

ICAR-IIMR

at a glance...



ICAR-INDIAN INSTITUTE OF MAIZE RESEARCH
LUDHIANA-141004, PUNJAB





**Nurturing diversity, resilience,
livelihood & industrial inputs**

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at a glance...



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Ludhiana - 141004 (INDIA)



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ICAR-Indian Institute of Maize Research

Ludhiana – 141004.

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भारत सरकार, कृषि भवन
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New Delhi 110001, India

डॉ. तिलक राज शर्मा
उप महानिदेशक (फसल विज्ञान)

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FOREWORD

Maize (*Zea mays* L.), the queen of cereals, is capable of adapting to a wide range of agroecological niches. It is the leading cereal crop in the world with more than one billion tonnes of production. In India, it holds the third rank among cereals, after rice and wheat in terms of area and production. Maize has traditionally been a kharif crop in India, but since 1970s, it has also been grown in the rabi and later extended to spring season. The crop is now being grown around the year in one or another part of India, not only for grain but for specialized purposes such as sweet corn, baby corn, popcorn and silage.

In 1957, the Indian Council of Agricultural Research established an all-India coordinated research project on maize. Later on, it was upgraded to the Directorate of Maize Research and subsequently to Indian Institute of Maize Research, Ludhiana. Since the beginning, ICAR-Indian Institute of Maize Research is a pioneer institute in the country involved in all aspects of maize research and development. The institute has played a pivotal role in developing many high-yielding maize hybrids suitable for commercial cultivation across different agro-climatic zones of India. In addition to this, the institute has developed many improved production and protection technologies for higher maize production.

I am happy to know that ICAR-Indian Institute of Maize Research, Ludhiana is publishing a document on "ICAR-IIMR at a glance". It contains complete information on the institute's history, technologies and cultivars developed. It also highlights the facilities available at the institute along with high-quality pictorial depictions. I congratulate the authors for their contributions in bringing out this important document. I am sure that this publication will be useful for various stakeholders including researchers, farmers, and other stakeholders in enhancing maize research and development in the country.


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Headquarter

The ICAR- Indian Institute of Maize Research (ICAR-IIMR) is a premier national institute under the aegis of the Crop Science Division of the Indian Council of Agricultural Research, New Delhi. The institute is mandated to plan, coordinate and execute the research programmes to augment the production and productivity of maize including fodder and specialty corn in India. It is an ISO 9001:2015 compliant institute. The headquarter of ICAR-IIMR has been established in a sprawling campus of 185 acres of land at Ladhawal, Ludhiana (30.9785°N, 75.7938°E). The Ladhawal campus is

nearly 20 km away from Ludhiana Railway station has two Regional Centres.

located on newly constructed Ladhawal Bypass. The institute

Brief History

Indian Council of Agricultural Research (ICAR) established the first Coordinated Crop Improvement Project on maize (CCIPM) in 1957. Dr. E.W. Sprague, a decorated maize scientist from the Rockefeller Foundation (RF), was the first coordinator of the first of its kind centralised crop improvement programme in India. Dr. N.L. Dhawan, a distinguished plant breeder from ICAR superseded Dr. Sprague. The CCIPM was further strengthened in 1963 through PL 480 funds by appointing new research staff and it was renamed as All India Coordinated Maize Improvement Project (AICMIP). It was further upgraded to Directorate of Maize Research (DMR) in January 1994. On 9th February 2015, DMR was upgraded to ICAR-Indian Institute of Maize Research (ICAR-IIMR) to further consolidate the maize research programme in the country. The headquarter of ICAR-IIMR was shifted from New Delhi to Ludhiana in 2017. The off-season nursery, Winter Nursery Centre (WNC) was established at Amberpet, Hyderabad in 1962 to accelerate the maize improvement programme of north Indian maize research centres where winter temperature is not conducive for maize cultivation. Subsequently, the WNC was shifted to Rajendranagar, Hyderabad in 2008. Realizing the growing importance of winter (*rabi*) maize in eastern India and to cater the need of seed production, a Regional Maize Research and Seed Production Centre (RMRSPC) was established at Kushmahaut, Begusarai, Bihar in 1997.



Regional Stations

Regional Maize Research and Seed Production Centre (RMR&SPC), Begusarai

The farm of RMR&SPC, Begusarai, is situated 16 km towards north from the Begusarai city at the village Kushmahaut (25.4556°N , 86.2267°E), Begusarai in the state of Bihar. It is approximately 9 km from Lakho village on National Highway 31. It has another campus at Vishnupur (25.4112°N , 86.1556°E) within the Begusarai city housing the office building, guest house and staff quarters.



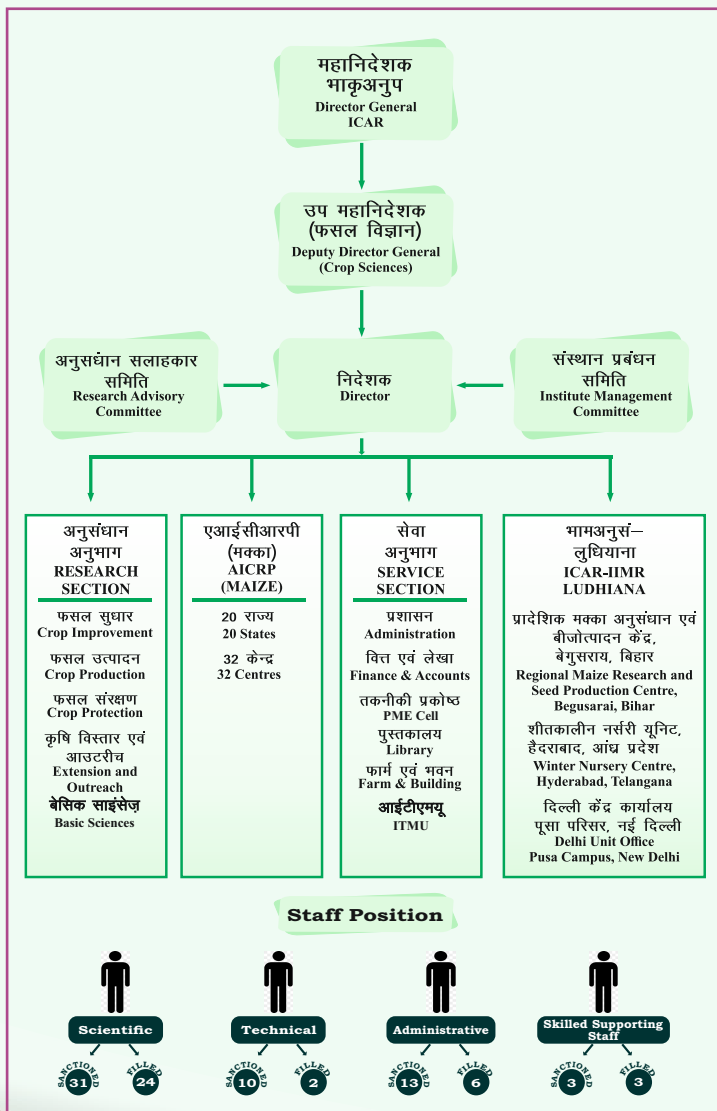
Winter Nursery Centre (WNC), Hyderabad

Winter Nursery Centre (WNC), Hyderabad is located within the campus of Maize Research Centre, Agricultural Research Institute of Prof. Jayashanker Telangana State Agricultural University (PJTSAU) at Rajendranagar, Hyderabad ($17.3219432^{\circ}\text{N}$, $78.400637^{\circ}\text{E}$) in the state of Telangana. The Winter Nursery centre is nearly 14.6 km from Rajiv Gandhi International Airport, Shamshabad; 21.6 km from secunderabad, 21.7km from Kachiguda and 15.2 km from Nampally railway stations, respectively.



