

MILLETS

Annual Report 2025



भारत-भारतीय श्री अन्न अनुसंधान संस्थान
श्री अन्न वैश्विक उत्कृष्ट शोध केन्द्र

ICAR-Indian Institute of Millets Research
Global Centre of Excellence on Millets (Shree Anna)

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Foundation stone laid for Global Centre of Excellence on Millets (Shree Anna) by Shri. Shivraj Singh Chouhan, Hon'ble Union Minister of Agriculture & Farmers' Welfare and Rural Development



A gathering of visionaries together in service of promotion of Millets

Annual Report

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Contents

S. No.	Particulars	Page No.
	<i>Preface</i>	
1.0	About ICAR – IIMR	1
2.0	Executive Summary	3
	Research Achievements	
3.0	Genetic Resources Management	
3.1	Collection, Conservation and Utilization	11
3.2	Pre-breeding	13
4.0	Genetic Improvement	
4.1	Pearl Millet	14
4.2	Sorghum	19
4.3	Finger Millet	25
4.4	Little Millet	27
4.5	Foxtail Millet	28
4.6	Kodo Millet	30
4.7	Barnyard Millet	31
4.8	Proso Millet	32
4.9	Browntop Millet	34
5.0	Basic and Strategic Research	
5.1	Molecular Breeding	36
5.2	Genome Editing	37
5.3	Seed Science	40
5.4	Crop Physiology	43
5.5	Biochemistry	45

S. No.	Particulars	Page No.
6.0	Crop Protection	
6.1	Insect Pests and Management	48
6.2	Diseases and Management	57
7.0	Crop and Natural Resource Management	
7.1	Agronomy	64
8.0	Extension Research, Economics and Value Addition	
8.1	Extension Research	66
8.2	Economics	70
8.3	Value Addition and Commercialization	71
9.0	Global Centre of Excellence on Millets (Shree Anna)	78
10.0	Millets and other Ancient Grains International Research Initiative (MAHARISHI)	103
11.0	Trainings and Capacity Building	105
12.0	Awards and Recognitions	116
13.0	Linkages and Collaborations	119
14.0	ICAR - AICRP on Pearl Millet and ICAR - AICRP on Sorghum and Small millets – AGM 2025 Highlights	124
15.0	Publications	126
16.0	Institute Research Projects	141
17.0	RAC and IRC Meetings	145
18.0	Participation in Meetings, Seminar, Workshop, Conference	148
19.0	Distinguished Visitors	157
20.0	Major Events	162
21.0	Meetings, Field days and Exhibitions	171
22.0	Staff position, Appointments, Promotion, Transfers	174
23.0	Official language (Raj Bhasha) Implementation	179

Preface



It is my pleasure to present the Annual Report of the ICAR-Indian Institute of Millets (Shree Anna) Research (IIMR) for the year 2025. As a Global Centre of Excellence on Millets (Shree Anna), ICAR-IIMR has begun comprehensive research and development on all the major and minor millets, focusing on crop improvement, crop management, basic and strategic research, training, capacity building, and processing technologies to boost profits for millet farmers. The All India Coordinated Research Projects (AICRPs) on Pearl Millet, Sorghum, and Small Millets constitute a nationwide network of research and testing centres. The Institute leads in basic, strategic, and applied research on millets, covering crop improvement, production techniques, crop protection, value chain enhancement, capacity development, and the promotion of entrepreneurship. Through ongoing research, the Institute has notably increased millet productivity, resilience and utilization and also supports the Government of India's efforts to position millets as climate-resilient, nutritious, and economically viable crops, strengthening national food and nutritional security.

As part of establishing the Global Centre of Excellence on Millets, the Institute has significantly strengthened its research infrastructure by acquiring state-of-the-art scientific equipment for the phenomics, speed breeding, functional genomics and genetic manipulation studies. To support multi-omics technology, and value-addition research, the Institute has procured advanced instruments Illumina NextSeq 2000, Nanopore PromethION Genome Sequencer, Digital PCR System, Real-Time Quantitative PCR (qPCR) System, and Genetic Analyser. For comprehensive nutritional and quality assessment of millet grains and value-added products, facilities such as the Automatic Dietary Fibre Analyser, Microwave Digestion System, and Microwave Ashing System have been established. In addition, an advanced imaging platform has been created, equipped with a fully automated laser-scanning confocal microscope for live-cell imaging, a fluorescence stereomicroscope, a Cryo-ultramicrotome and a Laser microdissection system. The Institute's state-of-the-art building to house the Global Centre of Excellence on Millets will soon be ready to serve as a hub for multidisciplinary research, innovation, training, and international collaboration. Furthermore, under the Global Centre of Excellence on Millets (Shree Anna), the newly developed Advanced Phenomics Complex to facilitate precision phenotyping, crop evaluation, plant tissue culture, functional genomics, and advanced field-based research. At the regional Research Station in Gudamalani, Barmer, infrastructure development for the Regional Millet Technology Innovation and Outreach Hubs is in progress. An important international platform for advancing collaborative research, strengthening institutional partnerships, and promoting millets and ancient grains, Millets and Other Ancient Grains International Research Initiative (MAHARISHI) platform was launched on July 16th, 2025, during the 97th Foundation Day celebrations of the ICAR at the NASC, New Delhi. ICAR-IIMR actively implemented SCSP, TSP and NEH outreach programs to promote and strengthen millet-based livelihoods for marginalized farming communities. ICAR-IIMR has established millet processing and value-addition units with farm-gate infrastructure support across states to boost value chains and post-harvest management at ARS Vizianagaram (Andhra Pradesh, with ANGRAU), KVK-II Sitapur (Uttar Pradesh, with ICAR-ATARI Kanpur), and KVK Gumla (Jharkhand, with ICAR-ATARI Patna) and other locations.

During the period, CSV 67 (SPV 2976), a grain sorghum variety for Gujarat and Rajasthan, One sweet sorghum variety (CSV 66SS) suitable for biofuel, syrup, and other value-added applications, One single-cut forage sorghum variety CSV 63F for Maharashtra, Tamil Nadu and Karnataka, One BMR forage sorghum variety CSV 69BMR for Tamil Nadu, Maharashtra, Punjab and Uttarkhand and one rabi grain sorghum hybrid CSH 59R/Maldandi Supreme for Maharashtra, Karnataka, Telangana and Andhra Pradesh were developed. Genome sequencing of little millet has been published in Nature Communications, addressing gaps by revealing an approximately 850 Mb tetraploid genome organized into 18 chromosomes and 59,045 genes. Genome sequencing of Kodo millet has been undertaken and is in the final stages of completion. Towards licensing and commercialization of millets technologies, 33 MoAs were signed for seed production of forage cultivars and value-added products. Institute has organized more than 64 national-level trainings on production practices, value chain development, start-up ignition, etc., for the benefit of various stakeholders from state governments, SAUs, FPOs, including farmers from states of Odisha, Maharashtra, Karnataka, Tamil Nadu, Andhra Pradesh, Telangana, Madhya Pradesh and Bihar. To support millet production and utilization various trainings were conducted A total of 19 value-added millet-based technologies have been developed and are being successfully commercialized. ICAR-IIMR facilitated the establishment of millet processing and value addition facilities in the NEH region. IIMR facilitated visit of about 4848 agricultural students and school students from different parts of the country. The institute has published 50 research articles in reputed national and international journals, ten books and several other publications.

The Institute's significant achievements in research, development and technology dissemination during the year have been made possible by the continuous support, guidance, and encouragement from the Indian Council of Agricultural Research (ICAR). I place on record my sincere gratitude and appreciation to Dr Mangi Lal Jat, Secretary (DARE) and Director General, (ICAR); Dr D. K. Yadava, Deputy Director General (Crop Science), ICAR; and Dr. S. K. Pradhan, Assistant Director General (FFC), ICAR, for their invaluable guidance, encouragement, and unwavering support. I also extend my heartfelt thanks to the administrative and technical functionaries at ICAR Headquarters, whose timely advice, constructive inputs, and generous assistance have greatly facilitated the effective implementation of the Institute's mandate.

Due credit is to be given to the expert guidance provided by the Chairman and members of various committees, Research Advisory Committee, Institute Management Committee, and different Institute committees, all the project leaders, scientists, administration and finance sections and other staff members of this institute for their efforts, support and help. I also appreciate the Principal Investigators and the multidisciplinary teams of millet scientists at AICRP centres, voluntary centres, and private-sector participants for their contributions to the success of the nationwide millet research network. I appreciate the support of various national, International, non-governmental, and private organizations, as well as all other stakeholders, who have been collaborating with us in our endeavors. The scientists, technical personnel, administrative, finance and other staff of the institute have put in their best efforts to accomplish the mandate of the Institute.

Hyderabad
10th April, 2026

C Tara Satyavathi
Director



About ICAR- IIMR

The ICAR-Indian Institute of Millets Research (IIMR), Hyderabad is the nodal research institute in India for all the research and development needs of millets with its linkages with All India Coordinated Research Projects (AICRP) on Pearl millet and Sorghum & Small millets. The Institute has been instrumental in developing high yielding varieties and hybrids of sorghum, and high yielding varieties of small millets as well as novel crop production, crop protection, processing and value-added product development technologies. It conducts basic and strategic research, while AICRP on sorghum and small millets with 31 centres across 15 states, and pearl millet with 13 centres located in 10 states undertake applied research and extension work in a network mode.

The Institute takes its origin in 1987 when the National Research Centre on Sorghum (NRCS) was established from the then IARI regional station at Hyderabad, which was later upgraded as Directorate of Sorghum Research (DSR) in 2009, and as the Indian Institute of Millets Research (IIMR) in 2015. During 1991, a research station named Centre on Rabi Sorghum (CRS) to support the research activities of rabi sorghum was established at Solapur (Maharashtra). Another off-season nursery was established at Warangal (Telangana) in 1995 as a national facility to support AICRP on Sorghum researchers of the country. In 2023, the institute has been elevated and declared as the Global Centre of Excellence for Millets (Shree Anna) by the Hon'ble Prime Minister of India signifying the role Institute has played in bringing the humble millets to global scenario. A Regional Research Station for Pearl millet to address exclusively the research needs of pearl millet for the state with largest area under cultivation in Gudamalani, Barmer, Rajasthan has been opened, and the foundation stone for the Centre was laid on 27 September, 2023 by Sh. Jagdeep Dhankhar, Hon'ble Vice President of India.

Vision

- To transform subsistence farming of millets into a globally competitive climate resilient nutri-cereal enterprise through value-addition to meet food, feed, fodder, nutrition, and bio-fuel requirements of the country for equitable prosperity

Mandate of IIMR

- Basic and strategic research to increase productivity of millets and their diversified utilization for enhancement of profitability.
- Coordination and development of improved crop production and protection technologies of millets.
- Training and consultancy on millet production and utilization.
- Dissemination of technologies and capacity building.

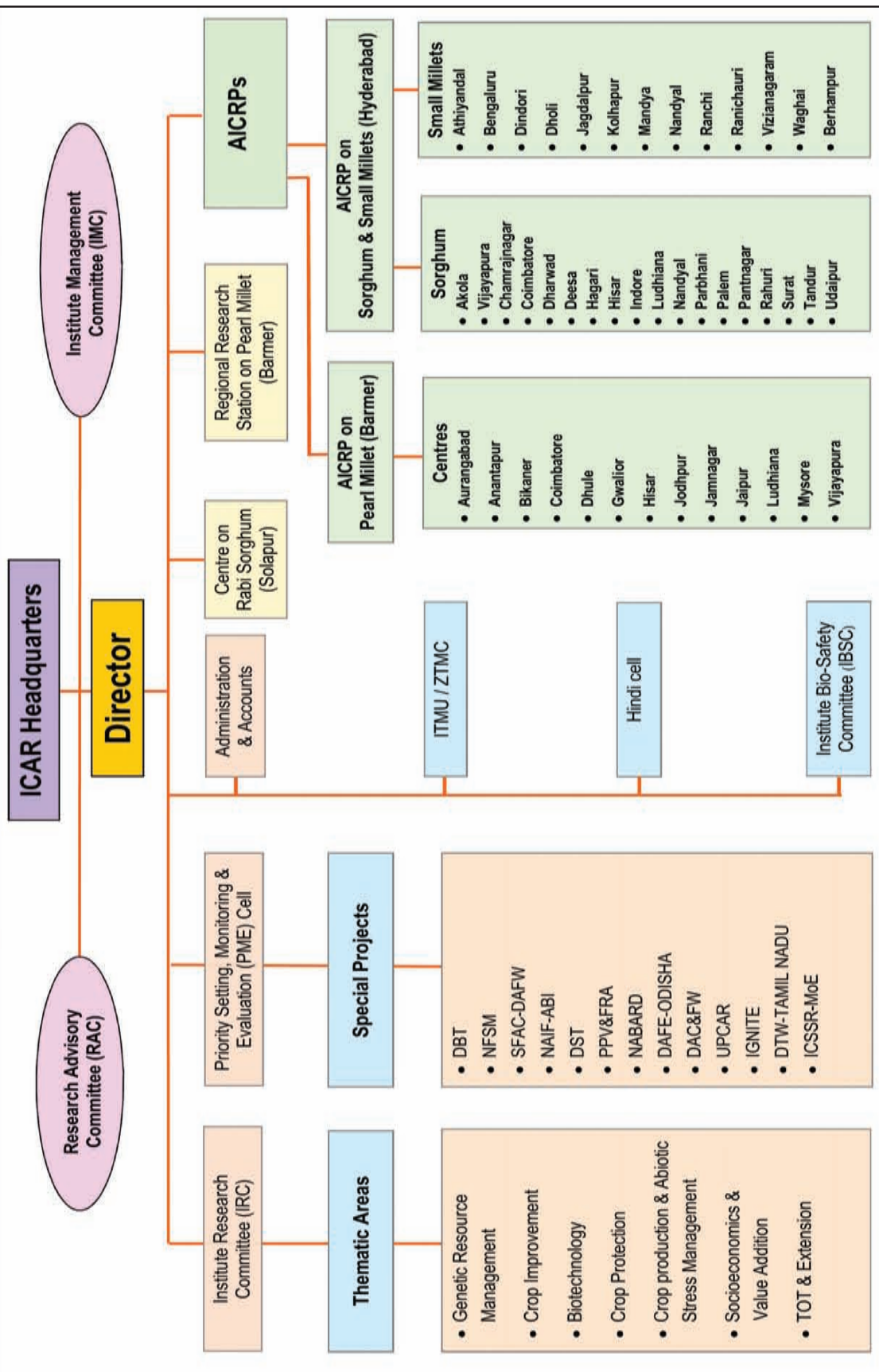
IIMR Staff Position (summary) as on 31st December, 2025

Category	Sanctioned	In-position	Vacant
RMP	1	1	0
Scientific	50	43	7
Technical	44	25	17 (2 posts deemed abolished)
Administrative	30	14	16
Supporting Staff	18	5	13
Total	143	88	53

Budget Details (In Lakhs) as on 31st March, 2026

Scheme	Sanction	Expenditure	Utilization
ICAR- IIMR Hyderabad	2901.95	2901.95	100%
GCoE on Millets	8683.80	8683.80	100%
AICRP on Pearl Millet	1626.68	1626.68	100%
AICRP on Sorghum and Millets	2847.40	2847.34	99.99%

Organization set-up of ICAR-Indian Institute of Millets Research **Global Centre of Excellence on Millets (Shree Anna)**



Genetic Resources Management

About 50,000 millets accessions are being conserved in the medium-term storage of ICAR-IIMR Genebank. Sorghum (27,366) occupying largest number of accessions, followed by finger millet (8,057), pearl millet (4,765), foxtail millet (4,575) and other small millets

About 1300 accessions of millets germplasm, including 384 sorghum, 286 finger millet, 190 foxtail and 476 proso millet, were multiplied during 2025-26. A total of 659 accessions were distributed to researchers, which include 356 sorghum accessions, 145 foxtail millet accessions, 80 kodo millet accessions and 78 accessions of pearl millet

Seven accessions from finger millet, foxtail millet, and sorghum were registered (INGR 25010–25058) by the germplasm registration committee of ICAR-NBPGR, New Delhi. Registered lines exhibited donor potential for disease and pest resistance, low hydrocyanic acid (HCN) content, early maturity with aromatic profiles, elevated amylopectin, and improved seed metrics

Mega-characterization of 4618 foxtail millet accessions encompassing indigenous and exotic collections representing the entire foxtail millet collection from the National Genebank was carried out at ZARS, UAS, Bengaluru

Genetic Improvement

Pearl Millet

From evaluation of 204 experimental hybrids for arid adaptation and 411 hybrids for semi-arid adaptation, 10 hybrids were identified with grain yield levels of 1.96–3.15 t/ha in the early-maturing group; medium-maturing hybrids (62 selected) yielded 2.14 - 4.41 t/ha and late-maturing hybrids (40 selected) yielded 2.12 - 4.14 t/ha.

For creation of new variability, 102 A/B-lines are in conversion, and 10 A/B-lines are stabilized for their use in the generation of new experimental hybrids.

The restorer line development program identified 93 R lines that performed well in different maturity hybrid combinations

In forage pearl millet, evaluation of 216 experimental crosses developed led to identification of 30 superior cross combinations with high forage yielding potential.

Screening of 300 diverse pearl millet inbred lines under PEG-induced drought stress identified 32 tolerant genotypes with superior antioxidant defenses. Enzymatic assays and histochemical staining confirmed lower superoxide and H_2O_2 accumulation in tolerant lines compared to susceptible ones

A blast resistance backcross breeding program was initiated with TCR 6, TCR 141, TCR 5, TCR 2, IC-K21-93, I-198, and I-89 as recurrent parents and PM-BC-1 ((ICMB 98222 × IP 21187) × ICMB 98222), PM-BC-8 ((ICMB 04999 × ICMR 11003) × ICMB 04999) and PM-BC-10 ((ICMB 04999 × ICMR 06444) × ICMB 04999) as blast-resistant donors, 17 BC_1F_1 lines were developed through targeted backcrossing.

Three hundred breeding lines were screened for heat and drought tolerance, low rancidity, and high micronutrient content. EGTB 1034 was identified as heat-tolerant, and ICMR 101205 showed superiority for drought tolerance and yield stability. ICMB 1803 and IC S23-346 exhibited delayed rancidity during storage. ICMR 100145, ICMR 1504, and ICMR 101548 showed elevated Fe concentrations of 111, 108, and 126 ppm, respectively, and Zn concentrations of 54, 47, and 46 ppm, respectively.

Sorghum

CSV 67 (SPV 2976), a high-yielding kharif grain sorghum variety, was developed with a mean grain yield of 2930 kg/ha, which is 9.3% grain yield superiority over the check CSV 41 (2681 kg/ha). For fodder yield, CSV 67 (170 q/ha) recorded 5.9% improvement over CSV 41 (161 q/ha).

From the evaluation of 177 experimental hybrids, 40 hybrids were identified that flowered in 54–60 days and matured in 95–100 days. Seven medium-maturing hybrids showed more than 10% yield advantage, seven early-maturing hybrids outperformed the best check CSH 48 by 8–22%. Sixteen hybrids recorded GM scores of 3.0–4.0 and 24 hybrids having a 100-seed weight greater than 3.0 g.

Evaluation of 33 advanced breeding lines and 30 colored sorghum genotypes for grain mold and shoot fly tolerance identified 12 promising lines with grain mold scores ranging from 2.5 to 5.0 on a 1–9 scale. For shoot fly tolerance, ten breeding lines had DH% of 15–25% and were better than CSV 41 (26% DH). BN488, which had high grain mold tolerance was also found to be moderately resistant to shoot fly damage.

Evaluation and identification of stabilized breeding material (MAGIC derived lines) for rabi adaptation lines identified S23026RV, S23017RV, S23024RV, S23035RV, S23036RV, S23050RV, S24245RV, S24221RV, S24224RV, S24235RV, and S24239RV as promising dual-purpose candidates for varietal testing.

Screening of 32 rabi sorghum breeding lines for charcoal rot under artificial inoculation at CRS-Solapur identified lines viz., S24113RV, S24111RV, S24107RV, S24104RV, S24102RV, S24101RV, S24097RV, S24092RV as resistant with CRI <10%.

Evaluation of 15 hybrids for multi-cut fodder sorghum yielding potential identified five hybrids viz., 321A × UPMC 503, NSS1003A × CSV 33MF, 296A × UPMC 503, 338A × SSG 59-3, 415A × CSV 33MF, and CSH-43MF with superiority for green fodder yield over check CSH 43MF.

In single cut forage trial, five entries exhibited more than 10% superiority over the check hybrid CSH 40F from testing of 17 test hybrids. Hybrids in general showed superiority in the number of leaves as well in plant height. Lines SC 225 and SC 227 exceeded the check by more than 100% for green fodder yield.

From evaluation of 20 sweet sorghum for sweet sorghum productivity traits, for total fresh biomass, (SSV84 Tall × SPV 2072)-1-1-3-1-1-2 recorded the highest biomass

yield of 111.1 t/ha. The entry also recorded highest fresh stalk yield of 86 t/ha, highest juice yield of 42895 L/ha and highest computed ethanol yield of 3380 L/ha.

Finger Millet

Evaluation of 28 advanced derivatives for grain yield and related traits from six different genetic crosses identified GPU28 × GPU48-4 and PR202 × GPU48-1, which recorded the grain yield levels of 4556 kg/ha and 3924 kg/ha and were found to be superior to the check variety CFMV 2.

From evaluation of 109 wild derivatives for grain yield and related traits, four derivatives showed 20–30% superiority compared to the best check CFMV 2. Larger variability was observed for finger traits ranging from long and branched fingers, compact types with 12–15 fingers, highly compact types and long and superior grain filling types

Little Millet

Forty-eight derivatives from *robusta* × *robusta* and *nana* × *nana* crosses were evaluated for grain yield and related traits. Derivatives IPmr 1036 × IPmr 1075-14 and IPmr 1036 × IPmr 1075-6 in robusta background and three derivatives from cross DHLM 36-3 × CLMV 1 showed significantly higher grain yield (up to 1.9 to 2.0 tonnes). Nana types were superior for tillering ability, test weight.

Five selections from Nana types were tested at Hiriyur, Karnataka, for state varietal testing, of which two lines, IIMR-LM8004, IIMRLM4816 showed superiority over the checks. The superior lines are advanced to On-farm trials during kharif, 2026 for its suitability for identification of superior variety for the target region.

Foxtail millet

CFXMV-2 (FXV 647) high yielding foxtail millet variety was developed through pure line selection of germplasm accession GS 510. The variety is medium maturing 85–88 days with grain yield of 25–28 q/ha and is resistant to important diseases. The variety also has produced superior fodder yield (57–60 q/ha) compared to popular variety SiA 3156.

From evaluation of 41 mutants for grain yield and related traits, FX1024 (M5 SiA400-7) and FX1030 (M5 SiA600-21) were found to be the stable genotypes with high grain yield while FX1043 (M5 SiA800-24) was the highest yielding mutant but highly sensitive to environment

Kodo Millet

The kodo millet variety TNAU 86 was gamma-irradiated to induce variability for yield and related traits. Germination and survival decreased with increasing doses, and abnormal panicles, striata, and xantha mutants were observed at 200–400 Gy. The population was advanced to M_6 , where 116 mutants were evaluated, and promising lines were identified.

Barnyard Millet

From screening of germplasm lines for seedling stage salinity stress tolerance, five tolerant (BAR 397, BAR 1407-1, BAR 1408-1, BAR 1453, BAR 1407-1) and susceptible genotypes (BAR 308, BAR 1418-1, BAR 414, BAR 1422-1, BAR 1424-1) were identified for salinity stress and its use in breeding programs.

Evaluation of stabilized mutants derived from four varieties viz., DHBM 93-3, VL 172, VL 29 identified seventeen mutants with high fodder yielding ability and four mutants were found superior for grain yield.

Proso Millet

A set of advanced derivatives was evaluated for grain yield and related traits. Lines viz., IC0483930 × IIMR225, TNPM548 × IIMR225, TNPM348 × GPMS578, IC0483930 × GPMS453 and TNPM548 × GPMS578 showed superiority for grain yield over the check TNPM230.

Browntop Millet

A set of 31 brown top millet genotypes were evaluated for fodder yield and related traits and the lines IC-0613558, AK 2, GPUPT 1, IC-0617957, GPUPT 6, IC-0617955, BTV 44, IC-0617958 (Compact), IC-0613557 and HBR 2 were promising with green fodder of some lines yielding up to 484 q/ha

To assess the seed quality, the test weight of seeds formed in the primary, secondary and tertiary rachis of

the inflorescence, and their germination percent were compared. Test weight (grain filling) and germination decreased in the seeds produced by secondary and tertiary branches, indicating that seeds formed on the primary rachis have better seed size and seed quality

Basic and Strategic Sciences

Molecular Breeding

From whole-genome *de novo* sequencing of kodo millet, a total of 51.39 Gb of HiC data was generated from 341,279,064 reads, which were assembled into 91 scaffolds with N50 and L50 values of 45.35 Mb and 9, respectively. Genome-wide repeat elements were identified and analyzed using *de novo* sequence assembly (~ 0.9 Gb) of kodo millet through various computational methods.

For the development of a genetic diversity kit in finger millet, a set of 40 SSR markers was constituted from a set of 100 hypervariable genomic SSR markers with PIC values ranging from 0.22 to 0.85. The genetic diversity kit is useful for cultivar identification, DNA fingerprinting, genetic diversity and population structure assessments.

Genome Editing

An experiment on CRISPR/Cas9-mediated editing of lipase genes to improve shelf life of pearl millet was conducted by editing key lipase genes (*PgTAGLIP1*, *PgTAGLIP2*, and *PgTAGLIP3*) in variety 'Dhanshakti' using the CRISPR/Cas9 system. Specific single-guide RNAs (sgRNAs) targeting the lipase genes were designed using the web-based tools CRISPR-P and CHOPCHOP. The sgRNAs were cloned into the pBUN421 binary vector, which contains a maize codon-optimized Cas9 gene driven by the ubiquitin promoter. The bar gene, regulated by the CaMV35S promoter, was used as the selectable marker for identifying transformed plants.

A total of 294 PPT-resistant lines targeting the three lipase genes were obtained, of which 201 lines were confirmed positive for Cas9. Subsequent Sanger sequencing identified 20 edited events across the targeted lipase genes, including 3 of 8 in *PgTAGLIP1-2*, 7 of 19 in *PgTAGLIP1-3*, and 10 of 18 in *PgTAGLIP2-3*. The detected mutations are predicted to generate loss-

of-function alleles that reduce lipase activity, thereby improving the shelf life of pearl millet flour.

Seed Science

Effect of boron and zinc on seed yield and quality traits in barnyard millet was studied and results indicated application of Zinc (Zn) significantly increased seed yield compared to the control, followed by Boron (B). Combination of Boron (B) spray with Zn resulted in a significantly lower seed yield than individual applications of either Zinc or Boron during both PRS and RS.

Identification of SNP-trait associations for seed longevity traits through association mapping in pearl millet identified a pleiotropic SNP, PMSnpB394 on chromosome 2, associated with 14 seed longevity traits, underscoring its potential as a key genomic region for improving seed viability.

Studies on seed treatment technologies in sorghum identified seed treatment of Thiamethoxam 30% FS @ 10 ml per kg of seed + Azoxystrobin 2.5% @ 4g/kg seed (T8) recording relatively lower incidence of shootfly. In pearl millet, seed treatment of Imidacloprid Gaucho FS 600 @ 7 ml per kg seed) + Azoxystrobin 2.5% @ 4g/kg seed (T11) recorded relatively lower incidence of major pests.

Crop Physiology

Studies on drought adaptive traits under terminal moisture stress identified tolerant genotypes (CSV29R, BJV 44, M35-1) with <30% yield loss sustained yield under terminal drought through superior phenology, higher biomass accumulation (TDMA), higher non-structural carbohydrate reserves, water-use efficiency, better panicle harvest index and root architecture traits.

Studies on high temperature tolerance identified five genotypes O7444R, 04999B, ICMR07444, ICMB04999, Dhanashakthi as heat tolerant based on morpho-physiological traits and reduced losses in growth and yield under high-temperature stress compared to the control

Biochemistry

Relationship between alcoholic acidity and mineral content in pearl millet grains was studied with diverse

set of samples. A significant correlation of 0.733 ($p < 0.01$) was found between Iron and Zinc while there was no significant correlation between alcoholic acidity, Iron and Zinc content in pearl millet grains.

Thermal processing methods of open-pan roasting, microwave roasting, and hydrothermal treatment was studied to understand the changes upon processing in foxtail millet varieties SiA 3156, SiA 3088. Hydrothermal treatment significantly reduced phytic acid while, microwave treatment led to a significant decrease in amylose content. Open pan roasting and hydrothermal treatment significantly reduced protein digestibility.

Crop Protection

Insect pests and Management

For exploring new plant traits for resistance against major insect pests, the morphological characteristics of Eulophidae parasitoids from various millets and alternate hosts like *Cynodon dactylon* attacked by shoot flies were documented. The parasitoids were reared from infested dead-heart plants in millets and associated grasses and identified based on morphological characters observed under a stereo zoom microscope

Evaluation of finger millet genotypes against pink stemborer, *Sesamia inferens* recorded significant variation among the genotypes for deadhearts (DH). The DH ranged from 1.6 to 34.6% with a mean DH (%) of 13.3%. Kumuda Red Mandia, Balu Mandia, KMR 630 and GPU 67 recorded <5% DH. The highest DH (33.3%) were recorded in CFMV2.

Stepwise regression was employed to identify the most influential variables for fall armyworm incidence. The model indicated that minimum temperature, relative humidity at evening, rainfall and wind speed were the most significant variables affecting fall armyworm pheromone catches, which accounted for 35 per cent of the variation in fall armyworm moth catches ($p < 0.05$).

From field screening of sorghum varieties for sorghum aphids, the varieties CSV-29R, Hathikunta, PKV-Kranti, TAM-428, PUGL-9, SPV-2217, SSV-84, ICSV-745, KR-191, and ICSV-745 were categorized as resistant to the sorghum aphid.

Studies on stored grain pests of small millets revealed resistance was governed by the combined action of grain hardness and biochemical defenses, particularly phenolic compounds whereas susceptible cultivars were characterized by softer grains with lower phenolic levels and higher sugar content.

Diseases and Management

Virulence profiling of pearl millet blast isolates was evaluated on ten pearl millet host differentials using 1–9 disease scale. Isolates viz., PMB 5, PMB 6, PMB 8, PMB 9 and PMB 11 recorded higher disease scores on multiple host differentials. Isolates viz., PMB 1, PMB 2, and PMB 43 exhibited lower virulence, with scores falling within the resistant-to-moderately resistant range (1–3).

Evaluation of 120 finger millet lines for finger and neck blast resistance indicated early flowering lines with higher finger blast (FB) mean 84.0% and neck blast (NB) mean 34.4%, compared to medium (FB mean 64.7% and NB mean 19.6%) and late flowering (FB mean 33.5% and NB mean 6.9%) genotypes. IE4671 was observed to be resistant in medium maturity group.

Viral disease incidence across rabi sorghum varieties recorded highest incidence red stripe in Solapur Dagdi followed by Phule Vasudha and CSV-29 R whereas, Parbhani Moti recorded the lowest incidence.

Crop and Natural Resources Management

Agronomy

Lysimetric experiments carried out with 29 foxtail millet and 42 finger millet genotypes recorded mean grain yield in foxtail millet ranging from 14.2 to 26.7 g/plant under WW and from 9.7 to 19.6 g/plant under WS conditions.

Mean grain yield in finger millet ranged from 43 to 21 g/plant in WW and 29 to 9 g/plant in WS conditions, respectively. In finger millet ML 365 and PR 202, with less than 0.5 drought susceptibility index, were identified as stable yielders under water stress.

Application of hydrogel had a positive and significant effect on the productivity of foxtail millet, with an increase in grain yield from 1725 kg/ha in the control to 2200 kg/ha at 7.5 kg/ha, representing a 27% increase.

Carbon emissions from sorghum and pearl millet cultivation were estimated by accounting for inputs such as diesel, seeds, fertilizers, herbicides, plant protection chemicals, spraying operations, and irrigation. Fertilizer application was the largest contributor to carbon equivalent emissions (CEE), followed by fuel use for land preparation and threshing. Overall, pearl millet cultivation exhibited marginally lower carbon emissions than sorghum.

Extension research, Economics and Value addition

Extension research

A total of 126 FLDs were organized in Maharashtra, Karnataka, Telangana, and Tamil Nadu with high-yielding varieties, moisture conservation and zero-tillage practices. Results revealed 32% higher grain yield and 20% higher fodder yield compared to local checks, with an additional net return of ₹60,706 ha⁻¹ at a cultivation cost of ₹27,682 ha⁻¹, resulting in about 41–46% higher profitability than local cultivars.

Adoption studies of demonstrated technologies in finger millet in Andhra Pradesh showed 45% higher grain yield, 44% better grain quality, 35% higher fodder yield, 47% higher net returns, and a 20% increase in benefit–cost ratio. In little millet, it recorded 58% higher technology adoption, 42% higher grain yield, 40% better grain quality, 30% higher fodder yield, 44% higher net returns, and a 25% increase in benefit–cost ratio.

FPO-led seed distribution resulted in substantial area expansion, including 2,609.7 acres from 7,829 kg of sorghum seed, 2,475 acres from 4,950 kg of foxtail millet seed, 2,291 acres from 4,582 kg of barnyard millet seed, 1,597.5 acres from 3,195 kg of little millet seed, and 962.5 acres from 1,925 kg of proso millet seed.

ICAR-IIMR, Hyderabad, through NABARD and SFAC-supported Millet FPO projects, distributed 47.5 tonnes of quality millet seed over the last five years via FPOs, KVKs, and line departments, resulting in a 39.5% increase in millet cultivation area in FPO villages.

Capacity building was strengthened through 22 training programs per FPO, along with field days, crop diversification initiatives, and millet promotion activities.

Millet farmers sale prices increased from ₹1,800–2,600/q before intervention to ₹2,800–3,200/q after FPO-led aggregation and processing, while value-added millet products fetched 30–40% higher prices than raw produce.

Economics

Analysis of pearl millet productivity (1991–92 to 2021–22) showed positive Total Factor Productivity (TFP) growth in both Gujarat and Uttar Pradesh, with overall TFP growth rates of 2.01% per annum in Gujarat and 1.52% per annum in Uttar Pradesh driven largely by research and extension efforts. Market integration analysis of pearl millet in Rajasthan revealed strong price linkages among Alwar, Barmer, Jaipur, and Jodhpur markets, with Alwar emerging as the key price-influencing market.

Resource use efficiency analysis in kharif sorghum indicated that expenditure on seeds, fertilizers plant protection chemicals and manure significantly increased gross returns. Coefficients of machine cost and hired labour cost were negative, indicating a negative relationship with gross return, but the effect of machine cost was found to be non-significant.

Value addition and commercialization

Caramelized sorghum puffs coated with sugar or jaggery and instant sorghum-based kheer mixes were successfully standardized offering nutritious and convenient food options with desirable sensory qualities.

A clinical study in individuals with Type 2 diabetes showed that barnyard millet tomato rice had the lowest glycemic index, while optimized jowar roti effectively improved glycemic control and reduced HbA1c levels when used as a meal replacement.

Gluten-free barnyard millet noodles developed using heat-moisture-treated flour exhibited good cooking quality, enhanced nutritional value, and high consumer acceptability. Additionally, starch extracted from major and minor millets exhibited suitable chemical, thermal, and structural properties for producing biodegradable packaging films.

Starch extracted from major and minor millets demonstrated that millet starch possesses desirable chemical, thermal, structural, and functional characteristics, making it a promising raw material for biodegradable packaging films and sustainable food processing applications.

Global Centre of Excellence on Millets

Component 1: Establishing a Medium-term Germplasm Storage Facility to Strengthen Millets GeneBank for Conservation, Trait-specific Characterization and Utilization of Millet Biodiversity for Crop Improvement

A set of 1,629 small millet germplasm accessions (finger, foxtail, proso, little, and kodo) was characterised for various target traits. A total of 4,305 new sorghum accessions were added to medium-term storage as part of germplasm management activities. Two sorghum germplasm lines and one each from finger millet and foxtail millet lines were registered with ICAR–NBPGR, New Delhi.

About 50,000 millet accessions were conserved under medium-term storage at 4–7 °C at the ICAR-IIMR gene bank, including sorghum, finger millet (8,057), pearl millet (4,765), foxtail millet (4,575), proso millet (1,463), barnyard millet (1,159), little millet (670), and kodo millet (1,500).

Component 2: Technology Innovation Centre for Trait, Seed, and Crop Improvement of Millets for Enhancing Yield and Productivity

To advance genetic studies in pearl millet CMS lines, long-read sequencing libraries were prepared to generate approximately 20-40X genome coverage of CMS lines representing A1, A2, A3, A4, and A5 cytoplasm, along with their corresponding maintainer (B) and restorer (R) lines

Genome-wide transcriptomic analysis of two inbred lines, ICMR 101205 (drought-tolerant) and ICMR 101580 (drought-susceptible) revealed 95,052 differentially expressed genes, upregulated genes were associated with several key functions, including cell wall remodelling (Xyloglucan endotransglucosylase/

hydrolase), stress signaling (Protein kinase domain-containing protein), and water transport (Aquaporin PIP2-1)

For the development of a mid-density SNP panel in sorghum, whole-genome resequencing data from public databases were retrieved for about 520 diverse sorghum accessions, leading to ~76 million variants, including 62.8 million SNPs and 13.4 million indels, with a Ts/Tv ratio of 1.71, indicating high data quality.

A high-quality reference genome of the little millet line JK-8 was sequenced, comprising 18 chromosomes and 59,045 genes. Eleven chromosomes were assembled from telomere to telomere, revealing an ~850 Mb tetraploid genome closely resembling broomcorn millet. The results have been published in Nature Communications with an NAAS impact of 20.0.

Kodo millet genome of cultivar RK390-25 was *de novo* sequenced and assembled. Optical mapping generated 2.28 Gb of data, resulting in a BioNano assembly comprising 30 scaffolds with a total size of 850 Mb. Gene prediction and annotation identified 133,861 genes, including 49,204 single-exon genes. Additionally, 51.39 Gb of Hi-C data from 341,279,064 reads produced a 900 Mb assembly distributed across 91 scaffolds. The hybrid assembly was resolved into 20 chromosomes, of which 10 were completely assembled.

Component 3: Nutri-cereal Analytical, Food Safety and Quality Assurance National Referral Laboratory for Millets.

Metabolite profiling for Fe/Zn in diverse pearl millet lines identified 1,941 plant-specific metabolites spanning diverse biochemical classes, of which eight metabolites are involved in Fe and Zn metabolism, including nicotianamine, mugineic acid, ferroportin, citrate, malate, ferritin, heme/heme-related metabolites, and phytate.

X-ray fluorescence (XRF) profiling of grain iron (Fe) and zinc (Zn) is standardized and phenotyping was carried out in 300 diverse pearl millet genotypes grown across four locations at ICAR-IIMR, Hyderabad, IARI, New Delhi, ARS, Vizianagaram and CAZRI, Jodhpur.

TLC-based method was standardized to identify cyclopiazonic acid (CPA), the causative agent of kodo poisoning, *Penicillium* and *Aspergillus* isolated from commercial kodo millet grain samples tested positive for CPA production in cultures.

Component 4: Centre of Excellence for Millet Value Chain and Business Facilitation for Entrepreneurship, Incubation and Startup Nurturing

Value-added millet recipes in Bajra (5), Ragi (10), Proso millet (2), Foxtail millet (5), Little millet (4), Kodo millet (1), Barnyard millet (5), Jowar (1), and Multi-millet (2) were developed to promote nutrition and product diversification. More than 50 startups from over 20 states were supported through incubation, technology transfer, and business facilitation, with a strong emphasis on women entrepreneurs and millet-based enterprises. Regular initiatives such as “Cooking with Millets,” Startup Ignition Programs, Entrepreneurship Foundation Programs, and technology training strengthened entrepreneurial skills and innovation.

Component 5. Establishment of International Knowledge, Skill Development and Capacity Enablement Centre with International Millet Museum & Halls of Residence

Union Minister for Agriculture and Farmers Welfare, and Rural Development, Shri Shivraj Singh Chouhan laid the foundation stones for the Global Centre of Excellence on Millets and Advanced Phenomics Complex on 9 June 2025 during “Viksit Krishi Sankalp Abhiyan” campaign with the gracious presence of Shri Bhagirath Choudhary, Union Minister of State for Agriculture and Farmers Welfare; Shri Thummala Nageswara Rao, Agriculture Minister, Telangana, Dr. M. L. Jat, Secretary (DARE) & DG (ICAR), Dr. D. K. Yadava, DDG (Crop Science) ICAR, Dr. Tara Satyavathi, Director, ICAR-IIMR, Hyderabad and various dignitaries from state and state government.

Construction of Global Centre of Excellence infrastructure and the construction of the Advanced Phenomics Facility featuring tissue culture greenhouses, high-tech climate control chambers, speed breeding

facility, phenomics facility, insect pest and disease screening facility are in progress.

ICAR-IIMR implemented SCSP, TSP, and NEH programs through the National Millets Kisan Mela, farmer trainings, demonstrations, seed and input distribution, and capacity-building initiatives, benefiting thousands of SC, ST, tribal and hill farmers while strengthening FPOs, SHGs, and millet entrepreneurship.

Millet processing and value-addition units, farm-gate infrastructure, mobile millet markets (Girijana Bazar), and post-harvest support such as tarpaulin distribution were established across multiple states, improving processing, reducing post-harvest losses, enhancing market linkages, and increasing farmers' incomes.

Improved millet varieties, quality seeds, farm inputs, agricultural equipment and processing facilities were provided through KVKs and regional institutions, while frontline demonstrations and field-level interventions were conducted to promote climate-resilient cultivation, value addition, and sustainable millet production.

Component 6. Global Facility for Millet Pilots on Feed, Fodder, Biofuels, Malting, Brewing and Promotion of Industrial utilization of Millets

To promote industrial utilization of millets through research, major pilots for biofuels, malting and brewing and feed and fodder is targeted. Construction of infrastructure and machineries for establishing pilots for brewery and biogas pilot units is in progress. Brewing experiments in different millets (sorghum, pearl millet, ragi and barnyard millet) in collaboration with NSI, Kanpur is taken up.

Component 7. Regional Millet Technology Innovation and Outreach Hubs

Significant progress was made in establishing the ICAR-IIMR Regional Research Station at Gudamalani,

Barmer, with completion of laboratory flooring, electrical and sanitary installations, commencement of parapet stone grill work, and development of the surrounding infrastructure.

Pearl Millet Technology Demonstration and Farmers's Meet 2025 was organized on 21 September 2025 at the ICAR-IIMR Regional Research Station, Gudamalani. The event was graced by Shri Bhagirath Choudhary, Union Minister of State for Agriculture and Farmers Welfare; Shri Kailash Choudhary, Former Union Minister of State for Agriculture and Farmers Welfare; Dr. M. L. Jat, Secretary (DARE) & DG (ICAR), Dr. D. K. Yadava, DDG (Crop Science), and Dr. Tara Satyavathi, Director, ICAR-IIMR.

Collaborative research programs with ICAR-IARI (Genetics), ICAR-IARI (Biochemistry), ICAR-NIPB, ICAR-CIPHET, ICAR-CIAE, ICAR-NDRI, ICAR-NRC on Camel, ICAR-CIRG, ICAR-CIRB, ICAR-VPKAS, ICAR-CRIDA, ICAR-CAZRI, ICAR-IGFRI, ICAR-IIAB, and ICAR-NBPGR generated significant advances in millet breeding, genomics, processing, value addition, climate resilience, feed and fodder and industrial utilization.

Millets and Other Ancient Grains International Research Initiative (MAHARISHI)

MAHARISHI was officially launched on July 16, 2025, with its Charter and logo. A steering committee (Chaired by Dr. M. L. Jat, Secretary, (DARE) and DG (ICAR) held four meetings during the year to guide research priorities and institutional partnerships.

Preparations for establishment of Mini-Secretariat at Nairobi through ICRISAT, participation in platforms like the Shree Anna symposium, preparations for Millets and Ancient Grains International Conference (MAGIC) -2026 conference in Hyderabad were carried out



Research Achievements

Genetic Resources Management

3.1 Collection, conservation and utilization

IIMR/CI/2021-2026/150: Nutri-cereals genetic resources management (PI: K Venkatesh)

ICAR-Indian Institute of Millets Research (IIMR) is one of the National Active Germplasm Sites (NAGS) to act as a national repository for millets germplasm in India. The objectives of the millets Genebank are collection, augmentation, conservation, characterization, evaluation, distribution, utilization and documentation of millets genetic resources.

Germplasm conservation: About 50,000 millets accessions are being conserved in the medium term storage of ICAR-IIMR Genebank. Sorghum (27,366) occupying largest number of accessions followed by finger millet (8,057), pearl millet (4,765), foxtail millet (4,575) and other small millets.

Germplasm multiplication: About 1300 accessions of millets germplasm including 384 sorghum, 286 finger millet, 190 foxtail and 476 proso millet were multiplied during 2025-26.

Germplasm distribution:

A total of 659 accessions were distributed to researchers which includes 356 sorghum accessions, 145 foxtail

millet accessions, 80 kodo millet accessions and 78 accession of pearl millet (Fig. 3.1)

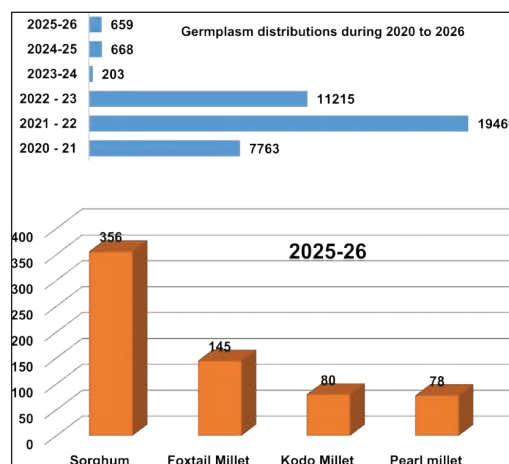


Fig. 3.1 Details of millet germplasm distribution from ICAR-IIMR genebank

Registration of trait specific genetic stocks with ICAR-NBPGR:

Seven accessions from finger millet, foxtail millet, and sorghum, registered (INGR 25010–25058) by germplasm registration committee of ICAR-NBPGR, New Delhi. Registered lines exhibited donor potential for disease and pest resistance, low hydrocyanic acid (HCN) content, early maturity with aromatic profiles, elevated amylopectin, and improved seed metrics (Table 3.1)

Table 3.1 Genetics stocks registered during 2025-26 by Plant germplasm registration committee

No	Crop	Donor identity	INGR_No	Novel / unique features
1	Finger Millet	VR 1136	INGR25010	Neck blast resistance and Banded blight resistance.
2	Foxtail Millet	IIMR FxM-6 (FXV 644)	INGR25011	Tolerance to shootfly and Resistance to brown spot.
3	Sorghum	SPV2861	INGR25012	Low HCN content in unstressed environment.
4	Sorghum	SPV 2859	INGR25040	Early flowering and early maturity scented aroma (2-acetyl-1-pyrroline)
5	Sorghum	HAS 5	INGR25057	High amylopectin content.
6	Sorghum	SPV 2918	INGR25058	Shoot fly resistance, Stem borer resistance and High 100 seed weight.

Mega-characterization of 4618 foxtail millet accessions at ZARS, Bengaluru (Consortia Research Platform on Agrobiodiversity, CRP-AB)

Mega-characterization of 4618 foxtail millet accessions encompassing indigenous and exotic collections

representing the entire foxtail millet collection from the National Genebank was carried out at ZARS, UAS, Bengaluru (Fig. 3.2). Subset of promising germplasm lines are being identified for its use in further crop improvement programs.



Visit by Dr. Sushil Pandey, NBPGR, Delhi



Visit by AICRP On Small millets, UAS Bangalore team

Fig. 3.2 Field view of variability observed in the foxtail millet accessions

Multilocation evaluation of finger millet germplasm for blast disease under CRP-AB project

Multi-locational trial (Mandya, Vijayanagaram and Almora) of finger millet germplasm for evaluation of leaf, stem and neck blast was taken up in augmented design under CRP-AB project. GE 4449 and KMR 204 as resistant KMR 301 and Uduru Mallige were used as susceptible checks for comparison.

Two accessions were identified as resistant for neck blast with incidence score between $< 10\%$. Three accessions were found to be resistant for finger blast with incidence score between $< 10\%$. Summary of promising accessions across locations and resistant accessions for finger and neck blast is given in Table 3.2, 3.3 and 3.4.

Table 3.2. Summary of resistant and common accessions across locations for finger millet blast disease

Blast	Disease score	Number of accession			
		Vizianagaram	Mandya	Almora	Common
Leaf Blast	HR to R (0-3G)	1361	774	68	12
Neck Blast	HR to R (0-10%)	57	88	1128	7
Finger Blast	HR to R (0-10%)	66	809	471	29

Table 3.3. Resistant accessions for finger millet neck blast from multilocation trial

SI No.	Accession	Neck blast Score (0-10%)		
		Almora	Mandya	Vizianagaram
1.	IC0312323	2.0	0.3	0.00
2.	IC0312326	1.0	7.6	0.00
3.	IC0474473	4.0	5.6	0.00
4.	IC0474474	6.0	0.5	0.00
5.	IC0612350	7.8	7.8	0.00
6.	IC0627119	8.00	5.7	8.33
7.	IC0642428	9.14	6.6	8.33

Table 3.4. Resistant accessions for finger millet for finger blast from multilocation trial

SI No.	Accession	Finger blast Score (0-10%)		
		Almora	Mandya	Vizianagaram
1.	IC0087502	8.6	3.6	0.0
2.	IC0262369	9.4	7.2	0.0
3.	IC0276896	7.7	8.7	0.0
4.	IC0282561	9.2	5.9	0.0
5.	IC0283758	9.0	9.2	0.0
6.	IC0326825	8.3	2.3	0.0
7.	IC0344221	4.5	7.8	0.0
9	IC0344999	4.3	7.9	4.8
9	IC0345085	9.7	5.6	9.5
10	IC0345111	9.1	5.4	0.0

3.2. Pre-Breeding

IIMR/CI/2021-2016/148: Pre-Breeding of sorghum and finger millet for specific trait improvement (PI: K Venkatesh)

Screening sorghum for shootfly resistance: A set of 18 *S. purpureo-sericeum* accessions collected from ICRISAT genebank were seed multiplied for shootfly screening and trait introgression to adapted germplasm through wide hybridization (Table 3.5)

Table 3.5 Set of wild sorghum accessions used for shootfly studies

S.No	Accession	Species
1	IS 14564	<i>bicolor</i>
2	IS 14717	<i>bicolor</i>
3	IS 18813	<i>bicolor</i>
4	IS 18819	<i>bicolor</i>
5	IS 18826	<i>bicolor</i>
6	IS 18830	<i>bicolor</i>
7	IS 18845	<i>halepense</i>
8	IS 18849	<i>halepense</i>
9	IS 18883	<i>bicolor</i>
10	IS 18891	<i>halepense</i>
11	IS 18943	<i>purpureosericeum</i>
12	IS 18944	<i>purpureosericeum</i>
13	IS 18945	<i>purpureosericeum</i>
14	IS 18947	<i>purpureosericeum</i>
15	IS 18956	<i>australiense</i>
16	IS 20995	<i>bicolor</i>
17	IS 23177	<i>versicolor</i>
18	IS 27584	<i>bicolor</i>

Characterization of interspecific derivatives:

Thirty two interspecific derivatives from crosses involving 27B × *Setaria hewisonii* IS18660; 27B × *S. versicolor* IS18926; 27B × *S. purpureosericeum* IS18944 (5); 126B × *S. purpureosericeum* IS18944 (4); AKMS 14B × *S. purpureosericeum* IS18944; 27B × *S. purpureosericeum* IS18944 (3); AKMS14A × *S. purpureosericeum* IS18944 (2); 27B × *S. australiense* IS18955 (3); SSV84 × *S. australiense* IS18955 (2); 126B × *S. versicolor* IS18926; (126B × *S. versicolor* IS18926) × SSV84 were characterized for phenotypic and seed traits and molecular evaluation for two seasons. Variability for grain related traits are as given in the below Fig.3.3. The interspecific derivatives forms important genetic resources for diversification of cultivated gene pool.



Fig 3.3. IS derivatives with purple endosperm

4.1. Pearl Millet

IIMR/CI/2021-26/141: Genetic enhancement of pearl millet for yield and adaptation to arid regions (PI: P Sanjana Reddy)

Parental line development

For creation of new variability, 102 A/B lines are being advanced and in BC₁ to BC₈ stages of conversion. Ten A/B lines are stabilized for their use in generation of new experimental hybrids. The restorer line development program identified 93 R lines that performed well in different maturity hybrid combinations

Evaluation of new experimental hybrids

During the 2025 kharif season, 204 experimental hybrids were developed and evaluated for arid adaptation, and 411 hybrids for semi-arid adaptation, across six different trials. Among these, 10 hybrids were identified with grain yield levels of 1.96–3.15 t/ha in early-maturing hybrids group (Table 4.1); medium-maturing hybrids (62 selected) yielded 2.14 - 4.41 t/ha (Table 4.2); and late-maturing hybrids (40 selected) yielded 2.12 - 4.14 t/ha (Table 4.3).

Table 4.1 Mean performance of top ten early maturing hybrids evaluated during *kharif* 2025 season

Hybrid	Days to 50% flowering	Plant height (cm)	Panicle length (cm)	Panicle width (cm)	Grain yield (t/ha)	Panicle harvest index	1000 Grain weight
221A x 1036	43	180	24.5	2.8	3.15	0.54	8.7
221A x 1028	44	170	21.8	2.5	2.97	0.55	7.9
221A x 525	43	190	23.0	3.2	2.88	0.64	10.9
04999A x 1083	44	195	21.5	1.8	2.64	0.58	7.8
264A x 42	44	215	21.5	2.5	2.63	0.65	9.8
221A x 520	43	183	21.4	2.4	2.51	0.70	10.9
221A x 1024	44	150	17.8	2.3	2.39	0.51	8.1
221A x 521	44	188	20.2	2.7	2.07	0.56	10.8
221A x 576	41	180	23.0	2.5	2.06	0.55	11.7
221A x 669	43	240	21.1	2.3	1.96	0.60	8.8

Table 4.2 Mean performance of top ten medium maturity hybrids evaluated during *kharif* 2025 season

Hybrid	Days to 50% flowering	Plant height (cm)	No. of productive tillers	Panicle length (cm)	Panicle width (cm)	Grain yield (t/ha)	Panicle harvest index	1000 Grain weight
291A x 521	50	210	2.3	21.8	3.1	4.41	0.73	9.7
269A x 448	47	200	1.6	22.4	2.4	3.64	0.58	11.4
269A x 549	50	190	0.9	21.0	2.3	3.57	0.62	8.6
221A x 517	48	215	1.7	23.8	3.4	3.55	0.67	10.7
221A x 16	50	198	1.6	24.9	2.8	3.50	0.57	9.0
221A x 567	47	180	1.4	22.0	2.3	3.48	0.76	10.3
221A x 1073 (21S 123R x Jafrabadi)	49	210	3.4	24.3	3.1	3.41	0.63	10.8
269A x 713	48	200	1.4	18.5	3.4	3.41	0.63	9.1
221A x 1071 (21S 134R x Jafrabadi)	50	220	2.4	20.5	2.8	3.37	0.60	10.1

Table 4.3 Mean performance of top ten late maturity hybrids evaluated during *kharif* 2025 season

Hybrid	Days to 50% flowering	Plant height (cm)	No. of productive tillers	Panicle length (cm)	Panicle width (cm)	Grain yield (t/ha)	Panicle harvest index	1000 Grain weight
221A x 3	53	225	1.3	24.7	2.7	4.14	0.63	8.1
291A x 740	54	240	1.3	24.3	3.5	3.74	0.65	9.3
291A x 631	55	220	1.5	27.5	3.3	3.62	0.71	9.6
269A x 697	59	220	1.4	27.5	3.5	3.45	0.60	9.3
291A x 16	58	220	2.3	24.3	2.3	3.40	0.69	8.8
269A x 16	55	160	1.6	29.5	3.0	3.39	0.62	9.3
269A x 555	53	200	1.0	21.5	2.0	3.31	0.60	7.3
291A x 539	52	190	1.4	21.4	2.8	3.25	0.61	8.8
291A x 30	53	210	1.1	25.8	2.5	3.17	0.60	7.7
291A x 593	55	200	1.7	27.5	2.8	3.12	0.65	11.3

Stability assessment of inbred lines for blast disease:

A diversity panel of 300 inbred lines was screened for blast resistance (1–9 scale; 1 = highly resistant, 9 = highly susceptible) at four locations (Hyderabad, Gudamalani, Dhule, Jaipur) during *kharif* 2025. Clustering pattern revealed substantial variability, with many genotypes

scoring 1–5 (moderate resistance). Genotypes positioned rightward in the biplot exhibited higher blast severity; and genotypes positioned leftward showed greater resistance. Genotypes near the horizontal axis (PCA1 $\approx$ 0) exhibited low interaction and greater stability across locations, while those genotypes farther (both positive and negative directions) are environment-specific (less stable). Gudamalani and Jaipur were related to genotype expression to blast resistance and they were unrelated to Hyderabad and Dhule locations. Gudamalani and Jaipur are located in quadrant having positive PC score (better interaction) (Fig. 4.1)

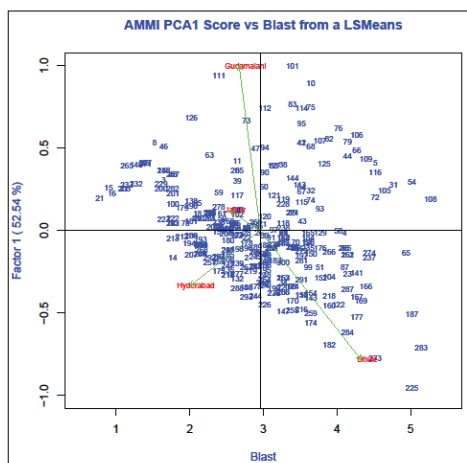


Fig. 4.1 AMMI Biplot 1 (four locations) for blast disease in pearl millet during *kharif* 2025

IIMR/CI/2018-2025/120: Development of high biomass pearl millet Forage Cultivars with improved quality (PI: Avinash Singode)

Promising OPVs developed were evaluated for green fodder yield and dry fodder yield. Performance of the promising forage pearl millet OPVs identified from station trials and submitted to AICRP on forage crop trials in 2025-26 are given in the below Table 4.4.

Table 4.4 Promising OPVs for green and dry fodder yield

OPV	GF1/Plot	GF2/Plot	DFY-1/Plot	DFY-2/Plot	1 Cut days	2 Cut days
IIMR-FB-MC-2024-1	29.4	25.1	7.1	6.0	52	75
IIMR-FB-MC-2024-2	29.6	25.3	7.1	6.1	54	77
IIMR-FB-MC-2024-3	28.7	24.4	6.9	6.3	50	74
IIMR-FB-MC-2024-4	28.4	24.0	6.8	6.1	51	81
IIMR-FB-MC-2024-5	26.4	21.2	6.5	5.7	52	76
IIMR-FB-MC-2024-6	25.2	22.6	5.9	4.6	50	79
Check 1 TSFB-15-8	28.9	24.9	7.4	6.5	53	78

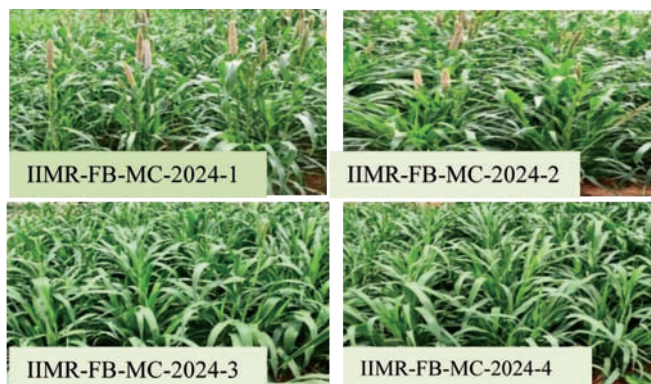


Fig. 4.2 Field view of the promising OPVs for fodder yield

Evaluation of superior combinations for forage yield and other forage components

A total of 216 experimental crosses were developed of which 30 selected crosses were evaluated for forage yield trial to assess the performance along with checks. Promising A lines and superior cross combinations identified are given Table 4.5.

Table 4.5 Superior crosses for green and dry forage yield

Cross	Green Forage yield (kg/ha)	Dry Forage yield (kg/ha)	Plant height	Internode length	Number of Tiller
ICMA-97777 x IIMR-FB-137	61113	14500	238	15.2	5
ICMA-97777 x IIMR-FB-122	59815	13944	230	14.8	5
ICMA-97777 x IIMR-FB-16	57204	13204	220	13.5	4
ICMA-97777 x IIMR-FB-113	63499	15056	245	16.1	6
ICMA-97777 x IIMR-FB-24	54800	12593	210	12.9	4
ICMA-97777 x IIMR-FB-67	60204	14019	232	14.5	5
ICMA-97777 x IIMR-FB-21	61796	14593	240	15.4	5
ICMA-97777 x IIMR-FB-82	62500	14759	242	15.8	6
ICMA-97777 x IIMR-FB-92	60796	14204	235	15.00	5
Check 1 TSFB-15-8	70204	16796	255	17.2	7
Nutrifed (Hybrid)	73500	17500	260	17.8	7
Nutrifast (Hybrid)	74800	17852	262	18.0	7

IIMR/CI/2023-28/162: Development of breeding resources and technologies through genomic approaches in pearl millet (PI: T Nepolean)

Deciphering molecular basis of drought tolerance in pearl millet for rainfed agro ecosystems

Screening 300 diverse inbred lines under PEG-induced drought stress identified 32 tolerant genotypes with superior antioxidant defenses. Enzymatic assays and histochemical staining confirmed lower superoxide and H_2O_2 accumulation in tolerant lines compared to susceptible ones. Quantitative H_2O_2 assays under drought showed elevated levels in susceptible genotypes, underscoring ROS homeostasis as a key factor in drought tolerance for breeding resilient varieties. Transcriptome profiling was performed in tolerant ICMR 101205 (high POD, moderate SOD, low ROS) and sensitive ICMR 101580 (excess

superoxide and H_2O_2) under PEG stress (Fig. 4.3 & Fig. 4.4). Differential expression in leaf and root tissues revealed upregulation of genes for ROS scavenging, cell wall remodeling, aquaporins (PIP2-1), and signal transduction, alongside downregulation of photosynthesis-related genes. Pathway enrichment and synteny analyses identified conserved ROS-regulated networks for drought tolerance.

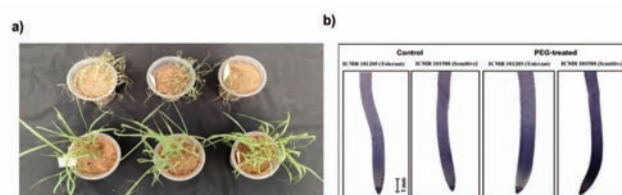


Fig. 4.3 Phenotypic response of pearl millet genotypes under control and PEG-induced drought stress conditions. b) ROS accumulation in pearl millet roots under PEG-induced drought stress

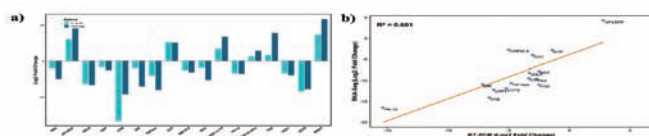


Fig. 4.4. Validation of selected drought-responsive genes in ROS and other major pathways. Comparison of $\log_2$ fold changes obtained from RNA-Seq, a) drought tolerant b) drought sensitive genotypes.

QTL-Seq analysis of cytoplasmic male sterility in pearl millet for identification of fertility restoration candidate genes

QTL-seq analysis was employed in F_2 populations (Fig. 4.5) from CMS-based crosses (A1: 08666A $\times$ PM-FZ-22; A4: HMS 37A $\times$ New IC-S23-129) to identify genomic regions and high-confidence SNPs associated with fertility restoration through bulked segregant analysis. A Line $\times$ Tester mating design is being employed to identify stable restorers across CMS systems and specific to individual cytoplasm. Restorer J-2340 effectively restored fertility across all five CMS systems PB213 (A1), PB313 (A2), PB408 (A3), HMS 52A (A4), and HMS 54A (A5). F_2 populations from these crosses will be subjected to sequencing based analysis to identify common and cytoplasm-specific Rf genes, enabling development of broadly compatible restorer lines and the discovery of shared fertility restoration genes aimed at enhancing of efficiency in pearl millet hybrid breeding (Fig. 4.5).



Fig. 4.5. Representative panicles illustrating complete sterility (0% seed set) to full fertility (100% seed set) in the F_2 population

Introgression and advancement of blast resistance through backcross breeding in pearl millet

Blast resistance backcross breeding program was initiated to introgress resistance into elite maintainer (B) and restorer (R) lines under desirable agronomic background. Using elite lines such as TCR 6, TCR 141, TCR 5, TCR 2, IC-K21-93, I-198 and I-89 as recurrent parents and blast-resistant donor lines viz., PM-BC-1 ((ICMB 98222 $\times$ IP 21187) $\times$ ICMB 98222), PM-BC-8

((ICMB 04999 $\times$ ICMR 11003) $\times$ ICMB 04999) and PM-BC-10 ((ICMB 04999 $\times$ ICMR 06444) $\times$ ICMB 04999) 17 BC_1F_1 lines were developed through targeted backcrossing. All 17 BC_1F_1 lines were evaluated during summer 2025 for blast reaction and grain yield. Response in progenies varied from highly resistant to moderately susceptible, indicating successful introgression of resistance alleles from donor parents. Several BC_1F_1 lines recorded low blast scores (0-1) with acceptable agronomic performance. 17 BC_2F_1 lines were generated through by backcrossing to the recurrent parents. All BC_1F_1 lines were selfed and advanced to BC_1F_2 generation to enable segregation and selection for blast resistance and yield-related traits in Kharif 2025. Stable blast-resistant lines will be advanced to identify superior blast resistant lines for pearl millet hybrid breeding.

Identification of trait-specific germplasm for heat, drought, rancidity, Fe and Zn content and blast resistance in pearl millet

To identify lines tolerant to key abiotic and biotic stresses, rancidity and nutritional superiority, 300 inbred lines, F_2 , and backcross populations of pearl millet were screened for adaptability to heat, drought, rancidity, Fe/Zn content, and blast resistance (Table 4.6). EGTB 1034 identified as heat-tolerant, with superior spike fertility, biomass, and seed set under stress. Drought screening identified ICMR 101205 with superior relative water content, chlorophyll retention, and yield stability under moisture stress. ICMB 1803 and NEW IC S23-346 were identified as low-rancid with lower free fatty acid accumulation and a delayed onset of rancidity. For these lines, the comprehensive acid value (CAV) increased from 4.1-4.9 mg NaOH/g in fresh flour to 6.9 mg NaOH/g on day 7 and 8.1 mg NaOH/g on day 14 of storage, indicating slower rancidity development. Screening for blast disease identified lines PM-BC-1 ((ICMB 98222 $\times$ IP 21187) $\times$ ICMB 98222), PM-BC-8 ((ICMB 04999 $\times$ ICMR 11003) $\times$ ICMB 04999) and PM-BC-10 ((ICMB 04999 $\times$ ICMR 06444) $\times$ ICMB 04999) with minimal lesion development and lower disease scores. Superior lines viz., ICMR 100145, ICMR 1504, and ICMR 101548 recorded elevated Fe (111, 108, and 126 ppm, respectively) and Zn (54, 47, and 46 ppm, respectively) were identified for grain micronutrients using XRF analysis.

Table 4.6 Trait specific donors identified for climate resilience, nutritional quality and shelf life in pearl millet

S. No	Trait	Genotype	Remarks
1	Heat stress	EGTB-1034	Heat-tolerant: Maintained higher spike fertility, biomass, and seed set under high-temperature stress
2	Drought stress	ICMR 101205	Drought-tolerant: Exhibited superior relative water content, chlorophyll retention, and yield stability under moisture-limited conditions
3	Low rancidity	ICMB 1803	Low-rancid line: Comprehensive acid value (CAV) increased from 4.1 mg NaOH g ⁻¹ (fresh flour) to 6.9 mg NaOH g ⁻¹ (day 7) and 8.1 mg NaOH g ⁻¹ (day 14), indicating delayed rancidity development
		NEW IC-S23-346	Low-rancid line: Similar trend of slower CAV increase, indicating improved flour shelf life
4	Iron and Zinc	ICMR 100145	High Fe (111 ppm) and Zn (54 ppm): Nutritionally superior genotype
		ICMR 1504	High Fe (108 ppm) and Zn (47 ppm): Suitable for biofortification breeding
		ICMR 101548	High Fe (126 ppm) and Zn (46 ppm): Excellent donor for micronutrient enrichment
5	Blast	PM-BC-1, PM-BC-8, PM-BC-10	Blast-resistant lines under field screening

Screening and biochemical characterization of pearl millet genotypes for rancidity

An initial screening of 101 genotypes was conducted using a pilot smell test to assess olfactory response to rancid odour after 14 days of storage. Based on smell scores, genotypes were ranked and classified into low rancid (score 3.0–3.3) and high rancid (score 4.1–4.5) categories, resulting in the selection of 20 genotypes (10 low and 10 high rancid) These selected genotypes were further evaluated using alcoholic acidity, which measures alcohol-soluble acids, including free fatty acids produced by lipase activity. Comparison between fresh (control) and 14-day stored (treatment) samples, with a cut-off value of 0.18%, enabled clear differentiation of low and high rancid genotypes. Correlation between

smell test and alcoholic acidity narrowed the selection to six promising genotypes. Comprehensive Acid Value (CAV) was estimated, which directly measures free fatty acids in flour. Based on CAV, four genotypes (TCB 139, NEW IC S23-346, I-207, and NEW IC S23-320) were identified as contrasting for rancidity (Fig. 4.6). Lipase activity assays conducted at day 0, day 7, and day 14 showed a strong correlation with CAV values, where low rancid genotypes exhibited reduced lipase activity.

