# Annual Report 2024




# वार्षिक प्रतिवेदन


## भा.कृ.अनु.प.-भारतीय मक्का अनुसंधान संस्थान

लाडोवाल, गाँव चाहड़, लुधियाना, 141008 पंजाब-(भारत)

## ICAR-Indian Institute of Maize Research

Ladhowal, Chahar Village, Ludhiana-141004 (India)

# Nurturing diversity, resilience, livelihood & industrial inputs

भाकृअनुप-भारतीय मक्का अनुसंधान संस्थान
ICAR-INDIAN INSTITUTE OF MAIZE RESEARCH

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# ANNUAL REPORT
# 2024

ICAR - INDIAN INSTITUTE OF MAIZE RESEARCH
Ladhowal, Chahar Village, Ludhiana (PB) - 141008 (INDIA)

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**संपादन मंडलः**
**Editorial Team :**

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Dr. Deep Mohan Mahala
Dr. Bahadur Singh Jat
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Dr. Pravin Kumar Bagaria
Dr. Ph. Romen Sharma
Dr. Mukesh Choudhary
Dr. H.S. Jat

**प्रकाशकः**
**Published By :**

निदेशक
Director
भा.कृ.अनु.प–भारतीय मक्का अनुसंधान संस्थान,
ICAR-Indian Institute of Maize Research
लाडोवाल, गाँव चाहड़, लुधियाना, पंजाब–141008
Ladhowal, Chahar village, Ludhiana – 141008
ई.मेलः pdmaize@gmail.com
E-mail: pdmaize@gmail.com
वेबसाइटः http://iimr.icar.gov.in
Website: http://iimr.icar.gov.in

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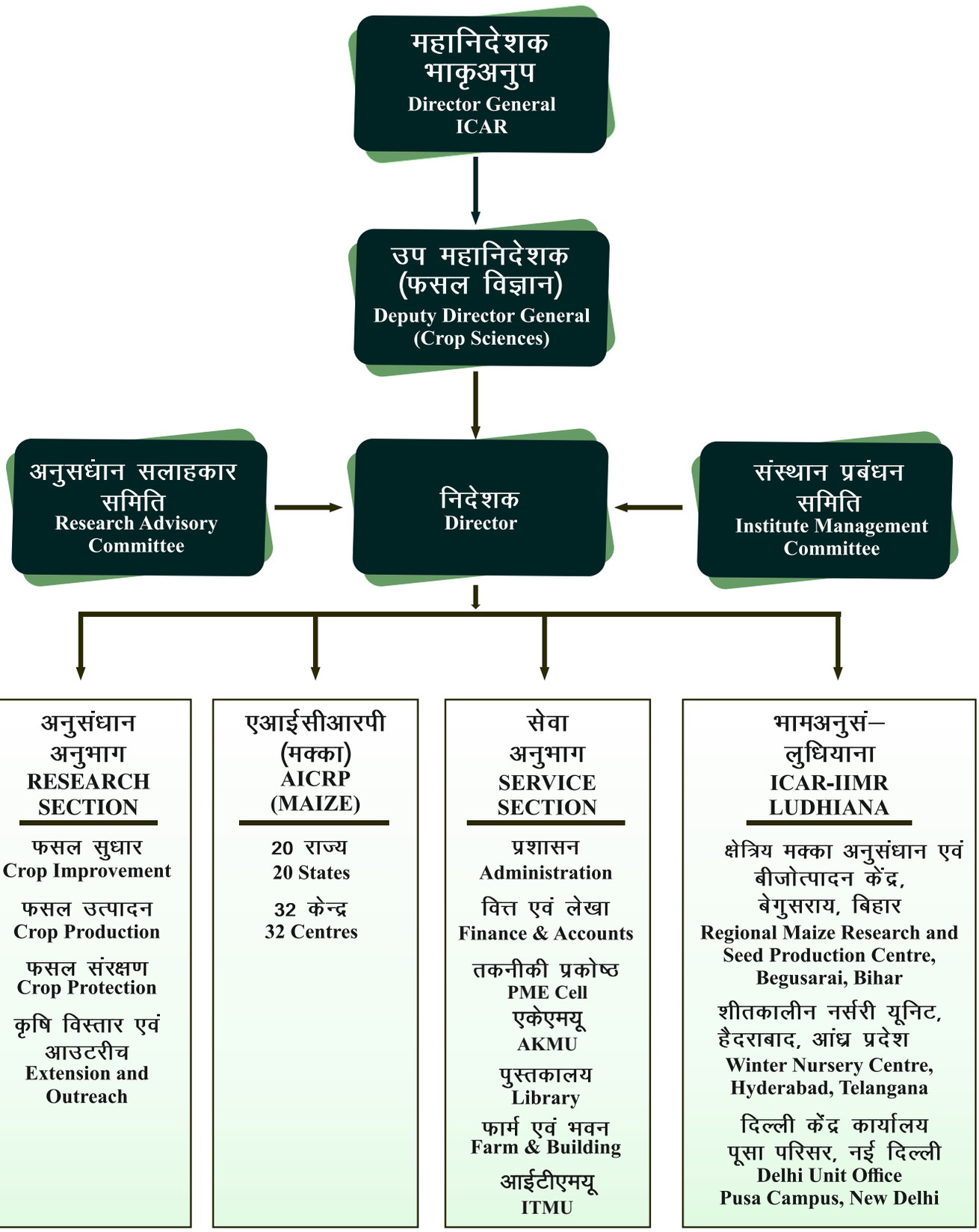


# प्रस्तावना

मुझे वर्ष 2024 के लिए भा.कृ.अनु.प.-भारतीय मक्का अनुसंधान संस्थान (ICAR-IIMR) की वार्षिक रिपोर्ट प्रस्तुत करते हुए अत्यंत गर्व और सम्मान की अनुभूति हो रही है। भारतीय कृषि अनुसंधान परिषद (ICAR) के अधीन देश का प्रमुख मक्का अनुसंधान संस्थान, ICAR-IIMR, अपनी स्थापना वर्ष 1957 में ''मक्का पर समन्वित फसल सुधार परियोजना'' के रूप में प्रारंभ होने के बाद से मक्का सुधार, मूल्यश्रृंखला विकास तथा क्षमता निर्माण के क्षेत्र में अग्रणी भूमिका निभा रहा है। दशकों में संस्थान को क्रमशः ''अखिल भारतीय समन्वित मक्का सुधार परियोजना'' (1963), ''मक्का अनुसंधान निदेशालय'' (1994) और अंततः ''भाकृअनुप–भारतीय मक्का अनुसंधान संस्थान'' (2015) के रूप में उन्नत किया गया। वर्तमान में संस्थान देश के विभिन्न कृषि–जलवायु क्षेत्रों में फैले अखिल भारतीय समन्वित मक्का सुधार परियोजना (AICRPM) केंद्रों के नेटवर्क के माध्यम से कार्य कर रहा है, जिससे अनुसंधान निष्कर्षों को बीज उत्पादकों एवं अंतिम उपयोगकर्ताओं से प्रभावी रूप से जोड़ा जा रहा है।

हमारे आदर्श वाक्य ''आर्थिक एवं पर्यावरणीय स्थिरता के साथ मक्का आधारित कृषि प्रणालियों की उत्पादकता, लाभप्रदता एवं प्रतिस्पर्धात्मकता को बढ़ाना'' के अनुरूप, वर्ष 2024 में मक्का सुधार कार्यक्रम ने उपज, तनाव सहनशीलता एवं विशेषता लक्षणों के लिए आनुवंशिक आधार को विविध एवं सुदृढ़ करने की दिशा में निरंतर प्रगति की है। उल्लेखनीय उपलब्धियों में, जैवसंवर्धित संकर LQMH 1 को हिमाचल प्रदेश, जम्मू एवं कश्मीर, पश्चिम बंगाल तथा असम में 50 हेक्टेयर से अधिक क्षेत्र में प्रदर्शित किया गया, जिसने रबी 2023–24 में प्रति हेक्टेयर 10.5 टन तक की उपज दी है, और इसके लिए कृषि एवं सहकारिता विभाग (DAC) द्वारा प्रजनक बीज की मांग एवं और निजी क्षेत्र की ओर से गहरी रुचि पहले ही प्राप्त हो चुकी है। विगत छह वर्षों में, संस्थान ने 32 संकर किस्में विकसित एवं जारी कीए हैं, इनमें से सात संकर किस्मों का 20 बीज कंपनियों के साथ 38 समझौता ज्ञापनों (MoUs) के माध्यम से व्यावसायीकरण किया गया। इस पहल के परिणामस्वरूप राष्ट्रीय मक्का प्रजनक बीज आवंटन में 26.6% से 62.4% तक की हिस्सेदारी सुनिश्चित करते हुए संस्थान ने अपनी अग्रणी स्थिति को सुदृढ़ बनाए रखा है।

वर्ष के दौरान, दो फील्ड कॉर्न हाइब्रिड (IMH 230 **एवं** IMH 231) तथा एक नर बाँझ बेबी कॉर्न हाइब्रिड (IBCH 402) को कृषि फसलों के फसल मानकों, अधिसूचना एवं किस्म विमोचन पर केंद्रीय उप–समिति (CNS&RVC on CSS) की 92वीं बैठक में 8 अक्टूबर, 2024 को गजट अधिसूचना S.O. 4388(E) के माध्यम से आधिकारिक रूप से अधिसूचित किया गया। इसके अतिरिक्त, तीन क्यूपीएम (QPM) संकर किस्मों - IQMH 206, IQMH 207 **एवं** IQMH 208 की पहचान प्रोफेसर जयशंकर तेलंगाना राज्य कृषि विश्वविद्यालय, हैदराबाद में आयोजित 67वीं वार्षिक मक्का कार्यशाला के दौरान की गई। अखिल भारतीय समन्वित मक्का सुधार परियोजना (AICRP) एवं राज्य स्तरीय परीक्षणों के अंतर्गत बहु–स्थान परीक्षणों में, फील्ड कॉर्न, क्यूपीएम, उच्च लाइसिन/ट्रिप्टोफैन, जिंक समृद्ध तथा वैक्सी हाइब्रिड्स के एक समूह को दूसरे एवं तीसरे वर्ष के मूल्यांकन के लिए उन्नत किया गया। यह प्रयास लक्षित लक्षण तैनाती हेतु विशिष्ट मक्का प्रजनन रणनीतियों और हेटेरोटिक ग्रुपिंग के प्रति हमारी निरंतर प्रतिबद्धता को दर्शाता है। इसके साथ ही अजैविक एवं जैविक तनाव सहनशीलता प्रजनन में भी उल्लेखनीय प्रगति प्राप्त हुई है। जलभराव और ठंड सहनशीलता की स्क्रीनिंग में कई हाइब्रिड्स एवं इनब्रेड लाइनों

को चेक किस्मों की तुलना में 10 प्रतिशत से अधिक उपज के साथ बेहतर प्रदर्शन करते हुए पहचाना गया। बैक्टीरियल लीफ स्ट्रेक, स्टेम बोरर और फॉल आर्मीवर्म के प्रति प्रतिरोधी नए स्रोतों की पहचान की गई है। साथ ही, मक्का की जंगली प्रजातियों से पूर्व–प्रजनन तथा डबल्ड हैप्लॉइड लाइन विकास के माध्यम से सूखा, कीट एवं चारा–गुणों के लिए मक्का जर्मप्लाज्म भंडार को समृद्ध किया गया है। ट्रांसक्रिप्ट प्रोफाइलिंग एवं जीनोम–व्यापी संघ अध्ययन (GWAS) के माध्यम से जिंक, आयरन, स्टार्च तथा मेथियोनीन जैव–सुदृढ़ीकरण से जुड़े सैकड़ों विभेदकरूप से व्यक्त जीन (DEGs) तथा सूचक लक्षण संघों (MTAs) की पहचान की गई। साथ ही, भविष्य की लक्षण अभियांत्रण गतिविधियों के लिए एग्रोबैक्टीरियम–मध्यस्थ रूपांतरण प्रणाली और CRISPR/Cas9 प्रोटोकॉल का सफलतापूर्वक अनुकूलन किया गया।

वर्ष 2024 में मक्का की रणनीतिक महत्ता और अधिक स्पष्ट रूप से उभरकर सामने आई, जब मक्का देश के एथेनॉल मिश्रित पेट्रोल (EBP) कार्यक्रम में एक केंद्रीय फसल के रूप में और अधिक मजबूती से स्थापित हुआ। सार्वजनिक क्षेत्र की तेल विपणन कंपनियों (OMCs) ने एथेनॉल आपूर्ति वर्ष (ESY) 2023–24 के दौरान 14.60 मिश्रण स्तर प्राप्त किया, जो 28 फरवरी 2025 तक बढ़कर 17.98 प्रतिशत तक पहुँच गया है, और ESY 2025–26 तक 20 प्रतिशत मिश्रण के लक्ष्य की दिशा में तेजी से अग्रसर हैं। इस प्रयास में मक्का की भूमिका अत्यंत महत्वपूर्ण होने जा रही है। एथेनॉल मिश्रण दर में हुई वृद्धि ने किसानों को मक्का की खेती की ओर आकर्षित किया है, जिसे न्यूनतम समर्थन मूल्य (MSP) में अनुकूल संशोधन एवं ऑफ–टेक समझौतों का समर्थन प्राप्त है। इस प्रक्रिया ने मक्का की खाद्य एवं ईंधन में दोहरी उपयोगिता के रूप में फसल को और अधिक स्पष्ट रूप से रेखांकित किया है।

इन उपलब्धियों का उत्सव मनाते हुए, भा.कृ.अनु.प.-भारतीय मक्का अनुसंधान संस्थान (ICAR-IIMR) फसल सुधार, फसल उत्पादन, फसल सुरक्षा, विस्तार एवं प्रसार के क्षेत्रों में अत्याधुनिक और बहुविषयक अनुसंधान को सशक्त रूप से आगे बढ़ाने के प्रति अपनी प्रतिबद्धता को दोहराता है। इस रिपोर्ट में उल्लिखित प्रगति साथ ही उच्च प्रदर्शन करने वाली संकर किस्मों एवं मूल्य श्रृंखला नवाचारों को हितधारकों द्वारा मिले व्यापक समर्थन ने मक्का को एक राष्ट्रीय प्राथमिकता वाली फसल के रूप में स्थापित किया है, जो ग्रामीण आजीविका, औद्योगिक विकास और ऊर्जा सुरक्षा को सशक्त बनाने में सहायक सिद्ध हो रही है।

**एच. एस. जाट**
निदेशक

# उद्देश्य और विज़न

# Mission & Vision

भाकृअनुप–भा.म.अनु.सं.
ICAR-IIMR

आर्थिक एवं पर्यावरणीय स्थिरता के साथ मक्का और मक्का आधारित कृशि प्रणालियों की उत्पादकता, लाभप्रदता तथा प्रतिस्पर्धा को बढ़ाना।

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

मक्का की खेती और उपयोग से प्रत्यक्ष या अप्रत्यक्ष रूप से जुड़े समस्त जनमानस के लिए कृषि और औद्योगिक क्षेत्रों में संपदा तथा रोजगार सृजन हेतु मक्का और मक्का आधारित उत्पादों के खाद्य, चारा (फीड) एवं औद्योगिक अनुप्रयोग में व्यापक रूप से वृद्धि करना।

*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.*

# Preface

I am privileged to present the Annual Report of the ICAR-Indian Institute of Maize Research for the year 2024. ICAR-IIMR, the nation's premier maize research institute under the Indian Council of Agricultural Research, has been at the forefront of maize improvement, value-chain development and capacity building since its inception in 1957 as the Coordinated Crop Improvement Project on Maize. Upgraded over the decades to the All India Coordinated Maize Improvement Project (1963), Directorate of Maize Research (1994), and finally ICAR-IIMR (2015), the Institute now operates through a network of AICRP on Maize centres across varied agro-climatic zones, linking research outputs effectively with seed producers and end-users.

Building on our motto of "Enhancing the productivity, profitability and competitiveness of maize-based farming systems with economic and environmental sustainability," the maize improvement programme in 2024 continued to diversify and strengthen the genetic base for yield, stress resilience and specialty traits. Among notable milestones, the biofortified hybrid LQMH 1 was demonstrated across over 50 ha in Himachal Pradesh, J&K, West Bengal and Assam, yielding up to 10.5 t/ha in *Rabi* 2023–24, and has already drawn substantial DAC breeder seed demand and private-sector interest . In the past six years, IIMR has developed and released 29 hybrids, of which seven have been commercialized through 39 MoUs with 27 seed companies, maintaining our leadership with a 26.6–62.4% share in national maize breeder seed allocations.

The year saw the official release of two field-corn hybrids (IMH 230, IMH 231) and one male-sterile baby-corn hybrid (IBCH 402) by the 92nd CSS on CSN & R VAC (Gazette S.O 4388(E), 08-10-2024), and two field hybrids IMH 232 & 233; identification of three QPM hybrids (IQMH 206-208); Biofortified hybrid PVAPMH-1; at the 67th Annual Maize Workshop, PJTSAU . In multi-location trials under AICRP and state testing, a suite of field-corn, QPM, high-lysine/tryptophan, zinc-enriched and waxy hybrids advanced to second- and third-year evaluation, underscoring our commitment to speciality-corn breeding and heterotic grouping for targeted trait deployment.

Abiotic- and biotic-stress breeding made significant strides. Waterlogging- and cold-tolerance screening identified several hybrids and inbreds with >10 % yield superiority over checks; new sources of resistance to bacterial leaf streak, stem borers and fall armyworm were identified; and wild-species pre-breeding and doubled-haploid line development enriched our reservior for drought, pest and fodder traits . Transcript one profiling and GWAS

identified hundreds of DEGs and MTAs respectively associated with zinc, iron, starch and methionine content, while Agrobacterium-mediated transformation and CRISPR/Cas9 protocols were optimized for future trait engineering.

In 2024, maize's strategic importance deepened with its pivotal role in India's Ethanol Blended Petrol (EBP) Programme. Public-sector OMCs achieved 14.60 % blending in Ethanol Supply Year (ESY) 2023-24 and 17.98 % up to 28 February 2025, on a roadmap to 20% by ESY 2025-26. Maize is going to play a highly significant role in this endeavour. This surge has catalyzed farmers' shift to maize cultivation, supported by favourable MSP revisions and has underscored maize's dual value as both food and fuel crop.

As we celebrate these achievements, ICAR-IIMR reaffirms its mandate to pursue cutting-edge, multidisciplinary research across crop improvement, production, protection, extension and outreach. The developments chronicled herein-together with stakeholders' enthusiastic adoption of high-performance hybrids and value-chain innovations-position maize as a crop of national priority, driving rural livelihoods, industrial growth and energy security.

**H. S. Jat**
Director

# अधिदेश
# MANDATE

विशिष्ट मक्का सहित मक्का की उत्पादकता और उत्पादन को बढ़ाने के उद्देश्यसे मौलिक एवं कार्यनीतिपरक अनुसंधान करना।

***Basic and strategic research aimed at enhancement of productivity and production of maize, including specialty corn.***

विविध कृषि जलवायु पस्थितियों के लिए उपयुक्त प्रौद्योगिकियों की पहचान करने हेतु बहुस्थानिक एवं बहुआयामी अनुसंधान में समन्वय करना।

***Coordination of multi-disciplinary and multi-location research to identify appropriate technologies for variedagro-climatic conditions.***

उन्नत प्रौद्योगिकियों का प्रसार, क्षमता निर्माण और विकासशील संपर्क स्थापित करना।

***Dissemination of improved technologies, capacity building and developing linkages.***

मक्का पर अखिल भारतीय समन्वित अनुसंधान परियोजना (एआईसीआरपी) का समन्वय और विस्तार एवं आउटरीच कार्यक्रम को कार्यान्वित करना

***Coordination of the All india Coordinated Research Project (AICRP) on Maize and to carry out extension andoutreach programmes.***

# विशिष्ट सारांश

## फसल सुधार

### जैव–संवर्धित हाइब्रिड्स का लोकप्रियकरण

संस्थान द्वारा विकसित किए गए जैव–संवर्धित संकर एलक्यूएमएच 1 का खरीफ 2024 एवं रबी 2023–24 सीजन के दौरान हिमाचल प्रदेश, जम्मू और कश्मीर, पश्चिम बंगाल एवं असम राज्यों में 50 हेक्टेयर से अधिक क्षेत्र में खेत स्तर पर प्रदर्शन किया गया। खरीफ मौसम में संकर ने 6.0–8.5 टन/हेक्टेयर तथा रबी में अधिकतम 10.5 टन/हेक्टेयर तक की उत्कृष्ट उपज दर्ज की। उच्च उत्पादकता एवं पोषण गुणवत्ता के कारण इस हाइब्रिड को छह प्रमुख निजी बीज कंपनियों द्वारा अपनाया गया है, और इसके विमोचन के पश्चात कृषि एवं सहकारिता विभाग (DAC) से इसके प्रजनक बीज की पर्याप्त माँग प्राप्त हुई है।

### आई.आई.एम.आर हाइब्रिड्स का व्यावसायीकरण और बीज उत्पादन

विगत छह वर्षों में, संस्थान ने 32 संकर किस्में विकसित एवं जारी किए हैं, इनमें से सात संकर किस्मों को 20 बीज कंपनियों के साथ 38 समझौता ज्ञापनों (MoUs) के माध्यम से व्यावसायीकरण किया गया । इस पहल के परिणामस्वरूप राष्ट्रीय मक्का प्रजनक बीज आवंटन में 26.6 % से 62.4% तक की हिस्सेदारी सुनिश्चित करते हुए संस्थान ने अपनी अग्रणी स्थिति को सुदृढ बनाए रखा है।

### संस्थान द्वारा विमोचित ध्सूचित हाइब्रिड्स

वर्ष के दौरान, दो फील्ड कॉर्न हाइब्रिड (IMH 230, एवं IMH 231) तथा एक नर बाँझ बेबी कॉर्न हाइब्रिड (IBCH 402) को कृषि फसलों के फसल मानकों, अधिसूचना एवं किस्म विमोचन पर केंद्रीय उप–समिति (CNS & RVC on CSS) की 92वीं बैठक में 8 अक्टूबर, 2024 को गजट अधिसूचना S-O-4388(E) के माध्यम से आधिकारिक रूप से अधिसूचित किया गया। इसके अतिरिक्त, तीन क्यूपीएम (QPM) संकर किस्मों – IQMH 206, IQMH 207, एवं IQMH 208 की प्रोफेसर जयशंकर तेलंगाना राज्य कृषि विश्वविद्यालय, हैदराबाद में आयोजित 67वीं वार्षिक मक्का कार्यशाला के दौरान पहचान की गई।

### अखिल भारतीय समन्वित मक्का सुधार परियोजना (AICRP) एवं राज्य परीक्षणों में प्रोन्नत संकर

रबी 2023–24 में AVT-I में सम्मिलित दो फील्ड कॉर्न संकरों को रबी 2024–25 के लिए AVT-I में प्रोन्नत किया गया। इसी प्रकार, एक फील्ड कॉर्न संकर को स्प्रिंग 2024 में AVT-I से स्प्रिंग 2025 में AVT-II के लिए उन्नत किया गया। दो फील्ड कॉर्न संकरों को NIVT (खरीफ 2023) से AVT-I (खरीफ 2024) में, तथा एक फील्ड कॉर्न संकर को NIVT (रबी–2023–24) से AVT-I (रबी–2024–25) में उन्नत किया गया। QPM वर्ग के अंतर्गत पाँच संकरों को AVT-II में तथा छह संकरों को AVT-I में परीक्षण हेतु खरीफ 2024 के दौरान उन्नत किया गया। इसके अतिरिक्त, लाइसिन, ट्रिप्टोफैन एवं जिंक समृद्ध तीन संकरों को AVT-I में तथा एक संकर को AVT-II में क्रमशः खरीफ 2024 एवं रबी 2024–25 के AICRP परीक्षणों के लिए उन्नत किया गया। उच्च एमाइलोपेक्टिन युक्त दो वैक्सी मक्का (waxy corn) संकरों को AVT-I से AVT-II में उन्नत किया गया। साथ ही, एक ब्डै–आधारित बेबी कॉर्न संकर (IBH 11–223) को चार प्रमुख कृषि जलवायु क्षेत्रों ; NHZ, NEPZ, PZ और CWZ में खरीफ 2024 के दौरान AVT-I से AVT-II में प्रोन्नत किया गया। राज्य स्तरीय परीक्षणों में, बिहार में एक संकर रबी 2023–24 से 2024–25 के दौरान द्वितीय वर्ष के परीक्षण में है, जबकि एक अन्य संकर खरीफ 2023 से 2024 के दौरान तृतीय वर्ष के परीक्षण में है। इसी प्रकार, गुजरात राज्य में एक सफेद संकर को खरीफ 2024 के लिए तृतीय वर्ष के परीक्षण हेतु उन्नत किया गया है।

### मक्का जीनोटाइप्स का विषमज (Heterotic) समूहीकरण

115 इनब्रेड लाइनों के एक सेट को दो टेस्टर (LM 13 एवं LM 14) के साथ क्रॉस किया गया और इन क्रॉसों का रबी मौसम में RMR- SPC, बेगूसराय में तीन वर्षों तक मूल्यांकन किया गया। मूल्यांकन के आधार पर, 18 इनब्रेड लाइनों को Group A (LM 13 के साथ नकारात्मक SCA) और 37 लाइनों को Group B (LM 14 के साथ नकारात्मक SCA) में वर्गीकृत किया गया।

### इसके अतिरिक्तरू

103 इनब्रेड लाइनों को स्ड 13 और स्ड 14 के साथ क्रॉस कर 206 संकर संयोजनों (crosses) का सामान्य एवं सूखा तनाव स्थितियों में दो वर्षों तक मूल्यांकन किया गया। इनमें से 15 लाइनों को Group A तथा 33 लाइनों को Group B में वर्गीकृत किया गया।

108 इनब्रेड लाइनों के एक सेट को LM 13 और LM 14 के साथ क्रॉस किया गया और 216 क्रॉसों का सामान्य एवं जलभराव तनाव स्थितियों में दो वर्षों तक मूल्यांकन किया गया। इसमें 23 लाइनें Group A तथा 29 लाइनें Group B में वर्गीकृत की गईं।

153 इनब्रेड लाइनों को LM 13 और LM 14 के साथ क्रॉस किया गया और 306 क्रॉसों का दो वर्षों तक मूल्यांकन किया गया। परिणामस्वरूप, 31 लाइनें Group A और 45 लाइनें Group B में वर्गीकृत की गईं।

108 इनब्रेड लाइनों को LM 13 और LM 14 के साथ क्रॉस कर 216 क्रॉस बनाए गए, जिनका मूल्यांकन दो स्थलों पर सामान्य एवं तापीय तनाव (heat stress) की स्थितियों में किया गया। इसमें 34 लाइनें Group A और 28 लाइनें Group B में वर्गीकृत की गईं।

## अजैविक तनाव के लिए प्रजनन

एक सेट, जिसमें 120 L × T एवं डायलल मेटिंग डिजाइनों से विकसित प्रायोगिक हाइब्रिड्स का मूल्यांकन खरीफ 2023 के दौरान जलभराव तनाव परिस्थितियों में किया गया। मूल्यांकन के परिणामस्वरूप, 30 हाइब्रिड्स ने जलभराव स्थितियों में प्रचलित श्रेष्ठ जांच (चेक) हाइब्रिड्स की तुलना में अधिक उपज प्रदर्शित की। एक अन्य सेट जिसमें 175 L × T एवं डायलल आधारित प्रायोगिक हाइब्रिड्स का मूल्यांकन रबी 2023–24 के दौरान ठंडे तनाव वाले वातावरण (cold stress) में किया गया। इन हाइब्रिड्स में से 31 हाइब्रिड्स ने श्रेष्ठ जांच (psd) हाइब्रिड्स की तुलना में अधिक उपज दी, जबकि केवल एक हाइब्रिड ने जांच हाइब्रिड की तुलना में 10 % से अधिक उपज वृद्धि प्रदर्शित की।

## जैविक तनाव के लिए प्रजनन

खरीफ 2020, 2021 और 2023 के दौरान लुधियाना और करनाल में 100 इनब्रेड लाइनों के एक सेट का मूल्यांकन किया गया। इस मूल्यांकन में 31 इनब्रेड लाइनों को मध्यम रूप से प्रतिरोधी (Moderately Resistant) और 26 इनब्रेड लाइनों को मध्यम रूप से संवेदनशील (Moderately Susceptible) रूप में वर्गीकृत किया गया। इसके अतिरिक्त, खरीफ 2023 में 100 इनब्रेड लाइनों के एक अन्य सेट का मूल्यांकन लुधियाना और करनाल में किया गया, जिसमें पाँच इनब्रेड्स — MIL 2–428–2, MIL 2–511–1, MIL 2–941–3, MIL 2–3470 और EI 670 ने बैंडेड लीफ एंड शीथ ब्लाइट (BLSB) के विरुद्ध प्रतिरोधी प्रतिक्रिया दर्शाई। वसंत 2023, खरीफ 2023 और खरीफ 2024 में क्रमशः 127, 100 और 85 इनब्रेड लाइनों का लुधियाना में मूल्यांकन किया गया। इस बहुवर्षीय मूल्यांकन में चार इनब्रेड्स — MIL–2–164–1, MIL–2–201–1, MIL–2–941–1 और MIL–2–1587 ने तुलनात्मक रूप से बेहतर प्रदर्शन एवं कम रोग स्कोर दर्शाया। इसके अतिरिक्त, 30 बेबी कॉर्न इनब्रेड लाइनों को वसंत 2023 और 2024 के दौरान चारकोल रॉट (Charcoal Rot) रोग के विरुद्ध स्क्रीन किया गया, जिसमें BIL–23–78 को दोनों सीजन में लगातार प्रतिरोधी पाया गया।