Delhi Unit Office, Delhi

Delhi Unit Office of ICAR-IIMR is located within the Campus of the Indian Agricultural Research Institute (IARI), New Delhi ($28.6395031^{\circ}\text{N}$, $77.1654559^{\circ}\text{E}$). The Delhi center is nearly 7 Km away from New Delhi Railway Station and nearly 20 Km from Indira Gandhi International Airport, New Delhi



Mission

Enhancing the productivity, profitability and competitiveness of maize and maize-based farming systems with economic and environmental sustainability.

Vision

Rapid growth in the food, feed and industrial application of maize and maize-based products, for generation of wealth and employment in farming and industrial sectors, and for all those who are directly or indirectly associated with maize cultivation and utilization.

Organization

The organizational set up of the institute is headed by the Director, has two regional centres and one sub-scheme, AICRP on Maize. The institute is the nodal centre which supports its sub-scheme AICRP on Maize comprising of 32 centres in the form of supply of maize germplasm as well as by providing off-season nursery facility for maize improvement programmes at its Winter Nursery Center, Hyderabad.

The Institute

The institute works under the Crop Science Division of the ICAR under Department of Agricultural Research and Education (DARE), Ministry of Agriculture & Farmers Welfare, Govt. of India. The institute has PME Cell for Prioritization, Monitoring and Evaluation of its research projects. The ITMU Cell headed by the Director deals with the IPR issues. The Research Advisory Committee (RAC) yearly reviews and advices on the research activities of the institute.

The five yearly review of the institute is conducted by a high level committee, The Quinquinal Review Team (QRT), constituted by ICAR. Besides, it has an Institute Bio-safety Committee (IBSC). IBSC ensures the compliance of bio-safety measures in various research activities. The ARIS Cell of the institute ensures the use of ICT in maize R&D. The Institute Management Committee (IMC) advises on administrative and finance matters. The institute has a Hindi Cell to promote the use of Hindi in the day-to-day official communication.

Mandate of ICAR-IIMR

- Basic and strategic research aimed at enhancement of productivity and production of maize, including speciality corn.
- Coordination of multi-disciplinary and multi-location research to identify appropriate technologies for varied agro-climatic conditions.
- Dissemination of improved technologies, capacity building and developing linkages.
- Coordination of the All India Coordinated Research Project (AICRP) on Maize and to carry out extension and improved maize technologies.

Objective of ICAR-IIMR

- To carry out basic, strategic and applied research aimed at enhancement of production and productivity of maize in the country.
- To conduct and coordinate multi-disciplinary and multi-location research to identify appropriate technologies for varied agro-climatic conditions in different parts of India.
- Germplasm collection, evaluation, maintenance and its enhancement.
- To develop speciality corn cultivars such as quality protein maize, baby corn, sweet corn, etc. towards its diversified uses.
- To conduct training, frontline demonstrations and on-farm research to maximize and accelerate adoption of research findings and innovative technologies.
- To serve as core centre for the supply of maize research material and information.
- To develop linkages with the national, international and private sector for the collaborative research program.
- To provide consultancy services and undertake contractual research.
- Post-harvest studies for value addition, quality control and storage.
- To evaluate technologies and transfer it as per IP policies of ICAR.

The AICRP on Maize

All India Coordinated Research Project (AICRP) was started with the basic objective to develop and disseminate superior cultivars and production/protection technologies across maize growing regions of the country. Based on the agro-climatic conditions, the country has been divided into five zones constituting 32 centres. AICRP organizes multi-disciplinary, inter-institutional systematic testing of newly developed cultivars from both private and public sectors. It also develops production and/or protection technologies for different agro-climatic zones of the country.

Zone-wise distribution of centres in AICRP

Zone	Zone Name	Centres
I	Northern Hill Zones (NHZ)	Srinagar, Kangra, Bajaura, Almora, Barapani, Imphal
II	North West Plain Zone (NWPZ)	Ludhiana, Karnal, Pantnagar, Delhi
III	North East Plain Zone (NEPZ)	Baharaich, Varanasi, Dholi, Sabour, Ranchi, Kalyani, Ambikapur, Bhubneshwar, Gossaingaon
IV	Peninsular Zone (PZ)	Rahuri, Kolhapur, Karimnagar, Hyderabad, Peddapuram, Dharwad, Mandya, Coimbatore, Vagarai
V	Central Western Zone (CWZ)	Udaipur, Banswara, Godhra, Chhindwara



Mandate of AICRP on Maize

- To develop superior hybrids and varieties combining high yield and acceptable quality of grain and fodder, wider adaptability and resistance to major pests, diseases and abiotic stress factors for each zone.
- To evolve appropriate crop management practices and formulate efficient maize-based cropping systems for sustainable maize production in each zone.
- To conduct investigations on key or potential pests and diseases of maize and identify and evolve elite sources of resistance to develop suitable integrated plant protection strategies for increasing the stability of maize production.
- To promote research and extension to meet local needs within each state through SAUs and other partners.

Objectives of AICRP on Maize

- Execution of strategic and applied research for genetic improvement in yield, quality and resistance to biotic and abiotic stresses.
- Development of varieties and hybrids with emphasis on single cross hybrids of different maturity durations to fit into *kharif*, *rabi* and spring cropping seasons and maize-based cropping systems for location-specific conditions in different parts of India.
- Development of efficient package of practices for increasing productivity.
- Tailoring maize for diversified uses for industry and special purposes in other sectors such as Quality Protein Maize, Baby corn, Sweet corn and Bio-fuel, etc.
- Strategic research on post-harvest handling and value addition of maize.
- Maintenance, development and evaluation of germplasm for use in breeding.
- To organize breeder seed production programme for maize hybrids and cultivars.
- To organize on-farm research to reduce the yield gap between attainable and realized yield on farmers fields.

Maize scenario of India

Maize is a versatile crop with a variety of types and uses, such as grain, fodder, silage, baby corn, popcorn, sweet corn, etc. India ranks fourth in terms of area and seventh in terms of production among countries that grow maize. Over the past decade, from 2013 to 2023, the maize area has increased from 9.07 mha to 10.74 mha, and production has grown from 24.26 mt to 38.09 mt. Maize productivity in India has increased significantly from 2.68 t/ha in 2013-14 to 3.55 t/ha in 2022-23. There has been a significant increase in hybrid maize area in the country. Hybrid maize has expanded to approximately 75% of the maize area in India. However, during rabi and spring, hybrid maize is grown in 100% of the maize area. Karnataka, Maharashtra and Bihar are the states with highest maize areas during *Kharif*, *Rabi*, and Spring, respectively. However, Madhya Pradesh, Andhra Pradesh and West Bengal are the states with highest production during the *kharif* (4.8 mt), *rabi* (1.84 mt) and spring (1.13 mt) seasons, respectively. Tamil Nadu ranked first during *kharif* (7.46 t/ha) and West Bengal ranked first during *rabi* (8.01 t/ha) and spring (7.3 t/ha) in maize productivity.



Maize has the highest genetic yield potential among cereal crops and therefore is known as the "queen of cereals". More than 160 countries grow maize on 203.5 million hectares of land. *Rabi* maize productivity in India (5.3 t/ha in 2022-23) is comparable to many temperate countries, and some districts like Krishna, West Godavari etc. records as high as 12 t/ha productivity. However, *kharif* maize has low productivity (2.96 t/ha) due to a rainfed ecology. It is used as poultry feed in India to the extent of 47% of the total harvest. The remaining 13% each is used for livestock feed and direct food, 14% for starch production, 7% for processed food, and 6% for export.

