accepted for implementation

Dr. Boraiah presented the recommendations and technical programme of Frontline demonstrations and he informed the house that totally 300 FLDs were conducted in small millets throughout the country and plan for conduct of 325 FLDs were proposed for 2017-18. As there was a request to increase the number of FLDs, Project Coordinator (Small Millets) alarmed the PI to constrain the FLDs to 300 ha only and should not exceed due to financial limitation. As there were no other specific issues, the technical programme for the year 2017-18 was accepted for implementation.

After the presentations of recommendations and technical programmes of various disciplines by Principal Investigators of the project, Dr Prabhakar, Project Coordinator (Small Millets) detailed on the genesis of identifying the best performing centres among AICRP centres. From this year onwards, Best centre awards were given to the best performing centres of AICRP on Small Millets based on criteria of selection by a committee constituted for the purpose. Based on the recommendations by committee, two centres namely ARS, Vizianagaram and ZARS, Mandya were chosen and awarded for their overall performance during 2016-17.

After the award of best performing centres, Dr. Prabhu Ganiger conducted the programme on felicitation of retiring AICRP Scientists during this year and recollected their invaluable contributions for the success of small millets research. Felicitations were given Dr. M Krishnappa, Breeder, and Shri R Munirajappa, Statistician, PC Unit, AICRP on Small Millets, Bengaluru for superannuation during this year 2017 by the group with shawl and mementos. Meanwhile two centres ARS, Vizianagaram and Nandyal, ANGRAU also felicitated the retirees.

Dr. DP Kumar, Chairman, Drs. MA Shankar and NR Gangadharappa, Co-chairmen of the session expressed that our major thrust is to popularize the small millet crops across India and create demand for grain, fodder and value added products. They further stressed on the need to achieve higher productivity particularly in small millets other than finger millet as the crops are becoming very popular in recent years for food and nutritional security. The Chairman appreciated all the scientists for the excellent research work during the year and urged to work more intensively for regaining the lost area and help in increased production of small millets.

Finally, Dr. Prabhakar, Project Coordinator (Small Millets) proposed vote of thanks to all for overall success of 28th AGM of AICRP on Small Millets and the Annual Group meeting was declared as closed at 6.00 p.m.

Part B: Proceedings of discipline-wise technical group meetings and recommendations

Technical programme for the year 2017-18

1. Breeding

Chairman: Dr. RS Kulkarni, EX-Director of Extension and Head, Dept of Plant Breeding
Co-Chairman: Dr. Prabhakar, Project Coordinator (SM)
Convener: Dr. CR Ravishankar, PI, Plant Breeding & ADR

The discipline-wise technical programmes were discussed and finalised in the session IV and the technical programme was finalised under the Chairmanship of Dr. RS Kulkarni, EX-Director of Extension and Head, Dept of Plant Breeding, UAS, Bangalore. The following issues are discussed in the Technical programme of breeding and finalised.

I: Naming of coordinated breeding trials

The following naming the trials from Kharif 2017 were decided and finalised as below.

1. Finger millet Initial Varietal Trial in South Zone
2. Finger millet Initial Varietal Trial in North Zone
3. Advanced Varietal Trial in Finger millet – Early & Medium duration, Long (AVT- I): South zone
4. Advanced Varietal Trial in Finger millet – Early & Medium duration, Long (AVT- I): North zone
5. Foxtail millet Initial and Advanced Varietal Trial (FIAVT)
6. Kodo millet Initial and Advanced Varietal Trial (KIAVT)
7. Little millet Initial and Advanced Varietal Trial (LIAVT)
8. Barnyard millet Initial and Advanced Varietal Trial (BIAVT)
9. Proso millet Initial and Advanced Varietal Trial (PIAVT)

Besides, it has also been finalized to adopt new coordinated project names for all the crops, like FINV, FOXV, BARV, KODV, LITV, PROV series for the new entries from Kharif 2017.

II. Review on checks being used in breeding trials and new checks to be added

In all, nine coordinated trials were formulated - 2 in finger millet and one each in kodo millet, foxtail millet, little millet, barnyard millet and proso millet. The details of entries, checks for various trials and testing centres for each trial were discussed and changes are made as in the Annexure -I

III. Sharing of breeding materials

The breeding materials should be shared among centres in all crops. Breeders are requested to contribute the segregating generation materials and send to PC Unit. A common set will be prepared and sent for evaluation across locations. Due credit will be given to breeders who share the materials and it would give an opportunity for the evaluation of materials in initial stage and help in identification of desirable materials at various locations according the objectives of the centre.

IV. National hybridisation programme

In order to generate new breeding materials, all the centres need to take up hybridisation programme compulsorily. The training for hybridisation programme was conducted last year and it is planned to conduct the training this year also for the benefit of all the breeders. The parents that can be used in hybridisation

programme for trait-wise are finalised and a crossing plan for the centres will be prepared and allotted. The breeders need to take up crossing programme as per the plan.

V. Criteria for promotion of entries

The promotion of entries from IVT to AVT-I and AVT-I to AVT-II would be strictly based on the overall performance/merit of the test entries. In the previous workshop, it was decided to adopt the procedure followed by Sorghum/Pearl millet crop for promotion of entries in coordinated trials of small millet also as there is no set procedure followed in these crops. Based on this, a criterion similar to sorghum has been devised and finalized as below.

In the previous workshop, it was decided to adopt the procedure followed by Sorghum/Pearl millet crop for promotion of entries in coordinated trials of small millet also as there is no set procedure followed in these crops. Based on this, a criterion similar to sorghum has been devised and followed.

Criteria 1: Outstanding performance for yield/main produce of the economic importance (by a margin of 10%) over the best performing check without compromising on other important features.

Criteria 2: More than 5% increase in GY over elite check, fodder yield on par or more than the check and disease/pest incidence numerically less or on par with the elite check

Criteria 3: In case of early duration varieties, more than 5% increase in GY over the elite early duration check, fodder yield on par/more than the check, and disease/pest incidence numerically less or on par with the elite check

Criteria 4: GY numerically on par or more than the elite check and significantly superior for major pest and disease resistance or significantly superior for grain and fodder quality, Yield marginally lower than the best performing check but outstanding in one or more strategic features relevant to the crop such as extra earliness, specific industrial product property, nutritional superiority etc..

Criteria 5: Variety or Hybrid based on diverse cytoplasm with numerical superiority or on par with the check on all the traits of interest

VI. Other issues discussed and finalized.

1. As the DUS guidelines are finalized, the AVT entries are to be characterized as per DUS guidelines in all crops of small millets.
2. The germplasm should be sent to PC Unit with passport data and also efforts to be made for getting IC numbers.
3. Materials and germplasm available are to be shared as per existing MTA.
4. For contribution of new entries, the centres are requested to send 3 kg each and it would be 2 entries per crop
5. ICAR-IIMR, Hyderabad would be allotted 5 coordinated trials (other than finger millet)
6. ICAR-IIMR, Hyderabad also would be allotted breeder seed allocation from this year for all the six crops, viz. Two varieties each crop.
7. Scientists are requested to propose new projects and collaborate with ICAR-IIMR for basic and strategic research.
8. Collaboration with BARC, Mumbai should be explored for mutation breeding.
9. For analyzing nutritional parameters, scientists are requested to take help from concerned universities, ICAR-IIMR, Hyderabad and NIN, Hyderabad.

VII. Formulation of technical programme for Kharif 2017-18

Based on the promotion of criteria decided, the entries were promoted and decided as below.

1) Finger millet Initial Varietal Trial in South Zone: Kharif 2017

South Zone				North Zone			
S. No.	States	No. of centres	Centres	S. No.	States	No. of centres	Centres
1	Andhra Pradesh	3	Vizianagaram, Chintapalle, Perumallapalle, Peddapuram	1	Bihar	1	Dholi
2	Chattisgarh	1	Jagdalpur	2	Jharkhand	1	Ranchi
3	Gujarat	2	Dahod, Waghai	3	Madhya Pradesh	2	Dindori, Rewa
4	Karnataka	3	Bangalore, Mandya, Hanumanamatti	4	Uttarakhand	4	Almora , Gaja Majhera Ranichauri
5	Maharashtra	2	Dapoli, Kolhapur, Berhampur	5	North east	2	Gossaigaon Agartala
6	Tamil nadu	1	Athiyandal				
7	Odisha	1	Berhampur				
	Total	13			Total	10	

New entries	Will be finalized and added after the receipt of seeds along with data
Checks	VL 352,GPU 45,GPU 67, PR 202

2. Finger millet Initial Varietal Trial in North Zone: Kharif 2017

New entries	Will be finalized and added after the receipt of seeds along with data
Checks	VL 352,GPU 45,GPU 67, PR 202

3. Advanced Varietal Trial in Finger millet – Early & Medium duration, Long (AVT- I): South zone

South Zone				North Zone			
S. No.	States	No. of centres	Centres	S. No.	States	No. of centres	Centres
1	Andhra Pradesh	3	Vizianagaram, Chintapalle, Perumallapalle, Peddapuram	1	Bihar	1	Dholi
2	Chattisgarh	1	Jagdalpur	2	Jharkhand	1	Ranchi
3	Gujarat	2	Dahod, Waghai	3	Madhya Pradesh	2	Dindori, Rewa
4	Karnataka	3	Bangalore, Mandya, Hanumanamatti	4	Uttarakhand	4	Almora , Gaja Majhera Ranichauri

5	Maharashtra	3	Dapoli, Kolhapur, Igatpuri	5	North east	2	Gossaigaon Agartala
6	Tamil nadu	1	Athiyandal				
7	Odisha	1	Berhampur				
	Total	14			Total	10	

Promoted	BR 14-3, PR 10-35, KOPN 942
Retained	VL 386
Checks	GPU 45, VL 352 , GPU 67, PR 202 (4)

4. Advanced Varietal Trial in Finger millet – Early & Medium duration, Long (AVT- I): North zone

Promoted	DHFM 78-33, KOPN 942, BR 14-3, VL 387, KMR 630, PR 10-35, GPU 94, GPU-93, TNEC 1281, VL 503
Retained	VL-386
Checks	GPU 45, VL 352 , GPU 67, PR 202 (4)

5. Foxtail millet Initial and Advanced Varietal Trial (FIAVT)

S. No.	State	No. of centers	Name of testing centers
1	Andhra Pradesh	4	Nandyal , Vizianagaram, Palem , Guntur
2	Bihar	1	Dholi
3	Jharkhand	1	Ranchi
4	Karnataka	3	Bangalore, Hanumanamatti and Mandya
5	Madhya Pradesh	2	Rewa, Dindori
6	Tamil Nadu	1	Athiyandal
7	Telangana	1	IIMR, Hyderabad
8	Maharashtra	1	IIMR, Solapur
9	North east	2	Gossaigaon and Agartala
Total no. of centres		17	

New entries	Will be finalized and added after the receipt of seeds along with data
Retained	DHFT 5-6, DHFT 77-3, SiA 3179
Checks	SiA 326 and SiA 3156

6. Kodo millet Initial and Advanced Varietal Trial (KIAVT)

S. No.	State	No. of centers	Name of testing centers
1	Andhra Pradesh	2	Nandyal
2	Chattisgarh	1	Jagdarpur

3	Gujarat	1	Dahod
4	Jharkhand	1	Ranchi
5	Karnataka	1	Bangalore
6	Madhya Pradesh	2	Dindori and Rewa
7	Tamil Nadu	3	Athiyandal, Pudukottai and Aruppukottai
8	Telangana	1	IIMR, Hyderabad
Total no. of centers		12	

New entries	Will be finalized and added after the receipt of seeds along with data
Retained	BK 48, TNPSC 176, BK 36, RK 64
Checks	TNAU-86, RK-390-25, GPUK 3 (3)

7. Little millet Initial and Advanced Varietal Trial (LIAVT)

Sl. No.	State	No of centers	Name of testing centers
1	Chattisgarh	1	Jagdalpur
2	Gujarat	1	Waghai
3	Jharkhand	1	Ranchi
4	Karnataka	3	Bangalore, Hagari, and Hanumanamatti
5	Odisha	1	Berhampur
6	Tamil Nadu	2	Athiyandal and Paiyur
7	Madhya Pradesh	2	Rewa and Dindori
8	Maharashtra	2	Kolhapur , Igatpuri
9	Andhra Pradesh	3	Vizianagaram, Perumalapalli, Guntur
10	Telangana	1	IIMR, Hyderabad
Total no. of centers		17	

New entries	Will be finalized and added after the receipt of seeds along with data
Retained	DHLT 28-4, WV 126, DLM 95
Checks	JK 8, OLM 203 and BL 6 (3)

8. Barnyard millet Initial and Advanced Varietal Trial (BIAVT)

S. No.	State	No. of centers	Name of testing centers
1	Andhra Pradesh	3	Vizianagaram ,Palem, Guntur
2	Karnataka	1	Bangalore
3	Madhya Pradesh	2	Dindori and Rewa
4	Tamil Nadu	3	Athiyandal, Chettinad and Madurai
5	Uttarakhand	3	Almora, Gaja and Ranichauri

6	Telangana	1	IIMR, Hyderabad
Total no. of centres		13	

New entries	Will be finalized and added after the receipt of seeds along with data		
Retained	VL 249, DHBM 99-6		
Checks	VL 172, VL 207		(2)

9. Proso millet Initial and Advanced Varietal Trial (PIAVT)

S. No.	State	No. of centers	Name of testing centers
1	Andhra Pradesh	3	Guntur, Palem and Nandyal
2	Bihar	1	Dholi
3	Karnataka	3	Bangalore, Hagari and Hanumanamatti
4	Tamil Nadu	2	Athiyandal, Pudukottai
5	Telangana	1	IIMR, Hyderabad
Total no. of centres		10	
New entries		Will be finalized and added after the receipt of seeds along with data	
Retained		TNPM 238, GPUP 25	
Checks		TNAU 164, GPUP 21, TNAU 151	(3)

Deadline for submission of entries: 30th April 2017

Deadline for submission of data: 31st December 2017

Quantities of seeds to be submitted under various stages of trials are as follows:

IVT : 3 kg AVT I : 5 kg
 AVT II : 5 kg for breeding and 5 kg for agronomy

The germination percentage of the seeds should be a minimum of 90%. Failing in any of the above criteria the entry will be rejected and informed.

VII. Allocation for Nucleus and breeder seed of varieties for Kharif 2017

The allocation has been made based on consolidated indent as placed on the web site of www.seednet.gov.in of DOA and MOA, New Delhi. The BSP program was finalized during 28th Annual Group Meeting of AICRP on Small Millets held at UAS, Bengaluru on April 14-15, 2017. All the Breeders/ Nodal officers concerned with small millets seed production are requested to take necessary action to organize the seed production as per the allocation and make all the efforts to achieve the target. If your seed production fails in a particular season, then contingency plans are to be made to produce in next favorable season in the same production year.

The schedule of sending BSP proformae is as follows:

BSP II : Immediately after planting
 BSP III : Immediately after inspection by monitoring team.
 BSP IV : Communication of final seed production figures (Last Date: 30th November)
 BSP V : Lifting Status against indent

BSP-I: Allocation of breeder's seed production (National varieties)

Year of Indent: 2018-19

Year of production: 2017-18

S. No	Location/ Crop	Name and address of the Breeder	Variety	DAC Indent	Quantities to be Produced in (quintals)	Organization for whom seed is to be produced		Members of monitoring team
1. Almora (Uttarakhand)						State	Quantity	
A)	Finger millet	Dr. RK Khulbe Sr. Scientist (Breeding) ICAR- Vivekananda Parvathiya Krishi Anusandhan Sansthan (VPKAS), Almora -263 601 (Uttarakhand)	VL 352	0.84	0.25	Odisha NSC Uttarakhand	0.04 0.10 0.70	1. Dr. Brij Mohan Pandey, Sr. Scientist (Agronomy) ICAR-V.P.K.A.S, Almora 2. Director, State Seed Certification Agency Basanth Vihar, Dehradun, Uttarkhand – 248 006 3. Managing Director Uttarakhand Seed & Tarai Development Corporation , Pant nagar, P.O. Haldi, Dist. Nainital, Uttarkhand
			VL 315	0.25	0.50	Bihar	0.25	
			VL Mandua 347	0.75	1.25	Uttarakhand Bihar	0.50 0.25	
			VL 348	0.50	1.00	Uttarakhand	0.50	
B)	Barnyard millet		VL Madira 207	1.50	2.50	Uttarakhand Bihar Tamil Nadu	1.00 0.50	
			Sub total	3.84	6.75		3.84	
2. UAS, NSP Unit, Bengaluru								
A)	Finger millet	Dr. Ramanappa/ Special Officer (Seeds), National Seed Project, GKVK, UAS, Bengaluru- 560 065	GPU 28	2.32	4.00	NSC CG Jharkhand K1Ka	0.10 1.00 0.02 1.20	1. Geneticist, P.C. Unit (Small Millets), GKVK, Bangalore- 560065 2. Director, Karnataka State Seeds & Organic Certification Agency, Bellary Road, Hebbal, Bangalore 560024, Karnataka. 3. Regional Manager, National Seeds Corporation, Hebbal, Bangalore 560024, Karnataka
			GPU 48	0.35	0.50	Bihar Karnataka	0.25 0.10	
			GPU 67	5.12	10.00	Jharkhand Bihar Tamil Nadu NSC	0.02 4.50 0.50 0.10	
B)	Finger millet	Dr. Shylaja Hittalamani Professor, Dept. of Plant Breeding, UAS, GKVK	ML 365	3.75	6.00	Karnataka Bihar NSC Tamil Nadu	1.15 2.00 0.10 0.50	
						Sub Total	11.54	
3. Kolhapur								
A)	Finger millet	Dr. Sunil Karad Breeder, National Agril. Res. Project Submontane zone, MPKV, Shenda Park, , Kolhapur-416012	Phule Nachini	0.03	0.05	Maharashtra	0.03	1. Dr. N.B. Gokhale, I/c Plant Biotech Center, Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri Dist. 2. Managing Director, Maharashtra State Seed Corporation Ltd., Mahabeej Bhawan, Amaravathi road, PB No. 119, Akola- 444 004, Maharashtra 3. Director, Maharashtra State Seed Certification Agency Shastrinagar, Akola- 444 004
	Little Millet		Phule Ekadashi	0.02	0.05	Maharashtra	0.02	
B)	Finger millet	Dr. Suchitra Desai Head, Dept. of Ag. Botany College of	Dapoli-1	0.02	0.05	Maharashtra	0.02	