## विशेष मक्का प्रजनन

खरीफ 2023 के दौरान CMS आधारित कुल 140 प्रायोगिक बेबी कॉर्न संकरों का मूल्यांकन किया गया, जिनमें से 4 संकरों ने बेबी कॉर्न उपज (बिना छिलके के) के संदर्भ में दोनों जांच संकरों की तुलना में श्रेष्ठता प्रदर्शित की। तीन जंगली प्रजातियों *Zea mexicana, Zea parviglumis* और *Coex spp.* के साथ कुल 39 जंगली क्रॉस विकसित किए गए, जिनका उद्देश्य वर्तमान मक्का जर्मप्लाज्म में जैविक, अजैविक एवं चारे से संबंधित लक्षणों की विविधता बढाना था। संभावित पृथक्कारी वंशों की पहचान करने के लिए लाइन यूएमआई 1201, यूएमआई 1210 और जंगली *Zea parviglumis* का उपयोग करते हुए जंगली आबादीयों की दो पीढियों के यादृच्छिक मैटिंग के बाद कुल 168 डबलड हैपलोइड लाइनें विकसित की गई । लीफी म्यूटेंट में भुट्टे के ऊपर अधिक पत्तियाँ होने के कारण अधिक बायोमास तथा कम लिग्निन सामग्री प्राप्त होती है, जिससे पाचनशीलता (digestibility) बढती है। इसी म्यूटेंट का उपयोग करते हुए एक लीफी संकर विकसित किया गया जिसकी उपज (8.6 टन/हेक्टेयर) जांच (चेक) के बराबर पाई गई, और जिसमें भुट्टे के ऊपर 10 पत्तियाँ देखी गईं। यह संकर अभी प्रारंभिक अवस्था में है और साइलेज (silage) उत्पादन के लिए अधिक उपयुक्त माना गया। इसके अतिरिक्त, कुल सात उन्नत चारा आबादियों/संकुलितों को खरीफ 2024 के दौरान चारा परीक्षण पर AICRP में परीक्षण हेतु भेजा गया।

## गुणवत्ता लक्षणों के लिए प्रजनन

250 इनब्रेड लाइनों के एक पैनल का मूल्यांकन दो स्थानों पर लाइसिन, ट्रिप्टोफैन और मेथियोनीन की मात्रा के लिए किया गया। इन जीनोटाइप्स का GBS (Genotyping - by - Sequencing) विश्लेषण किया गया, और पैनल की जीनोटिपिक जानकारी तथा दानों में मेथियोनीन सामग्री का उपयोग GWAS (Genome - Wide Association Studies) के लिए किया गया। इस विश्लेषण में क्रमशः Environment 1 में 21, Environment 2 में 28, तथा संयुक्त वातावरण में 13 Marker-Trait Associations (MTAs) की पहचान की गई। प्रतिलेख प्रोफाइलिंग (Transcript Profiling) के माध्यम से लोहे (Fe) और जिंक (Zn) के संचय से संबंधित विभेद रूप से व्यक्त जीनों (DEGs) की पहचान की गई। उच्च Zn, Fe और Zn+Fe संचय वाले दानों में क्रमशः 795, 4500 और 954 जीन विभेद रूप से व्यक्त पाए गए। उच्च जिंक युक्त लाइनों को परागदाता (pollen parent) के रूप में उपयोग करते हुए तथा राष्ट्रीय मक्का कार्यक्रम की उत्कृष्ट इनब्रेड लाइनों के वंशावली क्रॉस (pedigree crosses) के माध्यम से कुल 88 नई इनब्रेड लाइनों का विकास किया गया। इन लाइनों का उपयोग क्रॉसिंग कार्यक्रम में कर 302 प्रायोगिक संकर विकसित किए गए, जिनका 2024 में तीन विभिन्न स्थलों पर मूल्यांकन किया गया। इनमें से IQH 7–213, IQH 7–451, IMH 7–641, IQH 7–122, तथा IMH 7–126 जैसे चयनित संकरों ने सभी स्थानों पर जिंक सामग्री के लिए निर्धारित बेंचमार्क (>35 ppm) से अधिक प्रदर्शन किया। इसके अतिरिक्त, 226 इनब्रेड लाइनों के पैनल का दो स्थलों पर दाने की स्टार्च सामग्री के लिए मूल्यांकन किया गया। GWAS विश्लेषण द्वारा कुल स्टार्च सामग्री के लिए विभिन्न मॉडल्स के माध्यम से SNP की पहचान की गई: MLM मॉडल से: 36 SNPs CMLM मॉडल से : 36 SNPs

Farm CPU मॉडल से: 64 SNPs BLINK मॉडल से कुल 145 संभावित जीन (Candidate Genes) की पहचान की गई, जिनमें से 81 जीन ऐसे थे जो सभी चार मॉडलों द्वारा साझा रूप से पहचाने गए।

## बुनियादी विज्ञान

### मक्का में PDS जीन के माध्यम से जीनोम संपादन प्रोटोकॉल का मानकीकरण

मक्का में जीनोम संपादन को मानकीकृत करने हेतु फाइटोइन डीसैचुरेज (Phytoene Desaturase, PDS) जीन का चयन किया गया, क्योंकि यह एल्बिनो (Albino) फेनोटाइप उत्पन्न करता है, जिसे स्कोर करना तुलनात्मक रूप से आसान होता है। इस उद्देश्य के लिए, मक्का जीनोटाइप DMRH 1308 से प्राप्त एक्सप्लांट्स से विकसित कॉलस (calli) का उपयोग किया गया।

### मक्का में कॉलस प्रेरण एवं पुनर्जनन लक्षणों का मूल्यांकन

मक्का में कॉलस प्रेरण (callus induction) एवं पुनर्जनन (regeneration) से संबंधित लक्षणों को समझने के उद्देश्य से, BML 6 × HKI 163 और BML 6 × IML 418–1 क्रॉस से रिकॉम्बिनेंट इनब्रेड लाइन (RIL) आबादियों का विकास किया गया । वर्तमान में इन आबादियों में इन दोनों लक्षणों के लिए फिनोटाइपिंग (phenotyping) की प्रक्रिया चल रही है।

### मक्का जर्मप्लाज्म में स्टार्च सामग्री की स्क्रीनिंग

विभिन्न पर्यावरणीय परिस्थितियों में उगाए गए मक्का के विविध जीनोटाइप्स में स्टार्च सामग्री का मूल्यांकन किया जा रहा है। स्क्रीनिंग के दौरान मक्का जर्मप्लाज्म में कुल स्टार्च सामग्री 50.9% से 65.9% के बीच पाई गई है।

### मक्का की नाइट्रोजन उपयोग दक्षता का आकलन

मक्का में नाइट्रोजन उपयोग दक्षता से संबंधित कारकों को समझने के उद्देश्य से, जीनोटाइप्स के एक सेट को विभिन्न नाइट्रोजन स्तरों जैसे N - zero, N - half और N - full पर उगाया गया। साथ ही, नाइट्रोजन चयापचय (nitrogen metabolism) में प्रमुख भूमिका निभाने वाले दो एंजाइमों — Nitrate Reductase और Glutamate Synthase की गतिविधियों का विभिन्न परिस्थितियों में उगाए गए मक्का पौधों में मूल्यांकन किया गया है।

## फसल उत्पादन

### संरक्षण कृषि आधारित मक्का–गेहूं फसल प्रणाली का मृदा स्वास्थ्य एवं इनपुट उपयोग दक्षता पर मूल्यांकन

गत सात वर्षों के प्रयोगों से यह निष्कर्ष निकला कि मक्का–गेहूं प्रणाली ने चावल–गेहूं प्रणाली की तुलना में उत्पादकता, जल उपयोग दक्षता और लाभप्रदता के संदर्भ में उल्लेखनीय रूप से बेहतर प्रदर्शन किया। इस प्रणाली के माध्यम से जल उपयोग में 84% तक की कमी, प्रणाली की उत्पादकता में 30% वृद्धि तथा लाभप्रदता में 71% तक की वृद्धि दर्ज की गई। संरक्षण कृषि आधारित मक्का–गेहूं–मूंग प्रणाली ने, पारंपरिक मक्का–गेहूं–मूंग एवं चावल–गेहूं–मूंग प्रणालियों की तुलना में सर्वाधिक मृदा कार्बनिक कार्बन संचय, उच्चतम शुद्ध लाभ एवं लाभ–लागत अनुपात प्रदर्शित किया। इसके अतिरिक्त, Green Seeker सेंसर के माध्यम से किए गए उर्वरक प्रबंधन (fertilizer management) ने किसानों की पारंपरिक पद्धति और अनुशंसित उर्वरक मात्रा (RDF) की तुलना में शुद्ध लाभ में उल्लेखनीय वृद्धि की, और इसका प्रदर्शन स्थान विशिष्ट पोषक तत्व प्रबंधन (SSNM) के समकक्ष रहा।

### मक्का आधारित फसल प्रणाली में उत्पादकता एवं लाभप्रदता बढाने के लिए सर्वोत्तम उत्पादन पद्धतियाँ

पंजाब और हरियाणा राज्यों में खरीफ मौसम के दौरान किए गए फील्ड मूल्यांकन में पाया गया कि न्यूमैटिक प्लांटिंग (Pneumatic Planting) ने मक्का की उपज को उठी हुई क्यारी (Raised Bed) पद्धति की तुलना में 18.5 % तथा समतल क्यारी (Flat Planting) की तुलना में 33.3 % तक बढाया। उठी हुई क्यारी पद्धति ने भी समतल क्यारी की तुलना में 12.5 % अधिक उपज दी। न्यूमैटिक प्लांटिंग में अधिकतम उपज 8.8 टन/हेक्टेयर प्राप्त हुई, जबकि औसत उपज 6.4 टन/हेक्टेयर दर्ज की गई।

### मक्का एवं स्पेशलिटी कॉर्न में विभिन्न जैविक पोषक स्रोतों का अध्ययन

सात वर्षों के अध्ययन के पश्चात यह पाया गया कि सभी प्रकार की मक्का में अनुशंसित उर्वरक मात्रा (RDF) के अंतर्गत प्राप्त उपज, 100 % फार्मयार्ड मैन्योर (FYM) की तुलना में उल्लेखनीय रूप से अधिक रही। स्पेशलिटी कॉर्न में, जब 25 % FYM 25 % वर्मीकम्पोस्ट 1/3 भूसी (straw) का प्रयोग किया गया, तो तीसरे और चौथे वर्ष में उपज में प्रारंभिक गिरावट देखी गई। हालांकि, पांचवे वर्ष से उपज में पुनः सुधार होने लगा, जिससे यह संकेत मिलता है कि इस एकीकृत जैविक प्रबंधन प्रणाली का लंबी अवधि में सकारात्मक प्रभाव पडता है।

### मक्का में क्षेत्र, उपज एवं तनाव आकलन के लिए इमेज विश्लेषण का अनुप्रयोग

मक्का भारत के विभिन्न क्षेत्रों और ऋतुओं में व्यापक रूप से उगाई जाने वाली प्रमुख फसल है। खरीफ मौसम के दौरान, इसकी खेती मुख्य रूप से मध्य और प्रायद्वीपीय राज्यों जैसे मध्यप्रदेश, महाराष्ट्र, कर्नाटक, तेलंगाना और राजस्थान में की जाती है। रबी मौसम में मक्का की खेती का विस्तार दक्षिणी और पूर्वी राज्यों – जैसे आंध्र प्रदेश, तेलंगाना, कर्नाटक, बिहार और पश्चिम बंगाल की ओर रहा है।

उत्पादन की दृष्टि से, मध्यप्रदेश मक्का उत्पादन में अग्रणी राज्य है, इसके बाद कर्नाटक, महाराष्ट्र, राजस्थान और तेलंगाना का स्थान आता है। रबी मक्का का उत्पादन पूर्वी और दक्षिणी राज्यों में अपेक्षाकृत अधिक है, जिसका श्रेय वहां की अनुकूल शीतकालीन जलवायु और सिंचाई की उपलब्धता को जाता है। इन क्षेत्रों के कई जिलों में 5 लाख टन से अधिक मक्का उत्पादन दर्ज किया गया है, जो इसकी व्यावसायिक सफलता को दर्शाता है।

**मक्का में जिंक अवशोषणगतिकी एवं संकरों की प्रतिक्रिया**

पच्चीस मक्का संकरों पर तीन विभिन्न जिंक अनुप्रयोग रणनीतियों के अंतर्गत किए गए एक अध्ययन में यह पाया गया कि 1% फोलियर स्प्रे (foliar spray) ने जिंक अवशोषण, पौधों की ऊँचाई, और उपज में उल्लेखनीय वृद्धि की। इस अध्ययन में IMH 228 संकर ने उच्च जिंक अवशोषण और उच्च उपज, दोनों प्रदर्शित किए, जिससे यह जैव–संवर्धन (biofortification) के लिए एक आदर्श संकर के रूप में उभरा। वहीं, IMH 222 और IMH 224 ने मध्यम से कम जिंक अवशोषण के बावजूद अच्छी उपज दी, जो इन संकरों की जिंक उपयोग दक्षता (zinc use efficiency) को दर्शाता है। कुछ संकरों में, हालांकि जिंक अवशोषण अधिक रहा, परंतु उपज अपेक्षाकृत कम रही, जबकि PAC–741 और IMH 226 जैसे संकरों ने मध्यम स्तर के जिंक अवशोषण के साथ उच्च उपज बनाए रखी, जिससे इनकी संतुलित पोषण उपयोग क्षमता स्पष्ट होती है। ये निष्कर्ष जिंक की कमी वाले क्षेत्रों में पोषक तत्व–कुशल एवं उच्च उत्पादक संकरों के चयन हेतु मार्गदर्शन प्रदान करते हैं।

## फसल सुरक्षा

### रोग विज्ञान

मेडिस लीफ ब्लाइट (MLB) रोग के लक्षण दिखाने वाले कुल 42 Bipolaris maydis आइसोलेट्स को भारत के 18 प्रमुख मक्का उत्पादक राज्यों के 35 स्थानों से एकत्र किया गया। रूपात्मक अध्ययन में इन आइसोलेट्स की कोनिडियल लंबाई, चौडाई एवं सेप्टेशन में महत्वपूर्ण विविधता पाई गई, जिसमें कोनिडिया की लंबाई 30.4 माइक्रोमीटर (mμ) से 91.7 माइक्रोमीटर (mμ) तक दर्ज की गई। रोगजन्य विविधता (pathological variability) का मूल्यांकन विभिन्न साइटोप्लाज्मिक मेल स्टेरिलिटी (CMS) पृष्ठभूमि वाले मक्का जीनोटाइप्स का उपयोग कर किया गया। दीर्घकालिक संरक्षण हेतु पेपर डिस्क और ग्लिसरॉल स्टॉक्स जैसी तकनीकों का सफलतापूर्वक प्रयोग किया गया। टर्सीकम लीफ ब्लाइट (TLB) रोग के लिए आणविक विश्लेषण (molecular studies) से यह स्पष्ट हुआ कि 61 में से 30 आइसोलेट्स एक्ससेरोहिलम रोस्ट्रेटम प्रजाति के थे, न कि ई. टर्सीकम के। ITS प्रोफाइलिंग और अनुक्रमण (sequencing) के माध्यम से TLB रोग के नमूनों में मिश्रित या जटिल संक्रमण (mixed or complex infections) की उपस्थिति की पुष्टि हुई। इसके अतिरिक्त, रोगजन्यता परीक्षण (pathogenicity test) और रूपात्मक सत्यापन (जिसमें स्पोर इमेजिंग भी शामिल थी) द्वारा ई. रोस्ट्रेटम को TLB रोग का प्रमुख रोगकारक (causal organism) के रूप में पुष्टि की गई।

### कीट विज्ञान

खरीफ 2024 के दौरान स्पॉटेड स्टेम बोरर (Chilo partellus) के विरुद्ध प्रतिरोध के लिए 211 मक्का जीनोटाइप्स की स्क्रीनिंग की गई, जिनमें 9 जीनोटाइप्स प्रतिरोधी और 121 मध्यम प्रतिरोधी पाए गए। रबी 2023–24 में 200 जीनोटाइप्स का पिंक स्टेम बोरर (Sesamia inferens) के विरुद्ध मूल्यांकन किया गया, जिसमें 5 जीनोटाइप्स प्रतिरोधी तथा 86 मध्यम प्रतिरोधी वर्गीकृत किए गए। इसी प्रकार, 224 और 179 मक्का जीनोटाइप्स का फॉल आर्मीवर्म (Spodoptera frugiperda) के विरुद्ध आकलन किया गया, जिनमें 3 जीनोटाइप्स प्रतिरोधी और 88 मध्यम प्रतिरोधी लाइनों की पहचान हुई। मॉर्फो–बायोकैमिकल अध्ययनों से यह स्पष्ट हुआ कि फॉल आर्मीवर्म के प्रति प्रतिरोध का संबंध उच्च ट्राइकोम घनत्व, पत्ती की कठोरता तथा कुछ विशिष्ट जैव–रासायनिक संकेतकों से है। प्रतिरोधी जीनोटाइप्स में पत्ती क्षति कम, कुल फिनोल्स, लिग्निन एवं पोटैशियम का स्तर अधिक तथा शर्करा और नाइट्रोजन की मात्रा अपेक्षाकृत कम पाई गई। फाइटो–हार्मोनल प्रोफाइलिंग से यह जानकारी प्राप्त हुई कि प्रतिरोधी जीनोटाइप्स, जैसे CML 67, में संक्रमण से पहले और बाद में जैस्मोनिक अम्ल (Jasmonic acid, JA) और JA-Ile का स्तर उल्लेखनीय रूप से अधिक था। ये निष्कर्ष यह दर्शाते हैं कि मक्का में संरचनात्मक, जैव–रासायनिक और हार्मोनल लक्षण कीट–प्रतिरोधी किस्मों के विकास में महत्वपूर्ण भूमिका निभाते हैं, और इनका उपयोग कीट–प्रबंधन आधारित सुधार कार्यक्रमों में किया जा सकता है।

### विस्तार एवं प्रसार

संस्थान विभिन्न कार्यक्रमों के माध्यम से किसानों एवं अन्य हितधारकों से सक्रिय रूप से जुडा हुआ है। इनमें प्रमुख रूप से भारत सरकार के कृषि एवं सहकारिता विभाग द्वारा प्रायोजित अग्रिम पंक्ति प्रदर्शन (FLDs) शामिल हैं। ये कार्यक्रम राष्ट्रीय खाद्य सुरक्षा मिशन (NFSM), अनुसूचित जनजाति घटक (STC), उत्तर–पूर्वी पर्वतीय क्षेत्र (NEH)

घटक, अनुसूचित जाति उप–योजना (SCSP), एग्रीबिजनेस इनक्यूबेशन सेंटर (ABI) तथा अन्य बाह्य वित्तपोषित प्रसार परियोजनाओं के अंतर्गत संचालित किए जाते हैं।

राष्ट्रीय खाद्य सुरक्षा मिशन (NFSM) के अंतर्गत कुल 2315.4 हेक्टेयर क्षेत्र में अग्रिम पंक्ति प्रदर्शन (FLDs) आयोजित किए गए, जिससे रबी, वसंत एवं खरीफ ऋतुओं में कुल 5308 किसानों को लाभ प्राप्त हुआ। किसान पद्धतियों की तुलना में औसत उपज वृद्धि रबी में 16.7 %, वसंत में 18.0 %, तथा खरीफ में 30.7% रही। अनुसूचित जनजाति घटक (STC) के तहत 2023–24 में 386.8 हेक्टेयर क्षेत्र में FLDs आयोजित किए गए, जिससे 1101 किसानों को लाभ मिला। औसत उपज वृद्धि रबी में 18.2%, वसंत में 9.6%, और खरीफ में 26.8% दर्ज की गई। इसके अतिरिक्त, 44 प्रशिक्षण एवं जागरूकता कार्यक्रमों के माध्यम से 2328 जनजातीय किसानों (जिनमें 480 महिलाएँ शामिल थीं) तक पहुँच बनाई गई, तथा 2024 से अधिक परिवारों को इनपुट वितरण का लाभ प्राप्त हुआ। अनुसूचित जाति उप–योजना (SCSP) के अंतर्गत 230 हेक्टेयर क्षेत्र में FLDs आयोजित किए गए, जिनसे 718 किसानों को लाभ हुआ। औसत उपज वृद्धि रबी में 10.6 %, वसंत में 5.2 %, और खरीफ में 27.5% रही। प्रशिक्षण कार्यक्रमों के माध्यम से 926 किसानों (जिनमें 517 महिलाएँ शामिल थीं) को प्रशिक्षित किया गया और 1420 परिवारों को इनपुट सहायता प्रदान की गई। उत्तर–पूर्वी पर्वतीय क्षेत्र (NEH) घटक के अंतर्गत 100 हेक्टेयर क्षेत्र में FLDs आयोजित किए गए, जिनमें रबी में 37.09 %, वसंत में 49.16 % उपज वृद्धि दर्ज की गई और खरीफ में 483 किसानों को लाभ मिला। कुल 21 कार्यक्रमों के माध्यम से 2946 लाभार्थियों (जिनमें 1877 महिलाएँ शामिल थीं) तक पहुँच बनाई गई और 529 परिवारों को इनपुट्स वितरित किए गए।

एथेनॉल उद्योग की मांगों को ध्यान में रखते हुए इथेनॉल उद्योग जलग्रहण क्षेत्रों में 2024–25 के खरीफ (788 प्रदर्शन) और रबी (727 प्रदर्शन) मौसमों के दौरान 15 राज्यों के 15 क्लस्टरों में कुल 1515 अग्रिम पंक्ति प्रदर्शन (FLDs) आयोजित किए गए, जिनका उद्देश्य इन क्षेत्रों में मक्का उत्पादन को प्रोत्साहित करना था। क्षेत्र–विशिष्ट फ्लायर्स एवं लीफलेट्स के माध्यम से उन्नत मक्का उत्पादन तकनीकों का व्यापक प्रचार–प्रसार किया गया। इसके अतिरिक्त, कुल 126 कार्यक्रमों जिनमें 65 जागरूकता कार्यक्रम, 51 प्रशिक्षण सत्र, और 10 फील्ड दिवस शामिल थे, के माध्यम से एथेनॉल उद्देश्य हेतु गुणवत्ता युक्त मक्का उत्पादन में संलग्न कुल 3582 हितधारकों को प्रभावी रूप से जोडा गया।

मक्का साइलेज मूल्य श्रृंखला परियोजना के तहत पंजाब और हरियाणा में 150 संकरों का मूल्यांकन किया गया। साथ ही, 79 किसानों के खेतों में 52 हेक्टेयर क्षेत्र में अग्रिम पंक्ति प्रदर्शन (FLDs) आयोजित किए गए। इसके अतिरिक्त, क्षमता निर्माण (capacity building) के उद्देश्य से प्रशिक्षण एवं जागरूकता कार्यक्रमों का भी सफलतापूर्वक संचालन किया गया।

## अखिल भारतीय समन्वित मक्का अनुसंधान परियोजना

### 2024 में अधिसूचित किस्में

वर्ष 2024 में वाणिज्यिक खेती के लिए कुल 51 संकरों (हाइब्रिड्स) को अधिसूचित किया गया। इनमें से 32 संकर (18 सार्वजनिक क्षेत्र के एवं 14 निजी क्षेत्र के) फील्ड कॉर्न समूह से, 08 जैवसंवर्धित (बायोफोर्टिफाइड), 04 बेबीकॉर्न, 04 पॉपकॉर्न तथा 03 स्वीटकॉर्न संकर शामिल थे ।

### किस्मों की पहचान

किस्म पहचान समिति (Varietal Identification Committee & VIC) को वर्ष 2024 में कुल 37 प्रस्ताव प्राप्त हुए, जिनमें से 22 प्रस्ताव सार्वजनिक क्षेत्र से और 15 प्रस्ताव निजी क्षेत्र से थे। प्राप्त प्रस्तावों में से 36 प्रस्तावों की पहचान VIC द्वारा की गई।

### पादप प्रजनन प्रजनन (खरीफ)

अखिल भारतीय समन्वित अनुसंधान परियोजना (AICRP) के अंतर्गत खरीफ 2024 में सामान्य मक्का (अगेती, मध्यम एवं देर से परिपक्वता), गुणवत्तायुक्त प्रोटीन मक्का (QPM), स्वीटकॉर्न, बेबीकॉर्न, पॉपकॉर्न एवं OPV के परीक्षणों हेतु कुल 369 प्रविष्टियाँ प्राप्त हुईं। इन प्रविष्टियों में फील्ड कॉर्न की 252, QPM की 59, स्वीटकॉर्न की 20, बेबीकॉर्न की 21 तथा पॉपकॉर्न की 15 प्रविष्टियाँ शामिल थीं। सभी प्रविष्टियों का मूल्यांकन खरीफ 2024 में विभिन्न परीक्षण स्थलों पर किया गया।

### रोग विज्ञान (खरीफ)

AICRP के अंतर्गत पौधा रोगविज्ञान (प्लांट पैथोलॉजी) परीक्षणों का आयोजन पाँच प्रमुख कृषि–जलवायु क्षेत्रों में किया गया। इन परीक्षणों का उद्देश्य मक्का की प्रमुख बीमारियों कि जैसे टरकिकम लीफ ब्लाइट (TLB), मेडिस लीफ ब्लाइट (MLB), बैंडेड लीफ एंड शीथ ब्लाइट (BLSB), चारकोल रॉट (ChR), फ्यूजेरियम स्टॉक रॉट (FSR) और सर्सपोरा लीफ स्पॉट (CLS) के विरुद्ध विभिन्न जीनोटाइप्स की स्क्रीनिंग करना था।

- उत्तरी पहाड़ी क्षेत्र (Northern Hill Zone & NHZ) : ALH 4672 और DIL 372 जीनोटाइप्स ने TLB और MLB के विरुद्ध प्रतिरोध दर्शाया।
- उत्तर पश्चिम मैदानी क्षेत्र (North West Plains Zone & NWPZ) : APMH 2071 और IQPMH 104 प्रविष्टियाँ चारकोल रॉट (ChR) के प्रति प्रतिरोधी पाई गईं।
- उत्तर पूर्व मैदानी क्षेत्र (North East Plains Zone & NEPZ) : अगेती एवं मध्यम परिपक्वता समूहों की प्रविष्टियों ने TLB, BLSB और FSR के प्रति प्रतिरोध दिखाया, जिसमें BML 9 और KDM 9099 ने अच्छा प्रदर्शन किया।
- प्रायद्वीपीय क्षेत्र (Peninsular Zone & PZ) : DKI 9362 और IMH 21257 जीनोटाइप्स ने TLB और CLS के विरुद्ध प्रभावशाली प्रतिरोध प्रदर्शित किया।
- केंद्रीय–पश्चिमी क्षेत्र (Central Western Zone & CWZ) : Harlal 24 और KMH 23101 ने TLB और FSR के विरुद्ध प्रतिरोध दिखाया, जबकि CP 8489 और PMH 23107 ने CLS के प्रति प्रतिरोध दर्शाया।

इन बहु–क्षेत्रीय परीक्षणों ने कई ऐसे प्रतिरोधी मक्का जीनोटाइप्स की पहचान की, जो क्षेत्र–विशिष्ट पर्ण रोगों एवं तनासड़न रोगों के विरुद्ध प्रतिरोध प्रदान करते हैं और जिन्हें भावी प्रजनन कार्यक्रमों में उपयोग किया जा सकता है।

### कीट विज्ञान (खरीफ)

खरीफ 2023 के दौरान, अखिल भारतीय समन्वित अनुसंधान परियोजना के अंतर्गत कीटविज्ञान परीक्षणों में चार परिपक्वता समूहों की 108 मक्का प्रविष्टियों को स्पॉटेड स्टेम बोरर और फॉल आर्मी वर्म विरुद्ध विभिन्न हॉटस्पॉट स्थलों पर स्क्रीन किया गया। पत्ती क्षति रेटिंग के आधार पर इन प्रविष्टियों को प्रतिरोधी, मध्यम प्रतिरोधी तथा संवेदनशील श्रेणियों में वर्गीकृत किया गया। OPV, स्वीटकॉर्न और QPM परीक्षणों में कई प्रविष्टियों में उल्लेखनीय प्रतिरोध पाया गया।

इसके अतिरिक्त, विभिन्न क्षेत्रों में फॉल आर्मी वर्म तथा हेलिकोवर्पा आर्मिजेरा की जनसंख्या गतिकी की नियमित निगरानी की गई। फॉल आर्मी वर्म के प्रभावी नियंत्रण के लिए थायमेथोक्साम. क्लोरान्ट्रानिलिप्रोल का बीज उपचार और फोलियर स्प्रे का संयोजन प्रभावशाली पाया गया। वहीं, स्वदेशी तकनीकी ज्ञान (ITK) पर आधारित उपायों जैसे लोबिया की अंतरफसल, एंटोमोपैथोजेनिक नेमाटोड (EPN) का स्प्रे, तथा नीम आधारित उपचारों के संयोजन से बिना उपचारित प्लॉट्स की तुलना में कीट प्रकोप में उल्लेखनीय कमी देखी गई।

### सस्य विज्ञान (खरीफ)

खरीफ के दौरान मक्का आधारित प्रणालियों पर कृषि संबंधी अनुसंधान परीक्षण विभिन्न परिपक्वता वाले पूर्व–जारी मक्का संकरों के लिए पोषक तत्वों, एकीकृत पोषक तत्व प्रबंधन, सर्वोत्तम खरपतवार प्रबंधन प्रथाओं के विकास, पारंपरिक और उभरती प्रणालियों में फसल अवशेष प्रबंधन और बेबी कॉर्न आधारित प्रणाली की स्थिरता पर केंद्रित थे।