As part of the requirements for E20 by 2025-26 and E30 by 2030, the GOI is focusing on maize as a key feedstock. This would require 18-20 million tonnes of additional maize production over the next 6-8 years. Thus, maize crop is now envisaged for boosting agricultural economy, reducing reliance on imported fossil fuels, saving foreign exchange used in crude oil imports and reducing air pollution while saving energy and natural resources, especially precious water for our future generation.



Significant Achievements

Crop Improvement

Maize cultivars released: Since 1969, 392 cultivars are released in India through AICRP testing. Out of these 274 cultivars (139 hybrids: 135 open pollinated varieties) are released by public sector. During the last eight years ICAR-IIMR has released 24 hybrids for commercial cultivation across India.



Specialty corns: The demand for special end use maize like baby corn, sweet corn and popcorn was increasing during last several years. Several hybrids of baby corn, popcorn and sweet corn have been released. During 2017 – 2023, ICAR-IIMR has released nine specialty corn hybrids; four each of popcorn (DMRHP 1402, LPCH 2, LPCH 3 and IPCH 501) and baby corn (IMHB 1532, IMHB 1539, LBCH 3, and IBCH 401), and one sweet corn (ISCH 601) for commercial cultivation in different parts of India.

Protection of breeders' rights: IIMR facilitates registration of released cultivars with the PPV&FR Authority to protect the breeders' rights. Till date 104 cultivars have been protected under PPV&FR Act 2001.

Registration of unique maize genetic stocks: As a soft protection, promising genetic stocks are registered with the National Bureau of Plant Genetic Resources (NBPGR), New Delhi. As on date 103 genetic stocks are registered from ICAR-IIMR and AICRP centres.

Maize germplasm field day: IIMR organizes maize germplasm field days regularly at its Winter Nursery Centre, Hyderabad during *Rabi* season to strengthen the germplasm base of the AICRP and cooperating centres. Breeders across the country make selections and indent for germplasm lines. A total of 16 maize germplasm field days have been organized by the institute from 2005-2022, in which a total of 23307 maize accessions were displayed. A total of 38713 seed packets were provided to 419 centres. The 17th Maize germplasm field day was organized on 5th March 2024 where in 56 participants from 37 different public sector centres were participated and 714 maize accessions were displayed for selections.

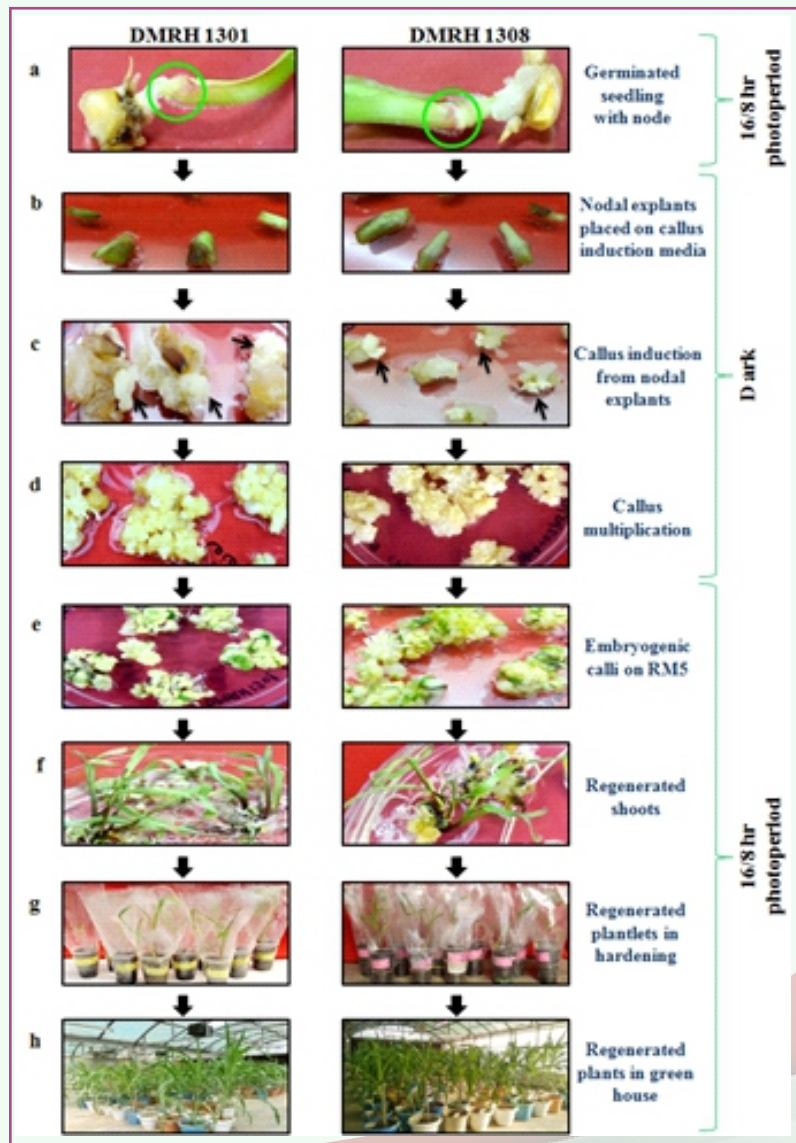
Regeneration of maize accessions with the national genebank: Till date more than 15000 maize accessions conserved in National Genebank at NBPGR have been regenerated through controlled pollination at Winter Nursery Centre, Hyderabad.



Biotechnology:

Regeneration and transformation protocol:

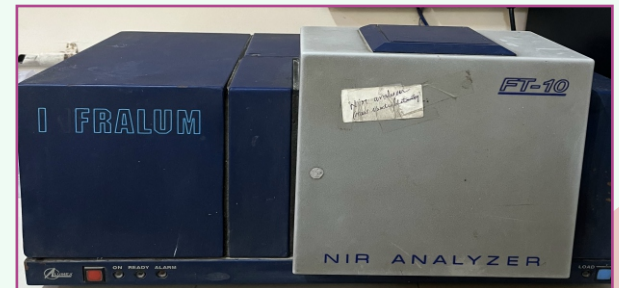
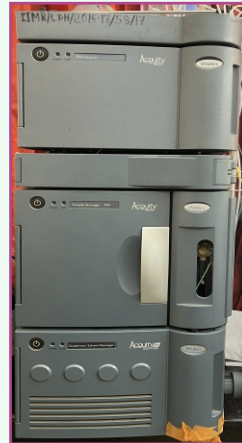
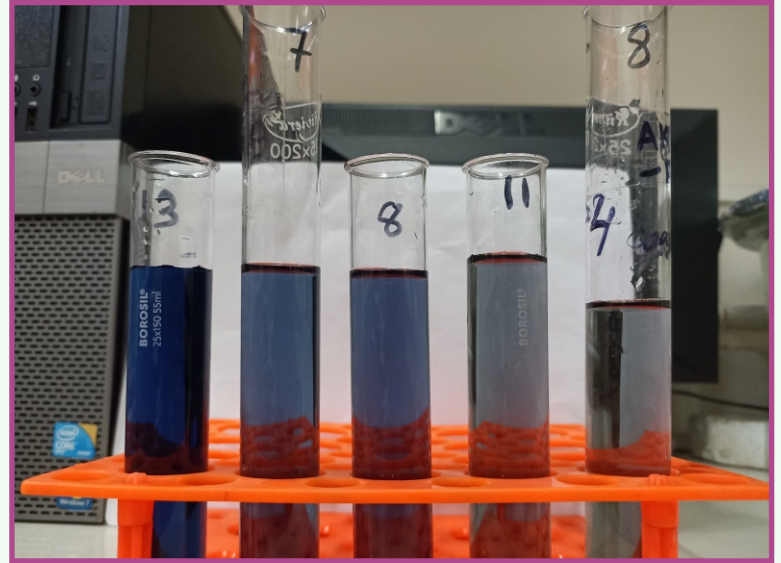
- ❖ An efficient, and reproducible *in vitro* regeneration and transformation protocol in tropical maize (*Zea mays* L.) was developed using mature seed-derived nodal explants.
- ❖ The standardized protocol is easier, reproducible, and has desirable advantages, *viz.*, high embryogenic callus induction (up to 87%), regeneration (up to 60%), and transformation efficiency (up to 5%)
- ❖ This would facilitate the faster application of transgenic and genome-editing technologies for molecular breeding in maize
- ❖ The protocol will help in the augmentation of novel and economic traits that are intractable through conventional breeding.