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		Agriculture B.S. Konkan Krishi Vidyapeeth, Dapoli Ratnagiri Dist. M.S.						4. Regional Manager, National Seed Corporation Ltd., No. 681-690, Gultekdi, Market yard, Pune- 411 037
			Sub total	0.07	0.15		0.07	
4. Mandya								
	Finger millet	Dr. C.R. Ravishankar Associate Director of Research , RRS, V.C. Farm, Mandya Karnataka 571 405	Divya (MR 6)	0.60	1.00	Karnataka NSC	0.50 0.10	1.Geneticist, P.C. Unit (SM),GKVK, Bangalore- 560065 2. Director, Karnataka State Seeds & Organic Certification Agency, Bellary Road, Hebbal, Bangalore 560024, Karnataka. 3. Regional Manager, National Seeds Corporation Hebbal, Bangalore 560024, Karnataka. 4. Managing Director, KSSC Ltd. Hebbal, Bangalore- 560 024
			KMR 301 (Gowri)	0.10	0.20	Karnataka	0.10	
			KMR-204 MR 1	0.08 0.15	0.20 0.25	Odisha Karnataka	0.08 0.15	
			Indaf 7	0.05	0.10	NSC	0.05	
			Sub total	0.98	1.75		0.98	
5. Ranchi								
	Finger millet	Dr. Z.A. Haider Breeder BAU, Kanke- Ranchi- 843006, Jharkhan d	A 404	0.01	0.05	Jharkhand	0.01	1.Managing Director, State Seeds Corp. Ltd., Ranchi 2. State Seed Certification Agency, Ranchi 3. Area Manager, NSC Ltd, Sukh deo Nagar, Rani, Road, Ranchi- 834 005.
			BM 2	0.02	0.05	Jharkhand	0.02	
			Sub total	0.03	0.10		0.03	
6. Dholi								
	Finger millet	Dr. S. K. Singh Breeder, Tirhut College of Agriculture, Dholi- 843 121 Muzafarpur, Bihar	RAU 8	0.25	0.50	Bihar	0.25	1. Managing Director, Bihar Rajya Beej Nigam Ltd. Mithapur Farm Campus, Mithapur, Patna 2. Director, State Seed Certification Agency, Mithapur Farm, Mithapur, Patna 3. Area Manager, NSC Ltd, Near Prabhat Talkies, Muzafarpur- 842 001
	Proso millet	-do-	BR-7	0.50	0.50	Bihar	0.50	
			Sub total	0.75	0.75		0.75	
7. Nandyal								
	Foxtail millet	Dr. CVCM Reddy Sr. Scientist (Breeding) AICRP on Small Millets RARS, Nandyal - 518 503(AP)	SiA 3085	3.50	6.00	Andhra Pradesh Bihar	3.00 0.50	1. Dr. M. Subbarao, ADR, ARS, Perumalapalle, Tirupathi- 517 505 2. Managing Director, APSSDC, HACA Bhavan, Hyderabad - 500 004 3. Director, AP State Seed Certification Agency, 1-10- 193,1st Floor, HACA Bhavan, Hyderabad-500 004 4. Regional Manager, NSC Ltd.,

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								17-11, Tukaram gate Lalaguda, Secunderabad- 500 017
			Sub total	3.50	6.00		3.50	
8. Hanumanamatti								
	Foxtail millet	Dr. Nagappa Harijan Breeder, Agriculture Research Station, Hanumanamatti-581 135, Haveri Dist.	HMT 100-1	0.04	0.10	Karnataka	0.04	1 Geneticist, P.C. Unit (SM),GKVK, Bangalore- 560065 2. Director, Karnataka State Seeds & Organic Certification Agency, Bellary Road, Hebbal, Bangalore 560024, Karnataka. 3. Managing Director Karnataka State Seed Corporation Ltd. Hebbal Bangalore- 560 024, 4. Area Manager, NSC Ltd, Devihosur village & post, Haveri- 581 110
			Sub total	0.04	0.10		0.04	
9. Jagdalpur								
A)	Finger millet	Dr. Prafulla Kumar Sahu Breeder, AICRP on Small millets, ZARS, Kumharwand Farm, Jagdalpur-494 005, Chattisgarh	Chattisgarh- 2	1.00	2.00	Chattisgarh	1.00	1.Dr. PK Sahoo, Breeder,ARS,Kumharwand Farm Jagdalpur – 494 005, Chattisgarh 2. Managing Director,Rajya Beej Evam, Krishi Vikas Nigam, Tellbandha, Raipur- 492 001 3. Managing Director, Chattisgarh State Seed Certification Agency, Labhandi Farm, Raipur- 492 001 4. Area Manager, NSC Ltd., Telibandha, Raipur- 492006
			Indira Ragi- 1 (BR 7)	1.50	2.50	Chattisgarh	1.50	
B)	Kodo millet		Indira Kodo 1 (BK 1)	2.25	4.00	MP Chattisgarh	0.75 1.50	
			Sub total	4.75	8.50		4.75	
10. Rewa								
	Kodo millet	Dr.R.P.. Joshi Breeder, AICRP on Small Millets, College of Agriculture Rewa – 486001.	JK 155	0.75	1.25	MP	0.75	1.Dr. A.K. jain, Pathologist (SM) & Oic, AICRP on Small millets, College of Agriculture, Rewa-486001 2.Managing Director, Madhya Pradesh Seeds & Farms Development Corpn. Ltd., Mother Theresa Marg, Area hills, Bhopal – 462 016 3. Regional Manager, NSC Ltd., 48/49, Industrial Area, Govindapura, Bhopal- 462 023. 4. Madhya Pradesh State Seeds Certification Agency, Office Complex Gautam Nagar, Bhopal- 462 023.
Jawahar Kodo 13 (JK 13)			1.50	2.50	MP	1.50		
JK 106			0.90	1.50	MP	0.90		
Jawahar Kodo 439			1.45	2.50	MP Chattisgarh	0.45 1.00		
Jawahar kutki-36			0.20	0.40	MP	0.20		
Sub Total			4.80	7.75		4.80		
11. Ranichauri								
	Barnyard millet	Breeder AICRP on Small	PRJ 1	0.50	1.00	Uttarakhand	0.50	1. Dr. Brij Mohan Pandey, Sr. Scientist (Agronomy)

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		millets, Uttarakhand University of Hort. & Forestry, Hill Campus Ranichauri- 249 199 Tehri, Garhwal, Uttarakhand						V.P.K.A.S, Almora 2. Director, State Seed Certification Agency Basanth Vihar, Dehradun, Uttarkhand – 248 006 3. Managing Director Uttarakhand Seed & Tarai Development Corporation, Pant nagar, P.O. Haldi, Dist. Nainital, Uttarkhand
			Sub Total	0.50	1.00		0.50	
12. Athiyandal								
	Foxtail millet	Dr. Nirmala Kumari, Sr. Breeder, Centre of Excellence in Millets, Athiyandal, Tiruvannamalai Dist., Tamilnadu	Co-7	2.45	4.00	AP Bihar Karnataka Maharashtra Tamil Nadu Telangana	0.10 0.10 0.10 0.05 2.00 0.10	1. Dr. Parashuraman Officer In-charge, Centre of Excellence in Millets, Athiyandal, Tiruvannamalai Dist., Tamilnadu 2. Director, State Seed Certification Agency, Chennai. 3. Managing Director Tamilnadu State Seed Corporation, Chennai.
			Sub Total	2.45	4.00		2.45	
			Grand Total	33.25	57.60		33.25	

Centre-wise Allocation of Nucleus seed to be produced during Kharif 2017

S. No.	Centre	Crop	Name of Variety	Year of notification	Nucleus seed (kg)
1	Almora	Finger millet	VL 352	2013	1.0
			VL 315	2006	0.5
			VL 347	2012	0.5
			VL 324	2006	0.5
			VL-348	2016	1.0
		Barnyard millet	VL Madira 207	2008	0.5
		Finger millet	PRM 2	2011	0.5
2	Ranichauri	Barnyard millet	PRJ 1	2009	0.5
3	PC Unit, Bengaluru	Finger millet	GPU 28	1998	1.0
			GPU 48	2009	1.0
			GPU 45	2001	1.0
			GPU 67	2010	1.0
			ML 365	2009	1.0
4	Mandya	Finger millet	MR 6	2008	1.0
			KMR 301	2012	1.0
			Indaf 7	1984	1.0
			KMR 204	2012	1.0
			KMR-340	2017	1.0
			MR-1	1998	1.0

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5	Hanumanamatti	Foxtail millet	HMT 100-1	2009	0.5	
6	Kolhapur	Finger millet	Phule Nachini	2013	1.0	
		Little millet	Phule Ekadashi	2016	1.0	
7	Dapoli	Finger millet	Dapoli-1	1994	0.5	
			Dapoli-2 (SCN-6)		1.0	
8	Ranchi	Finger millet	A 404	1993	1.0	
			BM 2	1996	1.0	
9	Dholi	Finger millet	RAU 8	1989	0.5	
		Foxtail millet	RAU-2	2017	1.0	
		Proso millet	BR-7	1984	0.25	
10	Berhampur	Finger millet	Bhairabi (BM-9-1)	1999	0.5	
			Suvra (OUAT-2)	1999	0.5	
			Chilka (OEB-10)		1.0	
			OEB-526	2011	0.5	
			OEB-532	2016	1.0	
11	Nandyal	Foxtail millet	SiA 3085	2011	1.0	
			SiA 3088	2012	1.0	
			SiA 3156	2012	1.0	
12	Vizianagaram	Finger millet	VR-936	2012	1.0	
			VR 847 (Sri Chaitanya)		1.0	
			VR 762 (Bharathi)		0.5	
13	Jagdalpur	Finger millet	Chhattisgarh -2	2015	1.0	
			Indira Ragi -1 (BR 7)	2012	1.0	
			Indira Kodo 1 (BK 1)	2012	1.0	
		Kodo millet	Chhattisgarh Kodo-2	2014	1.0	
			Little millet	BL-4	2016	1.0
				BR-6	2014	1.0
14	Rewa	Kodo millet	Jawahar Kodo 65	2009	0.5	
			JK 155	2000	0.5	
			Jawahar Kodo 13 (JK 13)	2007	0.5	
			JK-98	2010	0.5	
			JK-106		0.5	
			JK-439		0.5	
			RK-390-25	2012	0.5	
			Jawahar Kodo-137	2016	1.0	
			Little millet	JK 137		0.5
				JK 8		0.5
		JK 36			0.5	
		JK 4			0.5	

15	Dindori	Kodo millet	DPS-9-1	2011	0.5
16	Waghai	Finger millet	GNN-6	2016	1.0
			GN-5	2016	1.0
		Little millet	GV-2	2016	1.0
17	Athyandal	Finger millet	CO(Ra)14	1995	0.5
			CO 15	1996	0.5
		Fox millet	CO (Te) 7	2005	0.5
		Kodo millet	CO 3	2012	0.5
		Little millet	CO (Samai)4	2005	0.5
		Barnyard millet	CO (KV) 2	2008	0.5
		Proso millet	CO (PV) 5	2007	0.5

The technical meeting ended with vote of thanks to the chairman.

Technical programme for the year 2017-18

2. Agronomy

Chairman:	Dr. K.T. Krishne Gowda, Former PC, GKVK, Bengaluru.
Co-Chairman:	Dr. Nagaraja, Professor of Agroforestry and Comptroller, UAS, GKVK, Bengaluru.
Convener:	Dr. B .Boraiah, Agronomist, PC unit, GKVK, Bengaluru
Rapporteurs:	Dr. AL.Narayanan, Professor of Agronomy, Agriculture College, Karaikal

At the outset the chairman welcomed the gathering and stressed the need for reducing the production cost of small millets and to improve the productivity as a whole since the possibility of increasing the area under millet is ruled out. The stress for requirement of sustained conservative production of millets through mechanization was discussed and was planned to be targeted in future. Similarly climate and resilient aspects were debated and need to mitigate these problems were address. The co-chairman also indicated the need for long term research in agronomical aspects including climate change, conservation and mechanization. The following aspects of agronomic research were discussed:

1. The long term agronomic experiments either having conclusive results or not may be concluded and stress for new areas of research formulations
2. Four to five coordinated trials to be included at all the centers
3. Location specific trials with clear objective shall be adopted by the respective centers
4. Officer in charge of various centers narrated the conclusion of certain experiments and requested for continuation of other experiments. The chairman and Co chairman critically commented on above and approved.
5. Similar to SRI in rice, the system of Ragi intensification involving single and young seedlings with wider square planting was found to improve the productivity of finger millet.
6. FLD Studies involving 300 hectares of land under various small millets were carried out by various centers across the country depicting the improved management practices to realize the remunerative returns in small millets and improve their livelihood of small millet farmers.
7. House also decided to continue on Pre-released varieties with fertilizer trials in more précised manner involving three levels of fertilizer.
8. The importance of organic farming and its mode of operation in millets were discussed centre wise and shall be conducted for long term in fixed plots.
9. In view of temporal and spatial variation in rainfall observed throughout the country the discussion lead to strengthen and enhance sustained millet productivity through conservation practices
The need for low cost technologies utilizing farm mechanization was discussed in detail and all centers were requested to concentrate on a coordinated trial to address the problem

Recommendation made

- Pre sowing irrigation followed by irrigation at 20-25 days after sowing is sufficient enough to give 33 % increased foxtail millet yield under limited water supply condition at Nandyal area of Andhra Pradesh.
- Kodo millet/little millet based inter cropping system (Kodo /little millet + Pigeon pea 8:2) *was the most profitable system* in Dindori, Rewa and Athiyandal.
- Inclusion of sunhemp as green manure crop in rice fallows followed finger millet with 75% RDF enhanced the productivity and profitability of succeeding finger millet under irrigated condition.
- Two inter cultivations along with one hand weeding improved the grain yield in finger millet (80%), Kodo millet (36%) and little millet (42%) at Athiyandal, Dindori, Rewa and Jagdalpur.
- Production of millets through inter/sequence cropping with legumes improve the soil health and productivity

Technical programme of agronomic experiments for the year 2017 – 2018

2.1 Evaluation of pre- released genotypes to fertility levels

Finger millet

2.1.1: Response of pre released finger millet varieties to different levels of fertilizer under rainfed condition

Treatments:

Finger millet	
Main plot: Fertility levels (F) : 3	Sub plot: Varieties (V): 4
F ₁ : 75 % RDF	V ₁ : VL 386
F ₂ : 100% RDF	V ₂ : VL 352*
F ₃ : 125 % RDF	V ₃ : GPU 45*
	V ₄ : Local check**

*National check **Promising ruling variety, RDF: 50:40:25 kg NP₂O₅K₂O /ha

Note: The above mentioned varieties should invariably be included in the trial. Seeds for the same will be arranged from the Project Coordinating Unit (Small Millets), Bengaluru.

Treatment combinations: 12

Main plot – Fertility Levels- F (3),

Sub plot: varieties –V (4)

Design : Split plot, Replications : Three (3)

Plot size : Gross: 3.0 m x 4.5 m; net: 2.4 m x 4.2 m

Crop/variety : Finger millet varieties as per treatment

Spacing : 30 cm x 7.5 cm

Fertilizer : Rainfed : RDF- 50:40:25 (As per treatment (N in two equal splits).

Locations: Almora, Ranichauri, Waghai, Peddapuram and Vizianagaram

Foxtail millet

2.1.2: Response of pre-released foxtail millet varieties to different levels of fertilizer under rainfed condition.