The lowest activity was recorded in TCB 139 (4.02 U/g), while the highest was observed in NEW IC S23-320 (10.08 U/g) under treatment conditions. Enzyme activity increased mildly up to day 7 and declined by day 14, likely due to enzyme degradation.

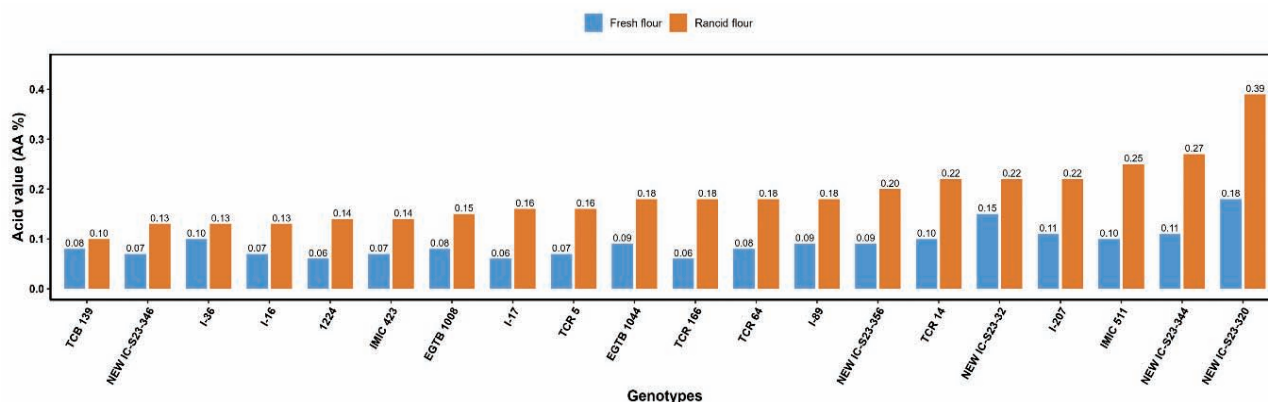


Fig. 4.6 Alcoholic acidity (%) of fresh (0 days post-milling) and rancid (14 days post-milling) flour in pearl millet inbred lines.

4.2. Sorghum

IIMR/CI/2021-2026/139: Breeding for genetically diverse kharif sorghum genotypes with improved grain yield, quality and resistance to important biotic stresses (PI: C. Aruna)

CSV 67 (SPV 2976): A high yielding kharif grain sorghum variety

CSV 67, a kharif grain sorghum variety with high grain and fodder yields and moderate tolerance to the important biotic stresses such as shootfly and stem borer, and grain mold, has been released for cultivation in the states of Gujarat and Rajasthan. In national breeding trials over three years (16 trials), in two states (Gujarat and Rajasthan) CSV 67 has recorded 2930 kg/ha mean grain yield compared to check CSV 41 (2681 kg/ha) which accounts to 9.3% grain yield superiority. For fodder yield also CSV 67 (170 q/ha) recorded 5.9% improvement over CSV 41 (161 q/ha). It has been derived from cross CSV 27 × IIMR 1150 (both parents

developed at IIMR, Hyderabad). It is medium maturing with duration of 115 days. It is nutrient-responsive and responded well for higher dose of fertilizer with 14.3% increase in grain yield at 150% RDF. It has semi-loose symmetrical panicles. It recorded 8.1% protein content, 27.2 ppm grain iron and 19.7 ppm zinc.

Performance of early and medium maturing kharif sorghum hybrids in station trials

One hundred and seventy-seven experimental hybrids based on 11MS and 70 R lines were evaluated in RCBD along with the checks. Forty hybrids were early maturing, which flowered in 54-60 days and matured in 95-100 days. Seven medium maturing hybrids recorded >10% yield advantage over the checks (Table 4.7). Seven early maturing hybrids recorded 8-22% yield advantage over the best check, CSH 48. Of these six hybrids flowered in 54-58 days. Nine medium and seven early hybrids recorded GM score of 3.0-4.0; 11 medium and 13 early hybrids recorded > 3.0g per 100 seed.

Table 4.7 Performance of promising sorghum hybrids

S. No.	Hybrid/Check	DTF	Grain yield (kg/ha)	Advantage over CSH 41 (%)	Plant height (cm)	100 Seed weight (g)	GMS (1-9)
Medium maturing hybrids							
1	151A x CB69	74	6624*	28.9	160	2.4	5.5
2	2911A x NR10-15	72	6611*	28.7	164	2.6	6.0
3	4414A x C43	70	6441	25.7	159	2.95	4.5
4	456A x CB11	71	6263	21.9	184	3.0	5.0
5	4918A x NR10-15	71	5991	16.6	166	2.55	5.0
6	151A x NR4118	72	5436	6.2	165	2.39	6.5
7	456A x I44	76	5478	6.6	179	2.70	5.0
8	279A x NR4018	70	5430	6.0	171	3.0	4.5
9	4414A x CB52	76	5374	5.0	168	3.0	4.0
10	4414A x CB69	74	5374	5.0	167	3.57	4.0
	CSH 41 (Check)	66	5137		173	3.0	6.0
Early maturing hybrids							
1	151A x DWR19-5	64	5389	22.0	165	2.6	4.0
2	1176A x NR4218	65	5187	17.5	140	2.73	5.5
3	151A x CB112	63	4999	13.2	147	3.0	5.0
4	151A x AKR150	60	4953	12.2	156	3.25	6.0
5	151A x CB119	65	4874	10.4	175	3.0	5.0
6	151A x CB95	64	4812	8.96	150	3.1	5.0
7	Pop4018AxAKR150	65	4753	7.6	158	3.0	5.5
	CSH 48 (Check)	63	4416		151	2.7	4.5
	CSH 30 (Check)	58	3756		179	3.2	5.0
	CV (%)	5.49	22.6		5.48	18.6	19.4
	CD (0.05)	7.64	1355		18.8	1.06	1.91

*-significant at 5% level

Evaluation of advanced breeding lines for shoot fly and grain mold tolerance

Two sets of material, one with 33 advanced breeding lines and another with 30 colored sorghum genotypes were evaluated for their grain mold and shoot fly tolerance in separate trials in collaboration with plant

protection group. For grain mold tolerance, 12 were good with a range of 2.5-5.0 GMS on 1-9 scale. BN 496 scored the least grain mold incidence (2.5 GMS) and was promising (Table 4.8). BN 488, 85 and 87 were found resistant to grain mold (score 3.0 on 1-9 scale).

Table 4.8. Promising advanced breeding lines for grain mold resistance

Genotype	Pedigree	GMS (1-9)	Grain color
BN 84	PVK809 x AKSV144-9	4	White
BN 85	PVK809 x AKSV144-10	3	White
BN 87	PVK809 x AKSV144-15	3	White
BN 488	CSV 20 x CSV 15 x IS23514)-8	3	Deep red
BN 496	CSV 20 x [(27B x (27B x IS24579)]	2.5	White
BN 618	C43 x IS3158-13	3.5	Red
BN 791	SR2957 x ICSV758-19	4	White
B58586	Res Check	3.1	White
Bulk Y	Sus Check	7	White

For shoot fly tolerance, ten breeding lines had DH% of 15-25% and were better than CSV 41 (26% DH). BN 84 was best with 15.8% DH (IS 18551-16.5% and DJ6514-54%) (Fig. 4.7). Among 36 colored lines, six lines recorded 22-24% DH (IS 18551-16% and DJ6514-51%). BN 134, 1118 and BN 845 more promising with

22-24%DH, CSV 50Red had 29% DH. BN84, BN618 and BN791 were found to have moderate resistance for both GM and SF. The red sorghum line, BN488 which had high grain mold tolerance was found to be moderately resistant to shoot fly damage.

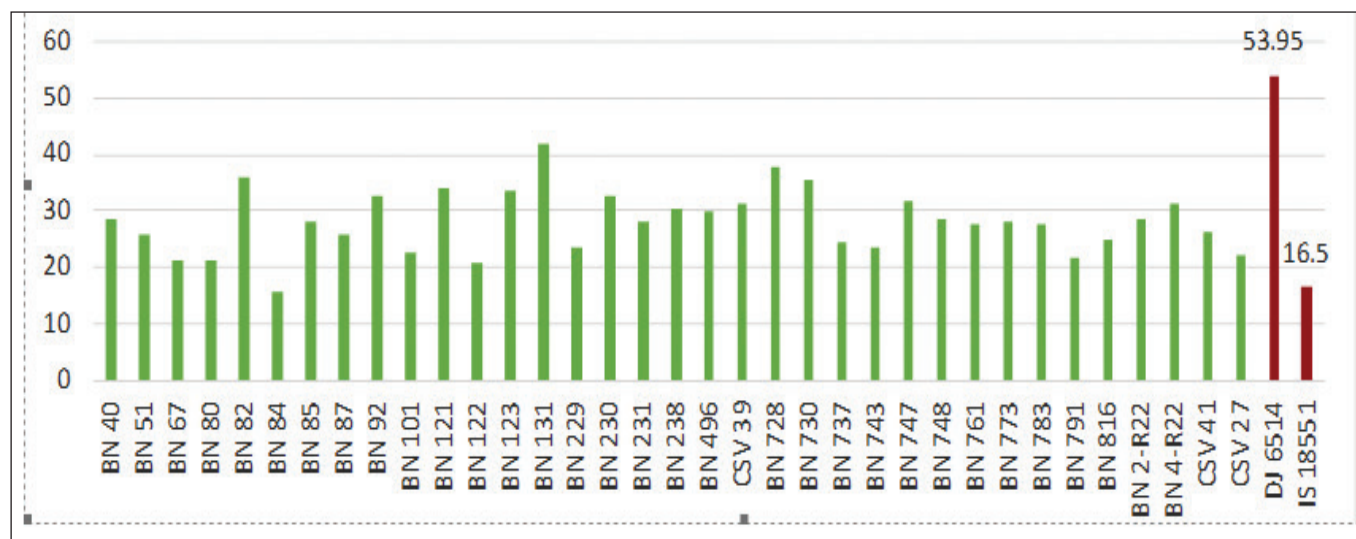


Fig. 4.7 Screening of advanced breeding lines for shootfly resistance

IIMR/CI/2020-2025/122: Genetic enhancement of rabi sorghum adaptive traits for improved varietal performance (PI: Parashuram Patroti)

Evaluation and identification of stabilized breeding material (MAGIC derived lines) for rabi adaptation

Four station rabi sorghum trials conducted revealed substantial genetic variability and enabled the identification of high-performing dual-purpose genotypes based on grain and stover yield. Across trials (a) and (b), stabilized derivative lines S23026RV, S23017RV, and S23024RV, along with bold-seeded entries S23035RV, S23036RV, and S23050RV, consistently outperformed the check varieties, recording grain yields

of about 5.3–5.7 t/ha and stover yields reaching up to ~10.2 t/ha. Similarly, in trials (c) and (d), a new set of advanced entries demonstrated clear yield advantages over checks, with S24245RV, S24221RV, S24224RV, S24235RV, and S24239RV. These genotypes registered higher grain yield (≈ 5.6 – 6.1 t/ha) along with enhanced stover yield (≈ 6.5 – 12.9 t/ha), confirming performance consistency across evaluation sets. From combined analysis, S23026RV, S23017RV, S23024RV, S23035RV, S23036RV, S23050RV, S24245RV, S24221RV, S24224RV, S24235RV, and S24239RV as promising dual-purpose candidates suitable for further MLT and advancement in the varietal development pipeline (Fig. 4.8.).

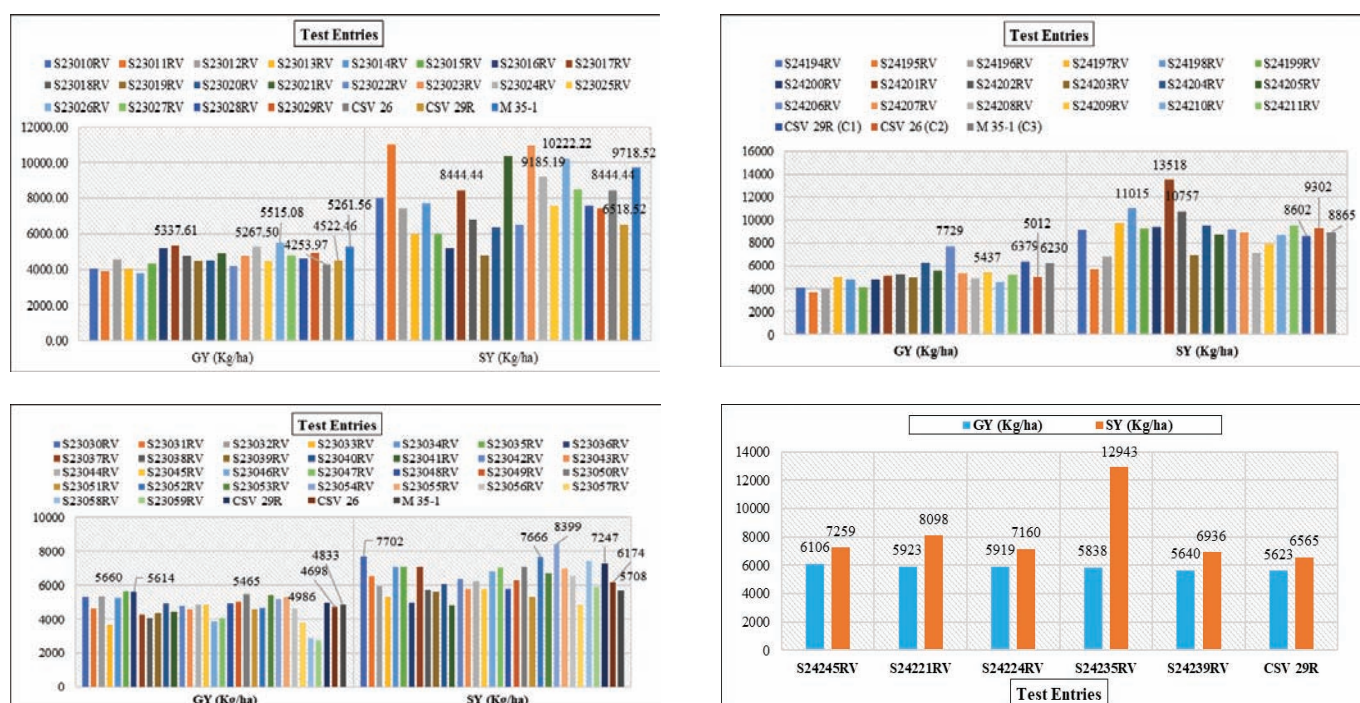


Fig. 4.8 Mean performance of MAGIC-derived rabi sorghum lines for grain and fodder yields during Rabi 2024–25

Evaluation of advanced rabi sorghum breeding lines for insect-pest, disease, drought tolerance and root characteristics: -

Response of rabi lines for insect-pests tested across multi-locations:

Thirty-two rabi sorghum lines were evaluated across multiple locations (Akola, Parbhani, Rahuri, Dharwad, Solapur, Bijapur, and Hagari) for resistance to shoot

fly and stem borer. Genotypes S24088RV, S24089RV, S24090RV, S24091RV, S24093RV, S24096RV, S24097RV, S24098RV, S24100 RV, S24101 RV, and S24102 RV showed resistance to shoot fly, performing comparable or superior to resistant checks and meeting the benchmark of <25% dead hearts. Among these, S24096RV, S24097RV, and S24101RV also exhibited resistance to stem borer, with dead hearts <10%, comparable or superior to resistant check varieties.

Screening of advanced rabi sorghum breeding lines under lysimeter for components of water use:

A lysimeter-based screening of 33 rabi sorghum entries

and three checks under well-watered and water-stressed conditions revealed significant genotypic variation in transpiration rate, transpiration efficiency, total water use, and grain yield Fig. 4.9 .

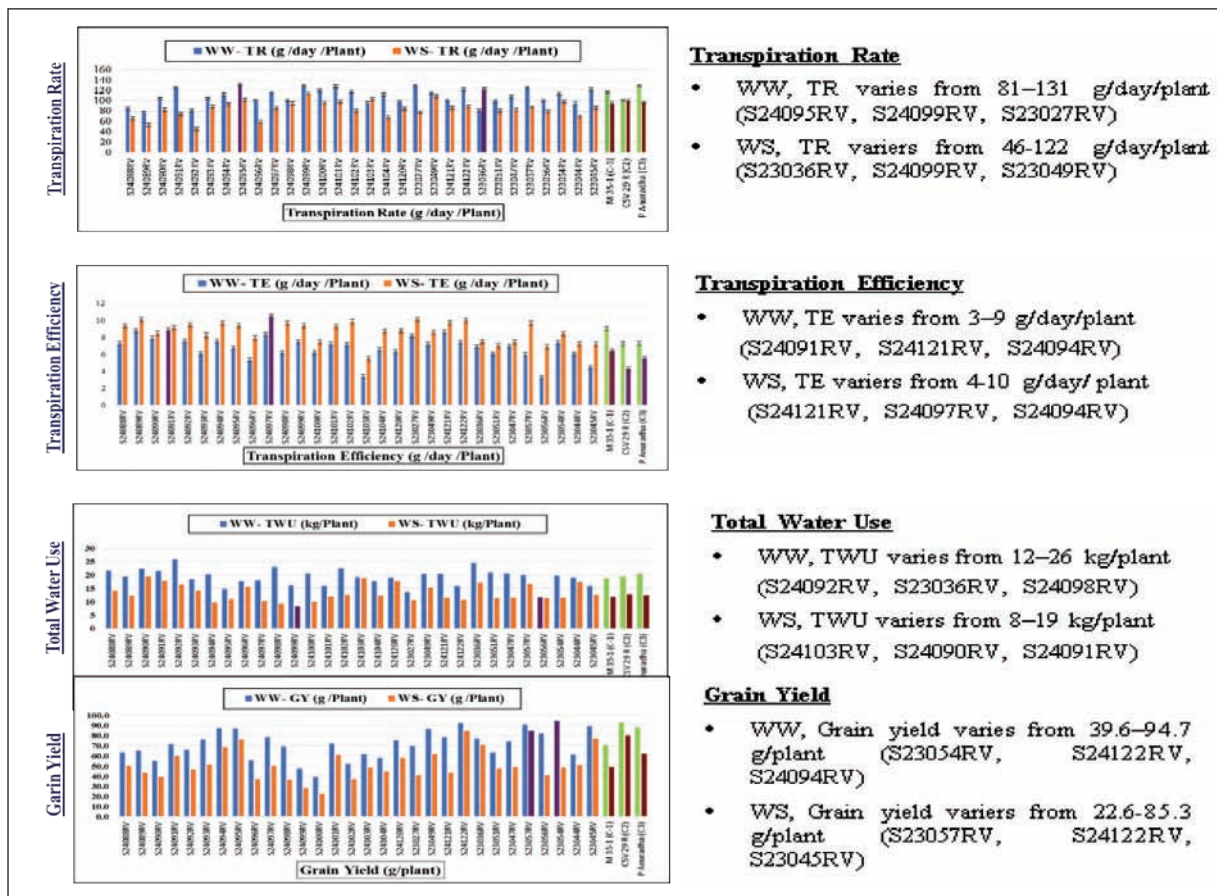


Fig. 4.9 Performance of the rabi sorghum genotypes for transpiration rate, transpiration efficiency, total water use, and grain yield

Disease reaction of improved rabi breeding lines for charcoal rot (Artificial inoculation) at CRS, Solapur

Thirty-two promising rabi sorghum breeding lines were evaluated for the second consecutive year under artificial inoculation at CRS-Solapur. Based on

their reactions to charcoal rot the lines were grouped into resistance categories, with several showing performance comparable or superior to the check varieties and meeting the benchmark of CRI <10%, as summarized in Table 4.9

Table 4.9 Reaction of sorghum breeding lines for charcoal rot and blight diseases

Charcoal rot		
CRI value	Genotypes	Disease reaction
≤ 5	Nil	Highly resistant
6-10	S24113RV, S24111RV, S24107RV, S24104RV, S24102RV, S24101RV, S24097RV, S24092RV	Resistant
11-25	S24119RV, S24118RV, S24117RV, S24116RV, S24115RV, S24114RV, S24112RV, S24110RV, S24109RV, S24108RV, S24106RV, S24105RV, S24103RV, S24100RV, S24098RV, S24096RV, S24093RV, S24091RV, S24090RV, S24089RV, S24088RV	Moderately resistant
26-40	S24099RV, S24094RV	
> 40	S24095RV	

Screening of advanced rabi sorghum breeding lines for root characteristics

Screening 33 rabi sorghum entries along with three check varieties for root studies. The evaluation was carried

out under water stressed, well-watered conditions by analyzing key root characteristics. The results showed significant differences among the genotypes in their response to water availability under stress environment is given in Table 4.10

Table 4.10 Root characteristics of selected rabi sorghum lines under stress environment

Test Entries	Root length	Shoot length	Root FW	Shoot FW	Root dry weight	shoot dry weight	Root tissue density	Grain Yield (g/plant)	Transpiration rate	Transpiration Efficiency	Total water use
S24088RV	173	172	85	170	11.0	52.5	0.13	50.0	66.7	9.3	14.0
S24089RV	172	136	120	175	23.0	55.5	0.19	43.1	54.5	10.0	12.2
S24090RV	124	155	115	220	21.5	59.0	0.19	39.5	82.6	8.5	19.3
S24091RV	158	145	45	115	11.0	38.5	0.24	59.7	74.1	9.1	17.8
S24092RV	178	170	110	170	12.5	50.5	0.11	46.6	45.9	9.5	16.4
S24093RV	171	174	110	220	18.0	52.0	0.16	51.6	88.6	8.2	14.1
S24094RV	165	155	115	155	22.0	49.0	0.19	68.9	93.7	9.6	9.7
S24095RV	190	157	115	145	27.0	49.0	0.23	76.2	100.7	9.4	11.0
S24096RV	165	193	75	125	16.0	48.0	0.21	37.0	59.0	7.9	15.6
S24097RV	158	165	165	150	36.0	42.0	0.22	50.1	85.9	10.5	10.4
S24098RV	178	165	76	152	16.0	49.5	0.21	36.6	94.9	9.6	9.2
S24099RV	182	165	130	145	22.0	50.0	0.17	81.1	114.4	9.3	8.3
M35-1 (C1)	185	182	65	125	33.0	57.0	0.51	48.7	95.9	6.4	11.9
CSV 29R (C2)	205	132	75	110	12.0	35.0	0.16	80.4	100.0	4.3	12.8
P Anuradha (C3)	180	180	130	185	22.5	40.5	0.17	62.1	96.4	5.5	12.5

IIMR/CI/2022-27/158: Breeding forage sorghum for higher productivity (PI: B Venkatesh Bhat)

Evaluation of experimental hybrids and varieties for fodder yield and related traits in multicut sorghum

To identify promising hybrids with high fodder and quality, 15 hybrids were evaluated during summer 2025.

Five hybrids exceeded the check CSH 43MF for green fodder yield (from 2 cuts). Hybrids with UPMC 503 as male performed well, followed by those with CSV 33MF as male parent. Newly developed female lines 321A, 338A and 415A derived hybrids were promising (Table 4.11).

Table 4.11 Green fodder yield and related traits in hybrids of multi-cut forage sorghum

Hybrid	Plant height (cm)	Leaf length (cm)	Leaf breadth (cm)	No of leaves	GFY kg/me-tre row	% over check CSH 43MF
321A x UPMC 503	270	95	7.00	11.33	42.46	34.0
NSS1003A x CSV 33MF	297	111	4.67	10.67	41.36	30.6
296A x UPMC 503	275	92	7.33	11.00	38.06	20.1
338A x SSG 59-3	210	94	4.83	10.33	36.96	16.7
415A x CSV33MF	310	82	6.00	11.67	34.54	9.0
CSH-43MF	206	91	5.33	10.67	31.68	

Evaluation of single cut forage sorghum hybrids for fodder yield and related traits

New hybrids to evaluate for single cut forage sorghum systems were developed using parental lines of forage sorghum and dual-purpose sorghum hybrids. A total of 17 hybrids were evaluated in kharif 2025 for green fodder yield and related traits. Plants were harvested for

fodder yield at 50% flowering stage. Of the 17 hybrids, five hybrids exhibited more than 10% superiority over the check hybrid CSH 40F (Table 4.12). They were superior to check for number of leaves as well as plant height, in most cases. SC 225 and SC 227 exceeded the check by more than 100% for green fodder yield. These hybrids will be again evaluated in the ensuing kharif to confirm the stability of expression of the traits.

Table 4.12 Green fodder yield and related traits in hybrids of single-cut forage sorghum

Hybrid	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Stem diameter (cm)	No. of leaves	Green fodder yield (kg) / plant	% GFY over CSH 40F
SC-225	303	89	3.9	1.90	15.0	5.16	120.1
SC-227	333	77	3.8	2.02	15.7	4.72	101.4
SC-226	323	99	3.7	1.93	16.0	4.41	88.4
SC-223	208	80	4.2	1.69	12.7	3.73	59.0
SC-232	330	84	5.2	2.05	13.0	2.72	16.0
CSH 40F	302	93	8.3	2.29	12.7	2.34	

IIMR/CI/2021-2026/140 Genetic enhancement of energy sorghums for renewable fuels and fodders (PI: AV Umakanth)

Sweet sorghum varietal evaluation

During Kharif 2025, 20 entries including the checks CSV 52SS and CSV 58SS were evaluated for sweet sorghum productivity traits. Significant differences were observed among them for most of the characters studied. For total fresh biomass, (SSV84 Tall x SPV

2072)-1-1-3-1-1-2 recorded the highest biomass yield of 111.1 t/ha which was 77% higher than the best check CSV 58SS (62.8 t/ha) (Table 4.13). It also recorded highest fresh stalk yield of 86 t/ha, highest juice yield of 42895 L/ha and highest computed ethanol yield of 3380 L/ha. Details of other entries is given in Table 4.13 The check variety CSV 58SS recorded the highest brix content of 19.5%. It was gratifying to note that the juice extraction was >50% for some of the entries.

Table 4.13 Performance of sweet sorghum varieties for different traits

Pedigree	Plant height (cm)	Total fresh biomass (t/ha)	Fresh stalk yield (t/ha)	Juice extraction (%)	Juice Yield (L/ha)	Brix (%)	Computed ethanol yield (L/ha)
(SSV84 Tall x SPV 2072)-1-1-3-1-1-2	401	111.1	86.0	55	42895	16.7	3380
(SSV84 Tall x SPV 2072)-1-1-3-1-1-3	368	84.8	76.8	52	35400	18.7	3085
(SSV84 Tall x SPV 2072)-1-1-3-1-1-1	359	86.0	65.8	60	35580	16.8	2808
(IS 18542 x SSV 74)-3-2-3-1-2-4	359	65.6	60.4	56	30820	18.7	2685
(SSV 84 x IS 18542)-1-1-3-1-2-4	412	53.9	43.4	48	18995	18.2	1607
(SSV 84 x IS 18542)-1-1-3-1-2-3	401	67.9	55.1	44	21960	15.3	1585
(ICSV 93046 x UK-81)-1-2-1-1-4-3	342	62.8	53.2	48	22570	12.3	1325
(SSV 84 x IS 18542)-1-1-3-1-2-2	339	42.4	30.0	59	15068	18.7	1316
(SSV 84 Tall x IS 18542)-5-1-3-1-1-1	393	62.1	47.6	41	17315	15.9	1313
(ICSV 93046 x UK-81)-1-2-1-1-4-1	353	64.3	58.5	44	22540	12.2	1297
(IS 18542 x SSV 74)-3-2-3-1-2-3-1	341	59.8	40.2	50	18420	14.2	1237

Pedigree	Plant height (cm)	Total fresh biomass (t/ha)	Fresh stalk yield (t/ha)	Juice extraction (%)	Juice Yield (L/ha)	Brix (%)	Computed ethanol yield (L/ha)
(N 596(bmr 6) x EC 538170)-2-1-1-1-1-3	351	46.9	36.5	48	15795	13.7	1030
(N 596(bmr 6) x EC 538170)-2-1-1-1-1-2	333	41.9	33.3	56	16365	12.9	980
(N 596(bmr 6) x EC 538170)-2-1-1-1-1-1	318	42.3	31.0	57	15518	12.3	900
(IS 18542 x SPSSV 40)-2-1-2-1-1-2	327	45.4	33.2	46	13805	12.2	802
(IS 18542 x SPSSV 40)-2-1-2-1-1-3	315	42.9	34.4	43	13283	12.2	767
(N 596(bmr 6) x EC 538170)-2-1-1-1-1-1-1	349	34.1	25.2	47	10735	13	667
(N 596(bmr 6) x EC 538170)-2-2-1-1-1-2-1	277	43.6	29.6	38	9295	10.7	474
CSV 52SS	375	62.7	47.8	55	23710	16.9	1876
CSV 58SS	363	62.3	51.9	51	24265	19.5	2234
Prob.	0	0	0	0	0	0	0
CD (5%)	56.1	17.4	14.1	10.9	6728	2.5	543

Evaluation of sweet sorghum derivatives for single-cut forage traits

A total of 20 sweet sorghum breeding derivatives including checks viz., CSH 22SS and CSV 58SS were evaluated for single cut yield parameters during kharif 2025 in a replicated trial. Observations on days to flowering, plant height, stem girth (%), brix (%) and green fodder yield were recorded.

The entry (SSV84 Tall x SPV 2072)-1-1-3-1-1-1 recorded the highest green fodder yield of 583 q/ha and was 33% and 66% significantly superior to the checks CSV 58SS (437 q/ha) and CSH 22SS (352 q/ha).

The next promising variety was (IS 18542 x SSV 74)-3-2-3-1-2-3-1 with a green fodder yield of 482 q/ha and 10% superiority over CSV 58SS and 37% superiority over CSH 22SS respectively. The entry (SSV 84 x IS 18542)-1-1-3-1-2-3 recoded the highest brix content of 17.1%.

4.3. Finger Millet

IIMR/CI/2021-2026/143: Development of improved finger millet genotypes for grain yield and related traits (PI: Ganapathy K. N.)

Performance of advanced derivatives for grain yield and related traits

Twenty eight advanced derivatives were evaluated for grain yield and related traits from six different genetic crosses. Among various crosses PR 202 x GPU 48 and GPU 28 x GPU 48 recorded large number of desirable segregants indicating superior general combining ability. All the test derivatives recorded medium flowering (80-85 days). The derivative GPU28 x GPU48-4 recorded the highest grain yield (4556 kg/ha), substantially outperforming both check varieties (CFMV 2: 3512 kg/ha, VL 376: 2012 kg/ha). PR202 x GPU48-1 (83.3%) and VL 376 (83.3%) had the highest grain filling percent.

GPU28 x GPU48-4 also had high grain filling (81.0%), superior to CFMW 2 (79.2%). GPU28 x GPU48-4 and PR202 x GPU48-1 are promising lines, showing both higher grain yield and superior grain filling compared to the standard check varieties. Both the entries recorded medium flowering. The performance of superior derivatives for flowering and finger traits are given in Table 4.14.

Table 4.14 Performance of advanced derivatives for grain yield and related traits in finger millet

Advanced derivatives (F7)	Grain yield kg/ha	Days to 50% flowering	Plant Height	No. of Panicles	No of fingers	Finger length	Finger width	Panicle weight/plot	Grain filling per cent
GPU28 x GPU48-1	1884	81	100	136	6	8.325	1.42	1038	45.4
GPU28 x GPU48-2	3120	84	95	130	6	6.55	0.76	1004	77.7
GPU28 x GPU48-3	3200	80	110	115	6.8	5	0.88	1048	76.3
GPU28 x GPU48-4	4556	85	105	138	7.2	5.75	0.9	1406	81.0
GPU28 x GPU48-5	2832	85	125	121	6	6.75	1.02	935	75.7
GPU28 x GPU48-6	1932	81	100	112	6.2	5.75	0.92	685	70.5
GPU28 x GPU48-7	2580	88	110	114	6.4	6.5	1.16	895	72.1
GPU28 x GPU48-8	2008	81	110	100	6	7	1.02	714	70.3
GPU28 x IE990-1	2240	87	105	124	5.4	8	0.98	776	72.2
PR202 x GPU48-1	3924	83	110	156	5.6	5.25	1.06	1178	83.3
PR202 x GPU48-2	2844	81	115	135	6.4	7	1.12	961	74.0
PR202 x GPU48-3	3644	85	105	141	7.2	7	1.04	1214	75.0
CFMV 2 (Check)	3512	81	110	64	7	7	1.04	972	79.2
VL 376 (Check)	2012	73	100	71	6.2	4.5	0.68	604	83.3

Effect of Tri fluoro methane sulfonamide (TFMSA) in inducing male sterility in finger millet

TFMSA treatment in the early reproductive stage showed effectiveness to induce pollen sterility in Cowpea (Sekiguchi et al. 2023) and Sorghum (Kyanam et al. 2021). Experiment to study the effectiveness of TFSMA for inducing male sterility was conducted in finger millet to standardise the treatment dose and correct stages for TFSMA application. Three

(early, medium and late) finger emergence stages was used at three different TFSMA concentrations (1%, 2%, 3%). Application of 2% TFSMA 2-3 days before stage of finger emergence is effective in inducing ~70% male sterility (Fig. 4.10). The variation in sterility among the three different stages is given in Figure. Future studies are aimed at use of TFSMA for effecting crosses & comparison between hot-water and TFSMA methods and increasing the sterility to 80- 90% for obtaining higher frequency of true F₁ hybrids.

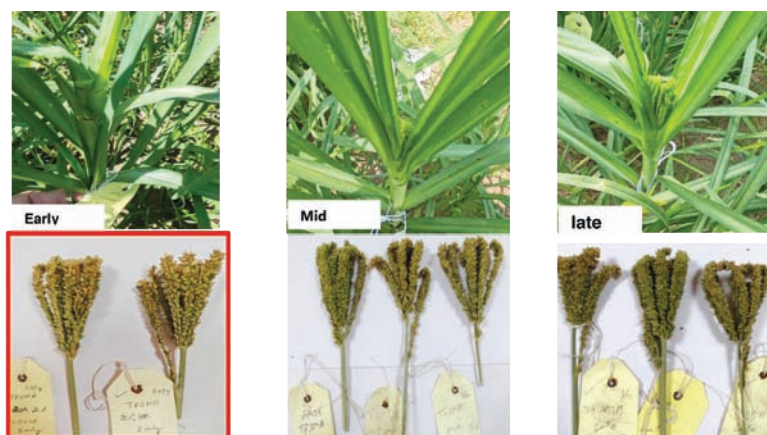


Fig. 4.10 Effect of TFSMA on inducing sterility in finger millet at different stages

Promising wild derivatives for productive tillers and grain yield

A total of 770 interspecific have been developed from *E. coracana* x *E. africana* crosses of which 109 derivatives superior for grain yield or its components traits were evaluated for grain yield and related traits.

Large variability was observed for finger traits ranging from long and branched fingers, compact types with 12-15 fingers, Highly compact types, long and superior grain filling types (Fig. 4.11).

The interspecific derivatives was also evaluated for grain yield and related traits. Four derivatives showed ~ 20 -30% superiority compared to promising check CFMV 2. However the same set of superior lines will be evaluated during forthcoming seasons to validate the performance and understand the traits associated with yield in wild derivatives. Efforts are also being made to backcross desirable interspecific types into cultivated types.

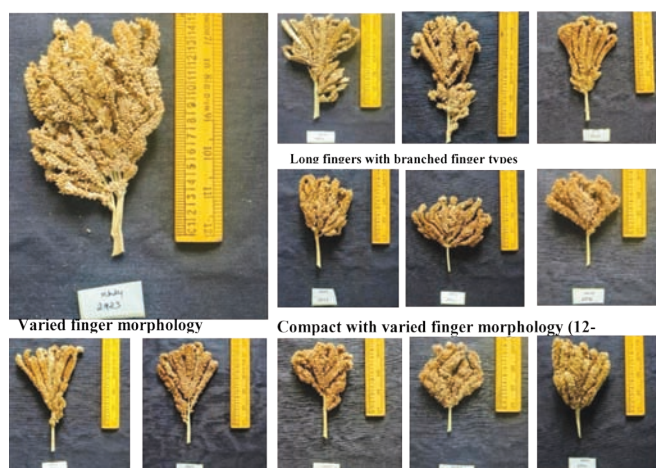


Fig. 4.11 Promising interspecific wild derivatives obtained from of *E. coracana* x *E. africana* for finger morphology

4.4. Little millet

IIMR/CI/2021-2026/144: Development of improved little millet genotypes for grain yield and related traits (PI: Ganapathy K. N.)

Development of improved derived lines through recombination breeding

To develop improved breeding lines from robusta x robusta crosses with bunchy type and long panicles, advanced derivatives from cross IPmr 1036 x IPmr 1075 were evaluated with the objective of identifying superior lines with desirable grain yield. Two derivatives IPmr 1036 x IPmr 1075-14 and IPmr 1036 x IPmr 1075-6 recorded high grain yield over the checks OLM 203 and BL 6 (Fig. 4.12).

Towards development of improved nana x nana types, 12 advanced derivatives from DHLM 14-1 x CLMV 1 and 28 derivatives form DHLM 36-3 x CLMV 1 were evaluated to identify superior derivatives. Three derivatives from DHLM 36-3 x CLMV 1s showed significantly higher grain yield (up to 1.9 to 2.0 tonnes) per ha as compared to checks which yielded around 1400 kg/ha. The improved lines were superior in terms of tillering ability and also had superior test weight which contributed to higher grain yield.



Promising bunchy derivatives in little millet

Performance of promising breeding selections in Karnataka state varietal trials

During 2023, drastic area increase in small millets from ~4300 ha to 17000 hectares was reported in Chitradurga district of Karnataka. Little millet occupies the major area (90%) followed by foxtail millet and other millets (10%). Based on the demand of the region for specific early maturing plant types, five selections from nana types tested of which two lines IIMR-LM8004, IIMRLM4816 showed superiority over the checks (Table 4.15). The superior lines are being tested in on-farm trials for its suitability for identification of superior variety for the region.

Table. 4.15 Promising lines in Karnataka state varietal trials in little millet

Code	Decode	Hiriyur		Karehosahalli, Hosdurga		Malenahalli, Hosdurga		Mean GY	Mean FY	% increase over BL 6	% increase over CLMV 1
		Grain yield (q/ha)	Fodder yield (t/ha)	Grain yield (q/ha)	Fodder yield (t/ha)	Grain yield (q/ha)	Fodder yield (t/ha)				
LMMLT-1	IIMR LM 8004	26.30	4.66	25.48	7.74	21.33	7.95	24.37	6.79	11.99	11.74
LMMLT-2	CLMV 1 ©	21.70	4.36	21.70	7.01	19.06	7.18	20.82	6.18	-4.31	-4.53
LMMLT-3	BL 6 ©	22.68	4.52	21.53	6.37	18.12	7.04	20.78	5.97	-4.52	-4.74
LMMLT-4	IIMR LM 4618	25.38	4.92	23.65	7.23	20.54	7.40	23.19	6.52	6.59	6.34
LMMLT-5	LM 4619	22.15	4.65	20.84	6.87	16.79	6.95	19.93	6.16	-8.43	-8.64
LMMLT-6	GPUL 6 ©	19.75	4.64	19.60	8.64	16.89	8.47	18.75	7.25	-13.84	-14.04
LMMLT-7	SHLM 2	19.80	4.53	22.47	7.67	19.26	7.67	20.51	6.62	-5.74	-5.96
LMMLT-8	SHLM 1	23.38	4.84	24.35	8.05	23.36	7.92	23.69	6.94	8.89	8.64
	Mean	22.53	4.64	22.50	7.45	19.42	7.57				
	CV	9.47	11.48	8.62	13.39	11.24	10.44				
	CD @5%	3.73	1.45	3.37	1.23	7.57	1.56				

4.5. Foxtail millet

IIMR/CI/2021-2026/142: Genetic improvement of foxtail millet for grain yield and nutritional quality (PI: K Hariprasanna)

CFXMV-2 (FXV 647) high yielding foxtail millet variety

CRS FxM-4, a pureline selection of foxtail millet from germplasm accession GS 510, evaluated as FXV 647 under AICRP-Small millets trials, was released as CFXMV-2 for the states of Karnataka, Maharashtra and Madhya Pradesh (vide Gazette No. S.O. 2128(E) dated 13th May 2025) for cultivation during rainfed *kharif* season. It is a high yielding (25-28 q/ha) medium duration (85-88 days) variety with resistance to important diseases such as rust (2.75G), and moderately resistant to brown spot (3.52G), leaf blast (3.41G) and banded blight (25%), and tolerant to shoot fly (7-8% dead hearts). It has shown about 5% grain yield advantage over SiA 3156 and 9% over DHFt 109-3, national checks. The variety also has superior fodder yield (57-60 q/ha) compared to SiA 3156 (56-57 q/ha). The grains have a protein content of 10.7%, 4.9% fat, 37 ppm iron and 48 ppm zinc. The plants are medium statured, panicles cylindrical to oblong in shape with short and thin lobes, medium sized bristles, and grayed yellow colour seeds.

Evaluation of promising foxtail millet genotypes

Promising advance breeding lines and selections made in the previous years were evaluated for the 2nd season in replicated station yield evaluation trial for grain yield and related traits at Hyderabad and Solapur. Six entries recorded grain yield advantage of >10% over the best check, DHFt 109-3. Pooled over two locations, FX24016 (Sel IC0345124), FX24048 (SiA 3156 × ISe 301), FX24053 (SiA 3156 × SIE 1598) and FX24051 (SiA 3156 × ISe 301) recorded grain yield advantage of > 10% over the best check, DHFt 109-3. High G × E interaction was recorded over seasons as well as locations. The high yielding genotypes were FX24048, FX24041 and FX24016, but only FX24041 had stable performance with near unity regression, and lowest yield stability index (Table 4.16). The best check DHFt 109-3 had high grain yield but high sensitivity to environment and high deviation from regression. Top 10 stable genotypes were FX24005, FX24030 and FX24004 with lower average rank as per AMMI analysis. The winning genotypes obtained from which-won-where analysis were FX24041 (Hyd-2023), FX24012 (SLR-2023), FX24016 (Hyd-2024) and FX24048 (SLR-2024). From the analysis, it is evident that no single genotype acts as best genotype across locations or seasons, and performance is highly environment dependent.

Table 4.16. Stable genotypes identified through Eberhart and Russel analysis and AMMI analysis

Genotype	Mean GY	bi	s ² di	YSI	ASV	ASTAB	Av Rank
FX24005 (G5)	1973	1.02	-68117	10	20	11	2
FX24030 (G30)	1942	0.84	-47371	15	54	32	4
FX24004 (G4)	1867	1.25	-50537	20	99	59	7
FX24026 (G26)	1732	1.18	-40279	47	56	31	8
FX24024 (G24)	1708	0.83	-61932	44	81	48	10
FX24041 (G41)	2177	0.96	-28499	11	267	145	10
FX24048 (G48)	2218	0.70	75,771	42	388	224	21
FX24016 (G16)	2175	1.26	148072	52	609	356	41
FX24022 (G22)	1553	1.08	-68211	57	79	42	11
FX24013 (G13)	1858	0.98	-5982	38	223	128	12
DHFt 109-3 (G20)	2117	1.86	121769	60	1,021	545	49

(bi = regression coefficient, s²di = deviation from regression, YSI=Yield stability index, ASV=AMMI Stability Value, ASTAB= AMMI Based Stability Parameter)

In another two trials, 38 early and 78 medium duration breeding lines were evaluated separately along with respective checks. The difference in maturity was not much evident due to prevailing weather conditions during the season. Significant variation was observed among the entries for days to flowering, panicle length, no. of lobes/panicle and test weight. In the early trial, five breeding lines recorded grain yield advantage of >10% over Suryanandi with on par duration. Seed size was largest in FX24123 (3.14 g) while best check for the trait was Suryanandi (2.98 g). In the medium duration trial, 13 out of 78 entries, recorded grain yield advantage of >25% over the best check, SiA 3156. FX24278, FX24268 and FX24233 had significantly longer (>26.2) panicle length compared to the best check DHFt 109-3 (21 cm).

Evaluation of mutants of foxtail millet

Superior mutants (41) in advance generation were evaluated along with the parents viz., Suryanandi and SiA 3156 for the 3rd year. Grain yield had a wide range of 945 to 2951 kg/ha with a mean of 1804 kg/ha. Five (out of 11) mutants of Suryanandi recorded grain yield advantage of >10% while maturity duration was on par. Fourteen (out of 30) SiA 3156 mutants recorded grain yield advantage of >10% over the parent with on par duration. Pooled over 3 years FX1024 (M₅ SiA400-7) and FX1030 (M₅ SiA600-21) were found to be the stable genotypes with high grain yield while FX1043 (M₅ SiA800-24) was the highest yielding mutant but highly sensitive to environment (Table 4.17).

Table 4.17. Stable mutants across seasons in station trials in foxtail millet

Pedigree	Grain yield (kg/ha)				Reg. Coeff	s2di	YSI	ASV	ASTAB	Av. rank
	Yr-1	Yr-2	Yr-3	Mean						
Stable mutants										
M ₅ SiA600-21	932	2007	1966	1635	1.09	-78468	12	99	38	6
M ₅ SiA400-7	1124	2221	2145	1830	1.10	-76946	4	132	56	6
M ₅ SiA600-25	602	1447	1409	1153	0.86	-78480	46	123	24	10
M ₅ SiA600-32	699	1548	1582	1276	0.90	-77796	41	124	50	11
High yielding mutants										
M ₅ SiA800-24	910	2303	2952	2055	1.77	146826	43	812	145	18
M ₅ SiA400-7	1124	2221	2145	1830	1.10	-76946	4	132	56	6
M ₆ SN600-28	935	2236	2197	1789	1.33	-78580	17	308	96	11
M ₅ SiA300-4	862	1884	1496	1414	0.86	-7969	47	397	157	22
SiA 3156	1067	1613	1688	1456	0.60	-75408	47	406	145	20
Suryanandi	635	2153	1684	1490	1.33	23047	50	690	317	31

4.6. Kodo Millet

IIMR/CI/2021-2026/146: Improvement of Kodo millet for economically important traits and development of markers for cultivar identification (PI: C. Deepika)

Generation of new variability using gamma mutagenesis

Kodo millet variety TNAU86 was gamma-irradiated at BAARC, Mumbai, to induce new variability for yield and related traits. In the M1 generation, germination and survival declined with increasing doses and abnormal panicles, striata, and xantha mutants were observed at 200–400 Gy. Significant morphological variation was not observed in M2–M3 and the population was advanced to M₆, where yield and its related traits variability was observed and recorded. Evaluated 119 advanced mutants for plant height, panicle length, panicle type,

thumb length, peduncle length, basal tillers, grain yield per plant fodder yield per plant and test weight. Wide variability was observed for grain yield and related traits (Table 4.18 and 4.19). High PCV was observed for grain yield (64.82), tiller number (26.73) and fodder yield (20.28). High GCV (28.5) and low heritability (16.6) was observed for grain yield per plant. Test weight reported moderate heritability (45.6) with low genetic advance (1.07). A positive correlation was observed between grain yield with tiller number and thumb length and negative correlation was observed by grain yield with plant height and peduncle length. Fodder yield reported significant correlation with plant height and tiller number and positive correlation was observed for seed weight and plant height. Eight Superior mutant lines for grain yield for long panicle length and higher seed weight (Table 4.19) and (Fig. 4.13).

Table 4.18 Comparisons of means of mutant lines and checks in kodo millet

Traits	Mutant lines		Checks	
	Mean	Range	Mean	Range
Plant height (cm)	74.1	39.0 -107.5	87.5	70.0-100.0
Panicle length(cm)	5.4	4.0 - 7.45	6.19	5.25-7.0
Basal tillers	10.7	5.5 - 17.5	10.9	9.5-11.5
Thumb length (cm)	4.38	3.25 - 6.25	4.88	4.1-6.15
Peduncle length (cm)	2.84	2.0 - 4.0	3.58	2.9-5.25
Test weight (g)	6.15	5.0 - 7.55	4.91	4.4-5.6
Grain yield (g/plant)	16.3	10.3 - 29.9	19.55	19.0-20.0
Fodder yield(g)	33.9	25.0 - 55.0	23.3	20.5-27.5

Table 4.19: Promising mutant lines for grain yield and related traits in kodo millet

Mutants	Plant height (cm)	Tillers	Panicle Length (cm)	Thumb length (cm)	Peduncle Length (cm)	Test Weight (g)	Grain yield/plant (g)	Fodder yield / plant (g)
G117	52.5	8.5	4.45	3.95	2.25	7.55	22.95	32
G119	71	8.5	4.25	3.7	2.3	7	26.0	28.5
G103	67.5	9.5	4.7	4.25	2.75	6	26.4	31
G96	63.5	15	4.65	3.95	2.1	6.45	25.07	30
G116	69.5	15	4.65	3.75	2.65	6.3	23.8	35
G114	60	10.5	4.85	4	2.2	6.45	25.1	28.5
G106	76	8.5	4.75	4.35	2.75	7	25.7	28.5
G118	63.5	11.5	4.35	3.95	3.05	7	29.9	29
GPUK3	100	11	7	4.1	3.75	4.4	19.5	22.5
TNAU86	86	11.5	5.25	4.25	3	4.9	20.7	23.5
CKMV1 (C)	95	9.5	6.25	4.85	2.9	4.55	19.5	27.5
CKMV2 (C)	70	11	6.1	6.15	5.25	5.6	19.25	22.5
CKMV3 (C)	86.5	11.5	6.35	5.05	3	5.1	20	20.5
Mean	73.92	10.88	5.2	4.33	2.91	6.02	23.22	27.61
CV%	18.8	20.1	17.5	15.8	20.9	16.8	14.7	15.9
CD 5%	8.8	2.42	0.95	0.79	1.17	0.32	5.1	6.47

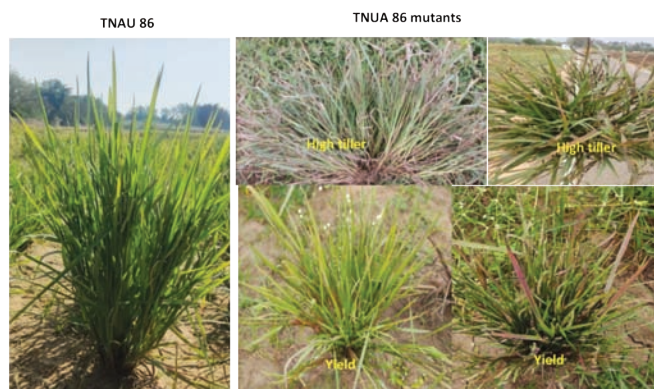


Fig 4.13. Superior mutants derived from TNAU 86

4.7. Barnyard millet

IIMR/CI/ 2021-26/145: Development of dual purpose cultivars with improved quality in barnyard (PI Amasiddha B)

Analysis of forage samples for protein digestibility, crude fibre content and other traits

Fodder sample from 136 genotypes was collected, grounded and used for the protein content. In the first set of 29 genotypes used for the analysis the protein content ranged from 2.5-10.41 %. VL 207-32-59-1-1 (10.41 %), VL 207-35-60-1-1 (9.7 %), VL 207 (9.1%), VL 207-41-61-1-1 (9.38 %) recorded highest protein content.

Standardization of NaCl concentration and Screening of germplasm lines for seedling stage salinity stress tolerance

Barnyard millet genotypes were screened for seedling stage salinity stress tolerance. NaCl concentration was standardized, in which five treatments were taken viz., 50ppm, 100ppm, 150ppm, 200ppm, 250ppm and 300ppm along with control. The genotypes DHBM 93-3, MDU1 and CBYMV-1, MDU1 were reported as tolerant cultivar. Data on the traits like germination percentage, shoot length, root length, seedling weight, fresh

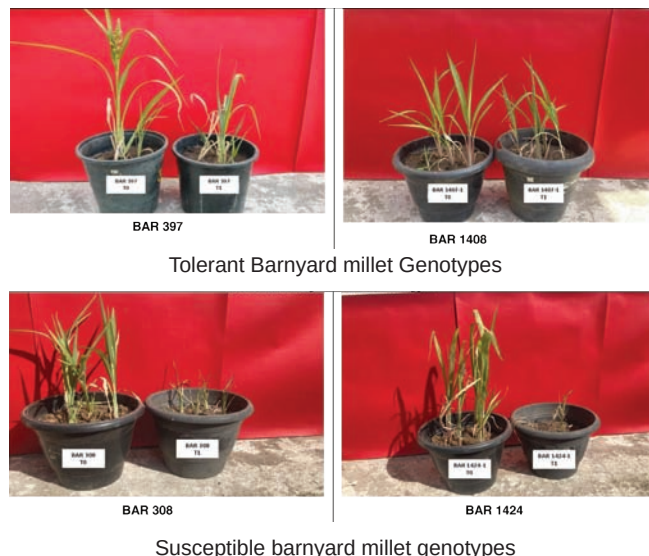


Fig. 4.14 Salinity stress tolerant and susceptible barnyard millet genotypes

weight and dry weight were collected and based on the ~50% reduction in the expression of the traits, the concentration 250ppm was identified as the optimum dose. In the later study, 45 genotypes were studied in pot culture experiment with 250ppm optimum dose as treatment and control condition. The data was collected for different morpho-physiological traits and the top five tolerant (BAR 397, BAR 1407-1, BAR 1408-1, BAR 1453, BAR 1407-1) and susceptible genotypes (BAR 308, BAR 1418-1, BAR 414, BAR 1422-1, BAR 1424-1) were identified for salinity stress (Fig. 4.14).

Evaluation of stabilized mutants over two years of testing.

The stabilized mutants of four varieties viz., DHBM 93-3, VL 172, VL 29 and VL 207 were screened in augmented design with checks replicated five times after every 35 entries. In the study, 17 mutants were identified for high fodder yielding ability and four mutants were found superior for grain yield (Table 4.20).

Table 4.20: Performance of stabilized mutants in barnyard millet

S. No.	Genotypes	Grain yield (kg/plot)	Fodder yield (kg/plot)
Check	DHBM 93-3	0.63	1.12
Check	VL 207	0.51	0.72
1	VL 172-33-3-39-1-1-1-56-81-119-263-90-2	0.47	1.36
2	VL 207-5-2-32-3-1-1-41-74-112-256-4-82-2	0.47	1.35
3	VL 207-5-2-32-3-1-1-41-74-112-256-5	0.3	1.35
4	VL 207-5-2-32-4-1-1-42-18-80-1-722-524-10	0.81	1.29
5	DHBM 93-3-208-4-1-1-110-100-138-282	0.27	1.36
6	VL 207-5-2-32-2-1-1-40-17-38-39	0.22	1.27
7	VL 207-5-2-32-4-1-1-42-18-39-40	0.36	1.27
8	DHBM 93-3-208-4-1-1-110-100-138-282-1	0.78	1.22
9	DHBM 93-3-208-8-1-1-114-103-141-1-725-529-10	0.48	1.24
10	DHBM 93-3-208-10-1-1-116-28-49-50-54-1	0.68	1.24
11	DHBM 93-3-210-1-1-1-119-31-52-53-57-2	0.48	1.21
12	DHBM 93-3-210-2-1-1-120-32-53-54-1	0.36	1.34
13	DHBM 93-3-210-2-1-1-120-32-53-54-1-59-1	0.25	1.31
14	VL 29-2-1-23-1-1-1-25-67-105-249	0.34	1.43
15	VL 29-2-1-23-3-1-1-27-69-107-251-3	0.74	1.16
16	VL 29-2-2-24-1-1-1-29-70-108-252-1	0.35	1.77

4.8. Proso millet

IIMR/CI/ 2021-26/147: Genetic Improvement of Proso Millet for yield and protein content (PI: Avinash singode)

Development of improved lines for grain yield and protein content

To develop improved proso millet varieties with improved

grain yield and protein content, experimental crosses were made using the high yielding, early maturing, high protein, released varieties and ICRISAT lines. The crosses were selfed to segregating populations and selections were made advanced generations to identify high yielding early maturing lines. The promising lines identified is given in Table 4.21.

Table 4.21. Performance of the promising lines for grain yield and related traits in barnyard millet

S.No	Pedigree of derivatives	Grain yield (kg/ha)	Forage yield (kg/ha)	Days to Maturity	Plant height (cm)
1	IC0483930 (AVS 59) x IIMR225	2400.6	4945	69	103
2	Tnmp548 (AVS 186) x IIMR225	2614.3	4744	71	107
3	TNPM348 (AVS 143) x GPMS578 (AVS 10)	2559.8	4114	68	83
4	IC0483930 (AVS 59) x GPMS453 (AVS 6)	2529.4	4083	67	80
5	Tnmp548 (AVS 186) x GPMS578 (AVS 10)	2496.3	4413	66	85
6	TNPm230 (C)	2418.4	4106	71	104
7	DHPM2693 (C)	2368.7	4943	71	108

Combined performance of proso millet lines for grain yield and related traits

The superior lines developed from crosses involving high protein and high yielding lines were evaluated over

two years to identify stable lines. Mean performance of selected and promising lines in the advanced generation for earliness, grain and forage yield over two years (2024 and 2025) (Table 4.22 & Fig. 4.15)

Table 4.22. Mean performance of selected and promising lines for earliness, grain and forage yield

S.No	Breeding line	Grain Yield (kg/ha)	Forage yield (kg/ha)	Days to Maturity	Plant height (cm)
1	IC0483930 (AVS 59) x IIMR225 – Sel - 24	2380	4417	64	102
2	Tnpm548 (AVS 186) x IIMR225 – Sel - 216	2455	4417	66	108
3	TNPM348 (AVS 143) x GPMS578 (AVS 10) – Sel - 51	2310	4226	62	95
4	IC0483930 (AVS 59) x GPMS453 (AVS 6) – Sel - 104	2525	4834	68	112
5	Tnpm548 (AVS 186) X GPMS578 (AVS 10) – Sel - 247	2260	4321	61	90
7	Check 1 TNPM230	2200	4741	67	104
8	Check 2 DHPM2693	2150	4743	68	109



TNPM348 (AVS 143) x GPMS578 (AVS 10) – Sel - 51



IC0483930 (AVS 59) x GPMS453 (AVS 6) – Sel - 104



Tnpm548 (AVS 186) x IIMR225 – Sel - 216



IC0483930 (AVS 59) x IIMR225 – Sel - 24

Fig. 4.15. Field view of the promising breeding lines in Proso millet

4.9. Browntop millet

IIMR/CI/2017-22/115: Brown top millet characterization and genetic improvement (PI: Venkatesh Bhat)

Evaluation of brown top millet genotypes for grain yield

Thirty germplasm accessions of brown top millet were evaluated for two years for seed yield and related traits. These germplasm lines flowered in 50 to 62

days while their grain yield varied from 6.22g to 21.65 g/plant. These accessions were 73.2 to 114.67cm tall, tillering type, with 19.47 to 32.8 productive tillers/plant. No significant yield differences were observed between compact and loose panicle types. Association studies among seed yield related traits revealed that plant height and days to flowering were positively correlated to grain yield; also 1000 seed weight was not correlated to yield parameters (Table 4.23).

Table 4.23 Associations (correlation coefficients) among grain yield related traits in brown top millet germplasm

Trait	Productive tillers	No of tillers	Grain yield / plant	1000 seed weight	Days to flowering
Plant height	-0.094	-0.103	0.477*	-0.009	0.401*
No of productive tillers		0.646**	0.107	-0.197	0.009
No of tillers			0.123	-0.143	-0.057
Grain yield /plant				-0.013	0.470*
1000 seed weight					-0.120

* Significant at 5% ** Significant at 1%

Evaluation of brown top millet genotypes for green fodder yield

A total of 31 brown top millet genotypes were evaluated for fodder yield and related traits in kharif season. The

morphological traits data revealed that the crop has adequate range of variation for grain yield, green fodder yield, plant height, number of leaves on main tiller (Table 4.24).

Table 4.24 Variability of brown top millet genotypes for green fodder yield

Character	Mean Squares	CD at 5 %	CV (%)	Mean	Minimum	Maximum
	Treatments df (30)					
Days to flowering	210.972**	2.910	2.989	59.62	39	66
Plant height (cm)	109.922	17.408	10.835	98.37	83.1	106.3
No of leaves	4.132**	1.409	9.752	8.85	6.2	10.0
Green Fodder yield (q/ha)	14179.728**	131.231	25.262	318.07	185	484
Grain yield (q/ha)	28.389	7.295	35.813	12.47	6.4	20.2

** Significant at 1% Green fodder- first cutting 50 DAS; second cutting 45 days after first cut.

Promising genotypes for green fodder yield (on par with the highest genotype; 10 no., i.e., IC-0613558, AK 2, GPUPT 1, IC-0617957, GPUPT 6, IC-0617955, BTV 44, IC-0617958 (Compact), IC-0613557 and HBR 2 and correlation analysis is given in Table 4.24. Highest

green fodder yields up to 484 q/ha indicated that brown top millet is a potential cereal fodder crop to be used for green fodder for feeding livestock in warm seasons (kharif and summer).

Seed formation and germination of seeds from primary, secondary and tertiary branches of brown top millet

In order to study the seed formation and effect on seed quality, the test weight of seeds formed in primary, secondary and tertiary rachis of inflorescence, and their germination percent were compared. Test weight (grain filling) and germination decreased in the seeds produced by secondary and tertiary branches. Thus, it desirable that more seeds are formed on the primary rachis to have better seed size and seed quality (Fig. 4.16).

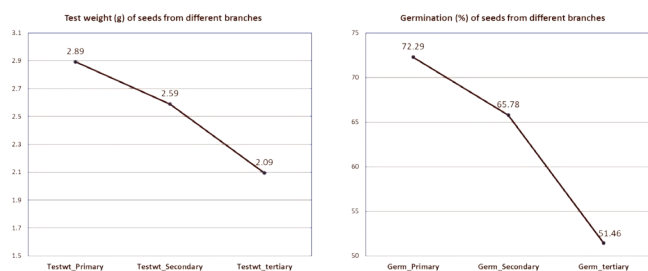


Fig. 4.16 Seed formation and germination of seeds

Nutritional profiling of brown top millet

Proximate composition of brown top millet varieties

The nutritional evaluation of dehulled brown top millet across the varieties AK 1, AK 2, HBR-2, and GPUBT-6 reveals a profile rich in protein and dietary fiber, positioning these grains as highly competitive functional food sources. AK 1 stands out as the most protein-dense variety, recording a value of 17.19%, while the other three varieties maintain a consistent protein level of approximately 15.8%. In terms of dietary fiber, HBR-2 and AK 2 exhibit the highest values at 11.69% and 11.63% respectively, which are significant for metabolic health.

The fat content was highest in AK 2 (6.09%) and is lowest in AK 1 (5.26%), while the ash content an indicator of mineral presence—remained remarkably uniform across all varieties, hovering around 2.2%. Overall, while all tested varieties were nutritionally robust, AK 1 and HBR-2 offer the most pronounced benefits for protein and fiber-focused dietary applications.

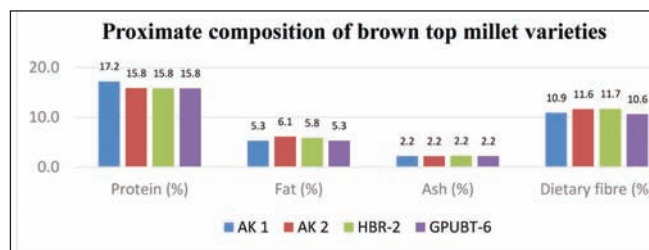


Fig. 4.17 Mineral profile of brown top millet varieties

The mineral composition analysis of dehulled brown top millet varieties demonstrated a high density of essential micronutrients, with magnesium being the most abundant element across all genotypes, ranging from 2135.3 ppm to 2272.03 ppm (Table 4.25). AK 1 emerges as the superior variety for Iron (56.66 ppm) and Calcium (149.64 ppm) content, making it a particularly strong candidate for addressing anemia and bone health. In contrast, HBR-2 leads in Zinc (53.98 ppm) and Magnesium (2272.03 ppm) concentrations, which are vital for immune function and metabolic regulation. GPUBT-6 and AK 2 also show robust mineral profiles, with GPUBT-6 notably maintaining a high calcium level of 142.43 ppm. Overall, brown top millet varieties provide a significant source of minerals, with AK 1 and HBR-2 offering specialized nutritional advantages depending on whether iron or zinc supplementation is the priority.

Table 4.25 Mineral content of brown top millet varieties

Genotype	Iron (ppm)	Zinc (ppm)	Calcium (ppm)	Magnesium (ppm)
AK 1	56.66	51.08	149.64	2135.3
AK 2	53.35	52.03	126.23	2186.33
HBR-2	51.69	53.98	137.68	2272.03
GPUBT-6	50.33	50.9	142.43	2225.56

5.1 Molecular breeding

IIMR/CI/2021-2026/149: Generation of genomic resources and its application for the improvement of millets (PI: P Rajendrakumar)

Whole genome *de novo* sequencing of kodo millet:

Hi-C is a type of chromosome conformation capture technique used to study the 3D structure of genomes. It helps to understand organization of different parts of

Table 5.1 HiC assembly statistics

Metric	HiC Assembly
No. of Scaffold	91
Assembly Size	900 Mb
Largest Contig	56.09 Mb
GC%	46.02
N50	45.35 Mb
N90	36.12 Mb
L50	9
L90	18

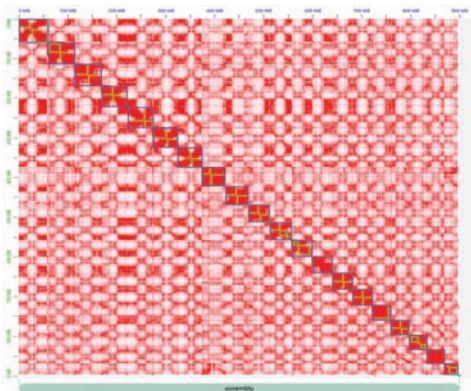


Fig. 5.1 HiC contact map (n=20)

a chromosome and their interactions with each other within the nucleus of a cell. Hi-C is a type of chromosome conformation capture (3C) technique that provides a genome-wide view of these interactions. A total of 51.39 Gb of HiC data was generated from 341,279,064 reads, which were assembled into 91 scaffolds with N50 and L50 values of 45.35 Mb and 9, respectively. The HiC assembly statistics and contact map are given in Table 5.1 and Fig. 5.1, respectively.

Contact map is the most common type of heat map for Hi-C data, which reveals the interactions between all regions in the genome. These heat maps are usually represented in a two-dimensional matrix, in which each cell represents the number of interactions between two genomic locations. High-value regions represent high-frequency interactions, while low-value regions represent low-frequency interactions. Genome-wide repeat elements were identified and analyzed using *de novo* sequence assembly (~ 0.9 Gb) of kodo millet through various computational methods. These methods help in understanding the structure, distribution, and function of repetitive DNA sequences, which are crucial for genome evolution and stability. The genome-wide identification of repeat elements in kodo millet genome is given in Table 5.2.

Table 5.2 Genome-wide repeat elements

Metrics	Number of Elements	Length Occupied (bp)	Percent-age of Total Sequence
Retroelements	160,042	161,536,623	17.93
- SINEs	0	0	0.00
- Penelope	0	0	0.00
- LINEs	25,737	16,793,069	1.86
- RTE/Bov-B	3,610	2,631,705	0.29
- L1/CIN4	22,127	14,161,364	1.57
- LTR Elements	134,305	144,743,554	16.07
- Ty1/Copia	60,918	61,358,025	6.81
- Gypsy/DIRS1	70,242	81,039,963	9.00
DNA Transposons	49,866	57,225,176	6.35
- hobo-Activator	7,070	4,063,804	0.45
- Tc1-IS630-Pogo	285	179,167	0.02
- MULE-MuDR	9,444	9,824,618	1.09
- Tourist/Harbinger	2,209	888,251	0.10
Rolling Circles	2,788	2,851,578	0.32
Unclassified	707,083	266,065,574	29.53
Small RNA	278	72,608	0.01
Simple Repeats	132,465	6,119,377	0.68

Ab initio gene prediction is a computational method for identifying genes within a DNA sequence without relying on external information such as transcriptome or RNA-sequencing data or protein sequences. It relies on analyzing the inherent statistical properties and patterns within the DNA itself to locate potential protein-coding regions. The genome-wide prediction of genes in kodo millet genome was performed *ab initio* through computational approaches and the results are given in Table 5.3.

Table 5.3 *Ab initio* gene prediction

Metrics	Numbers
Number of Genes	133,861
Number of mRNAs	133,861
Number of CDSs	388,208
Number of Exons	388,208
Number of Introns in CDS	254,347
Number of Single Exon Genes	49,204
Total Gene Length	290.23 Mb
Mean Gene Length	2.17 Mb
Mean CDS Length	0.84 Mb
Longest Gene Length	46.58 Mb
Longest CDS Length	10.18 Mb
Shortest Gene Length	0.201 Mb
Shortest CDS Length	0.201 Mb

Development of genetic diversity kit for finger millet

About 100 hypervariable genomic SSR markers were selected, and the thermal profiles were standardized using the genomic DNA of four finger millet genotypes (IE 2882, GE 4449, GE 3767 and IE 2911). One hundred of these genomic SSR markers were validated in 48 finger millet genotypes, of which, 74 markers were polymorphic, 26 were monomorphic. The number of alleles per SSR locus ranged from 2 to 10. The PIC value ranged from 0.22 to 0.85. Dendrogram was constructed using total 200 markers and using 40 SSR markers that exhibited PIC value > 0.6. The grouping of genotypes in these two dendrograms were similar, which was revealed by the Mantel test with a correlation value of 0.9167*. Hence, these 40 SSR markers (Table 5.4) were constituted as the genetic diversity kit for finger millet that is useful for cultivar identification, DNA fingerprinting, genetic diversity and population structure assessments.