### पादप प्रजनन (रबी)

रबी मौसम के दौरान फील्ड कॉर्न के परीक्षण मध्यम और देर से परिपक्वता समूहों के लिए आयोजित किए गए। मध्यम परिपक्वता समूह में NIVT में 46, AVT-I में 5 और AVT-II में 7 प्रविष्टियाँ सम्मिलित थीं। वहीं, देर से परिपक्वता समूह में NIVT में 26, AVT-I में 8 और AVT&II में 3 प्रविष्टियाँ परीक्षण हेतु प्राप्त हुईं। QPM परीक्षण में QPM I-II-II समूह के अंतर्गत कुल 6 प्रविष्टियों का मूल्यांकन किया गया। स्पेशलिटी कॉर्न परीक्षणों में बेबीकॉर्न, पॉपकॉर्न और स्वीटकॉर्न को शामिल किया गया, जिनमें क्रमशः 7, 4 और 2 प्रविष्टियों का मूल्यांकन किया गया।

### रोग विज्ञान (रबी)

रबी 2023–24 के दौरान AICRP के अंतर्गत प्लांट पैथोलॉजी परीक्षणों का आयोजन उत्तर–पूर्व मैदानी क्षेत्र (NEPZ), प्रायद्वीपीय क्षेत्र (PZ) और केंद्रीय–पश्चिमी क्षेत्र (CWZ) में किया गया। इन परीक्षणों का उद्देश्य प्रमुख मक्का रोगों के विरुद्ध जीनोटाइप्स के प्रतिरोध का मूल्यांकन करना था। विभिन्न परिपक्वता समूहों की कुल 114 प्रविष्टियों को कृत्रिम महामारी परिस्थितियों (artificial epiphytotic conditions) में स्क्रीन किया गया।

इन परीक्षणों में आशाजनक जीनोटाइप्स ने मेडिस लीफ ब्लाइट (MLB), टरकिकम लीफ ब्लाइट (TLB), फ्यूजेरियम स्टॉक रॉट (FSR), चारकोल रॉट (ChR) और सडाउन माइल्ड्यू (SDM) के विरुद्ध प्रभावी प्रतिरोध प्रदर्शित किया। वसंत 2024 में, चारकोल रॉट (ChR) के प्रतिरोध हेतु 65 प्रविष्टियों का परीक्षण किया गया, जिसमें IMH-2-24S-3 ने उत्तर–पश्चिम मैदानी क्षेत्र में उल्लेखनीय प्रतिरोध दिखाया।

ICAR-CIMMYT सहयोग कार्यक्रम के तहत 120 इनब्रेड लाइनों की बहु–रोग प्रतिरोध के लिए स्क्रीनिंग की गई। इनमें से चार प्रविष्टियाँ-SYN 623–29, AP2R–005–0109, AP2R–004–0010 और AP2R–004–0016 को चारकोल रॉट के प्रति मध्यम प्रतिरोधी के रूप में पहचाना गया। क्षेत्रवार परिणामों में BH 417144, DKC 9225 और IMH लाइनों को NEPZ तथा PZ की परिस्थितियों में प्रतिरोधी पाया गया।

## कीट विज्ञान (रबी)

रबी 2023–24 एवं वसंत 2024 के दौरान मक्का AICRP के अंतर्गत कीटविज्ञान परीक्षणों में कुल 322 प्रविष्टियों की प्रमुख कीटों –पिंक स्टेम बोरर, स्पॉटेड स्टेम बोरर, फॉल आर्मी वर्म और शूट फ्लाईकृके विरुद्ध स्क्रीनिंग की गई। इन प्रविष्टियों को पत्ती क्षति रेटिंग और डेड हार्ट (DH) लक्षणों के आधार पर प्रतिरोधी, मध्यम प्रतिरोधी और संवेदनशील वर्गों में विभाजित किया गया।

कृत्रिम प्रकोप की परिस्थितियों में 33 प्रविष्टियों ने पिंक स्टेम बोरर और स्पॉटेड स्टेम बोरर के विरुद्ध प्रभावी प्रतिरोध दिखाया। हैदराबाद और कोयंबटूर में परीक्षण की गई 22 प्रविष्टियों में से 10 प्रविष्टियाँ फॉल आर्मी वर्म तथा 4 प्रविष्टियाँ शूट फ्लाई के प्रति प्रतिरोधी पाई गईं।

प्रबंधन रणनीतियों के तहत, स्वदेशी तकनीकी ज्ञान (ITK) आधारित उपायों एवं नवीन कीटनाशकों जैसे जहरीला चारा. क्लोरान्ट्रानिलिप्रोल का उपयोगकृप्रभावी सिद्ध हुए। साथ ही, हेलिकोवर्पा आर्मिजेरा की निगरानी तथा कीट उत्तराधिकार (pest succession) का अध्ययन भी AICRP परीक्षण स्थलों पर किया गया, जिससे एकीकृत कीट प्रबंधन रणनीतियों के विकास को दिशा मिल सके।

## सस्य विज्ञान (रबी)

रबी और वसंत ऋतु में, विभिन्न परिपक्वता वाले पूर्व–जारी मक्का संकरों द्वारा पोषक तत्वों के प्रति प्रतिक्रिया के अलावा, वसंत मक्का के लिए बुवाई समय के अनुकूलन, वसंत मक्का में जल उपयोग दक्षता में वृद्धि, और मक्का प्रणालियों में सर्वोत्तम जल प्रबंधन पर अध्ययन किया गया।

# Executive Summary

## CROP IMPROVEMENT

### Popularization of Biofortified hybrids

LQMH 1, a released bio-fortified hybrid was demonstrated at farmers' fields in >50 hectacre land in HP, J&K, WB and Assam during *kharif* 2024 and *Rabi* 2023-24. The yield ranged from 6.0-8.5 t/ha (*kharif*) to up to 10.5 t/ha (*Rabi*). This hybrid has been taken up by the 6 different private seed companies and has received significant DAC breeder seed demands since its release.

### Commercialization and seed production of IIMR hybrids

In the past six years, the IIMR has developed and released 29 hybrids. Currently, seven of those have been commercialized by signing 39 MoUs with 27 different seed companies. For the last four years, ICAR-IIMR hybrids have remained on top in the country's DAC maize breeder seed demand with their share ranging from 26.6 to 62.4 %.

### Hybrids released/notified by the institute

Three field corn hybrids,viz.,IMH 229, IMH 230 and IMH 231and one male sterile baby corn hybrid (IBCH 402) were released by the 92$^{nd}$ meeting of Central Sub-Committee on Crop Standards, Notification and Release of Varieties for Agricultural Crops (CSS on CSN&R VAC) and notified vide Gazette Notification no. S.O 4388(E) Dt: 08-10-2024. Three QPM hybrids, namely IQMH 206, IQMH 207 and IQMH 208; were identified by Varietal Identification Committee during 67$^{th}$ Annual Maize Workshop held at PJTSAU, Hyderabad.

### Hybrids promoted in AICRP and state trial

Two field corn hybrids were promoted from AVT-I (*Rabi*-2023-24) to AVT-II (*Rabi*-2024-25), one field corn hybrid was promoted from AVT-I (spring 2024) to AVT-II (spring 2025). Two field corn hybrids were promoted from NIVT (*kharif* 2023) to AVT-I (*kharif* 2024), one field corn hybrids was promoted from NIVT (*Rabi*-2023-24) to AVT-I (*Rabi*-2024-25). Five QPM hybrids were promoted for testing in AVT-II and six hybrids for testing in AVT-I during *kharif* 2024. Three hybrids enriched in lysine, tryptophan and zinc were promoted to AVT-I and one hybrid promoted to AVT-II for Kharif 2024 and *Rabi* 2024-25 AICRP trials, respectively. Two waxy corn hybrids with high amylopectin content were promoted from AVT-I to AVT-II. One CMS based baby corn hybrid IBH 11-223 was promoted from AVT I to AVT II in four zones NHZ, NEPZ, PZ and CWZ in *kharif* 2024 season. In Bihar, one hybrid is under 2$^{nd}$ year of testing (*Rabi*-2023-24 to 2024-25), and another hybrid is under 3$^{rd}$ year of testing (*kharif*-2023 to 2024). One white hybrid was promoted to 3$^{rd}$ year of testing in the Gujrat during *kharif* 2024.

### Heterotic grouping of maize genotypes

A set of 115 inbred lines was crossed with LM 13 & 14 and crosses were evaluated for three years during *Rabi* season at RMR&SPC, Begusarai; 18 lines were classified in Gr-A (negative SCA with LM 13) and 37 lines in Gr-B (negative SCA with LM 14). Further, a set of 103 inbred lines was crossed with LM 13 & 14 and 206 crosses were evaluated under normal and drought stress for two years; 15 lines were classified in Gr-A and 33 lines in Gr-B. A set of 108 inbred lines was crossed with LM 13 & 14 and 216 crosses were evaluated under normal and waterlogging stress for two years, 23 lines were classified in Gr-A whereas 29 lines in Gr-B. A set of 153 Inbred lines was crossed with LM 13 & 14 and 306 crosses were evaluated for two years; 31 lines

were classified in Gr-A whereas 45 lines in Gr-B.A set of 108 inbred lines was crossed with LM 13 & 14 and 216 crosses were evaluated under normal and heat stress environment at two locations; 34 were classified in Gr-A and 28 lines in Gr-B.

**Breeding for abiotic stress**

A set of 120 L x T and diallel experimental hybrids was evaluated under in waterlogging stress environment during Kharif-2023, 30 hybrids out yielded the best check hybrids waterlogging environment. Another set of 175 L x T and diallel experimental hybrids was evaluated under cold stress environment during *Rabi*-2023-24. Thirty-one hybrids out yielded the best check hybrids and only one hybrid was found with >10% yield superiority over best check.

**Breeding for biotic stress**

A set of 100 inbred lines was evaluated during *kharif*-2020, 2021 & 2023 at Ludhiana and Karnal; 31 inbred were found moderately resistant and 26 moderately susceptible. Further, a set of 100 inbred lines was evaluated during *kharif*-2023 at Ludhiana and Karnal; five inbreds MIL 2-428-2, MIL 2-511-1, MIL 2-941-3, MIL 2-3470 and EI 670 have shown resistant reaction against BLSB. Another set of 127 inbreds in Spring 2023, 100 inbreds in *kharif* 2023 and 85 inbreds in *kharif*-2024 were evaluated at Ludhiana. Four inbreds MIL-2-164-1, MIL-2-201-1, MIL-2-941-1 and MIL-2-1587 showed comparatively good performance and disease score. Another, 30 baby corn inbreds lines were screened against the charcoal rot during spring seasons of 2023 and 2024. BIL-23-78 was found consistently resistant in both the seasons.

**Specialty corn breeding**

A total 140 CMS based experimental baby corn hybrids which were evaluated in *kharif* season 2023, among the total 140 experimental hybrids 4 hybrids showed superiority over both the checks in terms of baby corn yield without husk.

A total of 39 wild crosses have been attempted with three wild species (*Zea mexicana*, *Zea parviglumis* and Coex) to diversify the existing maize germplasm for various biotic and abiotic traits and also for fodder traits. A total of 168 doubled haploids (DH) lines were generated from promising segregating lines obtained after two generations of random matin in wild populations, using inbreds UMI 1201, UMI 1210 and in wild species *Zea parviglumis*.

The leafy mutant has extra advantage as having a greater number of leaves above the cob which provides the more biomass and less lignin content which ultimate enhance the digestibility, Hence, using this mutant one leafy hybrid has been developed which is having yield equivalent to check (8.6 t/ha) and 10 leaves above the cob. The hybrid is at the initial stage and will be more suitable for silage purposes. Total seven improved fodder population/composites contributed to AICRP on forage trial *kharif*, 2024.

**Breeding for quality traits**

A panel of 250 inbred lines was characterized for lysine, tryptophan and methionine content at two locations. The genotypes were subjected to GBS analysis. GWAS analysis, of panel identified 21, 28 and 13 MTAs (marker trait association) for kernel method in environment 1, 2 and combined, respectively.

A set of differentially expressed genes (DEGs) have been identified through transcript one profiling for iron and zinc accumulation in kernels and shoots. Total of 795, 4500, and 954 genes were found differentially expressed for high

Zn, Fe and Zn+Fe accumulation, respectively in kernels. 88 new inbred lines were developed from pedigree crosses of high zinc lines as pollen parent and elite inbred lines of national maize programme. These were used in crossing programme to develop 302 experimental hybrids, which were evaluated at three different locations during 2024. Some selected hybrids such as IQH 7-213, IQH 7-451, IMH 7-641, IQH 7-122, and IMH 7-126 were showing zinc content more than the benchmarks (> 35ppm) in all three locations.

The panel consisting of 226 inbred lines were evaluated for kernel starch at two locations. GWAS analysis identified 36 SNPs significantly associated with total starch content through MLM, 36 SNPs by CMLM, 64 SNPs by FarmCPU and 64 SNPs by BLINK. A sum of 145 candidate genes were identified among which 81 candidate genes were detected by all four models.

## BASIC SCIENCES

### Standardization of genome editing protocol through PDS gene in maize

In order to standardize genome editing in maize, phytoene desaturase gene has been taken as it produces albino phenotype which is easy to score. Explants derived calli from maize genotype DMRH 1308 have been taken for this purpose.

### Evaluation for callus induction and regeneration traits in maize

To decipher callus induction and regeneration traits in maize, Recombinant Inbred Line populations from BML 6, HKI 163 and BML 6 IML 418-1 have been developed and are currently being phenotyped for the two traits.

### Screening for starch content in maize germplasm

Assessment of starch content in different maize genotypes grown under different environments is being done. An overall range of 50.9% to 65.9% starch has been obtained for the germplasm.

### Assessment of maize Nitrogen Use Efficiency

To decipher factors responsible for Nitrogen Use Efficiency in maize, a set of genotypes was grown at variable nitrogen doses, viz., N-zero, N-half and N-full. The activities of two key enzymes responsible for nitrogen metabolism, viz., Nitrate reductase and Glutamate synthase have been assayed for maize grown under different conditions.

## CROP PRODUCTION

### Assessment of conservation agriculture-based maize-wheat cropping system on soil health and input use efficiency

Seven years of experimentation showed that the maize–wheat system significantly outperformed the rice–wheat system in terms of productivity, water-use efficiency, and profitability. It reduced water use by up to 84% and improved system productivity by 30% and profitability by 71%. The conservation agriculture-based maize–wheat–mungbean system recorded the highest soil organic carbon buildup, net return and benefit-cost ratio compared to conventional maize–wheat–mungbean and rice–wheat–mungbean systems. Fertilizer management using Green Seeker sensors resulted in significantly higher net returns over farmer practice and RDF, performing on par with SSNM.

### Best production practices for enhanced productivity and profitability in maize-based cropping system

Field evaluations in Punjab and Haryana during the *kharif* season showed that pneumatic

planting increased maize yield by 18.5% and 33.3% over raised bed and flat planting, respectively. Raised bed planting also yielded 12.5% more than flat planting, with pneumatic planting achieving yields up to 8.8 t/ha and averaging 6.4 t/ha.

### Study of different organic nutrient sources in maize and spatiality corn

After seven years, yields across all maize types were significantly higher under recommended dose of fertilizers (RDF) compared to 100% farmyard manure (FYM). In specialty corn, the yield under the 25% FYM + 25% vermicompost + 1/3 straw treatment initially declined in the 3rd and 4th years but began to recover in subsequent years.

### Application of image analysis for area, yield and stress estimation in maize

Maize is widely cultivated across India with distinct seasonal and regional patterns. During the *kharif* season, it dominates in central and peninsular states like Madhya Pradesh, Maharashtra, Karnataka, Telangana, and Rajasthan. In the *Rabi* season, cultivation shifts to southern and eastern states such as Andhra Pradesh, Telangana, Karnataka, Bihar, and West Bengal, indicating its rising importance as a winter crop. In terms of production, Madhya Pradesh leads, followed by Karnataka, Maharashtra, Rajasthan, and Telangana. *Rabi* maize production is strong in eastern and southern states due to favourable winter conditions and irrigation, with several districts producing over 5 lakh tonnes.

### Zinc uptake dynamics and hybrid response in maize

A study on 25 maize hybrids under three zinc application strategies found that 1% foliar spray significantly improved zinc uptake, plant height, and yield. IMH 228 showed both high zinc uptake and high yield, making it ideal for biofortification. IMH 222 and IMH 224 yielded well despite medium to low uptake, indicating efficient zinc use. Some hybrids had high uptake but low yield, while others like PAC-741 and IMH 226 balanced medium uptake with high yield. These results aid in selecting nutrient-efficient, high-performing hybrids for zinc-deficient conditions.

## CROP PROTECTION

### Pathology

A total of 42 *Bipolaris maydis* isolates showing maydis leaf blight symptoms were collected from 35 locations across 18 maize-growing Indian states. Morphological studies revealed considerable variation in conidial length, width, and septation among the isolates, with lengths ranging from 30.4 µm to 91.7 µm. Pathological variability was studied using different maize genotypes with varied cytoplasmic male sterility (CMS) backgrounds. Preservation techniques like paper disc and glycerol stocks were employed for long-term storage. For turcicum leaf blight, molecular studies showed that 30 out of 61 isolates belonged to *Exserohilum rostratum* instead of *E. turcicum*. ITS profiling and sequencing confirmed the presence of mixed or complex infections in TLB samples. Pathogenicity tests and morphological validation, including spore imaging, were conducted to confirm *E. rostratum* as a causal organism.

### Entomology

Screening for resistance against spotted stem borer (*Chilo partellus*) during *Kharif* 2024 identified 9 resistant and 121 moderately resistant

maize genotypes out of 211. In *Rabi* 2023-24, 200 genotypes were screened against pink stem borer (*Sesamiainferens*), and five were found resistant while 86 were moderately resistant. A total of 224 and 179 maize genotypes were evaluated against fall armyworm (*Spodoptera frugiperda*), resulting in 3 resistants and 88 moderately resistant lines. Morpho-biochemical studies revealed that resistance to fall armyworm was associated with high trichome density, leaf toughness, and specific biochemical markers. Resistant genotypes showed lower leaf damage, higher levels of total phenols, lignin, and potassium, and reduced sugar and nitrogen content. Phyto-hormonal profiling indicated that resistant genotypes like CML 67 had significantly higher Jasmonic acid (JA) and JA-Ile levels pre- and post-infestation. These findings highlight the role of structural, biochemical, and hormonal traits in developing insect-resistant maize varieties.

## EXTENSION AND OUTREACH

The institute engages with farmers and other stakeholders through various programs, including Frontline Demonstrations (FLDs) sponsored by the Department of Agriculture and Cooperation, Government of India, under the National Food Security Mission (NFSM), Scheduled Tribe Component (STC), North Eastern Hill (NEH) component, Scheduled Caste Sub Plan (SCSP), Agribusiness Incubation Centre (ABI), other externally funded outreach. Under the NFSM FLDs, Front Line Demonstrations (FLDs) were conducted on a total of 2315.4 hectares, benefiting 5308 farmers across *Rabi*, spring, and *kharif* seasons. The average yield gain over farmer practices was 16.7% during the *Rabi* season, 18.0% in the spring, and 30.7% in the kharif season. Under STC during 2023–24, FLDs were conducted on 386.8 ha, benefiting 1101 farmers, with average yield gains of 18.2% in *Rabi*, 9.6% in spring, and 26.8% in *kharif*. Additionally, 44 training and awareness programs reached 2328 tribal farmers (including 480 women), and over 2024 households benefited from input distribution. Under SCSP, FLDs on 230 ha benefited 718 farmers with yield gains of 10.6% (*Rabi*), 5.2% (spring), and 27.5% (*kharif*). Training and input support reached 926 farmers (517 women) and 1420 households respectively. Under the NEH component, FLDs covered 100 ha with yield gains of 37.09% (*Rabi*) and 49.16% (spring), benefiting 483 farmers in *kharif*. A total of 21 programs reached 2946 beneficiaries (including 1877 women), and 529 households received inputs. To enhance maize production in ethanol industry catchment areas, 1515 demonstrations were conducted during *kharif* (788) and *Rabi* (727) 2024–25 across 15 clusters in 15 states. Improved maize practices were promoted through region-specific flyers and leaflets. A total of 126 programmes—including 65 awareness events, 51 trainings, and 10 field days—engaged 3582 stakeholders involved in quality maize production for ethanol. Under the maize silage value chain project in Punjab and Haryana, 150 hybrids were evaluated, 52 ha FLDs conducted across 79 farms and capacity building programmes were also conducted.

# CROP IMPROVEMENT

I Chapter

The major activities under crop improvement include development of high yielding maize hybrids, improvement of parental lines, germplasm enhancement for resistance to biotic and abiotic stresses and improvement of quality traits to meet the changing climate and market demand.

## Popularization of Biofortified hybrids

LQMH 1, a released bio-fortified hybrid was demonstrated at Himachal Pradesh, Jammu & Kashmir, West Bengal and Assam farmers' fields in >50 acres land during *Rabi* 2023-24 and *kharif* 2024. It has performed very well in all the states with yield range from 6.0-8.5 t/ha (*kharif*) to upto 10.5 t/ha in the *Rabi*. This hybrid has been taken up by the 6 different private seed companies and has received significant DAC breeder seed demand since its release. All the indented quantities have been lifted so far by different seed producer organizations.

## Efforts on commercialization and seed production with estimated hybrids impact

In the past six years, the ICAR-Indian Institute of Maize Research has developed and released 32 hybrids. Currently, seven of these have been commercialized by signing 38 MoUs with 20 different seed companies. For the last four years (2021-22 to 2024-25), ICAR-IIMR hybrids have remained on top in the country's DAC maize breeder seed demand with their share ranging from 26.6 to 62.4 %. During 2024, DMRH 1308, DMRH 1301 and LQMH 1 received adequate breeder seed demand (25.9% of the total indent) from DAC, Govt. of India. Two more new hybrids such as IMH 221 (DMRH 1417, SMH 5) and IBCH 401 of ICAR-IIMR hybrids have entered in DAC breeder seed demand this year.

Over the past four years, DMRH 1308 has consistently remained on 1st rank in the country's DAC maize breeder seed demand with a share ranging from 20.1 to 34.9%. Considering the criteria for calculating coverage (minimal figures) using the DAC breeder seed supplied, this hybrid has been potentially cultivated on nearly 1 million hectares of land since its release in 2017.

DMRH 1308 has been taken up by 11 different private seed companies through signing of MoUs with the Institute. Since its release, 4628 Kg of breeder seed has gone into the seed chain through DAC and the remaining 28565 Kg through non-DAC channels, such as directly from institutes or through other Govt. agency partners. For DMRH 1308, a breeder seed indent of 2745 kg has been received through DAC for *kharif* 2025. This is highest among all available hybrids. In addition, DMRH 1301 released in 2017 covers nearly 4.5 lakh hectares, and LQMH 1 (released in 2020) covers nearly 0.70-1.0 lakh hectares.

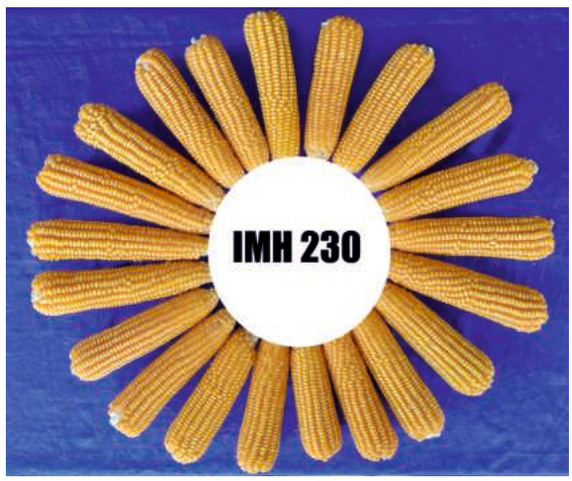
DMRH 1301, has also received significant demand through DAC. Through DAC, total 1837 Kg of breeder seed demand has been obtained and supplied for DMRH 1301. In addition, 4345 Kg of parental seed demand has been met through non-DAC channels, such as directly through institutes and other partners. For *kharif* 2025, a breeder seed indent of 135 kg has been received through DAC. So far, this hybrid has been taken up by 11 different private seed companies by signing MoUs with IIMR. The QPM hybrid, LQMH 1 released in 2020 is also gaining popularity among farmers and receiving substantial amounts of seed demand through DAC (320 kg for 2024) and directly from the institute or Govt agency partners (300 kg). For *kharif* 2025, a breeder seed indent of 393 kg has been received through DAC for LQMH 1. So far, six seed companies have taken up LQMH 1. Another biofortified hybrid IQMH 203, notified in 2021 has been taken up by two different

privates seed companies and started receiving significant amount of breeder seed demand through DAC. Furthermore, ICAR-IIMR is producing hybrid seeds for institute cultivars in a participatory manner with state seed corporations such as WBSSC, National seed corporations, cooperatives and SME's. Over the past five years, around 26175 quintals of hybrid seed (F1) have been produced, where IIMR provided breeders seed and technical advice to seed growers both on- and off-farm for quality seed production. From a total of 26175, the 16154 quintals of hybrid seed were produced for DMRH 1308, 8781 for DMRH 1301, 1000 for IQMH 203 and 240 quintals for LQMH 1. Further, nearly 20000 quintals of hybrids seed production has been taken up with the collaborator for year 2024-25 of which maximum is for DMRH 1308 (95%). The hybrid-wise details of parental seeds supplied into the seed chain is given in *Table 1.1*.

## Hybrids released by the institute

Two field corn hybrids, *viz*. , IMH 230 (IMHSB 20R-6) and IMH 231(IMHSB 20K10) were developed. These hybrids were released in the 92nd meeting of Central Sub-Committee on Crop Standards, Notification and Release of Varieties for Agricultural Crops (CSS on CSN&R VAC) and notified vide Gazette Notification no. S.O 4388(E) Dt: 08-10-2024.

**IMH 230:** This is a medium maturity single cross field corn hybrid for cultivation during *Rabi* season in Eastern UP, Bihar, Jharkhand, Orissa and west Bengal. It has grain yield of 9.24 t/ha and has shown significant yield superiority (25.59%) over the relevant best check in North-Eastern Plain Zone. This hybrid has conico-cylindrical long ears with semi-flint yellow kernels, moderately resistant to Stem borer *(Chilo partellus)* and Fall armyworm *(Spodoptera frugiperda)* insects. This hybrid is also moderately resistant to Maydis leaf blight, Charcoal rot and Turcicum leaf blight diseases. The hybrid is tolerant to lodging and responsive to high inputs. The female parent of the hybrid has higher seed productivity.




**IMH 231:** This is a medium maturity single cross field corn hybrid released for cultivation during *kharif* season in Eastern UP, Bihar, Jharkhand, Orissa and west Bengal. It has grain yield of 7.028 t/ha and has shown significant yield superiority (12.49%) over the relevant best check in North Eastern Plains Zone. This hybrid has conico-cylindrical semi-dent yellow kernels, moderately resistant to Stem borer *(Chilo partellus)* and Fall armyworm *(Spodoptera frugiperda)* insects. This hybrid is also moderately resistant to Maydis leaf blight, Turcicum leaf blight, and resistant FSR diseases. The hybrid is tolerant to lodging and responsive to high inputs.

## Table 1.1: Year-wise total breeder seeds* produced and supplied (kg) for ICAR-IIMR hybrids.

| Particular | Year wise breeder seeds produced and supplied (kg) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Parents of hybrids | **2018-19** | **2019-20** | **2020-21** | **2021-22** | **2022-23** | **2023-24** | **2024-25** | **Total** |
| **Female of DMRH 1301 & 1308** | 1110.0 | 188.0 | 2212.0 | 5542.0 | 4085.0 | 6157 | 8680 | 27974 |
| **Male of DMRH 1301** | 295.0 | 60.0 | 725.0 | 200.0 | 385.0 | 183 | 49 | 1897 |
| **Male of DMRH 1308** | - | - | 429.0 | 1895.0 | 2069.0 | 2415 | 2696 | 9504 |
| **Female of DMRH 1305** | - | 20.0 | 40.0 | - | - | - | | 60 |
| **Male of DMRH 1305** | - | 10.0 | 20.0 | - | - | - | | 30 |
| **Female of LQMH 1** | - | - | - | 30.0 | 45.0 | - | 455 | 530 |
| **Male of LQMH 1** | - | - | - | 15.0 | 15.0 | - | 230 | 260 |
| **Female of IMHB 1539** | - | - | 10.0 | - | - | - | - | 10 |
| **Male of IMHB 1539** | - | - | 5.0 | - | - | - | - | 5 |
| **Female of LPCH 3** | - | - | - | 5.0 | - | - | - | 5 |
| **Male of LPCH 3** | - | - | - | 2.5 | - | - | - | 2.5 |
| **Female of IMHB 1532** | - | - | 30.0 | - | - | - | - | 30 |
| **Male of IMHB 1532** | - | - | 10.0 | - | - | - | - | 10 |
| **Female of IQMH 203** | - | - | - | 20 | - | 32 | 186 | 238 |
| **Male of IQMH 203** | - | - | - | 10 | - | 30 | 134 | 174 |
| **Female of IMH 224** | - | - | - | - | - | 0.5 | 75 | 75.5 |
| **Male of IMH 224** | - | - | - | - | - | 0.5 | 40 | 40.5 |
| Grand total | **1405** | **278** | **3481** | **7719.5** | **6599** | **8818** | **12545** | **40845.5** |

**Note***:1. During 2021-22, 2794 Kg, during 2022-23, 160 Kg, in 2023-24, 510 kg, during 2024-25, 1400 Kg female line seed of DMRH 1308 was produced and sold @ breeder seed price through AICRP on Maize Hyderabad. 2. During 2021-22, 783 Kg, in 2022-23, 3174 Kg, in 2023-24, 6600 Kg and in 2024-25,6200 Kg parental lines seed of DMRH 1308 and 300 Kg of LQMH 1 in 2024-25 and 150 Kg of DMRH 1301 in 2023-24 was produced and sold @ foundation seed price through Zonal Adaptive Research Station Krishnagar Farm, Nadia WB. Rest of the quantity was produced at IIMR Farm Begusarai Bihar. For 2025-26, the advance DAC demand received from DAC Govt. of India for DMRH 1308, DMRH 1301 and LQMH 1 has been mentioned. It will be ready by May 2025 as is being produced in *Rabi* 2024-25.