Treatments:

Foxtail millet	
Main plot: Fertility levels (F) : 3	Sub plot: Varieties (V): 4
F ₁ : 75 % RDF	V ₁ : DHFT 5-6
F ₂ : 100% RDF	V ₂ : SiA 3179
F ₃ : 125 % RDF	V ₃ : SiA 3156**
	V ₄ : SiA 326*

*National check, ** Local check, RDF: 40:20:0 kg NP₂O₅K₂O /ha

Treatment combinations: 12

Main plot – Fertility Levels- F (3),

Sub plot: varieties –V (4)

Design : split plot Replications : Three (3)

Plot size : Gross: 3.0 m x 4.5 m; net: 2.5 m x 4.10 m

Spacing : 25 cm x 10 cm

Crop/variety : as per treatment

Fertilizer : RDF: 40:20:0 kg NP₂O₅K₂O /ha as per treatment

Locations : Nandyal , Hagari, Athiyandal

Little millet

2.1.4: Response of pre-released little millet varieties to different levels of Fertilizer under rainfed conditions

Treatments:

Little millet	
Main plot: Fertility levels (F) : 3	Sub plot: Varieties (V): 4
F ₁ : 75 % RDF	V ₁ : DLM 95
F ₂ : 100% RDF	V ₂ : JK 8*
F ₃ : 125 % RDF	V ₃ : OLM 203*
	V ₄ : BL 6

*National check, ** Local check, RDF: 40:20:0 kg NP₂O₅K₂O /ha

Treatment combinations: 12

Main plot – Fertility Levels- F (3), Sub plot: varieties –V (4)

Design : split plot Replications : Three (3)

Plot size : Gross: 3.0 m x 4.5 m; net: 2.5 m x 4.20 m

Spacing : 25 cm x 7.5 cm

Crop/variety : Little millet varieties as per treatment

Fertilizer: RDF: 40:20:0 kg NP₂O₅K₂O /ha as per treatment

Locations : Dindori, Jagdalpur, Kanke, and Kolhapur

Barnyard millet

2.1.5: Response of pre-released barnyard millet varieties to different levels of fertilizer under rainfed conditions

Treatments

Barnyard millet	
Main plot: Fertility levels (F) : 3	Sub plot: Varieties (V): 4
F ₁ : 75 % RDF	V ₁ : VL 249
F ₂ : 100% RDF	V ₂ : DHBMV 23-3
F ₃ : 125 % RDF	V ₃ : VL172*
	V ₄ : VL 207*

*National check, , RDF: 40:20:0 kg NP₂O₅K₂O /ha

Treatments combinations: 12

Main plot – Fertility Levels- F (3), Sub plot: varieties –V (4)

Design : SPLIT PLOT Replications : Three (3)

Plot size : Gross: 3.0 m x 4.5 m; Net: plot: 2.5 m x 4.1 m

Spacing : 25 cm x 10 cm

Crop/variety : Barnyard millet varieties as per treatment

Fertilizer : RDF: 40:20:0 kg NP₂O₅K₂O /ha

Locations : Almora, Athiyandal, Bengaluru,Ranichauri,

2.2: Nutrient management in small millets

2.2.1: Studies on seed palleting with biofertilizer and micronutrients

Total treatments: 10

Treatment details	
T ₁ :	Absolute control (no seed palleting & no manure)
T ₂ :	Recommended dose of FYM only (7.5 t /ha)
T ₃ :	Recommended dose of FYM (7.5 t/ha) + NPK (50:40:25 kg NPK /ha)

T ₄ :	T ₂ + <i>Azospirillum brasilense</i> + <i>Bacillus magathelium</i> + <i>Psuedomonas fluroscence</i>
T ₅ :	T ₄ + Zn So4 @ 3g /kg seed
T ₆ :	T ₄ + Boron @ 3g /kg seed
T ₇ :	T ₄ + ZnSo4 @ 3g /kg seed + Boron @ 3g /kg seed
T ₈ :	T ₇ + 50% RDF
T ₉ :	T ₇ + 75% RDF
T ₁₀ :	T ₇ + 100 % RDF

Design: RCBD Replications : 3
 Plot size : Gross: 3.6 m x 4.5 m Net: 3.0 m x 4.2 m
 Crop / variety : Finger millet variety as per location specific promising variety
 Spacing : 30 cm x 7.5 cm
 Fertilizer : NP₂O₅K₂O as per treatments
Location : Bengaluru and Kanke

2.2.2: Studies on efficient fertilizer management in finger millet under Irrigated condition

Total treatments: 6

Treatment details:

T₁: Application of recommended dose of FYM (5.0 t ha⁻¹) + Fertilizers (100:50:50 kg NP₂O₅K₂O ha⁻¹)
 T₂: Application of 100% recommended dose of fertilizers through briquettes
 T₃: Application of 75% recommended dose of fertilizers through briquettes
 T₄: Application of 50% recommended dose of fertilizers through briquettes
 T₅: Application of recommended dose of N through FYM
 T₆: Absolute control

Design : RCBD Replications : Four (4)
 Plot size : Gross: 3.6 m x 4.5 m Net: 3.0 m x 4.2 m
 Crop / variety : Finger millet variety recommended for the region
 Spacing : 30 cm x 7.5 cm
 Fertilizer : NP₂O₅K₂O levels as per treatments
Location : Mandya

2.2.3: Production package for organic finger millet under rainfed condition (Kolhapur)

Total treatments: 10

Treatment details:

T₁: FYM @ 5 tons/ha
 T₂: Vermicompost @ 3 tons/ha
 T₃: Poultry manure @ 2.5 tons /ha
 T₄: 100% N through FYM
 T₅: 100% N Through Vermi compost
 T₆: 100% N through poultry manure
 T₇: 50% N through FYM + 50% N through Vermicompost as top dress 6 to 7 weeks after sowing
 T₈: 50% N through FYM + 50% N through poultry manure as top dress 6 to 7 weeks after sowing
 T₉: Recommended dose of fertilizer (60:30:00 kg NP₂O₅K₂O /ha)
 T₁₀: Absolute control

Design : RCBD Replications : Three (3)
 Plot size : Gross: 5.4 m x 4.5 m net plot: 4.8 cm x 4.2 cm (experiment shall be on fixed site)

Crop/variety : Finger millet variety recommended for the region
Spacing : 30 cm x 7.5 cm
Fertilizers/Manures : As per treatment
Location : Kolhapur

Note: Application of recommended dose of fertilizers (T₉) this treatment shall be outside the organic block and shall be sown on the same day.

2.2.4 : Studies on zinc fortification in foxtail millet

Treatments: 9

T₁: Soil application of zinc sulphate @12.5 kg/ha

T₂: Soil application of zinc sulphate @ 25 kg/ha

T₃: Foliar application of zinc sulphate @ 0.25 %

T₄: Foliar application of zinc sulphate @ 0.5 %

T₅: T₁ + T₃

T₆: T₁ + T₄

T₇: T₂ + T₃

T₈: T₂ + T₄

T₉: Control

Design: RBD Plot size: 4.5 m X 4.0 m Location: Nandyal

2.2.5: Organic farming research in small millets – A comparative study

Treatment details

1. Only organics (FYM 5.0 ton/ha + VM 1 Ton/ha + Neem cake 500 kg/ha)
2. Inorganic (RDF NPK only)
3. INM (RDF + NPK)

Locations

Finger millet: Rainfed: Athiyandal, Bengaluru, Jagdalpur and Kolhapur, Irrigated – Mandya

Foxtail millet: Bengaluru, Nandyal

Kodo millet: Bengaluru, Rewa and Jagdalpur

Little millet: Berhampur, Dindori, Rewa, Kanke

Proso millet: Athiyandal, Ranichauri, Kanke

Barnyard millet: Athiyandal, Ranichauri,

Note: Seed treatment with biofertilizer, Pest and disease management as per treatments

Observations to be recorded: Soil nutrient composition: chemical and biological properties (Before and after experiment), growth parameters, days to maturity, yield and yield components, quality parameters: Reducing sugar, Fiber content, Protein, ash Macro and Micronutrient content, economics (NMR and B: C ratio) and partial budgeting and per day productivity

Plot size : Large sized non replicated trial (10m x 10m)

Crop/variety : Finger millet and small millet varieties as per treatment (Promising ruling variety)

Spacing : 30 cm x 7.5 cm

Experimental site should be in fixed plots

2.3: Assessing the performance of small millets to different sowing windows

2.3.1: Effect of different sowing windows for mitigating the climate change

Main factor (A) Sowing window

S₁: Early sowing S₂: Normal sowing S₃: Delayed sowing

Millet crops: C (3) Foxtail millet/Kodo millet/Little millet/Barnyard millet/ Proso millet

Treatment combinations: 9

T₁: S₁+ C₁ T₂: S₁+ C₂ T₃: S₁+ C₃

T₄: S₂+ C₁ T₅: S₂+ C₂ T₆: S₂+ C₃

T₇: S₃+ C₁ T₈: S₃+ C₂ T₉: S₃+ C₃

Design: RCBD Replication: 3 Plot size: 3 m x 4.5 m Spacing: 30 cm x 7.5 cm

Centres: All centres with respective crops

C₁: Foxtail millet, C₂: Little millet and C₃: Proso millet: Athiyandal, Bengaluru, Nandyal, Kanke

C₁: Kodo millet, C₂: Little millet, C₃: Barnyard millet: Dindori, Jagdalpur, Ranichauri

2.3.2: Addressing the problem of climate change (Response farming) :

1) To tackle early season drought (ESD) : (0-25 DAS)

- a) Dry sowing
- b) Use of long / medium duration variety
- c) Harrow and re sow the crop with a short duration variety if the crop stand is poor
- d) Application of 150% Rec. dose of N (immediately after the alleviation of stress)
- e) If germination is very poor then remove the seedling and plant them in a strip on one side and go for another crop (Horse gram/Minor millets) to cover the vacant land.

2) To tackle mid season drought (MSD) : (25-50 DAS)

- a) Repeated inter cultivation (25 -50 DAS)
- b) Reduce weed menace – post emergent herbicide (2,4-D)
- c) Potash spraying (0.1%)
- d) Reducing the plant stand by 25 per cent -Thinning of the crop either manually or by harrowing
- e) Top dress the crop with Urea after alleviation of stress

3) To tackle late season drought (LSD): (50-75 DAS)

- a) Providing soil mulch through Intercultivation.
- b) Potash spraying (0.1%).
- c) Mulching -Covering the surface with weeds and other locally available biological wastes
- d) Wherever water is available one life saving irrigation – 5mm.
- e) Wherever water is available two life saving irrigations – 5mm.

4) As per package of practice (POP) (control)

Design: split plot, Replication = 3

Plot size: 4.5 m X 4.5 m= 4.5 m X 22.5 m to accommodate all the treatments if necessary.

Spacing: 30 cm X 7.5 cm

Locations: Athiyandal and Bengaluru

Note: Need based drought management practices will be undertaken to mitigate drought (in sub plots 1, 2 and 3) if condition demands otherwise it shall be managed as per package of practice.

2.3.3: Effect of sowing dates and finger millet varieties for delayed sowing conditions (Kolhapur)

Treatments 16

a) **Main plot: sowing dates – D (4),**

D₁ – 2nd week of June

D₂ – 4th week of June

D₃ – 2nd week of July

D₄ – 4th week of July

b) Sub plot: varieties – V (4)

V₁ – Phule Nachani
 V₂ – GPU 28
 V₃ – GPU 67
 V₄ – Dapoli 1

Design : Split plot Replications : Three (3)
 Plot size : Gross: 4.5 m x 5.4 m
 Crop/variety : as per treatment Spacing : 22.5 cm x 10 cm
 Fertilizers : As per recommendation
 Location : Kolhapur

2.3.4: Evaluation of different dry land crops under late sown conditions

Treatments: 24

Main plot : sowing dates (D): 3

D₁ : 2nd fortnight of August
 D₂ : 1st fortnight of September
 D₃ : 2nd fortnight of September

Subplot : Crops (C): 8

C₁ : Sunflower C₅ : Soybean
 C₂ : Foxtail millet C₆ : Jowar
 C₃ : Pearl millet C₇ : Green gram
 C₄ : Pigeon pea C₈ : Cotton

Design : Split-plot Replications : Three (3)
 Plot size : Gross: Main-plot: 3.5 m x 36.0 m; Sub-plot: 3.5 m x 4.5 m
 Spacing : As per recommendations
 Crop/variety : As per treatment (promising varieties)
 Fertilizer : As per package of practices
 Location : Nandyal

2.4: Weed management for small millets

2.4.1: Chemical weed control studies in finger millet

Treatments: 12

T₁: Pre emergence application of pendimethalin 0.5 kg a.i / ha (30 EC)
 T₂ : Pre emergence application of pendimethalin 0.75 kg a.i / ha (30 EC)
 T₃: Pre emergence application of Bensulfuron methyl + Pretilachlor @ 0.132 kg a.i / ha (2 kg commercial product)
 T₄: Pre emergence application of Bensulfuron methyl + Pretilachlor @ 0.198 kg a.i / ha (3 kg commercial product)
 T₅: Pre emergence application of Isoproturon @ 0.5 kg a.i. / ha for rainfed / * Oxyflurofen @ 0.10 lit a.i/ha for irrigated condition.
 T₆: T₁ + 1 Inter Cultivation (IC)
 T₇: T₂ + 1 IC
 T₈: T₃ + 1 IC
 T₉ : T₄ + 1 IC
 T₁₀: T₅ + 1 IC
 T₁₁: Two Intercultivation + 1 HW
 T₁₂: Un weeded check (Control)

Design : RCBD Replication : Three (3)
 Plot size : 3.0 m x 4.5 m Spacing : as per treatment
 Locations : Rainfed - Bengaluru, Berhampur, Athiyandal, Kanke, Kolhapur & Jagdalpur
 * Irrigated – Mandya and Vizianagaram

2.4.2: Weed management studies in Finger millet under irrigated condition

Treatment Details: 11

- T₁: Alachlor 50 EC at 600 g a.i./ha (within 3DAP) + one intercultivation at 25-30 DAP
T₂: Alachlor 50 EC at 750 g a.i./ha (within 3DAP) + one intercultivation at 25-30 DAP
T₃: Atrazine 50 WP at 600 g a.i./ha (within 3DAP) + one intercultivation at 25-30 DAP
T₄: Atrazine 50 WP at 750 g a.i./ha (within 3DAP) + one intercultivation at 25-30 DAP
T₅: Bispyribac sodium 10 SC 15 g a.i./ha (15-20 DAP) + one intercultivation 35- 40 DAP
T₆: Bispyribac sodium 10 SC 20 g a.i./ha (15-20 DAP) + one intercultivation 35-40 DAP
T₇: Ethoxysulfuron 15 WG 12g a.i./ha (15-20 DAP) + one intercultivation 35- 40 DAP
T₈: Ethoxysulfuron 15 WG 15g a.i./ha (15-20 DAP) + one intercultivation 35- 40 DAP
T₉: Butachlor 50 EC 750 g a.i./ha (within 3DAP) + one intercultivation at 25- 30 DAP
T₁₀: Two intercultivation with hand weeding at 20 and 40 DAP
T₁₁: Un weeded check

Design : RCBD Replications : Three (3)
Plot size : Gross: 3.0 m x 4.5 m; net: 2.4 m x 4.2 m
Crop/variety : Finger millet varieties as per treatment
Location: Mandya

RDF- 100:50:50 kg NPK /ha

Observations to be recorded: weed count, weed density, weed control efficiency, type of weeds, growth, yield and yield components, economics (NMR and B: C ratio) and partial budgeting and per day productivity

2.4.3: Evaluation of Pre and Post emergence herbicides in foxtail millet during summer under irrigated conditions at Nandyal

Treatments (10)

- T₁: Pre emergence application of butachlor @ 1.0 kg a. i. /ha.
T₂: Pre emergence application of butachlor @ 1.5 kg a. i. /ha.
T₃: Post emergence of application of 2, 4-D @ 0.8 kg a. i. /ha.
T₄: Post emergence of application of 2, 4-D @ 1.0 kg a. i. /ha.
T₅: T₁ + T₃
T₆: T₁ + T₄
T₇: T₂ + T₃
T₈: T₂ + T₄
T₉: Hand weeded check
T₁₀: Un weeded control

Design : RCBD Replications : Three (3)
Plot size : Gross: 4 m x 3 m
Locations : Nandyal

2.4.4: Effect of different methods of crop establishment and weed control measures on growth and yield of Barnyard millet

Treatments: 16

Main Plot treatments: Method of establishment (M): 4

- M₁: Using high seed rate 15-18 kg/ha.
M₂: Providing wider row 45cm and plant to plant spacing 7.5 cm for Barnyard millet introduce

Sun hemp in between Barnyard millet (22.5 cm) rows and harvest Sun hemp at 35-40 DAS and use as mulch.

- M₃: Delayed sowing 8-10 days after normal time of sowing (though land is ready for sowing skip sowing during the 1st spell of sowing rains – harrow the field to uproot the weeds and then go for sowing).
M₄: Recommended/Conventional practice as per package of practice

Subplot treatments: Weed management practices (W): 4

- W₁: Control (No weeding/herbicide spray)
W₂: 1 Inter cultivation (IC) + 1 HW.
W₃: Use of pre emergent herbicide (Isoproturon @ 0.5 kg a.i. /ha).
W₄: Integrated weed control (1 Herbicide spray + 1 IC).

Design : Split plot Replication : Three (3)
Plot size : 3.0 m x 4.5 m
Spacing : as per treatment Fertilizer : as per recommended dose
Locations : Ranichauri

2.5 Conservation agriculture in small millets

2.5.1: Effect of moisture regimes on growth and yield of transplanted finger millet under irrigated conditions (Mandya)

Treatments: 12

Main plots: Irrigation levels: (I) - 3

- I₁: Irrigation 0.6 IW/CPE
I₂: Irrigation 0.8 IW/CPE
I₃: Irrigation 1.0 IW/CPE

Sub plots: Nutrient Management: N- 4

- N₁: Soil Test base
N₂: 100% RDF
N₃: 150% RDF
N₄: Vermi compost to supply recommended dose of nitrogen only and balance of P and K through rock phosphate and Wood ash.