Table 5.4 Genetic diversity kit for finger millet

SSR markers			
FMgSSR14734	FMgSSR20850	FMgSSR36513	FMgSSR67291
FMgSSR17149	FMgSSR43524	FMgSSR40096	FMgSSR10490
FMgSSR20850	FMgSSR20851	FMgSSR41976	FMgSSR46807
FMgSSR20868	FMgSSR20863	FMgSSR41978	FMgSSR26231
FMgSSR20870	FMgSSR38503	FMgSSR41989	FMgSSR30589
FMgSSR26222	FMgSSR36504	FMgSSR43538	FMgSSR32558
FMgSSR26229	FMgSSR36511	FMgSSR44381	FMgSSR41968
FMgSSR26232	FMgSSR41977	FMgSSR14725	FMgSSR43502
FMgSSR32535	FMgSSR35951	FMgSSR14729	FMgSSR43530
FMgSSR32540	FMgSSR36100	FMgSSR14733	FMgSSR44700

5.2 Genome editing

ICAR-Genome Editing project: Enhancing climate resilience and ensuring food security with genome editing tool (PI: D Balakrishna/Co-PI: S K Gupta)

CRISPR/Cas9-mediated editing of lipase genes to improve shelf life of pearl millet flour

The study focused on extending the shelf life of pearl millet flour by editing key lipase genes (*PgTAGLIP1*, *PgTAGLIP2*, and *PgTAGLIP3*) in the nutritionally rich variety 'Dhanshakti' using the CRISPR/Cas9 genome editing system. Specific single guide RNAs (sgRNAs) targeting the lipase genes were designed using the web-based tools CRISPR-P and CHOPCHOP. The sgRNAs were cloned into the pBUN421 binary vector, which contains a maize codon-optimised Cas9 gene driven by the ubiquitin promoter (Fig. 5.2). The bar gene, regulated by the CaMV35S promoter, was used as the selectable marker for identifying transformed plants. The validated constructs were introduced into *Agrobacterium tumefaciens* strain LBA4404 and used for transformation. Shoot meristem explants from the pearl millet variety 'Dhanshakti', known for its early maturity and high micronutrient content (iron: ~81 ppm; zinc: ~43 ppm), were used as explant material. A survival assay determined that 3.0 mg L⁻¹ phosphinothricin (PPT) was the optimal concentration for selecting transformed tissues (Fig. 5.3). Approximately 300 explants (100 per construct) were infected, selected under PPT pressure, and regenerated under in vitro conditions. The regenerated plantlets were rooted, acclimatized, and transferred to the greenhouse for further growth and seed production (Fig. 5.4). Genomic DNA isolated from putative T₀ plants was screened for the presence of the

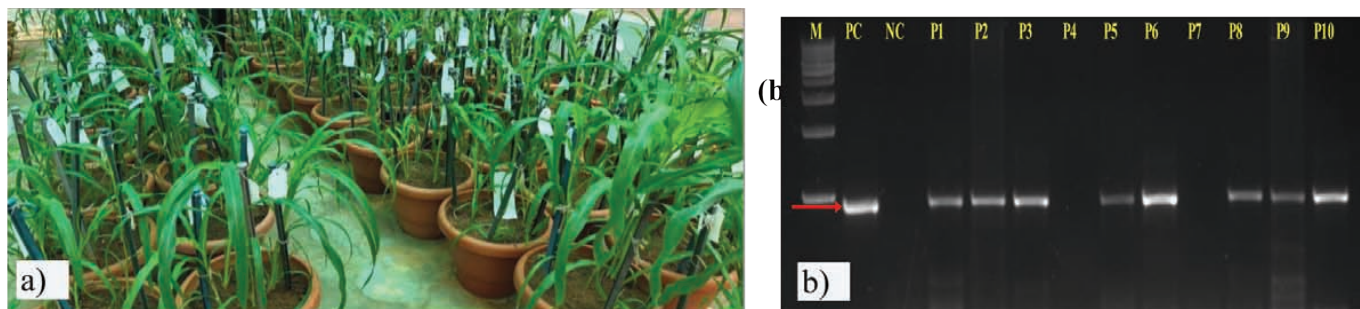


Fig 5.4 (a) Genome edited pearl millet plants in the glasshouse. (b) Molecular characterization of T0 Pearl millet plants. PCR amplification of 943 bp fragment of Cas9 gene: M: 1 Kb DNA ladder; PC: Positive

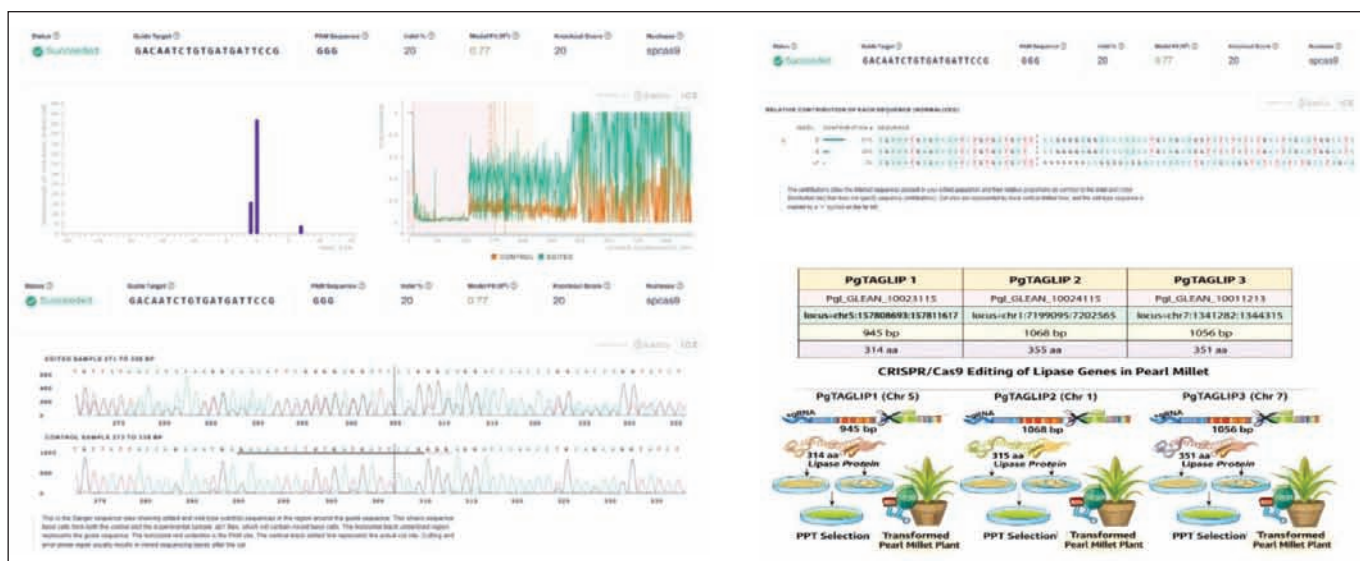


Fig. 5.5 Sanger sequencing showing the information on indels % and their distribution and schematic illustrates the genome editing strategy used to disrupt these lipases genes

IIMR/CI/2023-28/16: Identification of bioactive compounds in the grain and gene mining from millets (PI: Jinu Jacob)

DNA damage protection activity of millet phenolic extracts

Free radicals and reactive oxygen species are known to damage vital biomolecules such as carbohydrates, lipids, proteins and break DNA leading to clinical manifestations like cancer, heart attacks, mutagenesis, and age-related issues. Phenolic compounds are a diverse group of secondary metabolites found in a wide range of plant foods including millet grains. They exert their beneficial effects directly by scavenging free radicals, chelating metal ions, quenching singlet oxygen and other reactive oxygen species (ROS) or indirectly by inhibiting ROS producing enzymes. DNA

scission inhibitory activity of phenolics from 9 millets was analyzed in this study.

The DNA damage prevention efficacy of methanolic extracts of millets to inhibit hydroxyl radical-induced DNA strands scission was assessed using the plasmid DNA pBR322. One genotype from each millet namely, CSV20 (sorghum), suryanandi (foxtail millet), TNAU86 (kodo millet), GPU28 (finger millet), HBr-2 (brown top millet), BAR-1270 (barnyard millet), LM-4518 (little millet), Raj-171 (pearl millet) and PMHP-59 (proso millet), were used in the study. Hydroxyl radicals produced by Fenton's reagent (FeSO_4) are known to cleave DNA. Quercetin, a powerful antioxidant flavonoid acting as a strong scavenger of free radicals, was used as a standard to compare DNA damage protection activity.

The results of assay (Fig. 5.6) indicate that, control plasmid DNA was found showing two distinct bands: one demonstrated open circular DNA (with H_2O_2), while the other presented supercoiled DNA (without H_2O_2). In the absence of the plant extract, H_2O_2 caused fragmentation of the supercoiled pBR322 DNA, resulting in the generation of open circular DNA. The presence of plant extracts or quercetin prevented this breakage of strands in varying degrees. When the standard, quercetin, was incubated with linearized plasmid, it could in both the concentrations, prevent the nicking of the plasmid and

all of the DNA appeared supercoiled (lower molecular weight band). Millet phenolic extracts from all 9 millets could prevent the nicking in varied extents. But in the concentrations used, none of the genotypes could 100% prevent the DNA scission as was observed with quercetin. In general, phenolic extracts of all millet grains demonstrated effective inhibitory activity against DNA scission at both concentrations tested suggesting that phenolic compounds present in the crude extracts of cereal grains are effective against the scavenging of hydroxyl radicals.

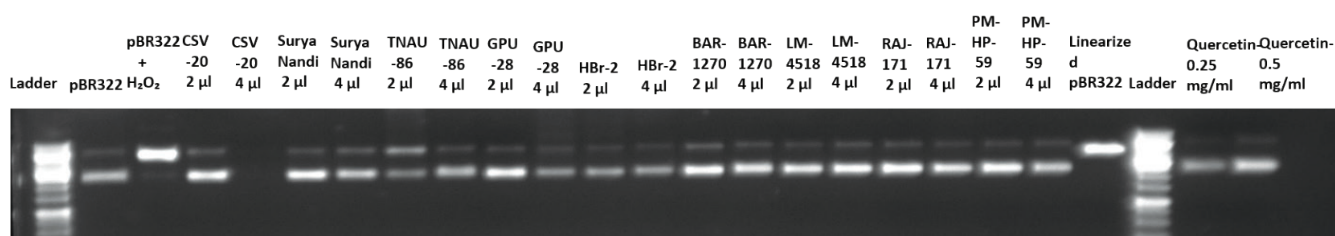


Fig. 5.6 Agarose gel electrophoresis of pBR322 DNA treated with hydroxyl radicals in the presence of millet phenolic extracts at 37°C

5.3 Seed Science

IIMR/SS/2020-2025/126: Investigations on genetics of seed vigor and longevity, and effect of foliar plant nutrition on seed yield and quality in small millets (PI: N Kannababu)

Effect of Boron and Zinc and their mode of application at different stages of crop on seed yield and quality traits in barnyard millet:

The experiments were conducted with barnyard millet (cv. DHBM93-3) to study the effect of Boron and Zinc, and mode of application at different stages of crop on seed yield and seedling vigor aiming to develop and refine the seed production technology of barnyard millet. Results indicated application of Zinc (Zn) significantly increased seed yield compared to the control, followed by Boron (B) (Fig 5.7). Combination of Boron (B) spray with Zn resulted in a significantly lower seed yield than individual applications of either Zinc or Boron during both PRS and RS. During RS, the Zinc and Boron combination produced a significantly higher yield than the control but remained on par with

individual applications during PRS. The increased seed yield due to Zinc, followed by Boron, could be attributed to a corresponding increase in productive tillers per plant, primary branches per panicle, panicle dry weight, seed setting, and seed test weight. Additionally, Zinc significantly enhanced the dry weight of stover per plant, followed by Boron, both showing marked improvements over the control.

Spray application of Boron, Zinc, and the combination of Boron + Zinc had a significantly greater impact on seed germination (SG), field emergence (FE), and seedling vigor index-2 (SVI-2) compared to the control during PRS 2023-24. However, Zinc was significantly more effective than the other three treatments for field emergence and seedling vigor index-1 (SVI-1), followed by Boron, during RS 2024. Among the methods of micronutrient application, foliar spray at PI was comparable to PI + FL and SA during PRS 2023-24. However, the PI stage was significantly more effective for field emergence, SVI-1, and root length traits compared to the other three application methods during RS 2024.

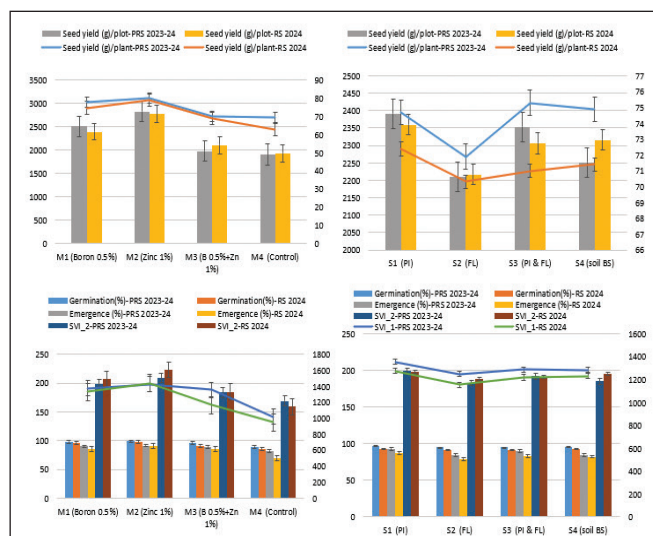


Fig 5.7: Effect of Boron and Zinc and their mode of application at different stages of crop on seed yield and quality traits in barnyard millet (cv. DHBM93-3) [B: Boron (0.5%), Zn: Zinc (1%), SVI_1: seedling vigor index-1, SVI_2: seedling vigor index-2, PI: Panicle initiation, FFL: 50% flowering]

Identification of SNP-trait associations for seed longevity traits through association mapping in pearl millet and finger millet [DST-SERB (ANRF) (PI: N Kannababu)]

Identification of SNP-trait associations for seed longevity and vigor traits through association mapping in pearl millet:

Genetically diverse GWAS panel was evaluated under both control and accelerated aging (AA) conditions to assess the fresh and aged seed quality traits along with their relative measures comprising a total of 27 traits related to seed vigor and longevity. Accelerated aging treatments simulated long-term storage conditions, revealing a significant decline in seed performance. This was evident from reduced germination percentages, lower seedling vigor indices, and prolonged mean germination times post-AA treatment. The study utilized a 4K mid-density genotyping panel, resulting in 2,015 high-confidence single nucleotide polymorphisms (SNPs) that were subjected to association analysis using the BLINK and MLM models. A total of 413 significant marker-trait associations (MTAs) were identified, of which 185 were common to both models (Fig 5.8).

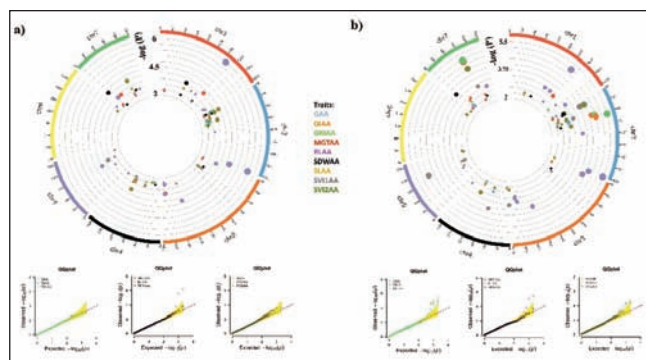


Fig 5.8. Circos plots showing the distribution of significant MTAs identified under accelerated aging treatment. Only markers with an adjusted p-value < 0.005 are visualized. The bubble color represents the associated trait, while the bubble size indicates the significance level. Q-Q plots illustrate the deviation between observed and expected p-values for strongly associated markers. a) BLINK model; b) MLM model. Among the identified MTAs, a pleiotropic SNP, PMSnpB394 on chromosome 2, was found to be associated with 14 seed longevity traits, underscoring its potential as a key genomic region for improving seed viability

IIMR/SS/2023-2026: Studies on seed treatment technologies for better crop establishment and yield in millets (PI: Sooganna)

Influence of seed treatments on control of pest infestation in sorghum

Control treatment (T16) noticed higher incidence of shoot fly and fall army worm. Seed treatments for control of shootfly, stem borer and fall army worm showed 25 %, 3% and 2% reduction in incidences respectively. Thiamethoxam 30% FS @ 10 ml per kg of seed + Azoxystrobin 2.5% @ 4g/kg seed (T8) recorded relatively lower incidence for all major pests followed by Arka microbial consortia @ 10 g/kg + Azoxystrobin 2.5 % @ 4 g/kg (T14), Treatment T8 (Thiamethoxam 30% FS @ 10 ml per kg of seed + Azoxystrobin 2.5% @ 4g/kg seed) recorded highest grain yield of 2991.89 kg/ha.

Influence of seed treatments on control of pest and disease infestation in pearl millet

Seed treatment with various chemicals noticed less than 2 per cent shoot fly and stem borer infestation and ergot less by 25 per cent. Imidacloprid Gaucho FS 600 @ 7 ml per kg seed) + Azoxystrobin 2.5% @ 4g/kg seed (T11) recorded relatively lower incidence of all the major pests whereas lower disease incidence was recorded in T13 followed by Arka microbial consortia (AMC) @ 10g/kg seed + Metalaxyl 35% WS @ 6g/kg seed. Treatment

T10 (Imidacloprid (Gaucho FS 600 @ 7 ml per kg seed) + Metalaxyl 35% WS @ 6g/kg seed) recorded highest yield of 2232.50 kg/ha. The grain yield of sorghum and pearl millet using various treatment methods is given in Table 5.5.

Table 5.5: Grain yield of pearl millet and sorghum as influenced by various seed treatments

Treatments	Grain yield (Kg/ha)	
	Bajra	Sorghum
T1	1924.17	2056.35
T2	1787.50	2184.56
T3	1971.83	2164.39
T4	1630.83	2029.83
T5	1660.00	2143.38
T6	1825.17	2134.41
T7	1788.67	2448.27
T8	2076.83	2991.89
T9	1916.67	2505.26
T10	2232.50	2967.12
T11	1756.83	2026.16
T12	1878.33	2428.67
T13	1750.83	2185.75
T14	1630.00	2166.52
T15	1624.17	2470.27
T16 (C)	1528.33	1979.8
T17	1799.17	2121.42
T18	1915.00	2005.95
S.Em	111.61	129.13
C D at 5 %	329.83	348.25

Influence of seed treatments on control of pest and disease infestation in finger millet

Seed treatment with Tebuconazole 2 % DS @ 6g/kg seed + Tricyclazole 75 WP @ 2g/kg seed (T8) recorded significantly lower incidence (51 per cent of the incidence was reduced compared to control). Seed treatment with Arka Microbial Consortia (AMC) @ 10g/kg seed + Azoxystrobin 2.5% @ 4g/kg seed (T12) recorded significantly higher grain yield followed by Thiamethoxam 30% FS @ 10 ml per kg of seed + Azoxystrobin 2.5% @ 4g/kg seed (T8). The best treatment recorded 15 per cent higher grain yield than control as represented in the Table 5.6.

Table 5.6 Seed treatments on control of pest and disease infestation in finger millet

Treatments	Stem borer (%)	Grain yield (Kg/ha)
T1	2.9	2386.67
T2	2.2	2646.67
T3	3.9	3420.00
T4	6.2	3286.67
T5	2.2	2430.00
T6	2.1	3400.00
T7	2.9	2390.00
T8	1.0	3823.33
T9	1.3	2463.33
T10	1.5	3170.00
T11	2.4	3363.33
T12	2.0	3900.00
T13	3.9	3180.00
T14	1.9	3583.33
T15	2.5	3203.33
T16 (C)	3.1	2923.33
S.Em	0.62	115.42
C D at 5 %	1.65	252.61

Influence of seed treatments on control of pest and disease infestation in finger millet at ARS, Vizianagaram

Percentage incidence leaf blast, neck blast, finger blast and banded blight were recorded in Vizianagaram for finger millet. Seed treatment with Tebuconazole 2 % DS @ 6g/kg seed + Tricyclazole 75 WP @ 2 g/kg seed (T8) recorded significantly lower incidence of leaf blast. For neck blast disease incidence was lower in seed treatment with Tricyclazole 75 WP @ 2gm per kg seed (T3). However, the lower incidence of finger blast and banded blight was recorded in Azoxystrobin 2.5% @ 4g/kg seed (T1) and Tricyclazole 75 WP @ 2gm per kg seed (T3) respectively. Treatment T12 (Arka Microbial Consortia (AMC) @ 10g/kg seed + Azoxystrobin 2.5% @ 4g/kg seed) recorded significantly superior values for grain and fodder yield (Table 5.7).

Table 5.7: Incidence of major diseases and yield of finger millet at Vizianagaram

Treatments	Leaf blast (Grade)	Neck blast (%)	Finger blast (%)	Banded blight (%)	Grain yield (Kg/ha)	Fodder yield (Kg/ha)
T1	3.3	52.04	3.33	20.00	2055.56	5100.00
T2	4.1	43.37	4.28	23.70	2577.78	5344.45
T3	3.5	32.65	19.17	17.04	2661.73	4630.86
T4	3.7	54.01	18.98	29.63	3412.35	5808.64
T5	3.3	56.30	47.76	24.44	2800.00	5738.68
T6	3.7	67.11	45.20	37.04	2061.73	6596.40
T7	3.9	53.52	7.61	17.06	3738.27	5917.17
T8	3.1	34.07	14.44	25.19	2908.64	6124.78
T9	4.3	52.59	28.41	22.96	3864.20	4439.21
T10	4.1	32.68	37.46	28.89	3281.48	5840.82
T11	4.1	52.25	21.03	25.93	3130.86	6087.90
T12	3.7	57.41	6.15	32.59	3908.64	7146.96
T13	3.3	53.15	17.72	37.04	3740.74	5771.55
T14	4.5	71.11	6.83	25.19	3693.83	5779.00
T15	3.7	57.66	23.81	30.74	2291.36	4617.38
T16 (C)	4.3	61.56	44.05	36.30	3108.64	5185.29
S.Em	0.23	4.85	5.62	2.94	112.87	425.3
C D at 5 %	0.66	13.99	16.21	8.49	293.56	1228.5

5.4. Crop Physiology

IIMR/CPD/2020-2025/128: Physiological dissection of key traits contributing for moisture stress adaptations in post rainy sorghum: with an emphasis on root architectural traits (PI: Srividhya S)

Root anatomical plasticity of rabi sorghum under water limited conditions

Root anatomical plasticity is a critical adaptive

mechanism governing water and nutrient acquisition under moisture-limited environments. In the study, substantial genotypic variation was observed for key root anatomical 'phenes' in rabi sorghum genotypes under well-watered (WW) and drought stress (DS) conditions. The quantitative assessment of root cortical aerenchyma (RCA), cortical cell file number (CCFN), cortical cell size (CCS), and metaxylem vessel area is presented in Table 5.8

Table 5.8 : Quantitative assessment of root parameters in sorghum

Genotype	Root cortical aerenchyma (RCA) (mm ²)		Cortical cell file no (CCFN)		Cortical cell size (CCS)		Metaxylem vessel area (mm ²)	
	WW	DS	WW	DS	WW	DS	WW	DS
CSV 29R	0.131	0.194	14.9	10.7	3.37	4.14	0.069	0.048
BJV 44	0.170	0.183	13.7	10.4	2.97	2.54	0.053	0.046
SPV 2217	0.120	0.121	11.7	10.3	3.33	3.97	0.049	0.040
CSH 39R	0.162	0.184	7.5	7.7	3.12	3.25	0.032	0.038
SPV 2758	0.124	0.111	9.2	11.7	2.85	3.33	0.031	0.039
CSV 26	0.134	0.169	14.3	11.8	3.21	3.88	0.052	0.025
M35-1	0.145	0.170	11.3	10.4	3.45	3.97	0.062	0.034
SPV 2407	0.080	0.089	8.7	8.9	2.65	3.34	0.063	0.041
Gidda Maldandi	0.117	0.110	7.3	7.8	2.55	2.99	0.047	0.029
Mean	0.131	0.148	10.96	9.97	3.06	3.49	0.051	0.038
P (0.001)	**	**	**	**	**	**	**	**

Across genotypes, drought stress significantly influenced all measured anatomical parameters ($P \leq 0.001$). Drought-tolerant genotypes exhibited increased RCA, reduced CCFN, enlarged cortical cell size, and optimized metaxylem vessel area under stress conditions. These anatomical modifications are indicative of genetically controlled plasticity, facilitating improved water-use efficiency and sustained physiological activity under soil moisture deficit.

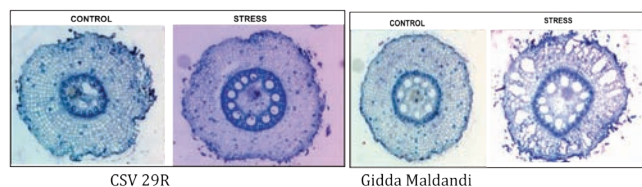


Fig. 5.9 Root anatomy of Tolerant genotype- CSV 29R and susceptible genotype- Gidda Maldandi

Among the evaluated genotypes, CSV 29R consistently recorded higher RCA and CCS under drought stress, coupled with reduced CCFN and relatively narrower metaxylem vessels. In contrast, the susceptible genotype Gidda Maldandi exhibited limited anatomical plasticity, characterized by lower RCA development and suboptimal vascular adjustments. The comparative root anatomical features of a drought-tolerant genotype (CSV 29R) and a susceptible genotype (Gidda Maldandi) are illustrated in Fig 5.9 highlighting clear structural differences in response to drought stress. These observations confirm that enhanced RCA formation restricts radial water loss, supports deeper rooting, and contributes to improved shoot water status, thereby sustaining photosynthetic activity and yield under terminal drought conditions.

Genotypic variation in drought adaptive traits under terminal moisture stress in *rabi* sorghum

Genotypic variation for key adapted traits of *rabi* sorghum genotypes evaluated under moisture stress adaptations over two seasons and two locations were identified for distinct physiological and morphological trait combinations linked to varying levels of drought tolerance. Tolerant genotypes (CSV29R, BJV 44, M35-1) with <30% yield loss sustained yield under terminal drought through superior phenology, higher biomass accumulation (TDMA), higher non-structural carbohydrate reserves, water-use efficiency, better panicle harvest index and root architecture traits.

Moderately tolerant genotypes (CSV26, SPV 2217, SPV 2407) with 30–40% yield loss maintain performance through good plant height, panicle traits, and higher canopy temperature depression (CTD). Moderately susceptible genotype (CSH39R) with 40–50% yield loss shows reduced transpiration efficiency (TE), lower stomatal conductance, and poor carbohydrate partitioning in the stem and leaves. Susceptible genotypes (SPV2758, G. Maldandi) with >50% yield loss exhibited early senescence, low TDMA, low TE and CTD, poor root plasticity resulting in severe yield decline and eventually susceptible to terminal drought stress conditions.

Drought induced early flowering and maturity in several genotypes, facilitating drought escape, with CSV 29R, BJV 44, and M35-1 consistently exhibiting favorable phenological shifts. Moisture stress reduced biomass and grain yield, particularly under prolonged drought; however, these genotypes maintained higher biomass and lower yield penalties. Enhanced chlorophyll fluorescence (Fv/Fm), lower canopy temperature, and higher canopy temperature depression were reliable indicators of stress tolerance and correlated with water-use efficiency and yield. Drought-tolerant genotypes possessed deeper roots, favorable root angles, higher root tissue density, optimal root–shoot ratio, and pronounced root anatomical plasticity. Strong root–shoot trait correlations confirmed the integrated physiological basis of drought adaptation, identifying CSV 29R, BJV 44, and M35-1 as promising donor lines.

IIMR/CP/2022-2025/160: Physiological Basis of High-Temperature Stress on Major and Minor Millets (PI: Seva Nayak D)

Twenty two pearl millet germplasm lines—AHB1200 (AHB12), Dhanshakthi, ICMB 01222 (1222), R35, ICMB 92777 (92777B), ICTP 8203, ICMV 221, R4, ICMB 94444 (94444B), Raj 171, ICMB 99222 (99222B), ICMB 97111 (97111B), ICMR 07444 (07444R), ICMB 89111 (89111B), R19, ICMB 04999 (04999B), R37, 120R, R1B494, 669R, 791R, and H77/833-2 (H77)—were evaluated for rapid screening of high-temperature stress tolerance under natural field conditions. Weather parameters, including maximum and minimum temperature, relative humidity (RH-I and RH-II), rainfall, wind speed, and evaporation, were recorded from January 2025 to May

2025. Growth, physiological, and yield parameters—namely plant height, leaf length, leaf width, leaf area (LA), leaf area index (LAI), days to 50% flowering, physiological maturity, canopy temperature depression (CTD), chlorophyll stability index (Chl SI), carotenoid stability index (Car SI), membrane stability index (MSI), relative water content (RWC), and yield traits—were recorded. Reduction in panicle length and panicle width was also assessed. Among the 22 germplasm lines

evaluated, five genotypes (AHB1200, Dhanshakthi, ICMB01222, R35, ICMB92777, ICTP8203, ICMV221, R4, ICMB 94444, Raj171, ICMB 99222, ICMB 97111, ICMR07444, ICMB 89111, R19, ICMB 04999, R37, 120R, R1B494, 669R, 791R, H77/833-2) were identified as heat tolerant based on morpho-physiological traits and reduced losses in growth and yield under high-temperature stress compared to the control (Table 5.9).

Table 5.9 Canopy temperature depression (CTD) in pearl millet genotypes

Pearl millet germplasm	Canopy temperature				Canopy Temperature Depression (CTD)
	1DOS	2DOS	3DOS	Mean Canopy temperature	
Ahb12	20	19	19	19	1.1
Dhanashakthi	20	20	18	19	1.6
1222	21	20	19	20	2.1
R35	20	20	18	19	1.4
92777B	21	20	18	20	2.2
ICTP8203	21	19	18	19	2.2
ICMV221	21	18	19	19	3
R4	21	18	18	19	3.1
94444B	21	18	19	19	3.1
Raj171	22	19	19	20	3.4
99222B	23	22	19	21	2.3
97111B	23	22	21	22	1.3
07444R	22	20	17	20	4.1
89111B	23	21	18	21	3.8
R19	22	21	18	20	3.3
04999B	22	21	17	20	3.4
R37	25	19	18	21	6.3
120R	24	19	17	20	5.8
R1B494	24	19	19	21	4.9
669R	23	19	19	20	4
791R	23	20	19	21	3.8
H77	23	20	17	20	4.6

CTD = Air temperature - Canopy temperature

5.5 Biochemistry

Project: IIMR/CP/2023-27- Biochemical characterization of iron and zinc rich pearl millet genotypes and their relationship with rancidity, anti-nutrients, and seed quality (PI: Venkateswarlu R)

An understanding of base levels of Iron and Zinc in pearl millet breeding program is required for targeted improvement of minerals with due consideration to anti-nutrients. The Fe and Zn content in multi-location trial (n=73) of released hybrids and cultivars has revealed mean Fe and Zn content to be 49.9 ppm and 38.4 ppm with an inter quartile range of 10.5 and 7.1 respectively.

This shows limited variability for Fe and Zn among released hybrids and cultivars tested.

Table 5.10: Variability for grain iron and zinc in pearl millet released hybrids and cultivars

Statistic	Iron	Zinc
Mean (ppm)	49.9	38.4
SD	9.2	4.95
Inter quartile range	10.5	7.1
Range	53.8	21.6

Further to analyze large number of samples X-ray fluorescence spectrometer (EDX-7200, Shimadzu, Japan) was calibrated for non-destructive determination

of Iron and Zinc in pearl millet grains. Pearl millet grain samples representing Iron and Zinc in a wide range were selected by analyzing the samples using microwave digestion and atomic absorption spectrometry (MWD-AAS). A calibration curve was built using wet lab values and fluorescence intensity in XRF. The calibration was

further validated with another set of samples analyzed using MWD-AAS which achieved a correlation (r) of 0.948 and 0.965 for Iron and Zinc in pearl millet grains respectively (Fig. 5.10). A throughput of 72 samples in a day could be achieved.

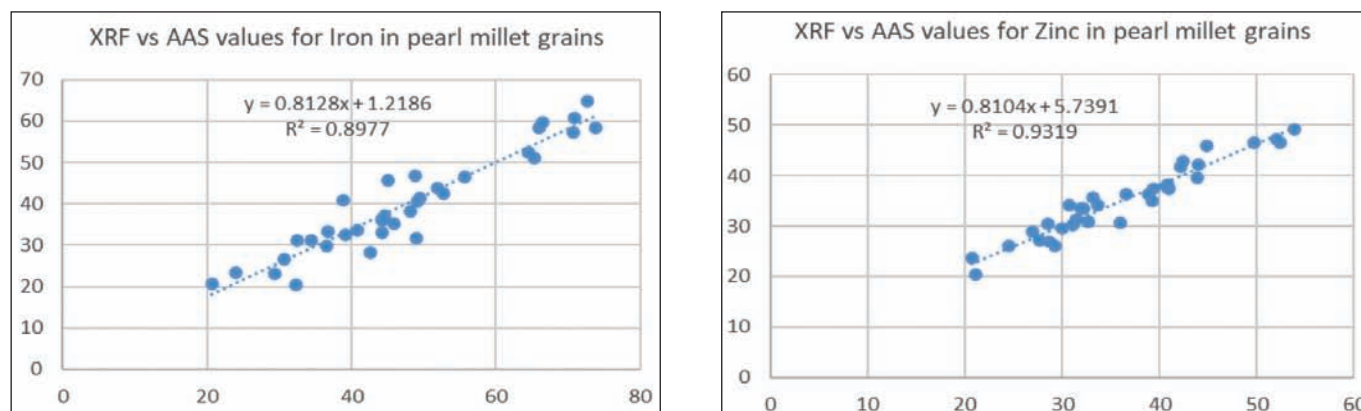


Fig. 5.10. XRF vs AAS values for iron and zinc values in pearl millet

Further to understand the relationship between alcoholic acidity and mineral content in pearl millet grains a selected set of samples representing a wide range for alcoholic acidity were analyzed for Iron and Zinc content. A significant correlation of 0.733 ($p < 0.01$) was found between Iron and Zinc while there was no significant correlation between alcoholic acidity, Iron and Zinc content in pearl millet grains.

IIMR/FF/2021-2026/154: Nutritional composition, phenolic profile and bioactivities of sorghum, foxtail, kodo and proso millet grains (PI: VM Malathi)

Nutritional evaluation of kodo millet varieties

A total of nineteen released varieties of kodo millet were evaluated for nutritional composition. Dehulled kodo grains were used in the study. Moisture content of the grains ranged from $6.94 \pm 0.62\%$ (Niwas-1) to $9.56 \pm 0.27\%$ (JK 48). Crude protein content of the grains, as determined by Kjeldahl method, ranged to 13.13 ± 0.09 g/100g in JK-65. The highest crude fat content recorded was 4.02 ± 0.03 g/100g (JK-137). The total ash content ranged from 1.30 ± 0.00 g/100g in RK 390-25 to 2.31 ± 0.07 g/100g in Chattisgarh kodo. Micronutrients viz. Fe, Zn, Ca, and Mg were determined

by microwave digestion followed by inductively coupled plasma-optical emission spectrometry (ICP-OES). The Fe content ranged from 8.6 ppm (RK-390-25) to 39.5 ppm (JK-41) and Zn content ranged from 27.2 ppm (Chattisgarh kodo) to 36.8 ppm (JK-65). The highest Ca content among the studied varieties was recorded in JK-98 (232.3 ppm) and the highest Mg content was reported in JK-65 (1437.7 ppm). The amylose content of kodo millet varieties was estimated by Iodine method (Spectrophotometric method); the content ranged from $6.96 \pm 0.15\%$ (JK-31) to $18.59 \pm 0.013\%$ (JK-41). The total phenolic content (TPC) of kodo millet varieties ($n=15$) were estimated in the acidified methanolic extracts of the samples. The results are presented in Fig. 1. The TPC ranged from 2.49 ± 0.045 mg/g (JK-41) to 4.50 ± 0.032 mg/g (Niwas-1). Further, the *in vitro* antioxidant activity of kodo millet varieties was estimated in terms of reducing power. The activity ranged from 0.73 ± 0.02 mg FeCl_3 equivalents/g (JK-155) to 2.44 ± 0.10 mg FeCl_3 equivalents/g (Niwas-1). The results revealed good nutritional as well as antioxidant potential of kodo millet varieties. Further, profiling of phenolic acids and flavonoids help to decipher bioactivities of kodo millet grains.

IIMR/FF/2021-2026/153 : Biochemical characterization of millets and millet food products for nutraceuticals and health benefits (PI: VM Malathi)

Deciphering the changes in nutritional constituents upon thermal processing in foxtail millet:

Post-harvest processing impacts nutritional and functional properties of grains. Thermal processing viz. cooking, roasting, popping, steaming, and baking are



Fig.5.11. Foxtail millet grains after thermal treatment: (a) Open pan roasted, (b) microwave roasted (c) hydrothermally treated

among the indispensable cereal processing methods, from the consumption point of view. In this study, the thermal processing methods of open-pan roasting, microwave roasting, and hydrothermal treatment have been employed to understand the changes upon processing in two foxtail millet varieties, SiA 3156, SiA 3088. The raw grains of the respective varieties were used as control. Foxtail millet grains after thermal processing is presented in Fig. 5.11.

The proximate parameters including crude protein, total fat, total ash content of the processed and raw samples were studied as per AOAC protocol. The results revealed that the protein, ash, and fat content ranged from 14.04 ± 0.51 to $16.83 \pm 0.31\%$, 1.10 ± 0.17 to $1.19 \pm 0.06\%$, and 4.51 ± 0.59 to $5.41 \pm 0.14\%$ (db) respectively in SiA 3156 (control and processed grains). In SiA 3088 the protein, ash, and fat content ranged from 13.90 ± 0.18 to $14.33 \pm 0.26\%$, 1.65 ± 0.16 to $2.00 \pm 0.29\%$, and 5.39 ± 0.21 to $5.64 \pm 0.26\%$ (db) respectively. Varietal variation was observed for protein as well as ash content in the studied grains. The Fe and Zn content of thermally treated samples are presented in Fig. 5.12. Fe content of the samples ranged from 45.09 to 56.19 ppm and the Zn content ranged from 44.10 to 57.37 ppm. No changes in the Fe content were observed upon the treatments.

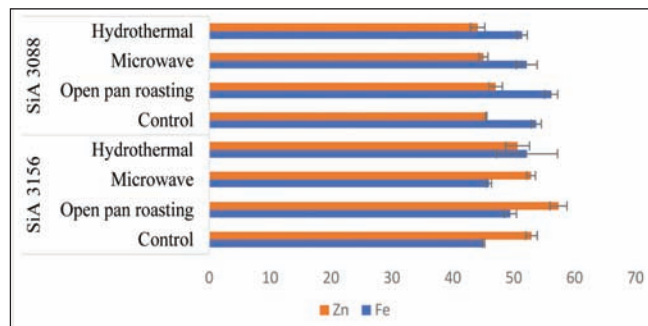


Fig. 5.12. Fe and Zn content of SiA3156 and SiA 3088 control and thermally processed foxtail millet

Estimation of the antinutrient, phytic acid showed that hydrothermal treatment significantly ($p < 0.05$) reduced phytic acid in both varieties of foxtail millet. A significant reduction in amylose content ($17.51 \pm 1.31\%$ and $11.91 \pm 0.99\%$ in SiA 3156 and SiA 3088 respectively) upon microwave treatment as compared to control ($21.60 \pm 1.04\%$ and $15.51 \pm 0.43\%$ in SiA 3156 and SiA 3088 respectively) was observed in both the varieties. This could be due to the changes in starch structure upon the treatment. A significant reduction in the protein digestibility ($p < 0.05$) has been upon open pan roasting as well as hydrothermal treatment (Table 5.11). This may be due to the interactions between starch, protein and lipids during the treatment. Further, assessing the phenolic composition would help in understanding the changes in bioactivities upon processing.

Table 5.11: *In vitro* protein digestibility of thermally processed foxtail millet

Foxtail variety	IVPD (%)			
	Control	Open pan Roasting	Microwave Roasting	Hydrothermal Treatment
SiA 3156	81.9 ± 0.53	62.2 ± 5.17	87.5 ± 3.22	49.4 ± 5.73
SiA 3088	78.9 ± 4.96	54.7 ± 1.47	78.2 ± 1.41	47.6 ± 6.87

6.1. Insect pests and management

IIMR/ PP/2023-2028/166: Exploring new plant traits for resistance against major insect pests in millets (PI: A Kalaisekar)

Documented the morphological characteristics of Eulophidae parasitoids collected from various millets and alternate hosts like *Cynodon dactylon* attacked by shoot flies. These eulophid size ranging from 1-2 mm in length. The differences between male and female Eulophidae parasitoids include males having more elaborate antennal structures, often with additional segments or specialized sensory features like whorls or setae, which aid in detecting pheromones. In contrast, female antennae are less elaborate and are adapted for locating hosts rather than mates. The tarsi are four-segmented in both sexes, a defining characteristic that differentiates these chalcids from the closely resembling pteromalid group. Additionally, the four-segmented tarsi are characterized by a short and straight protibial spur. Among the eulophids collected, four species of the genus *Neotrichoporoides* Girault, 1913 (Hymenoptera: Eulophidae) were collected from larvae of *Atherigona* spp. (Diptera: Muscidae) associated with 'dead heart' affected plants of sorghum (*Sorghum bicolor*), Proso millet (*Panicum miliaceum*), Little millet (*Panicum sumatrense*), Bermuda grass (*Cynodon dactylon*) and Crab grass (*Digitaria* sp.) in millet-based ecosystems. Sampling was conducted during the *kharif* and *rabi* seasons of 2024-25 at the ICAR-Indian Institute of Millets Research, Hyderabad. Adult parasitoids were reared from infested dead-heart plants in millets and associated grasses, and identified based on morphological characters observed under a stereozoom microscope (Fig. 6.1).

Key to the Indian species of the genus *Neotrichoporoides*

1.	Body mostly yellow with metallic green markings on mesosoma and metasoma; malar sulcus with a small fovea below the eye; Submedian grooves absent on the mesoscutellum; propodeum dull with only submedian area metallic green..... <i>Neotrichoporoides viridimaculatus</i> (Fullaway, 1955)
	Body mostly metallic green, with the presence of submedian grooves on the scutellum.....2
2.	Body completely metallic green , including head, mesosoma, and metasoma; malar sulcus distinctly curved backward; scape 3× as long as wide; pedicel 2.2× as long as wide; mesoscutum with median line and adnotaular setae in one row.... <i>Neotrichoporoides cavigena</i> (Graham, 1987)
3.	Body metallic green , with or without yellow markings; marginal vein at most 7× as long as stigmal vein; scape shorter than eye (at most 0.97× eye length); malar sulcus with a larger fovea below the eye; propodeum shiny; lower half of face yellow <i>Neotrichoporoides nyemitawus</i> (Rohwer, 1921)
4.	Body metallic green, lower half of the face, basal one-third of gaster were yellow coloured. Malar sulcus straight and larger malar fovea. mid-lobe of mesoscutum bearing two rows of adnotaular setae.... <i>Neotrichoporoides basiflavus</i> (Li & Li, 2021)

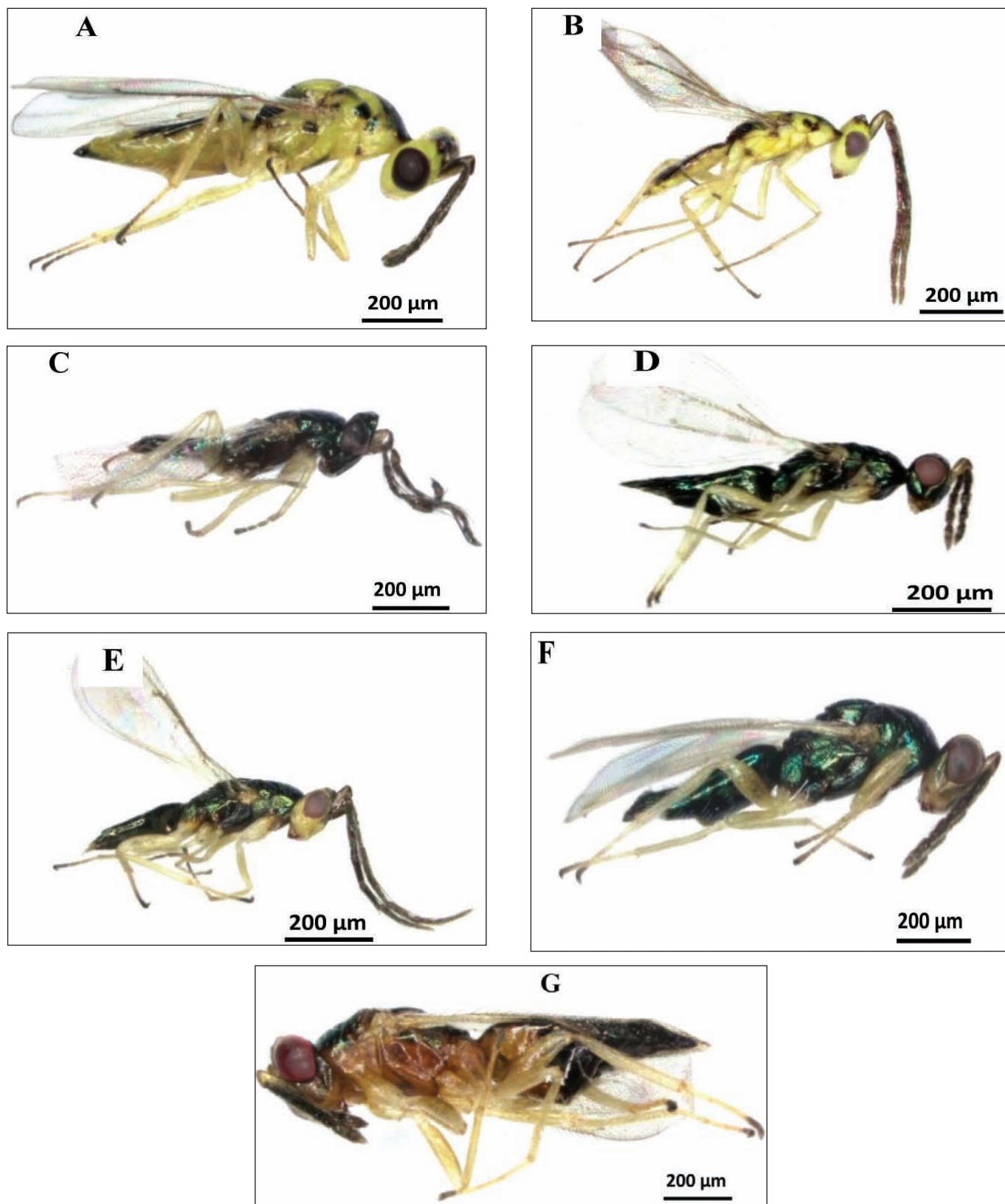


Fig. 6.1. Different *Neotrichoporoides* sp A-B. General habitus of *Neotrichoporoides viridimaculatus*, lateral view- male and female, C-D. General habitus of *N. cavigena*, lateral view- male and female, E-F. General habitus of *N. nyemitawus*, lateral view- male and female, G. General habitus of *N. basiflavus* female

IIMR/CPT/2025-2029/182: Unravelling the olfactory mechanisms of stemborer host-plant selection in millets for novel pest management strategies (PI: PG Padmaja)

Evaluation of finger millet genotypes against pink stemborer, *Sesamia inferens*

Seventy-three finger millet genotypes including wild derived lines (2), land races (21), mutants (8), improved breeding lines (6) and varieties (36) were evaluated for pink borer resistance during *rabi* 2025 at Hyderabad under artificial infestation. Five neonate larvae were released into the whorl of each plant. Leaf injury rating was recorded for ten randomly selected plants

individually in each genotype per replication on the rating scale of 1 to 9 at 45 days after sowing.

Leaf feeding rating ranged from 1.0 to 6.0 scale among the genotypes evaluated. Larva bored into the stem, resulting in yellowing and drying of the central shoot causing deadheart during the vegetative stage, and chaffy panicles (white ears) during the flowering stage. Oozing of excreta from bore hole was also observed (Fig. 6.2). Significant variation was observed among the genotypes for deadhearts (DH). DH ranged from 1.6 to 34.6% (Fig. 6.2) with a mean of 13.3%. Kumuda Red Mandia, Balu Mandia, KMR 630 and GPU 67 recorded <5% DH. Highest deadhearts (33.3%) were recorded in CFMV2.

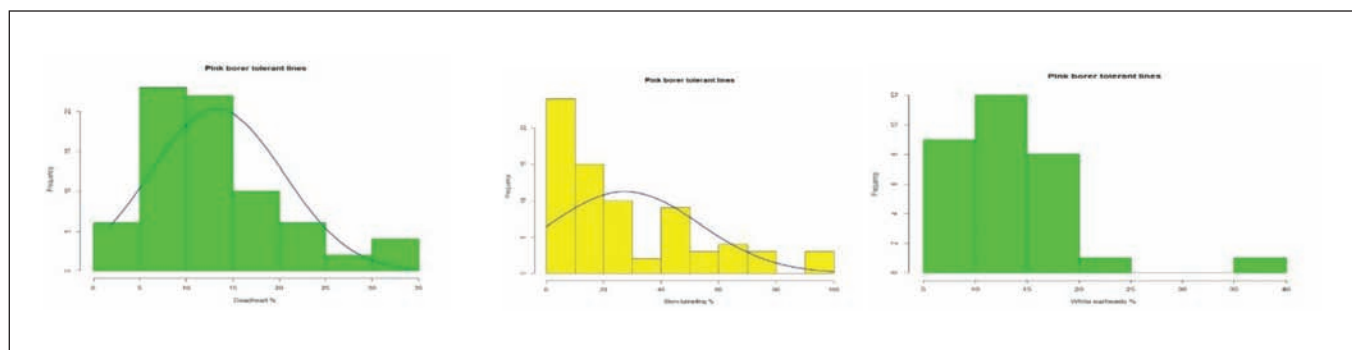


Fig. 6.2. Pink borer, *Sesamia inferens* damage in finger millet during *rabi* 2025

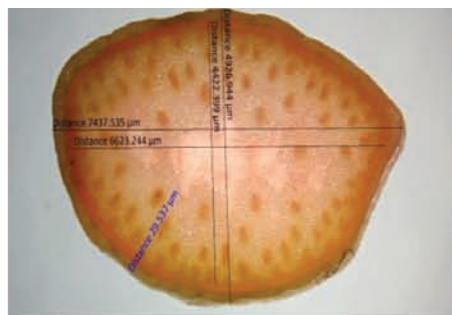
Significant variation was observed among the genotypes for stem tunnelling (ST). ST ranged from 0.0 to 100.0% with a mean of 27.4%. Kumuda Red Mandia and Balu Mandia, recorded <5% stem tunneling. Highest stem tunnelling was recorded in CFMV2 and mutant line (IIMR-K24-1991/GPU67 mutant). More number of white earheads was observed in Bharti mandia (36.4%) (Fig. 6.2).

CFMV2 was susceptible to pink borer with 33.3% DH, 100% ST and 10.2% white ears. Larvae bore through the leaf sheath and enter the stem, creating tunnels in the pith, which is the soft, internal central tissue of the stalk. They feed on the inner surface of the stem walls, often moving between internodes to continue feeding, leaving behind frass (fecal matter) and causing hollowed-out sections.

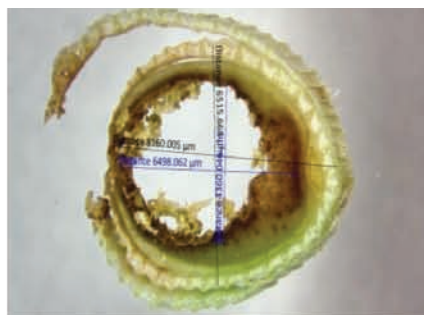
Damage to pith and Vascular bundles

Stem borer larvae bore into plant stems destroying the pith (inner tissue) and vascular bundles (nutrient-conducting tissues), leading to structural weakness and nutrient transport disruption in finger millet, barnyard millet and sorghum (Fig. 6.3).

As the larvae consume the pith, the stem becomes hollowed and structurally weak, making the plant susceptible to lodging. By feeding on the internal tissues, the larvae destroy the vascular bundles (xylem and phloem) disrupting the flow of nutrients to the panicle, resulting in empty or unfilled grain heads ("white heads").



Healthy

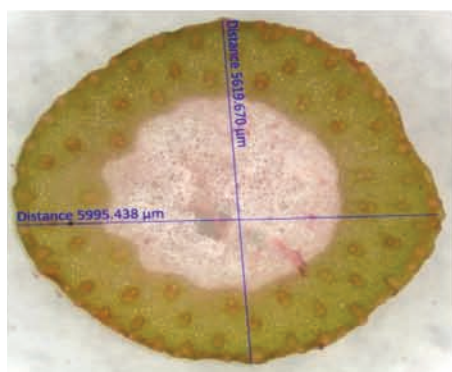


Pith region damaged by *Sesamia*

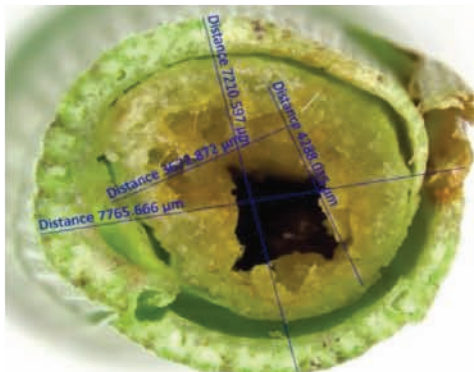


Stem tunnelling

Finger millet - Arjuna Mandia



Healthy

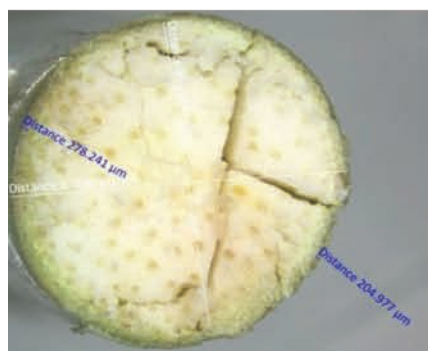


Pith region damaged by *Sesamia*

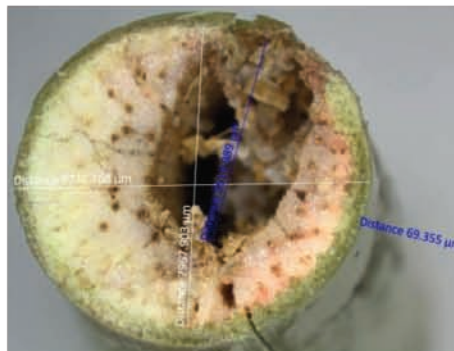


Stem tunnelling

Barnyard millet - K1



Healthy



Pith region damaged by *Chilo*



Stem tunnelling

Sorghum - CSV 19SS

Fig. 6.3. Pith and vascular bundles damage by stem borers (*Chilo* and *Sesamia*) in millets



Fig. 6.4. Damage symptoms of pink borer *Sesamia inferens* in finger millet during rabi, 2025

Effect of host plants on nutritional indices of the pink borer, *Sesamia inferens*

Nutritional indices of pink borer on different host plants including finger millet (cultivars wild derived line IIMR-K24-2891/*E.coracana* x *E. africana*, Arjuna Mandia, improved breeding line IIMR - K24-1058/GPU28 x IE 990 and CFMV1), barnyard millet (cultivars DHBM93-2, advanced breeding line Kh-24-580, mutant line and BAR1414-1), foxtail millet (cultivars Krishnadevraya, Suryanandi, K2 and CFXMV -2) and sorghum (cultivars CSH 30, CSV 41, M35-1, CSH 59R, CSV 49SS, CSH 22SS and CSV 47F) were studied under laboratory conditions ($27 \pm 1^\circ\text{C}$, $70 \pm 5\%$ RH, 16:8 L:D).

The larval weights, food consumed, and feces produced by the larvae are shown in Fig. 6.5. Larval weight was highest on finger millet Arjuna Mandia (30.2 mg) and barnyard millet DHBM93.2 (28.8 mg) respectively, and lowest on foxtail millet Suryanandi (6.3 mg). Food consumed by the larvae was highest on barnyard millet DHBM93.2 (287.7 mg) followed by sorghum CSV 49SS (284.2 mg) and lowest on foxtail millet Suryanandi (28.9 mg). The highest and lowest values of feces produced were on barnyard millet DHBM93.2 (128.1mg) and foxtail millet Suryanandi (5.3 mg), respectively. Foxtail millet Suryanandi was less preferred by pink borer with lowest consumption of food and larval weight.

Growth indices were calculated for pink borer on millets as follows:

$$\text{Consumption indices (CI)} = \frac{\text{Weight of the food consumed (g)}}{\text{Duration of feeding (days)} \times \text{Weight gained by larvae (g)}}$$

Efficiency of conversion of ingested food into body matter (ECI)

$$\text{ECI} = \frac{\text{Weight gained by the larvae (g)}}{\text{Weight of food ingested}} \times 100$$

Efficiency of conversion of digested food into body matter (ECD)

$$\text{ECD} = \frac{\text{Weight gained by the larvae (g)}}{\text{Weight of food ingested} - \text{Weight of feces}} \times 100$$

$$\text{Approximate digestibility (AD)} = \frac{\text{Weight of food ingested} - \text{Weight of feces}}{\text{Weight of food ingested}} \times 100$$

Nutritional indices of pink borer larvae reared on millets are shown in Table 6.1. The larvae fed on sorghum CSV49SS and barnyard millet mutant had the highest CI (1.206 and 1.143 respectively) indicating that the rate of intake relative to the mean larval weight during the feeding period was the highest on this host. Approximate digestibility (AD) values of the larvae were highest (86.10%) on foxtail millet Krishnadevaraya and lowest (45.13%) on barnyard millet BAR 1414-1. AD measures the efficiency with which they digest food. Larvae reared on finger millet CFMV1 showed the highest efficiency of conversion of digested food (ECD) (35.49%). The highest value of efficiency of conversion of ingested food (ECI) was on foxtail millet K2 (21.24%). ECI is a general index of an insect's ability to use the food consumed for growth and development, and ECD is an index of the efficiency of conversion of digested food into growth.

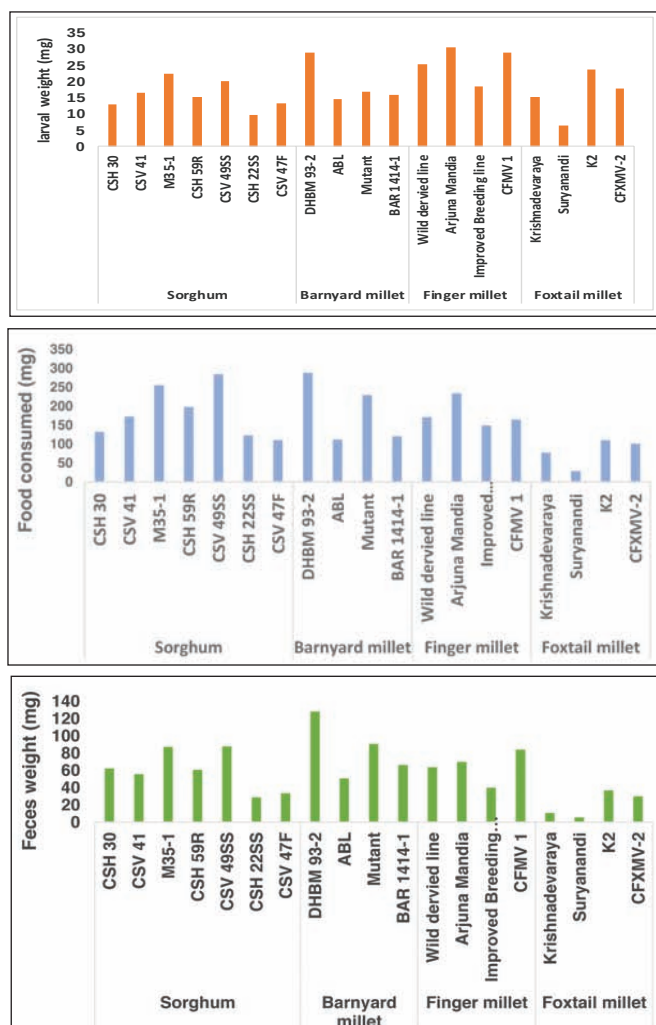


Fig. 6.5 (A) Mean larval weight, (B) food consumed, and (C) feces produced of larvae of *Sesamia inferens* on millets

Table 6.1. Nutritional indices of larvae of pink borer, *Sesamia inferens* on millets

Millet	Cultivar	CI	AD (%)	ECI (%)	ECD (%)
Sorghum	CSH 30	0.869	53.08	9.59	18.07
	CSV 41	0.888	67.82	9.38	13.84
	M35-1	0.965	65.84	8.63	13.11
	CSH 59R	1.107	69.31	7.53	10.87
	CSV 49SS	1.206	69.18	6.91	9.99
	CSH 22SS	1.107	76.71	7.52	9.81
	CSV 47F	0.702	69.78	11.87	17.01
Barnyard millet	DHBM 93-2	0.839	55.47	9.93	17.90
	ABL	0.654	54.57	12.74	23.35
	Mutant	1.143	60.52	7.29	12.05
	BAR 1414-1	0.649	45.13	12.84	28.44
Finger millet	Wild derived line (K24-2891)	0.570	62.76	14.61	23.27
	Arjuna Mandia	0.650	70.21	12.82	18.26
	Improved Breeding line (K24-1058)	0.682	73.23	12.22	16.69
	CFMV 1	0.481	48.84	17.33	35.49
	Krishnadevaraya	0.431	86.10	19.35	22.47
Foxtail millet	Suryanandi	0.401	81.66	20.76	25.42
	K2	0.392	66.55	21.24	31.92
	CFMV-2	0.484	70.50	17.23	24.44

CI = Consumption index, AD = Approximate digestibility, ECI = Efficiency of conversion of ingested food, ECD = Efficiency of conversion of digested food

IIMR/ CPT /2020-2025/131: Yield loss assessment in millets due to invasive fall army worm, (*Spodoptera frugiperda* J. E. Smith) and its integrated management with special emphasis on sorghum (PI: G Shyam Prasad)

Avoidable yield loss (AYL) in barnyard and finger millet due to fall army worm

The avoidable yield loss in barnyard millet and finger millet due to fall army worm was studied in 2024-25. The crop was grown under protected and unprotected condition in large plots and avoidable yield loss assessed using the formula

AYL= (yield in protected plot - yield in unprotected plot / yield in protected plot *100)

Table 6.2. Avoidable yield loss in barnyard and finger millet

Crop	Season	Cultivar	Grain yield (t/ha)		
			Protected	Unprotected	AYL (%)
Barnyard millet	Kharif, 2024	VL 172	2.21	2.05	7.23
Finger millet	Kharif, 2024	GPU 28	3.14	3.00	4.45

The avoidable yield loss in barnyard millet was 7.23 % while it was 4.45% in case of finger millet (Table 6.2). The damage and yield loss was due to reduction in panicle size, reduction of photosynthetic area. There was no reduction in plant stand.

Regression analysis

Multiple regression analysis was carried out between weekly mean moth catches of FAW and weather

parameters (2021-24) to develop a prediction model (Table 6.3). The analysis revealed that weather factors accounted for 37 percent of the variation in the moth catches ($R^2= 0.37$). Stepwise regression was further employed to identify the most influential variables by systematically adding significant predictors and removing less significant ones at each step. The final model generated by stepwise regression indicated that minimum temperature, evening relative humidity, rainfall and windspeed were the most significant variables affecting fall armyworm pheromone catches which showed 35 percent of the variation of fall armyworm moth catches ($p<0.05$). The most optimized stepwise regression model, $Y= 6.35 - 0.37 T_{min}^{***} + 0.076 RH_{II}^* - 0.091 RF^* - 0.159 W_{speed}^*$ was developed in this study (Table 6.3).

Table 6.3. Optimized stepwise regression model for fall armyworm for fall army seasonal incidence prediction

Regression equation	SE	R ²	F
Step wise: $Y = 4.86 + 0.055 T_{max} - 0.411 T_{min}^{***} - 0.0006 RH_I + 0.087 RH_{II}^* - 0.095 RF^* - 0.152 W_{speed}^*$	1.668	0.37	11.35
Optimized stepwise: $Y = 6.35 - 0.37 T_{min}^{***} + 0.076 RH_{II}^* - 0.091 RF^* - 0.159 W_{speed}^*$	1.655	0.35	17.25

T_{max} - Maximum temperature ($^{\circ}C$), T_{min} - Minimum temperature ($^{\circ}C$), RH_I - Morning relative humidity (%), RH_{II} - Evening relative humidity (%), RF - Rainfall (mm), W_{speed} - Wind speed (kmph).

IIMR/ CP/2025-2029/186: Comprehensive studies on aphids species infesting millets, their Identification, taxonomic studies, mechanisms of resistance and forecasting models against this pest (PI: K Srinivasa Babu)

Morphological characteristics of sorghum aphid

The morphological characteristics of *Melanaphis sacchari* collected from various sorghum fields were systematically documented. Different life stages were collected and examined using a Zeiss Stereo Discovery V20 microscope to ensure accurate identification. The body size of *M. sacchari* ranged from 1-2 mm in length, and the aphids were typically pale yellow in colour. The alate (winged) forms closely resembled the larger apterous (non-winged) individuals but frequently exhibited black markings along the dorsal sclerite. The antennae were darker and shorter than the body, with the terminal process (processus terminalis) of

the last antennal segment distinctly longer than the basal portion of the same segment. The antennal tips appeared darker in colour. The length of antennae is 904 -920 μm and width is 18-19 μm . Similarly, the tarsi were darker compared to the remaining parts of the legs. Prominent tubercles were observed on the hind tibia, and the cornicles were also darker in colour. The length and width of sphenoculi is 57-61 and 104-107 μm . The antenna measured 904-920 μm in length and 18-19 μm in width. Similarly, the tarsi were darker compared to the remaining parts of the legs. Prominent tubercles were observed on the hind tibia, and the cornicles were also darker in colour. The length and width of the siphunculi measured 57-61 μm and 104-107 μm , respectively (Fig. 6.5).

Identification of resistant lines to sorghum aphid

Field experiment was conducted during the kharif and rabi seasons of 2025–26 at the ICAR–Indian Institute of

Millets Research, Hyderabad. Analysis further revealed that key morphological plant parameters namely plant height, number of leaves, number of internodes, and leaf length were negatively correlated with aphid population buildup. Based on field screening, the varieties CSV-29R, Hathikunta, PKV-Kranti, TAM-428, PUGL-9,

SPV-2217, SSV-84, ICSV-745, KR-191, and ICSV 745 were categorized as resistant to the sorghum aphid. In contrast, DJ-6514, Y-75, ICSB-29004, IS-11919, IS-7679, CS-3541, B-35, CSV-27, BAR-162, IS-12735, and IS-4631 were identified as susceptible.

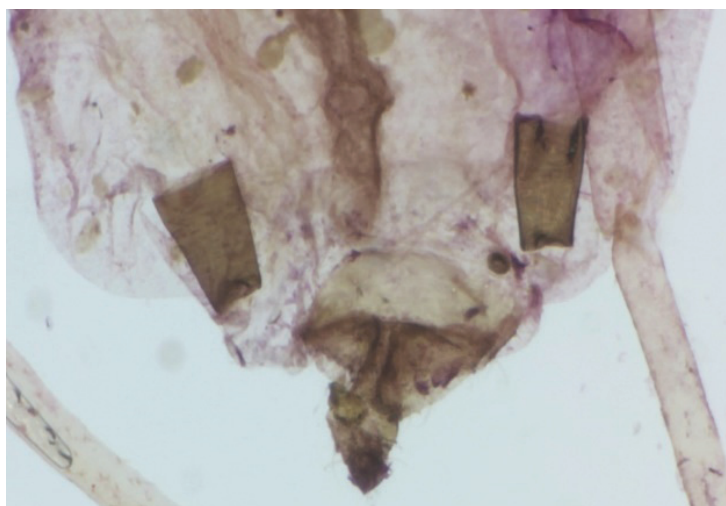




Fig. 6.5. Different stages of *Melanaphsis sacchari* A-D. *M. sacchari* slide E. Mouth parts and sphinoculi, cauda of *M. sacchari* E-G. Hind tibia, antennae and wing of *M. sacchari* H-J.

IIMR/CP/2024-2027/173: Mechanism of resistance and effect of Controlled Atmospheric Storage (CAS) in stored grain pest management in millets (PI: J. Stanley)

Screening of small millet cultivars for important stored grain pests

A laboratory experiment was conducted to evaluate the inherent resistance or susceptibility of 31 cultivars belonging to six small millets (proso, kodo, foxtail, barnyard, browntop and little millet) against three major stored grain pests viz., *Sitophilus oryzae*, *Tribolium castaneum* and *Rhyzopertha dominica*.

a. *Sitophilus oryzae*

The susceptibility indices of the 31 cultivars ranged from 0 to 10.95, indicating significant varietal differences. The overall order of susceptibility was proso millet > kodo millet > barnyard millet > foxtail millet > browntop

millet > little millet. Proso millet cultivars PM-HP-186, PM-HP-59, PM-HP-137, PM-163 and PM-HP-7 recorded the highest F_1 progeny emergence, shorter developmental periods and maximum grain weight loss, with PM-HP-186 (37.1%) and PM-HP-137 (30.8%) registering the highest losses, and were categorized as susceptible. Kodo millet cultivars JK-106 and JK-155 showed moderate susceptibility, whereas JK-13 and JK-137 were moderately resistant. Barnyard millet cultivars MDU-1 and VL-207 showed moderate susceptibility, while HBR-2, CO-1, CO-3 and CBYMV-1 recorded low progeny emergence and grain damage and were categorized as resistant. Browntop millet cultivars AK-1, AK-2, GPUBT-6 and BTV-44 showed negligible infestation and grain loss and were resistant. All little millet cultivars BL-6, CLMV-1 and JK-8 recorded zero F_1 progeny emergence and minimal grain weight loss and were classified as highly resistant.

b. *Tribolium castaneum*

The susceptibility pattern to *T. castaneum* differed from internal feeders, with the order Browntop millet > Proso millet > Barnyard millet > Foxtail millet > Kodo millet > Little millet. Browntop millet cultivar AK-1 recorded the highest susceptibility index with rapid population buildup and higher grain loss. Proso millet cultivars PM-HP-186, PM-HP-137 and PM-HP-7 supported higher adult emergence and grain damage and were categorized as susceptible. Barnyard millet cultivars MDU-1 and VL-207 showed moderate adult emergence and grain loss. In contrast, little millet cultivars BL-6, CLMV-1 and JK-8 and kodo millet cultivars JK-13 and JK-137 recorded minimal adult emergence and negligible grain damage, indicating strong resistance.

c. *Rhyzopertha dominica*

Significant varietal differences were observed for susceptibility to *R. dominica*. Proso millet cultivars PM-HP-186 and PM-HP-137 recorded higher F_1 progeny emergence and maximum grain weight loss and were categorized as highly susceptible. Kodo millet cultivars JK-106 and JK-155 and barnyard millet cultivars MDU-1 and VL-207 showed moderate progeny emergence with corresponding grain damage. In contrast, little millet cultivars BL-6, CLMV-1 and JK-8, browntop millet cultivars AK-2, GPUBT-6 and BTV-44, and barnyard millet cultivars CO-1 and HBR-2 recorded minimal infestation and grain weight loss and were categorized as resistant.