Biochemistry

A single kernel rapid method for amylose estimation in maize has been developed. It facilitates screening of a large set of germplasm in a short span of time. The method will greatly help in developing low GI maize genotypes.

Analytical facility: The biochemistry lab facilitates AICRP centres in analyzing the samples for various quality traits *viz.*, protein quality, starch profile, carotenoids, oil content, etc. The lab is well equipped with various equipments *viz.*, UPLC, Lyophilizer, Vacuum Concentrator, Geltech, Automatic Solvent Extractor System, NIRT, Double Beam Spectrophotometer, Automatic Fermentation System and High Speed Refrigerated Centrifuge, etc.



Crop Production

Conservation agriculture in maize based cropping systems: Under zero-tillage maize based cropping systems maize- chickpea-sesbania, maize-mustard-mungbean and maize-maize- sesbania are identified as better options for enhancing productivity and profitability with better soil health and saving of energy. In maize-wheat-mungbean cropping system, permanent bed planting is better planting option as compared to zero and conventional tillage. The application of neem/sulphur coated urea is effective for enhancing yield and profitability of maize systems under conservation agriculture.

Nitrogen scheduling in maize: Nitrogen application in 5 splits (10% basal, 20% at V4, 30% at V8, 30% at tasseling, 10% at grain filling) results in significantly higher grain yield over recommended N scheduling (33% basal, 33% at V8, 34% at flowering).

Agronomic management of low temperature stress: The foliar spray of N (1% urea)+K (2% K₂PO₄)+Fe (200 ppm) is the most effective treatment in improving cold tolerance in winter maize.

Intercropping systems: Planting of three rows of black gram between paired rows of maize proved beneficial over sole maize. Intercropping of high value crops, viz., beet root, peas, potato etc. with baby corn planted on raised beds is found more remunerative as compared to sole baby corn crop.

Sequential Cropping: Maize-cowpea-baby corn closely followed by maize-cowpea-okra is the best sequence and these systems recorded 25-30% higher maize cobs equivalents as compared to maize-maize cropping system.

Weed management strategies against complex weed flora in maize-wheat cropping system : Atrazine @1.0 kg a.i./ha as pre-emergence is the best treatment for controlling weeds. The non-herbicidal treatment, i.e. maize + cover crop (cow pea) also suppress weed and improve yield significantly. Post emergence application of the tembotrione @ 120 ml/ha at 25-30 days after sowing is recommended for weed management in maize.

Agro-techniques for inbred seed production: For higher seed yield from inbreds, the crop should be planted at higher plant density (60 cm x 20 cm plant spacing) along with application of higher doses of N (five splits), P, O, and K, O (250:90:90) coupled with of 15 t/ha FYM.

Agro-techniques for hybrid seed production: For seed production of maize hybrids, the planting spacing of 60 cm x 15 cm with combined application of 250 N, 90 P₂O₅ and 90 K₂O kg/ha and of 15 t/ha FYM are the best practices. The ratio between female and male rows should be kept as either 3:1 or 4:1.



Plant Pathology

Identification of sources of resistance: Four inbred lines (IML 11, IML 12, IML 13 and IML 21) resistant to Turicum leaf blight were registered with NBPGR.



IML 11 (INGR21126)



IML 12 (INGR21209)



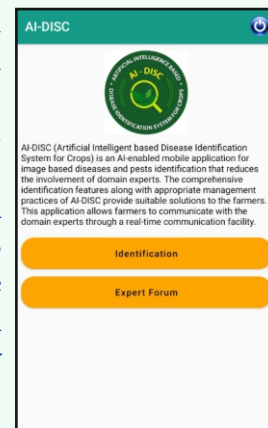
IML 13 (INGR21210)



IML 21 (INGR21208)

Control measures of maize diseases:

- ❖ The chemical module (Seed treatment with Thiram @ 3 g / kg seed+ foliar spray with Mancozeb 75 WP (2.5 g/litre water) at 45 days after sowing (DAS) + foliar sprays with Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC @ 1 ml/l water at 55 DAS) gave the highest mean percent disease control at 52.36% and mean percent yield increase at 49.18% against Maydis Leaf Blight (MLB).
- ❖ The chemical module (Seed treatment with Salicylic acid (100 ppm) foliar spray with Azoxystrobin 18.2% w/w Difenoconazole 11.4% w/w SC @ 0.1% (1ml/L) using 500 l water/ ha, twice at 3 and 15 days after inoculation) showed the highest PDC in Ludhiana (60.7%) and Pantnagar (53.5%) while the IDM module (Soil amendment with Trichoderma harzianum formulation @ 6t/acre Farm yard manure + Seed treatment with Salicylic acid (100 ppm) + Foliar spray with Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC @ 0.1% (1ml/l) using 500 l water/ ha (at 3 Days after inoculation) and neem leaf extract @ 1% at 15 days after inoculation showed the highest percent disease control (PDC) in Karnal (65.6%) and Delhi (59.1%).
- ❖ The removal of lower two/three leaves along with sheaths before flowering (approximately 40 DAS) is an important components in IDM module to manage BLSB of maize.
- ❖ The AI- DISC (Artificial Intelligence based Disease Identification System for Crops) mobile app was developed in collaboration with IASRI and IIT Delhi to identify major Insect pests and diseases of maize.



Entomology

Control measures for Fall Armyworm (FAW)

Identification of sources of resistance: Genotypes DMRE 63, CML 71, CML 60, CML 141, CML 336, CML 346, *Zea mays parviglumis* were found resistant to FAW. MIL-1-11 was found resistant to pink stem borer.

Seed treatment

- ❖ Cyantraniliprole 19.8% + Thiamethoxam 19.8% @ 6 ml/kg seed was found effective up to 14 days after germination (DAG) against FAW.

Chemical control

- ❖ Spraying of Chlorantraniliprole 18.5% SC @ 0.4 ml or Chlorantraniliprole 9.3% + Lambda cyhalothrin 4.6% ZC @ 0.5ml/l or Emamectin benzoate 5 SG @ 0.4.g/l or Spinetoram 11.7% w/w SC @ 0.5ml/l or Novaluran 5.25% + Emamectin benzoate 0.9% w/w SC @ 2ml/l or Flubendamide 480 SC @ 0.3ml/l at initial stage of damage was effective in the management of FAW.



ITK practise

- ❖ Soil + insecticide-chlorantraniliprole 18.5 SC @ 5 ml/kg soil followed by Bait + Chlorantraniliprole 18.5 SC @ 5 ml/kg bait and Sand + insecticide Chlorantraniliprole 18.5 SC @ 5 ml/kg sand was found effective in the management of FAW.



Patents

Insect handling device (Patent No. 252363, dt. 10 May 2012)

This device enables easy and unharmed transfer of flying insects for mass rearing. It is being widely used in biocontrol production units.