## QPM Hybrids identified

Three QPM hybrids, namely IQMH 206, IQMH 207 and IQMH 208 were identified by Varietal Identification Committee during 67th Annual Maize Workshop held at PJTSAU, Hyderabad.

**IQMH 206:** This hybrid has a yield potential of 5757 kg/ha. The hybrid has been identified for cultivation in Zone III (NEPZ) including Bihar, Jharkhand, Odisha, West Bengal and Eastern UP.




**IQMH 207:** This hybrid has a yield potential of 8174 kg/ha in zone-II including Punjab, Haryana, Western UP, Delhi and Plains of Uttarakhand and yield potential of 5919 kg/ha in zone-III including Bihar, Jharkhand, Odisha, West Bengal and Eastern UP.

**IQMH 208:** This hybrid has a yield potential of 6791 kg/ha. The hybrid has been identified for cultivation in Zone V (CWZ) including Rajasthan, MP, Chhattisgarh and Gujarat.

## Baby corn hybrids identified

**IBCH 402 (IBH 11-227):** It is CMS baby corn hybrid and EDV version of IMHB 1539 identified for release in varietal identification committee held in 67th Annual Maize Workshop at Professor Jayashankar Telangana Agricultural University, Hyderabad (May 8 to 10, 2024) and gazette notification S.O. 4388 (E) Sl. No. 86, Dated October 8, 2024. It is a CMS based baby corn hybrid that does not require detasseling and is recommended for NHZ zone (Jammu & Kashmir, Himachal Pradesh, Uttarakhand (Hill region), Meghalaya, Sikkim, Assam, Tripura, Nagaland, Manipur and Arunachal Pradesh). The Yield of the hybrid is 7064 kg/ha (with husk) and without husk yield is 1845 kg/ha. The hybrid does not require detasseling as it is male sterile. It is also moderately resistant against TLB and BLSB. The hybrid is also moderately resistant to spotted stem borer and fall armyworm. The colour of the baby corn is golden yellow.

**Export quality:** The 5 kg baby corn hybrid sample of IBCH 402 provided to Airtel field fresh, Ladhowal, Ludhiana to check the export quality as the company exporting baby corn in various countries. The quality of our baby corn hybrid was good. A total of 2 kg sample used to estimate the export quality. The export quality (recovery %) was 12.1 % which was equivalent to leading Syngenta hybrid G 5417.

## Hybrids promoted under AICRP testing

### Hybrid promoted in AICRP- Field corn

- A single cross medium maturity hybrid entry i.e. IMHSB 20R-3 completed three years (2020-21, 2022-23 & 2023-24) of evaluation in AICRP Trials for *Rabi* season and was found to be 20.51% superior over the best check hybrid.
- A single cross medium maturity hybrid i.e. IMHSB 19K-11 completed three years (2021,2022, 2024) of evaluation in state

Varietal Trials of Bihar for *Kharif* season and was found to be 13.39% superior over the best check hybrid.

- A single cross medium maturity hybrid entry IMH 2-20R-16 completed three years (2021-22, 2022-23, 2023-24) of evaluation in state Varietal Trials of Bihar for *Rabi* season and was found to be 11.18% superior over the best check hybrid Following field corn hybrid, entries were promoted in the AICRP and state trials. The details are given in the *Table 1.2*.

**Table 1.2 Hybrid promoted in different AICRP trials**

| S. no. | Name of hybrid | Type of hybrid | Trial | Promoted to | Maturity | Zone | Yield (q/ha) | Superiority (%) |
|---|---|---|---|---|---|---|---|---|
| AICRP on maize rabi 2023-24 to rabi-2024-25 | | | | | | | | |
| **1** | IMH 2-22R-10 | Field Corn | AVT-I | AVT-II | Medium | NEPZ (Zone-3) | 9.959 | 12.90 |
| | | Field Corn | AVT-I | AVT-II | Medium | PZ (Zone 4) | 11.027 | 3.32 |
| **2** | IMH 2-22R-4 | Field Corn | AVT-I | AVT-II | Medium | NEPZ (Zone-3) | 9.525 | 7.98 |
| AICRP on maize Spring 2024 to Spring 2025 | | | | | | | | |
| **3** | IMHSB 19R-8 | Field Corn | NIVT | AVT-I | Medium | NWPZ (Zone-2) | 9.78 | 0.65 |
| **4** | IMH 2-22R-2 | Field Corn | AVT-I | AVT-II | Medium | NWPZ (Zone-2) | 10.678 | 0.14 |
| AICRP on maize kharif 2023 to kharif 2024 | | | | | | | | |
| **5** | IMH2 23K-6 | Field Corn | NIVT | AVT-I | Medium | NHZ (Zone 2) | 9.165 | 4.1 |
| | | Field Corn | NIVT | AVT-I | Medium | NEPZ (Zone-3) | 7.276 | 2.0 |
| | | Field Corn | NIVT | AVT-I | Medium | PZ (Zone 4) | 10.126 | 2.7 |
| **6** | IMH 2-23K-5 | Field Corn | NIVT | AVT-I | Medium | NEPZ (Zone-3) | 9.191 | 1.4 |
| State Varietal Trial of Bihar (Rabi-2023-24 to 2024-25) | | | | | | | | |
| **7** | IMH2-2 | Field Corn | 1st year | 2nd year | Medium | Bihar | 11.41 | 14.10 |
| State Varietal Trial of Bihar (Kharif-2023 to 2024) | | | | | | | | |
| **8** | IMH 2-22K-23 | Field Corn | 2nd year | 3rd year | Medium | Bihar | 58.14 | 15.70 |

### Hybrid promoted - QPM

Five QPM hybrids namely, IQPMH 2205, IQPMH 2204, IQPMH 2203, IQPMH 2113, IQPMH 2114 have been promoted for testing in AVT-II and six hybrids for testing in AVT-I during *kharif* 2024. The details of these hybrids alongwith promoted zones is given in *Table 1.3*.

**Table 1.3 QPM hybrids promoted in different AICRP trials**

| S. No. | Hybrid | Grain Yield (t/ha) | | | Advanced to AVT I/AVTII |
|---|---|---|---|---|---|
| | | Hybrid | Best Check | | |
| 1 | IQPMH 2205 | 8.68<br>5.93<br>9.86 | 8.14 (IQMH 202)<br>5.60 (HQPM 1)<br>9.43 (IQMH 203) | Zone-II<br>Zone-III<br>Zone-IV | AVT-II |
| 2 | IQPMH 2204 | 10.15<br>9.07 | 9.43 (IQMH 203)<br>7.69 (LQMH 1) | Zone-IV<br>Zone-V | AVT-II |
| 3 | IQPMH 2203 | 7.69 | 7.69 (LQMH 1) | Zone-V | AVT-II |
| 4 | IQPMH 2113 | 5.67<br>8.53 | 5.60 (HQPM 1)<br>7.69 (LQMH 1) | Zone-III<br>Zone V | AVT-II |
| 5 | IQPMH 2114 | 8.09<br>6.23 | 7.69 (LQMH 1)<br>5.60 (HQPM 1) | Zon-V<br>Zone-III | AVT-II |
| 6 | IQPMH 2310 | 8.31<br>5.78 | 8.14 (IQMH 202)<br>5.60 (HQPM 1) | Zone-II<br>Zone-III | AVT-I |
| 7 | IQPMH 2311 | 5.61<br>8.45 | 5.60 (HQPM 1)<br>7.69 (LQMH 1) | Zone-V<br>Zon-V | AVT-I |
| 8 | IQMH 2302 | 5.62 | 5.60 (HQPM 1) | Zone-III | AVT-I |
| 9 | IQMH 2303 | 5.72 | 5.60 (HQPM 1) | Zone -III | AVT-I |
| 10 | IQMH 2305 | 7.72 | 7.69 (LQMH 1) | Zon-V | AVT-I |
| 11 | IQMH 2307 | 5.95 | 5.60 (HQPM 1) | Zone-III | AVT-I |

### Hybrids promoted - high zinc

Three hybrids enriched in lysine, tryptophan and zinc content, namely IQH 7-215, IQH 7-219 and IQH 7-225 have been promoted to AVT-I (2nd Year of testing) and one hybrid, namely IQH 7-219 has been promoted to AVT-II (Final year of testing) for *kharif* 2024 and *Rabi* 2024-25 AICRP trials, respectively. These entries have secured their rank in top entries during *Kharif* (with yield 6.0-8.45 t/ha) and *Rabi* (8-10 t/ha) AICRP testing. Along with QPM traits, IQH 7-215 and IQH 7-219 were found continuing high Zinc content (>35ppm) as well.

### Hybrid promoted - waxy corn

Two waxy corn hybrids with high amylopectin content were promoted from AVT-I to AVT-II. The details of these hybrids are given in *Table 1.4*.

**Table 1.4 Waxy corn hybrids promoted in different AICRP trials**

| S. no. | Name of hybrid | Type of hybrid | Trial | Promoted to | Maturity | Zone | Yield (q/ha) |
|---|---|---|---|---|---|---|---|
| **1** | IMH 10-292wx1 | Waxy corn | AVT-I | AVT-II | Medium | NEPZ,<br>NWPZ | 55.21<br>81.99 |
| **2** | IMH 10-282wx1 | Waxy corn | AVT-I | AVT-II | Late | CWZ | 58.04 |

## Hybrid promoted - Baby corn

Another CMS based baby corn hybrid IBH 11-223 was promoted from AVT I to AVT II in four zones NHZ, NEPZ, PZ and CWZ in *kharif* 2024 season with a superiority of 8.7, 14.3, 5.2 and 15.8, respectively.

## Hybrid promoted in state trial- white maize

As white maize is widely grown in Gujrat, two white maize (IMH 10-23K1 and IMH 10-23K2) were contributed for 2nd year testing in the state trial of Gujrat during *kharif* 2024. Out of these two hybrids, IMH 10-23K2 recorded significantly higher yield (5.8 t/ha) than the check hybrid and was promoted for third year of testing.

## Heterotic grouping of maize genotypes

### Heterotic grouping of maize inbred lines (Normal environment)

A set of 115 Inbred lines was crossed with LM 13 & 14 and crosses were evaluated for three years during *Rabi* season (2020-21, 2021-22 & 2022-23) at RMR & SPC, Begusarai for heterotic grouping of inbred lines. Based on pooled analysis and the Mean, GCA & SCA, 18 lines showed negative SCA with LM 13 whereas 37 lines shown negative SCA with LM 14 across three years (Table 1.2). Therefore, 18 inbreds in heterotic group "A" and 37 inbreds in heterotic group "B" were classified. However, on the basis of HSGCA (full form), 32 inbreds in heterotic group "A" and 39 inbreds in heterotic group "B" were classified. Ranking of inbreds was also done on the basis of HSGCA values with opposite tester and top ten inbreds in each group were selected for constitution of heterotic base population to develop next generation inbreds.

**Table 1.5: Heterotic grouping of inbred lines based on Mean, GCA, SCA & HSGCA under normal environment.**

| Heterotic Group A (Negative SCA with LM 13) | | | | | | Heterotic Group B (Negative SCA with LM 14) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sl. No. | Inbred | Line Mean | GCA | SCA | HSGCA (LM 14) | Sl. No. | Inbred | Line Mean | GCA | SCA | HSGCA (LM 14) |
| 1 | MIL 2-1624 | 10.447 | 1.835 | -0.422 | 2.257 | 1 | MIL 2-1625 | 11.333 | 2.721 | -1.561 | 4.283 |
| 2 | MIL 2-1620 | 10.417 | 1.805 | -0.210 | 2.015 | 2 | MIL 2-1062-1-2 | 11.070 | 2.459 | -1.125 | 3.584 |
| 3 | MIL 2-1601 | 8.863 | 0.251 | -1.354 | 1.605 | 3 | MIL 2-2083 | 10.406 | 1.794 | -0.923 | 2.717 |
| 4 | MIL 2-1623 | 9.785 | 1.174 | -0.307 | 1.481 | 4 | MIL 2-1292-2 | 9.900 | 1.288 | -1.064 | 2.352 |
| 5 | MIL 2-2039 | 9.598 | 0.987 | -0.377 | 1.364 | 5 | MIL 2-1627 | 10.249 | 1.638 | -0.689 | 2.327 |
| 6 | MIL 2-173-2 | 9.312 | 0.700 | -0.661 | 1.361 | 6 | MIL 2-1521 | 9.698 | 1.086 | -1.050 | 2.137 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | MIL 2-3-1 | 9.652 | 1.041 | -0.169 | 1.210 | 7 | MIL 2-3099 | 9.690 | 1.079 | -0.994 | 2.073 |
| 8 | MIL 2-428-2 | 9.612 | 1.001 | -0.169 | 1.170 | 8 | MIL 2-3482 | 9.805 | 1.193 | -0.879 | 2.072 |
| 9 | MIL 2-511-1 | 9.708 | 1.097 | -0.046 | 1.142 | 9 | MIL 2-467-2 | 9.318 | 0.707 | -1.235 | 1.942 |
| 10 | MIL 2-119-2 | 9.346 | 0.734 | -0.203 | 0.937 | 10 | EI-586-2 | 9.743 | 1.131 | -0.764 | 1.895 |
| 11 | MIL 2-1298-1 | 9.008 | 0.397 | -0.528 | 0.925 | 11 | MIL 2-457-2 | 8.917 | 0.305 | -1.483 | 1.789 |
| 12 | MIL 2-114-1 | 9.022 | 0.411 | -0.396 | 0.807 | 12 | MIL 2-1281-5 | 10.106 | 1.494 | -0.267 | 1.762 |
| 13 | MIL 2-195-1 | 9.372 | 0.760 | -0.019 | 0.779 | 13 | MIL 2-274-1 | 9.460 | 0.848 | -0.886 | 1.734 |
| 14 | MIL 2-342-1 | 9.374 | 0.762 | -0.010 | 0.772 | 14 | HKI-193-1 | 9.906 | 1.294 | -0.314 | 1.608 |
| 15 | HKI-1344 | 8.789 | 0.177 | -0.557 | 0.734 | 15 | MIL 2-343-3 | 9.710 | 1.099 | -0.412 | 1.511 |
| 16 | MIL 2-2034 | 9.001 | 0.390 | -0.137 | 0.527 | 16 | MIL 2-406-1 | 9.608 | 0.996 | -0.514 | 1.510 |
| 17 | MIL 2-287-1 | 8.805 | 0.193 | -0.116 | 0.309 | 17 | MIL 2-2077 | 9.883 | 1.271 | -0.214 | 1.485 |
| 18 | MIL 2-310-1 | 8.774 | 0.162 | -0.033 | 0.195 | 18 | MIL 2-381-2 | 9.766 | 1.154 | -0.246 | 1.401 |
| | | | | | | 19 | BML-6 | 9.621 | 1.009 | -0.364 | 1.373 |
| | | | | | | 20 | MIL 2-1621 | 8.944 | 0.332 | -1.025 | -1.025 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 21 | MIL 2-1298-8 | 9.254 | 0.643 | -0.668 | -0.668 |
| | | | | | | 22 | MIL 2-219-2 | 9.542 | 0.931 | -0.333 | -0.333 |
| | | | | | | 23 | MIL 2-334-B-2 | 9.029 | 0.418 | -0.785 | -0.785 |
| | | | | | | 24 | MIL 2-83-1 | 9.780 | 1.169 | -0.024 | -0.024 |
| | | | | | | 25 | MIL 2-366-2 | 9.301 | 0.690 | -0.449 | -0.449 |
| | | | | | | 26 | MIL 2-301-1 | 9.444 | 0.832 | -0.305 | -0.305 |
| | | | | | | 27 | MIL 2-481-2 | 9.229 | 0.617 | -0.477 | -0.477 |
| | | | | | | 28 | MIL 2-617-2 | 9.375 | 0.763 | -0.133 | -0.133 |
| | | | | | | 29 | MIL 2-1299-5 | 8.904 | 0.292 | -0.578 | -0.578 |
| | | | | | | 30 | MIL 2-1289-1 | 9.395 | 0.784 | -0.082 | -0.082 |
| | | | | | | 31 | MIL 2-1512 | 9.355 | 0.744 | -0.078 | -0.078 |
| | | | | | | 32 | MIL 2-591-2 | 9.119 | 0.508 | -0.297 | -0.297 |
| | | | | | | 33 | MIL 2-387-2 | 8.754 | 0.143 | -0.632 | -0.632 |
| | | | | | | 34 | MIL2-1510 | 9.221 | 0.609 | -0.143 | -0.143 |
| | | | | | | 35 | MIL 2-273-2 | 8.993 | 0.381 | -0.312 | -0.312 |
| | | | | | | 36 | MIL 2-571-1 | 9.079 | 0.467 | -0.060 | -0.060 |
| | | | | | | 37 | BML-7 | 8.980 | 0.369 | -0.103 | -0.103 |

## Heterotic grouping of maize inbred lines under drought environment

A set of 103 inbred lines was crossed with LM 13 & 14 and 206 crosses along with four standard checks were evaluated under normal and drought stress for two years during *Rabi* season (2020-21 & 2021-22) at RMR & SPC, Begusarai for heterotic grouping of inbred lines. Based on pooled analysis and the Mean, GCA & SCA 15 lines shown negative SCA with LM 13 whereas 33 lines shown negative SCA with LM 14 in across three years *(Table 1.3)*. Therefore, 15 inbreds in heterotic group "A" and 33 inbreds in heterotic group "B" were classified. However, on the basis of HSGCA 29 inbreds in heterotic group "A" and 36 inbreds in heterotic group "B" were classified. Ranking of inbreds was also done on the basis of HSGCA values with opposite tester and top ten inbreds in each group were selected for constitution of heterotic base population to develop next generation drought tolerant inbreds.

**Table 1.3: Heterotic grouping of inbred lines based on Mean, GCA, SCA & HSGCA under drought environment.**

| Heterotic Group A (Negative SCA with LM 13) | | | | | | Heterotic Group B (Negative SCA with LM 14) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sr. No. | Inbred | Line Mean | GCA | SCA | HSGCA (LM 14) | Sr. No. | Inbred | Line Mean | GCA | SCA | HSGCA (LM 14) |
| 1 | MIL 2-100 | 7.993 | 1.290 | -0.911 | 2.200 | 1 | MIL 2-49-2 | 8.345 | 1.641 | -1.427 | 3.068 |
| 2 | MIL 2-173-2 | 7.943 | 1.240 | -0.317 | 1.556 | 2 | MIL 2-114-1 | 8.831 | 2.128 | -0.050 | 2.178 |
| 3 | MIL 2-301-1 | 7.618 | 0.915 | -0.537 | 1.452 | 3 | MIL 2-1299-5 | 7.700 | 0.997 | -1.157 | 2.153 |
| 4 | MIL 2-428-2 | 7.752 | 1.049 | -0.391 | 1.440 | 4 | EI-586-2 | 7.499 | 0.796 | -1.116 | 1.912 |
| 5 | MIL 2-342-1 | 7.759 | 1.055 | -0.346 | 1.401 | 5 | MIL 2-3482 | 8.301 | 1.598 | -0.297 | 1.895 |
| 6 | MIL 2-388-1 | 7.618 | 0.914 | -0.392 | 1.306 | 6 | MIL 2-406-1 | 7.082 | 0.378 | -1.440 | 1.818 |
| 7 | MIL 2-195-2 | 7.663 | 0.960 | -0.301 | 1.261 | 7 | MIL 2-2083 | 8.068 | 1.364 | -0.453 | 1.817 |
| 8 | HKI-1144 | 7.444 | 0.740 | -0.282 | 1.023 | 8 | MIL 2-83-1 | 8.277 | 1.574 | -0.192 | 1.766 |
| 9 | MIL 2-274-1 | 7.688 | 0.985 | -0.018 | 1.003 | 9 | MIL 2-119-2 | 7.979 | 1.276 | -0.352 | 1.628 |
| 10 | MIL 2-58-2 | 6.888 | 0.185 | -0.655 | 0.839 | 10 | MIL 2-1621 | 7.931 | 1.228 | -0.400 | 1.628 |
| 11 | MIL 2-231-2 | 6.938 | 0.235 | -0.550 | 0.784 | 11 | MIL 2-1062-1-2 | 7.913 | 1.210 | -0.342 | 1.552 |
| 12 | MIL 2-1510 | 7.018 | 0.315 | -0.416 | 0.731 | 12 | MIL 2-2077 | 8.136 | 1.432 | -0.077 | 1.510 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 13 | MIL 2-571-1 | 7.049 | 0.346 | -0.290 | 0.636 | 13 | MIL 2-219-1 | 7.949 | 1.246 | -0.246 | 1.492 |
| 14 | MIL 2-1053-4-2 | 6.894 | 0.191 | -0.282 | 0.473 | 14 | MIL 2-1298-8 | 7.842 | 1.138 | -0.348 | 1.487 |
| 15 | MIL 2-1292-4 | 6.773 | 0.069 | -0.150 | 0.220 | 15 | MIL 2-343-3 | 8.090 | 1.386 | -0.082 | 1.468 |
| | | | | | | 16 | MIL 2-381-1 | 7.545 | 0.842 | -0.586 | 1.428 |
| | | | | | | 17 | MIL 2-1281-5 | 7.703 | 1.000 | -0.370 | 1.370 |
| | | | | | | 18 | MIL 2-121-1 | 7.871 | 1.168 | -0.171 | 0.996 |
| | | | | | | 19 | HKI-163 | 7.567 | 0.864 | -0.434 | 0.429 |
| | | | | | | 20 | BML-7 | 7.312 | 0.609 | -0.674 | -0.065 |
| | | | | | | 21 | HKI-193-1 | 7.535 | 0.831 | -0.415 | 0.416 |
| | | | | | | 22 | MIL 2-591-2 | 7.500 | 0.797 | -0.444 | 0.353 |
| | | | | | | 23 | MIL 2-511-1 | 7.757 | 1.054 | -0.108 | 0.946 |
| | | | | | | 24 | MIL 2-475-2 | 7.273 | 0.570 | -0.561 | 0.009 |
| | | | | | | 25 | MIL 2-2039 | 7.519 | 0.816 | -0.170 | 0.646 |
| | | | | | | 26 | MIL 2-3-1 | 7.025 | 0.322 | -0.550 | -0.229 |
| | | | | | | 27 | MIL 2-3240 | 7.356 | 0.653 | -0.151 | 0.502 |
| | | | | | | 28 | MIL 2- 574-1 | 7.306 | 0.603 | -0.111 | 0.491 |
| | | | | | | 29 | MIL 2-1041-1-2 | 7.180 | 0.477 | -0.236 | 0.240 |
| | | | | | | 30 | MIL 2-1298-6 | 6.952 | 0.249 | -0.321 | -0.072 |
| | | | | | | 31 | BML-6 | 7.191 | 0.488 | -0.024 | 0.464 |
| | | | | | | 32 | MIL 2-1060-8 | 6.961 | 0.257 | -0.245 | 0.013 |
| | | | | | | 33 | MIL 2-310-1 | 6.863 | 0.160 | -0.150 | 0.010 |

## Heterotic grouping of maize inbred lines under waterlogging environment

A set of 108 inbred lines was crossed with LM 13 & 14 and 216 crosses along with four standard checks were evaluated under normal and waterlogging stress for two years (2021 & 2022) during *Kharif* season at RMR&SPC, Begusarai for heterotic grouping of inbred lines. Based on pooled analysis and the Mean, GCA & SCA, 23 lines shown negative SCA with LM 13 whereas 29 lines shown negative SCA with LM 14 in across two years *(Table 1.4)*. Therefore, 23 inbreds in heterotic group "A" and 29 inbreds in heterotic group "B" were classified. However, on the basis of HSGCA 33 inbreds in heterotic group "A" and 42 inbreds in heterotic group "B" were classified. Ranking of inbreds was also done on the basis of HSGCA values with opposite tester and top ten inbreds in each group were selected for constitution of heterotic base population to develop next generation waterlogging tolerant inbreds.

**Table 1.4: Heterotic grouping of inbred lines based on Mean, GCA, SCA & HSGCA under waterlogging environment**

| Heterotic Group A (Negative SCA with LM 13 | | | | | | Heterotic Group B (Negative SCA with LM 14 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sl. No. | Inbred | Line Mean | GCA | SCA | HSGCA (LM 14) | Sl. No. | Inbred | Line Mean | GCA | SCA | HSGCA (LM 14) |
| 1 | MIL 2-1601 | 4.305 | 1.240 | -0.247 | 1.488 | 1 | MIL 2-1062-1-2 | 4.363 | 1.298 | -1.144 | 2.442 |
| 2 | MIL 2-511-1 | 3.839 | 0.775 | 0.506 | 1.280 | 2 | MIL 2-591-2 | 3.444 | 0.379 | -1.379 | 1.758 |
| 3 | MIL 2-763-3 | 4.037 | 0.972 | -0.250 | 1.222 | 3 | MIL 2-114-1 | 4.358 | 1.293 | -0.199 | 1.492 |
| 4 | MIL 2-1624 | 3.681 | 0.616 | -0.535 | 1.152 | 4 | MIL 2-1281-5 | 3.734 | 0.670 | -0.821 | 1.491 |
| 5 | MIL 2-3470 | 4.167 | 1.103 | -0.016 | 1.118 | 5 | BML-7 | 3.931 | 0.867 | -0.607 | 1.474 |
| 6 | MIL 2-883-1 | 4.031 | 0.967 | -0.082 | 1.049 | 6 | MIL 2-207-2 | 3.796 | 0.731 | -0.698 | 1.430 |
| 7 | MIL 2-1298-8 | 3.657 | 0.592 | -0.435 | 1.028 | 7 | MIL 2-15-2 | 3.303 | 0.238 | -1.028 | 1.266 |
| 8 | MIL 2-406-1 | 3.717 | 0.653 | -0.357 | 1.010 | 8 | MIL 2-301-1 | 3.735 | 0.670 | -0.572 | 1.243 |
| 9 | MIL 2-388-1 | 3.795 | 0.731 | -0.273 | 1.004 | 9 | MIL 2-381-1 | 3.777 | 0.713 | -0.481 | 1.194 |
| 10 | MIL 2-164-1 | 3.308 | 0.244 | -0.746 | 0.990 | 10 | MIL 2-173-2 | 3.608 | 0.544 | -0.620 | 1.164 |
| 11 | MIL 2-1060-8 | 3.791 | 0.726 | -0.179 | 0.905 | 11 | MIL 2-343-3 | 3.575 | 0.511 | -0.602 | 1.112 |
| 12 | MIL 2-3494 | 3.434 | 0.370 | -0.479 | 0.849 | 12 | HKI-193-1 | 3.942 | 0.878 | -0.082 | 0.960 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 13 | MIL 2-3482 | 3.598 | 0.534 | -0.211 | 0.745 | 13 | MIL 2-1298-1 | 3.492 | 0.428 | -0.434 | 0.861 |
| 14 | MIL 2-1621 | 3.296 | 0.231 | -0.492 | 0.723 | 14 | MIL 2- 571-1 | 3.688 | 0.624 | -0.074 | 0.697 |
| 15 | MIL 2-280-1 | 3.606 | 0.542 | 0.061 | 0.602 | 15 | MIL 2-1043-1-1 | 3.133 | 0.068 | -0.603 | 0.671 |
| 16 | MIL 2-428-2 | 3.118 | 0.054 | -0.512 | 0.565 | 16 | MIL 2-334 A-2 | 3.270 | 0.206 | -0.461 | 0.667 |
| 17 | MIL 2-269-1 | 3.523 | 0.459 | 0.059 | 0.518 | 17 | MIL 2-1248 | 3.520 | 0.455 | -0.210 | 0.665 |
| 18 | MIL 2-1299-5 | 3.342 | 0.278 | -0.235 | 0.513 | 18 | MIL 2- 569-3 | 3.175 | 0.111 | -0.539 | 0.650 |
| 19 | MIL 2-498-1 | 3.439 | 0.374 | 0.069 | 0.443 | 19 | BML-6 | 3.421 | 0.356 | -0.258 | 0.614 |
| 20 | MIL 2-310-1 | 3.195 | 0.131 | -0.145 | 0.275 | 20 | MIL 2-119-2 | 3.658 | 0.593 | -0.011 | 0.604 |
| 21 | MIL 2-58-2 | 3.133 | 0.069 | -0.168 | 0.237 | 21 | MIL 2-1289-2 | 3.305 | 0.241 | -0.352 | 0.593 |
| 22 | MIL 2-30-1 | 3.124 | 0.060 | -0.143 | 0.203 | 22 | MIL 2-457-2 | 3.382 | 0.317 | -0.269 | 0.586 |
| 23 | MIL 2-121-1 | 3.115 | 0.051 | -0.049 | 0.100 | 23 | MIL 2-244-1 | 3.146 | 0.082 | -0.416 | 0.498 |
| | | | | | | 24 | MIL 2-2005 | 3.243 | 0.179 | -0.308 | 0.487 |
| | | | | | | 25 | MIL 2-475-1 | 3.088 | 0.024 | -0.440 | 0.464 |
| | | | | | | 26 | MIL 2- 387-3 | 3.322 | 0.257 | -0.181 | 0.438 |
| | | | | | | 27 | MIL 2-1510 | 3.486 | 0.422 | 0.168 | 0.253 |
| | | | | | | 28 | MIL 2-1292-2 | 3.197 | 0.132 | -0.100 | 0.232 |
| | | | | | | 29 | MIL 2-49-2 | 3.107 | 0.042 | -0.025 | 0.067 |

## Heterotic grouping of maize inbred lines under cold stress environment

A set of 153 inbred lines was crossed with LM 13 & 14 and 306 crosses along with four standard checks were evaluated for two years (2020-21 & 2021-22) during *Rabi* season at ICAR-IIMR, Ludhiana for heterotic grouping of inbred lines. Based on pooled analysis and the Mean, GCA & SCA 31 lines shown negative SCA with LM 13 whereas 45 lines shown negative SCA with LM 14 (Table 1.5). Therefore, 31 inbreds in heterotic group "A" and 45 inbreds in heterotic group "B" were classified. However, on the basis of HSGCA, 57 inbreds in heterotic group "A" and 43 inbreds in heterotic group "B" were classified. Ranking of inbreds was also done on the basis of HSGCA values with opposite tester and top ten inbreds in each group were selected for constitution of heterotic base population to develop next generation cold tolerant inbreds.