Note: The above treatments shall be imposed after establishing the crop during summer

Design : split plot Replications : Three (3)
Plot size : Gross: 4.5 m x 5.4 m
Crop/variety : Finger millet variety Indaf 5 or HR 911
Spacing : 22.5 cm x 10 cm
Fertilizers : As per recommendation
Location : Mandya

2.5.2: Crop establishment methods under Zero tillage condition in Foxtail millet – Chick pea cropping system

Treatments

1. Sowing with Zero – strip till drill (developed by RARS, Nandyal)
2. Sowing with tractor drawn seed drill
3. Sowing with bullock drawn seed drill
4. Sowing with bullock drawn Anantha planter (Automatic seed drill)

5. Conventional method

Observations to be recorded: Soil nutrients composition: Before and after experiment, growth, yield and yield components, economics (NMR and B: C ratio) and partial budgeting and per day productivity

Design : RCBD Replications : Three (3)
Plot size : Gross: 3.0 m x 4.5 m; Net: 2.4 m x 4.2 m
Crop/variety : Foxtail millet variety as per treatment, RDF- 50:40 kg NP /ha
Location : Nandyal

2.5.3: Studies on evaluation of System of Ragi Intensification (SRGI)

Treatments

1. Planting young seedlings (12/15/18 DOS)
2. Planting single seedling and double seedling
3. Square planting (22.5 cm x 22.5 cm, 25 cm x 25 cm and 30 cm x 30 cm)

Design : Split plot Replications : Three (3)
Plot size : Gross: 3.0 m x 4.5 m; Net: 2.4 m x 4.2 m
Crop/variety : Finger millet varieties as per treatment
Location : Karaikal
RDF- 50:40:25 kg NPK /ha

Observations to be recorded: Soil nutrients composition: Before and after experiment, growth, yield and yield components, economics (NMR and B: C ratio) and partial budgeting and per day productivity

2.6 Millet based cropping systems for sustainable productivity

2.6.1: Enhancing the millet - system productivity with inter crops

Base crop/main crop: Foxtail millet/Kodo millet/little millet/Barnyard millet/ Proso millet

Inter crop (Red gram) variety: V (2) V₁: Medium duration
V₂: Long duration

Fertility: F (2) F₁: RDF to base crop/Main crop
F₂: Application of N to base crop + Phosphorus for IC

Moisture conservation practices: 3 M₁: Flat bed
M₂: Corrugation and conservation furrow for base crop
M₃: Conservation furrow for Inter crop

Treatment combinations (12)

T1: Base crop+ V ₁ +F ₁ +M ₁	T2: Base crop+ V ₁ +F ₁ +M ₂	T3: Base crop+ V ₁ +F ₁ +M ₃
T4: Base crop+ V ₁ +F ₂ +M ₁	T5: Base crop+ V ₁ +F ₂ +M ₂	T6: Base crop+ V ₁ +F ₂ +M ₃
T7: Base crop+ V ₂ +F ₁ +M ₁	T8: Base crop+ V ₂ +F ₁ +M ₂	T9: Base crop+ V ₂ +F ₁ +M ₃
T10: Base crop+ V ₂ +F ₂ +M ₁	T11: Base crop+ V ₂ +F ₂ +M ₂	T12: Base crop+ V ₂ +F ₂ +M ₃

Design: RCBD Replication: 3 Plot size: 4m x 5m Centres: All centres in respective crops

Foxtail millet, Little millet and Proso millet: Athiyandal, Bengaluru, Kanke

Foxtail millet, Little millet : Nandyal, Kolhapur

Kodo millet, Little millet Barnyard millet: Dindori, Jagdalpur, Ranichauri

2.6.2: Inter cropping studies in finger millet

Treatments:

T₁: finger millet sole crop / farmers practice

T₂: finger millet + green gram (8:2)

T₃: finger millet + guar (8:2)

- T₄: finger millet + cow pea (8:2)
- T₅: finger millet + urd (8:2)
- T₆: finger millet + bhendi (8:2)
- T₇: finger millet + pigeon pea (8:2)
- T₈: finger millet + maize (8:2)

Design: RCBD Plot size: 6.6 m X 4.5 m

Locations: Berhampur, Jagdalpur and Vizianagaram

2.6.3: Inter cropping studies in Finger millet + Amaranthus

Treatments- 7

- T₁: Sole crop finger millet (FM) with RDF
- T₂: Sole crop of Amaranthus (AM) with RDF
- T₃: Finger millet + Amaranthus intercropping (4:1)
- T₄: Mixed cropping of finger millet and Amaranthus (90:10 proportion by weight)
- T₅: Mixed cropping of finger millet and Amaranthus (85:15 proportion by weight)
- T₆: Mixed cropping of finger millet and Amaranthus (80:20 proportion by weight)
- T₇: Farmers practice

Design : RCBD Replications : Three (3)
Plot size : 6.0 m X 4.5 m
Spacing : Recommended spacing as per package of practices
Crop/Variety : As per treatment
Location : Ranichauri

2.6.4: Inter cropping studies in Foxtail millet

- T₁: Foxtail millet +Green gram 3:3
- T₂: Foxtail millet + Green gram 3:4
- T₃: Foxtail millet + Green gram 4:3
- T₄: Foxtail millet + Green gram 4:4
- T₅: Foxtail millet +Black gram 3:3
- T₆: Foxtail millet + Black gram 3:4
- T₇: Foxtail millet + Black gram 4:3
- T₈: Foxtail millet + Black gram 4:4
- T₉: Foxtail millet + Red gram 5:1

Design : RCBD Replications : Three (3)
Plot size : Gross: 3.0 m x 4.5 m; Net: 2.4 m x 4.2 m
Crop/variety : Foxtail millet varieties as per treatment
Spacing : 30 cm x 7.5 cm
Location: Nandyal (Rainfed condition), RDF- 50:40:25 kg NPK /ha

Observations to be recorded: Soil nutrients composition: Before and after experiment, growth, yield and yield components, economics (NMR and B: C ratio) and partial budgeting and per day productivity

2.6.5: Sustainable intercrop association of Niger in Little millet

Treatment details

- T₁: Sole little millet
- T₂:Sole niger
- T₃: Little millet + niger 2:1
- T₄: Little millet + niger 4:1

T₅: Little millet + niger 6:1
 T₆: Little millet + niger 2:2
 T₇: Little millet + niger 4:2
 T₈: Little millet + niger 6:2
 T₉: Farmers practice (In little millet, niger seed is mixed and broadcasted in the field)

Observations to be recorded: Soil nutrients composition: Before and after experiment, growth, yield and yield components, economics (NMR and B: C ratio) and partial budgeting and per day productivity

Design : RCBD Replications : Three (3)

Plot size : Gross: 3.0 m x 4.5 m; Net: 2.4 m x 4.2 m

Variety : Little millet – Phule Ekadashi and Niger – Phule karala

Spacing : 30 x 10 cm RDF- 50:40 kg NP /ha

Location: Kolhapur

Fertilizer: N as per treatment (in two equal splits) P & K as a basal dose

2.6.6: Inter cropping studies in Barnyard millet

Treatments- 07

T₁: Sole crop barnyard millet

T₂: Sole crop of Amaranthus

T₃: Barnyard millet + Amaranthus intercropping (4:1)

T₄: Mixed cropping of barnyard millet and Amaranthus (90:10 by weight)

T₅: Mixed cropping of barnyard millet and Amaranthus (85:15 by weight)

T₆: Mixed cropping of barnyard millet and Amaranthus (80:20 by weight)

T₇: Farmers practice

Design : RCBD Replications : Three (3)

Plot size : 3.75m x 4.5m

Spacing : Recommended spacing as per package of practices

Crop/Variety : As per treatment

Location : Ranichauri

2.6.7: Identification of profitable barnyard millet based cropping sequence in organic mode under rainfed conditions at Ranichauri

Treatment combinations: 12

Main-plot treatments: Manures (M): 2

M₀: No FYM

M₁: FYM @ 7.5 t ha⁻¹

Sub-plot treatments: Cropping systems (C): 6

Kharif	Rabi
C ₁ : Barnyard millet + Rice bean (90:10)	Radish
C ₂ : Barnyard millet + Rice bean (90:10)	French bean
C ₃ : Barnyard millet + Rice bean (90:10)	Vegetable pea
C ₄ : Barnyard millet + Rice bean (90:10)	Lentil
C ₅ : Barnyard millet + Rice bean (90:10)	Toria
C ₆ : Barnyard millet + Rice bean (90:10)	Wheat

Design : Split plot Replications : Three (3)

Plot size : Gross: 3.0 m X 4.5 m;

Spacing : Recommended spacings as per package of practices

Crop/Variety : As per treatment

Location : Ranichauri

2.7 Mechanization in small millets

2.7.1: Development of low cost technologies through mechanization

Method of sowing: S

S₁) Sowing with animal drawn seed drill S₂) Mechanized sowing

Method of harvesting and threshing: H

H₁) Farmers method H₂) Mechanical harvesting (reaper/combiner)

Treatment combinations: 4

T1: S₁+ H₁ T2: S₁+ H₂

T3: S₂+ H₁ T4: S₂+ H₂

Plot size: 6 m x 20m (120 m²)

Centres: Athiyandal, Bengaluru, Nandyal, Kolhapur

2.7.2: Farm mechanization in finger millet at Athiyandal

T1: Air accented seed drill sowing at 2 spacing

30 X 7.5 cm (weeding by hand operated weeder)

45 X 7.5 cm (weeding by power operated weeder)

T2: tractor drawn seed drill sowing at 2 spacing

30 X 7.5 cm (weeding by hand operated weeder)

45 X 7.5 cm (weeding by power operated weeder)

T3: As per recommended practice (manual)

30 X 7.5 cm (weeding by hand operated weeder)

45 X 7.5 cm (weeding by power operated weeder)

T4: Farmers practice

Location: Athiyandal

2.7.3: Testing the feasibility of mechanization in foxtail millet against the manual method (observation trial) at Nandyal

1. Sowing
2. Inter cultivation
3. Harvesting
4. Threshing

Manual method

- All operations as per the farmers practice

Plot size: large sized plots Design: non replicated

Technical programme for the year 2017-18

3. Plant Pathology

Chairman	: Dr. Srikant Kulkarni Professor (Rtd.), UAS, Dharawad
Convener	: Dr. A. Nagaraja Pathologist & PI, PC Unit (Small millets), GKVK, Bengaluru

The plant pathology discipline meeting began with welcome of the Chairman and other scientists from different AICRP centres by Dr A. Nagaraja, PI Plant Pathology.

The following pathologists were present.

Dr H. Rajashekhara, Almora
Dr.M. Rajesh, Athiyandal
Dr. S C Yadav, Jagdalpur
Mr. H.R. Raveendra, Mandya
Dr.S. Saralamma, Nandyal
Dr.Mrs.SavitaEkka, Ranchi
Dr. Mrs LaxmiRawat, Ranichauri
Dr. A. K. Jain, Rewa
Dr. T.S.S.K.Patro, Vizianagaram
Dr. A. Nagaraja, PC Unit, Bengaluru.
Dr IK Das, Pahologist, IIMR, Hyderabad

The PI introduced all the pathologists and made brief presentation on the type of trials as well as the progress made during 2016. The chairman requested all the pathologists to brief the results and the programme they plan for the ensuing season. After briefing by the pathologists the chairman made the following suggestions:

1. It was agreed to follow Standard Evaluation System (SES) 1-9 scale instead of 0-9 for recording the diseases as suggested (Action: All pathologists)
2. To initiate a management trial for Cercospora leaf spot involving both chemicals and bioagents (Action: Lakshmi Rawat)
3. Correlation studies on rust of foxtail millet should be initiated during *Rabi* (Action: S. Saralamma)
4. To initiate basic work on race identification particularly of *P. grisea* and to develop differential set (Action IK Das, all AICRP (SM) scientists to coordinate)

Following recommendation was made:

As soil application of value added *P.f.+T.v.+B.s.* not only minimized banded/ sheath blight, but also enhanced grain and fodder yields on all the small millets across locations and being a ecofriendly strategy pathologists were suggested to push the technology for package of their respective universities to encash the potential.

The following scientists will take lead in constituting the donor screening nursery by going through the previous annual reports and select around 30-40 lines in different crops mentioned against their names and make necessary arrangements for in time supply of seeds to all the test centers.

A.K. Jain-	Kodo and Little millet
H. Rajashekhara-	Barnyard millet

S. Saralamma- Foxtail millet
M. Rajesh- Proso millet
H.R.Raveendra- Finger millet

After a brief appraisal by Dr. A. Nagaraja, PI (Plant Pathology) on the ongoing experiments, the technical programme was thoroughly discussed and finalized.

Trials/experiments concluded, deleted, modified and added:

A) Trials/experiments Modified:

- | | |
|---|-------------------------------|
| 1) Epidemiological studies on rust of foxtail millet in Rabi-
On blast of finger millet- | Three
Nandyal
Athyandal |
| 2) DSN with the inclusion of finger millet- | All AICRP centres |
| 3) Eco friendly management of banded sheath blight on foxtail millet-
On finger and little millet- | Ranchi
Jagdalpur |

B) Continued experiments: 17

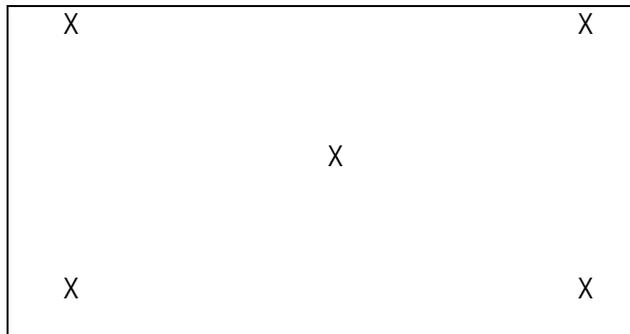
#	Trial	Test centres
1	Surveillance	All
2	IVT	Almora, Athiyandal, Bengaluru, Berhampur, Jagdalpur, Mandya, Ranchi, Ranichauri and Vizianagaram
3	AVT (E&M)	Almora, Athiyandal, Bengaluru, Berhampur, Jagdalpur, Mandya, Ranchi, Ranichauri, Rewa and Vizianagaram
4	AVT (L)	Athyandal, Bengaluru, Berhampur, Jagdalpur, Mandya, Ranchi and Vizianagaram
5	DSN –finger millet	Almora, Athiyandal, Bengaluru, Berhampur, Jagdalpur, Mandya, Ranchi, Ranichauri, Rewa and Vizianagaram
6	DSN-Kodo	Dindori, Jagdalpur, Rewa
7	DSN-Foxtail	Athyandal, Nandyal, Ranchi, Ranichauri, Rewa and Vizianagaram
8	DSN-Little millet	Athyandal, Berhampur, Ranchi, Rewa and Vizianagaram
9	DSN-Barnyard	Almora, Ranichauri, Rewa and Vizianagaram
10	DSN-Proso	Athyandal, Ranichauri, Rewa and Vizianagaram
11	KAVT	Athyandal, Bengaluru, Jagdalpur, Rewa and Vizianagaram
12	FAVT	Athyandal, Bengaluru, Mandya, Nandyal, Ranchi, Ranichauri, Rewa and Vizianagaram
13	LAVT	Athyandal, Bengaluru, Berhampur, Jagdalpur, Ranchi, Rewa and Vizianagaram
14	BAVT	Almora, Athiyandal, Bengaluru, Ranichauri, Rewa and Vizianagaram
15	PAVT	Athyandal, Ranichauri, Rewa and Vizianagaram
16	Epidemiological studies	Athyandal- Finger millet blast, Nandyal-Foxtail millet, rust, downy mildew & blast, Ranichauri-CLS
17	Eco friendly management of banded sheath blight	Vizianagaram-All six crops, Jagdalpur-Kodo millet, finger millet, little millet Ranchi- Little millet, Foxtail millet Rewa-Little millet, Kodo millet Ranichauri- Barnyard millet

Detailed technical programme for 2017-18

I FINGER MILLET:

FM (PP) 300: Surveillance for important diseases of finger millet

All centres have to take up survey on finger millet diseases and cover large area without fail to know the diseases and the extent of occurrence. Rowing survey preferably between flowering to grain filling is to be taken up. Data should be taken from five random points (four corners and centre. Refer picture below) from at least 1 m row length in the patches where there is maximum disease pressure. Location, severity index, variety, stage of crop, acreage etc. is to be mentioned in the report.



Note: X indicates location for taking observation

FM (PP) 301: Screening of finger millet entries for diseases important in the respective location

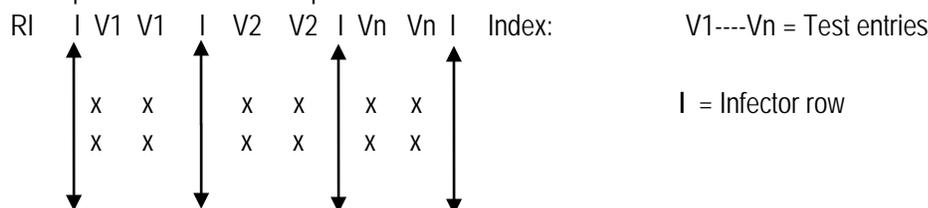
1. Initial Varietal Trial (IVT)
2. Advanced Varietal Trials (AVT) I & II; AVT III.

Centres: Athiyandal, Bengaluru, Berhampur, Jagdalpur, Mandya, Ranchi
 Vizianagaram (IVT; AVT I & II; AVT III)
 Almora and Ranichauri (IVT; AVT-I & II only)
 Rewa (AVT-I & II only)

Note: Seeds of entries will be supplied by the Project Coordinating Unit, Bengaluru. Add at least one susceptible and one resistant local check.