Insect rearing cage (Patent No. 311890, dt. 29 April 2019)

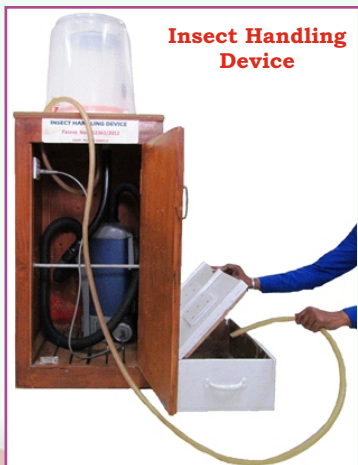
This cage is suitable for rearing a wide array of insect species and each part of this zero-energy cage is detachable.

Dynamic volatile collection system (Patent No. 431210, dt. 3 May 2023)

This device enables simultaneous sampling of organic volatiles from many specimens at a time, without volatile mixing, suffocation, and saturation.

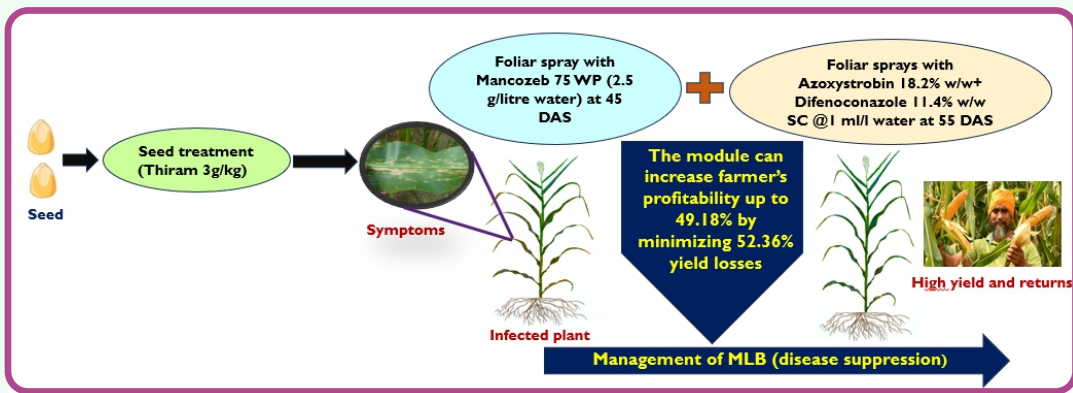
All the patented technologies are licenced to:

Amar Chand & Co., 56, Industrial Estate, Ambala Cantt-133 006,
accoindia56@gmail.com, Phone: 9315498499



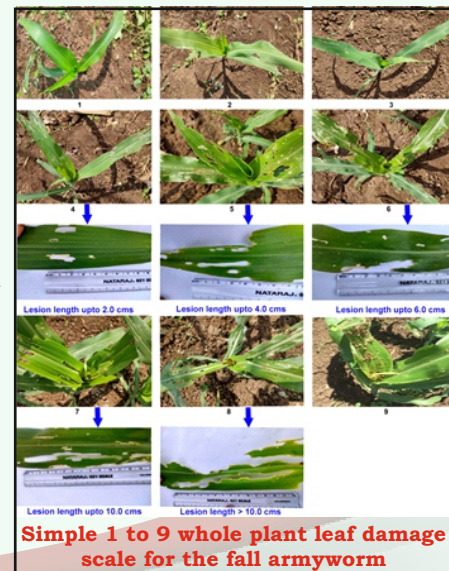
Chemical module for effective and eco-friendly management of maydis leaf blight disease of maize

Maydis leaf blight (MLB) disease is caused by the necrotrophic plant pathogen *Bipolaris maydis* can lead to yield losses of up to 40% or more. The chemical module: Seed treatment with Thiram @ 3 g/kg seed + Foliar spray with Mancozeb 75 WP (2.5 g/litre water at 45 days after sowing (DAS) + Foliar sprays with Azoxystrobin 18.2% w/w+ Difenoconazole 11.4% w/w SC @ 1 ml/l water at 55 DAS gave the highest mean percent disease control with yield increase of 49.18%. This management module can significantly enhance farmers' profitability by minimizing maize yield losses via 52.36% disease control. The benefit-cost ratio (BC ratio) of the module ranged from 1.99 to 2.68, underscoring its economic viability.



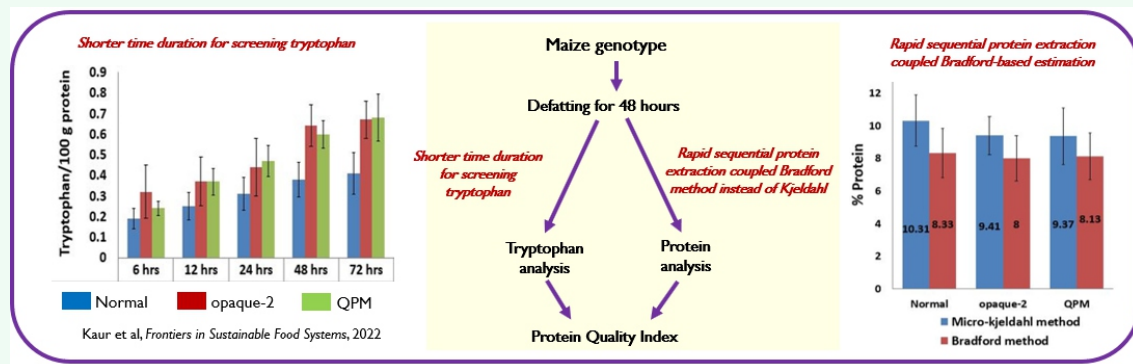
Leaf damage based phenotyping technique against fall armyworm, *Spodoptera frugiperda* (J.E.Smith) in maize

- ❖ The present technology optimized the screening technique against fall armyworm under artificial infestation suited to Indian conditions.
- ❖ This technique involves describing leaf damage rating (LDR) in 1-9 scale by comparing injury levels among maize genotypes.
- ❖ Exposure to 20 neonate FAW larvae at V5 phenological stage coupled with the adoption of LDR on a 1-9 scale aided to preliminary characterise maize genotypes as resistant (1-4), moderately resistant (4.1-6) and susceptible (6.1-9).



Optimization of protein quality assay in maize

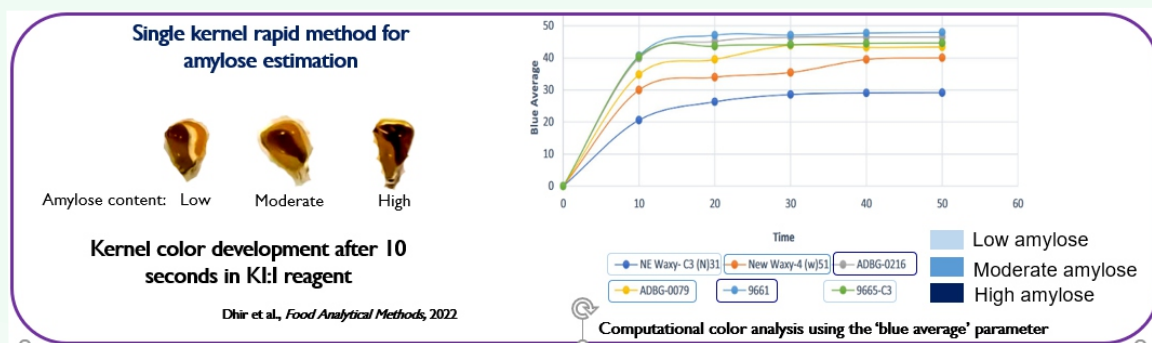
Brief introduction of the technology: Protein Quality Index, which is tryptophan per unit protein, is an important parameter of maize protein quality. The technology describes optimization of tryptophan and protein content estimations to determine the index for quality breeding.