**Table 1.5: Heterotic grouping of inbred lines based on Mean, GCA, SCA & HSGCA under cold stress environment**

| Heterotic Group A (Negative SCA with LM 13 | | | | | | Heterotic Group B (Negative SCA with LM 14 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sl. No. | Inbred | Line Mean | GCA | SCA | HSGCA (LM 14) | Sl. No. | Inbred | Line Mean | GCA | SCA | HSGCA (LM 14) |
| 1 | MIL 2-381-1 | 9.795 | 3.820 | -0.020 | 3.841 | 1 | MIL 2-457-2 | 9.124 | 3.150 | -1.430 | 4.579 |
| 2 | MIL 2-3680 | 6.696 | 0.722 | -3.050 | 3.771 | 2 | MIL 2-274-1-3 | 8.545 | 2.570 | -1.986 | 4.556 |
| 3 | MIL 2-571-1 | 7.356 | 1.382 | -1.602 | 2.984 | 3 | MIL 2-205-1 | 7.462 | 1.487 | -2.441 | 3.928 |
| 4 | MIL 2-387-3 | 7.573 | 1.598 | -1.268 | 2.866 | 4 | MIL 2-1281-5 | 7.154 | 1.179 | -2.513 | 3.692 |
| 5 | MIL 2-1299-5 | 7.486 | 1.511 | -1.175 | 2.687 | 5 | MIL 2-1292-2 | 8.021 | 2.046 | -1.375 | 3.420 |
| 6 | MIL 2-195-2 | 8.200 | 2.225 | -0.441 | 2.666 | 6 | MIL 2-343-3 | 9.110 | 3.136 | -0.146 | 3.282 |
| 7 | MIL 2-1521 | 6.958 | 0.983 | -1.281 | 2.264 | 7 | MIL 2-3678 | 7.273 | 1.298 | -1.863 | 3.161 |
| 8 | MIL 2-1624 | 7.201 | 1.227 | -1.032 | 2.258 | 8 | MIL 2-591-2 | 7.624 | 1.650 | -1.363 | 3.013 |
| 9 | MIL 2-1298-6 | 7.500 | 1.525 | -0.695 | 2.220 | 9 | MIL 4-2029 | 8.560 | 2.586 | -0.417 | 3.003 |
| 10 | MIL 2-334B-2 | 7.429 | 1.455 | -0.709 | 2.164 | 10 | MIL 2-302-1 | 8.122 | 2.147 | -0.819 | 2.967 |
| 11 | MIL 2-388-1 | 7.087 | 1.113 | -0.956 | 2.069 | 11 | MIL 2-349-2 | 7.674 | 1.700 | -1.162 | 2.861 |
| 12 | MIL 2-219-2 | 7.860 | 1.886 | -0.098 | 1.984 | 12 | MIL 2-201-1 | 7.888 | 1.914 | -0.781 | 2.695 |
| 13 | MIL 2-288-1 | 7.059 | 1.084 | -0.895 | 1.979 | 13 | MIL 2-1510 | 8.391 | 2.416 | -0.176 | 2.592 |
| 14 | MIL 2-428-2 | 7.792 | 1.818 | -0.156 | 1.974 | 14 | MIL 2-1060-8 | 7.138 | 1.164 | -1.293 | 2.456 |
| 15 | MIL 2-114-1 | 7.451 | 1.477 | -0.343 | 1.820 | 15 | MIL 2-91-1 | 8.019 | 2.045 | -0.394 | 2.438 |
| 16 | MIL 2-446-2 | 7.637 | 1.663 | -0.106 | 1.769 | 16 | MIL 2-406-1 | 7.185 | 1.210 | -1.146 | 2.356 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | MIL 2-265-2 | 7.044 | 1.069 | -0.674 | 1.743 | | 17 | MIL 2-121-1 | 7.308 | 1.333 | -0.944 | 2.277 |
| 18 | MIL 2-3494 | 6.764 | 0.789 | -0.920 | 1.710 | | 18 | MIL 2-1292-4 | 7.053 | 1.078 | -1.071 | 2.149 |
| 19 | MIL 2-1587 | 6.092 | 0.118 | -1.513 | 1.630 | | 19 | MIL 2-3746 | 6.322 | 0.347 | -1.766 | 2.113 |
| 20 | MIL 2-1625 | 7.231 | 1.256 | -0.307 | 1.564 | | 20 | MIL 2-291-2 | 7.613 | 1.638 | -0.444 | 2.082 |
| 21 | MIL 2-511-1 | 6.462 | 0.487 | -0.938 | 1.425 | | 21 | MIL 2-451-3 | 6.499 | 0.524 | -1.458 | 1.982 |
| 22 | MIL 2-274-1 | 7.259 | 1.284 | -0.126 | 1.410 | | 22 | HKI-1348 | 7.167 | 1.192 | -0.695 | 1.887 |
| 23 | MIL 2-353-1 | 6.926 | 0.951 | -0.290 | 1.241 | | 23 | MIL 2-3-1 | 7.174 | 1.200 | -0.646 | 1.846 |
| 24 | MIL 2-2165 | 6.551 | 0.577 | -0.648 | 1.225 | | 24 | HKI-323 | 7.306 | 1.332 | -0.445 | 1.777 |
| 25 | MIL 4-2002 | 6.968 | 0.993 | -0.022 | 1.015 | | 25 | MIL 2-3711 | 7.419 | 1.445 | -0.299 | 1.744 |
| 26 | MIL 2-173-2 | 6.426 | 0.451 | -0.333 | 0.784 | | 26 | MIL 2-100 | 6.110 | 0.136 | -1.582 | 1.718 |
| 27 | MIL 2-49-2 | 6.255 | 0.280 | -0.468 | 0.748 | | 27 | MIL 2-30-1 | 6.515 | 0.541 | -1.162 | 1.703 |
| 28 | EI-586-2 | 6.199 | 0.224 | -0.498 | 0.723 | | 28 | MIL 2-1621 | 7.312 | 1.337 | -0.250 | 1.587 |
| 29 | MIL 2-83-2 | 6.199 | 0.224 | -0.465 | 0.689 | | 29 | MIL 2-1512 | 7.331 | 1.356 | -0.167 | 1.523 |
| 30 | HKI-193-1 | 6.522 | 0.547 | -0.098 | 0.646 | | 30 | MIL 2-467-2 | 7.306 | 1.332 | -0.132 | 1.464 |
| 31 | MIL 2-133 | 5.985 | 0.010 | -0.051 | 0.061 | | 31 | MIL 2-3776 | 6.279 | 0.305 | -1.023 | 1.328 |
| | | | | | | | 32 | MIL 3-3482 | 6.578 | 0.604 | -0.717 | 1.320 |
| | | | | | | | 33 | MIL 2-874-2 | 6.474 | 0.500 | -0.695 | 1.195 |
| | | | | | | | 34 | MIL 2-2077 | 6.924 | 0.950 | -0.186 | 1.136 |
| | | | | | | | 35 | MIL 2-15-2 | 6.564 | 0.589 | -0.477 | 1.067 |
| | | | | | | | 36 | MIL 2-231-2 | 6.645 | 0.670 | -0.332 | 1.003 |
| | | | | | | | 37 | MIL 2-1062-1-2 | 6.724 | 0.750 | -0.217 | 0.967 |
| | | | | | | | 38 | MIL 2-261-2 | 6.736 | 0.761 | -0.203 | 0.964 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 39 | MIL 2-498 | 6.738 | 0.764 | -0.185 | 0.949 |
| | | | | | | | 40 | MIL 2-1248 | 6.637 | 0.663 | -0.222 | 0.885 |
| | | | | | | | 41 | MIL 2-3750 | 6.124 | 0.150 | -0.609 | 0.759 |
| | | | | | | | 42 | MIL 2-411-2 | 6.362 | 0.387 | -0.177 | 0.564 |
| | | | | | | | 43 | MIL 2-291-1 | 6.209 | 0.234 | -0.060 | 0.295 |
| | | | | | | | 44 | MIL 2-211-2 | 6.138 | 0.164 | -0.108 | 0.272 |
| | | | | | | | 45 | MIL 2-58-2 | 5.710 | -0.264 | -0.157 | -0.108 |

## Heterotic grouping of maize inbred lines under heat stress environment

A set of 108 inbred lines was crossed with LM 13 & 14 and 216 crosses along with four standard checks were evaluated under normal and heat stress environment at two locations (Karimnagar and Ludhiana) during Spring 2022 for heterotic grouping of inbred lines. Based on pooled analysis and the Mean, GCA & SCA, 34 lines shown negative SCA with LM 13 whereas 28 lines shown negative SCA with LM 14. (Table 1.6). Therefore, 34 inbreds in heterotic group "A" and 28 inbreds in heterotic group "B" were classified. However, on the basis of HSGCA, 40 inbreds in heterotic group "A" and 36 inbreds in heterotic group "B" were classified. Ranking of inbreds was also done on the basis of HSGCA values with opposite tester and top ten inbreds in each group were selected for constitution of heterotic base population to develop next generation cold tolerant inbreds.

**Table 1.6: Heterotic grouping of inbred lines based on Mean, GCA, SCA & HSGCA under cold stress environment.**

| Heterotic Group A (Negative SCA with LM 13) | | | | | | | Heterotic Group B (Negative SCA with LM 14) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sl. No. | Inbred | Line Mean | GCA | SCA | HSGCA (LM 14) | | Sl. No. | Inbred | Line Mean | GCA | SCA | HSGCA (LM 14) |
| 1 | MIL 2-176-2 | 5.551 | 1.262 | -0.531 | 1.793 | | 1 | MIL 2- 457-2 | 5.181 | 0.891 | -1.000 | 1.892 |
| 2 | MIL 2- 114-1 | 5.599 | 1.309 | -0.174 | 1.483 | | 2 | MIL 2- 590-1 | 4.983 | 0.694 | -1.069 | 1.763 |
| 3 | MIL 2- 173-2 | 5.156 | 0.867 | -0.594 | 1.462 | | 3 | MIL 2- 568-2 | 4.405 | 0.116 | -1.472 | 1.589 |
| 4 | MIL 2- 406-2 | 5.455 | 1.165 | -0.284 | 1.449 | | 4 | MIL 2-1527 | 4.699 | 0.410 | -1.123 | 1.532 |
| 5 | MIL 2- 274-1 | 5.181 | 0.892 | -0.467 | 1.359 | | 5 | MIL 2- 1042-6-1 | 4.540 | 0.251 | -1.277 | 1.528 |
| 6 | MIL 2- 571-1 | 4.837 | 0.548 | -0.781 | 1.329 | | 6 | MIL 2-1625 | 4.598 | 0.309 | -1.169 | 1.478 |
| 7 | MIL 2- 121-2 | 5.375 | 1.086 | -0.176 | 1.262 | | 7 | MIL 2- 207-1 | 5.423 | 1.134 | -0.270 | 1.404 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 | MIL 2-1000-2 | 4.763 | 0.474 | -0.764 | 1.238 | 8 | MIL 2- 3776 | 4.816 | 0.526 | -0.877 | 1.403 |
| 9 | MIL 2- 71-2 | 5.053 | 0.764 | -0.334 | 1.098 | 9 | EI 586-2 | 4.771 | 0.482 | -0.881 | 1.363 |
| 10 | MIL 2- 1253 | 4.834 | 0.545 | -0.541 | 1.086 | 10 | MIL 2- 459-1 | 5.054 | 0.765 | -0.575 | 1.340 |
| 11 | MIL 2- 164-1 | 5.069 | 0.780 | -0.301 | 1.081 | 11 | MIL 2- 1040-3-1 | 4.571 | 0.282 | -1.054 | 1.336 |
| 12 | MIL 2- 133-2 | 4.888 | 0.599 | -0.466 | 1.065 | 12 | MIL 2- 1286-3 | 4.338 | 0.049 | -1.225 | 1.274 |
| 13 | MIL 2- 269-1 | 4.973 | 0.684 | -0.343 | 1.027 | 13 | MIL2-3633 | 5.108 | 0.818 | -0.435 | 1.253 |
| 14 | MIL 2- 343-3 | 4.618 | 0.329 | -0.671 | 1.000 | 14 | MIL 2- 1041-4-2 | 4.458 | 0.169 | -1.047 | 1.217 |
| 15 | MIL 2-1523 | 4.484 | 0.195 | -0.794 | 0.989 | 15 | MIL 2-1626 | 5.013 | 0.724 | -0.472 | 1.196 |
| 16 | MIL 2- 2068 | 4.715 | 0.426 | -0.493 | 0.919 | 16 | MIL 2-1568 | 5.135 | 0.846 | -0.336 | 1.182 |
| 17 | MIL 2-1620-1 | 5.042 | 0.753 | -0.036 | 0.789 | 17 | HKI 193-1 | 4.400 | 0.111 | -0.993 | 1.105 |
| 18 | MIL 2-3099 | 4.787 | 0.498 | -0.255 | 0.754 | 18 | HKI 163 | 4.870 | 0.581 | -0.398 | 0.979 |
| 19 | MIL 2- 836-2 | 4.484 | 0.195 | -0.515 | 0.710 | 19 | MIL 2- 137-2 | 4.732 | 0.443 | -0.442 | 0.884 |
| 20 | MIL 2- 494-1 | 4.556 | 0.267 | -0.442 | 0.709 | 20 | MIL 2- 119-2 | 4.751 | 0.462 | -0.344 | 0.806 |
| 21 | MIL 2- 381-1 | 4.722 | 0.432 | -0.266 | 0.699 | 21 | MIL 2-1400 | 4.433 | 0.144 | -0.553 | 0.697 |
| 22 | MIL 2- 975-2 | 4.461 | 0.172 | -0.522 | 0.694 | 22 | MIL 2-3461 | 4.816 | 0.527 | -0.052 | 0.578 |
| 23 | MIL 2- 1209 | 4.392 | 0.103 | -0.507 | 0.610 | 23 | MIL 2- 566-1 | 4.389 | 0.099 | -0.441 | 0.540 |
| 24 | MIL 2- 324-1 | 4.550 | 0.261 | -0.308 | 0.569 | 24 | MIL 2-1624 | 4.505 | 0.216 | -0.234 | 0.450 |
| 25 | MIL 2- 363-1 | 4.551 | 0.262 | -0.302 | 0.564 | 25 | MIL 2- 681-2 | 4.353 | 0.064 | -0.321 | 0.385 |
| 26 | MIL 2- 428-2 | 4.667 | 0.378 | -0.185 | 0.563 | 26 | MIL 2- 49-2 | 4.578 | 0.288 | -0.055 | 0.344 |
| 27 | MIL 2- 219-3 | 4.714 | 0.425 | -0.118 | 0.543 | 27 | MIL 2- 456-1 | 4.547 | 0.258 | -0.031 | 0.289 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 28 | MIL 2- 200-2 | 4.669 | 0.380 | -0.163 | 0.543 | | 28 | MIL 2- 43-2 | 4.450 | 0.161 | -0.017 | 0.178 |
| 29 | MIL 2- 2114 | 4.351 | 0.062 | -0.420 | 0.482 | | | | | | | |
| 30 | MIL 2-1628 | 4.323 | 0.033 | -0.351 | 0.385 | | | | | | | |
| 31 | MIL 2- 37-2 | 4.579 | 0.290 | -0.016 | 0.306 | | | | | | | |
| 32 | MIL 2- 719-1 | 4.403 | 0.113 | -0.096 | 0.209 | | | | | | | |
| 33 | MIL 2-1621 | 4.325 | 0.036 | -0.041 | 0.077 | | | | | | | |
| 34 | MIL 2- 224-1 | 4.311 | 0.022 | -0.027 | 0.049 | | | | | | | |

## Evaluation of maize inbred lines

### Evaluation of early maturity inbreds for yield traits under normal condition during spring 2023 at Ludhiana

A set of 451 early maturity inbred lines was evaluated during Spring 2023 at ICAR-IIMR, Ludhiana for yield and yield traits. The inbreds were ranked as per grain yield/productivity and top ten inbreds yielding 3.16 to 3.89 t/ha productivity were selected for hybrid development Table 1.7.

**Table 1.7: Performance of early maturity inbreds for yield and yield traits during Spring-2023 at Ludhiana**

| Inbreds | DtA | DtS | DtM | EL (cm) | ED (mm) | KR | K/R | Sh% | GY(t/ha) | Rank |
|---|---|---|---|---|---|---|---|---|---|---|
| MIL 5-11002 | 78 | 80 | 117 | 14.8 | 43 | 18 | 26 | 71 | 3.892 | 1 |
| MIL 5-11675 | 74 | 75 | 116 | 16.2 | 39 | 13 | 30 | 73 | 3.835 | 2 |
| MIL 5-11050 | 70 | 69 | 119 | 13.1 | 34 | 12 | 26 | 82 | 3.761 | 3 |
| MIL 5-11103 | 67 | 68 | 114 | 14.7 | 40 | 12 | 36 | 84 | 3.442 | 4 |
| MIL 5-11492 | 71 | 69 | 113 | 14.7 | 37 | 12 | 26 | 78 | 3.242 | 5 |
| MIL 5-11447 | 76 | 78 | 122 | 13.8 | 42 | 16 | 30 | 86 | 3.197 | 6 |
| MIL 5-11154 | 72 | 73 | 119 | 13.2 | 37 | 15 | 28 | 77 | 3.191 | 7 |
| MIL 5-11114 | 73 | 74 | 117 | 14.3 | 39 | 14 | 32 | 80 | 3.168 | 8 |
| MIL 5-11086 | 76 | 78 | 120 | 13.7 | 38 | 13 | 30 | 77 | 3.162 | 9 |
| MIL 5-11523 | 67 | 68 | 112 | 14.6 | 37 | 15 | 33 | 75 | 3.162 | 10 |
| CV (%) | 1.8 | 1.8 | 1.6 | 9.2 | 5.6 | 7.7 | 12.1 | 5.5 | 19.0 | |
| CD P= 0.05 | 2 | 2 | 3 | 2.0 | 3 | 2 | 5 | 7 | 1.253 | |

Inbreds=51, rep=3, plot size=7.8 $m^2$

DtA= Days to 50% anthesis, DtS= Days to 50% silking, DtM= Days to 50% maturity, EL= Ear length, ED= Ear diameter, KR= Kernel Rows, K/R= Kernels per row, Sh%= Shelling percent, GY= Grain yield

### Screening medium maturity inbreds under normal and waterlogging stress during *kharif*-2023 at Ludhiana

A set of 40 medium maturity Inbred lines was evaluated under normal and waterlogging stress during *kharif* 2023 at ICAR-IIMR, Ludhiana. The inbreds were ranked as per grain yield/productivity. Among top 20 inbreds 12 inbreds were common under normal and waterlogging stress. Inbred MIL 2-883-1 was the highest yielder under normal as well as waterlogging stress.

**Table 1.8: Performance of inbreds under normal and waterlogging stress during *Kharif*-2023 at Ludhiana**

| Normal | | | | | | | | | Waterlogging | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Inbred | Survival % | Anthesis | ASI | Maturity | Pl. height | GY (t/ha) | Rank | Inbred | Survival % | Anthesis | ASI | Maturity | Pl. height | GY (t/ha) | Rank |
| MIL 2-883-1 | 100.0 | 55 | 2 | 97 | 165 | 2.831 | 1 | MIL 2-883-1 | 75.0 | 53 | 4 | 101 | 172 | 1.887 | 1 |
| MIL 2-975-2 | 100.0 | 56 | 2 | 97 | 175 | 2.626 | 2 | MIL 2-3470 | 72.7 | 56 | 4 | 109 | 156 | 1.846 | 2 |
| MIL 2-3470 | 100.0 | 60 | 2 | 97 | 168 | 2.215 | 3 | MIL 2-975-2 | 72.7 | 53 | 4 | 102 | 172 | 1.826 | 3 |
| MIL 2-173-2 | 100.0 | 58 | 3 | 96 | 205 | 1.887 | 4 | MIL 2-801-2 | 50.0 | 53 | 4 | 106 | 134 | 1.559 | 4 |
| MIL 2-3482 | 91.7 | 58 | 2 | 98 | 175 | 1.682 | 5 | MIL 2-164-2 | 80.0 | 57 | 4 | 107 | 141 | 1.231 | 5 |
| MIL 2-801-2 | 100.0 | 56 | 2 | 96 | 172 | 1.641 | 6 | MIL 2-3742 | 60.0 | 54 | 3 | 106 | 123 | 1.190 | 6 |
| MIL 2-343-3 | 80.0 | 56 | 4 | 90 | 100 | 1.559 | 7 | MIL 2-3633 | 53.8 | 53 | 5 | 108 | 122 | 1.149 | 7 |
| MIL 2-406-1 | 90.9 | 51 | 3 | 98 | 123 | 1.477 | 8 | MIL 2-201-1 | 61.5 | 53 | 5 | 107 | 123 | 1.108 | 8 |
| MIL 2-3742 | 90.9 | 59 | 1 | 97 | 145 | 1.477 | 9 | MIL 2-1062-1-2 | 53.8 | 53 | 4 | 107 | 125 | 1.067 | 9 |
| MIL 2-301-1 | 93.3 | 60 | 2 | 90 | 125 | 1.436 | 10 | MIL 2-1041-4-1 | 63.6 | 52 | 6 | 104 | 137 | 0.985 | 10 |
| MIL 2-428-2 | 100.0 | 58 | 2 | 98 | 133 | 1.436 | 11 | MIL 2-3482 | 58.3 | 54 | 6 | 107 | 136 | 0.944 | 11 |
| MIL 2-2039 | 91.7 | 56 | 3 | 96 | 171 | 1.436 | 12 | MIL 2-173-2 | 58.3 | 53 | 5 | 103 | 164 | 0.882 | 12 |

**Table 1.8: Performance of inbreds under normal and waterlogging stress during *Kharif*-2023 at Ludhiana**

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MIL 2-2077 | 80.0 | 58 | 2 | 98 | 133 | 1.436 | 13 | MIL 2-43-2 | 54.5 | 51 | 7 | 99 | 123 | 0.841 | 13 |
| MIL 2-43-2 | 88.9 | 53 | 2 | 97 | 147 | 1.395 | 14 | MIL 2-301-1 | 50.0 | 52 | 5 | 107 | 125 | 0.841 | 14 |
| MIL 2-274-1 | 100.0 | 60 | 2 | 98 | 120 | 1.395 | 15 | MIL 2-274-1 | 50.0 | 54 | 4 | 106 | 127 | 0.821 | 15 |
| MIL 2-1041-4-1 | 90.9 | 58 | 2 | 98 | 163 | 1.395 | 16 | MIL 2-388-1 | 42.9 | 54 | 5 | 107 | 107 | 0.821 | 16 |
| MIL 2-3633 | 83.3 | 63 | 1 | 97 | 183 | 1.395 | 17 | MIL 2-2077 | 38.5 | 57 | 5 | 110 | 111 | 0.821 | 17 |
| MIL 2-1623 | 100.0 | 56 | 3 | 99 | 137 | 1.313 | 18 | MIL 2-1624 | 30.8 | 55 | 5 | 110 | 133 | 0.821 | 18 |
| MIL 2-1062-1-2 | 92.9 | 59 | 1 | 97 | 152 | 1.313 | 19 | MIL 2-343-3 | 40.0 | 57 | 5 | 110 | 100 | 0.800 | 19 |
| MIL 2-201-1 | 91.7 | 53 | 5 | 95 | 140 | 1.272 | 20 | MIL 2-406-1 | 41.7 | 56 | 5 | 109 | 103 | 0.779 | 20 |
| Mean | 90.78 | 57 | 2.4 | 97 | 153 | 1.312 | | Mean | 47.5 | 54 | 4.8 | 107 | 121 | 0.799 | |
| CV (%) | 23.8 | 8.4 | 12 | 11 | 10.4 | 12.486 | | CV (%) | 28.4 | 8.9 | 14 | 11 | 12.6 | 18.79 | |
| CD (5%) | 16.4 | 4.3 | 0.1 | 5.9 | 12.3 | 0.038 | | CD (5%) | 18.4 | 4.7 | 0.9 | 6.8 | 13.5 | 0.019 | |

## Evaluation of experimental hybrids

### Evaluation of early maturity L × T experimental maize hybrids in Kharif 2023 at IIMR, Ludhiana

A set of 431 early maturity line x tester experimental hybrids including six checks was evaluated under normal environment during *kharif*-2023 at IIMR, Ludhiana. Five hybrids MIL 5-11637 × LM 16, MIL 5-11509 × LM 16, MIL 5-11663 × LM 15, MIL 5-11090 × LM 15 and MIL 5-11316 × LM 15 out yielded the best check DKC 7074 with more than 10% superiority. see the table 1.9.

**Table 1.9: Performance of early maturity L × T experimental maize hybrids in *Kharif* 2023 at IIMR, Ludhiana**

| Hybrids | DTS | DTM | Sh% | GY (t/ha) | Sup% |
|---|---|---|---|---|---|
| **Kharif-2023** | | | | | |
| MIL 5-11637 × LM 16 | 52 | 86 | 82 | 7.538 | 32 |
| MIL 5-11509 × LM 16 | 49 | 85 | 84 | 6.885 | 20 |
| MIL 5-11663 × LM 15 | 49 | 85 | 85 | 6.415 | 12 |
| MIL 5-11090 × LM 15 | 50 | 86 | 82 | 6.316 | 10 |
| MIL 5-11316 × LM 15 | 50 | 88 | 83 | 6.295 | 10 |
| DKC 7074 (Best check) | 52 | 89 | 83 | 5.726 | |
| CV (%) | 4.1 | 2.3 | 2.7 | 22.3 | |
| CD P=0.05 | 3 | 3 | 4 | 1.593 | |

### Evaluation of L × T medium maturity hybrids under normal/stress environment at IIMR, Ludhiana during Spring 2023

A set of 305-line x tester experimental hybrids including five checks was evaluated under heat stress environment during Spring 2023 at IIMR, Ludhiana. The trial was laid on mid-March month to impose heat stress during flowering. Although the trial was conducted to screen the experimental hybrids under heat stress but no heat stress was observed due to the environmental conditions resulted by intermittent rains. Therefore, the trial was considered as normal. Ten hybrids out yielded Ten hybrids out yielded the best check hybrids and six hybrids with >10% yield superiority over best check (Table 1.10).

**Table 1.10: Performance of medium maturity L x T experimental maize hybrids under normal/heat stress during Spring-2023 at IIMR, Ludhiana**

| Entry name | Pedigree | Anthesis | ASI | Maturity | Pl. height (cm) | Final Yield (t/ha) | % Sup | Rank |
|---|---|---|---|---|---|---|---|---|
| IMH 2-22K-263 | MIL 2-1625 × LM 14 | 72 | 1 | 107 | 222 | 10.641 | 18.58 | 1 |
| IMH 2-22K-150 | MIL 2-165-1 × LM 14 | 60 | 3 | 99 | 183 | 10.500 | 17.00 | 2 |
| IMH 2-22K-40 | MIL 2-376-2 × LM 13 | 64 | 2 | 106 | 202 | 10.154 | 13.15 | 3 |
| IMH 2-22K-196 | MIL 2-457-2 × LM 14 | 70 | 2 | 106 | 190 | 9.641 | 7.43 | 4 |
| IMH 2-22K-145 | MIL 2-137-2 × LM 14 | 68 | 3 | 105 | 198 | 9.333 | 4.00 | 5 |
| IMH 2-22K-64 | MIL 2-591-1 × LM 13 | 66 | 1 | 105 | 182 | 9.308 | 3.72 | 6 |
| IMH 2-22K-251 | MIL 2-1289-2 × LM 14 | 71 | 3 | 107 | 222 | 9.282 | 3.43 | 7 |
| IMH 2-22K-210 | MIL 2-590-2 × LM 14 | 68 | 1 | 104 | 203 | 9.179 | 2.29 | 8 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| IMH 2-22K-105 | MIL 2-1299-5 × LM 13 | 68 | 2 | 100 | 204 | 9.128 | 1.72 | 9 |
| IMH 2-22K-282 | MIL 2-1521 × LM 14 | 67 | 2 | 102 | 200 | 9.000 | 0.29 | 10 |
| Check 4 | CMH 08-287 | 69 | 2 | 105 | 235 | 8.974 | | |
| Check 2 | LG 34.05 | 71 | 2 | 107 | 215 | 8.769 | | |
| Check 5 | NK 6240 | 70 | 1 | 104 | 178 | 6.538 | | |
| Check 3 | DHM 121 | 70 | 1 | 106 | 204 | 6.410 | | |
| Check 1 | Bio 9544 | 72 | -1 | 108 | 167 | 3.256 | | |
| | Mean | 69.81 | 1.63 | 105.18 | 183.42 | 5.883 | | |
| Total crosses=305+5 | CV | 8.92 | 14.89 | 10.62 | 11.69 | 14.380 | | |
| | CD | 2.65 | 0.03 | 8.36 | 14.62 | 0.986 | | |

**Evaluation of diallel medium maturity hybrids under normal/stress environment at IIMR, Ludhiana during Spring 2023**

A set of 245 - diallel experimental hybrids including five checks was evaluated under heat stress environment during Spring-2023 at IIMR, Ludhiana. The trial was laid on mid-March month to impose heat stress during flowering. Although the trial was conducted to screen the experimental hybrids under heat stress but no heat stress was observed due to the environmental conditions resulted by intermittent rains. Therefore, the trial was considered as normal. Ten hybrids out yielded Ten hybrids out yielded the best check hybrids and three hybrids with >10% yield superiority over best check (Table 1.11).