Deciphering the mechanism of plant resistance (including biochemical) to stored grain pests of millets

Biophysical and biochemical basis of resistance in small millets

Biophysical and biochemical analyses were carried out to understand the mechanisms underlying resistance in small millet cultivars against stored grain pests.

a. Role of grain hardness

Grain hardness varied significantly among cultivars, with kodo millet cultivars JK-155, JK-13, JK-106 and JK-137 and browntop millet cultivars AK-1, AK-2, GPUBT-6 and BTV-44 recording the highest hardness values, while proso millet cultivars PM-HP-186 and PM-

HP-59 were consistently soft textured. Grain hardness showed a strong negative correlation with progeny emergence and susceptibility indices of *S. oryzae* and *R. dominica*, indicating that harder grains restricted insect penetration, feeding and development.

b. Role of total phenolic content

Total phenolic content was highest in barnyard millet cultivars HBR-2 and CO-1 and little millet cultivars BL-6 and CLMV-1, and lowest in proso millet cultivars. Phenolic content exhibited a significant negative correlation with susceptibility index, progeny emergence and grain weight loss, confirming its role as a key biochemical defense factor imparting antibiosis against stored grain pests.

c. Combined effect of biophysical and biochemical traits

Resistant cultivars generally possessed a combination of higher grain hardness and higher phenolic content, whereas susceptible cultivars were characterized by softer grains with lower phenolic levels and higher sugar content. These traits collectively influenced pest preference, development and survival, resulting in differential resistance or susceptibility among small millet cultivars. Thus, resistance to stored grain pests in small millets was governed by the combined action of grain hardness and biochemical defenses, particularly phenolic compounds, with little millet cultivars BL-6, CLMV-1 and JK-8 emerging as the most resistant.

6.2 Diseases and Management

IIMR/CP/2024-28/175: Genetic diversity, pathogenic variability and development of differential host against Pearl millet blast pathogen (PI: Rajesha G)

Collection of blast infected leaf samples and isolation of pathogen.

Pearl millet leaf-infected blast samples were collected from major growing regions, namely Andhra Pradesh, Rajasthan, Haryana, Gujarat, Madhya Pradesh, Telangana, and Karnataka. 30 and 62 samples were collected in 2024 and 2025, respectively. Isolation of *Pyricularia* was carried out by using spore drop method (Fig. 6.6). Around 55 isolates were isolated from infected samples from different regions i.e., 50 from Rajasthan, 3 from Haryana and 1 each from Gujarat & Telangana.

Virulence profiling of pearl millet blast isolates

The virulence pattern of twelve *Magnaporthe* isolates (PMB 1–11 and PMB 43) was evaluated on ten pearl millet host differentials using 1–9 disease scale (Table 6.4). Considerable variability in virulence was observed among the isolates, indicating pathogenic diversity within the population (Fig. 6.7a & b).

Isolates viz., PMB 5, PMB 6, PMB 8, PMB 9 and PMB 11 recorded higher disease scores on multiple host differentials. PMB 5 recorded scores up to 7.33 on ICMB 863BP2 and consistently high reactions on ICMB 95444, ICMB 97222, ICMB 01333 and ICMB 02444. PMB 6 and PMB 11 also demonstrated broad-spectrum virulence with moderate to high reactions across several differentials. Isolates viz., PMB 3, PMB 4, PMB

7 and PMB 10 showed intermediate virulence. These isolates produced susceptible reactions on specific differentials (ICMB 863BP2 and ICMR 06222) but remained moderately virulent on others. Isolates viz., PMB 1, PMB 2, and PMB 43 exhibited comparatively lower virulence, with scores falling within the resistant-to-moderately resistant range (1–3). Isolate PMB 43 showed least virulence, maintaining low disease scores across nearly all host differentials.

Studies on host differential response:

Among the differentials, ICMB 863BP2 and ICMR 06222 appeared more susceptible, as several isolates recorded high disease scores on these lines. In contrast, ICMB 06444 and IP2 generally exhibited resistance to most isolates.

Table 6.4 Virulence profiling of pearl millet blast isolates

Isolate	Host differentials									
	ICMB 93333	ICMB 95444	ICMB 97222	ICMB 01333	ICMB 02444	ICMB 06444	ICMB 863BP2	ICMR 06222	ICMR 11003	IP2
PMB 1	2.67	2.00	2.67	1.67	2.33	1.00	3.00	5.33	2.33	1.00
PMB 2	1.67	3.33	2.33	1.00	1.67	1.33	3.33	2.00	1.67	1.00
PMB 3	1.00	3.33	2.33	1.67	2.00	1.33	6.33	4.00	5.33	1.00
PMB 4	2.67	3.00	2.67	3.00	3.33	1.00	6.33	5.33	1.33	—
PMB 5	2.00	5.33	4.67	5.33	5.00	1.67	7.33	4.00	1.33	1.33
PMB 6	3.33	5.67	3.67	1.67	3.67	1.33	5.00	3.00	1.00	1.33
PMB 7	2.33	4.33	3.33	4.33	4.00	1.67	3.67	5.00	1.67	1.00
PMB 8	3.00	3.67	4.00	1.00	4.67	1.00	4.67	5.67	1.00	1.33
PMB 9	1.67	4.00	3.67	2.33	5.33	1.00	5.00	5.00	1.00	1.00
PMB 10	1.33	3.00	3.00	2.67	4.33	1.00	5.00	4.00	1.00	2.00
PMB 11	1.33	2.00	3.00	3.33	4.67	5.33	5.67	3.67	1.00	1.33
PMB 43	1.00	1.00	3.67	1.00	1.00	1.00	2.67	1.00	1.00	1.00

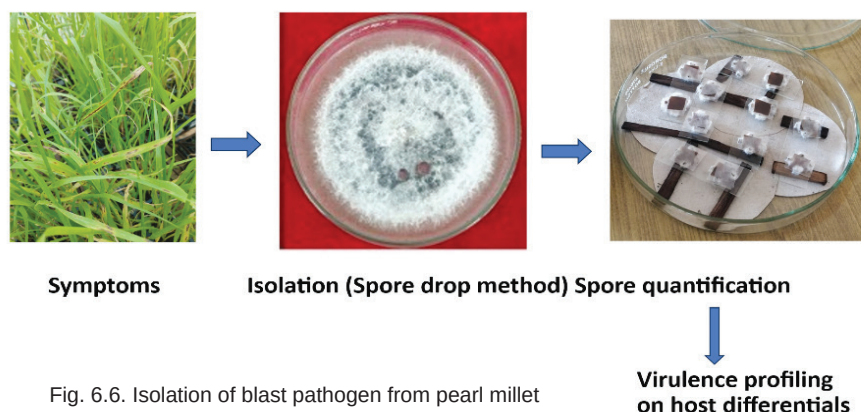


Fig. 6.6. Isolation of blast pathogen from pearl millet

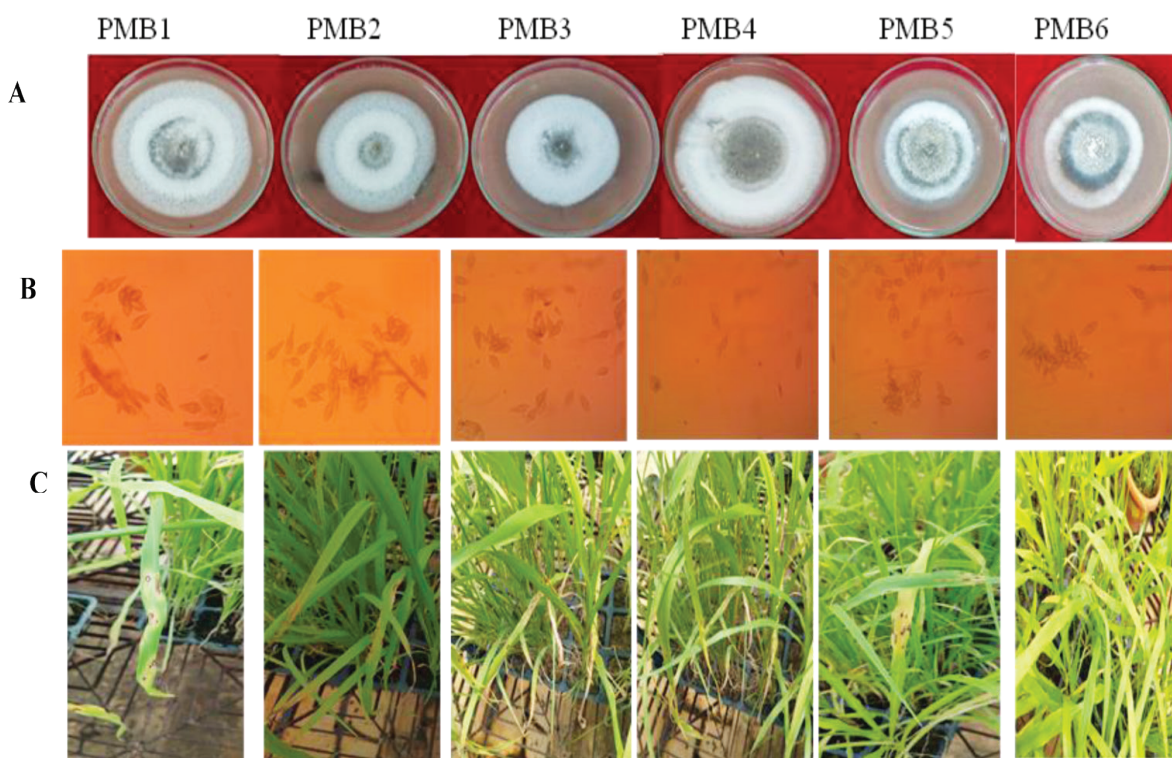


Fig. 6.7a. Virulence characteristics of *M. grisea* isolates from Pearl millet. A) Upper colony morphology, B) Morphology of conidia, and C) Symptoms on leaves 10 dpi

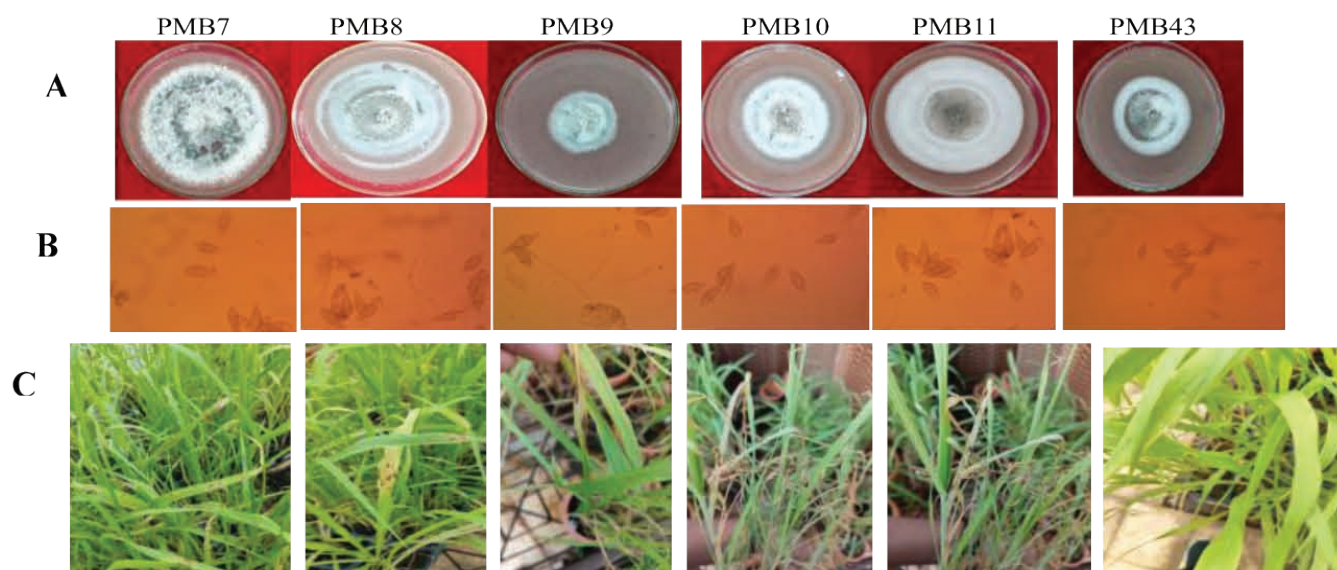


Fig. 6.7b. Virulence characteristics of *M. grisea* isolates from Pearl millet. A) Upper colony morphology, B) Morphology of conidia, and C) Symptoms on leaves 10 dpi

IIMR/CPT/2021-2026/151: Virulence and host plant resistance studies on important diseases of millets (PI: IK Das)

Identification of blast resistance in finger millet genotypes with diverse maturity group

A panel of 120 lines consisting of germplasm, breeding stock, mutants and cultivars were evaluated under replicated field trials with artificial inoculation for finger and neck blast resistance. As per flowering time the genotypes could be grouped as early (<70 days), medium (70-80 days) and late (>80 days). All the early flowering genotypes recorded considerably more finger blast (FB) mean 84.0% and neck blast (NB) mean 34.4% compared to medium (FB mean 64.7% and NB mean 19.6%) and late flowering (FB mean 33.5% and NB mean 6.9%) genotypes. In this panel there was no finger blast resistant ($\leq 10\%$) or moderately resistant ($\leq 20\%$) genotype in early flowering category and there was only one moderately resistant genotype (IE4671) in medium duration category (Fig. 6.8).

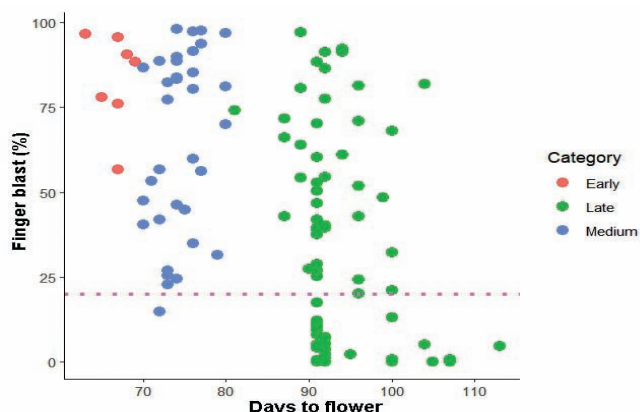


Fig. 6.8. Variation for finger millet blast among different maturity groups

Balancing charcoal rot resistance in high yielding rabi sorghum cultivars

A study was undertaken to establish the relationship between traits associated with CR resistance and yield. This multi-environment (multi location) study analysed genetic variation and relationships among the major traits associated with CR resistance namely, CR index (CRI), CR lesion length (LL), and lodging (LOG); and

yield namely, grain yield (GY), stover yield (SY), and harvest index (HI) in popular rabi sorghum cultivars. The objective was to identify cultivar(s) that balance(s) stability and performance for both CR resistance and yield traits with set of eight cultivars tested across eight environments in India during the post-rainy seasons. Most of the traits showed significant positive correlations with each other ($p < 0.05$ to $p < 0.001$) (Fig. 6.9). AMMI analysis of variance revealed highly significant ($p < 0.001$) genotypic (G), environmental (E), and $G \times E$ interaction effects for all the traits. Based on performance on mean and stability, the top two genotypes in AMMI analysis were CSV26 and CSV29R (Table 6.5).

Analysis using the multi-trait stability index (MTSI) identified the cultivar CSV26 for combined performance on mean and stability, as well as stability alone, whereas CSV29R was identified for performance on mean alone (Fig. 6.10). Among the eight tested cultivars, CSV26 was identified as the best genotype for performance on mean and stability in AMMI analysis, multi-trait stability index (MTSI) analysis, and based on predicted mean values in best linear unbiased prediction (BLUP).

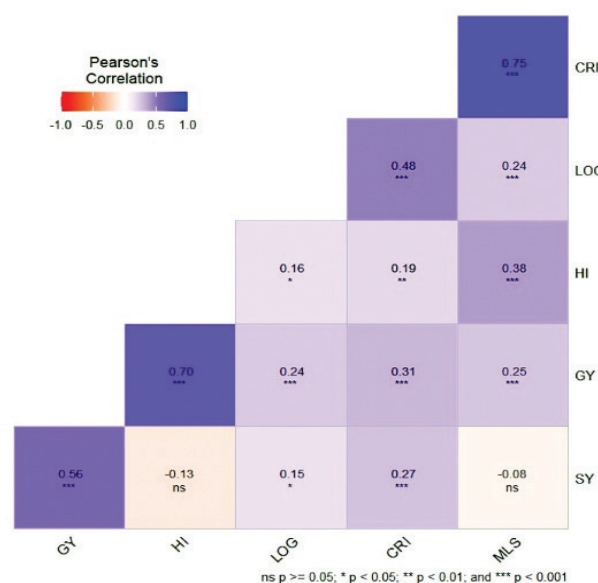


Fig. 6.9. Correlation coefficients between charcoal rot and yield related traits of eight post-rainy sorghum cultivars.

Table 6.5: Mean, modified AMMI stability value (MASV) and MASV rank (in parenthesis) for charcoal rot and yield traits of eight post-rainy sorghum genotypes

Genotype	Charcoal rot traits					
	Charcoal rot index		Lesion length (cm)		Lodging (%)	
	Mean	Stability	Mean	Stability	Mean	Stability
CSH15R	21.9(5)	4.8(2)	22.7(7)	1.3(1)	21.3(6)	5.9(7)
CSV22	19.6(3)	16.5(8)	21.6(4)	8.4(8)	21.9(7)	4.0(6)
CSV26	19.7(4)	1.1(1)	18.6(2)	1.3(2)	18.0(2)	2.0(1)
CSV29R	19.5(2)	14.6(6)	20.7(3)	5.8(5)	20.8(4)	3.0(4)
M35-1	23.3(7)	13.8(5)	22.0(5)	7.3(7)	20.1(3)	2.2(2)
Phule Mauli	22.8(6)	12.1(4)	22.2(6)	5.1(4)	23.4(8)	3.2(5)
Phule Anuradha	24.7(8)	15.2(7)	24.7(8)	6.9(6)	20.8(5)	6.7(8)
E36-1	15.6(1)	11.4(3)	15.2(1)	2.8(3)	15.4(1)	2.8(3)

§Calculated as sum of the ranks on mean or stability of all the traits of the genotype. AMMI= Additive Main effects and Multiplicative Interaction, MASV= Modified AMMI Stability Value.

Yield trait						Multi-trait rank on means and stability §	
Grain yield (kg/plot)		Stover yield (kg/plot)		Harvest Index (%)		Mean	Stability
Mean	Stability	Mean	Stability	Mean	Stability		
0.83(2)	6.2(6)	2.28(5)	1.8(6)	26.6(2)	6.2(6)	27	28
0.78(6)	1.2(1)	2.37(4)	1.6(5)	23.6(7)	1.2(1)	31	29
0.79(5)	3.4(5)	2.37(3)	0.9(3)	25.3(4)	3.4(5)	20	17
0.83(1)	10.1(8)	2.19(6)	0.7(1)	27.0(1)	10.1(8)	17	32
0.76(7)	1.4(2)	2.18(7)	2.1(7)	25.4(3)	1.4(2)	32	25
0.80(4)	2.2(3)	2.54(1)	1.2(4)	23.7(6)	2.2(3)	31	23
0.80(3)	2.5(4)	2.52(2)	2.6(8)	24.2(5)	2.5(4)	31	37
0.61(8)	6.9(7)	1.95(8)	0.9(2)	22.2(8)	6.9(7)	27	25

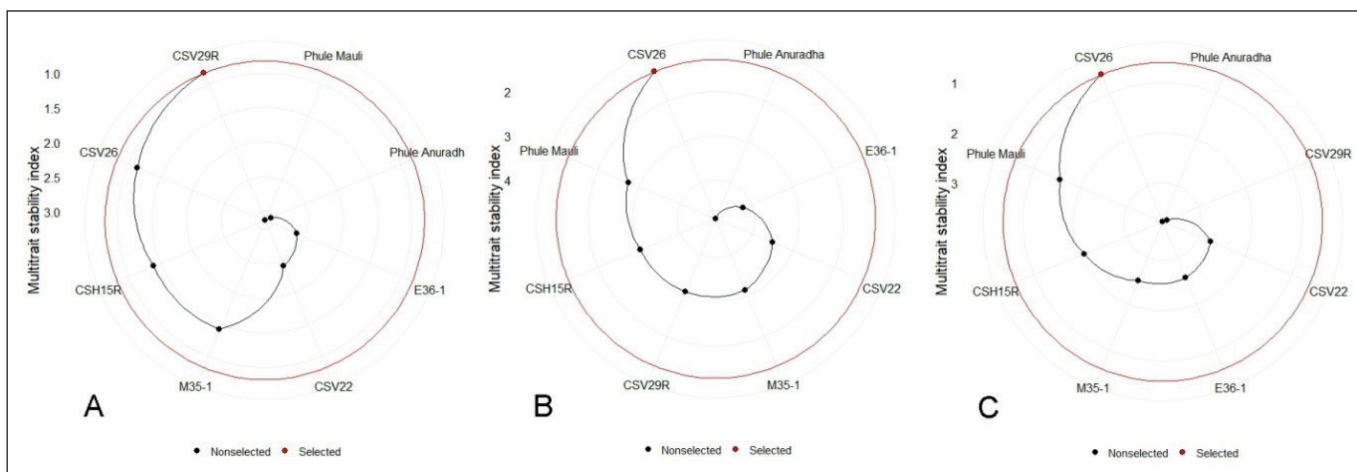


Fig. 6.10. Selection of genotypes based on multi-trait stability index (MTSI). A) 100% weightage on mean, B) equal weightage on mean and stability, and C) 100% weightage on stability.

IIMR/CPT2022-2027/159: Characterization, symptomatology and advanced diagnostics of viruses infecting millets (PI: Baswaraj R)

Viral disease incidence across the season and across the varieties on rabi sorghum

The incidence of viral diseases on rabi sorghum varied noticeably across seasons, where red stripe disease consistently showed its prevalence on higher side. The disease appeared in both kharif and Rabi and a peak was observed during Rabi 2022-23 and 2024-25. While there was a declined incidence during Kharif and summer seasons. Maize stripe and maize mosaic diseases were on low side across the seasons. The comparative evaluation of viral incidence on eight different released varieties of rabi sorghum revealed the dominance of Red stripe disease in comparison with maize stripe and maize mosaic diseases. The highest incidence red stripe was observed in Solapur Dagdi followed by Phule Vasudha and CSV-29 R whereas, Parbhani Moti recorded the lowest incidence. Overall, none of tested varieties were free from viral infection i.e., we don't find any resistance in the releases varieties particularly against Red stripe.

Influence of red stripe disease on morphological characters of rabi sorghum

A field trial was taken up during rabi 2024-2025

to know the impact of sorghum red stripe disease (SRSD) on morphological characters. Data clearly showed that the SRSD has a negative impact on the recorded morphological characters when compared with apparently healthy plants affecting overall plant performance. The disease has influenced more on reproductive parts (panicle and grain yield) over vegetative parts (leaves and stem). The disease has influenced more on reproductive traits by reducing the mean panicle length and mean panicle width thereby restricting the overall panicle development. Significant reduction was observed in yield related characters i.e., the reduction on mean panicle weight and also mean grain weight impacting the biomass accumulation followed by yield reduction.

Epidemiology: red stripe disease of sorghum and aphid vector progression

To study the influence or role of aphid vectors on the incidence of SRSD, a field studies was taken up during rabi 2024-25. The data suggest a strong association between aphid vector activity and disease development which are directly proportional. This gave a lead on identifying a crucial period to minimize crop losses by minimizing viral incidence which can be achieved indirectly by managing aphid vectors (Fig.6.11).

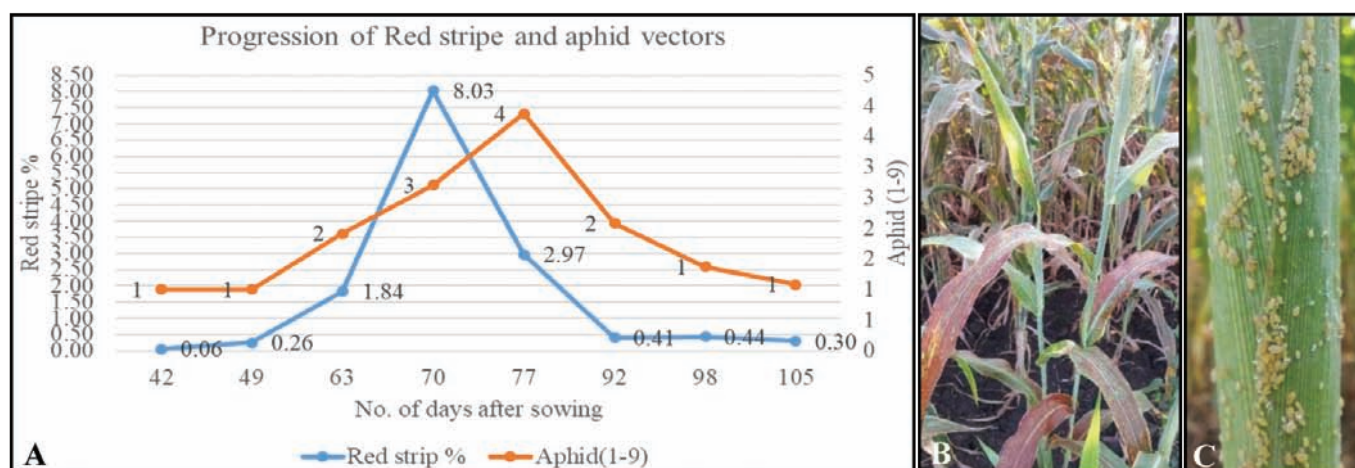


Fig. 6.11: Epidemiological study to understand the relationship between sorghum red stripe disease progression and aphid vector population (A) and the sorghum red stripe disease (B) with aphid

Viral disease incidence on foxtail millets and mechanical transmission studies

The data on the incidence of viral diseases in foxtail millets over the last three years across kharif and rabi seasons showed variation between both the seasons. Rabi season consistently showed higher viral incidence compared to kharif. Favorable environmental conditions coupled with insect vector population during rabi might be contributing factors for the higher viral disease incidence during rabi season. The suspected viral infected plants

(leaves) expressing continuous/ discontinuous chlorotic stripes/ band were used for mechanical transmission on to diagnostic hosts (*Nicotiana tabacum*). After two weeks, we could see the expression of necrosis along the veins in diagnostic hosts and at later stage the younger leaves expressed venial necrosis indicating systemic infection. This indicates the presence of viral pathogens in suspected leaf samples of Foxtail millet and also the successful transmission of virus particles on to diagnostic host (Fig.6.12).

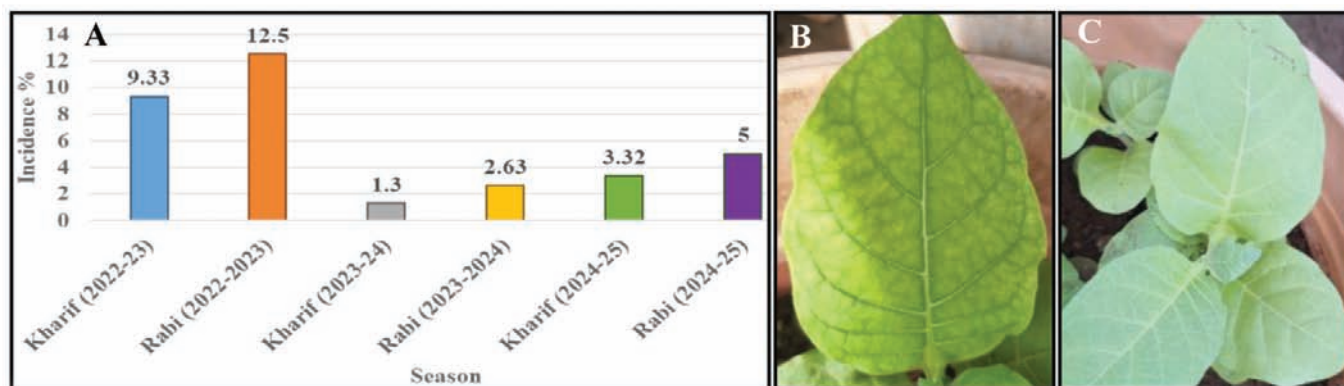


Fig. 6.12: Graphical representation on the scenario of viral disease incidence on foxtail millet across the season and over the years (A) and mechanical transmission of suspected viral pathogens on to diagnostic host *N. tabacum*, inoculated (B) and the healthy (C)

Viral disease in finger millet: Mechanical transmission and NGS viromics study

Chlorotic spots were observed on all along the leaves of finger millet. The symptoms were recorded and processed for mechanical transmission of suspected virus on to diagnostic host (*N. tabacum*) (Fig. 6.13). After two weeks *N. tabacum* expressed necrosis along the veins and the infection was observed on

young leaves indicating the possible presence of viral pathogen. Later, a non-targeted NGS approach was used to enumerate the viral pathogens in suspected leaf sample. Bioinformatics analysis of the sequenced data showed the presence of viruses belonging to three different families. Further, we need to identify specific viruses by wet lab analysis i.e., RT-PCR or RT-LAMP/RPA assays followed by sequencing the amplified fragments and its bioinformatics analysis.

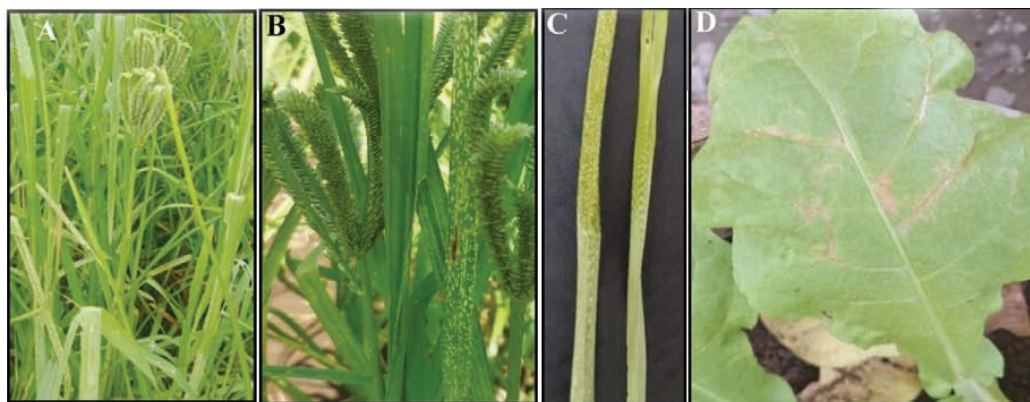


Fig. 6.13: Finger millet (A) leaf samples used for NGS analysis. Leaves expressing viral like symptoms i.e., chlorotic spots all along the leaves (B & C) and mechanical transmission of viral pathogens on to diagnostic host *N. tabacum* (D)

7.1 Agronomy

IIMR/CPD/2021-26/152: Improving water use efficiency of finger millet & foxtail millet under limited moisture conditions (PI: Swarna Ronanki)

Identification of water use efficient genotypes in finger and foxtail millet:

Lysimetric experiments were carried out with 29 foxtail millet and 42 finger millet genotypes under well-watered (WW) and water stressed (WS) conditions. The mean grain yield across foxtail millet genotypes ranged from 14.2 to 26.7g/plant in WW and 9.7 to 19.6 g/plant in WS conditions respectively (Fig. 7.1). Percent reduction

in grain yield and stover yield across genotypes due to WS treatment ranged from 2.8 to 51% and 2 to 34% respectively. Among the 29 foxtail millet genotypes evaluated, CO7, Prasad, CO1, CO 4 and K2 – with less than 6% yield reduction were identified as stable yielders under water stress. The mean grain yield across finger millet genotypes ranged from 43 to 21 g/plant in WW and 29 to 9 g/plant in WS conditions respectively (Fig. 7.2). Percent reduction in grain yield across genotypes due to WS treatment ranged from 8 to 61%. Among the 42 finger millet genotypes, MR1, ML 365, PR 202 and IIMR VL- 38-1 with less than 0.5 drought susceptibility index were identified as stable yielders under water stress.

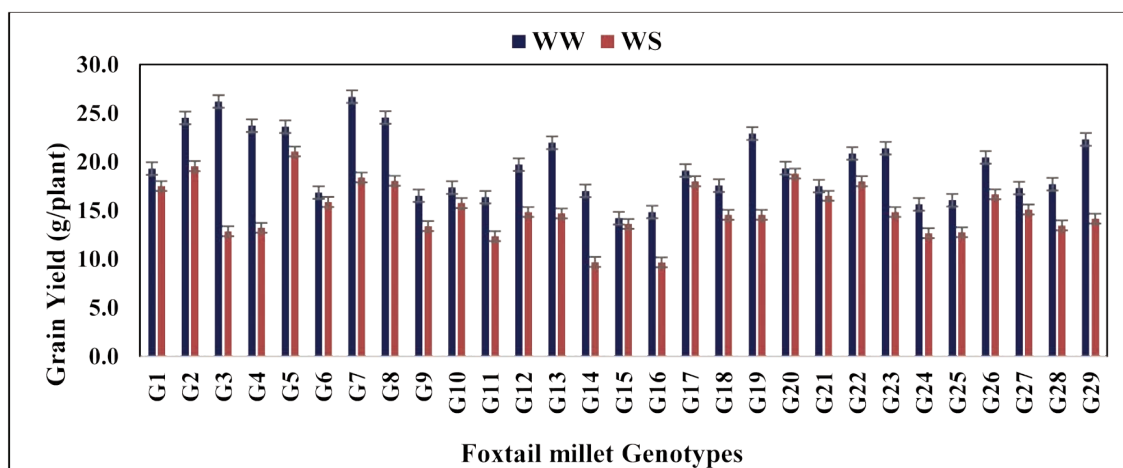


Fig 7.1. Yield performance of foxtail millet under well watered and water stress conditions

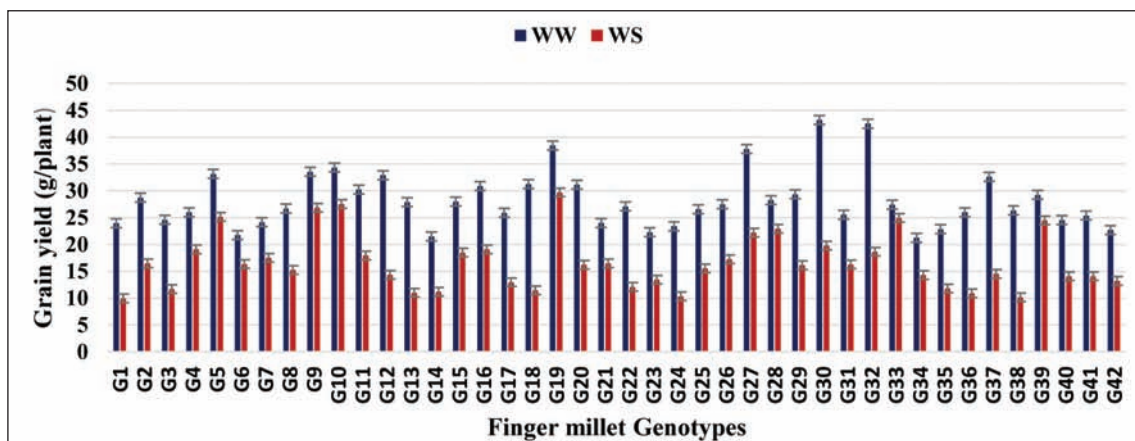


Fig 7.2. Yield performance of finger millet under well-watered and water stress conditions

Effect of hydrogel on growth and yield of foxtail millet under water stressed conditions

Application of hydrogel had a positive and significant effect on the productivity of foxtail millet. Grain yield increased steadily with rising hydrogel doses, from 1725 kg/ha in the control to 2200 kg/ha at 7.5 kg/ha, representing a 27% increase. Stover yield also improved, increasing from 3720 to 3950 kg/ha, indicating enhanced overall biomass production with hydrogel application (Table 7.1).

Table 7.1. Effect of hydrogel on grain yield, stover yield and harvest index of finger millet

Hydrogel Dose (kg/ha)	Grain Yield (Kg/ha)	Stover Yield (Kg/ha)	Harvest Index
0	1725	3720	31.7
2.5	2058	3820	35.0
5	2155	3941	35.4
7.5	2200	3950	35.8
SEm±	29.66	62.91	
CD (P=0.05)	104.27	221.91	

IIMR/CPT/2025-28/187: Assessment of environmental footprint of millets production, marketing and processing (PI: B Gangaiah)

Global Warming Potential (GWP) measured as Carbon Emission Equivalents (CEE) in kg/ha (using standard emissions for various inputs) involved in pearl millet and sorghum cultivation were estimated from a field study carried out during *kharif* 2025 at IIMR. The field study was carried out at terraces has different weed management treatments.

For land preparation (40 liters/ha) and threshing of panicles (10 liter/ha) diesel was used (CEE of diesel: 0.94 kg/ liter). A seed rate of 10 (sorghum) and 5 kg/ha (pearl millet) was used in the study (1 kg seed =0.25 kg CCE). A fertilizer dose of 80-17.5-33.2 kg N-P-K/ha was used and a CCE of 1.3-0.2-0.15 kg/kg N-P-K was taken. Pre, early-post and post emergence herbicides of Atrazine (0.75 kg a.i/ha), Tembotrione (0.08 kg a.i/ha) and 2,4-D-sodium salt (1.00 kg a.i/ha) have a CEE of 3.8, 1.7 and 1.0 kg/kg a.i. For plant protection against shoot fly and stem borer, carbofuron 3G (20 kg/ha) and chlorantraniliprole (60 ml/ha) were used in sorghum that have a CEE of 9 and 0.222 kg/ha. For knapsack sprayer petrol and drone spray battery charging, 0.75

and 0.35 kg CEE/ha/spray were used. Three irrigations were given for the crops and per irrigation, an electricity equivalent to 5 kg CEE/ha was taken. For the above inputs used in sorghum and pearl millet cultivation, C emissions were estimated.

From land preparation and threshing, 47 kg CEE/ha was generated. For seeds used for sowing, sorghum (2.5 kg CEE) has more CEE than pearl millet (1.25 kg CEE) on account of higher seed rate. Fertilizer application has the major contribution (112.54 kg/ha) to CEE (104-3.5-5.04 kg from N-P-K). Plant protection in sorghum has resulted in 9.222 kg additional CEE (that is not there in pearl millet). Three irrigations have contributed to 15 kg CEE/ha. Thus the field study indicates that C emissions from pearl millet cultivation are slightly (4.8%) lower than that of sorghum (193.3 kg CEE/ha) mainly on account of no emission from plant protection.

Regarding weed management, use of pre and post emergence herbicides through manual spray and drone spray have the highest CEE values 7.00 and 6.20 kg/ha (Table 7.2) while the early post emergence herbicide application has the least CEE values.

Table 7.2. Influence of weed management practices in sorghum and pearl millet on global warming potential

Treatment	Man power (no/ha)	Global warming potential (kg CEE/ha)
Weedy check (no weeding)	-	-
Hand weeding (HW), Twice	24	-
Pre-emergence herbicide (manual)	2	4.55
Pre-emergence herbicide (drone)	1	4.15
Early post-emergence herbicide (manual)	2	1.75
Early post-emergence herbicide (drone)	1	1.35
Pre & post emergence herbicides (manual spray)	4	7.00
Pre & post emergence herbicides (drone spray)	2	6.20



Extension Research, Economics and Value addition

8.1 Extension Research

IIMR/ER/2021-2026/156: Yield gap and constraints analysis of sorghum production in traditional area (PI: Chapke RR)

To determine yield gap at different levels, data on sorghum yields were collected from farmers of Udaipur and Rajsmand districts of Rajasthan directly and secondary sources on kharif sorghum of five years of 2016-17, 2017-18, 2023-24, 2024-25 and 2025-26. The Yield Gap (YG), Extension Gap (EG) and Technology Index (TI) of kharif sorghum production were computed (Table 8.1). During these five years of cultivation, Yield Gap-I which was between recommended and

demonstration yield was found to be 9.16 q/ha as technology gap, 7.62 q/ha as an extension gap and technology index of 33%, on an average. Value of technology index (TI) was 33 which need to be reduced by making technology more feasible to the farmers. Significant knowledge gap was found ($t=22.02^{**}$), inferring that beneficiary farmers had more knowledge compared to non-beneficiary farmers on improved practice. Crop damage by birds and animals was found to be top most serious constraint in sorghum production. and sustain sorghum production. The study also shows need of emphasizing on enhancing dissemination of improved technologies and adoption of the high yielding cultivars along with improved cultivation practices.

Table 8.1. Yield, extension gaps and technology index of rainy sorghum production

Year	Recommend- ed yield (q/ha)	Demonstra- tion yield (q/ha)	Farmers prac- tice yield (q/ha)	Increase over FP (%)	Technology gap (q/ha)	Extension gap (q/ha)	Technology Index (%)
2016-17	22.00	8.7	4.4	98	13.3	4.3	60
2017-18	28.00	11.8	6.4	84	16.2	5.4	58
2023-24	43.00	28.2	16.7	69	14.8	11.5	34
2024-25	22.00	21.0	17.6	42	1.00	3.4	05
2025-26	32.00	29.0	15.5	87	3.00	13.5	09
Mean	29.40	19.74	12.12	43	9.66	7.62	33

FP= Farmer's practices

Farmer FIRST Project on Participatory Technology Validation, Diversification, Value Addition for Small Holders Livelihood Improvement of Central Telangana Zone (PI: Chapke RR)

During 2025–26, the project implemented 12 crop technology interventions across 28 villages in Sangareddy district, Telangana, covering improved varieties of sorghum, pearl millet, finger millet, foxtail millet, barnyard millet, little millet, browntop millet, red gram, intercropping, and forage sorghum. Livestock interventions included maintaining and monitoring of Vanaraja poultry (12 families) and Nellore sheep (20

families), while enterprise activities involved assessing two flatbread-making machines and promoting millet processing facilities. Horticulture interventions introduced kitchen gardens (10 trials), and 90 trials on line sowing and moisture conservation were conducted under natural resource management were conducted. Capacity building was strengthened through pre-season trainings, field days, demonstrations, and regular advisories to 105 farmers via a WhatsApp group and the upgraded Millet FIRST mobile app. The integrated crop–livestock–enterprise approach demonstrated the potential of improved millet technologies and allied

enterprises to enhance productivity, reduce cultivation costs, improve resource use efficiency, and increase farmers' income in rainfed areas.

Frontline Demonstrations on rabi sorghum

A total 126 frontline demonstrations (FLDs) on sorghum were organized in five districts across three rabi sorghum growing states viz., Maharashtra, Karnataka, Telangana, and summer sorghum in Tamilnadu. Latest sorghum production technology viz., high yielding varieties; Parbhani Super Moti, Parbhani Shakti, SPV

2217 and SVT 55 (Tandur Jonna 1) along with moisture conservation technology (MCT), zero tillage cultivation were demonstrated and locally popular cultivar as a check in farmers' fields at different locations. The demonstrated rabi sorghum varieties gave 32% higher grain and 20% higher fodder yields than the local checks (Table 8.2). On an average, the demonstrated technologies could earn additional net returns of Rs. 60,706/- on the cost of Rs. 27,682/- per ha, which was 46 per cent (41%) than the local checks .

Table 8.2. Yield gap between the FLDs and local check (LC)

S. No.	Location	Grain yield (t/ha)			Stover yield (t/ha)		
		FLD	LC	Yield gap (%)	FLD	LC	Yield gap (%)
1	Parbhani	1.98	1.13	75	5.34	3.72	44
2	Akola	2.79	2.04	37	6.72	5.98	12
3	Dharwad	2.56	2.17	18	6.09	5.35	14
4	Tandur	1.94	1.69	15	4.86	4.21	15
	Mean	2.32	1.76	32	5.75	4.82	20

IIMR/ER/2022-26/161: Adoption and impact of improved millets production technologies in India (PI : Srinivas A)

A study was conducted in Vizianagaram and Visakhapatnam districts of Andhra Pradesh to assess the impact of FLDs on finger millet and little millet production technologies. Adoption of improved practices such as high-yielding varieties, field preparation, seed rate, spacing, nitrogen application, and disease management increased by more than 40%, with disease control recording the highest increase (58%). In finger millet, adoption of demonstrated technologies increased by 61%, resulting in 45% higher grain yield, 44% better grain quality, and 35% higher fodder yield compared to the pre-FLD stage. Similarly, little millet recorded 58% higher adoption, 42% higher grain yield, 40% improvement in grain quality, and 30% higher fodder yield. Increased productivity translated into 47% higher net returns and a 20% increase in benefit–cost ratio in finger millet, while little millet achieved 44% higher net returns and a 25% increase in benefit–cost ratio. Farmers also expanded the cultivated area under finger millet by 15% and little millet by 12%. Of the 15 demonstrated technologies, eight practices were widely adopted, including improved varieties, seed rate,

spacing, timely sowing, nitrogen use, and pest and disease management. Major production constraints included labour shortages, inadequate irrigation, and pest and disease incidence, while price fluctuations and limited transport, processing, and storage facilities were key marketing constraints. The study highlighted the positive impact of FLDs on productivity, profitability, food and nutritional security, and farmer livelihoods, with many farmers continuing the improved practices even after project completion. It also emphasized the need to expand FLDs and strengthen extension efforts through demonstrations, field days, training programmes, and digital platforms to further enhance millet adoption.

IIMR/ER/2024-27/176 : Evaluating performance, impact, and sustainability of farmer producer organizations (FPOs) for strengthening millet value chain (PI: Sangappa C)

During 2025, ICAR-IIMR, Hyderabad disseminated millet technologies of 10.37 tonnes of millet seed with increased emphasis on foxtail, little, browntop, and proso millets (shown in Table 8.3). In comparison, 11.97 tonnes (11,968 kg) of seed were distributed in 2024, with higher share of sorghum and barnyard millet (shown in Table 8.4). The year-wise comparison (Fig. 8.1)

highlights a strategic shift toward small millets in 2025 (Outer circle), aligned with climate resilience, nutritional security, and emerging market demand. While sorghum dominated seed distribution in 2024 (Inner circle), the 2025 distribution shows increased shares of foxtail millet, finger millet (ragi), barnyard millet, little millet, browntop millet, and proso millet, reflecting ICAR-IIMR's emphasis on diversifying millet-based farming systems through FPO-led dissemination. This shift in farmer preference was driven by better agronomic suitability and improved market opportunities created through aggregation, processing, value addition, and digital market linkages. Foxtail millet emerged as the most preferred crop due to its short duration, rainfed suitability, low input requirements, and stable demand, while higher adoption of ragi was influenced by its nutritional value and better price realization through FPO-supported branded products. The reduced share of sorghum indicates cropping system diversification,

with farmers reallocating land toward high-value small millets offering lower costs, reduced water use, and premium prices above MSP.

FPO-led dissemination of millet technologies resulted in significant area expansion under millets (Fig. 8.2), demonstrating a strong multiplier effect. Distribution of 7,829 kg of jowar seed expanded cultivation by 2,609.7 acres, 4,950 kg of foxtail millet by 2,475 acres, 4,582 kg of barnyard millet by 2,291 acres, 3,195 kg of little millet by 1,597.5 acres, and 1,925 kg of proso millet by 962.5 acres. Browntop millet showed high area conversion efficiency despite lower seed quantities, underscoring its suitability to marginal and rainfed environments and strong farmer preference. The observed shift toward small millets, expansion of cultivated area, and wider geographical coverage confirm the growing acceptance of millets as climate-resilient, nutrition-rich, and economically viable crops.

Table 8.3 Dissemination of millet technologies 2025

Dissemination of millet technologies-2025 (in Kgs)									
State	Jowar	Bajra	Ragi	Foxtail	Proso	Barnyard	Little	Browntop	Fodder Sorghum
AP	500	0	1100	940	0	200	60	30	0
Telangana	150	0	150	100	50	250	100	0	0
Karnataka	600	0	0	840	249	248	229	238	100
Odisha	250	100	50	250	250	458	290	260	20
UP	10	100	10	10	10	10	10	10	10
NEH	95	0	100	510	20	160	30	30	700
KVKs	50	30	50	10	0	100	50	0	0
Total	1655	230	1460	2660	579	1426	769	568	830

Table 8.4 Dissemination of millet technologies 2024

Dissemination of millet technologies -2024 (in Kgs)									
State	Sorghum	Bajra	Ragi	Foxtail	Proso	Barnyard	Little	Browntop	Fodder Sorghum
AP	1500	50	226	500	126	150	646	0	400
Telangana	250	10	150	120	50	50	100	20	0
Karnataka	820	0	326	910	450	1166	346	0	408
Odisha	120	20	160	50	20	220	100	30	0
UP	100	0	20	20	20	100	18	20	0
NEH	600	50	150	100	50	160	26	0	120
KVKs	500	50	20	20	10	120	150	50	0
Total	3890	180	1052	1720	726	1966	1386	120	928

Comparison of Millet Seed Distribution to Stakeholders between 2024-25)

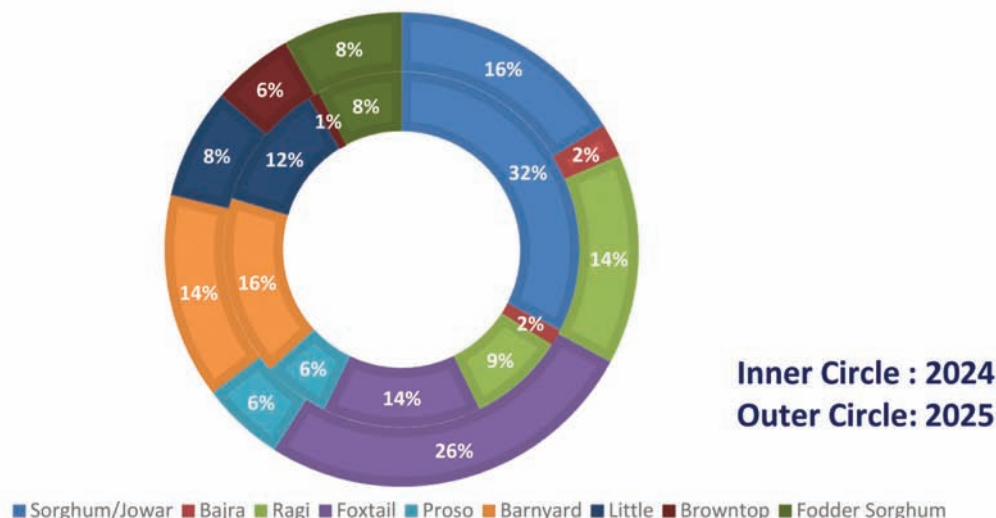


Fig 8.1: Comparison of Millet Seed Distribution to Stakeholders between 2024-25

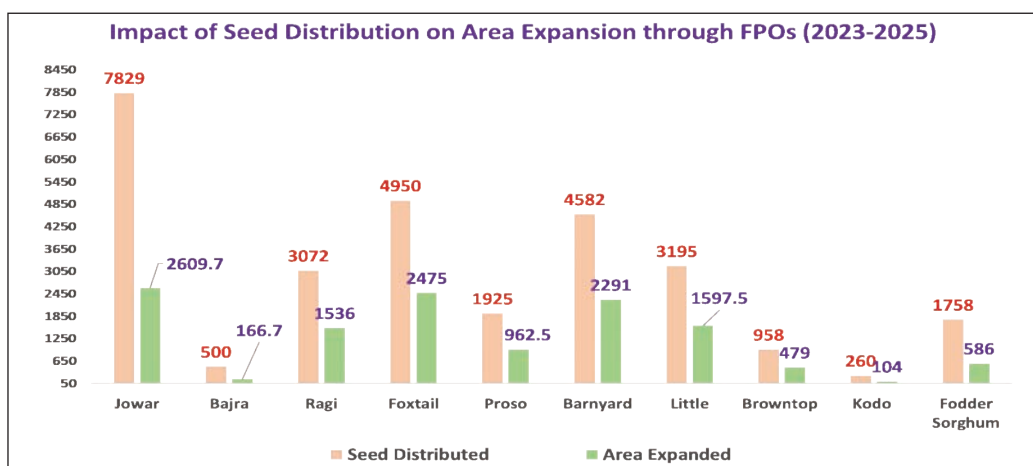


Fig 8.2: Impact of seed distribution on area expansion from 2023-25

Formation and Promotion of 10,000 FPOs under CSS Scheme of NABARD AP FPO Project & SFAC FPO Projects (PI : Dr.Sangappa)

Under the NABARD Andhra Pradesh FPO Project and SFAC Millet FPO Project, ICAR–Indian Institute of Millets Research (ICAR-IIMR), Hyderabad strengthened millet value chains through Farmer Producer Organizations (FPOs). Over the last five years, 47.5 tonnes of quality millet seeds were distributed through FPOs, KVKs, and government departments, contributing to a 39.5%

increase in millet cultivation area in FPO villages and improving local seed availability through seed multiplication initiatives (Fig 5.7).

The programme emphasized capacity building through 22 training programmes per FPO on millet production, post-harvest management, processing, quality control, and enterprise development. Additional activities such as field days, crop diversification programmes, and cooking demonstrations promoted millet cultivation and consumption.

To address post-harvest challenges, ICAR-IIMR supported the establishment of key infrastructure, including 11 Millet Primary Processing Units, 21 Paddy Processing Centres, 8 aggregation units, 18 Custom Hiring Centres, and 5 cold storage units. These interventions enabled aggregation, processing, and collective marketing, increasing millet prices received by farmers from ₹1,800–2,600 per quintal to ₹2,800–3,200 per quintal. Value-added millet products fetched 30–40% higher prices than raw produce.

Market access was further enhanced through marketing agreements, onboarding FPOs onto the Open Network for Digital Commerce (ONDC), and promoting inter-FPO collective marketing. As a result, average farmer income increased by 63%, 71% of farmers gained employment opportunities, and participation of tribal farmers and Self-Help Groups (SHGs) improved. Overall, the ICAR-IIMR millet FPO model (Fig 5.8) demonstrated a scalable approach to improving farmer incomes, market access, nutrition security, and the sustainability of millet-based farming systems.

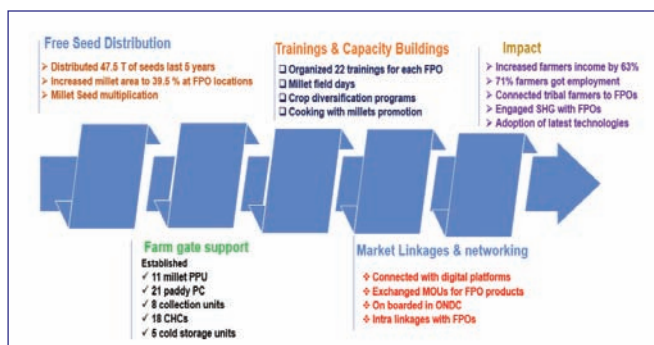


Fig 8.3 Impact of Millet FPOs on the Livelihoods of Farmers

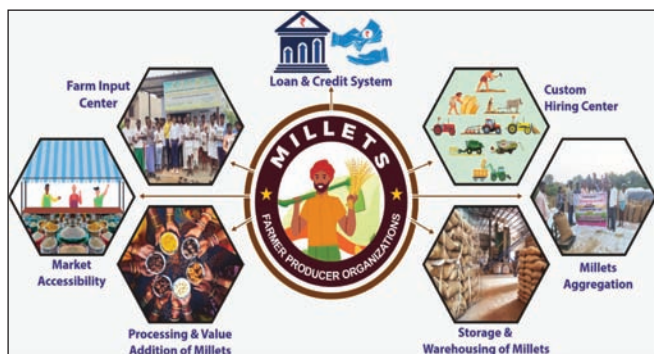


Fig 8.4 Millet Model developed by ICAR-IIMR, Hyderabad for Millet FPOs

8.2 Economics

IIMR/EVA/2020-2025/136: Economic analysis of production, marketing, Utilization and policy perspectives of sorghum in India (PI: Anuradha Narala)

Analyzed Total Factor Productivity (TFP) of pearl millet in Gujarat and Uttar Pradesh by using DES, GOI data (Includes both Kharif and Rabi) from 1991-92 to 2021-22. The Divisia-Tornqvist index or translog index was used in this study for computing the total output, total input, and TFP indices. Total factor productivity is the change output growth is not due to change in input growth, it is due to non-conventional factors such as research, extension, education, infrastructure, rainfall etc. the total factor productivity estimates in Pearl millet crop in Gujarat indicates that there is substantial growth with fluctuations in TFP. In case of Uttar Pradesh the TFP registered growth rate of 1.93 percent per annum during 1991-92 to 2021-22, the research and extension contributions were the reasons for positive TFP growth (Table 8.5 and Table 8.6).

Table 8.5: Annual growth rates in output, input use, and TFP growth in pearl millet from 1991-92 to 2021-22 (In Percent) in Gujarat

S. No	Period	Total output	Total input	TFP
1	1991-92 to 2004-05	0.59	-1.65	0.77
2	2005-06 to 2021-22	0.98	0.45	1.12
3	1991-92 to 2021-22	1.72	-1.45	2.01

Table 8.6: Annual growth rates in output, input use, and TFP growth in pearl millet from 1991-92 to 2021-22 (In Percent) in Uttar Pradesh

S. No	Period	Total output	Total input	TFP
1	1991-92 to 2004-05	5.04	2.02	0.84
2	2005-06 to 2021-22	1.62	3.12	1.40
3	1991-92 to 2021-22	4.58	3.65	1.52

To examines the integration of bajra markets across four major regional markets in Rajasthan, viz., Alwar, Barmer, Jaipur and Jodhpur markets were selected based on significant commodity arrivals. The monthly wholesale prices of bajra spanning from January 2019

to December 2023 were analyzed. The co-integration analysis demonstrated price linkages among these regional markets, indicating spatial integration. The Granger causality tests revealed that the price of the Alwar market influences the prices of these markets. Similarly, the Jaipur market exhibited unidirectional causality towards the Barmer and Jodhpur markets.

To measure the resource use efficiency of sorghum cultivation, Cobb-Douglas type of production function

was used. Primary data was collected from Karnataka and Maharashtra. Regression coefficient of manure cost, fertilizer cost, seed cost and plant protection chemicals cost included in the model were positive and significantly influencing the gross returns. Coefficients of machine cost and hired labour cost were negative indicates the negative relationship with gross return but effect of machine cost was found to be non-significant (Table 8.7).

Table 8.7: Estimated Cobb-Douglas production function coefficients in kharif sorghum cultivation

Particulars	Variable	Regression coefficient	t-value	P-value
Intercept	a	5.5675* (2.1041)	2.693	0.008
Manure cost	X1	0.2659* (0.0862)	2.734	0.007
Fertilizer cost	X2	0.3079* (0.0958)	3.224	0.001
Seeds cost	X3	0.3124*(0.1255)	2.647	0.009
Machine cost	X4	-0.1027NS(0.1461)	-0.723	0.471
Plant protection chemical cost	X5	0.2830* (0.0546)	4.630	1.27E-05
Hired labour cost	X6	-0.2012**(0.0933)	-2.164	0.033
Returns to scale ($\sum b_i$)		0.8327		
R ²		0.641		

Figures in parenthesis indicate standard errors

*Significant at 1 per cent level

**Significant at 5 per cent level

Markov Chain analysis of finger millet was analyzed at country level and in Karnataka to study the direction of changes in cropping pattern by using First order Markov Chain approach. The LP Solve IDE 5.5.05 software was used for the purpose. Transitional probabilities were computed based on a linear programming (LP) technique of crop area from 2014-15 to 2023-24. The results revealed that the Ragi probability of area retention was very low and may go to major share of area gone to the sugarcane (89.6%) followed by paddy (10.4%). Ragi gained 1.9% of area from Bajra and 3.6% from Oilseeds. In Karnataka, Ragi probability of retention was also low and major share of ragi area was replaced by pulses (51.1%) followed by paddy (25.9%), oil seeds (16.4%) and maize crops (6.6%). Ragi gained major share from maize crop (31.8%) and pulses (9.7%). Also, analyzed decadal growth and instability of area under small millets between 1966 and 2022. For the country the area under small millets drastically declined during the study period. State-wise decadal growth rate of production under small millets reveals that during

all decades overall, the country witnessed a negative growth except in the first decade 1966-75 and recent decade (2006-2022). However, yield witnessed growth during all decades. Highest growth was observed during the last decade with 4.30 percent. Madhya Pradesh registered highest significant productivity growth among the growing states (10.63 %). Overall instability ranged between 6 percent to 10 percent during the all decades.

8.3. Value addition and Commercialization

IIMR/VAE/2025-28/184: Development of suitable pre-processing and processing protocols for enhancing usability of millets and evaluation of the storage stability of the developed food products (PI : Vikas Kumar)

Caramelized sorghum puffs were developed using optimized combinations of sorghum puffs, butter, and either sugar or jaggery to formulate value-added ready-to-eat snack products. Different formulation ratios were standardized while maintaining a uniform level of leavening agent to ensure desirable expansion and

texture (Fig. 8.5). Both sugar- and jaggery-based coatings were prepared through controlled caramelization and uniformly applied to the puffs to achieve proper glazing and binding. The developed products were evaluated for their physicochemical properties, color characteristics, texture profile, and structural stability. The type of sweetener significantly influenced the overall product quality, particularly in terms of color development, caramelization intensity, crispness, and structural integrity. Sugar-coated variants exhibited lighter appearance and clean sweetness, whereas jaggery-coated samples showed enhanced browning,

characteristic flavor, and improved binding properties due to natural caramel and mineral components. The developed products remained shelf-stable for up to 60 days under ambient storage conditions when packaged in laminated aluminum pouches.

Overall, the study successfully standardized the process for producing caramelized sorghum puffs with desirable texture, appearance, and stability. The findings indicate strong potential for commercialization of both sugar- and jaggery-based variants as nutritious, shelf-stable, and marketable millet-based snack products suitable for large-scale production.

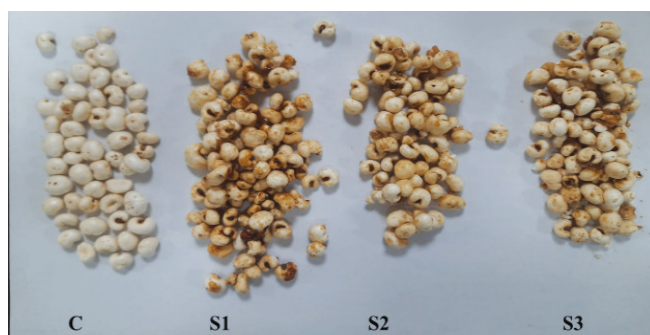


Fig. 8.5 Standardization of sugar and jaggery coated caramelized sorghum puffs

Development and Evaluation of Flaked and Puffed Sorghum Millet-Based Instant Kheer Mix

Instant kheer mixes were developed using sorghum in two different processed forms, namely sorghum flakes and sorghum puffs, resulting in two separate formulations. Sorghum flakes and puffs were incorporated at different levels as the major ingredient respectively while sugar and dairy whitener were adjusted accordingly to obtain the desired sweetness and creamy consistency (Fig 8.6). Almond and cardamom were added in fixed quantities to improve flavor, aroma, and nutritional quality.

The use of sorghum in flaked and puffed forms provides

functional advantages in instant food formulations. Sorghum flakes contribute to better hydration and a thicker texture during reconstitution, whereas puffed sorghum provides a light structure that allows rapid rehydration and quick preparation. The incorporation of almond and dairy whitener enhances the protein content and overall nutritional value of the product. Sensory attributes such as appearance, flavor, texture, and overall acceptability were important considerations, and the addition of almond and cardamom imparted a pleasant nutty taste and characteristic aroma similar to traditional kheer.



Instant Kheer Using Flaked Sorghum



Instant Kheer Mix Using Puffed Sorghum

Fig 8.6 Flaked and Puffed Sorghum Millet-Based Instant Kheer Mix

Resolving gaps in scaling of millets value chain for technical backstopping micro-units under PMFME and NAIF-ABI (Agribusiness Incubation) projects (PI: Dayakar Rao B [Till 31st May] and J. Stanley [1st June onwards]).

Effect of Millet Cultivars on Glycemic Index and Load in Type 2 Diabetic Subjects

This study assessed the glycemic index (GI) and glycemic load (GL) of various millet-based foods, including jowar roti, barnyard millet tomato rice, foxtail millet recipes, and ragi ambali, in individuals with Type 2 Diabetes Mellitus (Fig. 8.7). Conducted over 90 days, the study aimed to identify low-GI millet foods that could replace high-GI staples like refined rice and wheat. A

key dietary intervention involved the use of jowar roti as a one-meal replacement, owing to its nutritional benefits and low glycemic response.

The results showed variation in GI across foods, with barnyard millet tomato rice having the lowest GI (38), jowar roti and foxtail millet-based recipes showing moderate GI (52–63), and ragi ambali exhibiting the highest GI (86). The optimized jowar roti (GI $\approx$ 52) proved suitable for diabetic diets. After 90 days of consuming millet-based foods, especially jowar roti, participants showed significant improvements in glycemic control, including a reduction in HbA1c levels from 8.27 to 7.16. Additional benefits included improved postprandial glucose response, better fasting glucose levels, and



Fig. 8.7 Food provided for clinical study

improved lipid profiles. These findings confirm that specific millet foods, particularly jowar roti, are effective for long-term diabetes management.

Development of gluten-free barnyard millet noodles

In the present investigation, ten gluten-free (GF) noodle formulations (T1–T10) were developed utilizing heat-moisture treated barnyard millet flour in combination with gums, arrowroot powder, and varying proportions of psyllium husk, amaranthus, and oats flour through a sheeting and cutting process. Particle size distribution analysis of the constituent ingredients revealed significant differences, which were found to influence the cooking characteristics of the noodles (Fig 8.8). Colour measurements indicated that the developed GF noodles exhibited significantly lower lightness values compared to the control. Functional properties such as water absorption and peak viscosity showed an increasing trend, particularly with the incorporation of 10% psyllium husk. Among the formulations, T9 recorded superior nutritional attributes, including

crude protein (9.18%), crude fat (6.69%), total ash (2.42%), and crude fibre (12.64%), along with a high overall sensory acceptability score of 8. The findings demonstrate the potential for developing nutritionally enhanced and organoleptically acceptable barnyard millet-based GF noodles using the sheeting and cutting technique. Furthermore, the study highlights the novelty of employing barnyard millet in GF noodle production, in contrast to previous studies predominantly based on rice or starch matrices processed via cold extrusion.

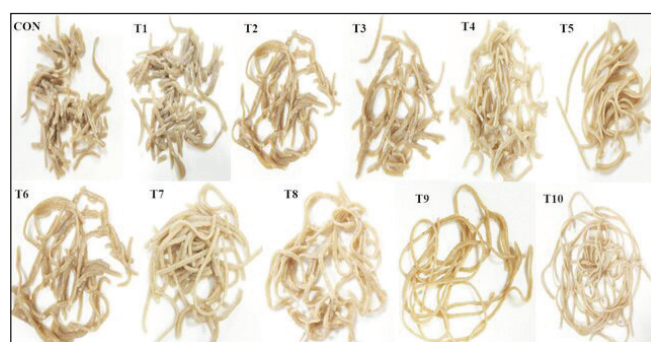


Fig. 8.8 Cooked samples of developed gluten-free noodles

Technologies Developed and Commercialized:

A total of 19 value-added millet-based technologies

have been developed and are being successfully commercialized financial year 2025–26.

New product technologies developed during 2025-26 at Nutrihub, ICAR-IIMR



Browntop Millet Rice



Sorghum Millday Biscuits



Finger Millet Jaggery Cookies



Sorghum Mil-Lite Biscuits



Foxtail Millet Instant Idli Mix



Sorghum Mil-Bite Biscuits



Finger Millet Premium Cashew Cookies



Finger Millet Peanut Delight Bar



Barnyard Millet Gluten-Free Pasta



Sorghum Pizza Base



Pearl Millet Namkeen (Chivda)



Multimillet Eggless Muffins



Sorghum Burger Bun



Sorghum Fruit Cake



Wheat Multi Millet Jaggery Bread



Sorghum Soft Pretzel



Pearl Millet Pizza Base



Sorghum Heat-and-Eat Roti



Jowar Cookies (Sugar Free)

IIMR/VA/2023-26/170 : Development of novel products with different texture characteristics and biodegradable films for packaging of value-added millet products (PI : Hema Shankari P)

Starch extracted from millets possesses adhesive, binding, and film-forming properties that make it suitable for biodegradable film production. These starch-based films can serve as sustainable alternatives to petroleum-based plastics, thereby reducing environmental pollution. Starch was extracted from major millets (sorghum, pearl millet, and ragi) and minor millets including foxtail,

proso, barnyard, kodo, little, and browntop millets.