Development of single kernel method for preliminary estimation of amylose in maize

The technology utilizes an optimized reagent that stains the amylose content of grains and utilizes a computational algorithm to perform preliminary estimation of amylose content of a particular maize variety.

Use of technology: The technology enables unambiguous, preliminary estimation of amylose in maize grains, cut longitudinally and stained with reagent followed by computational analysis.

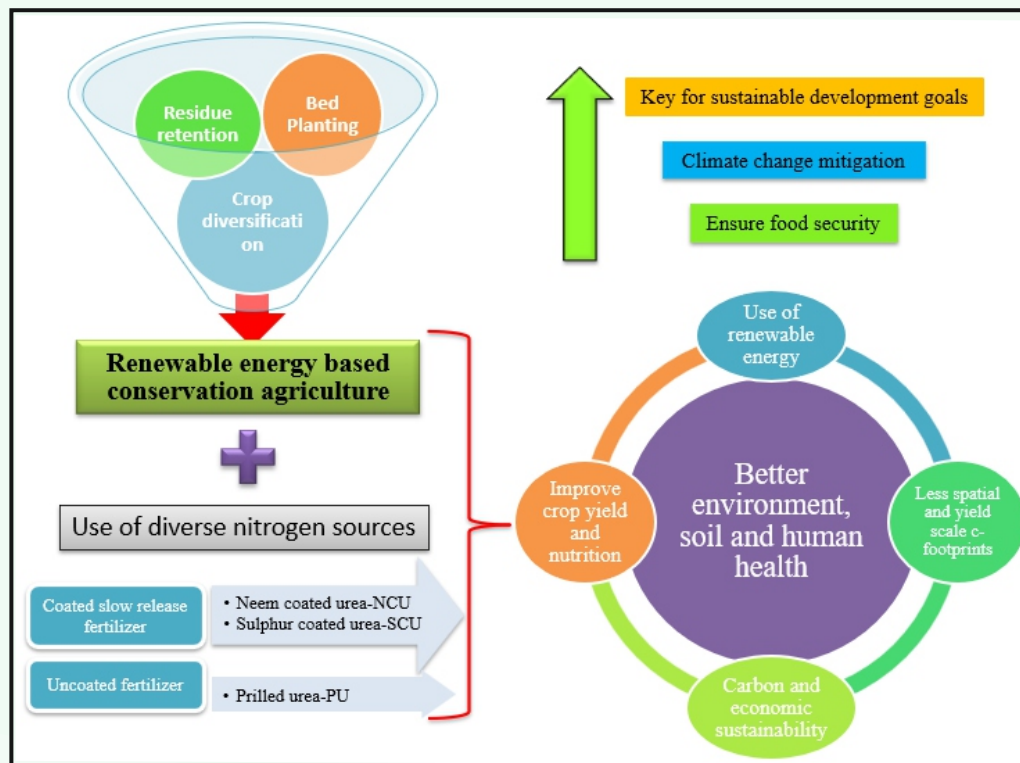


Coated urea application for enhancing profitability in CA-based maize systems

Coated urea fertilizer *viz.*, sulphur (SCU) or neem coated urea (NCU) enhances productivity and profitability with labour and time saving and enhancement of water, energy and nutrient use efficiency in conservation agriculture (CA) based maize-wheat/mustard cropping system under zero tillage. The net energy production from the use of NCU/SCU increased by 22 to 29 thousand MJ/ha with significant enhancement in energy productivity.

Conservation agriculture technology to develop adaptation-led mitigation in maize based systems

The CA and diversified crop rotations in north-western IGP and other similar agro-ecologies ensures food security, restoration of soil health and [climate change](#) mitigation, the key sustainable development goals (SDGs).





Future Thrust

- Genome editing for new plant type in maize.
- Genomic selection for yield and its component traits.
- Breeding for specialty corn and bio-fortification.
- Speed Breeding
- Development of high fermentable maize hybrids.
- Aflatoxin management in maize
- Development of suitable maize hybrids for silage.
- Development of maize catchment areas around the distilleries.
- Use of male sterility system (CGMS) for the development of field corn hybrids.
- Through better crop management, area expansion in non-traditional areas and increased cropping intensity
- Bridging yield gaps through aggressive technology transfer
- Accelerated seed replacement through establishment of self-reliant and sustainable seed system in PPP mode





Certificate

*This is to certify that
The Quality Management System of*

ICAR- INDIAN INSTITUTE OF MAIZE RESEARCH

Pusa Campus, New Delhi-110012, India

*has been assessed and found to be in compliance
with the requirements of the standard*

ISO 9001:2015

for the following scope :

Research & Development of Maize

CERTIFICATE NO.
ISSUED ON
VALIDITY DATE

:1617/QMS/CCLXIII
:04/08/2016
:03/08/2019



[Signature]

**BMG QMS
CEO**
www.bmgqms.com



- This Certificate is Intellectual Property of BMG and can be maintained through surveillance and renewal audits.
- Certificate should be returned to BMG in case of non compliance of certification procedure.
- Authenticity of this certificate can be verified at www.bmgqms.com

Quality Policy (ISO 9001:2015)

The attainment of ISO 9001:2015 certification by the maize research and development institute underscores its unwavering commitment to excellence and quality in every aspect of its operations. This internationally recognized certification serves as a testament to the institute's dedication to continuous improvement and adherence to the highest standards of quality management. By implementing robust quality management systems in accordance with ISO 9001:2015 standards, the institute ensures the consistency and reliability of its research processes, methodologies, and outcomes. Combined with its ISO 9001:2015 certification, the institute's advanced laboratories position it at the forefront of maize research and development, poised to make significant contributions to agricultural advancement and food security on a global scale.



KRITAGYA
A National Level Hackathon 3.0 (2022-23) on
Speed Breeding for Crop Improvement

CERTIFICATE OF AWARD

1st Rank

PRESENTED TO

TEAM02433: QORN

Dr Alla Singh, Ms. Hiroshi Chawla, Ms. Mathanki Mehra

KRITAGYA recognises and appreciates you for securing
1st Rank during National Level Hackathon 3.0
on Speed Breeding for Crop Improvement


Dr Himanshu Pathak
Chairman
National Steering Committee


Dr R. C. Agrawal
Co-Chairman
National Organizing
Committee


Dr T. R. Sharma
Co-Chairman
National Organizing
Committee


Dr D. K. Yadava
Organizing Secretary
National Organizing
Committee

Date: 16th July, 2023

Rapid Protein Quality Detection

Quality Protein Maize (QPM) contains elevated levels of two essential amino acids, lysine and tryptophan. The inability to rapidly distinguish QPM grains from those of normal maize has limited its cultivation. Traditional laboratory analysis for protein quality is time-consuming, requiring sophisticated equipment. Recent research conducted at the Institute has yielded a promising solution in the form of a 'rapid test' to differentiate QPM grains from normal maize.

The innovative assay, offers a single-parameter evaluation of maize protein quality, requiring only five minutes and minimal equipment to categorize maize samples as either Normal or QPM. It serves as a preliminary method to facilitate the aggregation of QPM grains in the market.

ICAR-IIMR Popular Hybrids

DMRH 1301

Type: Field Corn

Yield: 9.0-10.0t/ha

Growing Season: Rabi

Agroecology: Eastern UP, Bihar, Jharkhand, West Bengal, Odisha, Rajasthan, Gujarat, Chhattisgarh and Madhya Pradesh.



DMRH 1308

Type: Field Corn

Yield: 9.5-10.5t/ha

Growing Season: Rabi

Agroecology: Bihar, Rajasthan, Gujarat, Chhattisgarh and Madhya Pradesh.