**Table 1.11: Performance of medium maturity diallel experimental maize hybrids in Spring-2023 at IIMR, Ludhiana**

| Entry no. | Pedigree | Anthesis | ASI | Maturity | Pl. height (cm) | Final Yield (t/ha) | % Sup | Rank |
|---|---|---|---|---|---|---|---|---|
| IMH 2-22R-845 | MIL 2-231-2 × MIL 2-571-1 | 65 | 2 | 101 | 171 | 10.795 | 23.10 | 1 |
| IMH 2-22R-769 | MIL 2-3095 × HKI 1128 | 60 | 2 | 98 | 180 | 10.103 | 15.21 | 2 |
| IMH 2-22R-832 | MIL 2-1041-4-2 × MIL 2-1299-5 | 65 | 2 | 100 | 177 | 9.974 | 13.75 | 3 |
| IMH 2-22R-605 | MIL 2-164-2 × BML 6 | 67 | 4 | 100 | 203 | 9.590 | 9.36 | 4 |
| IMH 2-22R-839 | MIL 2-1299-5 × MIL 2-406-1 | 65 | 2 | 101 | 185 | 9.538 | 8.77 | 5 |
| IMH 2-22R-830 | CML-457 × LM-14 | 64 | 2 | 103 | 198 | 9.385 | 7.02 | 6 |
| IMH 2-22R-614 | MIL 2-393-1 × BML 6 | 69 | 3 | 105 | 183 | 9.128 | 4.10 | 7 |
| IMH 2-22R-781 | MIL 2-1443 × HKI 1128 | 62 | 2 | 98 | 174 | 9.051 | 3.22 | 8 |
| IMH 2-22R-805 | MIL 2-1289 × MIL 2-571-1 | 69 | 3 | 108 | 210 | 8.949 | 2.05 | 9 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| IMH 2-22R-815 | MIL 2-814 × MIL 2-406-1 | 65 | 2 | 101 | 211 | 8.821 | 0.59 | 10 |
| Check 5 | P-3522 | 69 | 4 | 106 | 221 | 8.769 | | |
| Check 4 | KMH-25K45 | 62 | 1 | 98 | 198 | 8.179 | | |
| Check 3 | NMH-713 | 66 | 2 | 99 | 168 | 7.077 | | |
| Check 1 | Bio-9544 | 68 | 3 | 106 | 150 | 7.026 | | |
| Check 2 | DHM-117 | 69 | 3 | 108 | 182 | 4.974 | | |
| | Mean | 60.06 | 1.96 | 101.23 | 176.28 | 5.778 | | |
| Total crosses=245+5 | cv | 8.66 | 14.90 | 9.41 | 10.18 | 14.960 | | |
| | cd | 4.21 | 0.23 | 6.24 | 9.28 | 0.768 | | |

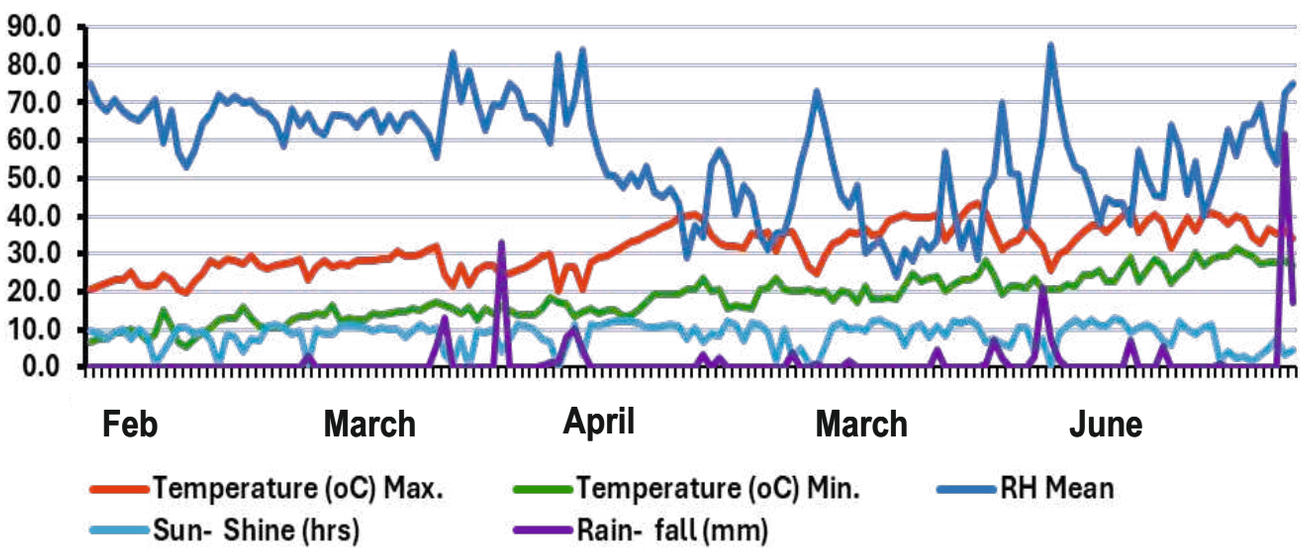



*Figure 1.1: Meteorological data of Spring 2023 at Ladowal, Ludhiana.*

**Evaluation of medium maturity Line × tester and diallel experimental hybrids under normal environment at IIMR, Ludhiana during *kharif*-2023**

A set of 120 L × T and diallel experimental hybrids including five checks was evaluated under normal environment during *kharif*-2023 at IIMR, Ludhiana. Seventeen hybrids out yielded the best check hybrids under normal environment and 7 hybrids with >10% yield superiority over best check *(Table 1.12)*.

**Evaluation of Line × tester and diallel experimental hybrids under normal environment at RMR&SPC, Begusarai during *Rabi*-2023-24**

A set of 195 L x T and diallel experimental hybrids including five checks was evaluated under normal environment at RMR&SPC, Begusarai during *Rabi*-2023-24. Although 19 hybrids out yielded the Local check DMRH 1308 but only two hybrids out yielded the best check hybrid P-3522 (Table 1.13). The experimental hybrid IMH 2-23R-103 showed highest yield (12.249 q/ha).

**Table 1.12: Performance of medium maturity Line x tester and diallel experimental hybrids under normal environment at IIMR, Ludhiana during *kharif*-2023.**

| Hybrid | Pedigree | DA | ASI | DM | GY (q/ha) | Sup % | Rank |
|---|---|---|---|---|---|---|---|
| IMH 2-23K-94 | MIL 2-800-1 × MIL 2-406-1 | 53 | 2 | 97 | 10.827 | 24.74 | 1 |
| IMH 2-23K-97 | IMH 228 | 54 | 2 | 95 | 10.811 | 24.57 | 2 |
| IMH 2-23K-114 | MIL 2-2034 × MIL 2-1062-1-2 | 54 | 2 | 96 | 10.247 | 18.07 | 3 |
| IMH 2-23K-57 | MIL 2-3010 × LM 14 | 54 | 2 | 96 | 10.246 | 18.05 | 4 |
| IMH 2-23K-110 | IMH 231 | 52 | 2 | 97 | 9.930 | 14.41 | 5 |
| IMH 2-23K-118 | MIL 2-1624 × LM 14 | 51 | 2 | 96 | 9.660 | 11.30 | 6 |
| IMH 2-23K-7 | MIL 2-466-1 × LM 13 | 55 | 1 | 96 | 9.563 | 10.19 | 7 |
| IMH 2-23K-99 | MIL 2-1062-1-2 X LM 13 | 52 | 1 | 97 | 9.456 | 8.96 | 8 |
| IMH 2-23K-117 | MIL 2-1621 × LM 13 | 53 | 2 | 97 | 9.372 | 7.99 | 9 |
| IMH 2-23K-96 | MIL 2-814-2 × MIL2-406-1 | 51 | 1 | 95 | 9.344 | 7.66 | 10 |
| IMH 2-23K-30 | MIL 2-369-1 × LM 14 | 53 | 2 | 97 | 9.314 | 7.31 | 11 |
| IMH 2-23K-55 | MIL 2-1561 × LM 14 | 54 | 2 | 96 | 9.243 | 6.49 | 12 |
| IMH 2-23K-60 | Mil 2-1477 × LM 14 | 53 | 2 | 96 | 9.050 | 4.27 | 13 |
| IMH 2-23K-116 | MIL 2-1625 × LM 13 | 55 | 2 | 98 | 9.045 | 4.21 | 14 |
| IMH 2-23K-107 | IMH 227 | 54 | 2 | 97 | 8.920 | 2.78 | 15 |
| IMH 2-23K-112 | MIL 2-3482 × LM 14 | 56 | 2 | 98 | 8.836 | 1.81 | 16 |
| IMH 2-23K-65 | LM 14 × MIL 2-1601 | 53 | 2 | 96 | 8.781 | 1.18 | 17 |
| Check 1 | Bio 9544 (C) | 53 | 3 | 97 | 8.090 | | |
| Check 2 | LG 34.05 (C) | 53 | 2 | 95 | 7.703 | | |
| Check 3 | NK 6240 (C) | 52 | 2 | 97 | 7.803 | | |
| Check 4 | CMH 08-282 (C) | 55 | 2 | 97 | 8.657 | | |
| Check 5 | CMH 08-287 (C) | 54 | 2 | 96 | 8.679 | | |
| | Mean | 53. | 0.30 | 96.0 | 6.515 | | |
| | CV (%) | 7.6 | 14.2 | 8.96 | 14.23 | | |
| | CD (5%) | 1.8 | 0.18 | 3.27 | 0.674 | | |

**Table 1.13: Performance of L × T & Diallel experimental hybrids under normal environment during *Rabi*-2023-24 at RMR & SPC, Begusarai**

| Entry name | Pedigree | Anthesis | ASI | Maturity (d) | Pl. height (cm) | Shelling % | Final Yield (t/ha) | % sup over DMRH 1308 | % Sup. over best check | Rank |
|---|---|---|---|---|---|---|---|---|---|---|
| IMH 2-23R-103 | MIL 2-406-1 × MIL 2-343-2 | 105 | 2 | 175 | 162 | 83.90 | 12.249 | 24.49 | 10.55 | 1 |
| IMH 2-23R-152 | MIL 2-1289 × BML 7 | 105 | 2 | 171 | 169 | 84.17 | 11.434 | 16.20 | 3.19 | 2 |
| IMH 2-23R-124 | MIL 2-83-1 × BML 7 | 106 | 2 | 174 | 138 | 88.10 | 11.069 | 12.49 | | 3 |
| IMH 2-23R-118 | LM 14 × MIL 2-1601 | 103 | 3 | 173 | 167 | 85.36 | 10.856 | 10.33 | | 4 |
| IMH 2-23R-163 | MIL 2-1625 × LM 13 | 103 | 2 | 174 | 152 | 85.25 | 10.772 | 9.47 | | 5 |
| IMH 2-23R-10 | MIL 2-346-2 × LM 13 | 103 | 2 | 171 | 145 | 85.86 | 10.686 | 8.60 | | 6 |
| IMH 2-23R-137 | MIL 2-343-3 × BML 7 | 106 | 2 | 174 | 148 | 82.06 | 10.659 | 8.32 | | 7 |
| IMH 2-23R-55 | MIL 2-590-2 × LM 14 | 102 | 2 | 175 | 143 | 86.66 | 10.643 | 8.16 | | 8 |
| IMH 2-23R-158 | MIL 2-1601 × BML 7 | 105 | 2 | 174 | 159 | 80.63 | 10.559 | 7.31 | | 9 |
| IMH 2-23R-161 | MIL 2-2039 × BML 7 | 104 | 2 | 174 | 177 | 76.71 | 10.476 | 6.46 | | 10 |
| IMH 2-23R-140 | MIL 2-591-1 × BML 7 | 101 | 3 | 176 | 144 | 89.28 | 10.429 | 5.98 | | 11 |
| IMH 2-23R-57 | MIL 2-795-2 × LM 14 | 104 | 2 | 176 | 164 | 78.43 | 10.223 | 3.89 | | 12 |
| IMH 2-23R-81 | MIL 2-2034-3 × LM 14 | 104 | 3 | 169 | 149 | 84.06 | 10.171 | 3.36 | | 13 |
| IMH 2-23R-135 | MIL 2-310-1 | 103 | 3 | 175 | 152 | 79.45 | 10.138 | 3.03 | | 14 |
| | ×LM 14 | | | | | | | | | |
| IMH 2-23R-110 | MIL 2-1299-5 × MIL 2-1062-1-2 | 104 | 3 | 177 | 152 | 87.39 | 10.109 | 2.73 | | 15 |
| IMH 2-23R-100 | MIL 2-1601 × BML 7 | 104 | 4 | 169 | 154 | 80.60 | 10.042 | 2.05 | | 16 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| IMH 2-23R-149 | MIL 2-1062-1-2 x LM 13 | 101 | 2 | 173 | 160 | 88.63 | 9.887 | 0.48 | | 17 |
| IMH 2-23R-150 | BML 7 × LM 14 | 102 | 3 | 176 | 147 | 84.81 | 9.861 | 0.21 | | 18 |
| IMH 2-23R-98 | MIL 2-1289 × BML 7 | 105 | 2 | 174 | 152 | 86.59 | 9.859 | 0.19 | | 19 |
| Check 1 | DMRH 1308 | 105 | 3 | 171 | 171 | 81.35 | 9.836 | | | |
| Check 2 | Bio 9544 | 101 | 3 | 176 | 134 | 84.97 | 6.662 | | | |
| Check 3 | DHM 117 | 108 | 2 | 172 | 141 | 83.92 | 4.026 | | | |
| Check 4 | P 3522 | 106 | 3 | 175 | 160 | 84.08 | 11.083 | | | |
| Check 5 | KMH 25K45 | 102 | 2 | 171 | 155 | 80.40 | 10.856 | | | |
| | Mean | 102.9 | 2.3 | 173.2 | 148.8 | 82.32 | 7.556 | | | |
| | CV (%) | 6.47 | 11.39 | 8.72 | 11.39 | 11.34 | 14.381 | | | |
| | CD (5%) | 6.48 | 0.23 | 8.98 | 8.79 | 4.37 | 0.891 | | | |

**Evaluation of IIMR hybrids under different seasons to explore their yield potential under varied Agro-ecologies at Begusarai and Ludhiana during 2023**

A set of 15 IIMR released/identified maize hybrids were evaluated under demonstration field at Begusarai (*Rabi*-2023-24) and at Ludhiana (*kharif* 2023 under normal and waterlogging and Spring 2024 normal) to explore their yield potential under varied agro-ecologies. Hybrid IMH 225 at Begusarai in *Rabi*-2023-24, hybrid IBCH 401 at Ludhiana under normal and hybrid IMH 231 under waterlogging and hybrid IMH 226 at Ludhiana in Spring 2024 were the highest yielder (Table1.14).

**Table 1.14: Performance of IIMR hybrids in different seasons/ecologies at Begusarai and Ludhiana**

| Name of hybrid | Maturity | DA (d) | DM (d) | Sh(%) | GY (t/ha) | DA (d) | DM (d) | Sh(%) | GY (t/ha) | DA (d) | DM (d) | Sh(%) | GY (t/ha) | DA (d) | DM (d) | Sh (%) | GY (t/ha) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Kh-2023 (Normal), LDH | | | | Kh-2023 (waterlogging), LDH | | | | Rabi-2023-24, BGS | | | | Spring 2024 (LDH) | | | |
| IMH 221 | Early | | | | | | | | | 93 | 148 | 86.1 | 9.774 | | | | |
| DMRH 1305 | Early | | | | | | | | | 91 | 145 | 80.0 | 8.869 | | | | |
| DMRH 1410 | Medium | | | | | | | | | 103 | 156 | 81.7 | 10.982 | | | | |
| DMRH 1308 | Medium | | | | | | | | | 100 | 154 | 80.7 | 9.048 | | | | |
| IMH 222 | Medium | 52 | 96 | 76.9 | 8.471 | 51 | 87 | 76.9 | 5.484 | 101 | 161 | 82.7 | 11.887 | 78 | 120 | 82.4 | 9.165 |
| IMH 223 | Medium | 51 | 96 | 77.8 | 8.556 | 54 | 87 | 76.1 | 4.225 | 103 | 158 | 83.1 | 11.690 | 75 | 120 | 83.7 | 8.662 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IMH 224 | Medium | 52 | 96 | 77.4 | 8.816 | 54 | 90 | 80.1 | 5.098 | 100 | 158 | 84.0 | 11.607 | | | | |
| IMH 225 | Medium | 57 | 96 | 90.6 | 7.552 | 53 | 92 | 85.5 | 5.034 | 99 | 160 | 84.3 | 13.607 | 78 | 125 | 84.4 | 11.348 |
| IMH 226 | Medium | 50 | 101 | 80.0 | 6.673 | 54 | 90 | 78.9 | 3.293 | 100 | 160 | 84.6 | 12.750 | 78 | 125 | 85.0 | 11.828 |
| IMH 227 | Medium | 51 | 102 | 75.9 | 6.775 | 50 | 90 | 82.4 | 4.727 | 102 | 156 | 84.9 | 13.452 | 81 | 126 | 81.8 | 8.942 |
| IMH 228 | Medium | 51 | 103 | 80.0 | 7.483 | 51 | 93 | 82.1 | 4.246 | 99 | 155 | 81.2 | 11.113 | 85 | 126 | 83.3 | 8.573 |
| IMH 230 | Medium | 54 | 97 | 80.0 | 6.207 | 62 | 92 | 85.3 | 4.087 | 100 | 153 | 81.7 | 10.190 | 76 | 128 | 88.1 | 8.750 |
| IMH 231 | Medium | 57 | 104 | 84.6 | 8.404 | 54 | 93 | 87.5 | 6.426 | 103 | 157 | 84.5 | 8.190 | | | | |
| IMH 232 | Medium | | | | | | | | | 104 | 160 | 81.0 | 9.387 | | | | |
| IBCH 401 | Medium | 52 | 101 | 81.5 | 11.407 | 56 | 94 | 79.7 | 5.449 | 98 | 158 | 83.6 | 12.143 | | | | |
| IMH 20R-16 | Medium | | | | | | | | | 106 | 155 | 79.4 | 9.417 | | | | |

## Evaluation of white maize hybrids

One hundred and twenty-three testcrosses were evaluated α- lattice design in two replications at Ludhiana during *kharif* 2023. Seven hybrids showed >15% superiority over the best check.

| Sl. No. | Cross | DTA | Mean Yield (Kg/ha) | Superiority |
|---|---|---|---|---|
| 1 | MIL10-14275 ×GM9C1 | 61 | 6985.41 | 30.53 |
| 2 | GM9C1 × BM1498 | 60 | 6811.42 | 27.28 |
| 3 | BM1472 × CML100 | 51 | 6720.42 | 25.58 |
| 4 | GM96C6 × GM328C1 | 50 | 6563.96 | 22.65 |
| 5 | GM9C1 × IMLSB2137 | 61 | 6536.46 | 22.14 |
| 6 | MIL 10-14349 × GPM696 | 55 | 6313.92 | 17.98 |
| 7 | MIL 10-14232 × IMLSB2137 | 56 | 6154.92 | 15.01 |
| | C2 (CMH 292) | 56 | 5351.58 | |
| | CD (5%) | | 764.15 | |
| | CV (5%) | | 16.74 | |

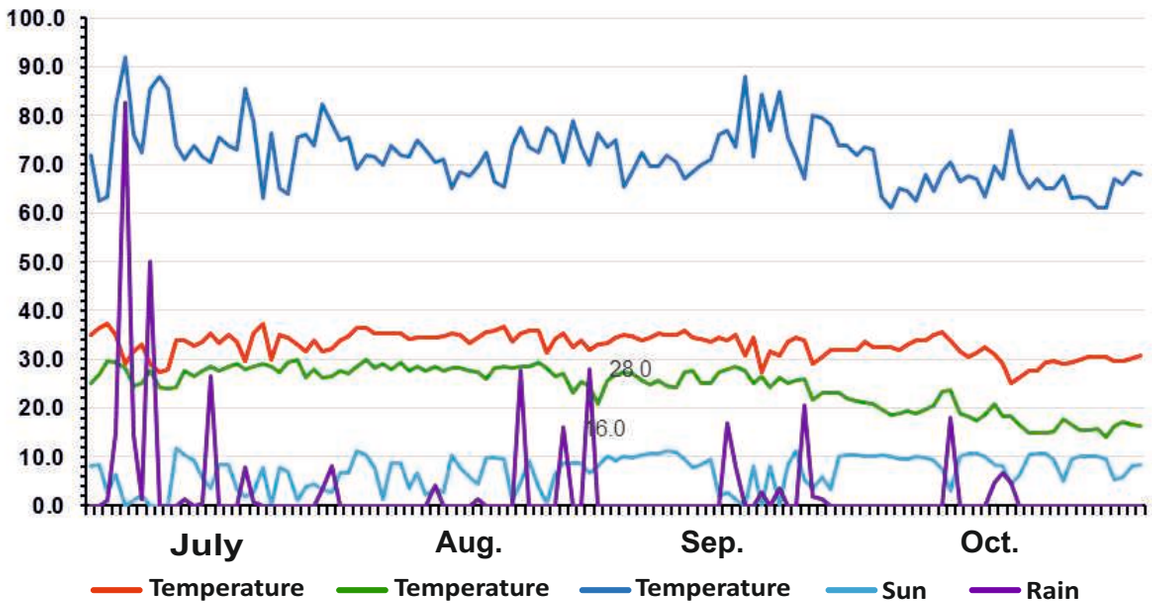
## Breeding for abiotic stress

### Evaluation of medium maturity Line x tester and diallel experimental hybrids under waterlogging stress environment at IIMR, Ludhiana during Kharif-2023

A set of 120 L x T and diallel experimental hybrids including five checks was evaluated under waterlogging stress environment during *kharif*-2023 at IIMR, thirty hybrids out yielded the best check hybrids waterlogging environment (Table 1.15). The hybrid IMH 231 showed highest yield (7.49 q/ha) under waterlogging.

**Table 1.15: Performance of medium maturity Line x tester and diallel experimental hybrids under waterlogging stress environment at IIMR, Ludhiana during *kharif*-2023**

| Hybrid | Pedigree | Survival (%) | DA | ASI | DM | GY (t/ha) |
|---|---|---|---|---|---|---|
| IMH 2-23K-110 | IMH 231 | 100.0 | 56 | 4 | 92 | 7.409 |
| IMH 2-23K-68 | MIL 2-1282 × MIL 2-1601 | 100.0 | 44 | 3 | 97 | 7.329 |
| IMH 2-23K-57 | MIL 2-3010 × LM 14 | 92.9 | 48 | 2 | 95 | 6.943 |
| IMH 2-23K-104 | MIL 2-1292-2 × LM 13 | 100.0 | 46 | 3 | 96 | 6.804 |
| IMH 2-23K-76 | MIL 2-93-1 × MIL 2-1062-1-2 | 100.0 | 47 | 4 | 92 | 6.675 |
| IMH 2-23K-101 | MIL 2-1282 × MIL 2-1289 | 90.0 | 50 | 4 | 95 | 6.614 |
| IMH 2-23K-6 | MIL 2-455-2 × LM 13 | 97.0 | 48 | 4 | 95 | 6.586 |
| IMH 2-23K-95 | IMH 224 | 100.0 | 50 | 3 | 95 | 6.503 |
| IMH 2-23K-112 | MIL 2-3482 × LM 14 | 100.0 | 50 | 4 | 93 | 6.200 |
| IMH 2-23K-89 | IMH 226 | 96.4 | 46 | 3 | 95 | 6.135 |
| IMH 2-23K-43 | MIL 2-1058-9-2 × LM 14 | 82.1 | 45 | 4 | 95 | 6.124 |
| IMH 2-23K-64 | LM 14 × MIL 2-571-1 | 92.9 | 46 | 3 | 94 | 5.925 |
| IMH 2-23K-114 | MIL 2-2034 × MIL 2-1062-1-2 | 100.0 | 43 | 6 | 93 | 5.880 |
| IMH 2-23K-62 | MIL 2-83-1 × MIL 2-1601 | 100.0 | 47 | 5 | 91 | 5.813 |
| IMH 2-23K-93 | MIL 2-791-3 ×BML-7 | 83.3 | 51 | 6 | 94 | 5.784 |
| IMH 2-23K-65 | LM 14 X MIL 2-1601 | 88.9 | 50 | 2 | 95 | 5.666 |
| IMH 2-23K-19 | MIL 2-3100 × LM 13 | 91.7 | 49 | 3 | 97 | 5.594 |
| IMH 2-23K-74 | MIL 2-58-2 × MIL 2-428 | 100.0 | 48 | 4 | 95 | 5.557 |
| IMH 2-23K-75 | MIL 2-83-1 × BML-7 | 100.0 | 48 | 2 | 97 | 5.525 |
| IMH 2-23K-55 | MIL 2-1561 × LM 14 | 100.0 | 47 | 4 | 95 | 5.451 |
| Check 1 | Bio 9544 (C) | 72.3 | 53 | 3 | 95 | 4.887 |
| Check 4 | CMH 08-282 (C) | 82.3 | 48 | 4 | 97 | 3.657 |
| Check 3 | NK 6240 (C) | 71.7 | 49 | 3 | 96 | 3.614 |
| Check 2 | LG 34.05 (C) | 54.3 | 54 | 4 | 97 | 2.966 |
| Check 5 | CMH 08-287 (C) | 36.6 | 49 | 3.5 | 93 | 1.379 |
| | Mean | 78.1 | 50 | 3 | 94 | 3.715 |
| | CV (%) | 24.50 | 8.76 | 14.8 | 7.68 | 17.62 |
| | CD (5%) | 9.42 | 1.78 | 0.23 | 3.41 | 0.60 |




**Evaluation of Line × tester and diallel experimental hybrids under cold stress environment at IIMR, Ludhiana during *Rabi*-2023-24.**

A set of 175 L x T and diallel experimental hybrids including five checks was evaluated under cold stress environment during *Rabi*-2023-24 at IIMR, Ludhiana. Out of 175 hybrids, 24 hybrids could not survive. The performance of to 20 hybrids shown in the Table19. Thirty-one hybrids out yielded the best check hybrids and only one hybrid was found with >10% yield superiority over best check. The experimental hybrid IMH 2-23R-19 showed highest yield (10.968 q/ha) under cold stress.

**Table 1.16: Performance of L × T & Diallel experimental hybrids under cold stress during *Rabi*-2023-24 at IIMR, Ludhiana**

| Entry name | Pedigree | Survival (%) | Anthesis | ASI | Maturity (d) | Pl. height (cm) | Shelling % | Grain Yield (t/ha) | Rank |
|---|---|---|---|---|---|---|---|---|---|
| IMH 2-23R-19 | MIL 2-1037-5-1 × LM 13 | 100.0 | 158 | 3 | 199 | 170 | 80.3 | 10.968 | 1 |
| IMH 2-23R-33 | MIL 2-3100 × LM 13 | 97.3 | 164 | 4 | 201 | 163 | 82.3 | 9.106 | 2 |
| IMH 2-23R-20 | MIL 2-1042-6-1 × LM 13 | 90.8 | 159 | 4 | 200 | 169 | 74.5 | 8.991 | 3 |
| IMH 2-23R-29 | MIL 2-1744-6-2 × LM 13 | 85.8 | 161 | 6 | 201 | 133 | 81.4 | 8.217 | 4 |
| IMH 2-23R-106 | MIL 2-1282 × MIL 2-1601 | 76.3 | 161 | 3 | 198 | 167 | 85.4 | 8.152 | 5 |
| IMH 2-23R-46 | MIL 2-312-1 × LM 14 | 77.2 | 157 | 7 | 202 | 155 | 82.2 | 7.752 | 6 |
| IMH 2-23R-109 | MIL 2-1299-5 × MIL 2- 571-1 | 79.5 | 161 | 5 | 202 | 152 | 85.0 | 7.668 | 7 |
| IMH 2-23R-118 | LM 14 x MIL 2-1601 | 65.3 | 164 | 8 | 198 | 171 | 83.9 | 7.343 | 8 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| IMH 2-23R-58 | MIL 2-798-2 × LM 14 | 68.9 | 163 | 7 | 197 | 159 | 83.4 | 7.136 | 9 |
| IMH 2-23R-11 | MIL 2-369-1 ×LM 13 | 83.0 | 156 | 3 | 195 | 171 | 79.3 | 6.748 | 10 |
| IMH 2-23R-9 | MIL 2-334B-1 × LM 13 | 82.1 | 157 | 5 | 197 | 168 | 84.3 | 6.605 | 11 |
| IMH 2-23R-134 | MIL 2-231-1 × MIL 2-571-1 | 79.0 | 160 | 6 | 199 | 132 | 83.3 | 6.603 | 12 |
| IMH 2-23R-74 | MIL 2-1712-3-2 × LM 14 | 67.5 | 160 | 5 | 199 | 160 | 87.5 | 6.596 | 13 |
| IMH 2-23R-139 | MIL 2-457-1 × HKI 1128 | 93.3 | 161 | 5 | 201 | 138 | 79.4 | 6.505 | 14 |
| IMH 2-23R-117 | LM 14 × MIL 2-571-1 | 60.0 | 163 | 8 | 198 | 145 | 80.5 | 6.406 | 15 |
| IMH 2-23R-150 | BML 7 × LM 14 | 68.6 | 163 | 4 | 205 | 173 | 86.7 | 6.400 | 16 |
| IMH 2-23R-121 | MIL 2-54-1 x LM 14 | 78.6 | 161 | 5 | 200 | 153 | 83.2 | 6.274 | 17 |

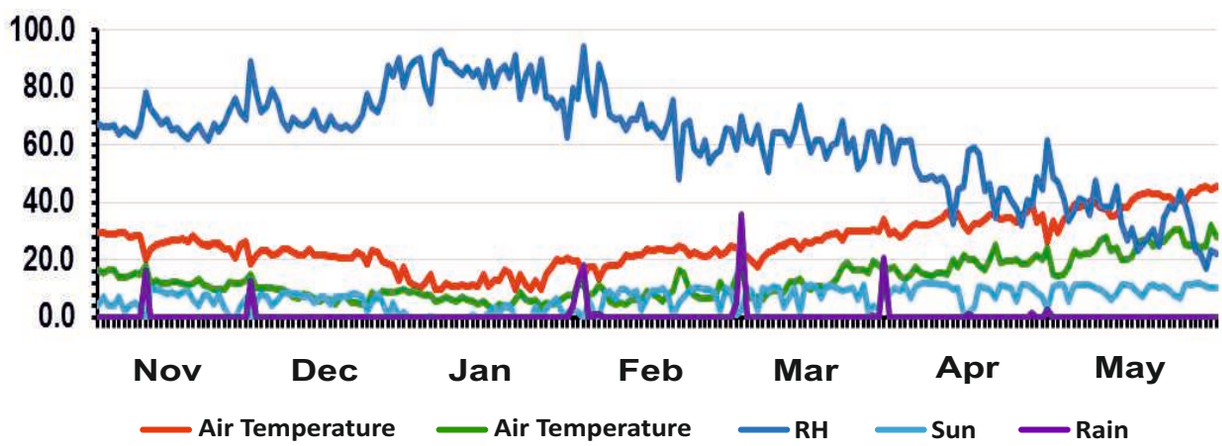



*Figure 3: Meteorological data of Ladowal, Ludhiana during Rabi-2023-24.*

## Screening of maize inbreds against disease and pests

### Screening of maize inbreds at Ludhiana and Karnal during kharif-2020,2021 & 2023 to identify resistant source against MLB

A set of 100 Inbred lines was evaluated during *kharif*-2020, 2021 & 2023 at Ludhiana and Karnal to identify resistant source against MLB. One inbred line MIL 2-173-2 2023 at ICAR-IIMR, Ludhiana for yield and yield traits. On the basis of pooled analysis 31 inbred were found moderately resistant and 26 moderately susceptible.