FTIR analysis used to identify functional groups present in native and modified millet starches revealed typical starch structure and provided information on chemical variations among millet varieties that may influence film-forming properties. The thermograms showed three stages of degradation: moisture loss, decomposition of starch polymers, and formation of residual carbon. Sorghum starch showed maximum degradation at around 325°C with initial degradation starting near 280°C which indicate adequate thermal stability of millet starch for biodegradable film applications.

Field Emission Scanning Electron Microscopy (FESEM) revealed that starch granules were spherical, polygonal, or round with an average diameter of about 41.6 µm. X-ray diffraction analysis showed that millet starch is semi-crystalline with both crystalline and amorphous regions. Sorghum starch exhibited an A-type crystalline pattern with characteristic peaks around 15°, 18°, and 24° (2θ), indicating the presence of ordered crystalline structures formed mainly by amylopectin.

The fibrous residue (thippi) exhibited higher oil absorption capacity than starch and protein fractions. This property indicates the ability of starch to interact

with lipids and contribute to improved texture and flavor retention in food products.

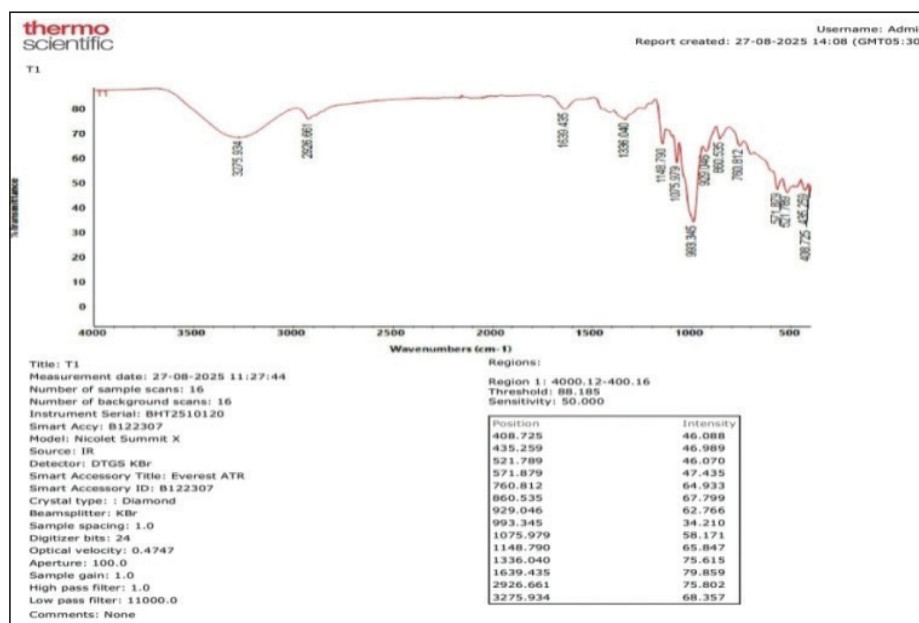


Fig. 8.9 Fourier Transform-Infrared Radiation graph of sorghum starch

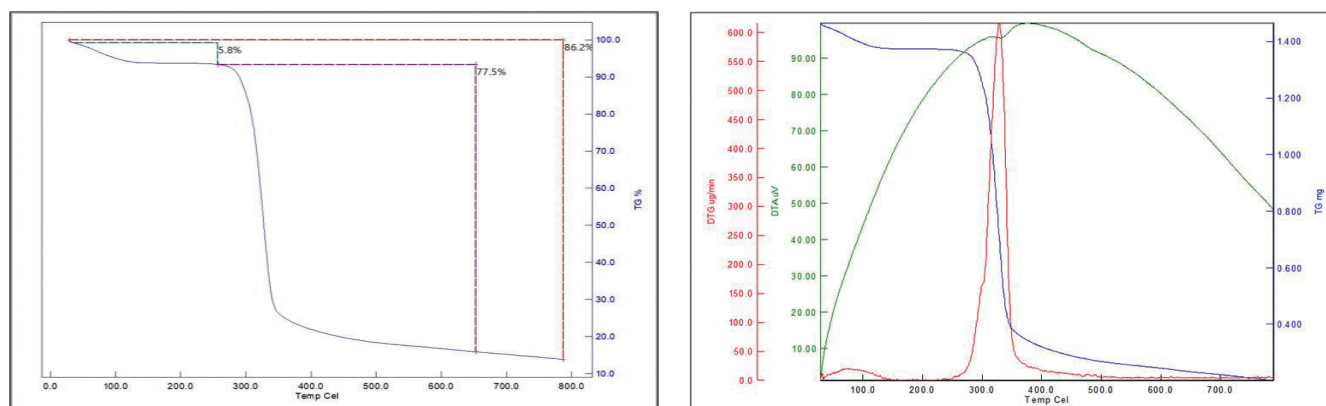


Fig. 8.10 Thermo-graphimetric graph of the sorghum native starch for its suitability for biofilm formation

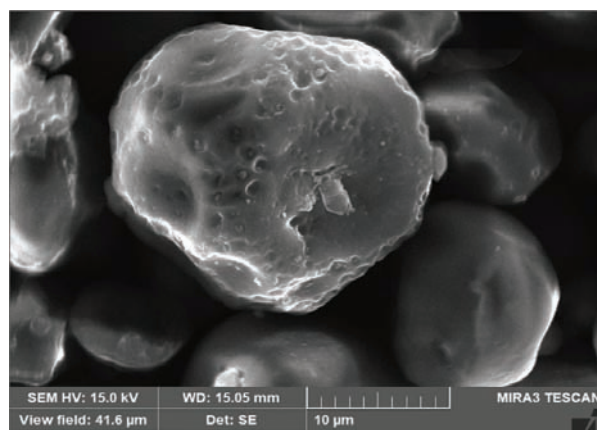


Fig.8.11 FESEM graph of sorghum starch

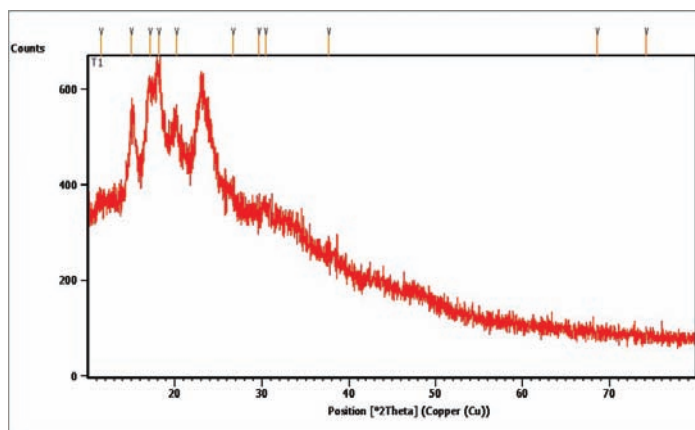


Fig. 8.12 XRD graph of sorghum millet starch

Global Centre of Excellence on Millets (Shree Anna)

IIMR/GC/2023-26/171A: Global centre of excellence on millets (Shree Anna) (Director & All Scientists)

The ICAR-Indian Institute of Millets Research (IIMR) in Hyderabad has been designated by the Government of India as the Global Centre of Excellence on Millets (Shree Anna), marking a pivotal step to advance millet cultivation, processing, and research. Honourable Prime Minister Shri. Narendra Modi inaugurated the centre on March 18, 2023, at the Global Millets (Shree Anna) Conference in New Delhi, coinciding with the launch of the International Year of Millets. The initiative aims to facilitate advanced research, innovation, and dissemination of knowledge in millets, highlighting their nutritional value, climate resilience, and economic importance. The centre will strengthen global collaborations, build capacities of researchers and stakeholders, and promote millet cultivation, processing, and value addition. By fostering a network of experts and supporting farmers, industry, and policymakers, the Global Centre of Excellence on Millets seeks to position millets as a sustainable, nutritious, and economically viable crop, contributing to food security and climate-smart agriculture worldwide.



The Hon'ble Prime Minister of India, Shri Narendra Modi declaring the Indian Institute of Millets Research of ICAR as a Global Centre of Excellence during The Global Millets (Shree Anna) Conference at New Delhi on 18 March 2023

Major Components:

1. Establishing global germplasm medium-term storage facility to strengthen millets Gene-Bank for conservation, trait-specific characterization and utilization of millet biodiversity for crop improvement
2. Global Technology Innovation Centre for trait, seed and crop Improvement of millets for enhancing yield and productivity
3. Nutri-cereal analytical, food safety and quality assurance National Referral Laboratory for millets
4. Global Centre of Excellence for Millet Value Chain for Entrepreneurship, Incubation and Start-up Nurturing
5. Establishment of International knowledge, skill development and capacity enablement Centre with International Millet Museum & Halls of Residence
6. Global facility for Millet Pilots on feed, fodder, biofuels, malting, brewing and promotion of industrial utilization of millets
7. Regional Millet Technology Innovation and Outreach Hubs

Salient progress on various components

Component 1: Establishing a Medium-term Germplasm Storage Facility to Strengthen Millets Gene Bank for Conservation, Trait-specific Characterization and Utilization of Millet Biodiversity for Crop Improvement

Germplasm characterization and evaluation

Set of 1,629 small millet germplasm accessions (finger, foxtail, proso, little, and kodo) were characterized for qualitative traits and in addition 953 proso millet accessions from ICAR-NBPGR were characterized for quantitative traits including grain yield and test weight. Based on the morphology and geographical diversity, set of 192 kodo millet accessions was identified for trait association mapping study. In sorghum, 583 accessions were characterized/multiplied

Germplasm conservation

About 50000 millet accessions were conserved under medium-term storage at 4–7 °C at ICAR-IIMR gene bank, including sorghum, finger millet (8,057), pearl millet (4,765), foxtail millet (4,575), proso millet (1,463), barnyard millet (1,159), little millet (670), and kodo millet (1,500). sorghum accessions (2,122) received from PDKV, Akola and 900 sorghum accessions received from Washim location were conserved at ICAR-IIMR gene bank. Total of 4,305 new sorghum accessions were added to medium-term storage as part of germplasm management activities.

Registration of germplasm lines

Two sorghum germplasm and one each from finger millet and foxtail millet line were registered with ICAR–NBPGR, New Delhi.

Component 2: Technology Innovation Centre for Trait, Seed, and Crop Improvement of Millets for Enhancing Yield and Productivity

Pearl millet:

Whole genome sequencing of diverse CMS lines (A1–A5 systems) and R lines

High-quality genomic DNA was isolated and long-read sequencing libraries were prepared to generate approximately 20-40X genome coverage of CMS lines representing A1, A2, A3, A4, and A5 cytoplasms, along with their corresponding maintainer (B) and restorer (R) lines procured from national and international gene banks. whole-genome sequencing of 5 pearl millet restorer lines viz., PPMI 1239, HTP 03/13, J 2340, and H 77-2-202 generated about 25x long-read genome coverage. De novo genome assembly and comparative genomic analyses is in progress.

Cross-compatibility experiments of cytoplasmic male sterility systems in pearl millet

To assess the cross-compatibility of five CMS systems (A1 to A5) in pearl millet, 75A×R hybrids were developed from 15 female and 5 restorers. Multi-location trials of 75 A×R hybrids and parental lines were carried out at ICAR-IIMR, Hyderabad; ICAR-IARI, New Delhi; and (HAU), Hisar. Phenotypic evaluation for agronomic, flowering and yield-contributing traits is recorded to understand CMS-restorer interactions and their influence on hybrid performance and yield potential.

Genic marker development for important traits in pearl millet

Expression profiles of CMS A lines (HMS 37A, 411A, PB 407A, and Tift 23A), B lines (HMS 37B, 411B, and PB 407B), and R lines (PPMI 1239, PM-R-2021-91, and AC 04/13) at boot stage and the stigma emergence stage, followed by cDNA synthesis for downstream gene expression analysis of fertility-restorer (Rf) genes using specific primers. Expression profiling was conducted using seven Rf gene specific primers targeting pentatricopeptide protein, tetratricopeptide repeat (TPR)-like superfamily protein, and pentatricopeptide repeat-containing proteins, with relative expression levels estimated using the $\Delta\Delta C_t$ method followed by PCR amplification of 11 Rf gene-specific primers in test genotypes lead to identification of fertility-restorer (Rf) genes across CMS systems.

Molecular analysis of seed size genes in pearl millet

Two trait-specific primers targeting genes encoding Glyco_hydro_17 domains associated with seed size were designed for relative gene expression analysis in pearl millet. Relative gene expression will be estimated from 12 genotypes representing contrasting seed-size groups, comprising large-seeded genotypes (411B, ICMB 982222, PB 408B, ICMB 97111, HMS 74B, and PM-FZ-25) and small-seeded genotypes (H77/833-2-202, J-2340, HTP 03/13, HBL 11, PM-FZ-7, and HMS 37B). using the $\Delta\Delta C_t$ method based on Ct value quantification, and expression profiling with these two seed-size-specific primers are in progress.

Identification of drought tolerance genotypes from the pearl millet association panel

Thirty two drought-tolerant genotypes was selected from phenotyping of 300 diverse genotypes by screening 10% and 20% polyethylene glycol (PEG) followed by enzymatic assays such as peroxidase (POD) and superoxide dismutase (SOD) assays leading to the identification of 11 tolerant and 5 sensitive genotypes under both control and drought treatments to investigate their antioxidant responses. Further tolerance to drought was confirmed by Nitroblue Tetrazolium (NBT) histochemical staining protocol for detecting superoxide radicals in root tissues of pearl millet under oxidative stress in drought-tolerant and susceptible pearl millet. The resulting superoxide radicals in root tissues were

visualized using the standardized NBT staining method. H₂O₂ levels in drought-resistant (PM-FZ-25) and drought-susceptible (PM-FZ-23) pearl millet genotypes revealed that drought conditions elevated H₂O₂ levels, with the susceptible genotype displaying higher levels than the resistant one, suggesting a more robust antioxidant defence in the latter (Fig 9.1).

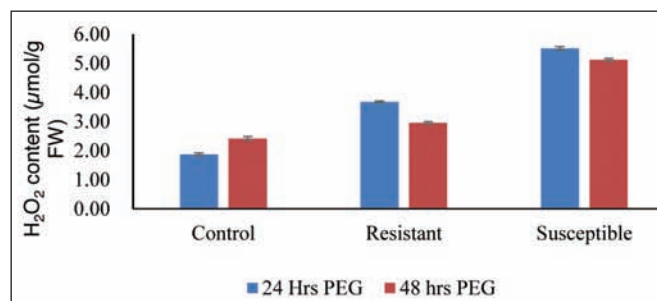


Fig 9.1: Levels of H₂O₂ in drought-resistant and drought-susceptible genotype

Comparative transcriptomic insights into drought tolerance in pearl millet

Genome-wide transcriptomic analysis from leaf and root samples of two inbred, ICMR 101205 (drought-tolerant) and ICMR 101580 (drought-susceptible) revealed 95,052 differentially expressed genes,

upregulated genes were associated with several key functions, including cell wall remodelling (Xyloglucan endotransglucosylase/hydrolase), stress signalling (Protein kinase domain-containing protein), and water transport (Aquaporin PIP2-1) (Fig 9.2 & 9.3). Downregulated genes were primarily linked to photosynthesis (PSI-G, Chlorophyll a-b binding protein) and lipid transport (Non-specific lipid-transfer protein). Key drought-responsive genes involved in photosynthesis (chlorophyll a-b binding protein, fructose-1, 6-bisphosphatase), signal transduction (Bet v 1 domain-containing protein), transcription regulation (bHLH and AP2/ERF transcription factors), and ROS scavenging (peroxidase, thioredoxin) were identified and primers were designed for RT-PCR and validation of those genes was completed through expression assay. Differential expression of genes related to secondary metabolism (amidohydrolase-related protein), nutrient uptake (ABC transporter), oxidative stress response (superoxide dismutase, WRKY transcription factor), and heat stress response (mitochondrial heat shock protein) were observed under control and drought conditions in pearl millet.

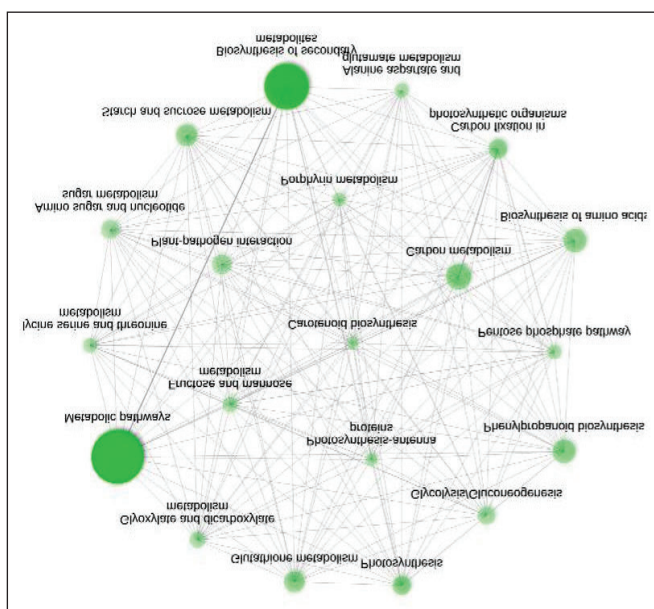


Fig. 9.2 KEGG pathway enrichment analysis of DEGs

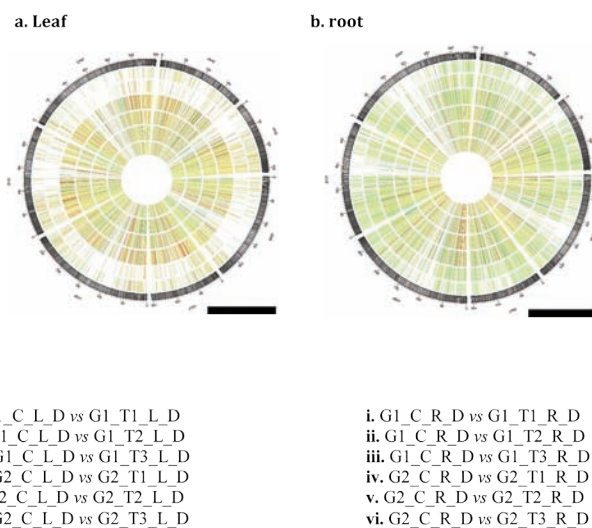


Fig. 9.3 Circos plot showing the genomic distribution of DEGs across chromosomes. The outermost track represents the chromosomes, while inner tracks display DEG density and specific gene locations. a) leaf b) root.

Genome-wide association mapping for foliar blast resistance in pearl millet

Genome-wide association study (GWAS) involving 281 diverse inbred lines conducted to understand the genetic basis of blast resistance in pearl millet identified 68 significant single nucleotide polymorphisms (SNPs) associated with blast resistance. Resistance-associated genomic regions were predominantly localized on chromosomes 1, 2, and 6, representing key hotspots for blast resistance. These regions harboured candidate genes involved in diverse defence-related mechanisms, including immune response, stress tolerance, signal transduction, transcriptional regulation, and pathogen defense. Key genes identified included 14-3-3-like proteins, RGA2, RGA4, hypersensitive response-induced proteins, NHL3, NBS-LRR, LRR-RLK, LRRNT_2, and several transcription factor families such as AP2/ERF and WRKY (Fig. 9.4). In addition, genes associated with transporter activity, redox homeostasis, and structural integrity were implicated, suggesting multiple complementary mechanisms underlying blast resistance.

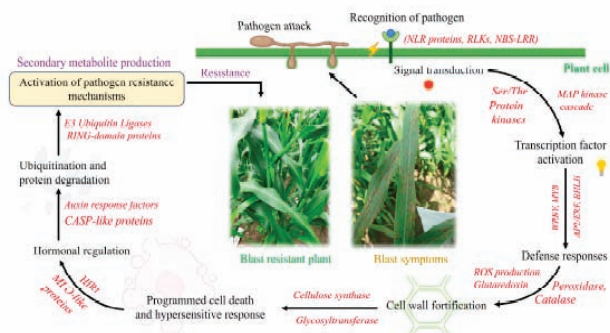


Fig 9.4: Mechanism of blast disease resistance in pearl millet

Standardization of speed breeding techniques

To facilitate rapid generation advancement for development of improved varieties in millets, speed breeding techniques (predominantly short day plants) is being optimized in pearl millet, sorghum, finger millet, little millet, and kodo millet by varying temperature, light, relative humidity and CO₂ concentration during vegetative and reproductive stages of crop growth (Fig. 9.5). During vegetative phase (temperature ranges between 30°C to 32°C during day and night temperature of 30°C, relative humidity 65%, CO₂

concentration of 400-450 ppm, light duration 22hr light 2hr dark and at reproductive stage temperature of 32°C at day time and night time 30°C, relative humidity 65%, CO₂ concentration: 400-450 ppm, light duration 8hr light and 16hrs dark at light intensity (800 $\mu\text{mol m}^{-2} \text{s}^{-1}$ (PAR) at high light intensity are being tested for standardization of techniques

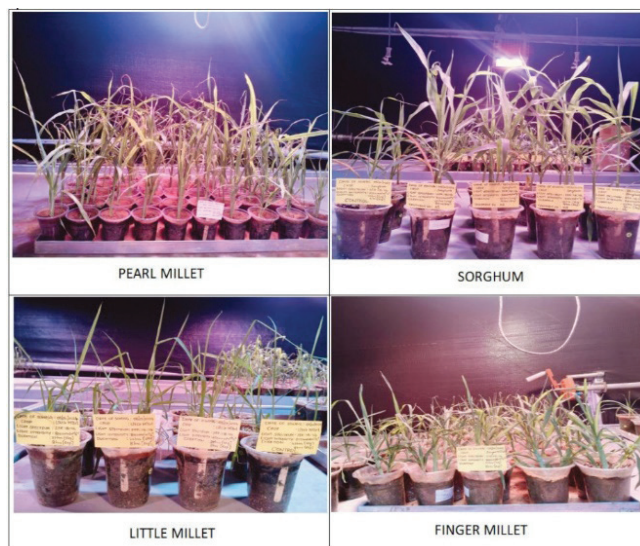


Fig. 9.5 Standardization of speed breeding techniques in different millets

Sorghum

Development of mid-density SNP panel to accelerate sorghum breeding

whole-genome resequencing data from public databases were retrieved for about 520 diverse sorghum accessions leading to ~76 million variants, including 62.8 million SNPs and 13.4 million indels, with a Ts/Tv ratio of 1.71, indicating high data quality. Concurrently, ~6000 reported QTLs governing agronomic, physiological, and stress-related traits were shortlisted to guide SNP selection for panel development. For validation of the variants in the panel, genomic DNA was isolated from ~250 genotypes of advanced breeding lines, B and R lines, diverse germplasm accessions for development of 4000–5000 highly informative mid-density SNP panel for breeding

Sorghum shoot fly genome assembly

High-coverage whole-genome sequencing was generated using long-read technology, achieving >100X coverage for female and ~80X coverage for male

shoot flies (Fig. 9.6). To improve genome assembly quality, short-read Illumina sequencing was performed producing 182 Gb of data for hybrid genome assembly. RNA sequencing libraries from both male and female shoot fly were prepared to construct a comprehensive whole-transcriptome map produced 18-25 million reads. In addition, molecular characterization and validation of shoot fly species using sorghum shoot-fly-specific primers are currently underway.



Fig. 9.6 Male and female shoot fly, infected plant

Comparative genomics of sorghum for identification of candidate genes conferring shoot fly resistance

To examine the molecular basis of host–pest interactions between sorghum and shoot fly, whole-genome sequencing of contrasting sorghum genotypes was initiated from one shoot fly–susceptible genotype (DJ 6514) and two shoot fly–resistant genotypes (IS 2205 and IS 18551), followed by the preparation of high-quality genomic libraries and long-read whole-genome sequencing, generating approximately 25× genome coverage for identifying genomic regions, candidate genes, and molecular mechanisms underlying shoot fly resistance in sorghum.

Finger millet

Identification of Fe and Ca-responsive genes in finger millet using transcriptome approaches

Genome-wide transcriptome profiling was performed on 48 samples in IC0621996 (low Ca–Fe) and IC0473957-1 (high Ca–Fe) under different Fe and Ca stress conditions using RNA-Seq, generating approximately 200 GB of high-quality raw sequencing data. Differential expression and pathway analyses revealed ~ 23,000 differentially expressed genes (DEGs), with over 100 key DEGs consistently associated with Fe and Ca regulation pathways, and alignment rates reaching up to 95.20% in leaf and root tissues under control

conditions. Transcriptome analysis of IC0621996 (low Ca–Fe) and IC0473957-1 (high Ca–Fe) identified several candidate genes involved in Fe and Ca homeostasis, including FRO7, VIT1, IRT2, ferritin 4, CAX-interacting protein 2, annexin 3, CBL-interacting protein kinase 3 (CIPK3), CDPK34, and FER-like regulators. Functional annotation and pathway analysis of these candidate genes were carried out, followed by expression validation of 45 key genes through RT-PCR using the $\Delta\Delta C_t$ method (Fig 9.7).

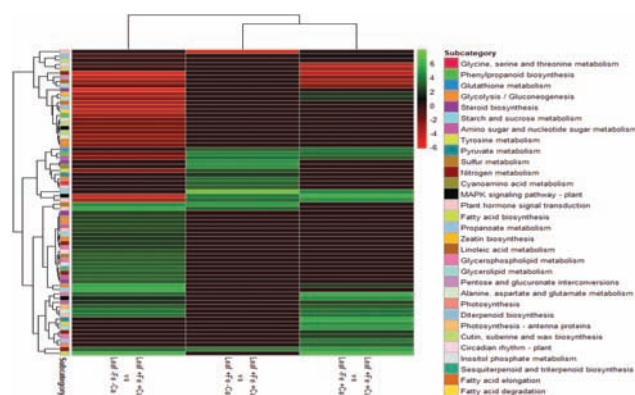


Fig 9.7 Heat map illustrating DEG's involved in Ca and Fe homeostasis in finger millet

Little millet

De-novo assembly of a high-quality reference genome for little millet

A complete genome sequence of little millet provides a foundation for identifying beneficial alleles for crop improvement. A high-quality reference genome of little millet was assembled and the genetic basis of grain micronutrient concentration was investigated. Using PacBio Hi-Fi, long-read sequencing and Hi-C sequencing, we assembled a nearly complete genome of little millet line JK-8, consisting of 18 chromosomes and 59,045 genes. Eleven chromosomes were assembled from telomere to telomere, revealing an ~850 Mb tetraploid genome closely resembling broomcorn millet. Comparative analyses indicate early diploidization, characterized by gene loss and subgenome-specific expression biases across genes and tissues. Genomic features, genomic collinearity, grain nutritional composition and LD plot are given in Fig. 9.8 to Fig. 9.11.

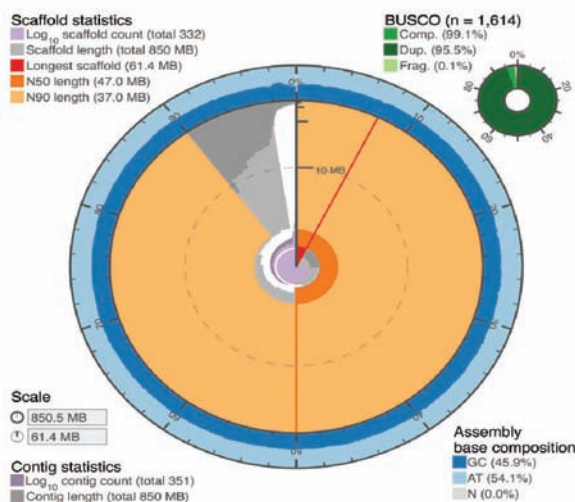


Fig. 9.8 Snail plot displaying genomic features. Light gray color (log10 scale) at the center indicates scaffold counts, while dark gray marks scaffold lengths

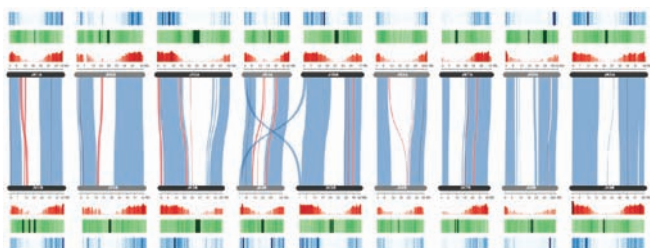


Fig. 9.9 SynVisio plot visualizes genomic collinearity between the two sub-genomes A and B of little millet through linked ribbons that connect conserved regions

Genome-wide association study for micro-nutrient accumulation in little millet

Diversity panel of 300 little millet germplasm accessions were phenotyped at two locations (ICAR-IIMR, Hyderabad and GKVU-UAS, Bengaluru) for seven micronutrient contents (Fe, Ca, Zn, P, K, Mn and Mg) and genotyped with 249,511 markers from resequencing. Significant markers–trait associations were identified for grain micronutrient traits, including several associated with high iron content. SNPs, Chr1A_560273 and Chr2A_32889668, were found to contain genes involved in iron metabolic pathways. Twenty reductase genes were identified in the JK-8 genome, including Psum.JK8.1r.7Ag009450 and Psum.JK8.1r.7Bg009660. Accessions with significantly higher micronutrient content can be directly incorporated into breeding pipelines to develop nutritionally enriched varieties.

Identification of candidate genes for iron fortification offers opportunities for advanced genetic interventions, such as gene editing or transgenic approaches, to further enhance micronutrient concentration.

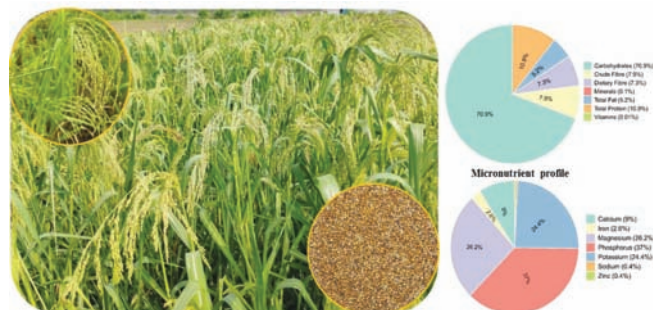


Figure: Overview of little millet crop and its grain nutritional composition.

Fig. 9.10: Overview of little millet crop and its grain nutritional composition

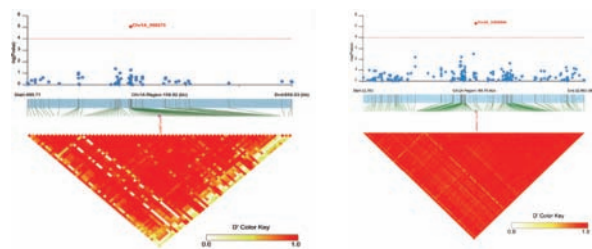


Fig. 9.11 Heat map illustrates the linkage disequilibrium blocks spanning 100 kb flanking regions of Fe-associated SNP markers Chr1A_560273 and Chr2A_32889668.

Kodo millet

Kodo millet de novo sequencing and comparative genomics of RK390-25

The genome of kodo millet (*Paspalum scrobiculatum*) cultivar RK390-25 was *de novo* sequenced and assembled. Optical mapping generated 2.28 Gb of data, resulting in a BioNano assembly comprising 30 scaffolds with a total size of 850 Mb. Gene prediction and annotation identified 133,861 genes, including 49,204 single-exon genes. Additionally, 51.39 Gb of Hi-C data from 341,279,064 reads produced a 900 Mb assembly distributed across 91 scaffolds, with a longest contig of 56.09 Mb, an N50 of 45.35 Mb, and an L50 of 9. The hybrid assembly was resolved into 20 chromosomes, including 10 completely assembled chromosomes. Furthermore, long-read sequencing of cultivar RK390-25 generated 28.85 Gb of data, providing approximately 14× genome coverage

Assessment of agronomic traits in kodo millet GWAS panel across diverse environments

Multi-location evaluation of a kodo millet GWAS panel comprising 305 diverse genotypes were taken up at ICAR- IIMR, Hyderabad, Surat and Vizianagaram locations. Phenotyping was carried out for key agro-morphological and yield-related traits (Fig. 9.12). In addition to these traits, grain nutritional quality parameters such as iron (Fe), calcium (Ca), and zinc (Zn) content are being quantified from harvested samples across all three locations. The phenotyping data will be integrated with high-density genotypic data to identify marker–trait associations governing agronomic performance, yield components, and micronutrient accumulation in kodo millet. Furthermore, short-read sequencing of these 305 association panel genotypes is currently in progress



Fig. 9.12 Panicle diversity of the kodo millet RK 390-25 and diverse panel

Barnyard millet:

Association mapping of smut resistance and nutritional traits in barnyard Millet

Phenotyping of a barnyard millet GWAS panel comprising 200 genotypes for smut resistance and nutritional traits is being taken up in collaboration with VPKAS, Almora. Data on key agronomic traits including grain and green fodder yield were generated from 200 germplasm lines, advanced breeding lines F_4 and F_5 populations of barnyard millet.

Component 3: Nutri-cereal Analytical, Food Safety and Quality Assurance National Referral Laboratory for Millets.

Metabolite profiling for Fe/Zn in diverse pearl millet lines

The metabolite profiling of selected pearl millet genotypes differing in grain iron (Fe) and zinc

(Zn) concentrations was conducted using LC–MS. 1,941 plant-specific metabolites spanning diverse biochemical classes were detected of which eight metabolites directly or indirectly involved in Fe and Zn metabolism—including nicotianamine, mugineic acid, ferroportin, citrate, malate, ferritin, heme/heme-related metabolites, and phytate were shortlisted for detailed evaluation to understand their role in micronutrient accumulation. Multivariate statistical analyses revealed clear discrimination between high-Fe/Zn and low-Fe/Zn genotypes. Key metabolite analysis showed that both genotypes and metabolites clustered distinctly into groups favouring either high or low Fe and Zn accumulation (Fig. 9.13). Notably, heme and heme-related metabolites had a significant influence. Higher levels of free heme was associated with low Fe and Zn accumulation, whereas siroheme showed an opposite, favorable association with higher micronutrient content.

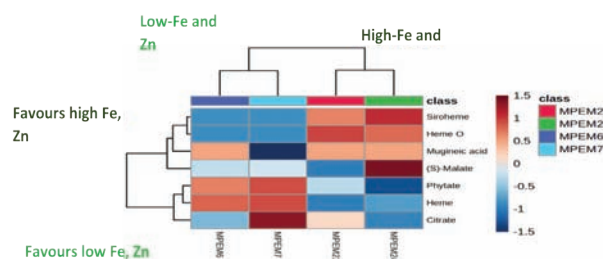


Fig. 9.13 clustering of genotypes based on metabolite profiling

Evaluation of total flavonoid content in dehulled grain extracts of diverse kodo millet germplasm

The total flavonoid content (TFC) in the dehulled grain extracts of 84 kodo millet germplasm lines ranged from 0.23 to 3.58 mg/g. Among the germplasm lines, GPLM 505, GPLM 514, GPLM 520, and GPLM 522 exhibited higher TFC values compared to the check samples.

Dissecting rancidity in pearl millet through comparative metabolomics analysis of contrasting lines

Untargeted LC-MS and GC-MS–based metabolomic analysis of high- and low-rancid inbred lines post-milling revealed significant accumulation of fatty acyls, unsaturated fatty acids like Palmitoleate, cis, trans-hepta-2,4,6-trienoic acid and 10-Hydroxy-3,7-dimethyl-2E,6E-decadienoic acid and fatty aldehydes like 10,12-hexadecadienal, 9Z,11E,13-Tetradecatrienal, 10E,12E,14E-Hexadecatrienal, glycerophospholipids,

and lipid oxidation products, particularly in the high-rancid line (Fig. 9.14 and Fig. 9.15). Elevated levels of oxidation-prone unsaturated fatty acids and secondary oxidation products such as aldehydes and ketones were associated with increased rancidity, whereas the low-rancid line retained higher levels of antioxidant flavonoids and phenolic compounds. Based on the pattern of the changes in content of metabolites using LC-MS analysis, Palmitate, 10,12-hexadecadienal, 3-Hexenol, 1,2-tricosanediol, Biochanin A 7-O-(6-O-

malonyl-beta-D-glucoside), Cyanidin-3-(p-coumaroyl)-rutinoside-5-glucoside, 6,8-dihydroxy-octanoic acid, 12-Hydroxyhexacosanoic acid, 2-Oxoglutarate, Delphin, Cyclokievitone, Biochanin A 7-O-(6-O-malonyl-beta-D-glucoside) were identified as the rancidity markers for pearl millet. These metabolite signatures provide potential biochemical markers for early detection of rancidity-prone genotypes and offer a foundation for metabolomics-assisted breeding of rancidity-resilient pearl millet varieties.

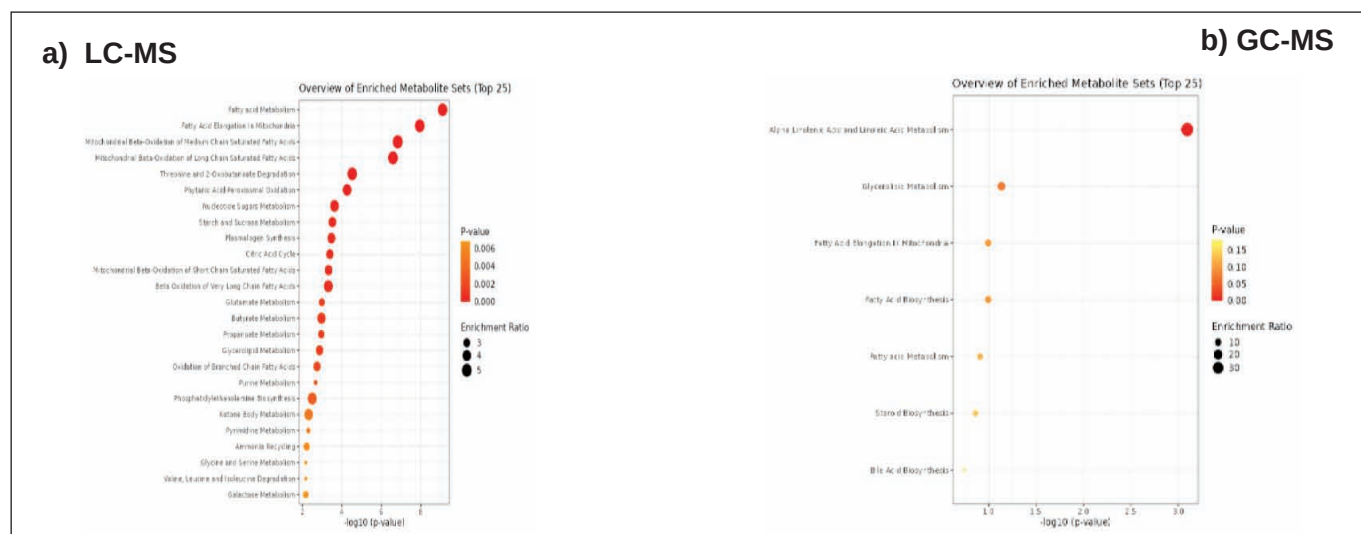


Fig. 9.14 Enrichment analysis of differentially accumulated metabolites in high and low rancidity pearl millet inbred lines, based on (a) LC-MS and (b) GC-MS data.

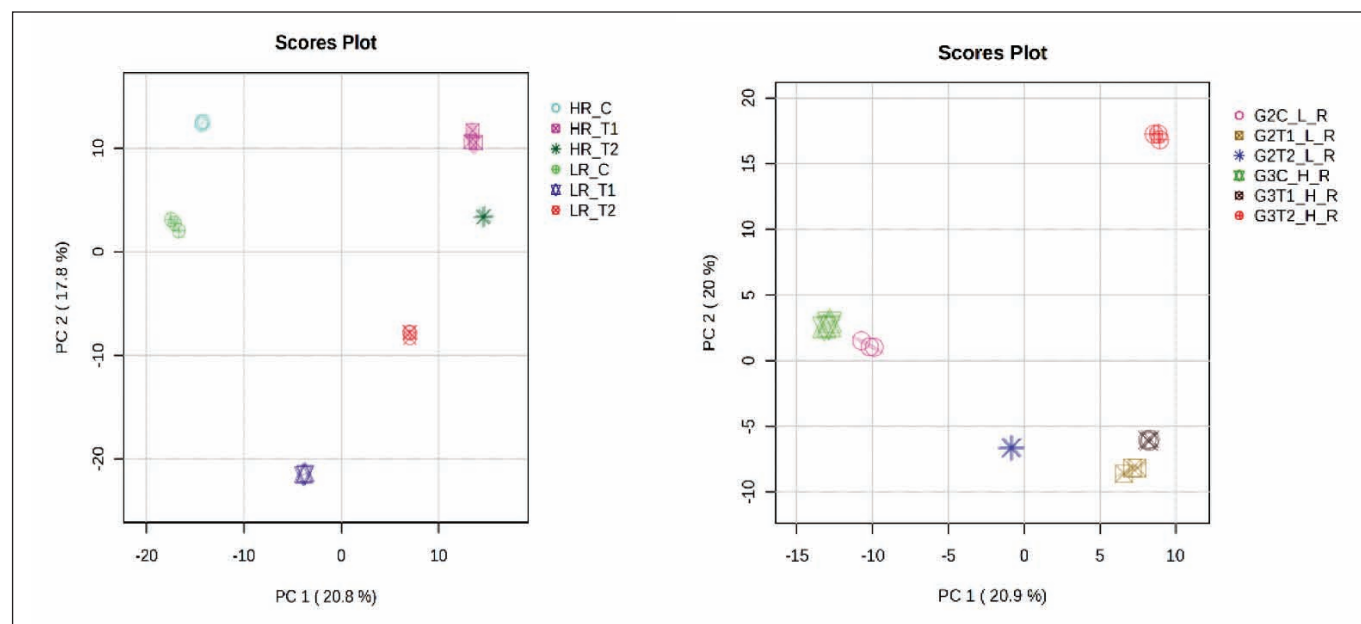


Fig. 9.15 Principal component analysis of metabolite profiles in high and low rancid pearl millet lines

Elucidation of changes upon processing in coloured sorghum grains: Untargeted metabolomics-based approach

Biochemical changes and comparative metabolite diversity upon hydrothermal treatment, malting and fermentation were elucidated in sorghum varieties, CSV41 (white), CSV50 (red) and PYPS2 (yellow). Dietary fibre in sorghum was found to be unaltered upon the three treatments. Malting and fermentation were found to reduce the antinutrient, phytic acid. *In vitro* protein digestibility (IVPD) was significantly reduced ($p < 0.05$) upon hydrothermal treatment while fermentation enhanced IVPD in both CSV 41 and PYPS-2. Fermentation significantly enhanced the total flavonoid content (TFC) and DPPH radical scavenging activity in all the three sorghum varieties.

Untargeted metabolomics and the downstream analysis in Metaboanalyst 6.0 revealed presence of metabolites belonging to lipids, amino acid and its derivatives, phenolic acids, flavonoids, tannins, vitamins, terpenoids among others. The treatments caused significant changes in the metabolites including the phenolic and flavonoid compounds that impart bioactivities to these grains. These included kaempferol 3-O-beta-D-glucosyl-(1->2)-beta-D-glucoside, isorhamnetin, cyanidin 3-O-(6-O-p-coumaroyl) glucoside among others in CSV 41, chlorogenate, cyanidin 3-O-rutinoside, malvidin-3-(p-coumaroyl)-rutinoside-5-glucoside among others in CSV 50 and cyanidin-3,5,3'-tri-O-glucoside, kaempferol 3-O-beta-D-glucosyl-(1->2)-beta-D-glucoside among others in PYPS-2. Volcano plot analysis revealed the differentially accumulated metabolites in each treatment in comparison with its unprocessed control and the details are as given in fig.9.16

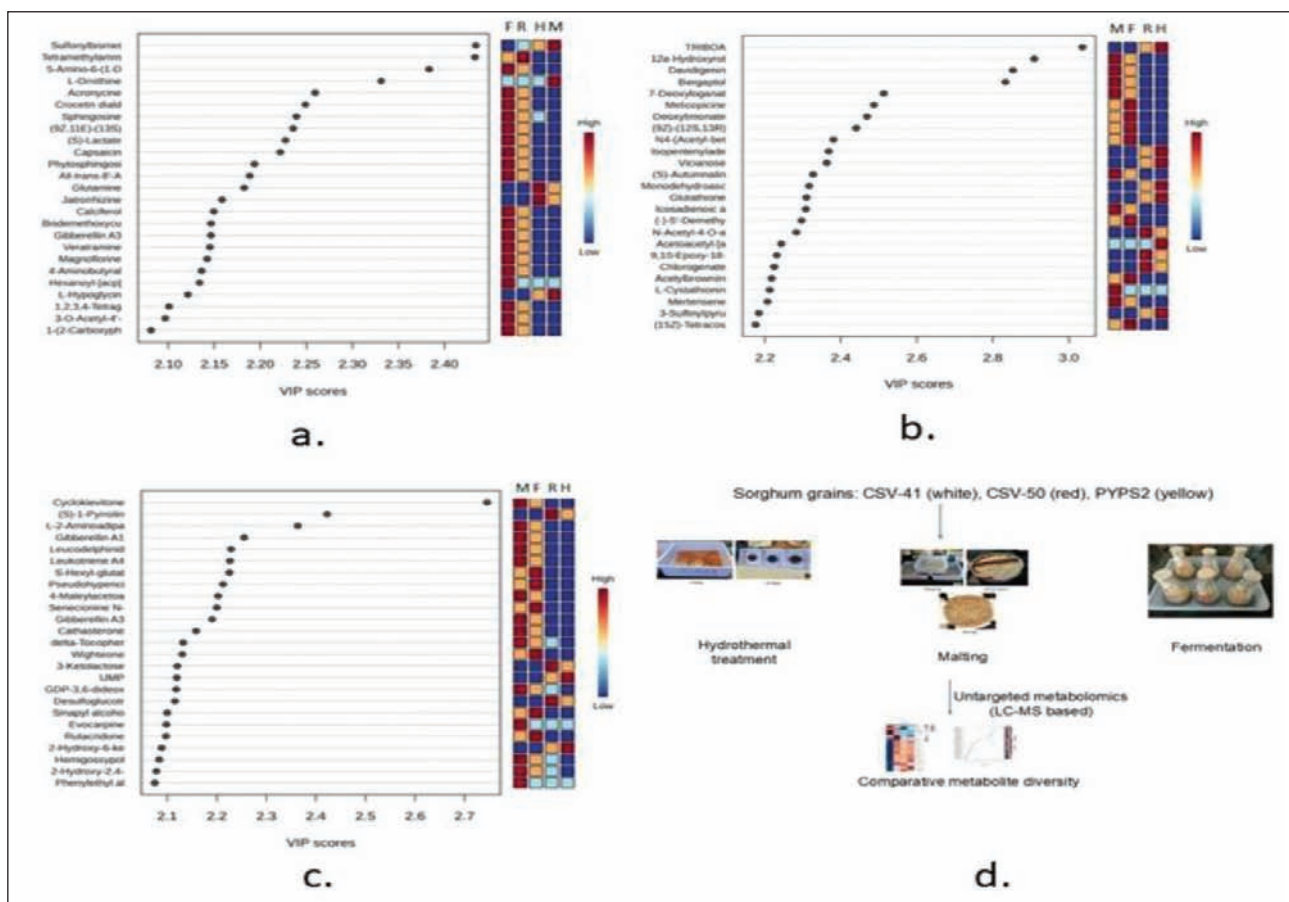


Fig. 9.16: PLSDA of processed sorghum grains: top 25 VIPs of (a) CSV 41 (b) CSV 50 and (c) PYPS-2. R, H, M and F represent raw, hydrothermally treated, malted and fermented grains respectively (d) elucidation changes upon treatment-metabolomics based approach

Phenol red dye assay as a reliable method for rancidity estimation

Phenol red dye assay for rancidity estimation was standardized and found to provide a calibration curve with a regression coefficient of 0.99 with standard acid dilutions. The absorbance of Phenol red dye at 510 nm increased linearly with changes in the pH of the extraction solution, demonstrating a regression coefficient of 0.996.

Rancidity development in foxtail millet under different storage treatments assessed using the Rancimat method

The foxtail millet under various storage treatments was tested for rancidity development using the Rancimat method. Preliminary results showed that the rancidity development curve for these samples is different from that of cooked food products and oil samples. The induction time of foxtail millet kept under various types of storage have been determined through rancimat analysis of the flour samples. The relative comparison of various treatments showed that the dehulled grains kept under PET, PET + vacuum, PET + N₂ filling, MET, and MET + vacuum recorded induction times of 691, 885, 369, 408, and 802 h, respectively, compared to fresh flour, which had an induction time of 1654 h.

XRF-Based profiling for grain micronutrients in pearl millet and finger millet GWAS panel

X-ray fluorescence (XRF) profiling of grain iron (Fe) and zinc (Zn) content is standardized and phenotyping carried out in 300 diverse pearl millet genotypes grown across four locations, namely ICAR-IIMR, Hyderabad; IARI, New Delhi; ARS, Vizianagaram; and CAZRI, Jodhpur. Similar XRF profiling of grain iron (Fe) and zinc (Zn) and calcium (Ca) content is being carried out in 250 finger millet lines evaluated during Kharif 2024 across three locations, namely ICAR-IIMR, Hyderabad; VPKAS, Almora; and IIAB, Ranchi. The multi-location evaluation enabled the assessment of genotype × environment interactions and provided robust phenotypic data for subsequent genome-wide association analysis aimed at identifying genomic regions governing micronutrient accumulation in pearl millet and finger millet.

TLC based method standardization to cyclopiazonic acid (CPA)

TLC-based method was standardized to identify cyclopiazonic acid (CPA), the causative agent of kodo poisoning, *Penicillium* and *Aspergillus* isolated from commercial kodo millet grain samples tested positive for CPA production in cultures.

Component 4: Centre of Excellence for Millet Value Chain and Business Facilitation for Entrepreneurship, Incubation and Startup Nurturing

Table 9.1: Development of various value-added millet recipes:

Millet	Value added recipes
Bajra (Pearl millet)	<i>Bajra gram brittle, bajra aloo patties, bajra tomato soup, Bajra pani puri murmure, bajra crispy corn. (5)</i>
Ragi (Finger millet)	<i>Ragi dry fruit chocolate slice, ragi-chocolate kaju katli, ragi chocolate truffle dora cake, ragi sabudhana namkeen, ragi sago moong dal khichidi, ragi dates nutty balls, ragi snicker bites, ragi flakes payasam, ragi dry nuts porridge, ragi banana cake. (10)</i>
Proso millet	<i>Proso millet ariselu, proso millet chandrahas halwa. (2)</i>
Foxtail millet	<i>Foxtail moong dal matri, foxtail paan leaves bajji, foxtail carrot curry leaves rice, foxtail methi matri, foxtail beetroot chilla. (5)</i>
Little millet	<i>Little millet chocolate coconut dessert, little millet chonge, little millet badam burfi, little millet soya Tikki. (4)</i>
Kodo millet	<i>Kodo millet vermicelli kesari. (1)</i>
Barnyard millet	<i>Barnyard kothimbir vadi, barnyard billala pulusu, barnyard jaggery rice, barnyard coconut kova bites, barnyard besan puri. (5)</i>
Jowar (Sorghum)	<i>Jowar milk pudding. (1)</i>
Multi-millet	<i>Multi-millet urad dhal burfi, multi-millet piri piri pop rings. (2)</i>

Table 9.2: Key startup activities at ICAR-IIMR supporting 50+ startups across 20+ states, emphasizing women participation and millet value addition

Event	Details
Incubation of startups	Startups covering 10 states viz., M/s Sankar Enterprises (AP), Masters of Millets (TS); later Maestro Millets (GJ), Srianna Divine Foods; Deep Root Food Tech (KA), Manga Srinivas (TS), Brahm Arpan (DL), G-Life (KA), Borne Tech (TN); Gold Dust Kitchen (MP), Isayu Foods (KA), Satvam Nutri (GJ); Rajhans Consultants (CG), Urban Firman (TS), Krisan Trading (KA), Tashvika (DL), Oraniq (UP), Munico (OD); Providence Health (TS), Vedndev, Unistem, Milletize, IE5 Foods (TS); Hora Millets (TS), Trishakthi (TS), Acuity Millets (DL); GMRK Foods (TS); Nenis Enterprise (TS), Wholly Good (AP), Tapti Global (MP); Uma Harvests (AP), Trie Roots (TS); Asscom Foods (DL); Millet Growers (TS), Kshetragna Agronomy (AP). Nuturemite tech licensees; Mavy Nutrition, Indlands Foods, Maagaani Foods; Chettiar Foods; Purferme (MH), AMC Nutrinest (AP).
Monthly event on "Cooking with Millets"	91 participants from seven different events covering Uttar Pradesh, Odisha, Maharashtra, Bihar, Telangana, Andhra Pradesh and Karnataka and NE states
Startup Ignition Programs:	51 participants from six events covering seven states
Entrepreneurship Foundation Program	139 participants from three events covering 11 states
Technology Training	Training to Startups viz., Nuturemite, Kshetragna/IE5 Guruswad, Millets/Urban Firman

Component 5: Establishment of International Knowledge, Skill Development and Capacity Enablement Centre with International Millet Museum & Halls of Residence

Global Centre of Excellence on Millets (Shree Anna) building progress:

In a major boost to millet research and innovation, Union Minister for Agriculture, Farmers Welfare, and Rural Development, Shri Shivraj Singh Chouhan, laid the foundation stones for the Global Centre of Excellence on Millets (GCoE on Millets) as well as for the Advanced Phenomics Facility at the ICAR-Indian Institute of

Millets Research, Hyderabad, were laid on 9 June 2025 during "Viksit Krishi Sankalp Abhiyan" campaign with the gracious presence of Shri Bhagirath Choudhary, Union Minister of State for Agriculture and Farmers Welfare; Shri Thummala Nageswara Rao, Agriculture Minister, Telangana; Dr. Mangi Lal Jat, Secretary (DARE) & Director General (ICAR); Dr. D. K. Yadava, Deputy Director General (Crop Science), ICAR; Dr. Tara Satyavathi, Director, ICAR-IIMR, Hyderabad and various dignitaries from state and state government (Fig. 9.17).



Fig. 9.17 Foundation Stone Laying of the Global Centre of Excellence on Millets at ICAR-IIMR, Hyderabad

The Global Center of Excellence on Millets (Shree Anna) at IIMR, Hyderabad facility will include a central instrumentation lab, a gene bank with MTS, a Center of Excellence for Millet Value Addition, technology demonstration areas, a museum, training facilities, international hostel accommodations, committee rooms, training rooms, classrooms and an international guest house (Fig. 9.18).



Fig. 9.18 Progress in Global Centre of Excellence on Millets building at ICAR-IIMR, Hyderabad

Advanced phenomics facility progress:

The construction of the Advanced Phenomics Facility will feature gene editing greenhouses, high-tech climate

control chambers, speed breeding facility, phenomics facility, microculture facility, and operation/utility areas, is in progress (Fig. 9.19).



Fig. 9.19: Construction of Field Research Facility at ICAR-IIMR, Hyderabad

Component 6: Global Facility for Millet Pilots on Feed, Fodder, Biofuels, Malting, Brewing and Promotion of Industrial utilization of Millets

The Global Facility for Millet Pilots at ICAR-IIMR supports targeted research and development for millet applications (food/non-food) under the Global Centre of Excellence on Millets (GCoE) with the objective of promotion of industrial utilization of millets.

Major Pilot Applications targeted in Millets

- **Biofuels:** Exploring millets especially sorghum and pearl millet for sustainable energy production.
- **Feed & Fodder:** Supports animal nutrition through processed millet fodder
- **Malting & Brewing:** Develops millet-based beverages and malts.

Basic studies to understand the sugar accumulation and bioethanol conversion from sweet sorghum is being carried out.

Evaluation of sweet sorghum breeding stocks for photo-insensitivity based on phenology and agro-meteorological indices at different locations and sowing intervals is conducted to promote sweet sorghum across range of millet growing ecosystems.

Brewing experiments conducted of different millets (sorghum, pearl millet, ragi and barnyard millet) in collaboration with NSI, Kanpur.

Construction of infrastructure and machineries for establishing pilots for brewery and biogas pilot units is in progress with through central public works department.

Component 7: Regional Millet Technology Innovation and Outreach Hubs

Infrastructure development at the Regional Centre at Barmer

The construction progress of the main building at the ICAR-IIMR Regional Research Station on Pearl Millet in Gudamalani is as follows: Flooring of the laboratories and corridors on both floors has been completed. The installation of electrical and sanitary fittings is completed. Developmental work in and around the building has now commenced (Fig. 9.20).



Fig. 9.20 Infrastructure development at Regional Research Station at Barmer

To promote the improved millet technologies, Pearl Millet Technology Demonstration and Farmers' Meet 2025 was organized on 21st September 2025 at the ICAR-IIMR Regional Research Station, Gudamalani. The event was graced by Shri Bhagirath Choudhary, MoS for Agriculture, Shri Kailash Choudhary, Former MoS for Agriculture, Dr. M. L. Jat, Secretary (DARE) & Director General (ICAR), Dr. D. K. Yadava, DDG (Crop Science) and Dr. Tara Satyavathi, Director, ICAR-IIMR. Foundation stone for the Pearl Millet Technology Demonstration Park was laid. Thirty exhibition stalls were set up and more than 1000 farmers and stakeholders participated in the event. Farm inputs (tarpaulins) were distributed to 600 SC farmers.

Activities under SCSP, TSP and NEH programs

ICAR-IIMR, under the Global Centre of Excellence on Millets, actively implemented SCSP, TSP, and NEH outreach programs to promote and strengthen millet-based livelihoods for marginalized farming communities. Initiatives include technology dissemination, capacity building, input support, farm-gate processing, market linkages, and entrepreneurship promotion (Fig. 9.21). Key activities include National Millets Kisan Mela for SC/ST farmers, large-scale trainings and demonstrations,

distribution of improved millet seeds and inputs, and FPO strengthening.

ICAR-IIMR established millet processing and value-addition units with farm-gate infrastructure support across states to boost value chains and post-harvest management at ARS Vizianagaram (Andhra Pradesh, with ANGRAU), KVK-II Sitapur (Uttar Pradesh, with ICAR-ATARI Kanpur), and KVK Gumla (Jharkhand, with ICAR-ATARI Patna). Millet processing machinery was supplied to tribal FPOs in Anakapalli district, Andhra Pradesh, to empower grassroots enterprises. Promoted millet conservation in tribal areas like Dindori, Madhya Pradesh, with storage facilities for germplasm and traditional cultivation. Tarpaulin initiatives enhanced post-harvest handling and reduced grain losses for small farmers. These programs benefited farmers

across several regions including Andhra Pradesh, Telangana, Karnataka, Jharkhand, Uttar Pradesh and Madhya Pradesh, through the distribution of processing machinery, training programs, and infrastructure support (Fig. 9.22). They raised awareness of production technologies, fortified farm-gate processing, refined post-harvest practices, and improved FPO market access. The initiatives contributed to increased productivity, improved income opportunities, enhanced nutritional security, and greater participation of women in millet-based enterprises, supporting sustainable livelihoods among SC, ST, tribal, and hill farming communities across India.

‘National Millets Kisan Mela for SC/ST Farmers & Industry Meet’

ICAR-IIMR hosted the ‘National Millets Kisan Mela for SC/ST Farmers & Industry Meet’ on March 3-4, 2025, in Hyderabad. This vibrant event united over 5,000 farmers, scientists, policymakers, industry leaders, entrepreneurs, and organizations to share millet knowledge and opportunities (Fig. 9.23). Under the theme “Millet Farming Systems for Viksit Bharat and Nutritional Security,” activities included exhibitions of advanced production tech, machinery, and value-added products; demonstrations of efficient agronomic practices; training on processing for flours, snacks, and ready-to-cook items; field visits to research plots and units; and farmer-scientist interactions on challenges. The Buyer-Seller Meet linked over 100 sellers with 60 buyers, including international clients, yielding potential deals worth Rs. 2.51 crore. Over 2,000 farmers from Telangana, Andhra Pradesh, Karnataka, Maharashtra, Madhya Pradesh, Chhattisgarh, and Odisha attended via ICAR-IIMR-promoted FPOs, gaining tech exposure, market access, and business insights.



Fig. 9.21: Flow chart of millet development interventions from seed to market



Local Partners of ICAR-IIMR, under Tribal Sub Plan in various states for Empowerment of Tribal Farmers

ATARI Zone	State	Name of the Institute
ICAR-ATARI Bangalore Zone-I	Karnataka	ICAR-KVK, Kalahurugi UAS, Raichur KVAFSU, Bidar Central University of Karnataka, Kalahurugi
ICAR-ATARI Jodhpur Zone-II	Rajasthan	ICAR-KVK, Karauli ICAR-KVK, Chittaur ICAR-IIMR, Regional Research Station on Pearl Millet
ICAR-ATARI Patna Zone-IV	Jharkhand	ICAR-KVK, Morabadi ICAR-KVK, Gumla ICAR-KVK, Khunti ICAR-KVK, Buxar
ICAR-ATARI Jabalpur Zone-IX	Madhya Pradesh	ICAR-KVK, Umaria ICAR-KVK, BCT, Haripuram Dr. YSR Horticulture University, Tadepalligudem, Andhra Pradesh
ICAR-ATARI Hyderabad Zone-X	Andhra Pradesh	DAATTC, Paduru, ANGRAU, Guntur ARS, Vizianagaram, Andhra Pradesh
ICAR-ATARI Ludhiana Zone-I	Jammu Kashmir	Dry Land Agriculture Research Station, SEAUAST, Kashmir

Fig. 9.22 Details of local partners in various states for TSP/SCSP activities



Fig. 9.23: Glimpses of National Millets Kisan Mela and Industry Meet

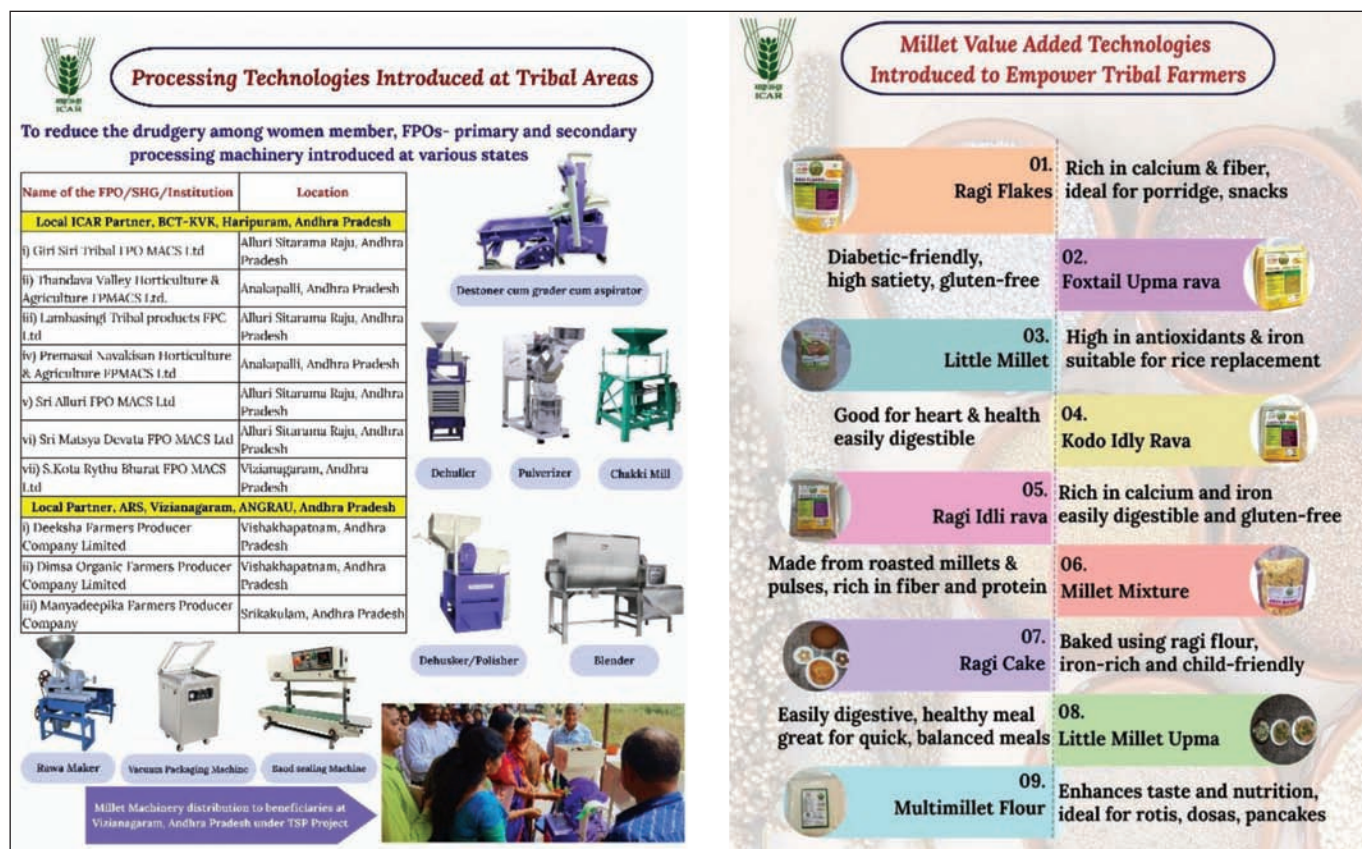


Fig. 9.24: Various processing and value added technologies introduced to Tribal Farmers

Table 9.3: Details of seeds of improved millet varieties distributed to farmers

Millet Type	Seed Variety(s)	Qty (kg)	Location(s)	Beneficiaries	Villages	FPOs	Varietal/crop features
Jowar	CSV 15, CSV 31	1,655	Mahbubnagar (Tel-angana)	356	10	4	Adapted to kharif sorghum growing regions
Bajra	ABV-04	340	Raichur (Karnataka)	56	4	3	Promotion of high yielding, biofortified pearl millet variety
Finger Millet	CFMV 1	1,460	AP & Odisha	347	18	6	Improved finger millet with blast disease resistance and biofortified variety
Barnyard Millet	DHBM 93-2	> 1,456	ASR district (AP)	150	12	4	Adaptable to drought suitability for cultivation in marginal rainfed
Foxtail Millet	SiA 3059	> 2,660	Kurnool district (AP)	115	6	2	High-yielding foxtail millet variety resistance to brown spot disease
Little Millet	CLMV 1	> 1,200	ASR (AP) & Mahbubnagar	166	18	5	Medium duration with higher grain iron and zinc
Proso Millet	TNAU 202	> 506	ASR district (AP)	132	12	4	High yielding adapted to rainfed conditions
Browntop Millet	HBr 2	> 568	ASR district (AP)	79	10	2	Compact panicle with desirable grain yield
Kodo Millet	JK 41, RK 390-25	> 200	Anantapur district (AP)	87	5	4	Improved varieties with nutritional superiority
Total	10	> 9,045	—	1,488	95	34	

Girijana Bazar Mobile Millet Market Initiative

ICAR–IIMR, Hyderabad introduced initiative known as the “Girijana Bazar Mobile Millet Market” designed to bridge the gap between tribal millet producers and urban consumers by creating a mobile marketplace that enables direct sale of millet products to consumers (Fig. 9.25). A commercial vehicle was converted to a fully functional mobile retail unit capable of displaying and selling millet-based products at urban residential colonies, markets, universities, IT hubs, exhibitions, and public events, enabling direct interaction between tribal producers and consumers. This resulted in increased price realization for farmers by eliminating intermediaries and providing an organized retail platform for tribal products with nearly 25–40 percent in income through direct marketing, along with improved understanding of consumer preferences, product packaging, branding, and pricing strategies. The initiative represents a cost-effective and scalable marketing model that strengthens millet value chains while promoting tribal entrepreneurship.



Fig. 9.25: Girijana Bazar Mobile Millet Market Initiative



Fig. 9.26 : Details of primary processing machineries and Lambasingi Tribal FPO activities

Enhancing post-harvest management for scheduled caste farmers

ICAR-IIMR supports millet cultivation among SC farmers by distributing critical inputs like quality

seeds, farm implements, and tarpaulins under SCSP programs. Post-harvest losses remain a significant challenge in millet cultivation particularly due to the lack of proper drying infrastructure and exposure of harvested grains to soil contamination and unexpected rainfall. ICAR–IIMR supplied tarpaulins under the GCoE SCSP program to support small and marginal farmers to secure their produce with quality often organized through events at KVKs and in collaboration with local agricultural departments. Tarpaulins were provided to farmers across through FPOs. A total of 528 tarpaulins were distributed in Andhra Pradesh, 794 in Telangana, and 678 in Karnataka, benefiting more than 2,000 small and marginal farmers (Table 9.4 & Fig. 9.27). Farmers experienced a 10–15 percent reduction in post-harvest losses, improved grain quality, and enhanced market value of their produce. The initiative also increased the participation of women in post-harvest operations such as drying, cleaning, and grading of grains.

Table 9.4: Details of inputs distributions in different states.

State covered	Tarpaulins distributed
Andhra Pradesh	528
Telangana	794
Karnataka	678
Total	2000



Fig. 9.27: Input (Tarpaulins) distributed to beneficiary farmers

Input (Tarpaulins) distributed to beneficiary farmers under GCoE SCSP program

Empowering millet growers through seed and input support

ICAR – IIMR Hyderabad supplied quality seeds and essential farm inputs to farmers across several states to enhance millet productivity and support farmers in adopting improved cultivation practices. Improved varieties seeds were supplied to farmers /FPOs in Karnataka, Telangana, Andhra Pradesh jointly with KVKs, local institutions, and FPOs, enabling wider

outreach and effective dissemination of improved millet technologies. Improved seeds were also supplied also as part of Viksit Krishi Sankalp Abhiyan. Special

emphasis was given to tribal and smallholder farmers, who often face challenges in accessing quality inputs (Fig. 9.28 and Fig. 9.29).



Fig. 9.28 Quality millet seeds distributed farmers

Field-Level activities implemented through KVKs under GCoE TSP/SCSP Krishi Vigyan Kendra (KVK)–II, Sitapur, Uttar Pradesh.