- Methodology:
- (a) No. of replications – 3
 - (b) Plot size: 2 rows of 3 m length
 - (c) Spacing: 22.5 cm x 10 cm
 - (d) Regional crop production practices to be followed
 - (e) To enhance susceptibility, application of extra Nitrogen is preferred at 25-35 days of crop growth.

Method of planting in the field: Two rows of each test cultures are to be sandwiched on either side with a susceptible check in each replication as shown below.



Second and third replications may be planted similar to the first replication by randomising the entries.

Blast is the major and common disease in finger millet, so the spore suspension (measure the spore concentration) of this fungus isolated from the respective region has to be sprayed preferably in the evening hours at pre-flowering of the test entries. Provide sprinkler/perfo/furrow irrigation frequently to create high humidity necessary for infection and disease development. Alternatively any one of the following methodologies may be adopted.

1. Prepare separate seedbeds for raising the nursery. Sow the susceptible finger millet variety on the nursery bed 20-25 days before heading of the test varieties. Harvest the infected leaf material and make spore suspension and spray the spore suspension (measure concentration) on the test varieties. In addition to this, harvest the infected leaf material, chop into small bits and apply on the test varieties preferably in the evening hours (check for the pathogen spores in the leaf bits by suspending them in the water and examining under microscope). Provide high humidity by sprinkler/perfo/furrow irrigation frequently.
2. Prepare spore suspension by using sterilised leaf bits with Richard's solution, or barley grains 20 g, chopped leaves 1 g and distilled water 30 ml.

Spray the spore suspension, once during the seedling/tillering stage and twice during heading stage. Spraying has to be taken at the time when environmental conditions are favourable for disease expression viz., temperature around 26-30°C and humidity over 90% (preferably in the evening).

Observations: At seedling stage (30-40 days) for leaf blast; at dough stage for neck and finger blasts and sheath blight, brown spot, foot rot.

II OTHER SMALL MILLETS:

SM (PP) 300: Surveillance for important diseases of small millets- As suggested under FM (PP) 300

- | | |
|-----------------------------------|------------|
| 1. Foxtail millet: | Nandyal |
| 2. Kodo millet and little millet: | Rewa |
| 3. Barnyard millet | Ranichauri |

SM (PP) 301: Evaluation of advanced entries of small millets for their reaction to important diseases

- 1) **Foxtail millet:** Foxtail millet advanced varietal trial (FAVT)
Centres: Athiyandal, Bengaluru, Mandya, Nandyal, Ranchi, Ranichauri, Rewa and Vizianagaram
Diseases: Blast, rust, smut and downy mildew/green ear
- 2) **Kodo millet:** Kodo millet advanced varietal trial (KAVT)
Centres: Athiyandal, Bengaluru, Jagdalpur, Rewa and Vizianagaram
Diseases: Head smut, sheath blight and Udbatta
- 3) **Little millet:** Little millet advanced varietal trial (LAVT)
Centres: Athiyandal, Bengaluru, Berhampur, Jagdalpur, Ranchi, Rewa and Vizianagaram
Diseases: Grain smut, sheath blight, brown spot / leaf blight
- 4) **Barnyard millet:** Barnyard millet advanced varietal trial (BAVT)
Centres: Almora, Athiyandal, Bengaluru, Ranichauri, Rewa and Vizianagaram
Diseases: Head smut, grain smut, sheath blight and Brown spot / leaf blight

- 5) Proso millet: Proso millet advanced varietal trial (PAVT)
Centres: Athiyandal, Ranichauri, Rewa and Vizianagaram
Diseases: Sheath blight, Leaf blight and grain smut

Note: The Project Coordinating Unit, Bengaluru will supply the seeds of test entries. **Local susceptible and resistant checks of respective location should also be sown.** Raise good crop following recommended Cultivation practices of the region.

SM (PP) 302: Evaluation of donor screening nursery (DSN)

- 1) Foxtail millet: **Athiyandal-** All diseases
 Nandyal- Blast, Downy mildew, rust,
 Rewa: Sheath blight, blast
 Ranichauri: Smut, Blast
- 2) Kodo millet: **Dindori & Rewa-** Head smut, sheath blight
 Jagdapur- Head smut
- 3) Little millet: **Berhampur-** Sheath blight
 Athiyandal- Brown spot
 Ranchi- Sheath blight
 Rewa- Grain smut, sheath blight
 Vizianagaram-Sheath blight
- 4) Barnyard millet: **Ranichauri-** Grain smut, Head smut, Sheath blight
 Almora- Grain smut
 Rewa- Grain smut, Sheath blight
- 5) Proso millet: **Athiyandal-** Rust and brown spot
 Ranichauri- Sheath blight
- 6) Finger millet: **Almora, Athiyandal, Bengaluru, Berhampur, Jagdalpur, Mandya, Ranchi, Ranichauri, Rewa and Vizianagaram-** All major diseases endemic to the location

Note: Rewa Pathologist will visit Dindori centre at appropriate crop stage/s to record incidence of various diseases.

Experimental details for trial on eco-friendly management of banded blight

Crop/s	Centres
Little millet	Jagdapur, Ranchi, Rewa and Vizianagaram
Barnyard millet	Ranichauri, Vizianagaram
Finger millet	Jagdapur, Vizianagaram
Kodo millet	Jagdapur and Rewa
Foxtail millet	Ranchi, Vizianagaram
Proso millet	Vizianagaram

Note: Design= RBD; Treatments= Eight; Replications= Three; Plot size= each treatment should have minimum six rows of three m length; Spacing= locally recommended for the crop
 Trial should be laid in a fixed plot to realize best benefits.
 If any centre has problem in procuring bio-agents they can obtain the same from the respective university or the concerned should intimate the PI in advance for making arrangements.

Use highly susceptible variety

Treatment details

- T₁: Seed treatment with *T. viride* @ 10 g/kg
- T₂: Seed treatment with *P. flourescens*@ 10 g/kg
- T₃: Seed treatment with *B. subtilis* @ 10 g/kg
- T₄: Soil application of value added *P.f.* {one kg talc formulation mixed in 25 kg FYM or vermicompost, incubated for 15 days} applied over an acre at the time of sowing
- T₅: Soil application of value added *T.v.* {one kg talc formulation mixed in 25 kg FYM or vermicompost, incubated for 15 days} applied over an acre at the time of sowing
- T₆: Soil application of value added *B.s.* {one kg talc formulation mixed in 25 kg FYM or vermicompost, incubated for 15 days} applied over an acre at the time of sowing
- T₇:Soil application of value added *P. f. + T.v.+B.s.*{three hundred and thirty five gram each of talc formulations mixed in 25 kg FYM or vermicompost, incubated for 15 days} applied over an acre at the time of sowing
- T₈:Check/Control

Standard Evaluation System for small millet diseases (SES scale)

I. Blast

A) SES for Leaf blast

Score	Description
1	Small brown specks of pinhead size without sporulatingcentre.
2	Small roundish to slightly elongated, necrotic grey spots, about 1-2 mm in diameter with a distinct brown margin and lesions are mostly found on the lower leaves.
3	Lesion type is the same as in scale 2, but significant numbers of lesions are on the upper leaves.
4	Typical sporulating blast lesions, 3 mm or longer, infecting less than 2% o the leaf area.
5	Typical blast lesions infection 2-10% of the leaf area.
6	Blast lesions infecting 11-25% leaf area.
7	Blast lesions infecting 26-50% leaf area.
8	Blast lesions infecting 51-75% leaf area.
9	More than 75% leaf area affected

B) Score chart for neck and finger blasts:

Neck and finger infections must be observed at the milky or dough stage and the per cent finger and / or neck blast will be recorded. Finger blast may be scored on the basis of percentage of finger infection (number of fingers infected out of the total fingers).

$$a) \text{ Neck blast (\%)} = \frac{\text{Number of infected panicles}}{\text{Total number of panicles}} \times 100$$

$$b) \text{ Finger blast (\%)} = \frac{\text{Number of infected fingers}}{\text{Average no. of fingers per plant} \times \text{Total number of panicles}} \times 100$$

Note: Average number of fingers is to be recorded from at least five panicles

Incidence of severely neck infected panicles: SES Scale for rating entries

Score	Description	Reaction
0-1	Less than 5%	R
1.1-3	5-10%	MR
3.1-5	11-25%	MS
5.1-7	26-50%	S
7.1-9	More than 50%	HS

II. SES Scale: Brown spot and Cercospora leaf spot diseases

Score	Description	Reaction
1	Less than 1% leaf area affected	R
2	1-3% leaf area affected	MR
3	4-5% leaf area affected	MR
4	6-10% leaf area affected	MS
5	11-15% leaf area affected	MS
6	16-25% leaf area affected	S
7	26-50% leaf area affected	S
8	51-75% leaf area affected	HS
9	76-100% leaf area affected	HS

III. Sheath blight disease: SES Scale (1996)

Score	Description	Reaction
0-1	Vertical spread of the lesions up to 20% of plant height	R
1.1-3	Vertical spread of the lesions up to 21-30% of plant height,	MR
3.1-5	Vertical spread of the lesions up to 31-45% of plant height	MS
5.1-7	Vertical spread of the lesions up to 46-65% of plant height.	S
7.1-9	Vertical spread of the lesions up to 66-100% of plant height	HS

IV. Incidence of severely sheath rot affected tillers: SES Scale (1996)

Score	Description	Reaction
0-1	Less than 1% sheath area affected	R
1.1-3	1-5% sheath area affected	MR

3.1-5	6-25% sheath area affected	MS
5.1-7	26-50% sheath area affected	S
7.1-9	51-100% sheath area affected	HS

V. Scale: Grain smuts (finger millet, barnyard, foxtail, little millet): SES Scale

Score	Description	Reaction
0-1	Less than 1% grains in a panicle affected	R
1.1-3	1-5% grains in a panicle affected	MR
3.1-5	6-25% grains in a panicle affected	MS
5.1-7	26-50% grains in a panicle affected	S
7.1-9	51-100% grains in a panicle affected	HS

VI. Incidence of Rust: SES Scale

Score	Description	Reaction
0-1	Pinhead flecks with no sporulation	R
1.1-3	Small scattered erumpent pustules with little sporulation	MR
3.1-5	Clear many erumpent pustules containing numerous spores	MS
5.1-7	Many coalescing pustules covering < 50% leaves	S
7.1-9	Many coalescing pustules covering most (>50%) leaves	HS

VII. Head smut of kodo millet:

$$\text{Head smut (\%)} = \frac{\text{Number of smutted panicles}}{\text{Total number of panicles}} \times 100$$

VIII. Udbatta disease:

$$\text{Udbatta (\%)} = \frac{\text{Number of transformed panicles}}{\text{Total number of panicles}} \times 100$$

$$\text{IX. Disease severity or Infection index (PDI)} = \frac{\text{Sum of all disease rating}}{\text{Total no. of rating} \times \text{maximum disease grade}} \times 100$$

(Wheeler, 1969)

The per cent disease incidence (PDI) in each variety is also to be recorded.

For sheath blight and head smut, number of infected plants in the entire plot/treatment is counted to compute the percentage infection (PDI).

X. In order to relate the productivity loss to **downy mildew** severity, disease severity scores are taken on individual plant basis at crop maturity using a 1-5 scale (Thakur RP, Sharma Rajan and Rao VP, 2011) where

- 1 = No infection;
- 2 = 20% productive tillers infected;
- 3 = 50% productive tillers infected;
- 4 = 80% productive tillers infected; and
- 5 = All tillers infected or total plant killed.

Disease severity (%) = $\frac{[(1-1).n_1 + (2-1).n_2 + (3-1).n_3 + (4-1).n_4 + (5-1).n_5]}{(5-1). N} \times 100$ where $n_1, n_2, n_3, n_4,$ and n_5 are total number of plants in each of 1 to 5 rating class, and N is the total number.

Technical programme for the year 2017-18

4. Agricultural Entomology

- Chairman** : Dr. V. V. Belavadi
Professor and Head of the Department, UAS, Bengaluru
- Convener** : Dr. Prabhu C Ganiger; Entomologist and PI (Entomology)
- Rapporteur** : Miss. Dr. Ipsita O.P. Mishra,
Entomologist, AICRP on Small Millets, OUAT, Berehampur

The agricultural entomology discipline meeting began with welcome by Dr. Prabhu Ganiger, PI, Ag. Entomology. In his opening remarks the chairman Dr. V. V. Belavadi, suggested the all the entomologists to develop susceptible and tolerant checks for screening of insect pests of millets and also concentrate on storage pests of minor millets. Dr. Shyamprasad, suggested all the scientists to keep your own pest screening nursery to evaluate the varieties.

The following scientists were present and discussed previous year results and technical programmes of 2017-18

1. Dr. Shyamprasad, PI and Entomologist, IIMR, Hyderabad (Telangana-State)
2. Dr. Prabhu Ganiger, PI and Entomologist, PC Unit, Bangalore
3. Dr. M K Chakravarthy, Entomologist, Birsa Agricultural University, Ranchi (Jarkhand)
4. Dr. S. K. Choubey, Scientist Entomology, RARS, JNKVV, Dindori (M.P)
5. Miss. Dr Ipsita O. P. Mishra, Entomologist, OUAT, Berhampur (Odisha)

After the discussion and deliberation with scientists, the chairman made the following suggestions/ recommendations

1. There is a need to identify the tolerant and susceptible checks in all crops (based on literature or previous work). Screening for shoot fly should be initiated in the nursery itself.
2. All insect pests of finger millet and other small millets should be recorded in percentage only (Follow similar method of observation/recording)
3. No. of observations for shoot fly should be 30 plants/replication.
4. Data sheet will be prepared and circulated to each scientists
5. Make arrangement to supply aspirator, vials and fish meal trap for collection of shoot fly
6. Collected specimens of all insect pests of small millets should be sent to main centre for identification. (Predators/parasitoids/ spiders to be identified from taxonomists)
7. For screening trials, seed quantity should be increased so as to maintain a minimum of 30 plants/3 m row
8. Weather parameters should be correlated with insect pests of different crops in different centers. Hence, all centers should record weekly observations of weather parameters during the cropping season (Temperature (max and min), humidity, rainfall, sunshine hours, wind speed etc)
9. Compile the ten years data to know the susceptible and resistant varieties/germplasms for screening of all the small millets

Trials/experiments concluded, deleted, modified and added:

- | | |
|---|-----|
| A) Trials/experiments excluded/ deleted for 2017: | - |
| B) Trials/experiments Modified: | One |
| C) New trials formulated: | Two |

1. Effect of different dates of sowing on incidence of shoot flies in small millets

(Weekly observation)

Ranchi : Little millet, Foxtail millet, Kodo millet

Dindori : Little millet

Berhampur : Little millet, Foxtail millet, Proso millet

Bangalore : Little millet, Foxtail millet,, Barnyard millet, Proso, Kodo millet

2. Storability of milled rice in all small millet crops (To know the lifespan of milled rice) and enumerate the stored grain pests and its incidence level

Ranchi, Bangalore, Berhampur: Finger millet - white ragi compare with brown ragi

Dindori, Bangalore : Kodo and Little Millet

Bangalore : Little millet, Proso millet, Foxtail millet, kodo millet

Half kilogram of milled rice will be kept for insect observation. The period of observation may from first week to sixth week. The incidence and per cent loss or damage of pest will be recorded.

3. Systematic study on alternate hosts for shoot fly in all small millets

Ranchi : Little millet

Dindori : Little millet and Kodo millet

Berhampur : Little millet, Proso millet, Foxtail millet

Bangalore : Little millet, Proso millet, Foxtail millet, kodo millet

Details of experiments allotted to different centers

Trial No.	Trial	Centres
SM (E) 401	Pest survey, surveillance and seasonal incidence with different dates of sowing	
SM (E) 401.1.1	The seasonal incidence with different dates of sowing on incidence of insect pests of finger millet	Bangalore, Berhampur and Ranchi
401.1.2	The seasonal incidence with different dates of sowing on incidence of insect pests of small millets Ranchi : Little millet, Foxtail millet, Kodo millet Dindori : Little millet Berhampur : Little millet, Foxtail millet, Proso millet Bangalore : Little millet, Foxtail millet,, Barnyard millet, Proso, Kodo millet	
401.1.3	Systematic study on alternate hosts for shoot fly in all small millets Ranchi : Little millet Dindori : Little millet and Kodo millet Berhampur : Little millet, Proso millet, Foxtail millet Bangalore : Little millet, Proso millet, Foxtail millet, kodo millet	
SM (E) 402	Multi-pest resistance screening trial (IVT, AVT I & II)	Bangalore, Berhampur and Ranchi
402. 2	Evaluation of kodo millet advanced varieties against shoot fly (KAVT)	Bangalore, Dindori, Ranchi,

402. 3	Evaluation of little millet advanced varieties to shoot fly (LAVT)	Bangalore, Berhampur, Dindori, Ranchi,
402. 4	Evaluation of proso millet advanced varieties to shoot fly (PAVT)	Ranchi, Bangalore
402. 5	Evaluation of foxtail millet advanced varieties to shoot fly (FAVT)	Bangalore, Ranchi
402.6	Evaluation of barnyard millet advanced entries to shoot fly (BAVT)	Bangalore
SM (E) 403	Management of shoot fly in small millets	
403.1 :	Stem borer management in finger millet	Berhampur
403. 2 :	Low cost management of shoot fly in little millet	Berhampur, Dindori, Ranchi
403.3	Low cost management of shoot fly in Proso millet	Ranchi
SM(E)404:	Stored pests of small millets	
404.1	Storability of milled rice in all small millet crops and enumerate the stored grain pests and its incidence level Ranchi, Bangalore, Berhampur - Finger millet - white ragi compare with brown ragi Dindori, Bangalore : Kodo and Little Millet	

Detailed technical programme for 2017-18

The prime objective of the small millet improvement program is to increase and stabilize crop production in the millets growing areas at National level. To achieve this goal, it is necessary to provide the national programs with genotypes which have higher and stable yield potential than those currently grown by the farmers. One of the important objectives of AICRP on small millets research program is to identify improved sources of resistance for various insect pests from the national germplasm. To ensure that such resistance is broad based, it is necessary to test the material under various levels of insect infestation and under different environmental conditions through AICRP collaboration.