DMRH 1305

Type: Field Corn

Yield: 6.0-6.5t/ha

Growing Season: Kharif

Agroecology: Jammu & Kashmir, Himachal Pradesh, Uttarakhand (Hill 1 region), Meghalaya, Sikkim, Assam, Tripura, Nagaland, Manipur and Arunachal Pradesh.



ICAR-IIMR Popular Hybrids

IMH 224

Type: Field Corn

Yield: 7.23 t/ha

Growing Season: Kharif

Agroecology: Eastern Uttar Pradesh, Bihar, Jharkhand, Orissa and West Bengal



LQMH 1

Type: Biofortified Maize

Yield: 7.5-8.0 t/ha

Growing Season: Kharif

Agroecology: Northern Hill Zone (NHZ) comprising the states of Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Meghalaya, Sikkim, Assam, Tripura, Nagaland, Manipur, Arunachal Pradesh



IQMH 203

Type: Biofortified Maize

Yield: 6.3 t/ha

Growing Season: Kharif

Agroecology: Central Western Zone comprising states Rajasthan, Madhya Pradesh, Chhattisgarh & Gujarat



ICAR-IIMR Popular Hybrids

IMHB-1539

Type: Baby Corn

Yield: 1.3-1.5t/ha (De-husked baby corn)

Growing Season: Kharif

Agroecology: Jammu & Kashmir, Himachal Pradesh, Uttarakhand (Hill region), Meghalaya, Sikkim, Assam, Tripura, Nagaland, Manipur and Arunachal Pradesh.



LPCH 2

Type: Popcorn

Yield: 3.0 t/ha (in Kharif)

Growing Season: Kharif; but also can does well during rabi

Agroecology: Rajasthan, Madhya Pradesh, Chhattisgarh & Gujarat



ISCH 601

Type: Sweet Corn

Yield: 12917 kg/ha (11529 to 14444 kg/ha) (with husk); 10510 kg/ha (8806 to 13769 kg/ha) (without husk)

Growing Season: Kharif

Agroecology: North Eastern Plain Zone (NEPZ) comprises the states of Eastern Uttar Pradesh, Bihar, Jharkhand, Odisha, and West Bengal



ICAR-IIMR Popular Hybrids

IMH 222

Type: Field Corn

Yield: 10.19 t/ha

Growing Season: Rabi & Spring

Agroecology: Punjab, Haryana, Plains of Uttarakhand, Western Uttar Pradesh and Delhi NCR under irrigated conditions.



IMH 223

Type: Field Corn

Yield: 10.48 t/ha

Growing Season: Rabi & Spring

Agroecology: Punjab, Haryana, Plains of Uttarakhand, Western Uttar Pradesh and Delhi NCR under irrigated conditions.



IMH 228

Type: Field Corn

Yield: 10.57 t/ha under irrigated conditions

Growing Season: Rabi

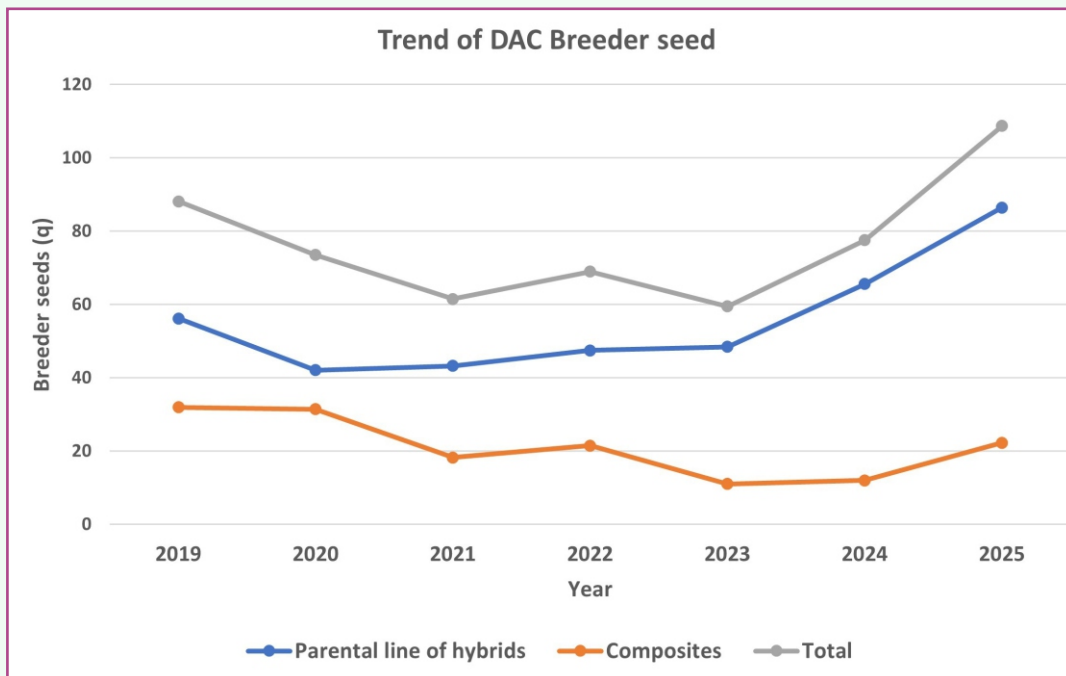
Agroecology: Eastern Uttar Pradesh, Bihar, Jharkhand, Orissa and west Bengal.



Maize hybrid seed production in single cross hybrids

To cover nearly ~ 11.0 mha area of maize under hybrids in India, we required around 2.2 lakhs tonnes of hybrids seeds. Around 65% of hybrids maize seed demand is being met out by private sector. The estimated share of public sector hybrids in total maize is coming around 20-22%. Hybrid maize covers around 85 % of the total maize area in the country. Of this, around 70 % are single cross hybrids, while the rest are three way or double cross hybrids. The remaining 12-15% of the area is used to grow improved maize varieties or land races. The share of IIMR bred hybrids remained on the top (24.6 to 62.4 %) for the last four

years in DAC demand. Amongst the IIMR Hybrids, DMRH 1308 and DMRH 1301 together stood on top for all years with a maximum share of 42.1% in DAC indent. In addition, DHM 121 and DHM 117 released by PJTSAU, Hyderabad and Pratap Hybrid Maize 3 from MPUAT, Udaipur are also in high demand. Other public sector hybrids including IQMH203, LQMH 1, IMH224, IMH 222, APH2, APH 3, and Pusa HQPM1 from IARI, have also started receiving good amount of breeder seed indent from various agencies.





Mobile Apps

- ❖ A comprehensive bi-lingual mobile app, Bharti MAKKA - Maize Agri-Knowledge and Know-how App.
- ❖ It is a user-friendly and strives to provide succinct targeted information.
- ❖ Covers all the relevant information of maize from seed to seed under distinct modules, viz., Cultivars, Production Practices, Insect Management, Disease Management, Weed Management, Nutrients, Non-host Pests, Mechanization, Pest Solution, Fertilizer Solution and information on Maize News/Updates, Marketing, e-maize advisories, Advisory for farmers and Video Gallery, etc.

Maize Germplasm Decision Support Database

The Maize Germplasm Decision Support Database is a pioneering Decision Support System (DSS) designed to optimize the utilization of maize inbred line germplasm. This DSS features a comprehensive database containing crucial information on 12 traits per inbred lines, alongside an image library showcasing ear and tassel images. By enhancing scientific productivity, it accelerates germplasm utilization effectively.

AICMIP automation system

The AICMIP Automation System streamlines the planning, execution, and monitoring of coordinated trials within the All India Coordinated Maize Improvement Project (AICMIP), established in 1957 as India's first All-India Coordinated Research Project (AICRP). This innovative system, developed under the auspices of KRISHI (ICAR Research Data Management for Knowledge Management), integrates seamlessly with the project's 34 centers across 23 states, ensuring significant enhancements to the efficiency and efficacy of AICMIP initiatives.