At Krishi Vigyan Kendra (KVK)–II, Sitapur, Uttar Pradesh, ICAR-IIMR, Hyderabad, supported SCSP activities to advance millet-based livelihoods and nutritional security for Scheduled Caste families (Fig. 9.30). The project strengthened the millet value chain via capacity building, technology demos, input supplies and establishment of processing unit



Fig. 9.29: Improved millet seeds distributed to farmers at KVK Banavasi equipping 200 farmers from select villages with training on seed selection, nutrient/pest management, organic methods, water efficiency, post-harvest care, value addition and market linkages through SHGs/ FPOs. Farmers received quality seeds, bio-inputs and small tools, while infrastructure like collection centers, storage and processing sheds enhanced handling and marketing. These efforts boosted production, income, entrepreneurship and nutritional awareness in the community.



Fig. 9.30 Field demos, millet processing unit at KVK – II, Sitapur, UP with support of ICAR–ATARI Kanpur

Krishi Vigyan Kendra (KVK), Gumla, Jharkhand: ICAR-IIMR via ICAR-ATARI Patna aimed at advancing millet farming among tribal communities through multiple initiatives. A key effort established a millet technology and processing facility equipped with machinery for cleaning, grading, drying, pulverizing, mixing, and packaging value-added products, enabling local food preparation. Frontline demonstrations of finger



millet (CFMV 1) spanned five blocks (Gumla, Raidih, Sisai, Ghaghra, and Bishunpur) reaching 249 farmers over 100 hectares with improved seeds and inputs for superior crop management (Fig. 9.31). Training programs for farmers, women, and rural youth covered millet production, processing, and utilization, boosting local cultivation, processing, and income opportunities for tribal households.



Fig. 9.31: Millet processing unit inauguration, farmer trainings, and input distribution activities conducted at KVK Gumla, Jharkhand under GCoE TSP with support from ICAR-ATARI, Patna, Bihar

Programs organized for dissemination of millet technologies and skills development

To promote millet-based technologies and strengthen the millet value chain, a series of training programs, farmers' meetings, and capacity-building activities were organized across different states during December 2025. (Fig. 9.32). These programs targeted farmers, Farmer

Producer Organizations (FPOs), Self Help Groups (SHGs), and students, with the objective of enhancing their knowledge and practical skills in millet cultivation, processing, value addition, and entrepreneurship. Special focus was given to tribal farmers and grassroots stakeholders through awareness programs, baseline surveys, and input distribution initiatives.



Fig. 9.32: Dissemination of millet value added technologies to various stakeholders

Table 9.5: Details of the training programs conducted

Date/Duration	Title of training program	State	No. of Participants		Target Group (Farmers/ FPO/SHG/Students)
			Male	Female	
4-5 December, (2 days)	Millet value addition & jackfruit processing	Andhra Pradesh	5	21	Farmers, FPOs, SHGs
12-13 December (2 days)	Millet value addition & jackfruit processing	Andhra Pradesh	7	25	Farmers, FPOs, SHGs
9-12 December (4 days)	Millet Based technologies to tribal farmers of Nandurbar, Maharashtra	Maharashtra	14	7	Farmers, FPOs, SHGs
11 December (1 day)	Farmers' Meeting and Baseline Survey at KVK, Kurnool	Andhra Pradesh	220	30	Farmers
16-18 December (3 days)	Millet Based technologies to tribal farmers of Pattikonda, Andhra Pradesh	Andhra Pradesh	23	0	Farmers, FPOs
15-26 December (10 Days)	Nutri Cereals-Entrepreneurship Foundation Program	Telangana & Karnataka	11	5	Students
15-26 December (10 Days)	Advanced Laboratory Techniques in Genomics, Tissue Culture, Microscopy & Grain Science	Madhya Pradesh, Maharashtra, Karnataka & Telangana	8	4	Students
18-19 December (2 Days)	Farmers' Meeting and Baseline Survey at KVK, Vamban, Pudukkottai (Dt)	Tamil Nadu	75	162	Farmers
23 December	Kisan Diwas 2025 (participated by Sangareddy farmers)	Telangana	35	40	Farmers
26 December (1 day)	Farmers' meeting and Seed distribution program at Narsimhulagudem, Mahabubabad (Dt)	Telangana	50	59	Farmers

ICAR – IIMR interventions in North Eastern Hilly (NEH) regions

India's North Eastern Hill (NEH) region, with its varied agro-climatic zones and largely tribal communities, offers vast potential for millet farming rooted in traditional practices in diverse ecologies covering six key states Arunachal Pradesh, Sikkim, Meghalaya, Manipur, Assam, and Tripura (Fig. 9.33.). ICAR-IIMR, Hyderabad under NEH program targeted strategic interventions with regional agricultural institutes and universities. These efforts focus on boosting millet production, processing, value addition and resilient value chains to uplift smallholder farmers' incomes. By integrating technology transfer, infrastructure upgrades, skill-building, and partnerships, the program advances nutritional security, climate adaptation and economic gains.

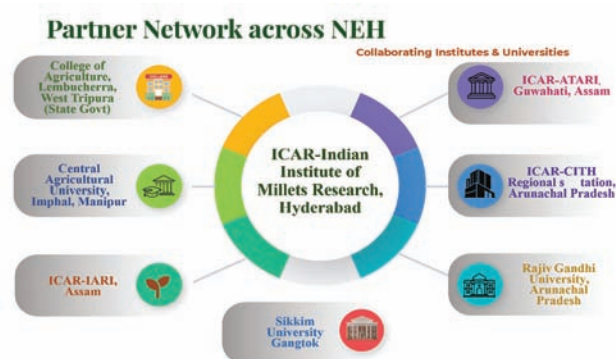


Fig: 9.33: ICAR- IIMR partnering millet network across NEH states

Distribution of seeds of improved millet varieties

An initiative was taken to introduce superior millet varieties and scientific farming techniques in Tripura, 1,478 kg of seeds were supplied to 326 farmers across 8 villages, at Arunachal Pradesh 2,084 kg seeds of 9 improved varieties to 413 farmers in 11 villages

(Fig. 9.34). Information on optimal production practices along with frontline demonstrations showcasing



Fig. 9.34 : Distribution of seeds of improved millet varieties to farmers of NEH region

Distribution of small agricultural equipments

To complement technology dissemination 13.2 quintals of fertilizers and needy plant protection chemicals were distributed, ensuring better crop management and productivity. About 750 units of small agricultural tools such as khurpis, spades, and sickles, as well as modern equipment like power sprayers, knapsack sprayers, and



Fig. 9.35: Distribution of seeds of improved millet varieties and small farm implements to farmers of NEH region

Establishment of processing and value addition facilities

ICAR-IIMR facilitated the establishment of millet processing and value addition facilities in the NEH region. A state-of-the-art millet processing unit and value addition laboratory was established at the College of Agriculture, Pasighat (Arunachal Pradesh). The facility is equipped with essential machinery such as destoners,

varieties such as GPU 67 in finger millet and in foxtail millet was carried out.



hand sealing machines were supplied to farmers (Fig. 9.35). These interventions helped to reduce drudgery, improve operational efficiency, and enable timely farm operations. This integrated approach of combining improved seeds with input and equipment support has strengthened the overall production system.



de-husking machines, and pulverizers, enabling primary processing and improving the marketability of millets. Similarly, a millet primary processing facility was set up at the College of Post Graduate Studies in Agricultural Sciences (CPGSAS), Umiam (Meghalaya). This facility supports the development of value-added millet products, enhances shelf life, and improves product quality.



Fig. 9.36: Capacity building training programs to millet stakeholders of NEH region

Capacity building and skill development

To support millet production and utilization, 25 trainings were conducted at 10 districts to farmers, extension personnel, women, and tribal youth on scientific cultivation of millets and fodder sorghum, Value



addition and product development, organic farming and bio-input preparation, seed treatment and improved sowing technique and entrepreneurship development and market linkages. Special emphasis was given to empowering women and tribal youth by promoting millet-based enterprises and livelihood opportunities.



Fig. 9.37: Capacity building training programs to millet stakeholders of NEH region

Outreach, demonstrations, and knowledge exchange

National conference on millets at Pasighat was organized to bring together experts, policymakers, and stakeholders, Farmers' Expos showcasing millet-based products from FPOs, startups, and institutions and farmer scientist interaction meet were conducted. Field days, frontline demonstrations and field visits were also conducted extensively across the NEH states to provide hands-on exposure to farmers to encourage adoption of improved technologies. "Cooking with Millets" competitions were organized in Meghalaya and Tripura to promote millet consumption and highlight their nutritional benefits. These initiatives aimed at bridging gap between production and consumption, strengthening millet ecosystem.



Salient achievements from collaborative research programs with ICAR institutes

Salient achievements from collaborative research programs with ICAR institutes

Institute: ICAR- IARI (Division of Genetics), New Delhi

Title of the Project: Evaluation of hybrid parental lines and phenotyping of pearl millet GWAS panel and hybrid trial:

- A pearl millet GWAS panel comprising 300 genotypes were phenotyped during *Kharif* 2025 for agronomic and yield-contributing traits and XRF analysis for iron and zinc content.

- Evaluation of 97 pearl millet hybrids was completed during *Kharif 2025* to study cross-compatibility among five cytoplasmic male sterility (CMS) systems (A1–A5) for agronomic and yield-contributing traits such as including days to 50% flowering, plant height, panicle length and girth, number of productive tillers, seed set percentage and 1000 seed weight and data analysis is under progress to assess CMS–restorer interactions and their effects on hybrid performance and yield potential.

Institute: ICAR-IARI (Biochemistry), New Delhi

Title of the Project: *De novo* transcriptome data analysis and metabolite sensor development for rancidity

- Tovolatome analysis from pearl millet samples identified abundance of volatile compounds like 2-Propenal, 9,12-Octadecadienoic acid, Hexadecanoic acid, Dodecane, Hexadecanol, etc. which can be used as possible marker for evaluating the diverse germplasm of pearl millet for rancidity.
- Cloned Allene oxidase synthase 3-like (PQ789839), Phenylalanine ammonia lyase(PQ789841), Peroxidase gene(PP785293) genes from contrasting pearl millets cvs. linked with Rancidity.
- Purified lipoxygenase enzyme from the developing seeds of pearl millet cv. MPMH17 and kinetics was performed to understand the mechanism of action of the enzyme in rancidity.
- Evaluated the effect of salt, gamma irradiation, micro-oven, lime water and hydrothermal treatment on shelf life of pearl millet flour. Hydrothermal along with lime water treatment was observed most effective in enhancing the shelf life by more than 6 months.

Institute: ICAR-NIPB, Delhi

Title of the Project: Screening for drought tolerance and epigenetic characterization of differentially expressed genes in pearl millet

- Evaluation for Physiochemical traits in pearl millet genotypes under controlled drought

stress conditions, followed by multivariate and machine learning (TOPSIS) analyses, lead to the identification of contrasting drought-tolerant (PPMI_1283) and drought-sensitive (PPMI_1304) genotypes.

- High-quality shoot and root samples from drought-stressed and control plants of PPMI_1283 and PPMI_1304 led to identification of differentially expressed genes (DEGs) associated with drought stress were shortlisted based on $\log_2$ fold change and literature support.
- RNA isolation, cDNA synthesis, and qRT-PCR-based differential expression analysis were successfully performed for key drought-responsive genes (ASR, DREB, P5CS, MYB, MYC, APX, ABF, NCED, SOD, bZIP, PIP) in shoot and root tissues of contrasting genotypes, with expression normalized using ACTIN and fold change calculated using the $2^{-\Delta\Delta Ct}$ method. Most genes exhibit stronger induction in roots than shoots in PPMI_1283 (notably *bZIP*, *MYB*, *RGS*, and *ABF*), indicating an active root-level drought adaptation mechanism in the tolerant genotype.
- Genome-wide DNA methylation samples were prepared from drought-stressed and control root tissues for bisulphite sequencing using Nanopore technology. An integrated study combining multivariate statistics, machine learning, transcriptomics, and gene expression analysis has resulted in a manuscript submitted to *Proceedings of INSA* on drought resilience in pearl millet.

Institute: ICAR-CAZRI, Jodhpur

- **Title of the Project: Evaluation of hybrids and diverse lines under moisture stress in pearl millet**

- Pearl millet GWAS panel comprising 300 lines was evaluated during *Kharif 2025* under drought stress and control conditions using an alpha lattice design. Phenotyping for agronomic and yield-related traits which includes days to 50% flowering, panicle length, panicle weight, panicle width, number of productive tillers and 1000-seed weight was completed.

- Pearl millet test hybrids (100) were successfully evaluated under sparse design for agronomic and yield trait includes days to 50% flowering, panicle length, panicle weight, panicle width, number of productive tillers and 1000 seed weight and superior hybrids were identified.

Institute: ICAR-NBPGR, New Delhi

Title of the Project: Genetic resource management of millets for enhanced utilization

- Physical Verification & Conservation: 10,000 accessions of sorghum physically verified and submitted to IIMR, Hyderabad for Medium Term Storage (MTS)
- 3,041 promising accessions of sorghum evaluated for quantitative and qualitative traits including plant height, days to 50% flowering, basal tiller number, leaf traits, inflorescence traits, seed shape, seed color, 1000-grain weight, ear-head characteristics, glume color, glume cover and grain yield.
- 1,800 accessions of barnyard germplasm were evaluated for quantitative and qualitative traits and promising lines identified. Validation of Near-Infrared (NIR) prediction model for starch content in 1,405 accessions, revealing a starch range of 61.9–72.7% (mean $66.3 \pm 2.13\%$), with low-starch (<63%) accessions including IC597304, IC356406, IC472848, IC589362, IC589398, IC326093, IC268130, IC404417, IC426590, and high-starch (>71%) accessions including IC472975, IC404363, IC263111, IC473128, IC279482, IC281472.

Proso Millet

- A total of 953 and 1,460 accessions of proso millet characterized for 8 quantitative and 6 qualitative traits including days to flowering, early maturing, seed shattering, plant height, leaf traits and seed weight (1000-seed weight)

Institute: ICAR - VPKAS, Almora

Title of the Project: Association mapping and trait phenotyping for blast, smut and nutritional traits in finger millet and barnyard millet

Finger millet

- A GWAS panel of 260 finger millet genotypes was phenotyped during *Kharif* 2025 for agronomic traits,

blast resistance and nutritional traits; phenotypic data including flowering, plant height, tillers, 1000-grain weight, maturity and grain yield were recorded.

- Twenty three finger millet genotypes collected from ICAR-VPKAS and ICAR-IIMR were evaluated in *Kharif* 2025 at ICAR-IIMR Hyderabad. Five genotypes (VR 24-2, VR21-8, VR18-3, VR20-32, IE 8987-1) were identified as superior for grain yield (>3500 kg/ha) as compared to the early check VL 376 (3135 kg/ha)

Barnyard millet

- A panel of 256 barnyard millet genotypes was evaluated for agro-morphological traits, yield components and smut disease incidence and promising genotypes with desirable agronomic performance were identified.

Institute: ICAR-IGFRI, Jhansi

Title of the Project: Harnessing genetic diversity in pearl millet and sorghum for development of trait specific genotypes and trait mapping for fodder yield and quality traits

Sorghum

- Phenotyping of 100 and 104 lines fodder sorghum genotypes (with checks) was carried out for fodder yield and its component traits. Fodder quality analysis for proximate, mineral, and micronutrient profiling and nutritional quality is in progress to identify superior fodder lines.

Pearl millet

- Pearl millet association (GWAS) panel of 300 genotypes was phenotyped during *kharif* 2025 for fodder yield and component traits and fodder samples from the GWAS panel are evaluated for fodder quality traits including dry matter, inorganic matter, crude protein, NDF, ADF, ADL, and in vitro organic matter digestibility for trait mapping.

Minor Millets

- Fifty-three genotypes of minor millets (Finger, Proso, Kodo, Barnyard, Brown top, Foxtail, Little Millet) received from IIMR, Hyderabad were phenotyped for fodder yield and quality-related traits. Stover samples were processed for proximate analysis,

and quality evaluation for crude protein and acid detergent fibre was completed; data compilation is in progress.

Institute: ICAR-CRIDA, Hyderabad

Title of the Project: Response of millets to elevated CO₂ and phenotyping of kodo millet lines for grain yield and related traits

Kodo millet

- Phenotyping and yield evaluation of 246 germplasm lines resulted in identification of eleven accessions (KM-CRD-38, KM-CRD-71, KM-CRD-121, KM-CRD-05, KM-CRD-15, KM-CRD-106, KM-CRD-95, KM-CRD-28, KM-CRD-184, KM-CRD-04, KM-CRD-135) with high grain yield (>30 g/plant) for its use in breeding programs

Pearl millet

- In the line development programme, several superior lines were identified based on panicle weight: R-lines (IIMR-R-3, R-7, R-11, R-4) and B-lines (IIMR-B-16, B-12, B-18, B-20, B-11, B-17) showing >40 g cob weight.
- A GWAS panel of 300 genotypes was successfully evaluated for agronomic and yield related traits such as flowering, plant height, tillers, panicle length, panicle weight, panicle width, and 1000 seed weight.

Elevated Co₂ experiment in millets

- Nine millet crops evaluated under elevated CO₂ and temperature exhibited differential morpho-physiological and yield responses across treatments. Pearl millet, sorghum, and brown top millet showed improved grain yield per plant under elevated temperature (+1 to +3 °C) alone and in combination with elevated CO₂, highlighting their adaptability to future climate scenarios.

Institute: ICAR-IIAB, Ranchi

Title of the Project: Deciphering gene network for conferring tolerance to aluminium toxicity in finger millet

- Evaluation of 275 finger millet genotypes, including checks, was completed at ICAR-IIAB, Ranchi during *Kharif 2025* for agronomic and yield-

contributing traits. Two contrasting finger millet genotypes (IC0071335-X and IC0344941) were identified from a panel of 275 genotypes by growing seedlings in Hoagland solution with 100–2000 µM aluminium, and measuring morphological traits (shoot/root length and dry weight) to determine toxicity thresholds and LD₅₀. These genotypes were further evaluated for callus induction under aluminium stress, with the selected genotype exhibiting superior tolerance, including higher shoot/root growth and biomass. Tissue-level analyses using SEM, Morin staining, ICP-OES, and EDX confirmed differential aluminium accumulation and distinct root cellular responses among the genotypes.

Institute: ICAR - CIPHET, Ludhiana

Title of the Project: Establishment of millet processing facility and development of value-added products from millets

- High-protein RTE millet snack: An optimized extruded formulation (40% finger millet, 30% roasted Bengal gram, 20% maize, 10% soy protein isolate) achieved 19.68% protein, delivering 6.89 g protein per 35 g pack (22% RDA for children, ICMR-NIN), with good expansion, low bulk density, 60.81% in-vitro protein digestibility, high calcium (2232 mg/kg), and high sensory acceptability (8.5/9); antinutritional factors were reduced (phytic acid ↓17%, tannins ↓41%).
- Shelf-life enhancement of pearl millet flour: Microwave (30–60 s) followed by infrared (5–15 min) pre-treatments significantly improved storage stability; vacuum-packed aluminum laminates maintained the lowest alcoholic acidity (0.09–0.14%) within FSSAI limits, while untreated LDPE-packed samples exceeded limits, confirming the effectiveness of combined processing and packaging.
- Low-fat millet-based cookies: Sorghum-based, gluten-free cookies with hydrocolloid fat replacers achieved up to 50% fat reduction while maintaining acceptable texture and structure; optimization using Box–Behnken RSM is in progress.

- Millet microgreens/nutraceuticals: Pearl millet varieties (Pusa 1803, Bajri, 2202, PC701, 8685) were successfully evaluated for microgreen production, indicating potential for antioxidant-rich, nutraceutical products from millet grass.

Institute: ICAR-CIAE, Bhopal

Title of the Project: Millet's processing and value addition

- Multi-millet de-husker, polisher, fermenter, flour mill, and roaster were developed and validated with good performance, achieving dehulling efficiency of 80–85%, polishing efficiency of 82.45%, roasting efficiency of 95%, and capacities of 40–60 kg/h at affordable costs suitable for small processors and FPOs.
- Improved processing of small millets: The developed de-husker and polisher effectively addressed major challenges in processing small millets (kodo, foxtail, kutki) by efficient hull and bran removal, reducing antinutritional factors, improving shelf life, and enhancing grain appearance and quality.
- Optimized fermentation and milling technologies: A controlled millet fermenter (40 kg/batch) significantly reduced fermentation time (3–4 h), while the multi-millet flourmill produced uniform flour with adjustable particle size, supporting diversified millet-based food processing.
- Development of diverse nutri-dense millet products: Multiple Ready-to-Eat (RTE), Ready-to-Serve (RTS), and Ready-to-Cook (RTC) products—including millet beverages, roasted millets, laddus, nutri bars, herbal soup, fermented powders, breads, and chikkis—were successfully developed using quality and shelf-life optimized formulations.

Institute: ICAR- NDRI, Karnal

Bioconversion of sorghum stalks into xylo-oligosaccharides (XOS) and its chromatographic characterization and prebiotic utilization efficiency

- This study examined XOS production from SS via enzymatic hydrolysis. Analysis of 3 M NaOH-extracted xylan showed high purity. XOS yield of 85.26% was achieved under optimized conditions: pH 5.5, 45.45°C, 20 IU enzyme dosage/200 mg

xylan, and 24 h incubation. The process produced significantly more XOS than similar biomasses.

- The main oligosaccharide fractions were DP2-6, with DP6 being the most predominant, followed by DP2. These fractions are known for strong prebiotic activity, making them commercially valuable. *In vitro* tests showed improved growth of probiotic bacteria and suppressed growth of pathogenic strains compared to commercial prebiotics. The results support SS as an effective substrate for XOS production.
- Combining alkali pre-treatment and enzymatic hydrolysis under RSM conditions proved scalable and efficient. Further, this approach offers a sustainable way to valorize agricultural residues into high-value prebiotics for food, feed, and nutraceutical uses.

Valorization of pearl millet biomass into prebiotic fibre and its utilization as a functional feed for augmenting neonatal calf health

- Supplementation with XOS and xylan significantly improved body weight gain, average daily gain, and body measurements (body length, wither height, hip height, and heart girth), with the XOS group outperforming both XYL and control groups.
- Prebiotic supplementation (especially XOS) reduced faecal pH and ammonia, improved faecal consistency, and increased short-chain fatty acid (SCFA) concentrations (acetate, propionate, butyrate), reflecting improved gut fermentation and overall intestinal health.
- XOS supplementation significantly reduced faecal pH, moisture, and ammonia ($5.44 \pm 0.16 \mu\text{mol/g}$), improved faecal consistency (0.57 ± 0.03), and increased total SCFAs ($45.41 \pm 0.75 \mu\text{mol/g}$), with higher acetate, propionate, and butyrate levels compared to control.

Institute: ICAR- NRC Camel, Bikaner

Title of the Project: Maximizing nutrient out put through bio-fortification of dual-purpose pearl millet for augmenting livestock production

- An agronomic field trial was conducted with biofortified pearl millet variety and used for proximate composition and in-vitro nutritional

analysis. Pelletization of harvested pearl millet fodder followed fodder quality and nutritional parameter analysis to identify the best biofortified treatment.

- Proximate analysis of biofortified fodder pellets was completed, enabling selection of superior treatments for feeding studies. A subsequent crop was sown during *Kharif 2025*, harvested, and processed into dry fodder and hay, and in-vitro trials were completed in preparation for animal feeding experiments.

Institute: ICAR- CIRG, Makhdum

Title of the Project: Utilization and evaluation of millets stover and by-products in quality and feed economics in goat

- In-vitro and in-vivo evaluation of millet stovers (pearl millet, sorghum, and finger millet (ragi) – based complete pellet feeds was successfully conducted, including gas, methane, digestibility, fermentation metabolites, digestion trials, growth, lactation, slaughter and meat quality studies in goats.
- Feeding-cum-lactation and growth trials in goats were completed, with detailed analysis of milk yield and composition, blood, rumen metabolites, feed, faeces, urine and meat composition.
- Technology development and dissemination achieved wide outreach, with training and demonstrations on complete pellet feed preparation using pearl millet, sorghum, and finger millet stovers to more than 600 farmers, para-vets,

entrepreneurs, students and veterinary officers across multiple states.

Institute: ICAR-CIRB, Hisar

Title of the Project: Evaluation of feeding value of promising millet fodder cultivation (sorghum and pearl millet) in Buffaloes: effects on body weight gain, milk production and enteric methane emission

- Proximate and fibre fraction analysis (DM, CP, NDF, ADF, ADL, etc.) was completed for pearl millet, barnyard millet, finger millet, little millet, and sorghum fodder samples, revealing wide variability in fodder quality among cultivars.
- In vitro rumen fermentation studies showed significant differences in gas production, IVDMD, methane, and VFA profiles across millet and sorghum fodders.
- Among pearl millet fodders, cultivars PM-13, PM-11, and PM-9 recorded superior digestibility (74%, 67%, and 67% IVDMD, respectively at 72 h), indicating high feeding value.
- Extended in vitro studies confirmed enhanced digestibility and reduced methane production in pearl millet cultivars 9, 11, and 13, supporting their suitability for ruminant feeding and need for *in vivo* validation.
- CSV 43 BMR sorghum demonstrated excellent farmer acceptability, better fodder quality, greener biomass, improved palatability, and enhanced milk performance, leading to strong demand for large-scale adoption.



Millets and Other Ancient Grains International Research Initiative (MAHARISHI)

The **Millets and Other Ancient Grains International Research Initiative (MAHARISHI)** is a global research collaboration platform endorsed under India's G20 Presidency to promote coordinated international efforts in the research, development, and promotion of millets and ancient grains. The initiative was launched on **July 16, 2025**, during the 97th Foundation Day celebrations of the Indian Council of Agricultural Research at the NASC, New Delhi. The launch ceremony was inaugurated by the Hon'ble Union Minister of Agriculture and Farmers Welfare, Shri Shivraj Singh Chouhan, marking an important milestone in strengthening India's leadership in global millet research and innovation. During the event, the foundational **MAHARISHI Charter** and logo of the initiative was unveiled along with the official knowledge portal, www.maharishi.res.in, which serves as a central platform for research collaboration, information exchange, and global engagement among scientists, policymakers, and stakeholders working on millets and ancient grains.

S.No	Meeting	Date
1	First Steering Committee Meeting	14 th July, 2025
2	Second Steering Committee Meeting	30 th September, 2025
3	Third Steering Committee Meeting	31 st December, 2025
4	Fourth Steering Committee Meeting	4 th February, 2026

The governance framework of MAHARISHI is guided by a high-level Steering Committee chaired by the Secretary DARE and Director General, ICAR. The committee provides strategic direction for the initiative, focusing on strengthening global research networks, developing collaborative projects, and facilitating knowledge exchange among partner institutions. During the reporting period, four Steering Committee meetings were convened to review progress and provide policy guidance on operational frameworks, research

priorities, institutional partnerships, and budgetary provisions necessary for the effective implementation of the initiative.

A major step in the international expansion of MAHARISHI has been the strategic collaboration with the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). In December 2025, the Director General of ICRISAT was formally inducted into the MAHARISHI Steering Committee, strengthening the initiative's global institutional linkages. This collaboration aims to leverage ICRISAT's expertise in dryland agriculture and millet research to accelerate the development of climate-resilient and nutrition-sensitive farming systems. As part of this partnership, plans have been initiated to establish a **MAHARISHI Mini-Secretariat in Nairobi, Kenya**, which will serve as a regional coordination hub for Africa.

MAHARISHI has also actively engaged with national and international platforms to promote the role of millets in sustainable food systems. In November 2025, the **International Symposium on Shree Anna and Women Farmers** was organized in Bhubaneswar, Odisha, highlighting the important role of women farmers in preserving agricultural heritage, agrobiodiversity, and traditional millet-based food systems. During the symposium, a dedicated technical session organized by the MAHARISHI Secretariat explored strategies for harnessing the value chain potential of millets, including improved processing technologies, entrepreneurship development, and market linkages for millet-based products. The discussions also emphasized gender-inclusive approaches for strengthening millet value chains and enhancing livelihood opportunities for women farmers.

To further strengthen global research networks and facilitate scientific collaboration, the initiative is developing the **Millets and Ancient Grains Information System (MAIS)**, a comprehensive digital

platform designed to connect scientists, institutions, and research programmes working on these crops worldwide. The database is developed as an integrated knowledge repository containing information on ongoing research projects, germplasm resources, technologies, and institutional expertise related to millets and ancient grains.

Looking ahead, MAHARISHI is coordinating the flagship **Millets and Ancient Grains International Conference (MAGIC 2026)** scheduled to be held at Global Centre of Excellence on Millets, ICAR-Indian Institute of Millets Research, Hyderabad (Tentative dates: July-Nov). The conference is expected to bring together leading

researchers, policymakers, development partners, industry representatives, and international organizations to deliberate on emerging research priorities, policy frameworks, and investment opportunities in the millet sector. The event will also serve as a global platform to showcase innovations in millet production, processing, value addition, and nutrition-based interventions.

Through these initiatives, MAHARISHI is emerging as an important international platform for advancing collaborative research, strengthening institutional partnerships, and promoting millets and ancient grains as climate-resilient, nutrition-rich, and sustainable crops.



Glimpses of activities and meetings under MAHARISHI

Trainings/Workshops conducted/organized (National/International)

S.No.	Title of the training/ workshop organized	Venue /place	Dates
1	Millets for prosperity: strategies for production, branding, and market linkages to Kalahandi district, Odisha farmers	ICAR-IIMR, Hyderabad	6-9 Jan, 2025
2	Millets, production, processing and value addition technologies	ICAR-IIMR, Hyderabad	07-10 Jan, 2025
3	Millets production, processing, value addition for sustainable agriculture to Kalahandi district, Odisha farmers	ICAR-IIMR, Hyderabad	28-31 Jan, 2025
4	Millet production, processing, and value addition technologies to Cuttack district farmers of Odisha	ICAR-IIMR, Hyderabad	4-7 Feb, 2025
5	Training programme on millets production, processing, and value addition technologies for Maharashtra Farmers	ICAR-IIMR, Hyderabad	4-7 Feb, 2025
6	Exposure of the activities research and extension activities on millets at the centre for NABARD officials.	CRS, Solapur	07 Feb, 2025
7	Millets production, processing, and value addition to Cuttack district farmers of Odisha	ICAR-IIMR, Hyderabad	13-14 Feb, 2025
8	Entrepreneurs on millets processing and value addition for entrepreneurship development (for NEH farmers)	ICAR-IIMR, Hyderabad	18-21 Feb, 2025
9	Farmers exposure cum training programme for SC & ST Farmers - 2025	ICAR-IIMR, Hyderabad	4 March, 2025
10	Exposure Visit cum training program on millet production, processing, and value addition technologies to Ganjam district, Odisha farmers	ICAR-IIMR, Hyderabad	4-7 March, 2025
11	Improved production technologies in millets training to Tamil Nadu farmers	ICAR-IIMR, Hyderabad	11-12 March, 2025
12	Induction training for Odisha FPO entrepreneurs on processing, value-addition, business opportunities, and exports	ICAR-IIMR, Hyderabad	11-13 March, 2025
13	Exposure on millets to farmers from Badwani, M.P. organized by SADO, Badwani, M.P.	CRS, ICAR-IIMR, Solapur	17-18 March, 2025
14	Exposure visit cum training programme on millets production, processing and value addition to Nabarangapur district, Odisha farmers	ICAR-IIMR, Hyderabad	18-21 March, 2025
15	Training programme on millets production, processing and value addition for Scheduled Caste farmers"	ICAR-IIMR, Hyderabad	24-27 March 2025
16	Exposure visit cum training programme on millets production, processing and value addition to Cuttack & Kalahandi district, Odisha farmers	ICAR-IIMR, Hyderabad	25-28 March, 2025

S.No.	Title of the training/ workshop organized	Venue /place	Dates
17	Training program on millets to Mahbubnagar farmers	ICAR-IIMR, Hyderabad	28 March 2025
18	Exposure visit cum training program on millets production, processing, and value addition to Nuapada district, Odisha farmers	ICAR-IIMR, Hyderabad	1-4 Apr, 2025
19	Exposure visit-cum-training program on millets production, processing, and value addition to Angul district, Odisha	ICAR-IIMR, Hyderabad	22-25 April, 2025
20	Entrepreneurship foundation Program in Millets (EFPM)	ICAR-IIMR, Hyderabad	23-26 April, 2025
21	Training cum visit on improved millet production technology	ICAR-IIMR, Hyderabad	04,07,14,21,30 May, 2025
22	Exposure visit-cum-training program on millets production, processing, and value addition to Sundargarh district, Odisha	ICAR-IIMR, Hyderabad	20-30 May, 2025
23	Exposure visit-cum-training program on millets production, processing, and value addition to Keonjhar district, Odisha	ICAR-IIMR, Hyderabad	27- 30 May, 2025
24	Farmers' orientation programme on millets	ICAR-IIMR, Hyderabad	3 June, 2025
25	Exposure visit cum training program on "Millets production, processing and value addition to Angul district, Odisha farmers	ICAR-IIMR, Hyderabad	10-13 June, 2025
26	Exposure visit cum training program on "Millets production, processing and value addition to Rayagada district, Odisha farmers	ICAR-IIMR, Hyderabad	17-20 June, 2025
27	Exposure visit cum training program on "millets production, processing and value addition to Sundargarh district, Odisha farmers	ICAR-IIMR, Hyderabad	24-27 June, 2025
28	Training Programme on millet processing and value addition for agricultural officers of Kerala	ICAR-IIMR, Hyderabad	30 June- 2 July, 2025
29	SAMAADHAN Webinar Series – I, "Startup pitch Mastery – a practical guide to millet based startups" by Ms. Vinutha Rallapalli	ICAR-IIMR, Hyderabad	14 July, 2025
30	Entrepreneurship foundation program in millets	ICAR-IIMR, Hyderabad	14-17 July, 2025
31	Exposure visit cum training program on "millets production, processing, value addition, branding & marketing" to udyogini NGO officials	ICAR-IIMR, Hyderabad	16-18 July, 2025
32	Mid-Season orientation training on improved millets production	ICAR-IIMR, Hyderabad	23 July, 2025
33	Latest advances in millets production, processing, and value addition for Scheduled Caste farmers	ICAR-IIMR, Hyderabad	23 July, 2025
34	Training programme on improved cultivation practices in millets	Yaragatti, Belgaum	25 July, 2025
35	SAMAADHAN Webinar Series – II. "Latest Advancements in Applications of ICAR-IIMR Millets in Extrusion" by Dr. Rajan Sharma PhD, PAU, Ludhiana	ICAR-IIMR, Hyderabad	25 July, 2025
36	Training programme on improved cultivation practices in millets	Yaragatti, Belgaum,	25 July, 2025
37	Training programme on 'latest advances in millets production, processing & value addition for Andhra Pradesh	ICAR-IIMR, Hyderabad	28 July-01 Aug, 2025

S.No.	Title of the training/ workshop organized	Venue /place	Dates
38	Training Programme on “Improved millet production technologies, processing opportunities, and the emerging prospects of millet cultivation in Maharashtra”	CRS Solapur.	25 Aug, 2025
39	Training on best practices in paddy cultivation and cattle health management by ICAR–IIMR and KVK	ICAR-IIMR, Hyderabad	1 Sept, 2025
40	National workshop on sustainable millet production	ICAR-IIMR, Hyderabad	1-2 Sept, 2025
41	Online training program on biofortification-a frontier novel approach to enrich micronutrients in millets to encounter food and nutritional Security in India”, organized	ICAR-IIMR, Hyderabad	1-3 Sept, 2025
42	Millet scientists -scheduled caste farmers interface meeting & input distribution program held at ICAR-KVK, banavasi	ICAR-IIMR, Hyderabad	8 Sept, 2025
43	Training programme on “latest advances in millets production, processing and value addition for school children and teachers of KGBV and TRS	ICAR-IIMR, Hyderabad	8-12 Sept, 2025
44	Millet seed production and quality assurance	ICAR- IIMR Hyderabad	9-12 Sept, 2025
45	“Mycotoxin management in indian agriculture” organized by ICAR–IIMR, hyderabad in collaboration with the horticulture produce management institute (HPMI)	ICAR IIMR, Hyderabad	15 Sept, 2025
46	Millets production, processing and value addition technologies to SC farmers at UAS Mandya	ICAR-IIMR, Hyderabad	19 Sept, 2025
	Training of Trainer's (TOT) program on upscaling of Millets Production, Value chain and Entrepreneurs Development	ICAR-IIMR, Hyderabad	22-24 Sept, 2025
47	Training of Trainers (TOT)	ICAR-IIMR, Hyderabad	22-25 Sept, 2025
48	Training Programme on Improved millets production technologies to the Women Farmers & Entrepreneurs from Tuljapur, Dist. Solapur	CRS Solapur	26 Sept, 2025
49	Training program on post-harvest and processing technologies for Odisha officials and stakeholders	ICAR-IIMR, Hyderabad	07-10 Oct, 2025
50	Prime Minister dhan dhaanya krishi yojana (pmddky)	CRS, Solapur	11 Oct, 2025
51	Farmers Field School (FFS) on finger millet production and value chain development	ARS, Viazianagarm, A.P.	13-14 Oct, 2025
52	Farmers Field School (FFS) on pearl millet production and value chain development	RRS Bajra, Gudamalani, Rajasthan	15-16 Oct, 2025
53	Training programme for scheduled caste (SC) farmers on adoption of millet technologies across diverse agro-ecological regions	CRS Solapur	28 Oct, 2025
54	Farmers field school (FFS) on foxtail millet production and value chain development	Waghai, Gujarat	04-05 Nov, 2025
55	Training programme on latest advances in millets production, processing & value addition for Andhra Pradesh farmers	ICAR-IIMR, Hyderabad	24- 26 Nov, 2025
56	Training program on millets value addition and jackfruit processing under TSP component of GCOE	ICAR-IIMR, Hyderabad	04- 06 Dec, 2025

S.No.	Title of the training/ workshop organized	Venue /place	Dates
57	Training program on millet based technologies to tribal farmers of Nandurbar	ICAR-IIMR, Hyderabad	9 -12 Dec, 2025
58	Training program on millet based value addition and product development to Odisha stakeholders	ICAR-IIMR, Hyderabad	9-12 Dec, 2025
59	Training program on nutri-cereals entrepreneurship foundation program	ICAR-IIMR, Hyderabad	15-26 Dec, 2025
60	Training program on advanced laboratory techniques in genomics, tissue culture, microscopy and grain science	ICAR-IIMR, Hyderabad	15-26 Dec, 2025
61	Training program on millet based technologies to tribal farmers of Pattikonda	ICAR-IIMR, Hyderabad	16-18 Dec, 2025
62	"Production, protection, post-harvest processing and value addition in rabi sorghum" under SCSP	CRS, Solapur	18 Dec, 2025
63	Terminal workshop on enhancing capacity on sustainable value chain development of millets for food and nutrition security in india	ICAR-IIMR, Hyderabad	19 Dec, 2025
64	Exposure visit-cum-training program on millets production, processing, and value addition to Nuapada, Odisha farmers	ICAR-IIMR, Hyderabad	26 Dec, 2025

Trainings Attended – (Physical)

S.No.	Name of Employee	Title of the training	Organized by	Venue /place	Dates
1	Hariprasanna K.	MDP on Priority setting, Monitoring and Evaluation (PME) of Agricultural Research Projects	ICAR-NAARM	Hyderabad	17-22 Feb, 2025
2	Parashuram Patroti	Exploring the opportunities in life sciences through artificial intelligence (AI)	BIRAC E-YUVA Centre and R& D Cell	PAHS, Solapur	25 Feb, 2025
3	Hariprasanna K.	One day Training cum Awareness programme on PPV&FRA	ATARI, Hyderabad and KVK-DDS	KVK, Zaheerabad	28 Feb, 2025
4	Baswaraj Raigond	"Understanding the PPV & FR Act, 2001: Rights, Roles and Responsibilities"	ICAR-NRC on Pomegranate, Solapur	ICAR-NRC on Pomegranate, Solapur.	10 Aug, 2025
5	Indra Kanta Das	Analysis of multi-environment trial data using R	ICAR-NAARM, Hyderabad	ICAR-NAARM, Hyderabad	17-19 Sept, 2025
6	Gopi Kishan	Training of trainers (TOT) on Upscaling of Millets Production, Value chain, and Entrepreneurship Development	ICAR- IIMR, Hyderabad	ICAR- IIMR, Hyderabad	22-25 Sept, 2025

S.No.	Name of Employee	Title of the training	Organized by	Venue /place	Dates
7	Santosh Kumar Gupta	Emerging Science, Technology, and Innovation Conclave (ESTIC-2025) 3rd to 5th November 2025 under the category of Senior S&T Leaders (above 45 years) Bharat Mandapam New Delhi	Department of Science and Technology, Ministry of S&T Govt of India	Department of Science and Technology, Ministry of S&T Govt of India	03-05 Nov, 2025
8	Santosh Kumar Gupta	"From Reads to Revelations: Transcriptome Data Decoded"	ICAR-NAARM, Hyderabad	ICAR-NAARM, Hyderabad	10-14 Nov, 2025
9	B. Amasiddha	MDP on Intellectual Property Valuation and Technology management	ICAR-NAARM, Hyderabad	ICAR-NAARM, Hyderabad	24-28 Nov, 2025
10	Sangappa	Rashtriya Karmayogi Large Scale Jan Seva program Phase I	ICAR-NAARM, Hyderabad	ICAR-NAARM, Hyderabad	15-17 Dec, 2025

Trainings Attended – (Online with Certificate)

S.No.	Name of Employee	Title of the training	Organized by	Venue /place	Dates
1	Baswaraj Raigond	"Virome Profiling in plants: Advanced methods for discovery and analysis"	Div. of Plant Pathology, ICAR-IARI	New Delhi	10-11 March, 2025
2	Parashuram Patroti	Advance Statistical & Machine Learning Techniques for Data Analysis Using Open-Source Software for Abiotic Stress Management in Agriculture	ICAR- National Institute of Abiotic Stress Management Baramati, Pune	Online	16 July - 5 Aug, 2025.
3	Santosh Kumar Gupta	"Impactful AI Tools in Agriculture	ICAR-NAARM, Hyderabad	Online	15-19 Sept, 2025
4	Y.S. Kshirsagar A. R. Limbhore J.V. Chatre	"Adoption of Millet Technologies Across Diverse Agro-Ecological Regions"	Centre on Rabi Sorghum, RS, ICAR-IIMR, Solapur	CRS Solapur	28 Oct, 2025
5	Sooganna	ISSS-ISTA Webinar on Seed Vigour - Mechanisms and Applications	International Society for Seed Science (ISSS) and the International Seed Testing Association (ISTA)	Online	10 Dec, 2025
6	Y.S. Kshirsagar J.V. Chatre	"Production, Protection, Post-harvest and Value Addition in Rabi Sorghum"	Centre on Rabi Sorghum, RS, ICAR-IIMR, Solapur	CRS, Solapur	18 Dec, 2025

Capacity Building

Ph.D Students

Passed out during 2025

S. No	Name of the Student	Discipline	Title of the Research work	Advisor /Co-Advisor from IIMR	University
1	B. Rajyalakshmi	Agronomy	Biochar fertilization impacts on pearl millet productivity, soil quality and resource use efficiency	B. Gangaiah (Advisor) and S. Srividhya (Co-advisor)	LAM, ANGRAU, AP
2	Ch. Trinath	Agronomy	Bio-fortification of zinc and iron in rabi sorghum through fertilization and their after effects on fodder sorghum	B. Gangaiah (Advisor)	LAM, ANGRAU, AP
3	D. Sravani	Genetics and Plant Breeding	Heterotic grouping of low rancid inbred lines based on morphological and molecular markers in pearl millet [<i>Pennisetum glaucum</i> (L.) R. Br.]	P Sanjana Reddy (Co-Advisor)	ANGRAU
On-going					
1	S. Likhita Reddy	Agronomy	Productivity of rabi sorghum as influenced by preceding crops and nutrition in deep vertisols	B. Gangaiah (Advisor), R. Swarna (Co-Advisor)	LAM, ANGRAU, AP
2	S. Sushma	Agronomy	Carbon sequestration by rabi sorghum {(<i>Sorghum bicolor</i> (L.))} and its response to carbon fertilization	B. Gangaiah (Advisor), C. Aruna (Co-Advisor)	PJTAU, Hyderabad
3	Vilas D Aghav	Agronomy	Development of drone herbicide protocols for pearl millet and sorghum and its validation against current weed management practices and their after effect on succeeding fodder cowpea crop	B. Gangaiah (Advisor), S. Srividhya (Co-Advisor)	PJTAU, Hyderabad
4	Trupti Revansiddha Vhanamane	Botany	Development of Heterotic groups in post-rainy season Sorghum (<i>Sorghum bicolor</i> L. Moench	Parashuram Patroti (Advisor)	PAHSU, Solapur
5	Priyanka Suresh Mashale	Botany	Development of high yielding rabi sorghum cultivars with enhanced resistance to biotic and abiotic stresses	Parashuram Patroti (Advisor)	PAHSU, Solapur
6	Archana Gurunath Basargi	Botany	Exploration of Multiparent Advanced Generation Inter Crosses (MAGIC) for broadening the Genetic base and Isolation of new Genotypes in Rabi Sorghum	Parashuram Patroti (Co-Advisor)	PAHSU, Solapur
7	Onkar Bhurale	Botany	Genetic enhancement of grain, fodder yield and related traits and identification of trait specific genotypes in Rabi Sorghum [<i>Sorghum bicolor</i> (L.) Moench]	Parashuram Patroti (Co-Advisor)	PAHSU, Solapur
8	G. Sravanthi	Plant Physiology	Physiological and biochemical studies on heat stress tolerance in sorghum (<i>Sorghum bicolor</i> (L.) moench	Jinu Jacob (member, advisory committee)	ANGRAU, Bapatla
9	Mrs. Kranthi Priya	Genetics and Plant Breeding	Genetic and Molecular Analysis of finger millet (<i>Eleusine coracana</i> (L.) Gaertn) for blast disease and grain yield traits	Ganapathy KN (Co-Chairman)	ARS, Vizianagaram, ANGRAU

S. No	Name of the Student	Discipline	Title of the Research work	Advisor /Co-Advisor from IIMR	University
10	Ms Padmini Sahu	Biotechnology	Regulation of Andrographolide Production in <i>Andrographis paniculata</i> Through Plant Growth-Promoting Rhizobacteria PGPR.	Santosh K Gupta (Co-supervisor)	VBS Purvanchal University, Jaunpur, UP
11	K. Alekya	Genetics and Plant Breeding	Genetic studies of blast resistance in Pearl millet (<i>Pennisetum glaucum</i> (L.) R. Br.)	P Sanjana Reddy (Co-Advisor)	ANGRAU
12	B.K. Nikhil	Genetics and Plant Breeding	Formation of heterotic pools and determining the efficiency of heterotic grouping methods in pearl millet [<i>Pennisetum glaucum</i> (L.) R. Br.]	P Sanjana Reddy (Guide)	IARI- Mega university

M.Sc. Students

Passed out during 2025

S. No	Name of the Student	Discipline	Title of the Research work	Advisor /Co-Advisor from IIMR	University
1	Mehraj	Genetics and Plant breeding	Genetic diversity studies for yield and biochemical traits of germplasm lines in kodo millet	Deepika C (Co-Advisor)	PJTAU, Hyderabad
2	Pasupuleti Ajay	Genetics and Plant Breeding	Genetic diversity and character association in foxtail millet [<i>Setaria italica</i> (L.) P. Beauv.] genotypes using DNA markers, agromorphological and nutritional traits	P Rajendrakumar (Chairperson)	ANGRAU, Guntur, AP
3	Soumya Priyadarsini Dixit	Genetics and Plant Breeding	Agro - morphological and molecular characterization of landraces and varieties in finger millet [<i>Eleusine coracana</i> (L.) Gaertn.]	P Rajendrakumar (Chairperson) Jinu Jacob (Member, Advisory committee)	IARI Mega University, Hyderabad Hub
4	Adithyan K Sathees	M Sc Food Technology and Quality Assurance	Optimization of hydrothermal treatment in barnyard millet using response surface methodology	V M Malathi (Advisor)	MG University, Kerala
5	Vishal N V	M Sc Food Technology and Quality Assurance	Evaluation of nutritional and sensory attributes of sorghum- pulse composite flour.	V M Malathi (Advisor)	Mahatma Gandhi University, Kerala
6	Soumyashree S Patil H	MBA (Agribusiness Management and Management of Rural Development)	A study on challenges in promotion of millet FPOs	Sangappa (Guide)	Mahatma Gandhi Rural Development and Panchyat Raj University, Gadag, Karnataka
7	Sagar B Patil	MBA (Agribusiness Management and Rural Development)	Marketing mix strategies of millet products in FPOs	Sangappa (Guide)	Mahatma Gandhi Rural Development and Panchyat Raj University, Gadag, Karnataka

S. No	Name of the Student	Discipline	Title of the Research work	Advisor /Co-Advisor from IIMR	University
8	Anjali H. Chakalabbi	MBA (Agribusiness Management and Rural Development)	A Study on operation business models adopted by millet FPOs in Tavargera	Sangappa (Guide)	Mahatma Gandhi Rural Development and Panchyat Raj University, Gadag, Karnataka
9	Sachingouda G Goudar	MBA (Agribusiness Management and Rural Development)	Analyzing the supply chain of millet with FPOs interventions	Sangappa (Guide)	Mahatma Gandhi Rural Development and Panchyat Raj University, Gadag, Karnataka
10	N Saritha	Seed Science and Technology	Effect of cold plasma treatment on seed quality of pearl millet	Sooganna (Advisor) R Venkateswarlu (Co-Ad)	PJTSAU, Hyderabad
11	GU Prabhas	Agriculture Entomology	Host plant interaction of spotted stem borer in forage sorghum	G Shyam Prasad (Advisor) K Kavitha (Member)	PJTAU, Hyderabad
12	Manisha R	Genetics and Plant Breeding	Genetic, molecular and biochemical screening for non-waxyness trait in barnyard millet (<i>Echinochloa frumentacea</i> (Roxb.) Link) genotypes	Amasiddha B. (Advisor) P Rajendrakumar (Member)	PJTSAU, Hyderabad
13	Mr. Nijaguna Swamy	Agronomy	Investigation on critical period of crop weed competition in semi arid direct seeded finger millet	Swarna Ronanki (Advisor) B. Gangaiah (Co-Ad)	IARI Hyderabad Hub
14	Mr. G. Bhanu Chander	Agronomy	Effect of crop establishment methods and nutrient management practices on productivity and carbon budgeting of finger millet	Swarna Ronanki (Co- Advisor)	PJTAU, Hyderabad
15	Ms. P. Vijaya Mary	Agronomy	Simulation of sowing time and nitrogen levels in rabi sorghum using APSIM sorghum model	Swarna Ronanki (Co- Advisor)	PJTAU, Hyderabad
16	Jagadisha N. S.	Genetics and Plant Breeding	Genetic analysis of groundnut (<i>Arachis hypogea</i> L): Phenotypic assessment of morpho-physiological and yield traits with SSR marker-based genotyping for climatic stress	Jinu Jacob (Member, Advisory committee)	IARI Mega University, Hyderabad Hub
On- Going					
1	Eppa Sowmya	Plant Pathology	Assessment of mycotoxin responsible for kodo poisoning in kodo millet	Rajesha (Advisor) R. Venkateswarlu (Co-Ad)	PJTSAU, Hyderabad
2	Pinky kumari	Genetics and Plant Breeding	Characterization of sorghum landraces for agro-morphological, molecular, and popping quality traits	Deepika C Advisor Aruna C P. Rajendrakumar Malathi V M (Co-Advisors)	IARI-Hub, Hyderabad

Students visit to ICAR-IIMR

In 2023, the Government of India, under the leadership of honourable prime minister Shri. Narendra Modi, supported the International Year of Millets recognizing millets as strategic crops for improving food security, nutritional quality, and agricultural sustainability. As part of this initiative, ICAR-IIMR Hyderabad, was recognized as a global Centre of Excellence, reflecting its role in advancing millet research and promoting awareness at national and international levels.

Millets and ancient grains, known for high nutritional value, including low glycemic index, high dietary fiber, and significant micronutrient content making them relevant in addressing modern dietary challenges. Current dietary patterns among younger populations show an increased consumption of fast foods and sugar-rich products, which are associated with a higher risk of metabolic disorders and nutritional deficiencies. This underscores the need for targeted nutrition education to encourage healthier eating behaviours among school and college students.

IIMR plays a critical role in this domain through structured educational and experiential learning programs to approximately 4800 school and college students from

across the country. These initiatives involve guided institutional visits, during which students are exposed to demonstration plots showcasing diverse millet species and scientifically validated agronomic practices. The institute also delivers educational modules on the nutritional composition of millets, their health benefits, and recent advancements in processing technologies and value-added product development.

Furthermore, IIMR highlights the economic potential of millets by promoting their role in entrepreneurship, particularly in food processing, product innovation, and sustainable agribusiness. IIMR has engaged thousands of students from schools across Telangana as well as from agricultural and other higher education institutions nationwide. Observations from these outreach activities indicate positive outcomes, including increased awareness of balanced diets, greater acceptance and adoption of millet-based foods, and knowledge transfer to households and communities. Strengthening collaborations between research institutions and educational organizations will be essential to expand the reach of such initiatives and to support long-term improvements in public health and sustainable food systems.

Date	University/college	Total No. of students
6 Jan, 2025	University of Agricultural Sciences, Dharwad, Karnataka	25
23 Jan, 2025	School of Agricultural Sciences, Nagaland University, Medziphema, Nagaland	45
22 Jan, 2025	D.Y. Patil Agriculture and Technical University (DYP-ATU), Kolhapur, Maharashtra	72
22 Jan, 2025	UAS, GKVK, Bangalore	32
22 Jan, 2025	Nagaland university	57
27 Jan, 2025	Padanakkad, Kerala Agricultural University	108
29 Jan, 2025	Dhanalakshmi Srinivasan University	112
30 Jan, 2025	SRM Institute of Science and Technology, Chennai, Tamil Nadu	105
10 Feb, 2025	PJTAU, Telangana	68
12 Feb, 2025	Thanthai Roever Institute of Agriculture and Rural Development	103
12 Feb, 2025	Agricultural College and Research Institute, Madurai	106
13 Feb, 2025	Kumaraguru Institute of Agriculture, Tamil Nadu	140
13 Feb, 2025	College of agricultural technology, Theni, Tamil Nadu	154
14 Feb, 2025	Adhiparashakthi college, Tamil Nadu	148
17 Feb, 2025	Sethu Bhaskara Agricultural College, Tamil Nadu	99
19 Feb, 2025	JSA College of Agriculture and Technology, Tamil Nadu	130
19 Feb, 2025	Annamalai University, Faculty of Agriculture	112

Date	University/college	Total No. of students
20 Feb, 2025	Annamalai University, Tamil Nadu	135
20 Feb, 2025	SRS Institute of agriculture and technology, Tamil Nadu	99
24 Feb, 2025	CSCSZI, Tamil Nadu	50
5 Mar, 2025	Tamil Nadu Agricultural University, Coimbatore	60
5 Mar, 2025	College of Agriculture, UAS, Raichur	65
6 Mar, 2025	Palar Agriculture College, Vellore, TN	112
9 Mar, 2025	Best University	32
11 Mar, 2025	University of Agricultural sciences Raichur,	50
12 Mar, 2025	JAC, Tamil Nadu	86
13 Mar, 2025	Oakridge school, Bachupally	8
25 Mar, 2025	Aravindhar Agricultural Institute of Technology	137
10 Jun, 2025	College of Agriculture and Research Station, Kumhrawand, Jagdalpur, Chhattisgarh	89
1 Apr, 2025	Annamalai university, Tamil Nadu	129
11 Apr, 2025	SR University, Telangana	50
11 Apr, 2025	RUS Agricultural College, Tamil Nadu	141
16 Apr, 2025	Nalanda Agricultural college	87
10 Jun, 2025	SG College of Agriculture and Research Station, Jagdalpur	69
18 Jun, 2025	Mahatma Phule Krishi Vidyapeeth Rahuri, Dondaicha, Maharashtra	92
10 Jul, 2025	Keystone school, Hyderabad	60
13 Aug, 2025	College of Agriculture, Lembucherra, West Tripura	102
29 Aug, 2025	St. Mary's College, Hyderabad	150
9 Sep, 2025	Intermediate students from Telangana	42
10 Sep, 2025	TNAU, Coimbatore	98
10 Sep, 2025	CEDI, TANUVAS, Tamil Nadu	40
11 Sep, 2025	Kasalingam university, Tamil nadu	29
17 Sep, 2025	Amrita University, Tamil nadu	104
17 Sep, 2025	Mahindra University, Telangana	60
15 Oct, 2025	CFNFI, Chennai	38
15 Oct 2025	Tamil Nadu Agricultural University (TNAU), Coimbatore,	112
17 Oct, 2025	Olive Mount school, Hyderabad	79
9 Nov, 2025	Agriculture college, Jharkhand	48
20 Nov, 2025	PJTAU, Telangana	52
9 Dec, 2025	Sethu Bhaskaran Agricultural College, TN	66
9 Dec, 2025	NICI, Tamil Nadu	106
10 Dec, 2025	RLBCAU, Thanse	64
11 Dec, 2025	TRIARD, Perambadur	120
16 Dec, 2025	Banda University, Banda	67
20 Dec, 2025	Agricultural College and Research Institute, Madurai	200
31 Dec, 2025	Tamil Nadu Agricultural University	69
23 Dec, 2025	PJTAU, Telangana	35
	Total	4848



Technical exposure for B.Tech. (Agricultural Engineering) students from D.Y. Patil Agriculture and Technical University (DYP-ATU), Kolhapur, Maharashtra (22nd Jan 2025)



B.Sc. (Agri.) students from College of Agriculture, Lembucherra, visit to ICAR-IIMR, Hyderabad, as part of their educational exposure program (13th August 2025)



Academic exposure for B.Sc. (Agriculture) students from Annamalai University, Tamil Nadu



Academic exposure for B.Sc. (Agriculture) students from Tamil Nadu



Educational exposure for B.Sc. (Agriculture) students from Best Innovation University – School of Agriculture, Andhra Pradesh



Visit of college student from Vanavarayar Institute of Agriculture, Tamil Nadu (23rd Feb 2025)

Awards and Recognitions

S.No.	Name	Title of award/Recognition	Award/recognition details and organization
1.	Dr. (Mrs.) C. Tara Satyavathi	United States House of Representatives – US Congressman 1st District Medal	In recognition to remarkable contributions to agricultural science, particularly in millets research, and her role in driving agricultural transformation and sustainable development at a prestigious ceremony in Washington DC, USA.
2.	Dr. (Mrs.) C. Tara Satyavathi.	Highest accolade from the American Multi-Ethnic Commission (AMEC)	In recognition to remarkable contributions her significant contributions to agricultural science and leadership from the American Multi-Ethnic Commission (AMEC)
3.	Dr. (Mrs.) C. Tara Satyavathi.	NAAS Fellow	In recognition of her outstanding scientific contribution in crop improvement and immense contribution over decades as Pearl Millet breeder from National Academy of Agricultural Sciences (NAAS), New Delhi
4.	Dr Nepolean T	NAAS Fellow	In recognition to his outstanding contributions to agricultural science, particularly in millet genomics and improvement National Academy of Agricultural Sciences, New Delhi
5.	Dr. P.G. Padmaja	Dr. B. Vasantharaj David Award for excellent research contributions on bio-ecology of insect pests of millet crops and their management with special reference on host plant resistance	Applied Zoologists Research Association (AZRA) during XIX AZRA International Conference on “Environmental shift: impact on animal biota, food, feed, nutritional security & human health” 12 November, 2025 at Bhubaneswar, Odisha, India
6.	Shri Srinivasa Babu K	Recognition from Honorable Chief minister of AP	Recognition from the Honourable chief Minister Shri Chandra Babu Naidu, Andhra Pradesh for promotion of millets in the state
7.	ICAR-Indian Institute of Millets Research, Hyderabad	Certificate of Appreciation	In recognition to significant registration of sorghum and small millets varieties with Protection of Plant Varieties and Farmers' Rights Authority, New Delhi
8.	Dr Rajesha G	Zonal Councilor, IPS (Central Zone)	Indian Phytopathological Society, New Delhi.

S.No.	Name	Title of award/Recognition	Award/recognition details and organization
9.	Dr Sangappa	Young Scientist	Society of Extension Education, Agra, Siksha 'O' Anusandhan (Deemed to be University), Bhubaneswar, Odisha, Central University of Odisha
10.	Dr Sangappa	Excellence in Extension Award	University of Agricultural Sciences, Raichur, Karnataka
11.	Dr Baswaraj Raigond	Nominee (as a member)	Ministry of Environment, Forest & Climate Change, Govt. of India
12.	Dr Baswaraj Raigond	State Level Coordination Team member	ICAR-NIASM, Baramati
13.	Dr Baswaraj Raigond	Scientific Advisory Committee member	Krishi Vigyan Kendra, Kegaon, Solapur
14.	Dr Baswaraj Raigond	Award Screening Committee	Indian Phytopathological Society (IPS), New Delhi
15.	Dr Parashuram Patroti	SAB Fellowship	Society for Applied Biotechnology, Tamil Nadu
16.	Dr Parashuram Patroti	SAB Award for Excellence in Bioresource technology	International Symposium on Bioresource Technology, Vijayapura, Karnataka, 11-13 April 2025
17.	Dr Parashuram Patroti	Member, Board of Studies (BoS) for Biotechnology	Walchand Institute of Biotechnology, Solapur.
18.	Dr Parashuram Patroti	Member of the Technical Evaluation Panel (TEP) for the E-YUVA Fellows (BIRAC 3rd Nationwide Call).	BIRAC E-YUVA Centre, Punyashlok Ahilyadevi Holkar Solapur University, Solapur.
19.	Dr Parashuram Patroti	R & D Expert	Institution's Innovation Council (IIC), R&D Cell / Idea Cafe, Walchand College of Arts and Science, Solapur
20	Ms. P. Sharmila M.Sc. Entomology student of Dr. P.G. Padmaja	Second prize in online oral presentation on "Oviposition preference of the Fall Armyworm (<i>Spodoptera frugiperda</i>) in millets"	International conference on Sustainable Innovations in Agriculture, Veterinary and Allied Sciences during 30 December, 2025 at University of Agricultural Sciences (UAS), Raichur, Karnataka
21.	Dr Amasiddha B	Bronze Medal	Long Jump in the Interzonal Sports Tournament (4.74 M)



Dr. (Mrs.) C. Tara Satyavathi, Director, ICAR-IIMR awarded Highest accolade from the American Multi-Ethnic Commission (AMEC) in recognition of her significant contributions to agricultural science and leadership



Dr. (Mrs.) C. Tara Satyavathi, Director, ICAR-IIMR awarded NAAS Fellow in recognition of her outstanding scientific contribution in crop improvement and immense contribution over decades as Pearl Millet breeder from National Academy of Agricultural Sciences (NAAS), New Delhi



Dr. Nepolean T, Principal Scientist, awarded NAAS Fellow in recognition of his outstanding contributions to agricultural science, particularly in millet genomics and improvement National Academy of Agricultural Sciences, New Delhi



Dr. Sangappa, Senior Scientist, awarded "Young Scientist" by the Society of Extension Education, Agra, Siksha 'O' Anusandhan, Bhubaneswar, Odisha, Central University of Odisha



Recognition to Shri K. Srinivasa Babu from the Honourable Chief Minister of Andhra Pradesh Shri Chandra Babu Naidu for promotion of millets in the state



Dr. B. Vasantharaj David Award to Dr. P. G. Padmaja for excellent research contributions on bio-ecology of insect pests of millet crops and their management

Externally Funded Projects

Sr. No.	Project Title	Principal Investigator	Funding Agency	Total budget (Rs in Lakhs)	Duration
1	Socio-Economic Analysis and Strategic Options to Enhance Small Millets Cultivation for Nutritional Security in India	Anuradha Narala	ICSSR-MoE	15.5	2024-2026
2	Sustainable enhancement of livelihood of tribal farmers of Tamil Nadu through improved production technologies and value chain of millets	A. Kalaisekar	Government of Tamilnadu	190	2023-26
3	Formation and Promotion of FPOs under NABARD AP Project 2.0	Sangappa	NABARD, AP	125	2023-2028
4	Formation and Promotion of FPOs Under NABARD Telangana Project 2.0	Sangappa	NABARD, Telangana	50	2023-2028
5	Deciphering the marker-trait associations for grain yield and blast disease resistance traits in finger millet through genome-wide association analysis	K. N. Ganapathy	SERB-DST	39.35	2023-2026
6	Evaluation of Nano DAP in pearl millet and sorghum	Swarna Ronanki	Coromandel Fertilizers	12.98	2023-2026
7	Evaluation of foliar application of Coromandel Nano-Urea in sorghum crop	Swarna Ronanki	Coromandel Fertilizers	7.08	2023-2025
8	Molecular prediction and candidate gene(s) identification for grain yield heterosis in <i>kharif</i> sorghum through genomics and transcriptomics approaches	P. Rajendra Kumar	SERB-DST	38.92	2022-2025
9	Development and characterization of trait specific lines from wide hybridization in sorghum	Jinu Jacob	SERB power grant	30.41	2022-2025
10	Combined effect of elevated CO ₂ and temperature on water use efficiency, productivity, quality of major cereal fodder crops and soil health	Seva Nayak	SERB-CGR	42.86	2022-2025
11	Biodiversity International: Consumption of resilient orphan products for healthier diets	Sooganna	Bioversity International & ICAR-NBPGR	23.00	2022-2025
12	Identification of SNP-trait associations for seed longevity traits through association mapping in pearl millet and finger millet	N. Kannababu	SERB-DST	49.28	2021-2025
13	Formation and promotion of FPOs under NCDC Telangana	Sangappa	NCDC-ATARI Hyderabad	50.00	2021-2026
14	Formation and promotion of FPOs under NABARD Telangana	Sangappa	NABARD Telangana	50.00	2021-2027

Sr. No.	Project Title	Principal Investigator	Funding Agency	Total budget (Rs in Lakhs)	Duration
15	Formation and promotion of FPOs under NABARD Andhra Pradesh	Sangappa	NABARD, AP	50.00	2021-2027
16	Upscaling millets production through mainstreaming landraces/improved cultivars, Crop diversification, Supply of quality seeds (grain and fodder), Capacity Building and Strengthening of Value chain in Millets for Food and Nutritional security of Odisha.	K. Srinivas Babu	Govt .of Odisha	665.828	2023- 2029

Other ICAR, DA &FW Funded Projects

S. No.	Project Title	Principal Investigator	Funding details	Total budget (Rs in Lakhs)	Duration
1	A comprehensive study to establish the health benefits (in vivo) of Nutri-cereals: A way forward for mainstreaming millets	R. Venkateshwarlu	NFSM	395.30	2022-2025
2	Formation and promotion of FPOs for oilseed crop and oil palm under Central Sector Scheme for formation and promotion of 10,000 FPOs	Sangappa	SFAC, DAFW	125.00	2021-2026
3	Formation and promotion of FPOs under Central Sector Scheme for formation and promotion of 10,000 FPOs	Sangappa	SFAC, DAFW	125.00	2021-2026
4	CRP in 'Biofortification in selected crops for nutritional security'	K. Hariprasanna	ICAR	120	2021-2026
5	CRP on Agrobiodiversity	K. Venkatesh	ICAR	150.00	2021-2026
6	AICRP on Seed (Crops)	B. Venkatesh Bhat	ICAR-IISS Mau	3.50	Continuous
7	Farmer FIRST programme component of KVK scheme "Participatory technology validation diversification, value addition for small holders livelihood improvement of Central Telangana Zone"	R. R. Chapke	ICAR	24.50 (contd...)	2020-2025
8	Central Sector Scheme for Protection of Plant Varieties and Farmers' Rights Authority	K. Hariprasanna	PPV&FRA	8.50 (contd...)	2008-till date
9	National Agriculture Innovation Fund- ZTMC	J. Stanley	ICAR	12.00 (contd...)	Continuous
10	Frontline demonstration on sorghum	R. R. Chapke	DA&FW, MOA	163.125 (contd...)	2009- till date
11	Enhancing climate resilience and ensuring food security with genome editing tool	D. Balakrishna	ICAR	107.0 lakhs	2023-2026
12	Establishment of Agri- Business Incubation (ABI) Centres under XIIth Plan Scheme for National Agricultural Innovation Fund	J. Stanley	NAIF-ABI	100.00	2017-2026
13	AICRP on Biological Control of Crop Pests Scheme	G. Shyam Prasad	ICAR	2.00	2009- till date

Memorandum of Agreements / Understandings

S. No.	Date of Agreement	Second Party/ Licensee	Purpose of MoA/ MoU	Signatory of Licensee/ Second party
1	01.01.25	Nitrogen Parameters, Chennai, TamilNadu	Manufacturing and sale of Leaf colour chart (LCC) for sorghum, pearl millet and finger millet	Mr. Benny Thomas, Managing Partner
2	01.01.25	Bharatiya Beej Sahakari Samiti Ltd, New Delhi	Licensing of sorghum fodder hybrid CSH 43MF	Mr. Chetan Joshi, Managing Director
3	13.02.25	Kshetragna Agronym Pvt Ltd., Hyderabad	Licensing of 6 millet value added technologies	Mr. Ravindra Babu, MD
4	11.03.25	Nutremite, Hyderabad	Licensing of 6 millet value added products	Smt. Ushasri, Director
5	24.03.25	Mahatma Gandhi University, Kerala	Collaborative research	Prof. Bismi Gopalakrishnan, Registrar
6	22.04.25	National Sugar Institute, Lucknow, UP (First party)	Collaborative research	Prof. Seema Paroha, Director
7	24.04.25	Heartyculture Natural Products LLP, Hyderabad	Licensing of 6 millet value added products	Mr. Sivasaravanan, Designated Partner
8	05.05.25	IE 5 Foods Private Limited, Hyderabad	Licensing of 2 millet value added products	Smt. Kalyani, Founder
9	30.05.25	NIFTEM, Kundli & JVS Food Pvt Ltd, Rajasthan	Collaborative research	Mr. PC Mahnot, Director
10	10.06.25	College of Food Technology, VNMKV, Parbhani, Maharashtra	Student research for Ph.D	Dr. BV Asewar, Director & Dean
11	11.06.25	Research & Innovation Circle (RICH), Hyderabad, Telangana	Collaborative research	Ms. Rashmi Pimpale, CEO
12	23.06.25	HPCL Biofuel Ltd., Patna, Bihar	Collaborative research and promotion of sweet sorghum	Mr. Sanjay Kumar Barman, CEO
13	03.07.25	Guruswad Foods Agriculture and Food Association, Maharashtra	Licensing of 2 millet value added technologies i.e. sorghum puffs & sorghum namkeens (Chivda)	Mr. Dagadu Savappa, MD
14	03.07.25	Urban Firman Nutrient India Pvt Limited, Andhra Pradesh	Licensing of 6 millet value added technologies i.e. sorghum multi grain atta, pearl millet puffs, sorghum muesli, foxtail millet vermicelli, multi millet cookies & finger millet based energy bar	Mr. Bothu Umamaheswar Reddy, Founder
15	03.07.25	Unistem Sales and Marketing LLP, Hyderabad	Licensing of 2 millet value added technologies i.e. multi-millet cookies & finger millet based energy bar	Mr. GNV Sampath Kumar, Designated Partner
16	04.07.25	Hora Millets and Organics Private Limited, Hyderabad	Licensing of 6 millet value added technologies i.e. sorghum puffs, sorghum eggless muffins, sorghum muruku, protein rich sorghum muesli, finger millet based energy bar & ragi choco chip cookies	Mr. Nagila Shashank Reddy, Director
17	01.08.25	Germanten Healthcare, Hyderabad	Providing medical facilities to IIMR Staffs as per the CGHS tariffs	Mr. Khalid Ali, Medical Director
18	11.09.25	Mahyco Private Limited, Mumbai	Licensing of sorghum hybrid CSH 24MF	Mr. Vivek Kwatra, Lead
19	11.09.25	Rallis India Limited, Mumbai	Licensing of sweet sorghum hybrid CSH 22SS	Mr. Vibhakar, Head
20	11.09.25	Rallis India Limited, Mumbai	Licensing of sweet sorghum variety CSV 49SS	Mr. Vibhakar, Head

S. No.	Date of Agreement	Second Party/ Licensee	Purpose of MoA/ MoU	Signatory of Licensee/ Second party
21	11.09.25	Providence Health & Lifestyle Private Limited, Hyderabad	Licensing of 2 millet value added technologies i.e. Finger millet jaggery cookies & finger millet (nut) delight bar	Mr. Samson, Founder & Director
22	17.09.25	Wholly Good Farms, Andhra Pradesh	Licensing of 7 millet value added technologies i.e. Multigrain atta, multimillet instant idli mix, sorghum instant upma mix, sorghum puffs, sorghum jeera cookies, finger millet premium cashew cookies & protein-rich jowar muesli	Mr. Vishal Dhanuka, Designated Partner
23	17.10.25	Trie Roots Origins Private Limited, Hyderabad	Licensing of Multi-millet cookies, Sorghum premium choco chip cookies, Finger millet nut delight bar	Mr Satya Narayana, Business Head
24	03.11.25	Eldorado Agritech Limited, Hyderabad	Licensing of multi cut forage sorghum hybrid CSH 24 MF	Dr. Linga Srinivasa Rao, Chairman & Managing Director
25	03.11.25	Sangam Milk Producer Company Limited, Andhra Pradesh	Licensing of 5 millet value added technologies i.e. Finger Millet cookies, Sorghum muffins, finger millet muffins, sorghum instant idli mix and multi-millet idli mix	Mr. P.Gopalkrishnan, Managing Director
26	03.11.25	Kaveri University, Hyderabad	Collaborative research	Dr. V. Praveen Rao, Vice Chancellor
27	19.11.25	Society for Elimination of Rural Poverty, Govt. of Telangana	Licensing of 13 millet value added technologies i.e. sorghum instant idli mix, finger millet premium cashew cookies, sorghum instant upma mix, finger millet delight bar (nut), sorghum instant Pongal mix, finger millet muffins, little millet instant dosa mix, sorghum puffs, sorghum instant khichdi mix, sorghum namkeen/chivda, sorghum vermicelli, sorghum pasta, finger millet bread	Mr. PW Johnson, Director
28	19.11.25	Happysun Foods Private Limited, Assam	Licensing of 4 millet value added technologies i.e. Sorghum mankeen/chivda, sorghum extruded snacks, sorghum puffs, sorghum instant khichdi mix	Mr. Ujjal Barua, Managing Partner
29	24.11.25	Temple Grains & Wellness Private Limited, Tamil Nadu	Licensing of 5 millet value added technologies i.e. Sorghum instant idli mix, Sorghum vermicelli, Finger millet pasta, Multimillet rava, Finger millet nut delight bar	Ms. Subramanian Rashmi, Director/Founder
30	02.12.25	Durgi Foods, Hyderabad	Licensing of finger millet nut delight bar	Mr. Durgi Vamshi, Managing Director
31	11.12.25	ICICI Foundation	Collaborative research	Mr. Venkatesh BK, Head of Operations
32	12.12.25	Vignan Foundation for Science, Technology and Research, Andhra Pradesh	Collaborative Research for students training (Post graduate research & Ph.D.)	Dr. PMV Rao, Registrar
33	18.12.25	School of Agriculture, Gandhi Institute of Engineering and Technology, Odisha	Collaborative Research for students training & Extension activities	Dr. VS Devadas, Dean



MoU with Hare Krishna Movement Charitable Foundation, Hyderabad



MoU with Borne Technologies Pvt. Ltd, Coimbatore



MoU with Vasantdada Sugar Institute, Pune and Indian Federation of Green Energy, New Delhi



MoU with Paani Foundation



MoU with ICICI Foundation



MoU with Sangam Dairy Milk Products

Highlights of ICAR-AICRP on pearl millet and ICAR-AICRP sorghum and small millets- AGM 2025 Highlights

The combined 60th (Diamond Jubilee) Annual Group Meeting of ICAR-AICRP on Pearl millet, 55th Annual Group Meeting of ICAR-AICRP on Sorghum, and 36th Annual Group Meeting of ICAR-AICRP on Small millets was organized during 28-30 May, 2025 in online mode by ICAR-Indian Institute of Millets Research (IIMR), Hyderabad in collaboration with ICAR-AICRP on Pearl millet and ICAR-AICRP on Sorghum and Small millets. As part of combined Annual Group Meeting, the centre-wise scientific work plan audit was organized on 6 May 2025 for Pearl millet, and on 7-8 May 2025 for Sorghum and Small millets. More than 200 researchers from different Pearl millet, Sorghum and Small millets centres, volunteer centres, private sector, NGOs, ICRISAT and other collaborating institutes participated in the group meeting.