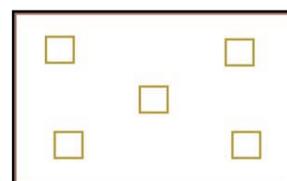
SM (E) 401 : Pest survey, surveillance and seasonal incidence with different dates of sowing

401.1.1: Survey for insect pests of Finger millet (*Eleusine coracana*)

Pest surveillance is the most important and integral part of IPM technology. It involves direct measurement of pest or disease occurrence, development of population and damage at regular intervals. Usually, sampling 25 plants in 5 clusters of the plot at 7-10 days interval is suitable for ascertaining insect pest levels, natural enemy populations.

Methodology for Random field survey:

During the survey the villages having large area under finger millet, will be selected randomly. Farmer's field has to be selected for surveillance and will be contacted and details of his crop will be noted in the following proforma. The surveyor will walk inside the field in 'X' or 'Z' manner and sample the plants at five spots randomly as shown in figure (four in the corners, at least 5 feet inside the borders and one in the centre). At each spot select ten random plants for recording observations of insect pests as follows (**Annexure-I**)



1. **Grass hoppers** : number/m² and per cent damage (Randomly counting the hundred plants with GH damage to calculate per cent and also record the per cent damaged leaves)
2. **Mylocerus sp.** : number/m²
3. **Stem borer** : Per cent dead hearts (expressed as per cent basis and per cent larvae)
4. **Earhead caterpillar, Helicoverpa armigera** : Per cent (Eggs/egg mass, larvae)
5. **Aphids** : presence of number of aphids and per cent affected plants/ panicles

6. **Defoliators** (RHC, *Spodoptera* sp.) : Larvae/m² and per cent defoliated plants
7. Natural enemies :

Egg parasitoids : Collect 50 eggs of lepidopterans in case of singly laid eggs and 3 egg masses for *Spodoptera* sp. and others which lay eggs in masses. Incubate them in the lab and observe for parasitoid emergence and express as per cent parasitisation. Get the parasitoid identified from taxonomist.

Larva: Count the parasitized or disease affected larvae in the field and express as per cent affected. Also, about 50 larvae could be brought to lab and reared for the emergence of parasitoids from them and express as per cent affected.

Predators: Predators such as adults of chrysoperla, syrphids and coccinellids, predatory bugs, spiders can be counted along larval counts of pests and expressed as number per square meter.

SM (E) 401. 1. 2: Seasonal incidence of insect pests on finger millet

Methodology:

To study the seasonal incidence of pests with different dates of sowing, take up sowing at staggered intervals of fifteen days interval starting from beginning of the season and continue at least two sowings after the completion of season. Based on standard weeks, the insect pests of finger millet with their natural enemies (grey weevil, grasshopper, shoot aphids, stem borer and earhead caterpillars) will be observed **weekly** with different stages of crop. Further, this data can be correlated with weather parameters. (Observation sheet as Annexure –I)

Note: The crop should be raised under protective irrigation where ever necessary.

Plot size: 2.0 meter x 2.25 meter (Each date of sowing will have three plots to maintain replication)

Variety: Popular variety of your region. First sowing should be based on your (farmers') normal sowing

S. No.	Different dates sowing	Centres	Record (Weekly)
1	30 th June	Bengaluru, Berhampur, Kanke (Ranchi)	<ul style="list-style-type: none"> • Insect pests and its natural enemies • Weather parameters
2	15 th and 30 th July		
3	15 th and 30 th August		
4	15 th September		

401.1.2 The seasonal incidence with different dates of sowing on incidence of insect pests of small millets

Ranchi : Little millet, Foxtail millet, Kodo millet

Dindori : Little millet

Berhampur : Little millet, Foxtail millet, Proso millet

Bangalore : Little millet, Foxtail millet, Barnyard millet, Proso, Kodo millet

To know the seasonal incidence of insect pests with different dates of sowing; sowing will be carried out at staggered intervals of fifteen days interval starting from beginning of the season and continue at least two sowings after the completion of season. Based on standard weeks, the insect pests of small millets with their natural enemies (dead heart by shoot fly, grass hopper, leaf roller, gall midge, flea beetles, ants, aphids, bugs etc) will be observed **weekly** with different stages of crop. (Observation sheet as Annexure -III)

Parasitoids: To observe parasitoids, randomly collect the dead heart symptomed plant samples and kept in polythene covers for parasitoid emergence and also for the adults of shoot fly and gall midges. (small holes should be made on covers for aeration).

Plot size: 2.0 meter x 2.25 meter (Each date of sowing will have three plots to maintain replication)

Variety: Popular variety of your region

transferring them by using camel hair brush into a vial, containing 70 % alcohol. The specimens collected may be sent to co-ordinating unit, Bangalore for identification.

Note: The material raised under project SM (E) 402 may be used for this study. In course of study on natural enemies of pests of finger millet; If you happen to collect parasites of shoot and root aphids, collect them in 70 % alcohol in vials and dispatch to PI (E), coordinating unit Bangalore for identification.

402.1.1..2 : Stem borer screening nursery

Methodology: Two rows of three meter length for each variety with a row spacing of 22.5 - 30 cm may be grown in three replications. IVT entries showing less, moderate and high incidence of stem borer in Kharif-2016 or based on previous year's data should be selected and further tested during the summer season. In addition released and pre released varieties and local promising varieties including released varieties may also be screened.

Observations: The incidence of stem borer should be recorded as per cent incidence by counting the entire population under each treatment (**Annexure-II**).

Centre: Berhampur, Bangalore

402. 2 Evaluation of kodo millet (*Paspalum scrobiculatum*) advanced varieties against shoot fly (KAVT)

Design : RBD **Plot size** : 3 rows of 3 meter length

Record the total number of germinated plants at ten Days After seedling Emergence (DAE), number of plants with eggs, plants with deadhearts, and the total number of plants at 14, 21, 30 and 45 DAE. Oviposition percentage is calculated at **14 and 21 DAE** by multiplying with 100, the ratio of number of plants with eggs to total number of plants. Similarly, the dead heart percentage is calculated by calculating the ratio of number of plants with dead heart to total number of plants and multiplying with 100 at 30 and 45 DAE. If possible, also record the number of tillers, and tillers with panicles at maturity as a measure of genotype's recovery resistance (ICRISAT, 1997) (**Annexure-IV , VI**).

402. 3 Evaluation of little millet (*Panicum miliare*) advanced varieties to shoot fly (LAVT)

Design : RBD **Plot size** : 2 rows of 3 meter length
Material : Coordinating unit will supply seeds **Centres** : Bangalore, Ranchi and Dindori

Record the total number of germinated plants at 10 DAE, number of plants with eggs, plants with deadhearts, and the total number of plants at 14, 21 and 28 days after seedling emergence. Oviposition percentage is calculated at 14 and 21 DAE by multiplying 100 with, the ratio of number of plants with eggs to total number of plants. Similarly, the dead heart percentage was calculated by calculating the ratio of number of plants with dead heart to total number of plants and multiplying with 100 at 14, 21 and 28 DAE. If possible, also record the number of tillers, and tillers with panicles at maturity as a measure of genotype's recovery resistance (ICRISAT, 1997) (**Annexure-IV, VI**).

Centre: Bangalore, Ranchi, Berhampur and Dindori

402. 4 **Evaluation of Proso millet (*Panicum miliaceum*) advanced varieties to shoot fly (PAVT)**
Follow the method as in LAVT 402.3. **Centre:** Ranchi

402. 5 **Evaluation of foxtail millet (*Setaria italica*) advanced varieties to shoot fly (FAVT)**
Follow the method as in LAVT 402.3. **Centre:** Bengaluru

402.6 **Evaluation of barnyard millet (*Echinochloa frumentacea*) advanced entries to shoot fly (BAVT)**
Follow the method as in LAVT 402.3. **Centre:** Bengaluru

SM (E) 403 : Management of shoot fly in small millets

403.1 : Stem borer management in finger millet

Design: RCBD Replication: 3 Season: Summer Variety: Bhairabi Centre: Berhampur

S. No.	Treatment	Dosage	Interval/ spraying at stage of crop
1	Release of <i>Trichogramma chilonis</i> as biocontrol agent	50,000/- per hectare	7 days interval
2	Foliar spray of Neem Pesticide	0.03% (300 PPM) @ 5 ml./ l water	
3	Foliar spray of Bt (<i>Bacillus thuringensis</i>)	2g /L	
4	NSKE	5%	15DAS
5	NSKE	5%	25DAS
6	NSKE	5%	35 DAS
7	Control		

403.2 : Low cost management of shoot fly in little millet

Design: Split plot Plot size: 2.0 m x 2.25 m Replication: 3 Centres: Ranchi, Dindori, Berhampur

Sl. No.	Treatments	Day after sowing (DAS)
1	1.5 times recommended seed rate	While sowing
2	Spraying of 1500 ppm neem/ azadirachtin	7 DAS
3	1500 ppm neem/ azadirachtin	15 DAS
4	1500 ppm neem/ azadirachtin	25 DAS
5	Early sowing,	15 days before the normal sowing
6	NSKE at 5%	7DAS
7	NSKE at 5%	15 DAS
8	Control	

403.3 : Low cost management of shoot fly in Proso millet

Design: Split plot Plot size: 2.0 m x 2.25 m Replication: 4 Centres: Ranchi (Kanke)

Sl. No.	Treatments
1	1.5 times recommended seed rate
2	Spraying of 1500 ppm neem/ azadirachtin 7 DAS
3	Spraying of 1500 ppm neem/ azadirachtin 15 DAS
4	Spraying of 1500 ppm neem/ azadirachtin 25 DAS
5	Early sowing, 15 days before the normal sowing
6	Spraying of NSKE at 5% 7DAS
7	Spraying of NSKE at 5% 15 DAS
8	Control

404 Store pests of small millets

404.1 Storability of milled rice in small millet crops (To know the lifespan of milled rice) and enumerate the stored grain pests and its incidence level

Ranchi, Bangalore, Berhampur : Finger millet - white ragi compare with brown ragi

Dindori, Bangalore : Kodo and Little Millet
 Bangalore : Little millet, Proso millet, Foxtail millet, kodo millet

Half a kilogram of milled rice will be kept for insect observation. Collect insect pests that occur on this stored milled rice and preserve in alcohol. Then specimen should be sent for identification. Observations may be recorded at weekly intervals for six to eight weeks. The pest incidence and per cent loss or damage due to pest may be worked out. For this two set of experiment must be designed, one for incidence and loss assessment another for control. The pest incidence may be recorded based on the known quantity should be scooped out from the sample and record the incidence at weekly interval. To calculate the loss, initial weight and weight at end of the week (from the control) should be recorded at weekly interval.

Replication: 4 Sample size: Half kg (250 g each set),
 Feeler trial at specific centre:

Little millet (*Panicum miliare*)

1. Seasonal incidence and assessment of loss due to blister beetle on little millet

Methodology: To study the seasonal incidence of pests in particular of blister beetles, based on standard weeks, the crop will be observed weekly at different stages of crop. Further, using this data correlate the incidence of blister beetle with weather parameters. The crop loss can be assessed by protected/treated with insecticides/ management and untreated with any insecticides. Yield per ha has to be recorded in protected and unprotected condition of the crop.

Centre : Dindori

Note: Seed entries of advanced and germplasm for evaluation trial of all crops will be sent by the PI (E) Co-ordinating Unit, Bengaluru.

Dr. Prabhu Ganiger, Entomologist, P.C. Unit, UAS, Bengaluru, thanked Chairman and Co-chairman and all the participants, on behalf of the project Coordinating Unit, ICAR for contributing their input to refine the technical programme.

AICRP Technical Programme: Small Millet Entomology-Kharif 2017-18

Trial No.	Name of the trial	Entries	Repliation	Plot size (Row x m)	Centers				
					Bangalore	Berham pur	Dindori	Ranchi	Total
SM (E) 401	Pest survey, surveillance and seasonal incidence with different dates of sowing								
401.1.1	Different dates of sowing-finger millet		3	2m X 2.25 m	1	1		1	3
401.1.2	Different dates of sowing-Small millets		3	2m X 2.25 m	1	1	1	1	4
401.1.3	Alternate hosts for shoot fly		3	2m X 2.25 m	1	1	1	1	4
SM (E) 402	Multipest resistance screening trial								
402.1	FM-IVT, AVT I & II		3	2r x 3m	1	1		1	3
402.2	KAVT		3	3r x 3m	1		1	1	3
402.3	LAVT		3	2r x 3m	1	1	1	1	4

402.4	PAVT		3	2r x 3m	1			1	2
402.5	FAVT		3	2r x 3m	1			1	2
402.6	BAVT		3	2r x 3m	1				1
403	Management of shoot fly in small millets								
403.1	Stem borer management in finger millet *	Summer				1			1
403.2	Low cost management of shoot fly in little millet			2.0 m x 2.25 m		1	1	1	3
403.3	Low cost management of shoot fly in Proso millet			2.0 m x 2.25 m				1	1
SM(E) 404	Stored pests of small millets								
404.1	Storability of milled rice in all small millet crops and enumerate the stored grain pests and its incidence level				1	1	1	1	4
	Total				10	8	6	11	35

* Summer experiment

Annexure – V

Screening of insect pests of finger millet

- Screening of Stem borer** : Visual damage rating scale for deadheart formation and chaffy and broken panicles caused by borer infestation. Record the total number of plants, plants showing borer deadhearts, and the visual score (1-9) for deadhearts.

Scores	Dead heart/ chaffy broken panicles (%)
1	< 10
2	10 - 20
3	21 - 30
4	31 - 40
5	41 - 50
6	51 - 60
7	61 - 70
8	71 - 80
9	> 80

- Aphid density**: Injury rating based on visual scoring to screen for resistance to Aphids. At peak infestation, evaluate the test genotypes for aphid resistance by recording aphid density. For this, count the number of aphids in a unit area on three leaves, and record observations on five plants selected at random from each genotype. This can be evaluated in a 1 to 9 scale (where 1 = a few aphids present with no apparent damage to the leaves, and 9 = heavy aphid density on infested leaves).

Aphid density/injury rating	Aphid density/injury (%)
1	1-10
2	11-20
3	21-30
4	31-40
5	41-50
6	51-60

7	64-70
8	71-80
9	>80

3. **Defoliators** : The test lines can be screened by using 1-9 scale scoring where 0= No damage and 9 = 81-100% foliage destroyed. (Defoliators include RHC, *Spodoptera* sp., grey weevil, grasshopper etc)

Rating	Leaf area damaged (%)
0	No damage
1	1-10
2	11 - 20
3	21 - 30
4	31 - 40
5	41 - 50
6	51 - 60
7	61 - 70
8	71 - 80
9	81 - 100

Annexure -VI

Screening of small millets against shoot fly

Shoot fly : Based on per cent dead hearts by shoot fly, the germplasms are grouped in to five categories

Sl. No.	Level of tolerance	Score	Per cent deadheart
1	Highly tolerant	1	≤ 10% infestation
2	Tolerant	3	10 to 20% infestation
3	Moderately tolerant	5	20 to 35% infestation
4	Susceptible	7	35 to 50% infestation
5	Highly susceptible	9	≥50% infestation

Monitoring adult populations of shoot fly : Studies on the population monitoring of the pest was carried on small millets. During study period the pest population was observed on crops grown during the August-October and October –January months by employing Fish meal trap.

Fish meal trap : Moistened fish should be kept for attraction of shoot flies. Fish meal changed once in five days. The flies from the trap were collected every day morning with help of wire mesh/ hair brush from sieved material. The specimens collected from the trap should be labeled and then send it for identification.

Observation units for seasonal incidence and screening of varieties for insects pests of small millets:

SI No.	Pest/Resistant parameters	Observation Unit
1	Plant population at 10 Days After Emergence (DAE) (No.)	Number in per cent
2	Grass hoppers	Per cent
3	<i>Mylokerussp.</i> weevil	Per cent
4	Earhead caterpillar	Per cent
5	Aphids Rating (1-9)	Per cent affected and Number/3 leaves
6	Defoliators (Leaf area)	Per cent
7	Stem borer deadhearts (%)	Per cent
8	Shoot fly eggs/5 plants at 14 and 21 DAE (No)	Number
9	Shoot fly deadhearts (%) - at peak time (14, 21, 28) (30 and 45 in Kodo millet)	Per cent
10	Grain yield/ plot (g) / five plants	Gram

Option for each centre:

Shoot fly screening nursery (SSN) : All entomologists should keep their own SSN. Available germplasms will be procured from different plant breeders of small millets and then will be screened against shoot fly. From this you can develop your own/ local susceptible and tolerant variety for insect pests.