Maize Agridaksh

Maize Agridaksh, accessible at <http://agridaksh.iasri.res.in/maize.html>, is an innovative expert system designed to streamline maize crop management. Developed using AgriDaksh, this tool emulates human expert interaction and assists farmers and agricultural extension personnel in optimizing irrigation, fertilizer application, and pest control strategies, ultimately enhancing maize yield and farmers' income.



Awards

- ❖ Recognizing its treasured contributions toward maize research and development across India, the institute was awarded the “Chaudhary Devi Lal Outstanding All India Coordinated Research Project Award” for the year 2019.
- ❖ Dr. R. Sai Kumar, Ex. Director, DMR had been awarded Dr. MS Swaminathan award for his outstanding work in the field of agriculture.
- ❖ Directorate of Maize Research has awarded the Best Institution Award for promoting Plant Variety Registration for the year 2010-11
- ❖ Recognizing its contribution towards the promotion of the National Language, the institute publication “Krishi Chetna” has been awarded best publication for consecutive 6 years from 2018 to 2023 by Nagar Rajbhasha Karyanvan Samiti, Ludhiana
- ❖ Dr. Sujay Rakshit, former Director ICAR-IIMR, has been elected NAAS Fellow for the year 2022.
- ❖ Dr. Bhupender Kumar and Dr. S.L. Jat have been awarded Associateship of the National Academy of Agricultural Sciences New Delhi in the years 2020 and 2021, respectively.



Commercialized Maize Hybrids from ICAR-IIMR, Ludhiana

S. No.	Name of Hybrid	Licence Company
1	DMRH 1301	1. Sampoorna seeds, Andhra Pradesh 2. Koshi Agro Biotech Pvt Ltd, Bihar 3. Chakra Seeds, Andhra Pradesh 4. Beej Sheetal Research Pvt. Ltd., Maharashtra 5. Astha Agrigenetics, Cooch Bihar 6. Dadabhai Seed Farm, West Bengal 7. Indo US Biotech Limited, Gujarat 8. Padamati-I Watershed Association, West Bengal 9. Nutranta Seeds Pvt Ltd., Telangana 10. Basudha Seeds, West Bengal 11. Ramnagar Seed Farm Pvt Ltd, West Bengal
2	DMRH 1305	1. Sampoorna Seeds, Andhra Pradesh 2. Koshi Agro Biotech Pvt Ltd, Bihar 3. Bionex Agrigenetics India Private Limited, Bihar
3	IMHB 1539	1. Koshi Agro Biotech Pvt Ltd, Bihar
4	DMRH 1308	2. Sampoorna seeds, Andhra Pradesh 3. Indo US Biotech Limited, Gujarat 4. Padamati-1 Watershed Association, West Bengal 5. Basudha Seeds, West Bengal

S. No.	Name of Hybrid	Licence Company
		6. Khajuraho Hybrid Seeds Pvt Ltd., Bhopal, Madhya Pradesh 7. Mulukanoor Women Cooperative, Telangana 8. Dadabhai Seed Farm, West Bengal 9. Krishi Vikas Sahakari Samiti Ltd., Rajasthan
5	LPCH 3	1. Gourmet Popcornica Limited, Andhra Pradesh
6	LQMH 1	1. Chakra Seeds, Andhra Pradesh 2. Koshi Agro Biotech Pvt Ltd, Bihar 3. Siddi Vinayaka Seeds Pvt. Ltd., Bengaluru 4. Ramnagar Seed Farm Pvt Ltd, West Bengal 5. Invicta Agritech India Pvt. Ltd., Telangana 6. Bionex Agrigenetics India Private Limited, Bihar
7	IQMH 203	1. Sampoorna seeds, Andhra Pradesh 2. Chakra Seeds, Andhra Pradesh
8	IMH 224	1. Agrowin Agri Solution Pvt. Ltd., Bihar
9	Dynamic Volatile Collection System	1. Amar Chand and Company, Ambala Cantt

Institutional Collaborations

The ICAR-Indian Institute has developed many active collaborations with premier research and academic institutions for the research and development of maize. The institute has also developed research collaborations with private organizations to develop a strong public-private partnership

International collaborations

The institute has a strong collaboration with The International Maize and Wheat Improvement Center (CIMMYT), Mexico for germplasm procurement, Improving rainfed (*Kharif*) maize productivity and development of Heat Tolerant Maize for Asia. In addition to this, the institute has also collaborated with CIMMYT for the Development and validation of IPM modules against Fall Army worm [*Spodoptera frugiperda* (J.E. Smith)] infestation on maize in India.

National collaborations

The institute has active collaborations with Punjab Agricultural University, Ludhiana; ICAR-Indian Agricultural Research Institute, New Delhi; ICAR-Indian Institute of Agricultural Biotechnology, Ranchi; CCS Haryana Agricultural University, Hisar; Guru Nanak Dev University, Amritsar, Ramakrishna Mission Vivekananda Educational and Research Institute, Howrah and Lovely Professional University, Phagwara for teaching and students guidance.

The institute has also developed collaboration with the Council of Scientific and Industrial Research, National Dairy Development Board, Anand; Hi-Tech International, Ludhiana; and National Sugar Institute, Kanpur to address various issues of maize research and utilizations.





Consultancies

The institute has provided consultancies on sustainable maize cultivation to various organizations both nationally and internally from time to time

International consultancies

The institute is providing consultancies to FAO for the management of new insect for FAW through two consultancies projects on “Time – critical measures to support early warning and monitoring and sustainable management of the FAW in India” and “The seed treatment-based field trial and Agro-ecological options for FAW Management”.

National consultancies

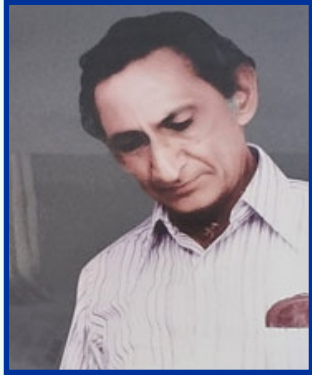
The institute is providing consultancy to Assam Government for enhancing production and productivity of maize in the state.



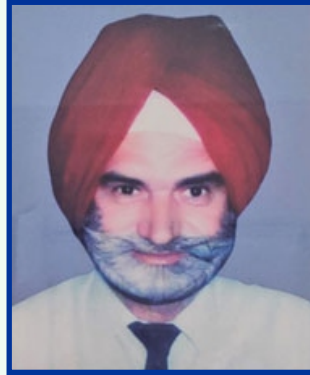
Publications

- ❖ The scientific outputs of the institute are published in International and National journals of repute. During the last ten years, the scientist of the institute have published 380 research papers and 25 review papers making an average of about 40.5 research papers every year.
- ❖ The quality of the research papers can be judged from their NAAS rating, about 50% of the research papers are published in research journals having NAAS rating between 6.0 and 10.0.
- ❖ The Institute has published 14 books/manuals, 125 book chapters and 21 bulletins on maize related activities.
- ❖ The institute also regularly brings out popular literatures in the form of leaflets, folders, etc. in local languages for use by the farmers and other stakeholders.

Directors of ICAR-IIMR



Dr. N.L. Dhawan
(From 1957 to 1968)



Dr. Joginder Singh
(From 1968 to 1987)



Dr. N.N. Singh
(From 1987 to 2005)



Dr. Sain Dass
(From 2006 to 2010)



Dr. R. Sai Kumar
(From 2010 to 2012)



Dr. O.P. Yadav
(From 2012 to 2015)



Dr. Sujay Rakshit
(From 2017 to 2022)



Dr. H.S. Jat
(From 2023 to till date)







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