Inaugural session of Combined AGM 2025

The Inaugural session was held under the Chairmanship of Dr. DK Yadava, DDG (CS), ICAR, New Delhi on 28th May 2025. Dr. ML Jat, Secretary, DARE & DG, ICAR was the Chief Guest while Dr. S.K. Pradhan, ADG (FFC), ICAR was the Guest of Honour. Dr. (Mrs.) C Tara Satyavathi, Director, ICAR-IIMR and Project Coordinator, AICRP, Pearl millet, and Dr. R. Madhusudhana, Project Coordinator, AICRP, Sorghum and Millets presented the overall progress under each AICRPs during 2024-25 and priority areas. Dr. SK Pradhan in his address projected the expected requirement of millets by 2047 and the preparedness we need to have to meet this. The Chairman emphasized on area decline under millets, benchmarking for biotic and abiotic stresses, plant types, shelf life in biofortified millets, area expansion through Intercropping, strengthening of seed system, donor identification for hybridization, diversification of CMS, pre-breeding, organic cultivation, conduct of trials by the centres, rezonalization, soil regeneration

and digitization of AICRP trial data. The Chief Guest stressed upon the need to identify niche areas for millet cultivation, millet systems mapping, intercropping, shorter duration millets, fodder quality, methane emission study, reduction of yield gaps, strengthening of RRS-Barmer, domain for sweet sorghum, perenniality, and more emphasis on agronomic management in millets.



Review of Research: Scientific audit based on presentations of ICAR-AICRP on Pearl millets, Sorghum and Small millets Centres

The review of research and scientific audit of ICAR-AICRP on Pearl millet, Sorghum and Small millets centres based for work done during 2024-25 and plan for next year was conducted under the Chairmanship of Dr. S K Pradhan, ADG (FFC), ICAR while Dr. (Mrs.) C. Tara Satyavathi, Director, ICAR-IIMR and Project Coordinator, Pearl millet, and Dr. R. Madhusudhana, Project Coordinator, Sorghum and Millets were the Co-chairs. Dr. O P Yadav, Chairman, PAMC, and Dr. Chennabyre Gowda, Member, PAMC were the experts during the presentations. A total of 43 presentations across three ICAR-AICRPs were made by the respective Officers-in-charge of the ICAR-AICRP centres. The

presentations covered general information about the centre, staff position, ATR on recommendations of AGM 2024, no. of trials conducted under each discipline, significant achievements, priority areas of research for the centre and action plan for each, major efforts and achievements under each priority area and discipline, utilization of AICRP material in the research programmes, seed production, technology adopted based on AICRP programme, publications, constraints, and future line of work. Each presentation was followed by discussion and recommendations for further improvement of the performance of the centre based on regional and national requirements. Details of suggestions and recommendations received during presentations have been recorded and presented in the detail report.

Technical Programme (2025-26) Planning Meeting of ICAR-AICRP on Pearl millet, Sorghum and Small millets

The review of research results and progress report under different crops and disciplines was conducted under the Chairmanship of Dr. DK Yadava, DDG (CS), ICAR and Dr. SK Pradhan, ADG (FFC), ICAR acted as Co-Chairman in the presence of Dr. (Mrs.) C Tara Satyavathi, Director, ICAR-IIMR cum Project Coordinator, Pearl millet, and Dr. R Madhusudhana, Project Coordinator, Sorghum and Millets. PAMC Chairman Dr. OP Yadav, and member Dr. Chennabyre Gowda were the experts during the presentations. Scientists from public sector, private sector and ICRISAT attended this online meeting. All the principal investigators (total 20) of ICAR-AICRP on Pearl millet, Sorghum and Small millets presented their technical programmes under different disciplines viz., Plant breeding, Agronomy, Plant Physiology, Agricultural Entomology, Plant Pathology, FLDs & TSP, Seed production, and Millets Genetic Resources management. Details of suggestions and recommendations received during presentations have been recorded and presented in the detail report.

Presentation of Progress Report 2024-25 during combined AGM

These discipline-wise sessions were organized under the Chairmanship of different ADGs of ICAR as well as PAMC experts in the presence of Project Coordinators of

both AICRPs during 28-29 May 2025. The presentations were divided into five thematic groups as Crop Improvement, Crop Production, Crop Protection, Outreach activities & ICAR-ICRISAT partnership trials, and Seed production, Germplasm & IPR management. The Chairman and Co-chairman of the respective groups overviewed the progress in all the disciplines in all millets. The research outputs of the three AICRPs were published in peer reviewed national and international journals. The Chairmen and Co-chairmen stressed on the development of more high yielding hybrids/varieties, more profitable cultivation practices, pest management strategies, effective out-reach of research outputs to farmers, and availability of quality seed in all millets and enhancing the seed replacement rate (SRR). The productivity should be increased in all the small millets and sorghum to make millets cultivation profitable to the farmers. Use of advanced genomic and phenomic approaches should be emphasized for enhancing the genetic gains.

Plenary session

The session started with brief welcome of Chairman and Co-Chairman and briefing about the three-day event session-wise by Dr. (Mrs) C. Tara Satyavathi, Director, ICAR-IIMR. This was followed by the presentation of the major technical recommendations of various sessions by the session rapporteurs. Dr. Chennabyre Gowda, Member PAMC gave his observations. Dr. SK Pradhan, ADG (FFC) and Co-Chairman and Dr. DK Yadava, DDG (CS) and Chairman gave their remarks and suggestions.

New millet varieties identified for release

The Varietal Identification Committee meeting was held on 28 May 2028 in online mode chaired by Dr. DK Yadava, DDG (CS), ICAR. A total of 24 proposals (Pearl Millet - 9, Sorghum - 13 & Small millets - 2) were placed before the Committee. The committee critically examined the proposals of Pearl Millet, Sorghum and Small millets for different zones / states and made the recommendations.

Journal Papers

> 6.0 NAAS rating

1. Krishna Kishore Gali, Kevin C. Koh, Tara Chellapilla Satyavathi, Ganapathy Kuyyamudi Nanaiah, K.B. Palanna, Morgan W. Kirzinger, Sandeep Nanjundappa, Sampath Perumal, Deekshitha Bomireddy, H.B. Mahesh, Harshal Eknath Patil, Raju Chaudhary, Loveleen Kaur Dhillon, Venkat Bandi, V.B. Reddy Lachagari, Surya Teja Veeramachaneni, Renuka Malipatil, Peng Gao, Shankar Pahari, Andrew G. Sharpe, Thomas D. Warkentin, Raju Soolanayakanahally*, M.K. Prasannakumar*, Nepolean Thirunavukkarasu* and Sateesh Kagale*. 2025. Little millet genome reveals evolutionary insights into tetraploid structure and genetic basis of micronutrient density. *Nature Communications*. <https://doi.org/10.1038/s41467-025-66716-6> (**JrnlID: N024; Score:20.00**).
2. Chapke, R.R., Balakrishna, D., Satyavathi, C.T. and Laxmiprasanna, P. 2025. Asset-based millets production interventions for livelihood improvement in semi-arid Telangana: A multidimensional livelihood capital approach. *Environmental and Sustainability Indicators*. <https://doi.org/10.1016/j.indic.2025.101088> January 2025 (**JrnlID;; Score:11.60 (6.00 + 5.60)**).
3. Singh, T., Goswami, S., Ali, A., Munibyrappa, S., Dutta, M., Thimmegowda, V., Kumar, R.R., Bansal, N., Kundu, A., Meena, M.C., Mishra, G.P., Singh, S.P., Singh, N. and Tara Satyavathi, C. 2025. Characterization of phenolics and influence of phytic acid content on iron and zinc bioaccessibility in chapati prepared from diverse pearl millet genotypes. *Molecular Nutrition & Food Research* p.e70130. June 2025 (**JrnlID: M105; Score:10.50**).
4. Chapke, R.R., Satyavathi, C.T., Israel Oliver King, E.D., Laxmiprasanna, P. and Priyanka, V. 2025. Perceptions of climatic variability among millet farmers: insights from tribal communities in the Kolli Hills, Tamil Nadu, South India. *Frontiers in Climate* 6: 1506084 January 2025. (**JrnlID;; Score:10.1 (6.00 + 4.10)**).
5. Prasanna, S. Koti, Patro, T.S.S.K., Palanna, K.B., Jeevan, B., Prasanth, P., Ramesh, G.V., Anuradha, N., Sandhya Rani, Y., Triveni, U., Lavanya Devi, K., Poonacha, T., Farooq Khan., Praveen, B., Divya, M., Sabina Mary, D., Prasanna Kumari, V., Nagaraja, T.E., Madhusudhana, R. and Tara Satyavathi, C. 2025. Unraveling the pathogenomics of *Rhizoctonia solani* infecting proso millet (*Panicum miliaceum* L.): genomic perspective on ruthless virulence and adaptive evolution. *Frontiers in Microbiology* 07 March 2025 (**JrnlID: F101; Score:10.00**).
6. Kumar, R.R., Kumar, A., Goswami, S., Kumar, S., Singh, S.P., Prasad, C.T.M., Mishra, G.P., Padaria, J.C., Jha, G.K., Chellapilla, T.S. and Chinnusamy, V. 2025. Characterizing the enzyme-driven metabolic shifts in rancid pearl millet flour using metabolomics approaches: A step towards improving quality and shelf-life. *Frontiers in Nutrition*, 12, p.1691522 October 2025 (**JrnlID: F103; Score:10.00**).
7. Yadav, S., Tomar, M., Singhal, T., Joshi, N., Bhargavi, H.A., Aavula, N., Langyan, S., Joshi, T., Tara Satyavathi, C., Chand Rana, J., Singh, S.P., Rakesh Bhardwaj, R. and Riari, A. 2025. Near-infrared reflectance spectroscopy (NIRS): An innovative, rapid, economical, easy and non-destructive whole grain analysis method for nutritional profiling of pearl millet genotypes. *Journal of Food Composition and Analysis* 142: 107373 June 2025. (**JrnlID: J257; Score:10.00**).
8. Aruna, C., Kanti Meena, Visarada, K.B.R.S., Hariprasanna, K., Deepika, C., Venkateswarlu, R., Das, I.K., Meena, D.K., Madhusudhana, R., Tara Satyavathi, C. 2025. Red sorghum variety: A dual solution for functional food and grain mold resistance. *Journal of Cereal Science* 123 May 2025 <https://doi.org/10.1016/j.jcs.2025.104150> (**JrnlID: J145; Score:9.90**).

9. Hemanth, S., Singh, S.P., Singhal, T., Yadav, S., Kapoor, C., Naveen, A., and Satyavathi, C.T. 2025. Nutrient dynamics in pearl millet: Impact of seed soaking on minerals and anti-nutrient contents. *Journal of Cereal Science*: 104252. September 2025 (**JrnlID: J145; Score:9.90**).
10. Kannababu, N., Nanjundappa, S., Narayanan, N., Vetriventhan, M., Venkateswarlu, R., Das, I.K., Srikanth, A., Viswanath, A., Singh, S., Malipatil, R., Satyavathi, T.C., and Nepolean Thirunavukkarasu*. 2025. Role of functional genes for seed vigor related traits through genome-wide association mapping in finger millet (*Eleusine coracana* L. Gaertn.). *Scientific Reports* 15(1):5569 May 2025 (**JrnlID: S023; Score: 9.80**).
11. Patroti, P., Madhusudhana, R., Sundaram, S., Prasad, G.S., Raigond, B., Das, I.K., and Satyavathi, C.T. 2025. Development of high yielding and stress resilient post-rainy season sorghum cultivars using a multi-parent crossing approach. *Scientific Reports* 15(1):17224 May 2025 <https://doi.org/10.1038/s41598-025-02777-3> (**JrnlID: S023; Score: 9.80**).
12. Chapke, R.R., Tara Satyavathi, C., Srinivasa Babu, K. and Peddiveeti, L. 2025. Integrating indigenous traditional knowledge and ergonomic efficiency for sustainable millets farming: A study from Koraput, Odisha, India. *Frontiers in Sustainable Food Systems* 9:1673772. Accepted: 12 September 2025. (**JrnlID: F109; Score:9.70**).
13. Kumar, R.R., Babu, H. P., Pandit, K., Kumar, A., Ranjan, A.T.V., Goswami, S., Singh, S., Mishra, G.P., Rai, G.K., Jha, G.K., Satyavathi, C.T., Praveen, S.C.V. 2025. Characterizing the mono- and triacylglycerol lipase (MAGL and TAGL) genes from pearl millet (*Pennisetum glaucum* L.) and elucidating their dynamics with biochemical traits linked with rancidity. *Planta* 261(3):57 February 2025 doi: 10.1007/s00425-025-04621-4. PMID: 39934346. (**JrnlID: P133; Score:9.60**).
14. Chapke, R.R., Satyavathi, C.T., Israel Oliver King, E.D., Laxmiprasanna, P. and Priyanka V. 2025. Perceptions of climatic variability among millet farmers: insights from tribal communities in the Kolli Hills, Tamil Nadu, South India. *Frontier Climate* 6:1506084. doi: 10.3389/fclim.2024.1506084 January 2025 (**JrnlID: #; NAAS: 10.10; IF:4.10**).
15. Dudekula, R., Eduru, C., Balaganoormath, L., Sangappa, S., Kurra, S.B., Bellundagi, A., Narala, A. and Satyavathi C, T., 2025. Exploring factors that drive millet farmers to join millet FPOs for sustainable development: An ISM approach. *Sustainability*, 17(20):8986 October 2025 (**JrnlID: S100; Score:9.30**).
16. Chapke, R.R., Kalaisekar, A., Satyavathi, C.T., Balakrishna, D. and Laxmiprasanna, P. 2025. Women farmer's behaviour and drudgery in adopting indigenous traditional millet production practices for sustainable food system in the tribal Kolli hills of Tamil Nadu, India. *Frontiers in Sustainable Food Systems-Climat-Smart Food Systems*. (Accepted) November 2025 (**JrnlID; Score:9.30 (6.00 + 3.30)**).
17. Malathi, V.M., Sehwat, R., Seth, D., Pravitha, M., Venkateswarlu, R., Subeesh, A., Krishnan, V., nd Satyavathi, C.T. 2025. Heat matters: role of thermal processing on millet composition, digestibility, bioaccessibility and bioavailability. *European Food Research and Technology* 251: 4185 - 4213 October 2025 (**JrnlID: E131; Score:9.00**).
18. Bhardwaj, P., Raigond, B., Raigond, P., Verma, A., Verma, G., Kochhar, T., Patroti, P., Das, I.K. and Satyavathi, C.T. 2025. Antiviral activity of ribosome inactivating proteins for management of plant viral infection. *Virology* :110403. February 2025 (**JrnlID: V040; Score:8.80**).
19. Pooja, B., Baswaraj, R*, Pinky, R, Ambika, V., Gaurav, V., Tarvinder, K., Parashuram, P., Das, I.K. and Tara, C.T. 2025. Antiviral activity of ribosome inactivating proteins for management of plant viral infection. *Virology*, 603:110403. <https://doi.org/10.1016/j.virol.2025.110403> (**JrnlID: V040; Score: 8.80**).
20. Palanna, K.B., Ramesh, G.V., Koti, P.S., Raveendra, H.R., Patro, T.S.S.K., Bhandhari, D., Brahmani, G., Netam, P., Bhat, S., Patil, H.E. and Salam, S.A. 2025. Multi-environmental and multi-trait evaluation of elite finger millet genotypes for blast resistance using GGE biplot and stability analysis. *Physiological and Molecular Plant*

Pathology 140 :102873 November 2025 (**JrnlID: P067; Score:8.80**).

21. Panzade, K.P., Kharate, P.S., Shende, R., Jinu Jacob*, Srividhya, S. and Bhavyasree, M. 2025. Genome-wide identification, comparative analysis, and expression profiling of stress-associated protein (SAP) gene family in *Sorghum bicolor* under abiotic stress. 3 *Biotech* 15:246 August 2025. <https://doi.org/10.1007/s13205-025-04424-0> (**JrnlID: B124; Score:8.60**)
22. Das, I.K., Madhusudhana, R., Baswaraj, R., Gholve, V.M., Govindappa, M.R., Kannababu, N. and Girish, G. 2025. Stability analyses of charcoal rot resistance and yield-related traits in post-rainy sorghum genotypes using AMMI and MTSI in multi-environment trials. *Crop Protection* September 2025 (**JrnlID: C181; Score:8.50**) <https://doi.org/10.1016/j.cropro.2025.107427>.
23. Palanna, K.B., Ramesh, G.V., Koti, P.S., Vinaykumar, H.D., Bhandhari, D., Raveendra, H.R., Patro, T.S.S.K., Krishna, T.V., Nagaraja, T.E., Madhusudhana, R. and Satyavathi, C.T. 2025. Deciphering mating type and population genetic landscape of Magnaporthe population adapted to millets and rice in blast hotspots of India. *Archives of Microbiology* 207(9):1-13 July 2025 (**JrnlID: A302; Score:8.30**).
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2. Other Publications

Books

1. Gangaiah, B. and Tara Satyavathi, C. 2025. Good Agricultural Practices (GAP) Manual for Sustainable Millets production in India. 128 p.
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- Ganapathy, K.N., Parashuram Patrotri, Vikas Khandelwal, Avinash Singode, Amasiddha, B., Deepika, C., Visarada, K.B.R.S., Venkatesh, K., Rajendrakumar, P., Nepolean, T., Balakrishna, D., Anuradha, N., Pradhan, S.K. and Yadava, D.K. 2025. Millets Improvement in India. ICAR-Indian Institute of Millets (Shree Anna) Research, Rajendranagar, Hyderabad - 500 030. ISBN: 978-93-94673-65-6. Pp 120.
8. Rajendra R. Chapke, Kalaisekar, A., Stanley, J. Hemasankari, P. TaraSathyavathi, C., Arunkumar, P. and LaxmiPrasanna, P. 2025. சமீபத்திய தினை உற்பத்தி மற்றும் செயலாக்க தொழில் நுட்பங்கள் (Latest Millets Production and Processing Technologies), (Tamil Version). ICAR-IIMR Publication, Hyd, 170p, ISBN:978-93-94673-97-7. Pp 170.
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26. Venkatesh, K., Ganapathy, K.N., Amasiddha, B., Satyavathi, C.T. 2025. Genetic resources of small millets: Collection, Characterization, and Utilization. In: Joshi, D.C., Singh, A.K., Sood, S., Prasad, M. (eds) Minor Millets. Springer, Singapore. https://doi.org/10.1007/978-981-96-4265-6_4.

Presentation in Workshops/Seminars/ Symposi/Conferences

Lead talk

National

1. Jinu Jacob. 2025. Omics-aided crop improvement in millets, In: National symposium on Recent trends in omics in plant biology held at ICAR-IISR, Calicut from 21-22 May, 2025.

Invited speaker

National

2. Anuradha, N. 2025. Sustainable livelihood, food security and rural transformation through millets for Viksit Bharat on 12 February 2025 at the Central University of Odisha, Koraput.
3. Anuradha, N. 2025. Millets farming profitable management. In: National Workshop on Sustainable Agricultural Practices and Livelihood: Challenges and Alternatives in India by School of Economics of University of Hyderabad from 15th -16th February, 2025.
4. Anuradha, N. 2025. Introduction to millets and overview. In: Workshop conducted by The Centre for Agrarian Studies, in collaboration with NRLMRC on "Millets Value Addition, Technologies and Methods", for the SRLM functionaries of Tamil Nadu, on 8-05-2025 at NIRDPR, Hyderabad.
5. Anuradha, N. 2025. Millet value chain development and enhanced nutritional security conducted

by Department of Agriculture at Guru Nanak University, Hyderabad on 21-11-2025.

6. Malathi, V.M., Venkateswarlu, R., Hariprasanna, K., Aruna Reddy, C., Deepika, C., Avinash, S. and Tara Satyavathi, C. 2025. Leveraging Millets (Shree Anna) for sustainable Nutrition. Souvenir of abstracts: National conference on Millets and forgotten foods: Reviving traditions for nutritional security and ecological sustainability in Agriculture & Farmers Expo 2025 held from 21-22 March, 2025, College of Agriculture, Pasighat, Arunachal Pradesh (Pg. 17-18).
7. Srividya, S. 2025. Exploiting key traits of Millets for climate resilience and improved production practices. In: National Conference on "Millets and Forgotten Foods: Reviving Traditions for Nutritional Security and Ecological Sustainability in Agriculture", cum Farmers Expo organized by ICAR-IIMR and College of Agriculture, Pasighat, Arunachal Pradesh held at College of Agriculture, Pasighat, Arunachal Pradesh during 21-22, March, 2025.

International

8. Srividya, S. 2025. Root adaptations and water use strategies in sorghum under drought and optimal moisture conditions. In: 6th International conference on Plant Physiology on "Translational Genomics and Physiology for Sustainable Agriculture" organized by ISPP, New Delhi and TNAU, Coimbatore, held at TNAU Coimbatore during 15-18th December, 2025

Oral Presentation

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Policy papers

1. Sangappa, Rafi, D., Ramkiran, K., Meghana, G., Charishma, E., Chandhini, K., Abbuseat, Kailashnath, Anup, Prashanth, Monalisha, Srinivasa Babu, K., Laxmi, B., Premaradhya, N. and Tara Satyavathi, C. 2025. Millet Farmer Producer Organization (FPOs) in India - A sustainable choice for nutritional & livelihood security of small & marginal farmers. ICAR-IIMR, Hyderabad. ISBN: 978-93-94673-84-7.
2. Sangappa, Charishma, E., Chandhini, K., Rafi, D., Meghana, G., Premaradhya, N., Laxmi B., Mahesh, T., Pavan Kumar, G., Srinivasa Babu, K., Madhusudhana, R. and Tara Satyavathi, C. 2025. Shree Anna for Viksit Bharat (Farm to Fork) – A Policy Guide for North Eastern States. ICAR-IIMR, Hyderabad. 1-48.

S.No.	Project Title	Principal investigator	Duration	Remarks
	CROP IMPROVEMENT			
	Pearl Millet			
1.	Development of breeding resources and technologies through genomic approaches in pearl millet	T. Nepolean	2023-2028	Ongoing
2.	Genetic enhancement of pearl millet for yield and adaptation to arid regions	P. Sanjana Reddy	2021-2026	Ongoing
3.	Forage pearl millet improvement for high biomass	Avinash Singode	2021-2026	Ongoing
	Sorghum			
4.	Breeding for genetically diverse kharif sorghum genotypes with improved grain yield, quality, and resistance to important biotic stresses	C.Aruna	2021-2026	Ongoing
5.	Breeding forage sorghum for higher productivity	B. Venkatesh Bhat	2022-2027	Ongoing
6.	Genetic enhancement of energy sorghums for renewable fuels and fodders	AV. Umakanth	2021-2026	Ongoing
7.	Genetic enhancement of rabi sorghum adaptive traits for improved varietal performance	Parashuram Patroti	2020-2025	Concluded
8.	Exploiting the potential of MAGIC populations and diverse parental base for developing improved varieties and hybrids in rabi sorghum	Parashuram Patroti	2025-2030	Newly Approved
	Small Millets			
9.	Genetic improvement of foxtail millet for grain yield and related traits	K. Hariprasanna	2021-2026	Ongoing
10.	Genetic diversification for grain yield and related traits in finger millet genotypes	K. N. Ganapathy	2021-2026	Ongoing
11.	Development of end-use specific little millet genotypes with improved grain yield and grain micronutrients	K. N. Ganapathy	2021-2026	Ongoing
12.	Genetic improvement of proso millet for yield and protein content	Avinash Singode	2021-2026	Ongoing
13.	Improvement of kodo millet for economically important traits and development of markers for cultivar identification	C. Deepika	2021-2026	Ongoing
14.	Development of dual purpose cultivars with improved quality in barnyard millet	B. Amasiddha	2021-2026	Ongoing
15.	Browntop millet-Characterization and genetic improvement	B. Venkatesh Bhat	2017-2025	Concluded
16.	Genetic diversification of browntop millet	B. Venkatesh Bhat	2025-2028	New Approved

S.No.	Project Title	Principal investigator	Duration	Remarks
	Genetic resources management			
17.	Nutri-cereals genetic resources management	Karnam Venkatesh	2021-2026	Ongoing
18.	Pre-breeding of sorghum and finger millet for specific trait improvement	Karnam Venkatesh	2021-2026	Ongoing
19.	Seed science and technology			
20.	Investigations on genetics of seed vigor and longevity, and effect of foliar plant nutrition on seed yield and quality in small millets	N. Kannababu	2020-2025	Concluded
21.	Deciphering the genetic basis of seed vigor and longevity through GWAS, and assessing the foliar spray treatments for seed yield and quality enhancement in millets	N. Kannababu	2025-2030	Newly Approved
22.	Studies on seed treatment technologies for better crop establishment and yield in millets	Sooganna	2023-2026	Ongoing
	CROP PRODUCTION & PHYSIOLOGY			
23.	Development of intra-millet intercropping systems for resilience and sustainability	B. Gangaiah	2020-2025	Concluded
24.	Assessment of environmental footprint of millets production, marketing and processing	B. Gangaiah	2025-2028	Newly Approved
25.	Improving water use efficiency of finger millet & foxtail millet under limited moisture conditions	Swarna Ronanki	2021-2026	Ongoing
26.	Development of a crop modelling framework to simulate climate change Impacts and guide adaptation strategies for pearl millet production in India	Swarna Ronanki	2025-2030	Newly Approved
27.	Collection and evaluation of pearl millet landraces and farmers varieties for climate resiliency, higher yield, nutritional and culinary characteristics	SN Saxena	2024-2029	Ongoing
28.	Physiological dissection of key traits contributing for moisture stress adaptations in postrainy sorghum: with an emphasis on root architectural traits	S. Srividhya	2020-2025	Concluded
29.	Understanding combined heat and drought tolerance in pearl millet: Dissecting traits, ABA mediated stress response and metabolic adaptations	S. Srividhya	2025-2030	Newly Approved
30.	Physiological basis of high temperature stress on summer sorghum	Seva Nayak	2022-2026	Ongoing
	CROP PROTECTION			
31.	Yield loss assessment in millets due to invasive fall army worm, and its integrated management with special emphasis on sorghum	G. Shyam Prasad	2020-2025	Concluded
32.	Insect biodiversity in sorghum ecosystem	G. Shyam Prasad	2025-2029	Newly Approved

S.No.	Project Title	Principal investigator	Duration	Remarks
33.	Understanding the host-pest interactions of shootfly, stem borer and fall army worm in millets and management through semio-chemicals	P.G. Padmaja	2020-2025	Concluded
34.	Unravelling the olfactory mechanisms of stem borer host plant selection in millets for novel pest management strategies	P.G. Padmaja	2025-2030	Newly Approved
35.	Popularization of pearl millet in rice fallows of Krishna Godavari basin, along with study of socio economics, marketing opportunities and biotic stress tolerance	Anuradha Narala (B. Subbarayudu retd.)	2023-2026	Ongoing
36.	Studies on major insect pests of rabi sorghum and development of EILs	K. Srinivas Babu	2020-2025	Concluded
37.	Comprehensive studies on aphids species infesting millets, their identification, taxonomic studies, mechanisms of resistance and forecasting models against this pest	K. Srinivas Babu	2025-2030	Newly Approved
38.	Exploring new plant traits for resistance against major insect pests in millets	A. Kalaisekar	2023-2028	Ongoing
39.	Mechanism of insect resistance and effect of Controlled Atmospheric Storage (CAS) in stored grain pest management in millet grains	J. Stanley	2024-2027	Ongoing
40.	Studies on virulence and host plant resistance on important diseases of millets	I.K.Das	2021-2026	Ongoing
41.	Viral diseases of millets: A focused study on characterization, and developing advanced diagnostic and strategy towards management	Baswaraj Raigond	2022-2027	Ongoing
42.	Studies on endophytes for management of major soil-borne diseases of millets	G. Rajesha	2020-2025	Concluded
43.	Genetic diversity, pathogenic variability, and development of differential host against pearl millet blast pathogen	G. Rajesha	2024-2028	Ongoing
44.	Evaluation of pearl millet germplasm for downy mildew resistance in arid zone/ A1 zone	Gopi Kishan	2024-2027	Ongoing
BASIC & STRATEGIC RESEARCH				
45.	Generation of genomic resources and its application for the improvement of millets	P. Rajendra Kumar	2021-2026	Ongoing
46.	Manipulating SbSERK gene(s) to understand their effect on generating apomixis components through CRISPR-Cas9 mediated gene editing technology	D. Balakrishna	2020-2025	Concluded
47.	Application of genome editing technology for herbicide tolerance and generation of apomixis in sorghum	D. Balakrishna	2025-2030	Newly Approved
48.	Identification of bioactive compounds in the grain and gene mining from millets	Jinu Jacob	2023-2027	Ongoing

S.No.	Project Title	Principal investigator	Duration	Remarks
49.	Biochemical characterization of Iron and Zinc rich pearl millet genotypes and their relationship with rancidity, anti-nutrients and seed quality	R. Venkateswarlu	2023-2027	Ongoing
50.	Nutritional composition, phenolic profile and bioactivities of sorghum, and foxtail, kodo and proso millet grains	V. M. Malathi	2021-2026	Ongoing
51.	Biochemical characterization of millets and millet foodproducts for nutraceuticals and health benefits	V. M. Malathi	2021-2026	Ongoing
EXTENSION RESEARCH				
52.	Yield gap and constraints analysis of sorghum production in traditional area	R. R. Chapke	2021-2026	Ongoing
53.	Development of advance information and communication technology (ICTs)- enabled communication and education tools for millets promotion	R. R. Chapke	2023-2026	Ongoing
54.	Adoption and Impact of Improved millets production technologies in India	A. Srinivas	2022-2026	Ongoing
55.	Evaluating performance, impact, and sustainability of farmer producer organizations (FPOs) for strengthening millet value c	Sangappa	2024-2027	Ongoing
VALUE-ADDITIONS & SOCIO-ECONOMICS				
56.	Development of millet based composite foods in collaboration with fishery, dairy, horticulture and meat commodities	Dayakar Rao	2021-2026	Concluded
57.	Economic analysis of production, marketing, utilization and policy perspectives of sorghum, pearl millet and ragi in India	Anuradha Narala	2020-2026	Ongoing
58.	Development of novel products with different texture characteristics and biodegradable films for packaging of the different value added products made from millets	P. Hemashankari	2023-2026	Ongoing
59.	Development of suitable pre-processing and processing protocols for enhancing usability of millets and evaluation of the storage stability of the developed food products	Vikas Kumar	2025-2028	Newly Approved
GLOBAL CENTRE OF EXCELLENCE				
60.	Global Centre of Excellence on Millets (Shree Anna)	Tara C Satyavathi	2023-2026	Ongoing

Research Advisory committee (RAC) and Institute Research Committee (IRC) Meetings

XXVI Research Advisory Committee Meeting

The XXVI Research Advisory Committee (RAC) meeting of ICAR-Indian Institute of Millets Research, Hyderabad was held during 21-22 August 2025 under the Chairmanship of Dr. Arvind. Kumar, Former Deputy



Director General, ICRISAT, Patancheru, to review the progress of research projects of the institute during 2024-25. The Members of RAC present physically were - Dr. S.R. Maloo, Former Director of Research, MPUAT, Udaipur; Dr. S.T. Kajjdoni, Former Dean, College of Agriculture, UAS, Dharwad, Dr. A. Nirmala Kumari, Former Professor (Plant Breeding and Genetics), Centre of Excellence on Millets, TNAU, Athiyandal; Dr. O.P. Yadav, Former Director, ICAR-CAZRI, Jodhpur; Dr. Sridevi Annapurna Singh, Former Director, CFTRI, Mysuru; Prof. R.S. Chauhan, Dean, School of Biosciences, Mahindra University, Hyderabad; Shri. G. Vinod Kumar Rao (Farmer's Representative), Hyderabad; Shri. Muthamil Selvan Paramasivam (Farmer's Representative), Tiruchirapally; Dr. C Tara Satyavathi, Director, ICAR-IIMR, Hyderabad and Dr. P Rajendrakumar, Principal Scientist and Member-Secretary, RAC. The Special Invitees to attend the meeting were; Dr. Raj Kumar Bhandari, NTBN, Niti Aayog, Mumbai and Dr. R. Madhusudhana, Project

Coordinator (Sorghum and Small Millets), Hyderabad. Dr. SK Pradhan, ADG (FFC), ICAR, New Delhi joined the meeting through online mode.

The meeting commenced with a welcome address by Dr. C. Tara Satyavathi who warmly welcomed the Chairman and Members of RAC, special invitees, and all the scientists of the Institute. Dr. S.K. Pradhan, ADG (FFC), ICAR, in his opening remarks, emphasized the importance of making millets more remunerative and competitive in comparison to other cereals. Dr. Arvind Kumar (Chairman, RAC) expressed satisfaction on the implementation of the recommendations given by the RAC during the last two years and new R&D initiatives taken-up for quality research. After his initial remarks, Dr. P. Rajendrakumar, Member Secretary, presented the Action Taken Report on the recommendations of the XXV RAC meeting held during 19-20 September 2024 as well as the updated action taken on the recommendations of the previous two RAC meetings.

Dr. C Tara Satyavathi presented an overview of research and development in millets during 2024-25. She highlighted key initiatives such as augmentation and characterization of millet germplasm, quality seed production, identification of new varieties and hybrids (Kharif grain sorghum - SPV 2976, Kharif BMR forage sorghum - SPV 2997, SPV 2912 and Rabi sorghum - SPH 2026), development of leaf colour chart for nitrogen management, research on bioavailability and diversification of the genetic base, whole genome sequencing, metabolite profiling, biofortification and genome editing in millets. She also informed the Committee about the MoU's signed for licensing of elite lines, support for FPOs, and facilities provided for incubation, start-ups, and millet processing. Additionally, she outlined the Institute's outreach initiatives through frontline demonstrations, exhibitions, and farmer/industry visits. She highlighted the infrastructure development under the Global Centre of Excellence on Millets including procurement of advanced equipment for

high quality research and emphasized the collaborative research involving 15 ICAR Institutes under the Global CoE on Millets for efficiently utilizing the expertise available. She also highlighted the establishment of a Regional Research Station at Gudamalani, Barmer, Rajasthan focused on the pearl millet research.

The scientists representing different crop / thematic groups presented the progress, achievements and expected outcome from their projects. The RAC team also visited the kharif field experiments and discussed the research outputs with the concerned scientists on 22 August, 2025. This was followed by visits to Integrated Genome Editing, Phenomics and Speed Breeding Facility, Centre of Excellence on Millets, Primary and



Secondary Processing Facilities and Nutrihub. The Chairman and members appreciated the efforts of scientists and other staff of the Institute for the excellent work.

The recommendations as approved by the RAC and the Council are given below:

S.No.	Recommendations of XXVI RAC Meeting	Timeline
1	Millet Research at ICAR-IIMR has become more focused during the last few years. The initiative on formation of Crop Teams has strengthened the team research on different crops ICAR-IIMR is involved with. However, millet area continues to decrease. Steps are needed to create additional demand for millets including better collaboration with different Govt. agencies to identify water short areas suitable for millet cultivation and promoting millet cultivation in such areas with suitable Central/State Govt. policies/promotion initiatives. For generating demand for millets, push millets for inclusion into public distribution system as well as create export opportunities for millet. ICAR-IIMR should link better with Veterinary institutes in India for use of millets in poultry industry.	2-3 years
2	There is need to improve experimental field conditions at different research farms for good expression of genotypes/ treatments covering various millets at ICAR-IIMR as well as to further improve the quality of research at par with international standards.	1-2 years
3	After successful launch of International Year of Millet and promoting it round the year in 2023, the efforts to promote millets at Global level as well as at country level need to continue. Significant efforts are needed to push forward the Global Centre of Excellence on Millets to fulfill the dream of Hon'ble Prime Minister of India to promote millets at Global level. The Global Centre should engage into multi institutional collaboration with international as well as national institutes in other countries especially with countries in Africa. For this, a clear road-map must be prepared along with milestone with indicated timeline and responsibilities.	1-2 years
4	The work on biotechnology and molecular biology is good and combined work between molecular biologist and plant breeder is taking shape with formation of crop Teams. There exist further opportunities to strengthen linkages between molecular biologist and plant breeder. Genomic resources generated in different millets can be explored for molecular markers conserved across genomes and associated with major agronomic traits so that those can be utilized in marker-assisted breeding. Efforts should continue towards development of Diagnostic DNA fingerprints for parental lines used in the development of hybrids for protecting IP issues.	2-3 years
5	Significant progress has been achieved in promoting sweet sorghum as biofuel and ICAR-IIMR has taken some initiatives with private sectors. These efforts should continue with the same speed. An economic analysis can be made for biofuel production using sweet sorghum in different growing season and conditions. In view of promotion of crops for bioethanol at policy level, there exist opportunities to explore the possibility of using pearl millet grain for bioethanol production. This would require assessing pearl millet germplasm for starch content to find out the genetic variation for this trait. Such project must be initiated at IIMR to enhance the demand of pearl millet grain which is largely static now.	2-3 years
6	Post-harvest technology needs more attention including development of machines for different agricultural operations in the field as well as processing machines. A primary (processing) value addition model unit for millets at village level needs to developed with its functions and economics.	1-2 years

Institute Research Council (IRC) meeting

Institute Research Council (IRC) meeting was held at ICAR-IIMR, Hyderabad during 17-19 June and 2nd July, 2025 to review the progress and dialogue on ongoing institute projects. The meeting was chaired by Dr. C. Tara Satyavathi, Director IIMR and Chairperson IRC, and attended by the external experts - Dr. J.V. Patil, former Director, IIMR Hyderabad; Dr. A. Nirmalakumari, Officer In-charge (Retd.), AICRP on Small Millets, Athiyandalal, Tamil Nadu; Dr R Madhusudhana, Project Co-ordinator, Sorghum and Millets, ICAR-IIMR Hyderabad and Dr. I.K. Das, Member Secretary-IRC and Scientists of the institute. During deliberations a total of 50 ongoing projects were thoroughly reviewed and discussed. The RPPs were presented by the principal investigators. Twelve projects were concluded and one

was extended (Annexure-II) during IRC. A total of 11 new project proposals were presented and discussed. Details about the presentations of the projects and comments and suggestions received during the meeting are available in the proceedings of the meeting. Before the formal IRC, Pre-IRC meeting was conducted on 23, 25, and 28 April, 2025 for in depth discussion on research priorities on each of the nine crops. The meeting was chaired by Dr. C Tara Satyavathi, Director, IIMR and chairperson IRC and co-chaired by Dr. R Madhusudhana, Project co-ordinator, Sorghum and Millets. Each crop had a separate session, which was attended by the crop-specific group of scientists. Major research gaps emerged during discussion are documented in the proceeding.



Participation in Meetings / Seminar/ Workshops / Conferences etc.

S No	Name of Employee	Meeting organized by	Details	Program	Mode	Date
1	C Tara Satyavathi	Trust for Advancement of Agricultural Sciences (TAAS), New Delhi	National Symposium on Hybrid Technology for Enhancing Crop Productivity	National Symposium	Physical	08-09 Jan, 2025
2	Sangappa	ICAR-DMAPR in collaboration with Medi Hub technology Business Incubator (TBI)	10th Entrepreneurship orientation program on Medicinal and Aromatic plants (EOPMAP-10)	Meeting	online	09 Jan, 2025
3	Sangappa	ICAR-IIMR in collaboration with MANAGE	Abiotic Stress Management in Agriculture for Enhancing Farmers' Income with Special Reference to Millets and Fodder Crops Cultivation in Arid and Semi-Arid Regions of India	Meeting	online	10 Jan, 2025
4	C Tara Satyavathi	Central University of Odisha, Koraput	International Conference on Millet as Future Food for Sustainable Planet	International Conference	Physical	12 Jan, 2025
5	C Tara Satyavathi	PVP&FRA, New Delhi	Extant Variety Recommendation Committee (EVRC) meeting	Meeting	Physical	15 Jan, 2025
6	Srividhya, S	Intellectual Property & Technology Management (IP&TM) Unit, ICAR, New Delhi,	IPR awareness week	Workshop	online	16-23 Jan, 2025
7	R. Venkateswarlu	IP&TM Unit, ICAR, New Delhi	IPR awareness week	Meeting	Physical	16-23 Jan, 2025
8	Rajesha G	Indian Phytopathological Society, New Delhi and ICAR- Central Citrus Research Institute, Nagpur, Maharashtra	National Conference on Emerging Issues and Sustainable Strategies in Plant Health Management: A Global Perspective. Presentation paper on "Characterization of endophytes for antimicrobial properties and in silico analysis of effective volatile compounds against millets pathogens"	Nagpur	Physical	19-21 Jan, 2025
9	C Tara Satyavathi	ICAR-IIHR, Bhubaneswar	National Conference on Seed Chain Management in Eastern & North Eastern Hill Region: Challenges & Opportunities	National Conference	Physical	21 Jan, 2025
10	C Tara Satyavathi	Amity University, Uttar Pradesh	International Conference on Millet Fusion: Cultivating Sustainability, Nourishing Nations	International Conference	Physical	22 Jan, 2025
11	C Tara Satyavathi	Tata-Cornell Institute (TCI) for Agriculture and Nutrition, NY & ICRI-SAT, Hyderabad	Future Pathways for India's Public Distribution System	Meeting	Physical	24 Jan, 2025
12	C Tara Satyavathi	ICRISAT, Hyderabad	Global Dryland Crops Networking and Partnership Meet	Meeting	Physical	27-28 Jan, 2025

S No	Name of Employee	Meeting organized by	Details	Program	Mode	Date
13	Rajesha G	National Academy of Agricultural Sciences	Attend the 8th Batch of Pedagogy Development Programme on "Enhancing Pedagogical Competencies for Agricultural Education"	Workshop	Physical	28 Jan, 2025 to 01 Feb, 2025
14	Srividhya, S	ICAR-CRIDA , Hyderabad	International Conference on "Rainfed Agriculture: Building Pathways for Resilience & Sustainable Livelihoods"	International Conference	Physical	29-31 Jan, 2025
15	Hariprasanna K.	PPV&FRA	21st DUS project review meeting	Meeting	Physical	30-31 Jan, 2025
16	V M Malathi	Avinashilingam Deemed University	WUACD International Conference 2025 on One Health: Oral presentation on 'Elucidation of the changes in the nutritional properties of foxtail millet grains upon thermal processing'	International Conference	Online	05-07 Feb, 2025
17	C Tara Satyavathi	IRRI-Odisha, Bhubaneswar	Promoting Self Help Group-Led Entrepreneurship through Rice Value Addition	Meeting	Physical	10 Feb, 2025
18	C Tara Satyavathi	ICAR-IIMR Regional Station on Pearl Millet, Gudamalani	Millet Farmer Fair (under SCSP & TSP of Global CoE)	Shree Anna Kisan Mela	Physical	16 Feb, 2025
19	Baswaraj Raigond	Conducting Techno commercial assessment committee	ICAR-National Research Centre on Pomegranate	Meeting	Physical	17 Feb, 2025
20	Hariprasanna K.	ICAR-NAARM	MDP on Priority setting, Monitoring and Evaluation (PME) of Agricultural Research Projects	Meeting	Physical	17-22 Feb, 2025
21	Sangappa	ICAR-CRIDA, Hyderabad	Institutional Mechanism for Improved Livelihood Opportunities for Farmers	Meeting	Online	20 Feb, 2025
22	C Tara Satyavathi	Central Tribal University of Andhra Pradesh, Vizianagaram	National Conference on "Millets Quest 2025: Building Resilience, Feeding the World"	National Conference	Physical	24-25 Feb, 2025
23	C Tara Satyavathi	MSSRF, Chennai at the Tribal Agrobiodiversity Centre, Jeypore, Koraput, Odisha.	National Consultation on "Building climate resilient, sustainable and inclusive local seed systems for food and nutrition security"	National Consultation	Physical	27 Feb, 2025
24	Hariprasanna K.	ATARI, Hyderabad and KVK-DDS	One day Training cum Awareness programme on PPV&FRA	Meeting	Physical	28 Feb, 2025
25	C Tara Satyavathi	DA & FW Govt. of India, New Delhi	Budget Webinar on the theme "Agriculture & Rural Prosperity"	Webinar	Online	01 Mar, 2025
26	C Tara Satyavathi	Indian Institute of Packaging, New Delhi	5th International Summit for Packaging Industry	Summit	Physical	08 Mar, 2025
27	C Tara Satyavathi	ICAR-IIOR, Hyderabad	Industry Meet of ICAR-IIOR, Hyderabad.	Meeting	Physical	10 Mar, 2025
28	Hariprasanna K.	University of Calicut	National Seminar on Cells to Genes : Integrative Approaches in Cell and Molecular Biology	National Conference	Physical	11 Mar, 2025

S No	Name of Employee	Meeting organized by	Details	Program	Mode	Date
29	C Tara Satyavathi	Ministry of Agriculture & Farmer's Welfare, New Delhi	93rd Meeting of the Central Sub-Committee on Crop Standards, Notification and Release of Varieties for Agricultural Crops	Meeting	Online	13 Mar, 2025
30	C Tara Satyavathi	Vignan University, Vadlamudi	Academia-Industry-Farmer Partnerships Conclave	Conclave	Physical	15 Mar, 2025
31	Jinu Jacob	ANRF	Workshop on Molecular strategies for heterologous gene expression and protein purification	Workshop	Physical	17-19 Mar, 2025
32	C Tara Satyavathi	Confederation of Indian Industry, New Delhi	10th CII India - Latin America and Caribbean (LAC) Conclave	Conclave	Physical	19 Mar, 2025
33	Hariprasanna K., Rajesha G, Srividhya, S, V M Malathi	College of Agriculture, Pasighat	National Conference on Millets and Forgotten Foods - Reviving Traditions for Nutritional Security and Ecological Sustainability in Agriculture	National Conference	Physical	21-22 Mar, 2025
34	Sangappa	CAU, Imphal & ICAR-IIMR, Hyderabad & ICAR-NBPGR, New Delhi	National conference on Millets and forgotten foods at Pasighat, Arunachal Pradesh	National Conference	Physical	22 Mar, 2025
35	C Tara Satyavathi	ICAR-NBPGR, New Delhi	54th meeting of Plant Germplasm Registration Committee (PGRC)	Meeting	Online	24 Mar, 2025
36	C Tara Satyavathi	ICAR-NIRCA, Rajahmundry	Innovators Meet on Fostering Agri-Innovation and Agri-Entrepreneurship.	Meeting	Physical	08 Apr, 2025
37	C Tara Satyavathi	College of Agriculture, CAU, Tawang, Arunachal Pradesh.	Regional Workshop & Stakeholders' Meeting on Strengthening of FPOs for Efficient and Sustainable Agri-entrepreneurship in Vibrant Villages of North-east India	Workshop	Physical	18-19 Apr, 2025
38	Baswaraj Raigond	ICAR-National Research Centre on Pomegranate	ITMC	Meeting	Physical	21 Apr, 2025
39	C Tara Satyavathi	NAAS, New Delhi.	Expert Consultation on Preparing Future Ready Youths for Entrepreneurship Development in Agriculture	Meeting	Online	22 Apr, 2025
40	C Tara Satyavathi	Mahindra University, Hyderabad	Bharat Higher Education Summit (BHES) 2025	Meeting	Physical	24 Apr, 2025
41	Sooganna	Sanjeevini NGO Araku	16th Old Seeds Festival	Meeting	Physical	26 Apr, 2025
42	C Tara Satyavathi	Hearty culture Natural Products (HNP) at Kanha Shanti Vanam	Meeting on Heartfulness day	Meeting	Physical	29 Apr, 2025
43	C Tara Satyavathi	ICAR, New Delhi	Meeting on "VIKSIT KRISHI SANKALP ABHIYAN"	Meeting	Online	09 May, 2025
44	Rajesha G	ICAR- National Bureau of Agricultural Insect Resources, Bengaluru	XXXIV Annual Group Meeting of All India Co-ordinated Research Project on Biological Control of Crop Pests	Meeting	Physical	11-12 May, 2025

S No	Name of Employee	Meeting organized by	Details	Program	Mode	Date
45	B Venkatesh Bhat, Sooganna,	ICAR- National Institute of Seed Science & Technology, Mau	40th AGM of AICRP on Seed (Crops)	Meeting	online	14-15 May, 2025
46	B Venkatesh Bhat, Sooganna,	ICAR- National Institute of Seed Science & Technology, Mau	28th Annual Breeder Seed Review Meeting	Meeting	online	14 May, 2025
47	C Tara Satyavathi	DA & FW, MoA & FW, Krishi Bhavan, New Delhi	Online meeting to review the preparations of MoA & FW along with DAHD and D/o Fisheries in the World Expo 2025 at Osada, Japan	Meeting	Online	14 May, 2025
48	Srividhya, S	NutriHub, ICAR- IIMR	Millet Stakeholders Summit	Meeting	Physical	15 May, 2025
49	Seva Nayak D	MANAGE, Hyderabad,	Promotion of Bio-fortified Crops for Nutrition	Meeting	online	16-18 May, 2025
50	C Tara Satyavathi	ICAR, New Delhi	Annual meet of Vice Chancellors of Agricultural Universities and Director's conference of ICAR Institutes on theme "Convergence in Action: Shaping Vikshit Bharat @ 2047"	Meeting	Physical	20 May, 2025
51	Jinu Jacob	ICAR-IISR, Calicut	National symposium on recent trends in omics in plant biology	National Symposium	online	21-22 May, 2025
52	C Tara Satyavathi	ICAR, New Delhi	Interaction meeting by the Hon'ble Minister for Agriculture and Farmers' Welfare with all the pre-kharif campaign named Viksit Krishi Sankalp Abhiyan (VKSA) teams	Meeting	-	24 May, 2025
53	C Tara Satyavathi	NAARM, Hyderabad	Implementation of National Education Policy in Agricultural Universities: Status, Challenges and Way Forward	Meeting	Physical	27 May, 2025
54	C Tara Satyavathi	ICAR-IIMR, Hyderabad	Annual Group Meeting (AGM) of 60th ICAR-AICRP on Pearl millet and 55th ICAR-AICRP on Sorghum and 36th ICAR-AICRP on Small millets	Workshop	Online	28-30 May, 2025
55	Hariprasanna K.	IIMR & AICRP on Sorghum & Small millets	Annual Group Meeting of AICRP on Sorghum & Small millets	Meeting	Online	28-30 May, 2025
56	Srividhya, S	Launched by Ministry of Agrl. & Famers Welfare, New Delhi	Viksit Krishi Sankalp Abhiyan (VKSA) 2025 : Farmers Innovations 2025	Meeting	Physical	29-12 May, 2025
57	C Tara Satyavathi	NAAS, New Delhi	National Academy of Agricultural Sciences (NAAS) Foundation Day & Annual General Body Meeting	Meeting	Physical	04 Jun, 2025
58	C Tara Satyavathi	NAAS, New Delhi	Annual General Body Meeting of NAAS and Prof. MS Swaminathan Foundation Day Lecture 2025	Meeting	Physical	05 Jun, 2025

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59	V M Malathi	ICAR-IIMR and MAN-AGE	Training programme on 'Abiotic stress management in agriculture for enhancing the farmer's income with special reference to millets/ fodder crops cultivation in arid and semi-arid regions of India'	Workshop	online	06-10 Jun, 2025
60	C Tara Satyavathi	HPCL, Mumbai	MoU with HPCL, Mumbai for a collaborative project on sweet sorghum at HPCL, Mumbai	Meeting	Physical	12 Jun, 2025
61	V M Malathi	District Industries Centre Kozhikode, Government of Kerala	Raising and Accelerating MSME Performance - Technology Clinic: invited lecture on 'Value-added Millet Products'	Workshop	Physical	12 Jun, 2025
62	Baswaraj Raigond	ICAR-National Research Centre on Pomegranate	ITMC	Meeting	Physical	13 Jun, 2025
63	P.Hemasankari	CNR Rao Research Centre, Avinashilingam Deemed University for women	Short term - Skill Development based Instrument Training/ Internship	Workshop	Physical	19-26 Jun, 2025
64	C Tara Satyavathi	Meeting with officials at HPCL, Mumbai.	HPCL Biofuels Ltd., Mumbai	Meeting	Physical	23 Jun, 2025
65	C Tara Satyavathi	Dr. RPCAU, Pusa, Samastipur, Bihar	19th Research Council Meeting, Kharif 2025 of Dr. Rajendra Prasad CAU, Pusa, Samastipur, Bihar	Meeting	Physical	26-27 Jun, 2025
66	C Tara Satyavathi	Meeting with Minister of Agriculture, Govt. of Telangana regarding the AgriTech 2025.	DoA, Govt. of Telangana	Meeting	Physical	03 Jul, 2025
67	C Tara Satyavathi	Industry-Academia Partnerships for Agriculture during the 16th Agriculture Leadership Conclave	Agriculture Today Group, New Delhi.	Meeting	-	09 Jul, 2025
68	C Tara Satyavathi	Interaction Session of Local ICAR Directors with 114th FOCARS	ICAR-NAARM, Hyderabad	Meeting	-	12 Jul, 2025
69	C Tara Satyavathi	First MAHARISHI Steering Committee meeting called by Secretary (DARE) & DG (ICAR), New Delhi	ICAR, New Delhi	Meeting	-	14 Jul, 2025
70	C Tara Satyavathi	97th Foundation Day of the ICAR organized by ICAR, New Delhi	ICAR, New Delhi	Meeting	-	16 Jul, 2025
71	C Tara Satyavathi	Millet Research Collaboration meeting with DG, ICRISAT along with ICAR-IIMR team	ICRISAT, Hyderabad.	Meeting	Physical	23 Jul, 2025

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72	C Tara Satyavathi	Women Development and Child Welfare Department, Telangana.	Committee meeting of Supplementary Nutrition Program on Arogya Lakshmi programme	Meeting	Physical	25 Jul, 2025
73	C Tara Satyavathi	DA &FW, New Delhi.	Online meeting called by the Hon'ble Agriculture Minister regarding release of 20th Instalment of PM-Kisan Scheme	Meeting	Online	30 Jul, 2025
74	C Tara Satyavathi	ICAR, New Delhi	Online meeting with KVKs called by ICAR HQ, New Delhi.	Meeting	Online	30 Jul, 2025
75	C Tara Satyavathi	ICAR-IIOR, Hyderabad.	49th Foundation Day celebrations of ICAR-IIOR, Hyderabad.	Meeting	Online	01 Aug, 2025
76	C Tara Satyavathi	DA &FW, New Delhi.	PM Kisan Samman Nidhi meeting	Meeting	Online	01 Aug, 2025
77	Seva Nayak D	MANAGE AND LUDI-ANA	Carbon credits in agriculture	Workshop		06-08 Aug, 2025
78	C Tara Satyavathi	MS Swaminathan Research Foundation, Chennai	Prof. M.S. Swaminathan Centenary International Conference "Evergreen Revolution – The Pathway for Biohappiness	Meeting	Physical	07 Aug, 2025
79	C Tara Satyavathi	ICAR, New Delhi	EFC preparation meeting called by the PIM Section	Meeting	Physical	08 Aug, 2025
80	C Tara Satyavathi	ICAR-IISWCRC, Ballari Climate Crisis with a specific focus on Karnataka State	National Workshop on Transforming Food, Land, and Water (FLW) Systems to Combat the Viksit Krishi Sankalp Abhiyan (VKSA) Rabi campaign	Workshop	Online	13 Aug, 2025
81	C Tara Satyavathi	Untapped opportunities in India-Oman trade relations	Embassy of India, Muscat (Oman)	Meeting	Online	14 Aug, 2025
82	C Tara Satyavathi	Stakeholder consulting workshop on 'Transforming Food, Land, and Water (FLW) Systems to Combat the Climate Crisis'	ICAR-CRIDA, Hyderabad	Workshop	Online	18 Aug, 2025
83	Seva Nayak D	EEI, Hyderabad	Ensuring nutritional security through Agriculture	Meeting	Online	19-23 Aug, 2025
84	C Tara Satyavathi	Selection of opportunity crops for the implementation of the Power of Diversity Funding Facility	MSSRF, Chennai	Meeting	Physical	19 Aug, 2025
85	C Tara Satyavathi	64th All India Wheat and Barley Worker's Meet	RVSKVV, Gwalior & ICAR-IIW-BR, Karnal	Meeting	Physical	26 Aug, 2025
86	Sangappa	Webinar on "Entrepreneurship Opportunities and Skill Development in Millets"	MANAGE, Hyderabad	Meeting	Online	26 Aug, 2025
87	Baswaraj Raigond	Viksit Krishi Sankalp Abhiyan	ICAR-NIASM, Baramati	Meeting	online	26 Aug, 2025

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88	C Tara Satyavathi	Telangana State on Viksit Krishi Sankalp Abhiyan (VKSA) Rabi campaign meeting	ICAR-IIMR, Hyderabad.	Meeting	Physical	29 Aug, 2025
89	C Tara Satyavathi	Purdue University, Illinois, USA	Global Strategic Alliance (GSA) Global Eye Sorghum & Millets Initiative Series 2025	International Conference	Physical	05-06 Sep, 2025
90	C Tara Satyavathi	ICAR Convention Centre, New Delhi.	Dialogue NEXT-India by World Food Prize Foundation, CIM-MYT, the Borlaug Institute for South Asia (BISA) and ICAR	Meeting	Physical	08-09 Sep, 2025
91	Sangappa	Millet Scientists -Scheduled Caste Farmers Interface Meeting & Input Distribution Program	ICAR-IIMR & ICAR-KVK, Banavasi	Meeting	Physical	08 Sep, 2025
92	C Tara Satyavathi	Indian Chamber of food and Agriculture (ICFA), New Delhi	Role of Research and Development in Advancing Seed Technology at the India-Africa Seed Summit 2025	Meeting	Physical	12 Sep, 2025
93	Santosh Kumar Gupta	ICAR-NAARM, Hyderabad	Impactful AI Tools in Agriculture	Workshop	Online	15-19 Sep, 2025
94	C Tara Satyavathi	Ministry of Agriculture, New Delhi	National Conference on Agriculture for Rabi Campaign 2025	National Conference	Physical	15-16 Sep, 2025
95	Baswaraj Raigond	Krishi Vigyan Kendra, Solapur	Scientific Advisory Committee	Meeting	Physical	16 Sep, 2025
96	I K Das	NAARM Hyderabad	Analysis of Multi-environment Trial Data using R	Meeting	Physical	17-19 Sep, 2025
97	C Tara Satyavathi and team	PJTAU, Hyderabad.	Research Collaboration meeting with Hon'ble Vice-chancellor and Director of Research, PJTAU and ICAR-IIMR team.	Meeting	Physical	23 Sep, 2025
98	C Tara Satyavathi	ICAR, New Delhi	VKSA Rabi 2025 Meeting	Meeting	Online	24 Sep, 2025
99	C Tara Satyavathi	ICAR-NAARM, Hyderabad	Inaugural program of Stakeholders Consultation Meeting for RuTAG 2.0 Innovations	Meeting	Physical	24 Sep, 2025
100	C Tara Satyavathi	ICAR-NAARM	2nd International Conference 2025 on "Frontiers in Science and Technology for Agricultural Transformation	International Conference	Physical	25-26 Sep, 2025
101	Srividhya, S	Launched by Ministry of Agrl. & Famers Welfare	Prime Minister Dhan Khaanya Krishi Yojana (PMDDKY)	Meeting	Online	11 Oct, 2025
102	C Tara Satyavathi	ICAR-NDRI, Karnal	Curtain Raiser Program on Emerging Agriculture Technologies (EAT) for ESTIC-2025	Meeting	--	13 Oct, 2025
103	C Tara Satyavathi	Ministry of Electronics and IT, Govt. of India	16th edition of the Aegis Graham Bell Awards (AGBA) Virtual Innovation Presentation (As Jury for Agriculture)	Meeting	Online	15 Oct, 2025

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104	C Tara Satyavathi	Dept. of Women Development & Child Welfare Govt. of Telangana	Committee meeting - Food Based Intervention or recommending a comprehensive Diet chart and food models for the Anganwadi beneficiaries	Meeting	Online	27 Oct, 2025
105	C Tara Satyavathi	National Innovation Foundation-India, Gujarat	Research Advisory Committee (Agriculture) meeting	Meeting	Physical	30 Oct, 2025
106	Sangappa	IIPM, Bangalore	Business opportunities in Millets for promotion of Millet Entrepreneurship	Meeting	Physical	31 Oct, 2025
107	Hariprasanna K.	UPCAR, Lucknow & BHU, Varanasi	National Conference on Innovative Approaches in Millets Improvement	National Conference	Physical	07-08 Nov, 2025
108	C. Tara Satyavathi	Institute of Agricultural Sciences, BHU, Varanasi	National Conference on Innovative Approaches for Millets Improvement (IAMI 2025).	National Conference	Physical	07 Nov, 2025
109	C. Tara Satyavathi	Government of Odisha, Bhubaneswar	International Symposium on Shree Anna & Woman Farmer 2025	International Symposium	Physical	10 Nov, 2025
110	Hariprasanna K.	PPV&FRA	21st Foundation day celebration of PPV&FRA and Plant Genome savior Award ceremony	Meeting	Physical	12 Nov, 2025
111	C Tara Satyavathi	NABARD and Internet and Mobile Association of India (IAMAI)	Discussion on "Women-led Rural Innovation & Entrepreneurship" during the EARTH Panel Summit 2025-26 – Empowering Agriculture, Rural Tech & Humanity	Panel Discussion	Physical	21 Nov, 2025
112	Sangappa	Society of Extension Education, Agra, Siksha 'O' Anusandhan (Deemed to be University), Bhubaneswar, Odisha, Central University of Odisha	2nd International Extension Education Congress (IEEC)- 2025 on "Rethinking Social Ecology in a Digital Landscape" presented paper titled 'Transformative Role of FPOs from Collective Action to Climate-Smart Agriculture'	Conference	Physical	24-26 Nov, 2025
113	C Tara Satyavathi	PJTAU, Hyderabad	State-Level Consultative meeting on the Draft Seeds Bill, 2025	Meeting	-	28 Nov, 2025
114	B Venkatesh Bhat , Sooganna	Professor Jayashankar Telangana Agricultural University (PJTAU) and Department of Agriculture, Telangana	State-Level Consultative Meeting on the Draft Seeds Bill, 2025	Meeting	Physical	28 Nov, 2025
115	Sooganna	ATPBR in collaboration with Seed Uber and AIH	Webinar on Perspectives on the Seed Bill 2025	Webinar	Online	29 Nov, 2025
116	Baswaraj Raigond	School of Pharmacy, IEC University, H.P	Institute Animal Ethics Committee	Meeting	Online	01 Dec, 2025
117	C Tara Satyavathi	Food and Agricultural Organization, Bangkok, Thailand	Regional Project Terminal Review and Workshop of FAO Project on Millets	Workshop	Physical	4-5 Dec, 2025

S No	Name of Employee	Meeting organized by	Details	Program	Mode	Date
118	Srividhya, S	conducted by Statoberry LLP in association with Dept. of Agricultural Statistics, College of Agriculture, Vellayani,	7-day Online training on Next-Gen Data Analysis with R and AI-Powered RAISINS	Workshop	Online	05-11 Dec, 2025
119	C Tara Satyavathi	Government of Telangana	Telangana Rising Global Summit 2025	Summit	Physical	08 Dec, 2025
120	Gopi Kishan	By ICAR-IIMR, Hyderabad under FAO Funded Project "Enhancing capacity on sustainable value chain development of millets for food and nutrition security in India" (TCP/RAS/3909)	National Terminal Workshop of FAO Project (TCP/RAS/3909)-India Presented "Project Implementation & Achievement of Gudamalani center"	Workshop	Physical	10 Dec, 2025
121	Sooganna	International Society for Seed Science (ISSS) United Kingdom and the International Seed Testing Association (ISTA), Switzerland	ISSS- ISTA Webinar on Seed Vigour - Mechanisms and Applications	Webinar	Online	10 Dec, 2025
122	Sangappa	NAARM, Hyderabad	Training Program on Rashtriya Karmayogi Large Scale Jan Seva program Phase II	Workshop	Physical	15-17 Dec, 2025
123	Srividhya, S	ISPP, New Delhi and TNAU, Coimbatore	6th International conference on Plant Physiology on "Translational Genomics and Physiology for Sustainable Agriculture" and delivered a session talk on Root adaptations and water use strategies in sorghum under drought and optimal moisture conditions	International Conference	Physical	15-18 Dec, 2025
124	Seva Nayak D	University of Agricultural Sciences (UAS) Raichur & National Agriculture Development Cooperative Ltd. (NADCL) Baramulla	International Conference On Sustainable Innovations in Agriculture, Veterinary and Allied Sciences" SIAVAS-2025" Paper title: Physiological Smart Millets, Processing, and Value Addition Technologies for Empowering Farmers	Meeting	Online	29-31 Dec, 2025
125	Sangappa	UAS Raichur and NADCL	International conference SIAVAS-2025 presented paper titled 'Farm to Fork: A Sustainable innovation in Lambasingi FPO to empower tribal farmers'	International Conference	Physical	29-31 Dec, 2025
126	C Tara Satyavathi	IFPRI, New Delhi	Network of Policy Advisors and analysis (NePAA) Webinar	Webinar	Online	17 Dec, 2026

Visit of Dr Himanshu Pathak, Secretary (DARE) and DG (ICAR)

Dr. Himanshu Pathak, Secretary (DARE) and DG (ICAR) visited the ICAR- IIMR on 29th January 2025. Dr. C. Tara Satyavathi, Director, ICAR-IIMR appraised him the upcoming facilities at the Global Centre of Excellence (CoE) on Millets (Shree Anna) and MAHARISHI. The dignitaries toured the under-construction Global CoE building, Innovation Centre,



farm facilities, and nutri-cereal referral laboratories equipped with advanced equipments. DG reviewed the work and accomplishments of all Hyderabad based ICAR institutes and provided valuable guidance. Dr. R.M. Mathur, Director, ICAR-IIOR; Dr. S.K. Bera, Director, ICAR-IIGR, Junagadh; Dr. S.B. Barbuddhe, Director, ICAR-NIMR; Dr. R.N. Chatterjee, Director, ICAR-DPR; Dr. Shaik N. Meera, Director, ATARI; Dr. R. Mahender Kumar, Director-in-Charge, ICAR-IIRR; Dr. V. Ramasubramanian, Joint Director-in-Charge, ICAR-NAARM; Dr. L. Saravanan, Officer-in-Charge, ICAR-NBPGR Regional Station; and Dr. N. Sunil, In-Charge, ICAR-WNC Maize along with ICAR-IIMR scientists IIMR scientists attending the meeting.