Proforma for Survey of Insect Pest complex of finger millet

Name of the centre	:	Name of the Scientist	:
Village	:	Taluk & District	:
Crop season	: Rabi/ Kharif/ Summer/Rabi- summer	Name of the farmer	:
Sowing date	:	Whether the crop is	: Rainfed/Irrigated
Date of observation	:	Plant stand	: Good/Moderate/Poor
Stage of crop	: Seedling/vegetative (tillering)/ Milky stage /seed filling	Name of variety / hybrid	:
Sampling size	: 25 plants of five replication in one field	If any :	

Sl. No.	Myllocerus weevil / m ²	Grasshoppers/ defoliators			Stem borer %	Earhead caterpillar %	Leaf hopper %	Shoot / root aphid			Predators/ m ²			Others/Approx. % crop loss / if any egg mass / larvae to be collected for parasitoid emergence
		GH/ m ²	Plants %	Affected leaves (%)				Plants affected %	Panicles Affected %	Nos/ 3 Leaf/ panicle	Coccinellids	Syrphids	Spiders	
1														
2														
3														
4														
5														
Total/Mean														
1														
2														
3														
4														
5														
Total/Mean														

Annexure-II Observations on the Seasonal incidence/ screening of insect pests on finger millet

Season: Crop (var) : Different Date of sowing:
 Trial: Weekly observation mean then enter into the standard weeks. All observations measured in per cent

Sl. No.	Mylocerus weevil (%)	Grasshoppers/Defoliators			Stem borer %	Earhead caterpillar %	Leaf hopper %	Shoot aphid			Predators			Others
		GH %	Plants %	Affected leaves/ leaf area (%)				Plants affected %	Panicles Affected %	Nos/ 3 Leaves/ 3 panicle	Coccinellids	Syrphids	Spiders	
1														
2														
3														
4														
5														
Total/Mean														
1														
2														
3														
4														
5														
Total/Mean														
1														
2														
3														
4														
5														
Total/Mean														
1														
2														
3														
4														
5														
Total/Mean														

Seasonal Incidence of Insect pests of finger millet at Bangalore (Karnataka) : Five different dates of sowing

1. Sowing date : 15.07.16 First DOS (Days After Sowing)

Observation date	Std week	<i>Mylocerus</i>	Grasshopper	Stem borer (%)	Earhead caterpillar	Leaf hopper	Cetonid	Flea beetles	Earhead bugs	Aphids	Coccinellids	Syrphids	spiders
28.07.16	30												
05.08.16	31												
11.08.16	32												
16.08.16	33												
22.08.16	34												
01.09.16	35												
06.09.16	36												
15.09.16	37												
22.09.16	38												
29.09.16	39												
6.10.16	40												
13.10.16	41												
21.10.16	42												
28.10.16	43												

Annexure -III Observations on the Seasonal incidence of insect pests of small millets

Season: **Crop (var) :** **Different Date of sowing:** **Trial:**

Crop : Little millet, Foxtail millet, Kodo millet, Proso millet, Barnyard millet (✓ tick mark while observation)

Weekly observation mean then enter into the standard weeks. All observations measured in **per cent**

Sl. No.	Shoot fly/dead heart (%)	Grasshoppers			Stem Borer/ flea beetles/bugs %	Leaf roller %	Gall midge /ants %	Aphid			Predators/parasitoids			Remarks/if any other pests
		GH %	Plants %	Affected leaves (%)				Plants affected %	Panicles Affected %	Nos/ Leaf/ panicle	Coccinellids	Spiders	Others	
1														
2														
3														
4														
5														
Total/Mean														
1														
2														
3														
4														
5														
Total/Mean														
1														
2														
3														
4														
5														
Total/Mean														
1														
2														
3														
4														
5														
Total/Mean														

Annexure-IV Observations on the screening for insect pests of small millets

Season:

Crop (var) :

Date of sowing:

Trial:

Crop : Little millet, Foxtail millet, Kodo millet, Proso millet, Barnyard millet (✓ tick mark while observation) DOB :

All observations measured in per cent (30 plants to be observed for per replication/treatment/germplasm)

Code of germplasm	Sl. No.	Total number of germinated plants(10 days after seedling emergence (DASE))	Eggs (per cent) (DASE)		Total number of plants/plot after seedling emergence (days)			Dead heart (shoot fly) (%) Days after seedling emergence (DASE)			White ear head (WEH) % At Panicle emergence stage	Remarks/if any other pests
			14	21	14	21 (30 for kodo)	28 (45 for kodo)	14	21 (30 for kodo)	28 (45 for kodo)		
Germplasm -1	R1											
	R2											
	R3											
	Total/ Mean											
Germplasm -2	R1											
	R2											
	R3											
	Total/ Mean											
Germplasm -3	R1											
	R2											
	R3											
	Total/ Mean											
Germplasm -4	R1											
	R2											
	R3											
	Total/ Mean											
Germplasm -5	R1											
	R2											
	R3											
	Total/ Mean											

Technical programme for the year 2017-18

5. Physiology

Chairman:	Dr. K.T. Krishne Gowda, Former Project Coordinator (SM), GKVK, Bangalore
Co-chairman:	Dr. Nagaraju, Professor (Agro-forestry) & Comptroller UAS, GKVK, Bangalore
Convener:	Dr. Y.A.Nanja Reddy, Physiologist

Highlights of the results of 2016-17

- Superior accessions for high yield potential over the GPU-28 have been identified based on physiological traits viz., SLW, leaf angle, leaf temperature, LAI. The accessions are GE- 50, 199, 292, 469, 1026, 1200, 1264-A, 1360, 1681, 1855, 2650, 4568, 4597, 4748, 4995, 5117. Similarly for drought tolerance are, 4568, 388, 4929, 4798, 144.
- Mapping population has been advanced from F4 to F5 generation (GE-496 x 156 (218) and GE-208 x GE-156 (302).
- Foliar application of ZnSO₄ @ 0.75% at ear emergence enhanced the grain zinc content by 16 %, while application @ 0.5 % twice at ear emergence & 15-20 days after enhanced the grain zinc content by 30 percent.

Technical Programme for 2017-18

(1) Enhancing grain zinc content in finger millet

As per the suggestions of the house, the experiment will be repeated in the same centers for confirmation.

Centers: PC Unit, GKVK (Dr. Nanja Reddy, Y.A), Athiyandal (Dr. Nirmalakumari, A), Vizianagaram (Dr. T.S.S.K. Patro), Perumalapalle (Dr. Subba Rao), Hanumanamatti (Dr. Nagappa)

Design: RCBD

- (1) Control No Zn SO₄ application
- (2) Soil application @ 12.5 Kg ha⁻¹ (7.5 g ZnSO₄ per plot of 7 rows x 3 meter length in 30 x 10 cm spacing)
- (3) Foliar application @ 0.75 % ZnSO₄ at flowering (4.5 g ZnSO₄ per plot) (Dissolve 4.5 g in 600 ml of water and spray to respective treatment)
- (4) Foliar application @ 0.50 % ZnSO₄ at flowering (3.0 g ZnSO₄ per plot) and 15 days after (3.0 g ZnSO₄ per plot) (Dissolve 3.0 g in 600 ml of water and spray to respective treatment)

Plot size: 2.1 m x 3 m (7 rows of 3 meter length) with a variety: GPU-28.

Replications: 5

Layout

R1	R2	R3	R4	R5
CONTROL	Foliar application @ 0.75 % ZnSO ₄	Soil application @ 12.5 Kg ha ⁻¹	Foliar application @ 0.75 % ZnSO ₄	Soil application @ 12.5 Kg ha ⁻¹

Soil application @ 12.5 Kg ha ⁻¹	CONTROL	Foliar application @ 0.5 % ZnSO ₄ at flowering and 15 days after	Foliar application @ 0.5 % ZnSO ₄ at flowering and 15 days after	Foliar application @ 0.75 % ZnSO ₄
Foliar application @ 0.75 % ZnSO ₄	Foliar application @ 0.5 % ZnSO ₄ at flowering and 15 days after	CONTROL	Soil application @ 12.5 Kg ha ⁻¹	CONTROL
Foliar application @ 0.5 % ZnSO ₄ at flowering and 15 days after	Soil application @ 12.5 Kg ha ⁻¹	Foliar application @ 0.75 % ZnSO ₄	CONTROL	Foliar application @ 0.5 % ZnSO ₄ at flowering and 15 days after

Spray solution: The said quantity (pack) shall be dissolved in 600 ml water and spray respectively as per the treatments.

Observations:

- 1) Initial soil sampling in each replication
- 2) Final soil sampling in each replication after crop harvest
- 3) Days to 50 % ear emergence
- 4) Earhead weight / plot leaving the border rows (5 rows x 2.6 m)
- 5) Grain yield/ plot leaving the border rows (5 rows x 2.6 m)
- 6) Dry straw weight / plot leaving the border rows (5 rows x 2.6 m)

(2) Multi-location evaluation of selected genotypes for drought tolerance in finger millet

Main treatments: Control and rainfed (No irrigation at EHE to 30 days after and control)

Sub-Treatments (Accessions): 20 , Replications: Three , Plot size: Three lines of 1.4 m²

Observations:

- 1) Leaf folding (No, mild and full)
- 2) Leaf angle (using protractor)
- 3) SLW (in five leaves in each replication. In 5 plants collect the 3rd leaf from the tip, measure the length x width of each leaf totalling to all 5 leaves together and oven dry to take leaf weight in mg).
- 4) Biomass (Remove the borders of 2+2 plants in the remaining 30 plants, together harvest separate the earheads and weigh the same and thresh to get seed weight. After harvesting the ears, harvest the straw to ground to the extent possible, dry without termite attack and weigh the same after arriving to constant weight)
- 5) Yield and yield attributes (No. of productive tillers/ m², number of ears/ m², earweight/ m², seed yield/m² and 1000 seed weight)

Centres:

PC Unit, GKVK (Dr. Nanja Reddy, Y.A), Athiyandal (Dr. Nirmalakumari, A), Vizianagaram (Dr. T.S.S.K. Patro)

Perumalapalle (Dr. Subba Rao), Hanumanamatti (Dr. Nagappa)

(3) Identification of physiological growth stages in finger millet

In the similar lines of sorghum, different growth stages will be identified in finger millet belonging to short, medium and long duration finger millet variety.

Season: Kharif, 2017

Technical programme for the year 2017-18

6. Frontline demonstrations

Chairman:	Dr. K.T. Krishne Gowda, Former PC, GKVK, Bengaluru.
Co-Chairman:	Dr. Nagaraja, Professor of Agroforestry and Comptroller, UAS, GKVK, Bengaluru.
Rapporteurs:	Dr. AL.Narayanan, Professor of Agronomy, Agriculture College, Karaikal
Convenor:	Dr. B .Boraiah, Agronomist, PC unit, GKVK, Bengaluru.

At the outset the chairman welcomed the gathering and stressed to adopt all improved practices in farmers field to improve the productivity. FLD Studies involving 300 hectares of land under various small millets were carried out by various centers across the country depicting the improved management practices to realize the remunerative returns in small millets and improve their livelihood of small millet farmers.

Improved package of practices for Minor millets

The following recommended practices were advocated to implement in the FLD programme. However, all the Practices could not be followed uniformly by the FLD farmers of the different regions due to various practical reasons. The precaution was taken to maintain similar situation by using same inputs to both FLD and local cultivars in the farmers' fields.

Sowing time:	2nd fortnight of June to 1st fortnight of August
Seed rate:	8-10 kg/ha (3 – 4 kg/acre)
Spacing:	Row to row 22.5 - 30 cm and plant to plant 7.5 to 10 cm
Plant population:	3.33 – 4.44 lakh per ha
Seed treatment:	Azospirillum brassilense and Aspergillus awamouri 25 gm/ Kg of seeds
Fertilizer dose (N: P₂O₅:K₂O):	50:40:25 kg /ha NP ₂ O ₅ K ₂ O for rainfed and 100:50:50 kg /ha for Irrigated (Finger millet), other small millets 40:20:0 kg /ha NP ₂ O ₅ K ₂ O (50% N and full P ₂ O ₅ and K ₂ O as basal and 50% N at 30-35 days after sowing)
Irrigation:	I st at germination, II nd at panicle initiation and III rd at grain filling stage, if available
Weed management:	Spray of Isoproturon @ 0.5 kg a.i./ha immediately after sowing, inter-cultivation 2 times at 25 and 35- 40 DAS
Plant protection:	Need-based soil application of Carbofuron 3G @ 2 g/m at sowing,

Proposal of FLD's on Small millets for the year 2017-18

SL. NO.	Center	FM	FTM	LM	KM	PM	BM	Total Area. Ha
1	P.C. unit	20	5	-	5	-	-	30
2	VPKAS Almora	10	-	-	-	-	5	15
3	Mandya	15	-	-	-	-	-	15
4	Hagari	-	10	-	-	-	-	10
5	Nandyal	-	20	-	-	-	-	20
6	Vizianagaram	15	-	10	-	-	-	25
7	Jagdapur	15	-	5	10	-	-	30
8	Athiyandal	5	5	5	5	5	5	30
9	Ranichauri	10	-	-	-	-	10	20
10	Dindori	-	-	15	15	-	-	30

11	Rewa	-	-	15	5	-	-	20
12	Kolhapur	15	-	5	-	-	-	20
13	Kanke	15	-	-	-	-	-	15
14	Waghai	10	-	10	-	-	-	20
	Total	130	40	65	40	5	20	300

Improved varieties to be demonstrated under FLDs through AICRP (SM) 2017-18

State	Finger millet	Foxtail millet	Kodo millet	Little millet	Barnyard millet	Proso millet
Karnataka	GPU-67 GPU-66 KMR 204 KMR 301	SiA 3088 SiA 3156 SiA 3085	RK 390-25 JK-155 JK -137 JK-439	-	-	-
Uttarakhand	VL-352 VL-315 VL-348	-	-	-	VL 207, VL-181, VL- 172 PRJ -1	-
Andhra Pradesh	VR 990	SiA 3088 SiA 3156 SiA 3085	-	JK – 8 OLM 208 BL-6 BL-4	-	-
Madhya Pradesh	-	-	RK 390-25 JK-155 JK -137 JK-439	JK – 8 OLM 208 BL-6 BL-4	-	-
Tamil Nadu	GPU -67 GPU-28 CO-4	SiA 3156 TNAU 186 CO-3	TNAU 86	TNAU 63 OLM 208 TNAU 91	CO-2 VL 207	TNAU 202 TNAU 164
Maharashtra	KOPN-235	-	-	OLM 208	-	-
Chattisgarh	GPU 28 GPU 67 Indira ragi	-	Indira kodo 1 RK 390-25	OLM 208 OLM 217	-	-
Jharkhand	GPU 67 GPU 45 A 404	-	-	-	-	-
Gujarat	GNN-6 GN- 5	-	-	OLM 217 OLM 208	-	-

Part C: Appendices

Annexure-I

Agenda



28th Annual Group Meeting of

All India Coordinated Research Project on Small Millets

Date: 14-15, April, 2017

Venue: University of Agricultural Sciences, Bengaluru

Day 1: April 14, 2017 (Friday)

9.00-9.45	:	Registration
10.00-12.00	:	Session - I: Inaugural session
		Chief Guest : Dr. A. Seetharam, Ex-PC (Small Millets)
		Chairman : Dr. H. Shivanna Vice Chancellor, UAS, Bengaluru
		Guests of Honour : Dr. V.A. Tonapi , Director, IIMR, Hyderabad : Dr. T. N. Prakash, Chairman, Karnataka Agriculture Price Commission, Bengaluru
		Welcome : Dr. N. R. Gangadharappa Director of Research, UAS
		Highlights of Research in Small Millets: 2016-17 : Dr. Prabhakar, Project Coordinator (Small Millets)
		Release of Publications By dignitaries
		Remarks by Guest of Honour : Dr. V.A. Tonapi, Director, IIMR, Hyderabad
		Remarks by Guest of Honour : Dr. T. N. Prakash, Chairman, KPAC
		Remarks by Chairman : Dr. H. Shivanna Vice Chancellor, UAS, Bengaluru
		Vote of Thanks : Dr.T. Sheshadri, Associate Director of Research
		Rapporteurs : Drs. AK Jain and Laxmi Rawat

12.00-12.30	:	Tea break		
12.30-14.00 & 15.00-16.30	:	Session – II: Presentation of progress report 2016-17 Each presentation shall not exceed 10 minutes ; Handouts to be circulated in advance		
		Chairman	Dr. NR Gangadharappa Director of Research, UAS, Bengaluru	
		Co-chairman	Dr. VA Tonapi, Director, ICAR-IIMR	
		Rapporteurs	Drs. TSK Patro and P Muniratnam	
		Plant Breeding	Dr. CR Ravishankar	
		Agronomy	Dr. B. Boraiah	
		Plant Pathology	Dr. A. Nagaraja	
		Entomology	Dr. Prabhu C. Ganiger	
		Plant Physiology	Dr. YA Nanja Reddy	
		Frontline demonstrations	Dr. B. Boraiah	
		Tribal Sub Plan & NEH	Shri R Munirajappa	
14.00-15.00		Lunch Break		
		Discussions & recommendations		
16.30-17.30		Session – III: Review of research: Scientific audit based on presentations of AICRP centres during 2016-17 (One consolidated presentation by centre In-charges as per template provided; each presentation shall not exceed 10 minutes; handouts to be circulated in advance)		
		Chairman	Dr. T Sheshadri, ADR, UAS, Bengaluru	
		Co-Chairman	Dr. Prabhakar, Project Coordinator (SM)	
		Rapporteurs	Drs. RK Khulbe and LN Yogeesh	
		Athyandal, Mandya, Nandyal, Vizianagaram, Jagdalpur		
17.30-19.00	:	Session - IV: Discipline-wise programme planning group meetings and finalization of technical programmes (concurrent sessions)		
		Discipline	Chairman	Convenor
		Place		
		Plant Breeding	Dr. RS Kulkarni Ex- DE, UAS & HOD	Dr. CR Ravishankar
		Agronomy & Physiology, FLD	Dr. T Sheshadri ADR, UAS	Dr. B. Boraiah
		Plant Pathology	Dr. Shrikant Kulkarni Ex-HOD,	Dr. A Nagaraja
		Entomology	Dr. VV Belavadi	Dr. Prabhu C.
				Dr. Babu Rajendra Prasad International Convention Centre
				Dr. Babu Rajendra Prasad International Convention Centre
				Dr. Babu Rajendra Prasad International Convention Centre
				Dr. Babu Rajendra Prasad