**Table 1.17: Disease reaction of MIL 2-173-2 against MLB during three years (2020, 2021 & 2023) at Ludhiana and Karnal**

| Entries | Ludhiana | | | Karnal | | | Pooled | Disease reaction |
|---|---|---|---|---|---|---|---|---|
| | 2020 | 2021 | 2023 | 2020 | 2021 | 2023 | | |
| | Mean | Mean | Mean | Mean | Mean | Mean | Mean | |
| MIL 2-173-2 | 3.9 | 2.6 | 2.5 | 2.5 | 2.9 | 4.00 | 3.0 | R |
| Res. Check: BML-6 HKI 193-1 (2023 Karnal) | 4.2 | 3.2 | 4.6 | 5.5 | 5.2 | 2.5 | 4.5 | MR |
| Sus. Check: CM 600 HKI 586 (2023 Karnal) | 6.7 | 7.2 | 6.8 | 6.0 | 6.0 | 8.1 | 6.76 | MS |

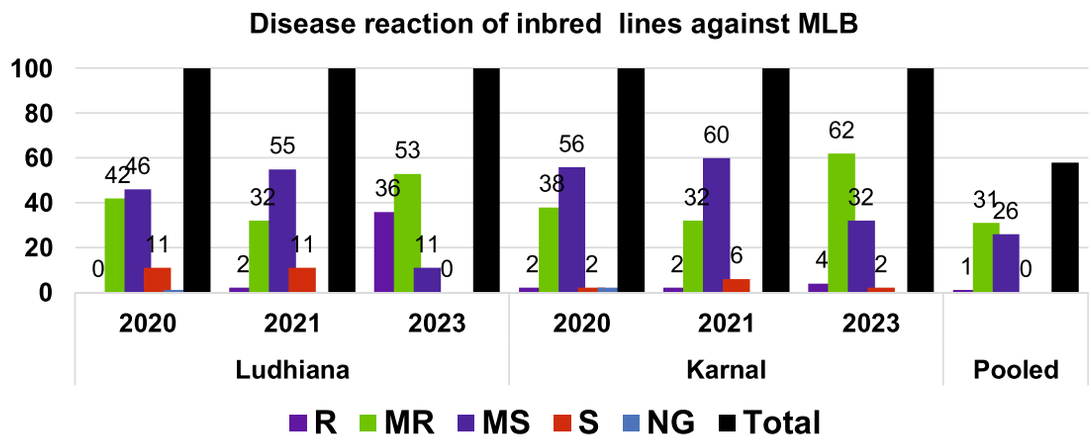



*Figure.4: Screening of maize inbreds against MLB at Ludhiana and Karnal during kharif 2020, 2021 & 2023*

**Screening of maize inbreds against BLSB at Ludhiana and Karnal during *kharif*-2023**

A set of 100 Inbred lines was evaluated during *kharif*-2023 at Ludhiana and Karnal to identify resistant source against BLSB. On the basis of pooled analysis over location five inbreds MIL 2-428-2, MIL 2-511-1, MIL 2-941-3, MIL 2-3470 and EI 670 have shown resistant reaction against BLSB. The trial will be repeated to confirm the results.

**Table 1.18: Identification of resistant inbred lines against BLSB at Ludhiana and Karnal during *kharif*-2023.**

| Entries | Ludhiana | | Karnal | | Pooled | |
|---|---|---|---|---|---|---|
| | Score | Reaction | Score | Reaction | Score | Reaction |
| MIL-2-428-2 | 1.8 | R | 4.2 | MR | 3.0 | R |
| MIL-2-511-1 | 2.2 | R | 3.6 | MR | 2.9 | R |
| MIL-2-941-3 | 2.9 | R | 2.9 | R | 2.9 | R |
| MIL-2-3470 | 2.6 | R | 2.7 | R | 2.6 | R |
| EI-670 | 2.7 | R | 2.8 | R | 2.8 | R |
| Resistant Check | 2.6 | R | 2.8 | R | 4.5 | MR |
| Susceptible check | 6.8 | MS | 7.5 | MS | 6.5 | MS |
| Resistant Check : BML 6 (LDH), HKI 193-1 (Karnal)<br>Susceptible check: CM 600 (LDH), HKI 586 (Karnal) | | | | | | |

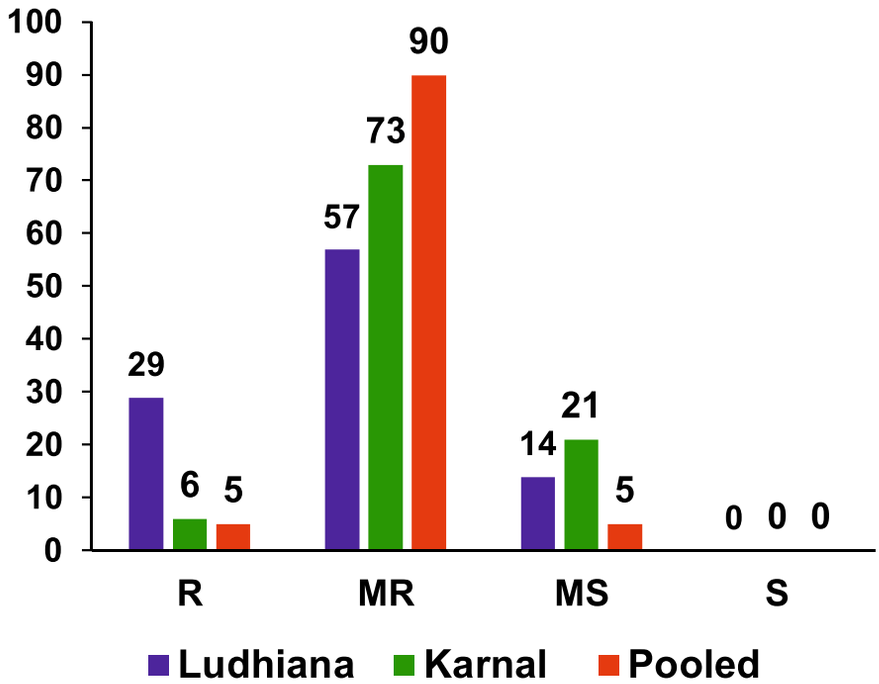



*Figure 1.4: Disease reaction of maize inbreds against BLSB at Ludhiana and Karnal during Kharif -2023*

**Screening of inbred lines against Charcoal rot at Ludhiana during Spring 2023, *kharif*-2023 and Spring 2024**

A set of 127 inbreds in Spring 2023, 100 inbreds in *kharif* 2023 and 85 inbreds in *kharif*-2024 were evaluated at Ludhiana. Sixty-one inbreds were common during three seasons. Out of these 61 inbreds 59 were found moderately resistant and two moderately susceptible. However, four inbreds MIL-2-164-1, MIL-2-201-1, MIL-2-941-1 and MIL-2-1587 showed comparatively good performance and disease score (Table: 1.19)

**Table1.19: Screening of inbred lines against Charcoal rot disease at Ludhiana during Spring 2023, *kharif*-2023 and Spring 2024.**

| Entries | Ludhiana | | Karnal | | Pooled | |
|---|---|---|---|---|---|---|
| | Score | Reaction | Score | Reaction | Score | Reaction |
| MIL-2-428-2 | 1.8 | R | 4.2 | MR | 3.0 | R |
| MIL-2-511-1 | 2.2 | R | 3.6 | MR | 2.9 | R |
| MIL-2-941-3 | 2.9 | R | 2.9 | R | 2.9 | R |
| MIL-2-3470 | 2.6 | R | 2.7 | R | 2.6 | R |
| EI-670 | 2.7 | R | 2.8 | R | 2.8 | R |
| Resistant Check | 2.6 | R | 2.8 | R | 4.5 | MR |
| Susceptible check | 6.8 | MS | 7.5 | MS | 6.5 | MS |
| Resistant Check : BML 6 (LDH), HKI 193-1 (Karnal)<br>Susceptible check: CM 600 (LDH), HKI 586 (Karnal) | | | | | | |

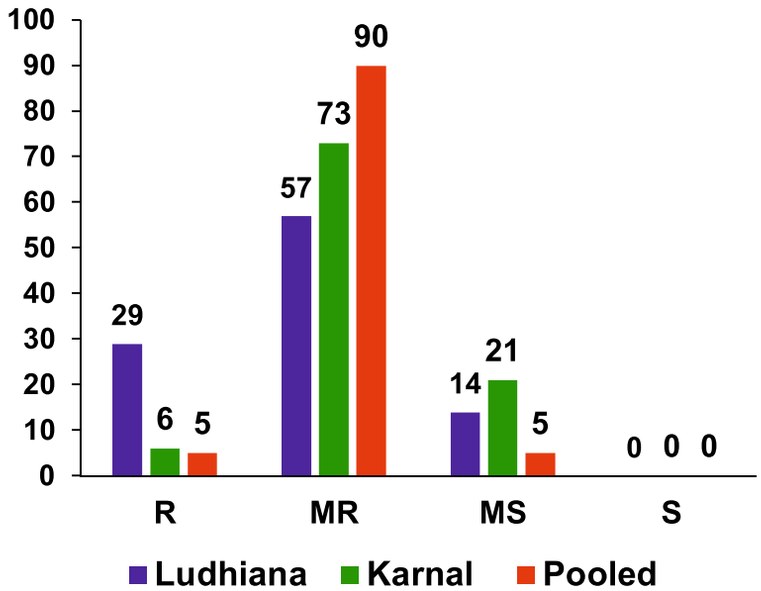



*Figure 1.5: Disease reaction of maize inbreds against BLSB at Ludhiana and Karnal during Kharif-2023*

**Screening for charcoal rot of baby corn genotypes**

A total of 30 baby corn inbreds lines (Table 1.20) screened against the charcoal rot during spring seasons of 2023 and 2024. Among the 30 inbreds lines BIL-23-78 was found consistent resistant in both the seasons, hence can be tested at other location to confirm its resistance.

**Table 1.20: List of inbreds lines and their reactions against the charcoal rot**

| S. No. | Entry Name | 2024 | | 2023 | |
|---|---|---|---|---|---|
| | | Average score | Reaction | Mean | Reaction |
| 1. | BIL-23-61 | 3.9 | MR | 4.8 | MR |
| 2. | BIL-23-62 | 4.2 | MR | 6.1 | MS |
| 3. | BIL-23-63 | 4.3 | MR | 5.2 | MS |
| 4. | BIL-23-64 | 4.2 | MR | 5.4 | MS |
| 5. | BIL-23-65 | 3.4 | MR | 5.2 | MS |
| 6. | BIL-23-66 | 3.8 | MR | 3.8 | MR |
| 7. | BIL-23-67 | 3.9 | MR | 4.9 | MR |
| 8. | BIL-23-68 | 3.1 | MR | 4.9 | MR |
| 9. | BIL-23-69 | 3.6 | MR | 3.6 | MR |
| 10 | BIL-23-70 | 3.9 | MR | 5.5 | MS |
| 11 | BIL-23-71 | 3.9 | MR | 5.7 | MS |
| 12 | BIL-23-72 | 3.6 | MR | 4.4 | MR |
| 13 | BIL-23-73 | 2.9 | R | 4.1 | MR |
| 14 | BIL-23-74 | 3.9 | MR | 3.0 | R |
| 15 | BIL-23-75 | 3.4 | MR | 3.2 | MR |
| 16 | BIL-23-76 | 3.4 | MR | 4.6 | MR |
| 17 | BIL-23-77 | 3.0 | R | 3.9 | MR |

| | | | | | |
|---|---|---|---|---|---|
| 18 | BIL-23-78 | 2.9 | R | 2.2 | R |
| 19 | BIL-23-79 | 4.4 | MR | 2.5 | R |
| 20 | BIL-23-80 | 5.3 | MS | 6.4 | MS |
| 21 | BIL-23-81 | 2.8 | R | 5.8 | MS |
| 22 | BIL-23-82 | 4.7 | MR | 5.4 | MS |
| 23 | BIL-23-83 | 3.5 | MR | 5.0 | MR |
| 24 | BIL-23-84 | 3.4 | MR | 2.5 | R |
| 25 | BIL-23-85 | 4.0 | MR | 5.6 | MS |
| 26 | BIL-23-86 | 4.4 | MR | 5.1 | MS |
| 27 | BIL-23-87 | 4.3 | MR | 5.0 | MR |
| 28 | BIL-23-88 | 3.2 | MR | 5.6 | MS |
| 29 | BIL-23-89 | 3.6 | MR | 3.0 | R |
| 30 | BIL-23-90 | 3.8 | MR | 4.2 | MR |

## Specialty corn breeding

### Evaluation of CMS based baby corn hybrids

To develop the CMS based baby corn hybrids, a total 140 CMS based experimental baby corn hybrids which were evaluated in *kharif* season 2023, in Alpha lattice design with two replications and two rows per replication with check CMVL baby corn 2 and G 5417. Among the total 140 experimental hybrids 4 hybrids showed superiority over both the checks in terms of baby corn yield without husk (Table 1.21).

**Table 1.21: Evaluation of baby corn hybrids**

| S. No. | Experimental hybrids | Baby Yield without husk (q/ha) | % superiority over checks | | BCL (cm) | BCD (cm) |
|---|---|---|---|---|---|---|
| | | | CMVL BC 2 | G 5417 | | |
| 1. | IBCH 11-24K1 | 14.38 | 33.76 | 13.85 | 10.25 | 1.3 |
| 2. | IBCH 11-24K2 | 12.63 | 17.44 | 0.00 | 9.83 | 1.4 |
| 3. | IBCH 11-24K3 | 11.50 | 6.98 | - | 11.5 | 1.5 |
| 4. | IBCH 11-24K4 | 11.13 | 3.49 | - | 10.6 | 1.3 |
| Check | CMVL BC 2 | 10.75 | | | | |
| Check | G 5417 | 12.63 | | | | |

### Evaluation of normal corn hybrids using CMS lines

To develop the normal grain maize hybrid using CMS lines, a total 140 experimental maize hybrids which were evaluated in *kharif* season 2023, in Alpha lattice design with two replications and two rows per replication in spacing 70×20 cm with check Bio 9544and CMH 08-282. Among the total 140 experimental hybrids, 4 hybrids showed superiority over both the checks in terms of grain yield (Table 1.22). The developed hybrid will reduce the cost of seed production as female line is sterile and does not require detasseling.

**Table 1.22: Evaluation of normal corn hybrids using CMS lines**

| S. No. | Experimental hybrids | Yield (t/ha) | % superiority over checks | |
|---|---|---|---|---|
| | | | Bio 9544 | CMH 8-282 |
| 1. | IMH 11-2401 | 6.58 | 11.68 | 15.35 |
| 2. | IMH 11-2402 | 7.07 | 20.17 | 24.12 |
| 3. | IMH 11-2403 | 6.36 | 8.00 | 11.62 |
| 4. | IMH 11-2404 | 6.11 | 3.82 | 7.24 |
| Check | Bio 9544 | 5.89 | | |
| Check | CMH 8-282 | 5.70 | | |

## Diversification of genetic base for stress tolerance and fodder traits in maize

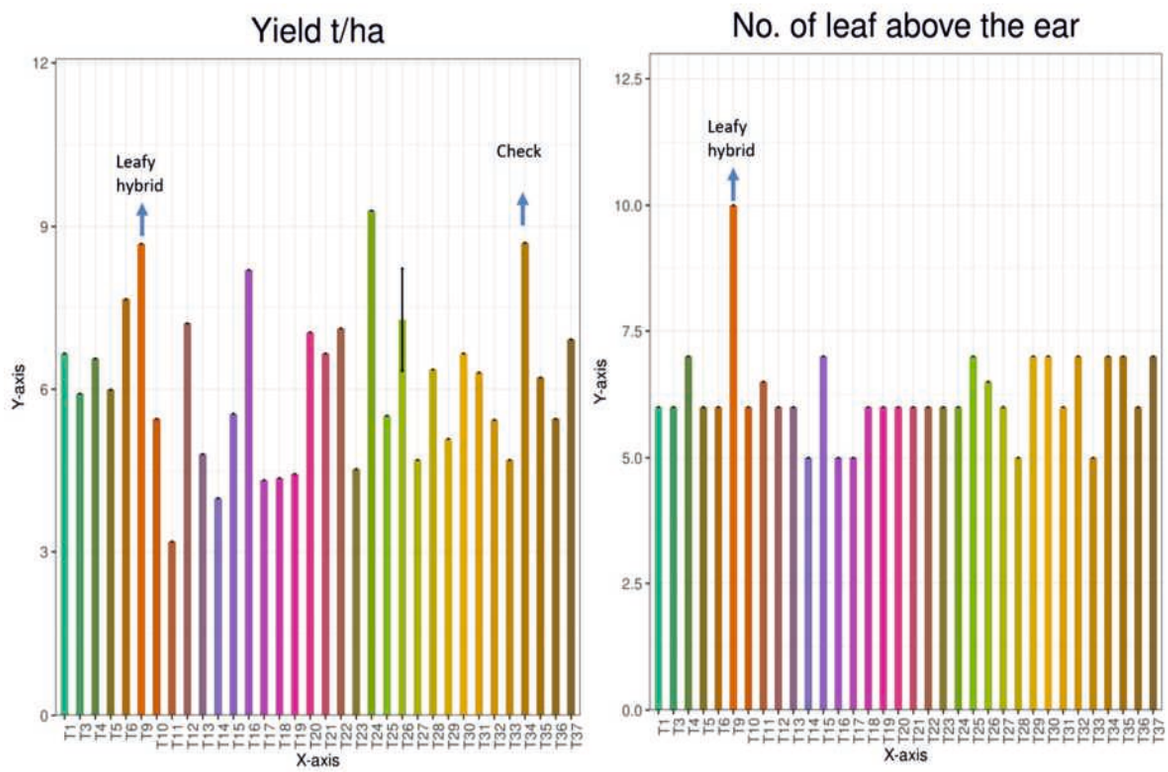
**Wild crosses for diversification:** A total of 39 wild crosses *(Table 1.23)* have been attempted with three wild species (Zea mexicana, Zea parviglumis and Coex) as given below to diversify the existing maize germplasm for various biotic and abiotic traits and also for fodder traits. A total of 168 doubled haploids (DH) lines generated using two 2GenRM wild populations using inbreds UMI 1201, UMI 1210 and wild species Zea parviglumis to find out the promising segregants.

**Table 1.23: List of wild crosses attempted**

| *Zea mexicana* | *Zea parviglumis* | Coex |
|---|---|---|
| IML 242-1 | MIL 388-1 | IML 194-1 |
| UMI 1210 | LM 14 | 0499C130 |
| 0591C130 | IML 194-1 | UMI 1230 |
| BIL-23-1 | UMI 1210 | |
| BIL-23-2 | 0591C130 | |
| BIL-23-3 | MIL 274-1 | |
| IML 164 | IMLSB 1294-1 | |
| IML 194-1 | HKI 1105 | |
| IMH 222 (hybrid) | IMR 297 | |
| LM-14 | LG 35 | |
| UMI 1230 | VS 143 | |
| IML 127-1 | IMH 222 | |
| EC 447173 | UMI 1230 | |
| EC 646916 | | |
| MLSP1770217 | | |
| IMLSB 2039 | | |
| 0499C130 | | |
| IMLSB 2136 | | |
| CM 108 | | |
| IMLSB 1294-1 | | |
| IMR 340 | | |
| BML 6 | | |
| IMR 323 | | |

## Development of high biomass fodder, silage and dual-purpose maize cultivars:

The leafy mutant has extra advantage as having a greater number of leaves above the cob which provides the more biomass and less lignin content which ultimate enhance the digestibility, Hence using this mutant one leafy hybrid developed which is having yield equivalent to check (8.6 t/ha) and 10 leaves above the cob. The hybrid is at the initial stage and will be more suitable for silage purposes.




Breeding for fodder composites,

Total seven improved fodder population/composites contributed to AICRP on forage trial *kharif*, 2024 as details given below:

**Table 1.24: List of wild crosses attempted**

| S. No. | Entry Name | Green fodder Yield (2022-23) (q/ha) | |
|---|---|---|---|
| | | 2022 | 2023 |
| 1 | IFH 11-241 | 416 | 451 |
| 2 | IFH 11-242 | 407 | 408 |
| 3 | IFH 11-243 | 459 | 461 |
| 4 | IFH 11-244 | 461 | 409 |
| 5 | IFH 11-245 | 427 | 399 |
| 6 | IFH 11-246 | 396 | 409 |
| 7 | IFH 11-247 | 409 | 402 |

## Breeding for quality traits

Characterization of germplasm for lysine, tryptophan and methionine content a panel of 250 inbred lines was characterized for lysine, tryptophan and methionine content at two locations i.e. Ludhiana and Begusarai. Based on pooled data box plots have been constructed which are given below:

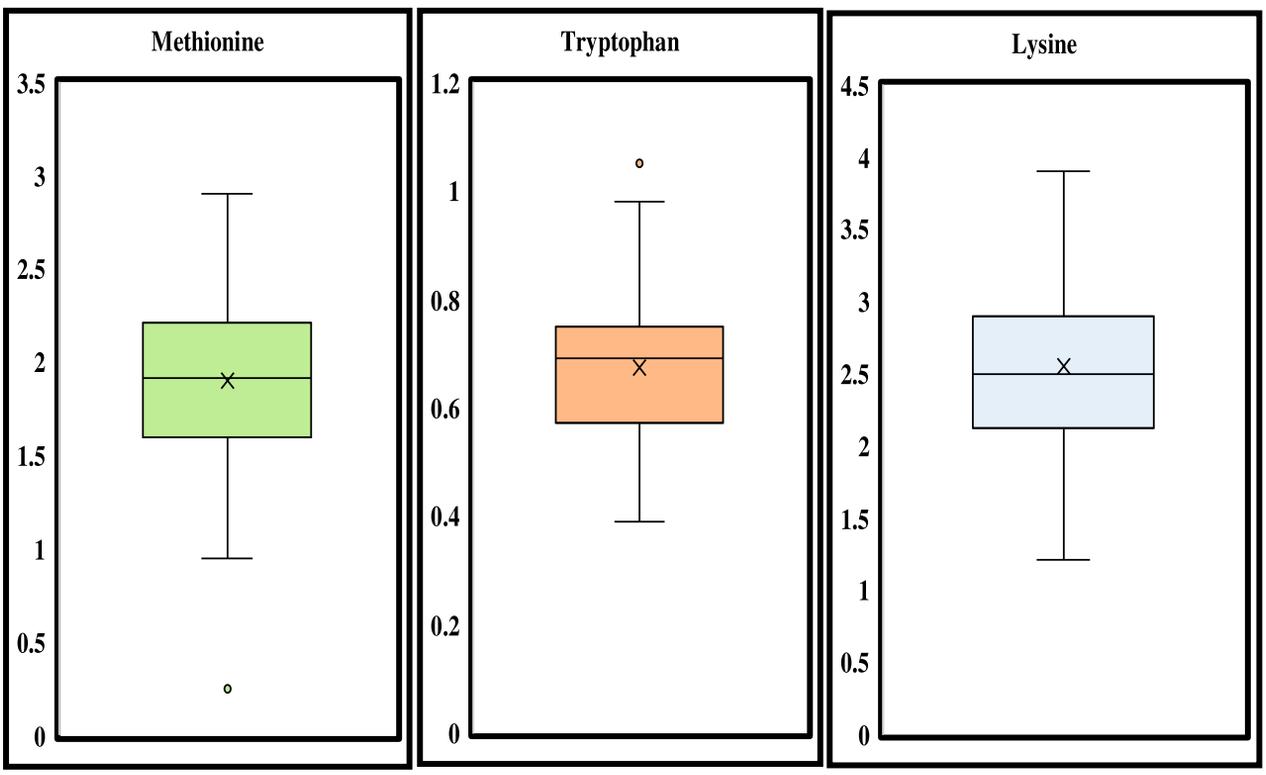



**Table 1.25 The descriptive statics are also given below for these traits:**

| Variability Parameters | Methionine (%) | Tryptophan (%) | Lysine (%) |
|---|---|---|---|
| Maximum | 3.03 | 1.096 | 4.03 |
| Minimum | 0.252 | 0.3847 | 0.115 |
| Grand Mean | 0.1913 | 0.6737 | 2.5542 |
| CD (1%) | 0.244 | 0.369 | 1.381 |
| ECV (%) | 6.0343 | 2.5901 | 2.5604 |
| GCV (%) | 20.2456 | 19.6352 | 20.0395 |
| PCV (%) | 20.9095 | 19.8028 | 20.2033 |

## Population structure and cluster analysis

The genotypes were subjected to GBS analysis and based on genotypic data population structure have also been constructed for the above-mentioned panel and whole panel is clearly divided into three groups. Cluster analysis also revealed similar patterns as of population structure.

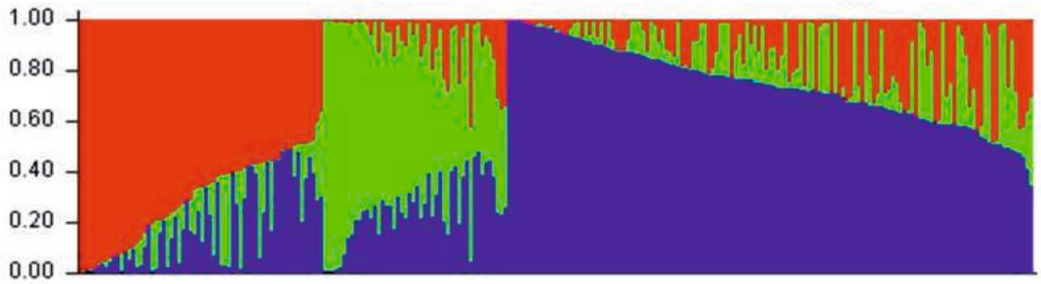



*Figure 1.6: Population structure of genotypes from SNP markers generated through GBS analysis*

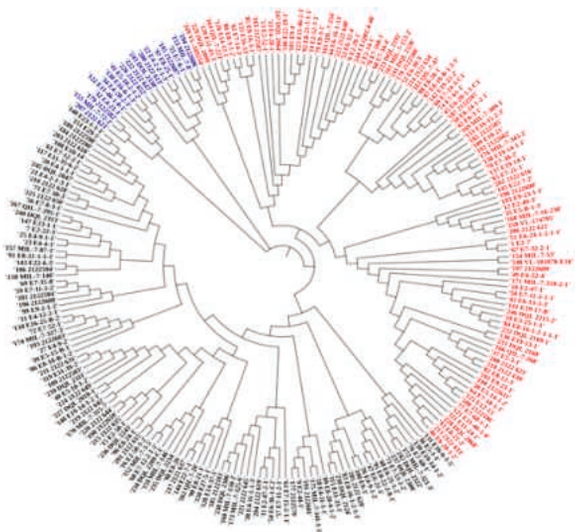


*Figure 1.7: Cluster analysis of genotypes from SNP markers generated through GBS analysis*

## Genome wide association studies for kernel methionine

The genotypic and kernel methionine content of the above mentioned panel were used for GWAS analysis. Based on GWAS analysis 21, 28 and 13 MTAs (marker trait association) were detected in Environment 1, 2 and Combined, respectively and 7 stable MTAs (common in both locations) were detected, of which 2 were also detected when combined GWAS analysis (both locations) was done.