Visit of Shri. Kamlesh D Patel (Daaji)

Shri Kamlesh D. Patel, popularly known as Daaji and Global Guide of Heartfulness at Kanha Shanti Vanam,



Hyderabad visited ICAR-IIMR on 15th February 2025 accompanied by Dr. R.C. Agarwal, DDG (Education), ICAR. The visit focused on understanding millet production, advanced processing techniques, discussions on their significant health benefits including nutritional enhancement and wellness promotion. Dr. C. Tara Satyavathi, Director, ICAR- IIMR extended warm welcome and accompanied the guests through the institute's cutting-edge infrastructure under the Global Centre of Excellence on Millets including the under-construction buildings equipped with state of art instrumentation for research and processing and a guided tour of the millet demonstration fields showcasing improved cultivation practices and the Centre of Excellence on Millet Processing and Value Addition.

Visit of Dr. D.K. Yadava, DDG (Crop Science), ICAR to ICAR – IIMR

Dr. D.K. Yadava, DDG (Crop Science), ICAR, visited ICAR–IIMR, Hyderabad on 26th April 2025 to review ongoing research and infrastructure advancements



under the Global Centre of Excellence on millets. He was accompanied by Dr. H.S. Jat, Director of ICAR-IIMR (Maize). He reviewed upcoming research infrastructure, particularly the advanced phenomics complex which is expected to significantly strengthen high-throughput plant phenotyping capabilities. Such infrastructure will play a crucial role in accelerating breeding programs and developing climate-resilient millet varieties. Dr. Yadava also held detailed interactions with IIMR scientists across disciplines, where ongoing research initiatives, technological innovations, and outreach programs were discussed. He provided constructive scientific and strategic guidance to further strengthen millet research and development efforts in the country.

Visit of Secretary, DARE and DG, ICAR to ICAR – IIMR

Dr. Mangi Lal Jat, Secretary (DARE) and DG (ICAR) inaugurated the IIMR FPOs Agro-Mart and Shree Anna (Millet) Mechanization Centre along with Padma



Bhushan Dr. R.S. Paroda, Former Secretary (DARE) and DG (ICAR) at the ICAR-IIMR, Hyderabad on 27th April, 2025. The facility is aimed to support FPOs in marketing value-added millet products with technical backing from ICAR-IIMR and financial support from the ICICI Foundation under its Corporate Social Responsibility (CSR) initiative. Dr. M. L. Jat lauded ICAR-IIMR's contribution to rural development and millet promotion through farmer collectives stating that the new Agro-Mart would enhance consumer access and visibility for FPOs, thereby improving farmer incomes. He also emphasized mechanization units especially under the Tribal Sub-Plan (TSP) will be pivotal in supporting millet farming in tribal regions, easing the workload of farm women, and strengthening the millet value chain through improved marketing and processing infrastructure. The event was graced by several dignitaries, including Padma Bhushan Dr. R.S. Paroda,

Former Secretary (DARE) and DG (ICAR); Dr. Rakesh Chandra Agrawal, Deputy Director General (Agricultural Education), ICAR and Acting Director, ICAR-NAARM. Dr. C. Tara Satyavathi, Director, ICAR- IIMR highlighted the institute's dedicated work in nurturing millet-based FPOs across Andhra Pradesh, Telangana, Karnataka, and Odisha.

Visit of Hon'ble Minister of Agriculture, Jharkhand to ICAR-IIMR, Hyderabad

Smt. Shilpi Neha Tirkey, Hon'ble Minister of Agriculture, Animal Husbandry & Cooperative, Government of Jharkhand, visited ICAR-IIMR, Hyderabad on 30th April



2025. Minister visited the Shree Anna Processing Unit along with Dr. C. Tara Satyavathi, Director, ICAR-IIMR, Hyderabad. Director, ICAR-IIMR briefed the millet-based technologies, research activities undertaken, primary processing, and value addition techniques developed by IIMR for strengthening millet eco-system. Dr. Sangappa & Dr. Srinivasa Babu, explained the role of IIMR FPOs in strengthening millet value chain at grass root level. The visit highlighted opportunities for collaboration and millet promotion in Jharkhand.

Dr. Stanford Blade, DDG, ICRISAT visit to ICAR – IIMR

Dr. Stanford Blade, DDG, ICRISAT along with Srinivas Bollam, Manager, AIP-ICRISAT, visited ICAR – IIMR on 17th December, 2025 to review institutional facilities and discuss potential areas of collaboration. The visit included a guided tour of the Centre of Excellence on millet processing and value addition and the research farm, offering a comprehensive view of ongoing research, value addition and processing and start-up



support activities. The delegation was accompanied by Dr. Tara Satyavathi C, Director, IIMR, Dr. Johnson Stanley, CEO, Nutrihub ICAR-IIMR, and Dr. Nepolean, Principal Scientist, ICAR-IIMR who shared insights on current programmes and institutional strengths. While ICRISAT and ICAR - IIMR share a long-standing partnership in millet research the discussions indicated a clear interest in extending cooperation beyond existing engagements, with emphasis on structured collaboration across research, value chains, and enterprise linkages.

Shri Sanjay K. Agarwal, Joint Secretary (Extension), DA &FW visit to ICAR- IIMR

Shri Sanjay K. Agarwal, IAS, Joint Secretary (Extension), Department of Agriculture & Farmers' Welfare, visited



ICAR-IIMR on 18th December 2025. During the visit, he reviewed the upcoming advanced phenomics complex which provides an integrated platform for advanced crop research and high-throughput phenotyping. He also examined ongoing initiatives in millet processing, value

addition, start-up incubation, and capacity-building programs. Shri Agarwal commended ICAR-IIMR for its significant contributions to millet promotion, particularly its targeted efforts to support millet-based start-ups, foster linkages between research and entrepreneurship, and develop market-oriented extension frameworks. The interaction facilitated constructive discussions and provided strategic guidance on scaling outreach activities, enhancing stakeholder coordination, and aligning institutional efforts with national priorities related to nutrition security, farmer income enhancement, and Agri-startup development.

Padma Shri Awardee Farmers visited ICAR-IIMR

Padma Shri Kanwal Singh Chauhan, ICAR governing board member along with Padma Shri Seth Pal Singh and Padma Shri Chandra Shekhar Singh visited ICAR-IIMR, Hyderabad on 3rd February 2025. They gained firsthand insights into the institute's activities, particularly post-harvest management, value addition in millets and the Global Centre of Excellence on Millets. The delegates visited key facilities including the GeneBank,



Centre of Excellence on millet processing and value addition. They engaged in discussions on millet product manufacturing and entrepreneurship development within the millet ecosystem at NutriHub, ICAR- IIMR.

Visit of UPCAR team to ICAR-IIMR

Uttar Pradesh Council of Agricultural Research (UPCAR) led by Dr. Sanjay Singh, Director General, UPCAR along with members Dr. Permendra Singh, Deputy Director General, UPCAR, Dr. Rajarshi Gaur,

DDG, UPCAR and Dr. Rinni Singh, Scientific Officer, UPCAR visited ICAR- IIMR on 5th September 2025 to deliberate on the collaborative project on “Improving the adaptability and productivity of millets in Uttar Pradesh”. Dr. P. Sanjana Reddy presented an overview of research activities taken up in the project. The team visited the experimental plots featuring breeding trials, pipeline cultivars, and germplasm collections in all millets. The delegation visited upcoming Global Centre of Excellence facilities at IIMR and Nutri-Hub. The visit provided a comprehensive understanding of ICAR-IIMR's research and infrastructure and gave insights on building an innovation network under the millet revival programme for Uttar Pradesh.

Visit of Shri. Yogendra Kumar, Chairman BBSSL & MD, IFFCO to ICAR-IIMR

Shri. Yogendra Kumar, Chairman, Bharatiya Beej Sahakari Samiti Ltd and Marketing Director, IFFCO along with Dr. Tarunendu Singh, Chief Agriculture Officer IFFCO, Mr. Krupasankar State Marketing Manager IFFCO along with Dr Neeraj Awasti Country Manager, Anglo American Crop Nutrients Company, visited ICAR-IIMR on 30th January, 2025. The delegates were explained about the latest and improved high yielding cultivars in all millets followed by germplasm



activities such as collection, preservation and utilization including the landraces in each of the millets. He visited Centre of Excellence in millet processing and value addition, Common Facility Centre and Nutrihub and was apprised about the value-added technologies and entrepreneurship development in millets at ICAR-IIMR.

Malaysian Delegation Visits ICAR-IIMR

A three member senior delegation from Malaysia's Agricultural Research and Development Institute visited ICAR – IIMR, Hyderabad on 25–26th June 2025. The visit was part of a study programme organized by the African Asian Rural Development Organization in collaboration with the Ministry of Rural Development, Government of India, to enhance bilateral cooperation in millet research and development, with a special focus on sorghum and quinoa. Dr Tara C. Satyavathi apprised about the latest development in millets. The visit included technical sessions on millet production, sorghum technologies and exposure to processing and value-addition techniques. The delegation also

explored innovation initiatives such as Nutrihub, which supports millet-based startups. Overall, the visit highlighted IIMR's expertise in millet research and opened opportunities for future collaboration between India and Malaysia in technology transfer, value chain development, and policy support for millet promotion.



Other distinguished Visitors

S. No.	Name	Affiliation	Date
1	Dr S K Pattanayak, IAS	Former Secretary, DAC, New Delhi	13 th June, 2025
2	Dr Rakesh Kaur	Adviser Sc 'G' Office of PSA, New Delhi	24 th September 2025
3	Sri V. Bhagaiah	Executive Member, RSS, Guwahati	25 th September 2025

National Millet Kisan Mela and Industry Meet-2025

ICAR-IIMR, Hyderabad organized the “National Millet Kisan Mela and Industry Meet 2025” on March 3rd, 2025



organized under the SCSP and TSP components of the Global Centre of Excellence on Millets (Shree Anna) project dedicated to empowering Scheduled Caste and Scheduled Tribe (SC & ST) farmers. Shri Bhagirath Choudhary, Hon'ble Minister of State for Agriculture and Farmers Welfare graced the occasion and inaugurated the Shree Anna processing and training unit at ICAR-IIMR, Hyderabad. More than 5,000 farmers, government officials, researchers, policymakers, agribusiness experts, startups, entrepreneurs, and machine manufacturers participated. The event fostered a vibrant platform for knowledge sharing and collaboration across multiple stakeholders. Participants

were showcased millet based production technologies, processing and value-addition technologies. About 80 millet-based stalls exhibiting innovative products and solutions, field visits, live demonstrations and a millet machinery exhibition and interactive 'buzz sessions' for direct engagement between scientists, industry leaders and farmers addressing field challenges and exploring millet-based solutions were organized. The event was organized by Dr C. Tara Satyavathi, Director ICAR IIMR along with Drs. Sangappa, K. Srinivasa Babu, A. Kalaisekar, J. Stanley and ICAR-IIMR scientists.

Millets B2B (Buyer-Seller) Meet

ICAR-IIMR, Hyderabad organized Buyer-Seller Meet with 40 FPOs, 35 startups on 3rd March 2025 during the National Millet Kisan Mela & Industry Meet 2025. This



B2B meet also brought about 60 buyers, 5 international clients and 15 exporters together for establishing market linkages. The meeting was inaugurated by Shri. R.P. Naidu, Regional Head, APEDA, Hyderabad; Dr. C. Tara Satyavathi, Director, ICAR-IIMR; Dr. Sangappa, Scientist, ICAR-IIMR and farmer representatives. The B2B meet enhanced the visibility of millet-based value-added products, millet grains, ready to eat millet foods, pulses, oils, pickles, spices, honey and organic jaggery sold by ICAR-IIMR FPOs in Andhra Pradesh, Karnataka and Telangana. The event provided FPOs with an opportunity to establish strategic partnerships, expand

market access, and secure business deals with retailers and exporters. Multiple agreements and Letters of Intent worth of Rs. 2,51,92,500 were initiated and exchanged between the sellers and buyers for future collaborations

Millet zone in Udyan Utsav at Rashtrapati Nilayam, Secundrabad

The Udyan Utsav (Flower and Horticulture Festival) took place from 2 to 13 January 2025 at Rashtrapati Nilayam, Secundrabad, Telangana. ICAR-IIMR organized a dedicated Millet Zone in the exhibition, showcasing diverse millets, scientific production methods, protection techniques, processing, value addition, and ready products. Twenty ICAR-IIMR-supported startups joined the exhibition and displayed their products. Dr C. Tara Satyavathi, Director, ICAR-IIMR along with Dr. J. Stanley and Dr. Avinash Singode participated in the exhibition on 4th January, 2025 to oversee and encourage the exhibitors and startups of millet zone.

Online Awareness program on Intellectual Property

ICAR's IPTM division with ZTMCs of ICAR-IIMR and ICAR-IARI, organized a six-day online IP Awareness Program (16-23 Jan 2025) for crop science institutes ITMU In-charges and scientists. The program was inaugurated by Dr. Neeru Bhooshan, ADG IPTM. In her initial remarks mentioned about the importance of this awareness program. The inaugural session was presided by Dr. Ch. Srinivasa Rao, Director, ICAR-IARI, New Delhi and a talk on 'Trademark & design essentials: safeguarding creativity and innovation' was given by Mr. Rahul Bagga, Founder and MD, Aumirah, New Delhi. Program was attended by more than 300 participants. Sessions on patents, copyrights, PPVFRA and Plant Variety Rights, Technology Licensing was presided by Dr. Pankaj Kaushal, Director, ICAR-IGFRI, Dr C. Tara Satyavathi, Director, ICAR-IIMR, Dr. R. M. Sundaram, Director, ICAR-IIRR, Hyderabad, Dr Sujay Rakshit, Director, ICAR-IIAB, Ranchi respectively. Panel Discussion on "Issues and challenges in agri IPRs ecosystem' was chaired by Dr T. R. Sharma, DDG (Crop Science) ICAR, New Delhi and co-chaired by Dr. Neeru Bhooshan, ADG, IPTM & PME, ICAR, New Delhi.

The panellists included Dr. Prithpal Kaur Sidhu, Joint registrar of Trade marks, New Delhi, Dr. Rahul Bagga Founder and MD, Aumirah New Delhi, Dr. Ashwani Siwal, University of Delhi, Dr. Jupi Gogoi, Faculty of Law, University of Delhi, Dr Dipal Roy Choudhary Joint Registrar PPVFRA and Dr. Praveen K Malik CEO AgrInnovate India, New Delhi.

Foundation Day celebrations of ICAR-IIMR

ICAR- IIMR celebrated its 10th Foundation day on 9th February, 2025. Dr. RC Agrawal, DDG (Education), ICAR participated as Chief-guest and Shri. Asif Iqbal,



Zonal Head, ICICI Foundation as Guest of honour. Dr. C Tara Satyavathi welcomed the delegates and briefly presented the progress of the Institute. She highlighted the journey of Institute starting as a PIRRCOM centre in 1958 to the ICAR- IIMR in 2014 and elevation as a Global Centre of Excellence for R&D in Millets in 2023. Dr. R Madhusudhana, Project Coordinator, AICRP on sorghum and small millets also participated in the event. The chief guest lauded the remarkable progress achieved by IIMR and efforts of the Institute in awareness creation and promotion of millets throughout the country. He expressed his happiness at the success of millets startups and Incubates who are engaged in millets value chain development and promotion.

Shree Anna Kisan Mela at ICAR-IIMR- RRS on Pearl Millet, Gudamalani, Barmer

ICAR - IIMR Regional research station on pearl Millet, Gudamalani Barmer organized Shree Anna Kisan Mela-2025 on 16th February, 2025 under the Scheduled Caste Sub Plan (SCSP) and Tribal Sub Plan (TSP) programs. Honorable Union Minister of State for Agriculture and

Farmers Welfare, Government of India Shri Bhagirath Choudhary attended as chief guest and his address emphasized on the use of pearl millet/millet in our daily diets. The kisan mela was participated by 2000 farmers (1700 SC farmers and 350 ST farmers). Millet seed kits of improved pearl millet hybrid seed have been distributed to these farmers during the kisan mela. Chief guest also elaborated about the different strategies and plans of Govt. of India to promote the millets among different stakeholders. Shri. Kailash Choudhary, Former Union Minister of State for Agriculture and Farmers Welfare and Shri. K. K. Bishnoi, Minister of state, Govt. of Rajasthan along with Dr C. Tara Satyavathi, Director, ICAR – IIMR participated and addressed the gathering.

Launch of IIMR FPOs Agro Mart and Shree Anna mechanization centre

Dr. Mangi Lal Jat, Secretary (DARE) and DG (ICAR) inaugurated the IIMR FPOs Agro Mart and Shree Anna mechanization centre at the ICAR- IIMR, Hyderabad on 27th April 2025. The event was graced by Padma



Bhushan Dr. R. S Paroda, Former Secretary (DARE) and DG (ICAR); Dr. Rakesh Chandra Agrawal, DDG (Agricultural Education), ICAR and Acting Director, NAARM; Dr. C. Tara Satyavathi, Director, ICAR-IIMR;

Mr. Asif Iqbal, Project Manager, ICICI Foundation and Scientists of IIMR. The Agro-Mart is supported by ICICI foundation under its CSR activity to showcase and promote value added millet products developed by Farmer Producer Organizations (FPOs) with technical support from ICAR-IIMR. Dr. C. Tara Satyavathi highlighted IIMR's efforts in strengthening millet based FPOs across Andhra Pradesh, Telangana, Karnataka and Odisha. Dr. M. L. Jat appreciated ICAR-IIMR's initiatives in empowering rural communities through millet promotion and processing and value addition with the help of farmer collectives (FPOs). He highlighted that the FPOs Agro-Mart would provide FPOs and farmers direct access to consumers, improving market visibility and income generation.

World Environment Day Celebrations at ICAR-IIMR, Hyderabad

ICAR- IIMR, Hyderabad organized an awareness program and plastic cleanliness activity in the experimental fields and office premises on 31st May 2025. Cleanliness activity in the office premises was taken up under the WED-2025 theme "Ending Plastic Pollution Globally". All staffs along with farm labours actively involved in collection and proper disposal of the plastic items. The awareness on the hazardous effect of plastic on health and environment was explained to the farm labours and advised them to stop the use of single use plastics in day to day life. An awareness program on 'Single Use Plastic Pollution' and Plantation drive was conducted on June 5th 2025 at IIMR premises. During the awareness session Dr. B.Venkatesh Bhat emphasized the critical need for individual action in reducing and ultimately eliminating single-use plastics from daily routines. The awareness session was complemented by a hands-on plantation drive. The program and coordinated by Drs. B Amasiddha, Sangappa and Mr. J Bhagavantham.

Visit of Hon'ble Union Agriculture Minister to IIMR Exhibition Stall

The Hon'ble Union Minister of Agriculture and Farmers welfare, Shri Shivraj Singh Chouhan accompanied by Shri Bhagirath Chaudhary, Hon'ble Minister of State for Agriculture and Farmers' Welfare and other regional dignitaries visited the ICAR-IIMR millet exhibition



stall during the Viksit Krishi Sankalp Abhiyan (VKSA) event at Mangalpalli Village, Ibrahimpatnam Mandal, Rangareddy District, Telangana on 9th June 2025. Dr. (Mrs.) C. Tara Satyavathi, Director ICAR-IIMR and Dr. Rajendra R. Chapke presented the institute's advancements in improved millet production and processing technologies. The visit concluded with the Union Minister's interactive session with farmers and

participants, where he offered guidance on profitable millet farming practices. Most farmers expressed keen interest in adopting millets and sought seeds of improved cultivars

Viksit Krishi Sankalp Abhiyan (VKSA) report of ICAR-IIMR, Hyderabad

A total of 16 scientists (5 teams) from ICAR-IIMR participated actively conducted by Viksit Krishi Sankalp Abhiyan (VKSA) programme activities with ICAR-ATARI Hyderabad at different KVKs during 28 May-12 June, 2025 in Telangana and Andhra Pradesh. During the period, scientists interacted with farmers of the respective district nodal officer of KVKs. All 5 teams together have visited 284 villages (71 in Telangana and 213 in Andhra Pradesh). Details of teams and number of villages visited under each KVK are briefed below.

S.No	Name of Scientist	KVK allotted	Number of villages covered
1.	Dr. G. Shyam Prasad	Kadapa II (Vontipenta), Andhra Pradesh (TEAM-1)	45
2.	Dr. A.V. Umakanth		
3.	Dr. B. Subbarayudu		
4.	Dr. C. Aruna	Medak 1 (DDS), Sangareddy, Telangana (TEAM-II)	45
5.	Mr. K Srinivasa Babu		
6.	Dr. D. Sevanayak		
7.	Dr. P. Rajendra Kumar		
8.	Dr. N. Kanna Babu	Warangal 2 (Mamnoor), Telangana (TEAM-III)	26
9.	Dr. P. Sanjana Reddy		
10.	Dr. Sooganna	Kurnool (Yagantipalli), Andhra Pradesh (TEAM-IV)	135
11.	Dr. Venkateswarlu Ronda		
12.	Dr. A Srinivas		
13.	Dr. Sangappa	Kurnool II (Banavasi), Andhra Pradesh (TEAM-V)	33
14.	Dr. Srividhya		
15.	Dr. R. Swarna		
16.	Dr. N. Anuradha	ATARI, CRIDA	-

Pradhan Mantri Kisan Samman Nidhi (PM-KISAN) awareness programme

Pradhan Mantri Kisan Samman Nidhi (PM-KISAN) programme was organized on 2nd August 2025 as part of the nationwide event with the objective of raising awareness among farmers about the benefits and

objectives of the PM-KISAN scheme and to highlight the government's continued commitment to ensuring direct financial support to small and marginal farmers. A total of 50 farmers from various districts of Telangana participated in the event. The live telecast of the Hon'ble Prime Minister's address under the PM-KISAN initiative



was arranged at the institute. A total of 23 FPOs and about 1800 farmers from Andhra Pradesh, Karnataka and Telangana virtually participated in this event. The programme also created awareness among farmers about the role of ICAR–IIMR in promoting millet-based livelihood opportunities.

Commemoration of centenary birthday of Prof. M. S. Swaminathan

ICAR- IIMR commemorated the birth centenary of Bharat Ratna Prof. M.S. Swaminathan, Father of the Green Revolution and pioneering agricultural scientist on 6th August 2025. Scientists and technical staff gathered to remember on his illustrious life, contributions, numerous accolades and visionary leadership for sustainable agriculture. Dr. (Mrs.) C. Tara Satyavathi launched a commemorative souvenir titled *Hunger Free India is Achievable*, published by the Society for Hunger Elimination in tribute to Prof. Swaminathan. In her address, she described scientific interactions and his enduring advocacy for millets as a resilient crop ideally suited to empower smallholder farmers and combat nutritional insecurity. The event was coordinated by Dr. Venkatesh Bhat.

Independence Day Celebrations at ICAR-IIMR

The 79th Independence day was celebrated at ICAR-IIMR, Hyderabad on 15th August 2025. Dr. C. Tara Satyavathi, Director, ICAR-IIMR, hoisted the national flag and addressed the gathering. In her speech, she paid tribute to freedom fighters and emphasized the various research achievements made by the institute during the year for enhancing production and institute's role in promoting millet research and contributing to national food and nutrition security. Staff and students participated in the celebration which included cultural

performances and patriotic songs. The event concluded with a vote of thanks.

Pearl millet Technology Demonstration and Farmer's Meet

The Pearl Millet Technology Demonstration and Farmer's Meet 2025 was organized on 21st September



2025 at the ICAR–IIMR Regional Research Station on Pearl Millet, Gudamalani, Barmer under the SCSP program of the institute. The event aimed at showcasing improved pearl millet technologies through exhibitions and field demonstrations. A total of 30 exhibition stalls were set up by ICAR institutes located in Rajasthan, private seed companies, and FPOs. The programme was graced by Hon'ble MoS Agriculture and Farmers Welfare Sh. Bhagirath Choudhary as Chief Guest, and was presided over by Dr. M. L. Jat. Hon'ble Secretary (DARE) & DG (ICAR), Sh. Kailash Choudhary, Former MoS for Agriculture and Farmers Welfare, Dr. D. K. Yadava, DDG (Crop Science) and Dr. C. Tara Satyavathi, Director ICAR-IIMR Hyderabad graced the occasion. The dignitaries reviewed the ongoing administrative and laboratory building works, urged CPWD to expedite completion of the work. The delegates laid foundation stone of the Pearl Millet Technology Demonstration Park under the TSP scheme, which will house a modern training hall and demonstration facilities. About 600 beneficiary farmers received tarpaulins for grain protection and field use. The event witnessed the participation of about 1000 farmers and stakeholders.

Launch of Dhan Dhaanya Krishi Yojana and Pulses Mission

ICAR– IIMR, Hyderabad, organized a nationwide farmer scientist interface and millet promotion meet



on 11th October 2025 coinciding with the launch of the Hon'ble Prime Minister Dhan Dhaanya Krishi Yojana (PMDDKY) and Mission Aatmanirbharta in pulses. The program witnessed the gracious presence Shri. Konda Vishweshwar Reddy Member of Parliament (MP) for Chevella, Telangana; Dr. C. Tara Satyavathi, Director, ICAR-IIMR, Hyderabad along with the active participation of scientists, farmers and FPO members across multiple states both onsite and virtually. A total of 1,992 farmers took part in the event including 672 members from Karnataka FPOs and 1,020 farmers from Andhra Pradesh FPOs promoted by ICAR-IIMR joining virtually and about 300 farmers from Telangana and neighbouring states visited IIMR, Hyderabad. The commitment of the government to agricultural transformation was highlighted during the live telecast of the Prime Minister's address.

Workshop on millets promotion for bioethanol and compressed biogas production

An one-day workshop on promotion of millets, especially sorghum and pearl millet for bio-ethanol and CBG Production was organised at the ICAR-IIMR, Hyderabad in collaboration with the Indian Federation of Green Energy (IFGE), New Delhi on 13th November at ICAR-IIMR, Hyderabad. About 40 delegates representing academic institutions and industries participated. The programme served as an important platform for knowledge exchange, practical insights, and dialogue among researchers, experts, and industry stakeholders on the use of sweet sorghum, high biomass sorghum, low-lignin sorghum, and forage pearl millet as promising feedstocks for ethanol and compressed biogas (CBG) production. A field visit to ICAR-IIMR's sorghum and forage pearl millet experimental plots offered participants first hand exposure to advanced crop

varieties and technologies. The programme concluded with a collective commitment to strengthen collaboration among ICAR-IIMR, IFGE, and industry partners to accelerate research, technology dissemination, and large-scale adoption of biofuel and bioenergy solutions.

Celebration of Constitution Day (Samvidhan Diwas)

ICAR-IIMR, Hyderabad celebrated "Constitution Day" on 26th November, 2025. The programme commenced with the administration of the Constitution Day (Samvidhan



Diwas) pledge by Dr. C. Tara Satyavathi, Director, ICAR-IIMR, Hyderabad and all staff members and students. All staff members participated in oath ceremony reflecting their collective commitment to uphold the principles and values enriched in the constitution. Director briefed about the historical background on constitution along with the rights, duties and responsibilities and summarized the vision of Hon'ble Prime Minister on this occasion. Centre for rabi sorghum, Solapur and Regional research station on pearl millet, Gudamalani, Barmer celebrated constitution day (Samvidhan Diwas) by taking pledge and conducting various other programmes.

Commemoration of 150 years of Vande Mataram

ICAR- IIMR commemorated 150 years of the National Song "Vande Mataram" through a series of activities conducted during the launch week (7–14 November 2025). The programme was formally launched on 7th November 2025 with a mass singing of "Vande Mataram". Dr. Shyam Prasad, Director In-charge inaugurated the event and highlighted the historical importance and national relevance of the song. A total of 73 participants, including scientific, technical, administrative, supporting staff, research scholars, students and project staff participated. Mass singing programmes were organized



at CRS, Solapur and RRS on Pearl millet, Gudamalani, Barmer with enthusiastic participation by all staff. Brief presentation on the historical background and patriotic significance of Vande Mataram events was conducted at CRS, Solapur. The activities at ICAR-IIMR were digitally documented and streamed on social media platforms (Facebook, Twitter, and YouTube) on 10th November 2025. An exhibition display on “Vande Mataram – history, lyrics, translations and freedom movement relevance” was organized on 11th November 2025 showcasing banners, photographs, and inspirational quotes of freedom fighters. To encourage intellectual and creative engagement an essay writing competition on “Vande Mataram: The Song that United a Nation” was held on 12th November 2025 followed by a poster/drawing competition on “My Motherland, My Pride” on 13th November 2025 and a quiz competition on 14th November 2025. These activities witnessed active participation by all staff with winners being recognized through certificates.

ICAR-IIMR observes Kisan Samman Diwas

ICAR- IIMR, Hyderabad observed Kisan Samman Diwas on 23rd December 2025 to honour farmers on the birth anniversary of Late Shri Chaudhary Charan Singh,



Former Prime Minister of India. The program created awareness among farmers and stakeholders about the Viksit Bharat – Guarantee for Rozgar and Aajeevika Mission (Gramin) Bill, 2025 which aims to strengthen rural livelihood security through enhanced employment opportunities and income stability. About 250 farmers from Sangareddy district participated in the event. Dr. C. Tara Satyavathi, Director, ICAR-IIMR, highlighted the critical role of farmers in nation-building and encouraged farmers to adopt improved millet production technologies, scientific post-harvest management, and value addition to enhance income and livelihood security. ICAR-IIMR scientists interacted with farmers and showcased millet value chain initiatives followed by exposure visit to NutriHub and the Shree Anna processing and training unit.

PM-KISAN Webcast and Millet Awareness Drive at ICAR- IIMR

ICAR-IIMR, Hyderabad organized a live webcast of the Hon'ble Prime Minister's release of the 21st instalment of the PM-KISAN scheme to create awareness among farmers about the importance and benefits of the scheme. Dr. Tara Satyavathi, Director, ICAR-IIMR, highlighted the objectives of the programme in her inaugural address. This was followed by an orientation session for farmers on scientific millet production practices, processing technologies and value addition to enhance income and promote sustainable millet cultivation. About 300 tribal and scheduled caste (SC) farmers visited ICAR- IIMR and witnessed the release of Rs. 18,000 crores under PM-KISAN to nearly 9 crore eligible farmers. Hon'ble Prime Minister emphasized farmer welfare, financial empowerment and national agricultural development goals. ICAR-IIMR facilitated conduct of live webcast at the 30 FPOs promoted by ICAR-IIMR. Scientists,





technical staff, administrative staff and all employees of ICAR-IIMR actively participated in program. Dr. C. Tara Satyavathi, Dr. A. Kalaisekar, Dr. Sangappa, Dr. A. Srinivas, Shri K. Srinivasa Babu from ICAR-IIMR, Hyderabad coordinated the event.

International Symposium on Shree Anna and Woman Farmer 2025

The International Symposium on Shree Anna and Woman Farmer 2025 (ISSWF) was organized by the DA &FE, Bhubaneswar, Odisha during 10–11th November 2025 with ICAR -IIMR as technical partner



on the theme “Role of Women in Agriculture Heritage and Conservation of Agrobiodiversity.” Chief guests of the conference were Shri. Mohan Charan Majhi, Hon’ble Chief Minister of Odisha, Shri. Shivraj Singh Chouhan, Hon’ble Union Minister for Agriculture and Farmers welfare, Dr. Hari Babu Kambhampati, Hon’ble Governor of Odisha and Shri. Kanak Vardhan Singh Deo and Smt. Pravati Parida, Hon’ble Deputy Chief Ministers of the State. The chief guests appreciated the innovation, effort and community participation acknowledging the strong role of women farmers and grassroots groups in shaping Odisha’s millet revolution. Their visit underscored the growing national momentum behind millets and reaffirmed Odisha’s position as a frontrunner

in millet-based development, nutrition security and climate-resilient agriculture. ICAR- IIMR showcased millet value-added products, traditional seed diversity, processing technologies, women-led SHG enterprises, FPO initiatives, and start-up innovations coordinated by Dr. K. Srinivasa Babu, Dr Ganapathy KN and Dr. Sangappa.

ICAR-IIMR conducted VKSA Rabi Campaign Meeting for Telangana

ICAR-IIMR conducted a meeting on Viksit Krishi Sankalp Abhiyan (VKSA) Rabi campaign on 29th August



2025. As the Nodal Officer for Telangana State, Dr. C. Tara Satyavathi chaired the meeting. The meeting focused on planning and coordinating outreach and extension activities for the upcoming Rabi season under the VKSA initiative which aims to enhance farmer awareness, promote climate-resilient agriculture and ensure widespread adoption of best practices. Key stakeholders from agricultural departments, KVKs and research institutions participated in the discussions. Strategies for effective implementation, state-level targets and convergence of efforts across departments were deliberated.

Make Your Campus Healthy Campaign

The National Institute of Ayurveda (NIA) an apex body under the Ministry of AYUSH, organized an interactive awareness session at ICAR-IIMR on 10th October 2025 under the “Make Your Campus Healthy Campaign.” The programme focused on promoting a healthy lifestyle through healthy eating habits and better sleep practices based on ayurvedic principles. Dr. Punit Chaturvedi, Assistant Professor highlighted the importance of balanced and mindful eating, the benefits of incorporating nutritious foods such as millets

and the need to follow seasonal and body-type-based dietary practices. The session included discussions, practical tips and an interactive Q&A session. The event successfully encouraged the ICAR–IIMR community to adopt simple, holistic and sustainable lifestyle practices for improved health and productivity.

Vigilance Awareness Week 2025

As per the directions of the Central Vigilance Commission (CVC) and ICAR, Vigilance Awareness Week was organized at ICAR-IIMR from 27th October to 2nd November 2025 under the theme “Vigilance: Our shared responsibility”. The observance commenced with integrity pledge at ICAR-IIMR, Hyderabad and regional stations at CRS Solapur and Gudamalani. Various programs were organized to bring awareness among the public including schools and gram sabhas. Competitions, including essay writing, elocution, quizzes and poster presentations were conducted to enhance awareness and responsibility among the staff. During the valedictory program (3rd November 2025) Dr C. Tara Satyavathi, Director, ICAR- IIMR briefed the

employees on measures taken to enhance transparency and emphasized the need for discipline in working.

Swachhta Awareness Week (Swachhta Pakhwada 2025)

ICAR–IIMR, Hyderabad observed Swachhta Pakhwada 2025 from 16 - 31 December 2025 in alignment with the Swachh Bharat Mission aimed at promoting cleanliness, hygiene, environmental sustainability and community participation. The Pakhwada was inaugurated on 16th December 2025 with Swachhta Pledge to maintain cleanliness at workplaces and public spaces. Series of activities were organized throughout the the period including cleanliness drives, weeding, disposal of scrap and e-waste, plantation programmes, walkathon, waste segregation and recycling awareness, “Say No to Plastic” campaigns and community outreach programmes in nearby residential colonies and villages. Community participation, including involvement of women, youth, students and local representatives are key feature of the observance.

Discussion on millet mechanization with ICAR-CIAE, Bhopal

Dr. V.P. Chowdary, Head & Principal Scientist, Machinery Division, ICAR-CIAE, Bhopal visited ICAR-IIMR, Hyderabad on 31st January, 2025 to explore collaborative research opportunities for mechanization in millets production and processing. Dr RR. Chapke, Principal Scientist emphasized the need for sorghum harvester and, suitable seed-cum-fertilizer planter. Dr. Chowdhury also visited the processing unit of millets and observed cleaning, grading, and preparation of various value-added products operations.

ICICI foundation team visit to ICAR-IIMR

Mr. Sanjay Datta, President, ICICI Foundation visited ICAR-IIMR for discussion and strengthening millet research through CSR funding of ICICI Foundation. Director ICAR-IIMR, Hyderabad briefed the institutional activities at IIMR for boosting the millet ecosystem from farm to fork. Drs. Srinivasa Babu & Sangappa explained the role of IIMR as CBBO in promotion of FPOs in Andhra Pradesh, Karnataka, Telangana and Madhya Pradesh. Mr. Datta responded positively and suggested to submit the project proposals for the promotion and value-chain development of millets (Shree Anna) across India. ICICI Foundation team interacted with scientists to understand ongoing innovations and grassroots impact in millet processing and entrepreneurship.

Visit of BIRAC and FCDO officials at ICAR-IIMR, Hyderabad

Officials from Biotechnology Industry Research Assistance Council (BIRAC) and Foreign, Commonwealth and Development Office (FCDO) under their programme “Train the Trainers Workshop” along with a team from ICAR-NAARM headed by Dr Vijay Avinashilingam, Principal Scientist, visited ICAR-IIMR on 26th March, 2025 and were explained about the activities of Nutrihub technology business incubator. They were taken around the common facility centre and the other facilities for the startups.

ICRISAT scientists visit to ICAR- IIMR

Dr. Kuldeep Singh, Principal Scientist & Head, Genebank, ICRISAT and Dr. Vetriventhan, Senior Scientist (Genetic Resources), ICRISAT visited ICAR-IIMR on 11th July, 2025 to discuss about the possibility of taking forward the Network Project Proposal entitled: “Characterization, Evaluation, Genetic Enhancement and Generation of Genomic Resources of Small Millets for Augmenting Food and Nutritional Security”. After a brief discussion with Dr Tara Satyavathi, Director ICAR-IIMR, the team visited the facilities under development under GCoE and Nutrihub.

Interaction meeting with newly recruited AOs and FAOs of ICAR

The newly recruited AOs and FAOs who are undergoing training at ICAR-NAARM visited ICAR-IIMR on 26th March, 2025 to get exposed to administrative and other activities of the institute. The SAO, Mrs. Ritu Dalal and FAO Shri Shaik Rukman addressed the new AOs and FAOs and discussed about the activities of the institute especially the Global Centre of Excellence related activities. They were taken to demonstration field, CFC and Nutrihub where in millet snacks were served. Dr. Dayakar Rao, CEO, NutriHub addressed them and briefed about the core activities of Nutrihub in millet research and promotion paving way to international year of millets and global center of excellence.

Empowerment of Tribal Farmers with Millets Processing & Custom Hiring units in Andhra Pradesh

ICAR-IIMR, Hyderabad, ATARI Zone-X, Hyderabad and BCT-KVK, Haripuram jointly organized millet awareness program to tribal farmers and tribal FPOs under Tribal Sub Plan (TSP) component of ICAR-IIMR, Hyderabad on 8th July 2025 at BCT-KVK, Haripuram village, Rambilli Mandal of Anapalli district, Andhra Pradesh. A total of 10 FPOs and 40 farmers participated in this meeting and FPOs arranged stalls at BCT-KVK during the meeting. AS part of the event, Drs. Shaik

N. Meera, Srinivasa Babu, Sangappa, Sailaja, Patro distributed free millet processing and value-added machineries to tribal FPOs under GCoE-TSP component of ICAR-IIMR, Hyderabad. Dr. C. Tara Satyavathi, Director, ICAR-IIMR, Hyderabad through her video message addressed tribal farmers and suggested them to utilise these machines and focus on millet-based value-added products and output marketing through online platforms.

Participatory varietal selection cum Field day on Millets at Kundra, Koraput, Odisha

ICAR-IIMR, Hyderabad and Dept. of Agriculture and Farmers Empowerment, Odisha jointly organized one day “Farmers Participatory varietal selection cum Field Day on Millets” on 27th November, 2025 at Kundra Block, Koraput, Odisha. The farmer’s participatory varietal selection cum Field day program aimed at integrating indigenous knowledge of the farmers along with scientific approaches to identify locally adapted, superior varieties enhancing adoption and resilience in rainfed tribal areas of the region. A set of 40 traditional and nationally released finger millet varieties were raised under the farmer’s package of practices (less / no external inputs) at Kundra, Koraput for the above program. A total of 50 tribal farmers including woman farmers participated in the program. Team of ICAR-IIMR scientists, Drs Srinivasa Babu, Ganapathy KN, Sooganna, Sangappa under the guidance of Dr C. Tara Satyavathi, Director, ICAR-IIMR along with WASSAN (Mr Biswa), MSSRF demonstrated and facilitated farmers participatory varietal selection in finger millet.

Field Day of Kodo Millet CKMV2 variety

A field day to popularize kodo Millet variety CKMV-2 was organized on 24th January, 2025 at the Central State Farm (NSC) Jawalgera. CKMV 2 variety was sown in 2.5 acres land and at maturity stage officials from ICAR-IIMR and NSC jointly organized the event. About 100 farmers participated in the field day. IIMR scientists, Drs Sooganna, Amasiddha delivered talk on seed production aspects, salient features of variety and package of practises for obtaining higher yields. Mr. Sharanabasappa, KSSOCA, Ballari urged farmers to take up millet production and consumption. Sh. Nazeer Ahmed ADA, Sindhanur and Sh. Vinay kumar, Farm Head, NSC CSF and Mr Raghunath Kulkarni spoke on

importance of millets, soil related aspects and schemes related to millet farmers.

Workshop cum round table discussion on “Mycotoxin Management in Indian Agriculture”

Program was organized by ICAR-IIMR in collaboration with the Horticulture Produce Management Institute on 15th September, 2025. Programme commenced with an overview of the objectives and significance of the workshop by Dr. Satyen Yadav followed by a technical presentation on aflatoxin and its management by Dr. Ranajit Bandyopadhyay, who shared insights from global research and practical management strategies. Key lecture was delivered by Dr. S. Chandra Nayaka on “Aflatoxin in nutriceals: An Indian perspective with global linkages,” highlighting challenges and opportunities in the Indian context. 24 participants representing various institutions, including ICAR-IIRR, ICAR-IIOR, ICAR-IIMR (Maize), ICAR-NBPGR (Hyderabad Regional Centre), ICAR-DPR, NIPHM Hyderabad, IGMRI (Hyderabad Regional Station), and PJTAU, Rajendranagar attended. A roadmap outlining future strategies, recommendations, and actionable points was developed. The programme was coordinated by Dr. J. Stanley, Dr. Rajesha G and Scientists.

Interaction meeting with Jai Jawan Kisan participants

As part of the Jai Jawan Kisan Program, a group of 32 ex-servicemen visited ICAR-IIMR Hyderabad, where they explored the institute’s millet processing units and Agromart, gaining first-hand knowledge of FPO operations, marketing linkages, and value-addition techniques. Dr. Rafi from FPO-NEST briefed about the FPO activities promoted by ICAR-IIMR, Hyderabad and explained about the business opportunities and collaboration opportunities available with FPOs in Andhra Pradesh. The visit was coordinated by Dr. Sangappa, Dr. Rafi and Mr. Anup from FPO NEST Team.

National Conference on Millets and Forgotten Foods at Pasighat, Arunachal Pradesh

The Expo were jointly organized by College of Agriculture Pasighat (CAU, Imphal), ICAR-IIMR, Hyderabad, and ICAR-NBPGR, New Delhi during 21 – 22 March 2025. The event highlighted the importance of millets and its value-added products for food security

in NEH region. Shri. Gabriel Denwang Wangsu, Hon'ble Agriculture Minister of Arunachal Pradesh, inaugurated the newly established Millets Processing Unit and Value Addition Lab (funded by ICAR-IIMR, Hyderabad), and released policy papers on millets, millet publications and MPMoS dashboard. The conference also included a farmers-scientists interaction meet, where experts from ICAR-IIMR, NBPGR, CAU, and other institutions engaged with farmers. Soil kits were distributed and demonstrated to farmers for assessing the soil health. The event gathered by 75 dignitaries, 400 farmers, and 38 exhibitors from across the NEH region and other parts of the country.

Quarterly review of NABARD sponsored IIMR FPOs

NABARD, Hyderabad conducted 3rd quarterly CBBO review meeting for AP FPOs in Vijayawada on 12th February, 2025. The FPO-NEST team of ICAR-IIMR, Hyderabad presented the status of IIMR FPOs. The key challenges faced by FPOs in getting credit linkage and building linkages for output markets were discussed. The CGM, NABARD suggested enrolling more members in the FPOs for obtaining equity grant assistance, which could further strengthen the financial base of FPOs.

SARAS (Sale of Articles of Rural Artisans Society) Mela 2025, Vizianagaram

Millets took center stage as ICAR-IIMR FPOs participated in the SARAS (Sale of Articles of Rural Artisans Society) Mela 2025 at Vizianagaram from 28th September to 8th October 2025. The event served as a platform for rural artisans and women entrepreneurs to showcase their products. Special attention was drawn by the stalls of IIMR-promoted FPOs, which featured live demonstrations of value-added millet products. Experiences regarding membership mobilization and collective farming were shared by FPO representatives with over 2,000 visitors. Feedback on product quality and branding was received, strengthening market linkages and entrepreneurial confidence.

Unique Wedding with Farmer -Scientist Interaction Session on Millets and Organic Farming

Shri Siddappa Bhusagond, a progressive farmer and director of Indi Savayava Hagu Siridhanya FPCL,

promoted by ICAR-IIMR, Hyderabad hosted a unique wedding celebration centered around millets and organic farming on 19th January, 2025. The event transformed the wedding venue into a hub for learning and awareness. The event drew nearly 1,000 attendees, including farmers and millet consumers, who were treated to a delightful millet-based feast such as foxtail millet bisibele bath, kodo millet curd rice, finger millet bajji, and browntop millet Mysore pak. Dr Sangappa shared valuable insights on millet cultivation in dryland areas and the numerous health benefits of millets

Helping hand to flood affected families of Taratgaon, Mohol, Solapur

A helping hand was extended to flood-affected families in Taratgaon, Solapur. Due to heavy floods in the Seena River, thousands of acres of land and livestock were damaged. Social responsibility was shown by the Agriculture Graduate Group of N Series Batch (1989-1993), of Shri Shivaji Agricultural College, Amaravati under DPDKV, Akola who raised funds for the affected families. Useful items and kits worth of Rs. 1500 were distributed to 50 families. Assistance in organizing the program was provided by Dr. Baswaraj Raigond and his team.

IIMR supports tribal advancement during Janjatiya Gaurav Varsh Pakhwada-2025 through Tribal FPOs

Janjatiya Gaurav Varsh Pakhwada was a nationwide two week observance held from 1 to 15 November 2025. This year's celebration marked the 150th birth anniversary of Bhagwan Birsa Munda. The Pakhwada concluded with Janjatiya Gaurav Diwas on 15th November, a day dedicated to strengthening tribal identity, dignity and empowerment. As part of the national initiative, ICAR-IIMR and the North Coastal Andhra Pradesh FPOs promoted by ICAR-IIMR, Hyderabad actively participated by organising various events. These programmes also included public outreach in tribal areas, branding of tribal products, promotion of direct market access for tribal farmers and the establishment of seed banks to conserve indigenous crops. Dr. Sangappa and Shri K. Srinivasa Babu, Scientist organized the event.

Staff Positions, Appointments, Promotion and Transfers

Scientific Staff as on 01.03.2026

Dr. C. Tara Satyavathi
Director

S.No.	Names	Designation	Discipline
1.	Dr. G. Shyam Prasad	Principal Scientist	Agrl. Entomology
2.	Dr. Aruna Chandrasekhar Reddy	Principal Scientist	Plant Breeding
3.	Dr. B Venkatesh Bhat	Principal Scientist	Genetics & Cytogenetics
4.	Dr. B Gangaiah	Principal Scientist	Agronomy
5.	Dr. A V Umakanth	Principal Scientist	Plant Breeding
6.	Dr. N. Kanna Babu	Principal Scientist	Seed Science & Technology
7.	Dr. I K Das	Principal Scientist	Plant Pathology
8.	Dr. P G Padmaja	Principal Scientist	Agrl. Entomology
9.	Dr. K Hariprasanna	Principal Scientist	Plant Breeding
10.	Dr. P Rajendra Kumar	Principal Scientist	Bio-Technology
11.	Dr. Rajendra R Chapke	Principal Scientist	Agrl. Extension
12.	Dr. A Kalaisekar	Principal Scientist	Agrl. Entomology
13.	Dr. D Balakrishna	Principal Scientist	Bio-Technology
14.	Dr. T Nepolean	Principal Scientist	Genetics and Plant Breeding
15.	Dr. P Sanjana Reddy	Principal Scientist	Plant Breeding
16.	Dr. K.N. Ganapathy	Principal Scientist	Plant Breeding
17.	Dr. J Stanley	Principal Scientist	Agrl. Entomology
18.	Dr. Avinash Singode	Principal Scientist	Plant Breeding
19.	Dr. Vikas Khandelwal	Senior Scientist	Plant Breeding
20.	Dr. Venkateswarlu Ronda	Senior Scientist	Biochemistry
21.	Dr. Karnam Venkatesh	Senior Scientist	Genetics & Plant Breeding
22.	Dr. Anuradha Narala	Senior Scientist	Agricultural Economics
23.	Dr. Sevanayak D	Senior Scientist	Plant Physiology
24.	Dr. Jinu Jacob	Senior Scientist	Bio-Technology
25.	Dr. Sangappa	Senior Scientist	Agricultural Extension
26.	Dr. A Srinivas	Senior Scientist	Agricultural Extension
27.	Dr. Vikas Kumar	Senior Scientist	Food Technology
28.	Dr. Santosh Kumar Gupta	Senior Scientist	Plant Physiology

S.No.	Names	Designation	Discipline
29.	Sh. K. Srinivasa Babu	Scientist (Senior Scale)	Agri. Entomology
30.	Er. Smt. P Hemasankari	Scientist (Senior Scale)	AS & PE
31.	Dr. Srividhya	Scientist	Plant Physiology
32.	Dr. G Rajesha	Scientist	Plant Pathology
33.	Dr. Amasiddha Bellundagi	Scientist	Plant Breeding
34.	Dr. Deepika Cheruku	Scientist	Genetics and Plant Breeding
35.	Dr. Sooganna	Scientist	Seed Science & Technology
36.	Dr. Swarna Ronanki	Scientist	Agronomy
37.	Dr. Malathi V M	Scientist	Plant Biochemistry
Centre on Rabi Sorghum, Solapur			
38.	Dr. R. Baswaraj	Senior Scientist	Plant Pathology
39.	Dr. Parashuram Patroti	Senior Scientist	Plant Breeding
Regional Research Station, Barmer			
40.	Dr. S.N. Saxena	Principal Scientist & Head, Regional station. Acting charge of PC, AICRP on Pearl millet	Plant Physiology
41.	Dr. Gopi Kishan	Scientist	Plant Pathology
42.	Dr. Danakumara T	Scientist	Genetics and Plant Breeding
43.	Dr. Somanath Nayak	Scientist	Agronomy

Technical Staff as on 01.03.2026

S.No.	Names	Designation
1.	Sh. HS Gawali	Chief Technical Officer
2.	Smt. D Revati	Chief Technical Officer
3.	Dr. Mahesh Kumar	Assistant Chief Technical Officer
4.	Sh. S. Narender	Technical Officer
5.	Dr. V Ravi Kumar	Sr. Technical Officer
6.	Sh. Raghunath Kulkarni	Sr. Technical Officer
7.	Sh. PV Rajappa	Sr. Technical Officer
8.	Sh. Aghav Vilas Dyanoba	Technical Officer
9.	Sh. Surabhi Naresh	Sr. Technical Assistant
10.	Ms. Usha R Satija	Sr. Technical Assistant
11.	Sh. Prashant Bhusari	Sr. Technical Assistant
12.	Sh. J. Bhagavantam	Sr. Technical Assistant
13.	Sh. C. Bikshapathi	Sr. Technician

S.No.	Names	Designation
14.	Mr. Sai Karthik	Sr. Technician
15.	Sh. G. Chimanlal	Sr. Technician
16.	Sh. Manthri Kumara Swamy	Sr. Technician
17.	Sh. Rahul Pandey	Technician
18.	Sh. Sumit Kumar	Technician
19.	Sh. Shaik Abdul Gani	Technician
20.	Sh. Sumit Kumar Tyagi	Technician
21.	Sh. Rudradip Dhar	Technician
22.	Sh. Belal Ansari	Technician
Centre on Rabi Sorghum, Solapur		
23.	Sh. A.R. Limbore	Chief Technical Officer
24.	Sh. Kshirsagar	Sr. Technician
Regional Research Station on Pearl millet, Barmer		
25.	Sh. Kanhaiya Lal Athya	Technician

Administrative Staff as on 01.03.2026

S.No.	Names	Designation
1.	Sh. Shaik Rukman	FAO
2.	Sh. Shivaprasad Perumalla	Administrative officer
3.	Sh. D. Ram Babu	Asst. Admn. officer
4.	Sh. K. Suresh Kumar,	Asst. Admn. officer
5.	Smt. N. Kanaka Durga	Private Secretary
6.	Smt. A. Usha Rani	Private Secretary
7.	Sh. S. Rama Murthy	Private Secretary
8.	Sh. Mohd. Inayat-Uddin	Assistant
9.	Mr. Abhijeet	Assistant
10.	Ms. Mangaiahgari Susmitha	Assistant
11.	Mr. Mohammad Shadab	Assistant
12.	Ms. Amandeep Kaur	Assistant
13.	Sh. J. M. Nadaf	AAO
14.	Mr. Durvesh Koushik	Assistant, Barmer, Rajasthan

Skilled Supporting Staff as on 01.03.2026

S.No.	Names	Designation
1	Sh. J. Narsimha	SSS
2	Smt. G. Prameela	SSS
3	Sh. Amruth Raj Santosh	SSS
Solapur		
4	Sh. J.V. Chatre	SSS
5	Sh. Malik Dharma Nanaware	SSS

Personnel Promoted During the Year 2025

S.No.	Name	Designation	Grade / Level
Scientific			
1	Dr. Venkateshwarlu Ronda,	Sr. Scientist Grade Pay Rs.8000	Sr. Scientist Grade Pay Rs.9000
2	Sh. P. Mukesh	Scientist Grade Pay Rs.7000	Scientist Grade Pay Rs.8000
3	Dr. Jinu Jacob	Scientist	Senior Scientist
4	Dr. Parashuram Patroti	Scientist	Senior Scientist
5	Dr. Sangappa	Scientist	Senior Scientist
6	Dr. A. Srinivas	Scientist	Senior Scientist
7	Dr. Srividhya	Scientist	Scientist Grade Pay Rs.7000
8	Dr. Avinash Singode	Senior Scientist	Principal Scientist
Technical			
1	Dr D M Bahadure (Retired)	ACTO	CTO
2	Sh. A. R. Limbore	ACTO	CTO
3	Dr. V. Ravi Kumar	Technical Officer	Senior Technical Officer
4	Mr. Raghunath Kulakarni	Technical Officer	Senior Technical Officer
5	Dr. Rajappa P.V	Technical Officer	Senior Technical Officer
Administration			
1	Smt. VSG Parvathi (Retired)	AAO	Administrative Officer
2	Sh. M J Nadaf	Assistant	AAO
3	Smt. G. Saraswathi	AAO	Administrative Officer
4	Sh. K. Suresh Kumar	Assistant	AAO
5	Smt. Ritu Dalal	SAO	CAO

Personnel Joined in 2025

S.No.	Name	Designation	Joining Date
Scientific			
1	Dr. Danakumara T	Scientist	7 Jul, 2025
2	Dr. Somnath Nayak	Scientist	28 Oct, 2025
3	Dr. Vikas Kumar	Senior Scientist	24 Jun, 2025
4	Dr. Santosh Kumar Gupta	Senior Scientist	10 Jul, 2025
Technical			
1	Sh. Rudradip Dhar	Technician	12 Feb, 2025
2	Sh. Belal Ansari	Technician	3 Mar, 2025
Administration			
1	Mr. Durvesh Koushik	Assistant	2 Sep, 2025

Personnel Superannuated in 2025

S.No.	Name	Designation	Superannuation date
Scientific			
1	Dr. P. Mukesh	Scientist	31 Mar, 2025
2	Dr. Dayakar Rao	Pr. Scientist	31 May, 2025
3	Dr. B. Subbarayudu	Pr. Scientist	30 Jun, 2025
Technical			
1	Dr. D.M. Bahadure	CTO	31 Aug, 2025
Administration			
1	Smt. VSG Parvathi	AO	31 May, 2025
Skilled Supporting Staff			
1	Smt. M. Parvathamma	SSS	30 Sep, 2025

Official Language Implementation

Hindi Chetana Maas Celebration

ICAR-Indian Institute of Millets Research, Hyderabad celebrated *Hindi Chetana Maas* during 14 September – 13 October, 2025. Dr. G Shyam Prasad, Director-in-Charge, IIMR was inaugurated the celebration on 16 September 2025 by lighting a lamp and administered the Rajbhasha Pledge to all the personnel. Extempore, Essay writing, Translation, & Quiz competitions were held during the Hindi Chetana Maas. All the staff



including scientists, technical, administrative, research scholars etc. participated with great enthusiasm and zeal. Apart from this, a Hindi workshop was organized during the Hindi Chetana Maas and a signature campaign was also held in Hindi, in which all the officers and employees signed their official documents in Hindi.

Prize distribution ceremony was organized on 13 October, 2025. The programme started with ICAR song. At the outset, Dr. Jinu Jacob, Senior Scientist & OIC Hindi Cell welcomed the delegates and participants and presented the report on official language implementation at IIMR during 2024-2025. Dr. Mahesh Kumar, Assistant Chief Technical Officer (Official Language) presented the report on various programs organized during Hindi Chetna Maas and expressed his gratitude to all the participants and judges for making the program successful.

Dr. (Smt.) C Tara Satyavathi presented cash prizes & citation to Smt. Ritu Dalal, SAO & Sri. Shaik Rukman, FAO as an incentive to promote official Language in routine official work. She distributed cash prizes and certificates to the winners of various competitions and



gave away the consolation prizes and certificates to all participants. She honored the judges and facilitators of the various competitions organized during Hindi Chetana Maas by presenting them Mementos & certificates.

Dr. Tara Satyavathi in her address said that we should work as much as possible in the official language Hindi, because only Hindi and local languages can help us reach our target audience, the farmers. Hindi is our official language, and it is our responsibility to give it the respect it deserves by working in it. Therefore, I urge everyone to use Hindi as much as possible in their speech and writing, and to elevate Hindi to new heights within the organization. Finally, the ceremony concluded with a vote of thanks by Dr. Mahesh Kumar and the national anthem. The entire programs of the Hindi Chetana Maas celebration held in the institute was conducted and coordinated by Dr. Jinu Jacob and Dr. Mahesh Kumar under the guidance of Dr. C. Tara Satyavathi.

Book Released: "Naveenatam Shree Anna Utpadan evam Prasanskaran Praudyogikiyan"

ICAR-Indian Institute Millets Research, Hyderabad published the book entitled "Naveenatam Shree Anna Utpadan evam Prasanskaran Praudyogikiyan" with the aim of ensuring food and nutrition security and increase the income of poor farmers despite climate change. Dr. Rajendra R Chapke, Dr. Mahesh Kumar and Dr. C Tara Satyawati are authors of the book. The book was released by Shri Kishan Reddy, Hon'ble Union Minister of Coal and Mines, Govt. of India, Shri Harivansh, Hon'ble Deputy Chairman, Rajya Sabha, Shri Pawan Kalyan, Hon'ble Deputy Chief Minister, Andhra Pradesh, Prof. Manikyamba, Hindi Educationist, Telangana, Prof. Anantha Krishnan, Hindi Educationist, Tamil Nadu and Smt. Anshuli Arya, Secretary, Department of Official Language during the Official Language Golden Jubilee Celebration organized by Department of Official Language, Ministry of Home Affairs, Government of India on 11th July, 2025 at Hyderabad. Dr. Mahesh Kumar, Assistant Chief Technical Officer (Official Language) represented the IIMR.

The book includes advanced agricultural techniques of Millets i.e. Sorghum, Pearl Millet, Finger Millet, Little Millet, Kodo Millet, Barnyard Millet, Proso Millet & Browntop Millet crops so that farmers can benefit by using the techniques. Apart from this, with the aim of increasing the demand for Millets, processing and value addition techniques of Millets have also been included in this book so that coordination can be established between Millets entrepreneurs and farmers and every section can benefit from it. Consumption of Millets will also help in preventing lifestyle related disorders of people. This book is a small effort to realize the dream of Honorable Prime Minister Shri Narendra Modi ji of a prosperous farmer and a healthy country.

Inspection of Official Language Implementation

Shri Anirban Kumar Vishwas, Deputy Director, Regional Implementation Office Bengaluru, Department of Official Language, Ministry of Home Affairs, Government of India inspected the Institute's Official Language Implementation activities on 27th October, 2025. Dr. (Mrs.) C Tara Satyawathi, Director, IIMR welcomed



him in IIMR, Hyderabad. He addressed the staff and told them about the necessity of compliance with the Official Language Rules and reviewed the Institute's Official Language Implementation Report, point by point, and while commending the Institute for its smooth functioning, he offered some suggestions to accelerate the implementation of the Official Language.

A meeting of the Institute's Official Language Implementation Committee was held in the presence of Dr. Anirban Kumar Vishwas. The committee was chaired by Dr. (Mrs.) C Tara Satyawathi, Director, and attended by Dr. B Venkatesh Bhat, Dr. Jinu Jacob, Dr. Sooganna, Shri Sheikh Rukman, Shri P. Shivaprasad, Shri Ramamurthy, Members, and Dr. Mahesh Kumar, Member Secretary. Mr. Biswas briefed the committee on the Official Language Policy and Regulations and emphasized the importance of their compliance. Dr. C Tara Satyawathi assured them that they were properly adhering to the policies and would continue. The entire inspection was coordinated by Dr. Mahesh Kumar, Assistant Technical Officer (Official Language), Dr. Jinu Jacob, Senior Scientist and In-charge of Hindi, and Mr. P. Shivaprasad, Administrative Officer, under the guidance of Dr. Tara Satyawathi, Director.

Hindi Workshops

Indian Institute of Millets Research, Hyderabad organized Four Hindi workshops on 13th March, 2025, 26th June, 2025, 23rd September 2025 and 27th October, 2025. Smt. Ritu Dalal, Senior Administrative Officer and Dr. Mahesh Kumar, Assistant Chief Technical Officer (OL), ICAR-IIMR, Hyderabad were delivered the lectures on the various aspects of Official Language Implementation & provided hands on trainings to the participants. The above workshops were coordinated by Dr. Jinu Jacob

and Dr. Mahesh Kumar under the guidance of Dr. C Tara Satyavati, Director, IIMR.

Other Official Language Implementation activities done at IIMR

Official Language Implementation of IIMR in Highlights: “Hindi Milap”, “Swatantra Vaartha”, “Shubha Labha”, “The South India Times”, “Andhra Jyothi”, “Rajbhasha Alok” etc. published the news regarding different activities related to Official Language Hindi & other programme organized at IIMR, Hyderabad.

Official Language Implementation Committee (OLIC) Meetings: The meetings of the OLIC were held during every quarter i.e. on 13th March, 2025, 25th June, 2025; 29st August, 2025 and 27th October, 2025. The committee reviewed the progress made in Official Language Implementation at IIMR and discussed the ways to improve it according to Department of Official Language targets.

Quarterly Progress Report of Official Language Hindi: The quarterly progress report of IIMR regarding progressive use of official language Hindi is being sent to the Regional Implementation Office (South), Dept. of Official Language, Bangalore, ICAR, New Delhi and

TOLIC-2-Hyderabad-Secunderabad.

Hindi Edition of Annual Report: The IIMR Annual Report 2024 published in Hindi.

Publishing of IIMR News Letter in Hindi: IIMR Newsletters is publishing in Hindi.

IIMR Advertisement in Hindi: On the occasion of *Hindi Divas* advertisement in Hindi were published in daily Hindi newspaper “Hindi Milap”, “Swatantra Vaartha” & “Shubh labh on 14th September 2025.

Bilingual forms: The official forms used for various purposes in the IIMR were prepared in bilingual (Hindi and English) & uploaded on IIMR Server.

Hindi Roster: A roster was prepared on ‘Hindi knowledge’ of IIMR staff and it is being updated regularly.

Hindi Learning Board: Daily one Hindi word, its pronunciation in English and its equivalent English word was displayed on Hindi Learning digital Board at IIMR premises and compiled. It was found very useful for increasing the Hindi vocabulary of IIMR staff.

Varieties Released and Notified by CVRC

Grain Sorghum (*Kharif*)



Name of Variety	:	CSV 67 (SPV 2976)
Grain yield	:	2930 kg/ha
Dry fodder yield	:	170 q/ha
Salient features	:	High grain and fodder yield, tolerant to biotic stresses (shootfly, stem borer) and moderately resistant to grain mold, downy mildew, rust, anthracnose and leaf blight
Recommended for states	:	Gujarat and Rajasthan

Varieties Released and Notified by CVRC

Grain Sorghum (*Rabi*)



Name of hybrid	:	CSH 59R (Maldandi Supreme)
Grain yield	:	3523 kg/ha
Fodder yield	:	88.39 q/ha
Salient features	:	Rabi sorghum hybrid with high grain and fodder yields . Plant height (230-240 cm) with maturity of 115 to 117 Days
Recommended for states	:	Maharashtra, Karnataka, Telangana and Andhra Pradesh

Varieties Released and Notified by CVRC

Single cut Forage Sorghum (*Kharif*)



Name of variety	:	CSV 63F
Grain yield	:	450-500 q/ha
Dry Fodder Yield:	:	180-200 q/ha
Salient features	:	CSV 63F is a single-cut forage variety in sweet sorghum background providing high green and dry fodder yields
Recommended for states	:	Maharashtra, Tamil Nadu and Karnataka

Varieties Released and Notified by CVRC

Forage Sorghum (Brown midrib)



Name of Variety	:	CSV 69 BMR (BMR Forage Gold / SPV 2912)
Grain yield	:	364 q/ha
Dry fodder yield	:	133 q/ha
Salient features	:	Single cut (BMR) fodder sorghum variety with high fodder yields. Resistant to shootfly, stem borer and fall armyworm
Recommended for states	:	Tamil Nadu, Maharashtra, Punjab and Uttarakhand

Varieties Released and Notified by CVRC

Sweet Sorghum (*Kharif*)



Name of variety	:	CSV 66SS
Fresh Stalk Yield	:	48-50 tons/ha
Juice Yield	:	17000-18000 L/ha
Salient features	:	Sweet sorghum variety with high fresh stalk yield, juice Yield, brix (%) 16-17, tolerance to anthracnose, rust and zonate leaf spot diseases
Recommended for states	:	Maharashtra, Telangana, Andhra Pradesh, Karnataka, Tamil Nadu, Punjab, Uttar Pradesh, Madhya Pradesh and Gujarat



Insightful guidance rendered by Dr. ML Jat, Director General & Secretary DARE, ICAR in the presence of Dr. RS Paroda, Former Director General, ICAR



Dr. DK Yadava, DDG (Crop Science), reviewing the exhibits in the presence of Director, ICAR-IIMR and Scientists



हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद

Agr^osearch with a human touch



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श्री अन्न वैश्विक उत्कृष्ट शोध केन्द्र

ICAR-Indian Institute of Millets Research
Global Centre of Excellence on Millets (Shree Anna)

Rajendranagar, Hyderabad-500 030

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