		HOD	Ganiger	International Convention Centre
19.30-21.00	Dinner			

Day 2: April 15, 2017 (Saturday)

09:00-12:00	:	Session -V: Presentation of lead topics		
		Chairman	Dr. A. Seetharam, Ex-PC (Small Millets)	
		Co-chairman	Dr. Prabhakar	
		Rapporteurs	Drs. BM Pandey and H. Ravindra	
		Digitalization of Millets Genetic Resources Management	Dr. M Elangovan, Principal Scientist, ICAR-IIMR, Hyderabad.	
		Hybrids in Finger millet: Fantasy or Possibility?	Dr. MV Channabyre Gowda, Ex-PC (Small Millets)	
		Role of small millets in enhancing system productivity in sustainable agriculture	Dr. KT Krishne Gowda, Ex-PC (Small Millets)	
		Recent advances in processing and value addition in Small Millets	Dr. NG Malleshi, Rtd, Scientist, CFTRI	
		Nutrition and value added products in small millets.	Dr. HB Shivaleela, University Head, Dept of Food Nutrition, UAS	
		<i>Guli</i> method of cultivation in Ragi	Dr. N Devakumar	
12.00-12.15	:	Tea Break		
12-15-14.00 & 15.00-16.30		Session – III: Review of research: Scientific audit based on presentations of AICRP centres during 2016-17 (Continued)		
		Waghai, Ranichauri, Berhampur, Dholi, Ranchi, Rewa, Dindori, Kolhapur,		
14.00-15.00		Lunch Break		
16.30-18.00		Session – VI: Plenary session (Presentation of session-wise recommendation and technical programme of work)		
		Chairman	Dr. D. P. Kumar Director of Education, UAS, Bengaluru	
		Co-chairman	Dr. MA Shankar, Ex-DOR, UAS	
			Dr. Prabhakar, Project Coordinator (SM)	
		Rapporteurs	Drs. CV Chandra Mohan Reddy and Harshal Patil	
		Plant Breeding	Dr. CR Ravishankar	
		Agronomy	Dr. B. Boraiah	

	Plant Pathology	Dr. A. Nagaraja
	Entomology	Dr. Prabhu Ganiger
	Plant Physiology	Dr. YA Nanja Reddy
	Frontline demonstrations	Dr. B. Boraiah
	Award for Best centres	Dr. Prabhakar
	Felicitations to retiring AICRP scientists	Dr. Prabhu Ganiger
	Co-chairman's remarks	Dr. MA Shankar, Ex-DOR, UAS
	Chairman's remarks	Dr. D. P. Kumar Director of Education, UAS, Bengaluru
	Vote of thanks	Dr. Prabhakar, Project Coordinator (SM)
16.00-16.15	:	Tea Break and Conclusion of AGM

Press Note

The 28th Annual Group Meeting of the All India Coordinated Research Project on Small Millets was held at University of Agricultural Sciences, Bengaluru on April 14-15, 2017. About 71 participants from various SAUs, voluntary centers, private companies and other collaborating institutes participated in the group meeting.

The group meeting was held in 6 sessions spanned over two days. First day started with Inaugural Session. The group meeting was formally inaugurated by Dr. A. Seetharam, Ex-Project Coordinator (Small Millets) under the chairmanship of Dr. H. Shivanna, Vice-Chancellor, University of Agricultural Sciences, Bengaluru. Dr. NR Gangadharappa, Director of Research, UAS, Bengaluru welcomed the delegates. Dr. Prabhakar, Project Coordinator (Small Millets), AICRP on Small Millets, ICAR, Bengaluru presented the research highlights of AICRP centers. Dr. VA Tonapi, Director, ICAR-IIMR, Hyderabad and Dr. TN Prakash, Chairman, Agriculture Price Commission, Government of Karnataka, Bengaluru were the Guests of Honor. Dr. T. Sheshadri, Associate Director of Research, UAS, Bengaluru proposed the vote of thanks.

In the afternoon, presentation of progress reports of various disciplines was made by respective Principal Investigators, followed by discipline-wise group meetings to review the results and finalization of 2017-18 technical programmes for the ensuing seasons. Second day was dedicated to presentation of lead topics by distinguished speakers, followed by scientific auditing of each center and the scientists working under the AICSIP scheme so that the shortfalls could be identified and addressed effectively. Discussion on various issues related to AICRP activities and collaborative projects were discussed on the second day, which was followed by Plenary session. The plenary session was presided over by Dr. DP Kumar, Director of Education, UAS, Bengaluru. Dr. NR Gangadharappa, Director of Research and Dr. MA Shankar, Ex-Director of Research, UAS, Bengaluru were the co-chairman. Dr. Prabhakar, Project Coordinator (Small Millets) proposed vote of thanks.

Dr. Prabhakar, Project Coordinator (Small millets), Bangalore presented the research highlights of small millets for 2016-17, mentioning that all the six small millets are cultivated in all the states of India. Research work on small millets is going on in 13 AICRP and 21 co-operating centers. He presented the action taken report on recommendations of previous workshop. It was mentioned that web site of AICRP on Small millets (www.aicrpsm.res.in) has been launched on 24th Feb., 2017. Performance of AICRP breeding trial in 2016-17 and comparisons of 3 years were presented. He mentioned that Zonal concept was adopted for evaluation of entries only in finger millet along with national, zonal check and local checks. Accordingly, North zone and Southern zones were formulated on trial basis for 2016-17. Against a total allocation of 108 trials, comprising six millet crops, to various centres all over India, 92 trials were conducted and the overall success was 81.14 %.

Dr. Prabhakar highlighted the performance of all the entries in six crops of small millets. Performance of AICRP breeding trial in 2016-17 and comparisons of 3 years were presented. Agronomical recommendations, Front line demonstrations, TSP, drought tolerance accessions of finger millet superior to GPU 28 were presented. Banded leaf blight is becoming major threat in all the small millets and soil application of bio-agents is effective in managing the disease. Scenario of insect pests in small millets and promising varieties with multi pest resistance were highlighted. He mentioned that TSP was implemented in 6 centers covering 520.1 ha demonstrations and 28 lakhs were spent in the programme. During the year, the indent of 25.58 quintals of breeder seed was made by DAC for all the six crops. Accordingly, the total production of breeder seed was 105.90q and it is 206.99 % more than the allocation. The work of new programme started on popularization of small millets in 3 centers of North eastern hilly regions was presented. Progress on registration of genetic stock, DUST guide lines, publications made by the scientists in small millets and recognition received by the scientists were also highlighted.

Dr. V.A Tonapi, Director, IIMR, Hyderabad emphasized that though we have increased the productivity but is there any chance or opportunity or mechanization that could double the yield of small millets? He pointed that in the

scenario where 10- 20 years old varieties are ruling, how can new varieties make their place? He mentioned that we have perhaps failed in not putting the mechanization in right time. He also brought attention towards that as millets are climate resilient crops so why not all centres take all the crops for testing and evaluation. Real enthusiasm and zeal is required from each centre. He requested to the scientists to participate in the deliberations and concrete steps should be taken for the development of millets.

Dr. Tonapi emphasized that we need to think as policy makers, as markets and we really need to push the progressive farmers to go for these crops with one irrigation and productivity will get doubled. He figured out that the indents for seed production of small millets are very less; there is a need to popularize the small millets among the farming community so as to increase indents. Entire ranges of varieties in small millets evolved are from selection, only few are from recombination breeding. Seed supply system is also very poor and 90% farmers saved seeds are in use. Training of the farmers to produce quality seed is essential. There is about 40% deficit between demand and supply of small millets. Awareness, demand generation, better processing, better prices and interest of progressive farmers to grow small millets can increase the area. Karnataka, Tamil Nadu and A.P. government is doing better job for small millets.

Dr. T. N. Prakash, Chairman, KPAC welcomed on behalf of Karnataka government and emphasized that govt. of Karnataka is the first state to include finger millet and Jowar in PDS system. Government has procured 20 lakh quintal ragi @ Rs 2100 per quintal during last year in Karnataka and now promoting organic finger millet. Several NGOs are also working to promote the finger millet. He emphasized that there is enormous gap between trial yield and farmers yield. One protective irrigation can increase 10-15% grain yield of finger millet. Nearly 10 lakh ha area of finger millet has gone out due to shifting of cropping pattern in Karnataka. Reduction in cost of production, yield enhancement, procurement and timely repayment can sustain the area under finger millet. He mentioned that the interest, awareness and eagerness among consumers have been increasing across India, among health conscious people.

Dr. A. Seetharam, former Project Coordinator (Small millets), who developed first sunflower hybrid expressed his views and told that millets are passing challenging time. There is drastic reduction in area and production of small millets and shares less than 1% in regional food security. In the situation of high cost of cultivation and low production, farmers will not grow the millets. Lot of publicity in the urban area about nutritional security through small millets may be the future line of work. AICRP system is doing better job and IIMR is giving basic and strategic support. Uses of modern tools, their integration with conventional tools for yield improvement and diversity creation are important researchable issues. Generation of more variability especially in kodo millet and little millet through mutation breeding and biotechnological tools can help us. Grain size is an important factor to enhance 15-20% grain yield. Production system is important and more research is needed on mechanization system. Good raw material is needed for value and supply chain. Millets area may be conserved through proper linkages between productions to consumption.

Dr. H. Shivanna, Vice- Chancellor, UAS, Bengaluru, in his presidential address asked all the delegates to seriously think on the initiatives by which we can increase the productivity of small millets. He expressed his views on progress of research work carried out all over the country in different disciplines by AICRPs, programme of IIMR, programmes running in Karnataka and comments of Dr. Seetharam on kind of work in small millets and problem facing. He suggested that production level has to be increase. However, it is not a magic. A lot of cultivable area is still fallow in the country and 5-10% area is under encroachment. Land size is coming down and expectations are more. Government wants improvement in technology development, their transfer to farmers and socio-economic development. Dry land farmers always suffer a lot. Monsoon and market are important factors that largely fluctuate. It is suggested that small millets cannot be promoted without profit in the market and scientists working in the field will take the challenges. We will have to put our heart and soul to rightly design the future programmes to address these problems. He insisted that all the Breeders, Pathologists, Entomologist and Agronomists should work together and come out with a package in order to increase the productivity levels in millets systems.

During this occasion, a total of 13 publications were released by the dignitaries.

Acknowledgments

Project Coordinating Unit, AICRP on Small Millets, ICAR, GKVK, Bengaluru is sincerely thankful to Dr. TR Mohapatra, Secretary, DARE and Director General, ICAR and Dr. JS Sandhu, Deputy General (Crop Sciences), ICAR for giving permission to hold the 28th Annual Group Meeting of AICRP on Small Millets at University of Agricultural Sciences, Bengaluru on April 14-15, 2017. We are grateful to Dr. IS Solanki, Assistant Director General (FFC), ICAR for his constant support, guidance and valuable suggestions to plan and conduct the group meeting successfully.

We also express our sincere thanks to Dr. H. Shivanna, Vice-Chancellor, University of Agricultural Sciences, Bengaluru for kindly accepting our invitation to be as Chairman of the Inaugural function. We are highly grateful to Dr. A. Seetharam, Ex-Project Coordinator (Small Millets) to be as Chief Guest of the Inaugural function at a short notice and also serve as Chairman for the session on Lead Topics. Also, we express sincere gratitude to Dr. VA Tonapi, Director, ICAR-IIMR, Hyderabad and Dr. TN Prakash, Chairman, Karnataka Agriculture Price Commission, Bengaluru to be as Guest of Honour.

Our special thanks are due to Dr. DP Kumar, Director of Education, Dr. NR Gangadharappa, Director of Research and Dr. T Sheshadri, Associate Director of Research, UAS, Bengaluru for chairing various technical sessions and guiding the group. Also, we express our sincere thanks to Dr. Nagarju, Comptroller, Dr. RS Kulkarni, Ex- Director of Education and Head, Plant Breeding, UAS, Bengaluru, Dr. Shrikanth Kulkarni, Ex-Head, Plant pathology, UAS, Dharwad and Dr. KT Krishne Gowda, Ex-Project Coordinator (Small Millets) and Dr. VV Belavadi, Head, Dept of Entomology for chairing various technical sessions and guiding the group in finalizing the technical programmes of various disciplines for the year 2017-18.

We profusely thank all the invited speakers namely Dr. MV Channa Byregowda, Dr. KT Krishne Gowda, Dr. N. Devakumar, Dr. NG Malleshi, Dr. HB Shivaleela and Dr. M Elangovan for delivering lecture on key topics and sharing their experiences with the participants. Thanks are also due to all the rapporteurs of different sessions who recorded the proceedings meticulously. We also thank scientists of ICAR-IIMR, Hyderabad, Dr. Shobha Sija of ICRISAT, Hyderabad and all the representatives of private companies for their help and active participation in the meeting. We also thank all the Chairpersons and members of various committees of University of Agricultural Sciences, Bengaluru, who helped in organizing the group meeting and made the stay of participants highly comfortable.

The significant contributions of all the Principal Investigators of the AICRP on Small Millets namely Dr. CR Ravishankar, Dr. A Nagaraja, Dr. Nanja Reddy, Shri R Munirajappa, Dr. B Boraiah and Dr. Prabhu Ganiger are thankfully acknowledged. A special note of thanks is expressed to Dr. K Madhusudan, Dr. Prabhu C Ganiger, and Shri MV Ramana, Statistician, ICAR-IIMR, Hyderabad who immensely contributed in organizing the workshop. All the scientists, technical and Administrative staffs of Project Coordinating Unit, AICRP on Small Millets have contributed significantly on various capacities throughout the year. Contribution of each and every one of them is thankfully acknowledged. Thanks are also due to Mrs. B Sujata, Mrs. Hemalatha, Shri M Valeppa, Mr. Chandra Shekhar Angadi, Mr. Suresh Patil, Shri Siddharaju, Shri A. Narayana Swamy and Ms. H. Nethravathi for their support in organizing the workshop.

10th May 2017
AICRP on Small Millets, ICAR
GKVK, Bengaluru-560005

Dr. Prabhakar
Project Coordinator (Small Millets)

Weekly weather data format									
Standard Week	Period		Temperature (oc)		Rainfall (mm)	Rainy days	Sunshine hours	Relative humidity	
	From	To	Max.	Min.				Min.(%)	Max.(%)
1	01-Jan	07-Jan							
2	08-Jan	14-Jan							
3	15-Jan	21-Jan							
4	22-Jan	28-Jan							
5	29-Jan	04-Feb							
6	05-Feb	11-Feb							
7	12-Feb	18-Feb							
8	19-Feb	25-Feb							
9	26-Feb	04-Mar							
10	05-Mar	11-Mar							
11	12-Mar	18-Mar							
12	19-Mar	25-Mar							
13	26-Mar	01-Apr							
14	02-Apr	08-Apr							
15	09-Apr	15-Apr							
16	16-Apr	22-Apr							
17	23-Apr	29-Apr							
18	30-Apr	06-May							
19	07-May	13-May							
20	14-May	20-May							
21	21-May	27-May							
22	28-May	03-Jun							
23	04-Jun	10-Jun							
24	11-Jun	17-Jun							
25	18-Jun	24-Jun							
26	25-Jun	01-Jul							
27	02-Jul	08-Jul							
28	09-Jul	15-Jul							
29	16-Jul	22-Jul							
30	23-Jul	29-Jul							
31	30-Jul	05-Aug							
32	06-Aug	12-Aug							
33	13-Aug	19-Aug							
34	20-Aug	26-Aug							
35	27-Aug	02-Sep							
36	03-Sep	09-Sep							
37	10-Sep	16-Sep							
38	17-Sep	23-Sep							
39	24-Sep	30-Sep							
40	01-Oct	07-Oct							
41	08-Oct	14-Oct							
42	15-Oct	21-Oct							
43	22-Oct	28-Oct							
44	29-Oct	04-Nov							
45	05-Nov	11-Nov							
46	12-Nov	18-Nov							
47	19-Nov	25-Nov							
48	26-Nov	02-Dec							
49	03-Dec	09-Dec							
50	10-Dec	16-Dec							
51	17-Dec	23-Dec							
52	24-Dec	31-Dec							

Daily rainfall data

DATE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1												
2												
3												
4												
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22												
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24												
25												
26												
27												
28												
29												
30												
31												
Total												
Gross Total Rainfall, mm												
Total no. of Rainy days												
Rainfall from 1 st June												
Total no. of Rainy days from 1 st June												
Average rainfall, mm												
Deficit %												

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