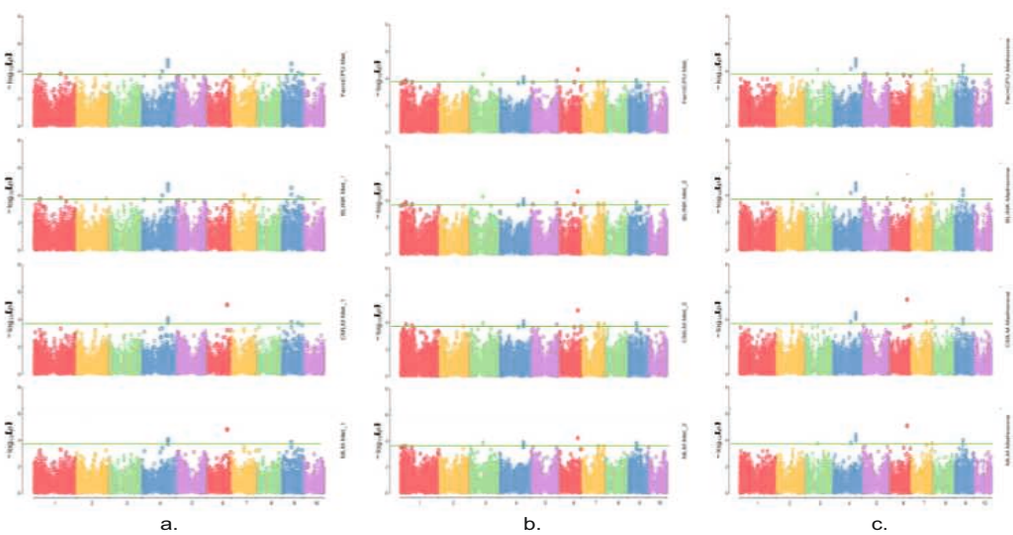



*Figure 1.8: Manhattan plot showing associated SNPs a. environment 1, b. environment 2, and c*

### Development of high methionine line through DH Technology

New inbred lines have been developed by using DH technology and these lines were estimated for methionine content. The best lines selected from this set for methionine content have given below:

**Table 1.24 The descriptive statics are also given below for these traits:**

| S.No. | Pedigree | Methionine content (%) | S.No. | Pedigree | Methionine content (%) |
|---|---|---|---|---|---|
| 1 | QIL4-3267 | 2.9 | 8 | QIL4-3273 | 2.4 |
| 2 | QIL4-3252 | 2.8 | 9 | QIL4-3258 | 2.3 |
| 3 | QIL4-3265 | 2.5 | 10 | QIL4-3275 | 2.3 |
| 4 | QIL4-3253 | 2.4 | 11 | QIL4-3278 | 2.3 |
| 5 | QIL4-3255 | 2.4 | 12 | QIL4-3269 | 2.2 |
| 6 | QIL4-3256 | 2.4 | 13 | QIL4-3270 | 2.2 |
| 7 | QIL4-3271 | 2.4 | 14 | QIL4-3279 | 2.1 |

### Evaluation of experimental hybrids during *kharif*, 2024

A set of 68 experimental hybrids was evaluated at ICAR-IIMR, Ludhiana during *kharif* 2024. Twelve experimental hybrids out yielded the best check Bio 9544 (field corn) and IQMH 202(QPM hybrids) which is given below.

**Table 1.24 The descriptive statics are also given below for these traits:**

| S.No. | Experimental Hybrid | Grain Yield(Q/ha) |
|---|---|---|
| 1 | P-41 × MB-109 | 96.4 |
| 2 | P-42 × MB-109 | 95.9 |
| 3 | P-17 × MB-109 | 94.9 |
| 4 | P-5 × MB-122 | 93.3 |
| 5 | P-37 × MB-109 | 91.3 |
| 6 | P-37-1 × MB-122 | 86.7 |
| 7 | P-43 × MB-122 | 86.2 |
| 8 | P-7 × MB-109 | 84.1 |
| 9 | P-43 × MB-109 | 84.1 |
| 10 | P-38 × MB-122 | 83.1 |
| 11 | P-11 × MB-122 | 83.1 |
| 12 | P-7 × MB-122 | 82.1 |
| | Bio-9544 | 76.9 |
| | IQMH-202 | 68.2 |
| | **CD** | **9.45** |
| | **CV (%)** | **10.38** |

In another experiment, 56 experimental hybrids were evaluated for grain yield at ICAR-IIMR, Ludhiana. Five hybrids out yielded the best check ADV 765 (Field corn hybrid) and 10 experimental hybrids have out yielded the best QPM check (IQMH 202).
The details of these hybrids is given below:

| S.No. | Experimental Hybrid | Grain Yield(Q/ha) |
|---|---|---|
| 1 | BC-18 × MB-109 | 94.4 |
| 2 | BC-1 × MB-109 | 93.8 |
| 3 | BC-47 × MB-109 | 87.7 |
| 4 | BC-18 × MB-122 | 86.2 |
| 5 | BC-60 × MB-122 | 85.6 |
| 6 | BC-7 × MB-122 | 83.6 |
| 7 | BC-6 × MB-109 | 78.5 |
| 8 | BC-1 × MB-122 | 77.4 |
| 9 | BC-20 × MB-122 | 74.9 |
| 10 | BC-3 × MB-109 | 71.3 |
| | ADV-765 (Check) | 84.1 |
| | IQMH-202(Check) | 76.9 |
| | **CD** | **11.3** |
| | **CV (%)** | **13.4** |

## Genetic enhancement for high zinc in maize kernels

A set of Differentially expressed genes (DEGs) have been identified through transcript profiling playing role in iron and zinc accumulation in kernels and shoots. Total of 795, 4500, and 954 genes were found differentially expressed for high Zn, Fe and Zn+Fe accumulation, respectively in kernels. The validation of selected genes is going on using qRT-PCR. There are very few regulatory genes have been identified and validated at the functional level playing role in Fe and Zn accumulation in plants. Amongst those HRZ (Hemerythrin RING Zinc-finger) genes identified in the recent past are one of the well proven genes playing role in Fe and Zn accumulation (2-4 times increase when knockdown) in Rice and ARabidopsis. In our transcriptome profiling also, we observed that the HRZ has the regulatory role in Fe and Zn accumulation in maize. In thisregard, we identified and isolate two rice HRZ orthologue in maize, designed genes specific primers, amplified the same from Indian maize genotype DMRH 1308 and clones for further sequencing and designing construct for its editing. Previously we identified significant SNPs for high Fe on chromosome 1, 3, 5, 7 and for high Zn on chromosome 1, 3, 4, 8, 9 with R2 values ranged from 10.0% to 30.0%. With in these associated genomic regions, a total of 25 candidate genes (CGs) and their function were identified using in-silico approach which play role in Fe and Zn regulation in maize and its related species. Out of 25, 12 CGs showed synteny with sorghum, rice, and wheat. Ortho-CGs involving maize SNPs were identified in syntenic regions on chromosomes 1, 3, 4, 7, and 9 in sorghum, chromosomes 1, 2, 5, 6,7, 9 in rice, and chromosome 1A, 1D, 2A, 2B, 3B, 5A, 5B, 6D, 7B in wheat.
We have also developed 88 new inbred lines from pedigree crosses attempted between high zinc lines as pollen parent and elite inbred lines of national maize programme. These were used in crossing programme and developed 302 experimental hybrids, which were evaluated at three different locations during 2024. Some selected hybrids such as IQH 7-213, IQH 7-451, IMH 7-641, IQH 7-122, and IMH 7-126 were showing zinc content more than the benchmarks (> 35ppm) in all three locations. Further we also

evaluated 341 inbred lines and 28 best F3 (derived from CIMMYT high zinc hybrids) breeding lines for Zinc in kernels and found some line such as IML7-182, IML 7-537, IML 7-267 etc. as best materials with significant Zn (> 45ppm) in kernels.

**Molecular tagging of genomic regions associated with increased starch accumulation in maize kernel**

The panel consisting of 226 inbred lines from CIMMYT, Mexico and IIMR, Ludhiana were evaluated for kernel starch during summer (*kharif*) season of 2023. The field trials were conducted at two locations, viz. ICAR-IIMR, Ludhiana, Punjab and Winter Nursery Centre (WNC), Hyderabad. The individuals were self-pollinated in both the locations, and the starch estimations were done, and each of the genotypes were characterized through GbS (Genotyping by sequencing). The starch content among inbred lines varied from 57.68% to 73.47% with an average of 66.04% at Hyderabad and from 57.34% to 70.02% with an average of 63.36% at Ludhiana. Overall starch content estimated from two locations of these genotypes and 84976 high quality SNP marker (MAF?0.05) were subjected to marker trait association using four models including MLM, CMLM, FarmCPU and BLINK for markers trait association. The Q-Q (quantile-quantile) plots of expected (under a Gaussian distribution) vs observed p-values and Manhattan plots of -log10(p-values) for SNP-based genotype-phenotype association for the starch content has been presented in Figures 1.9. Considering -log10P≥3.30 as significant thresholds, a total of 36 SNPs significantly associated with total starch content in maize kernel were identified through MLM, 36 SNPs by CMLM, 64 SNPs by FarmCPU and 64 SNPs by BLINK. Among these identified SNPs, 36 SNPs were co-detected by all four models. Only additional 28 SNPs were co-detected by the two multi-locus models. These total 64 SNPs were found to be distributed on all ten chromosomes with the highest number of significant SNPs on chromosome 7 (23) and least number of significant SNPs on chromosome 9 (1). The LOD score of significant SNPs ranged from 3.30 (chr3:182643672) to 4.69 (chr7:138286490) for 36 SNPs detected by MLM, CMLM. Meanwhile, for 64 SNPs examined with FarmCPU and BLINK, the LOD scores ranged from 3.30 (chr6:88457581) to 5.22 (chr7:138286490). The estimated effects of 36 co-identified QTNs (Quantitative Trait Nucleotides) by MLM, CMLM and FarmCPU models were completely distinct, whereas the effects of these QTNs remained consistent across the model. A negative sign in the effect value denotes that these QTNs have negative effect on the starch content trait in maize kernel. The BLINK method did not detect any negative signs in the effects, and it presented entirely divergent effect values other than MLM, CMLM and FarmCPU for those 36 QTNs. Sign and values of effect for additional 28 QTNs detected by BLINK were also different from FarmCPU. Six significant QTNs co-detected within range of 138286243bp-138286501bp (258bp) and twelve significant QTNs co-detected within range of 154064761bp-154065013bp (252bp) on chromosome 7 indicating these are important region. Similarly, within short base pair range, multiple number of QTNs detected on different chromosome (Chr.01, Chr.03, Chr.07, Chr.08, Chr.10). Therefore, utilizing a 262 kb window size to define QTL, it was possible to classify total 64 QTNs as 33 distinct QTLs. We have identified 21 significant QTNs within the range of previously identified QTLs for starch content. Out of these 21 QTNs, 14 were identified by all four models, while the remaining 7 were specifically detected by both FarmCPU and BLINK. Potential candidate genes associated with starch content were identified using Maize Genetics and Genomics Database (MaizeGDB). As, the overall LD decay across the genome of this panel was 131kb, we predicted candidate genes within the 262kb region flanking the left and right side of each SNP as QTLs. A sum of 145 candidate genes were identified among which 81 candidate genes were detected by all four models, in addition to that 64 genes solely by FarmCPU and BLINK model were detected. All the candidate genes are involved in diverse functions including carbohydrate metabolism, transcription factor, sugar transporter, protein binding, cytoplasmic components, DNA binding and other related processes. Twenty-nine genes without known functions were also discovered that could potentially be involved in the starch synthesis process.

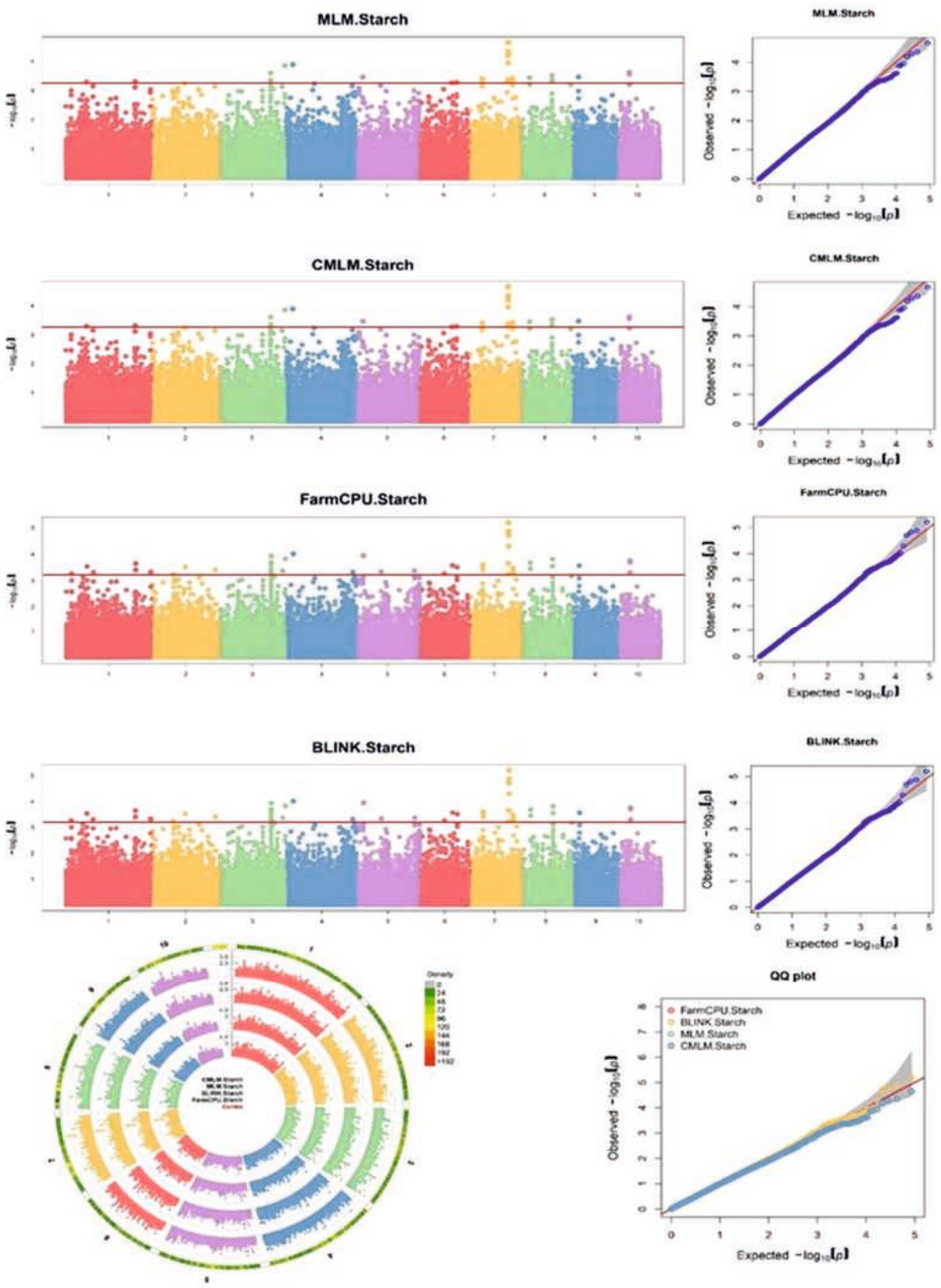



*Figure 1.9: Comparative Manhattan and Q_Q plot of four GWAS Model*

# BASIC SCIENCES

2 Chapter

## Generating knockout mutants of phytoene desaturase gene in maize

Phytoene desaturase, PDS, gene sequence was isolated from DMRH 1308 genotype and is being utilized for tissue culture and transformation experiments. The CDS sequence information generated from the specific cultivar (DMRH 1308) was used to design a target-specific guide RNA (gRNA) towards the 5' end of the coding region with minimal off-targets using CRISPR Direct (https://crispr.dbcls.jp/) and CHOP-CHOP (https://chopchop.cbu.uib.no/) softwares. The secondary structure of gRNA was predicted using the RNA fold 2.0 tool. The selected gRNA was cloned in pRGEB32-BAR vector and the same was confirmed by colony PCR, restriction digestion and Sanger sequencing. The successfully assembled construct was used for biolistic transformation into the nodal explants derived callus from DMRH 1308. After three rounds of selection in the dark in a callusing medium having 2 mg/l DL-Phosphinothricin (PPT or Basta), calli were shifted for regeneration under 16 hr light and 8 hr dark photoperiod. Further, the regenerated shoots were shifted in the rooting medium. The integration of the construct was confirmed by PCR analysis of putative transformants with bar and nptII gene-specific primers *(Figure 2.1)*.

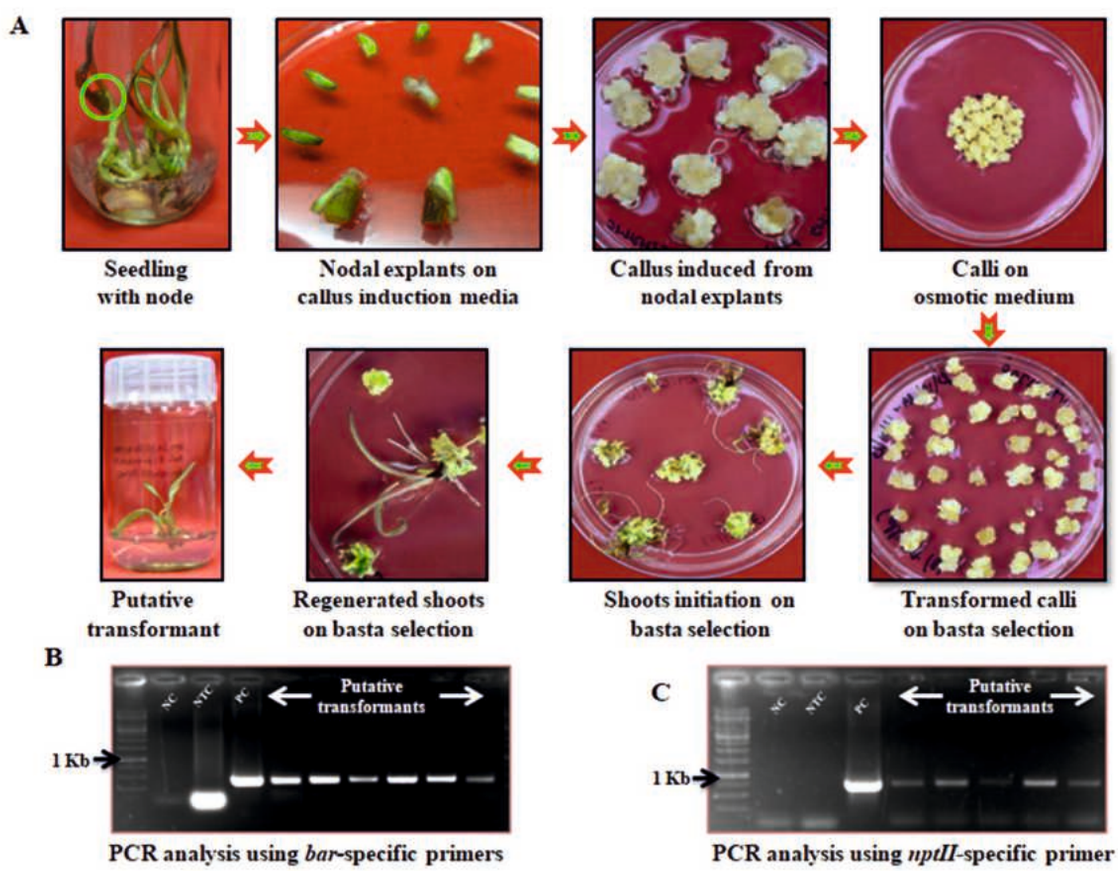



*Figure 2.1: Editing of DMRH1308 maize genotype by knockout of PDS gene with CRISPR/Cas9 (A). Molecular confirmation of putative transformants using PCR (B-C).*

## Evaluation of RIL population for Callus induction & regeneration

Previously, we have standardized an efficient and reproducible regeneration protocol using mature seed as a starting material in DMRH 1308 and DMRH 1301 hybrids. Since the main genotypes used in our tissue culture and transformation work are hybrid, getting fixed genome-edited events in hybrid will take more time due to segregation in subsequent generations. Therefore, to address the same, we have developed RIL mapping population (250 lines) for better callusing and regeneration traits *(Figure 2.2)*. We have also started phenotyping these RILs for callusing and regeneration. So far, 26 genotypes/RILs have been evaluated for their ability to form embryogenic calli using nodal explants. Significant variations in callus induction efficiency were observed. Out of 26 RILs, four genotypes namely DMRH1308-239, DMRH1308-274, DMRH1308-85, and DMRH1308-40 displayed high callus induction (up to 75%) and regeneration frequency (up to 70%), making them promising candidates for further research *(Figure 2.3)*. Conversely, other genotypes exhibited lower efficiency. Evaluation of the rest of the RILs is underway.

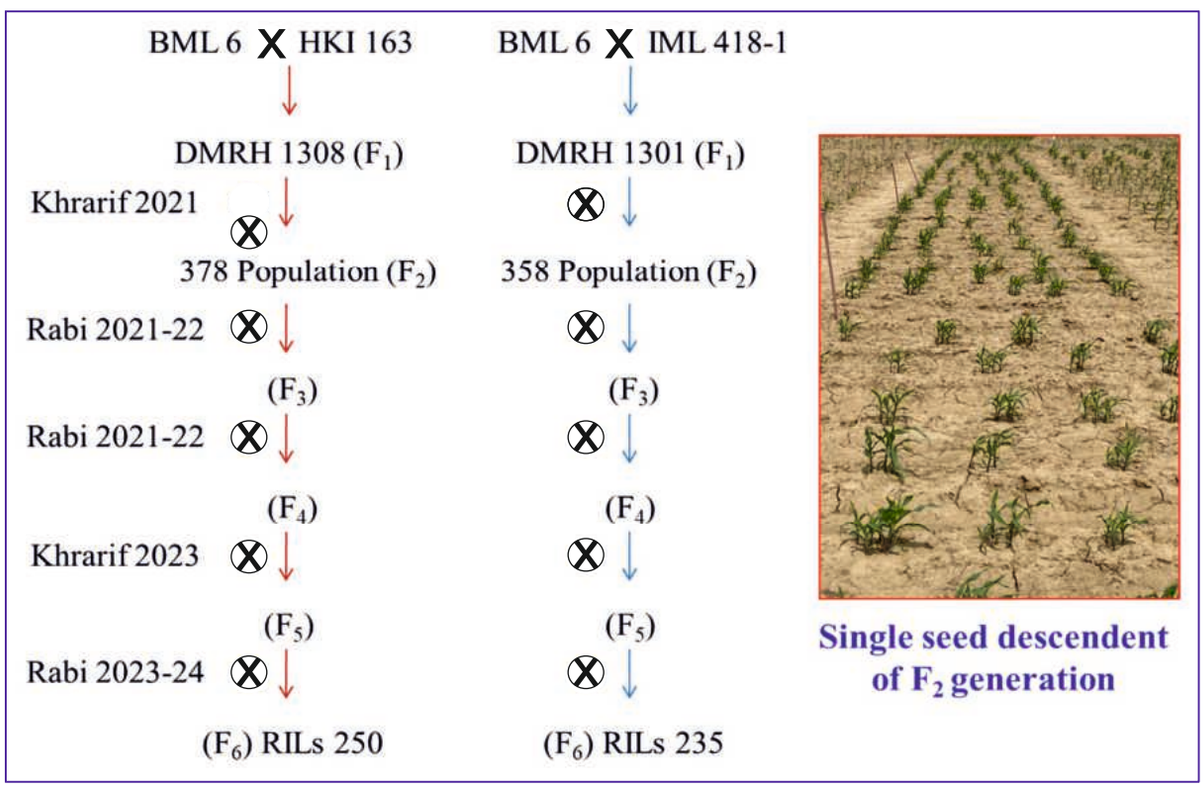



*Figure 2.2 : Development of RIL population for callusing and regeneration traits*

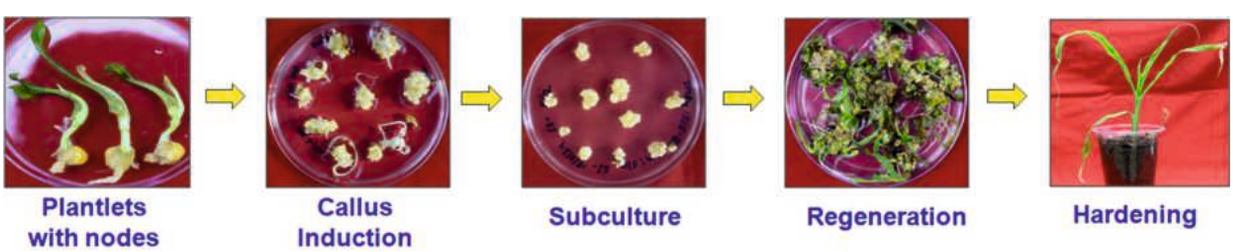



*Figure 2.3 : Schematic representation of callus induction and regeneration in DMRH1308-85 line*

## Screening of germplasm for starch content

The assessment of maize germplasm for starch content highlights the unexplored potential of various hybrids for ethanol production. During 2024, a total of 23 public and private maize hybrids were obtained from eight AICRP maize centers across NWPZ (Pantnagar, Delhi), NEPZ (Begusarai, Bhubaneswar), PZ (Hyderabad, Kolhapur), and CWZ (Banswara, Chhindwara) for starch estimation. These hybrids representing early, medium and late maturity groups, were analyzed for endosperm starch content using the polarimetric method. The starch content recorded in different maturity groups ranged from 56.4% - 64.2% for early maturity hybrids, 56.0% - 67.6% for medium maturity hybrids and 56.4% - 65.9% for late maturity hybrids.

A total of 154 lines from Delhi centre were further examined for starch content, ranging from 50.9% to 62.2%, along with an additional 37 lines, exhibiting starch levels between 51.9% and 64.9%. Key seed parameters, such as hundred kernel weight, ranged from 18.6 g to 38.9 g. Additionally, various morphophysiological traits, including shape (flat or round), size (small, medium, or large), and color (white, orange, yellow, or red), were recorded to determine their influence on starch content and processing suitability.

A set of 142 lines from the National Demonstration (2024-25) was also analyzed, with starch content ranging from 50.80% to 61.2%. These lines were classified into early, medium, and late maturity groups. The early maturity group included 20 samples with starch content ranging from 53.4% to 60.6%, while the medium maturity group consisted of 80 samples with starch content between 50.8% and 61.2%. Similarly, the late maturity group comprised 40 samples, with starch content ranging from 51.46% to 60.96%.

## Assessment of nitrogen responsive traits by screening inbreds under different nitrogen conditions.

Nitrogen is the most limiting macronutrient as it is an essential component of biomolecules. The dynamic nature of nitrogen and its tendency to escape plant-soil systems reduces the efficacy of its utilization by the cereal crops. Almost 50-70% of nitrogen is from plant-soil system due to poor utilization efficiency of cereals. To completely understand NUE it is important to determine the traits that are nitrogen responsive for their utility as phenotypic markers for selection of nitrogen use efficient germplasm. A diverse of maize inbred lines were screened under different nitrogen conditions i.e. zero nitrogen (N0), half of the recommended doze (NH) and full recommended doze(NF).Performance of different lines at different nitrogen treatments were assessed for traits including germination, vigour, chlorophyll content, flowering, plant height and cob height. There was high visual variability among the germplasm grown under different nitrogen treatments *(Figure 2.4)*.

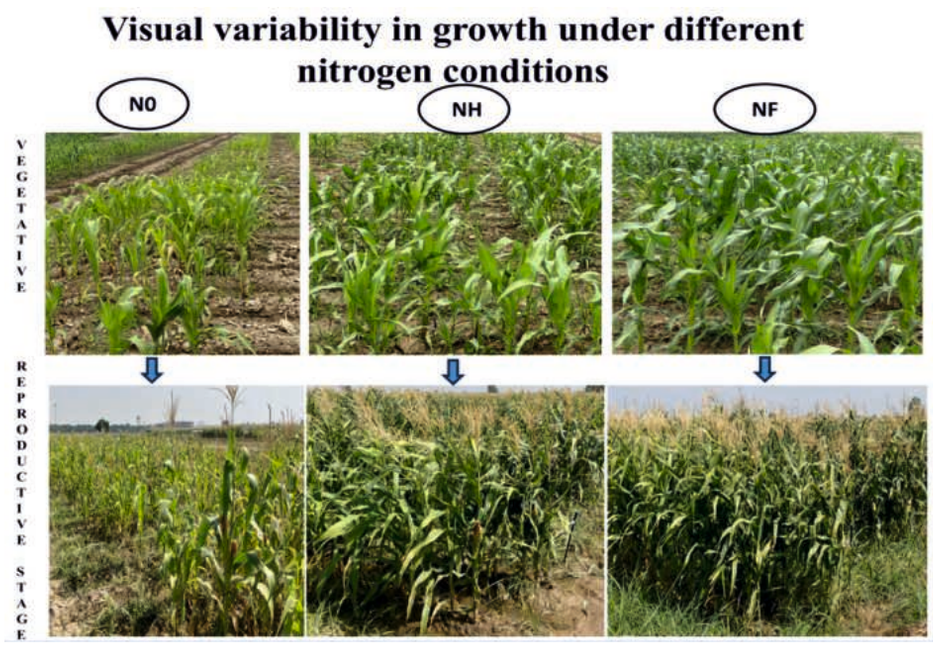



***Figure 2.4**: Visual Variability among the genotypes under different nitrogen conditions*

Based on the phenotypic screening, five nitrogen use efficient and five nitrogen responsive genotypes were selected analysis of activity of nitrogen metabolism responsive enzymes i.e. nitrate reductase glutamate synthase (GOGAT). Nitrate reductase is the primary enzyme involved in conversion of inorganic form of nitrogen to ammonia and GOGAT is involved in GS/GOGAT cycle for driving ammonia toward amino acid formation. This is a rate limiting enzyme. Activity of nitrate reductase and GOGAT was assayed at 30-35, 45-50 and 75-80 days after sowing (DAS). Results depicts that irrespective of genotype or treatment, NR activity was maximum at 30-35 DAS i.e. initial growth stages whereas GOGAT showed maximum activity at 75-80 DAS i.e. later vegetative stages (Fig 2.5a, b). While comparing different nitrogen treatments, it was observed that irrespective of genotypes, maximum enzyme activity for both NR and GOGAT was observed at NF followed by NH and least at N0. However, comparison of subset of NUE efficient and nitrogen responsive inbreds, it came out that NUE efficient retained more NR and GOGAT activity at all the treatments in comparison to nitrogen responsive genotypes.

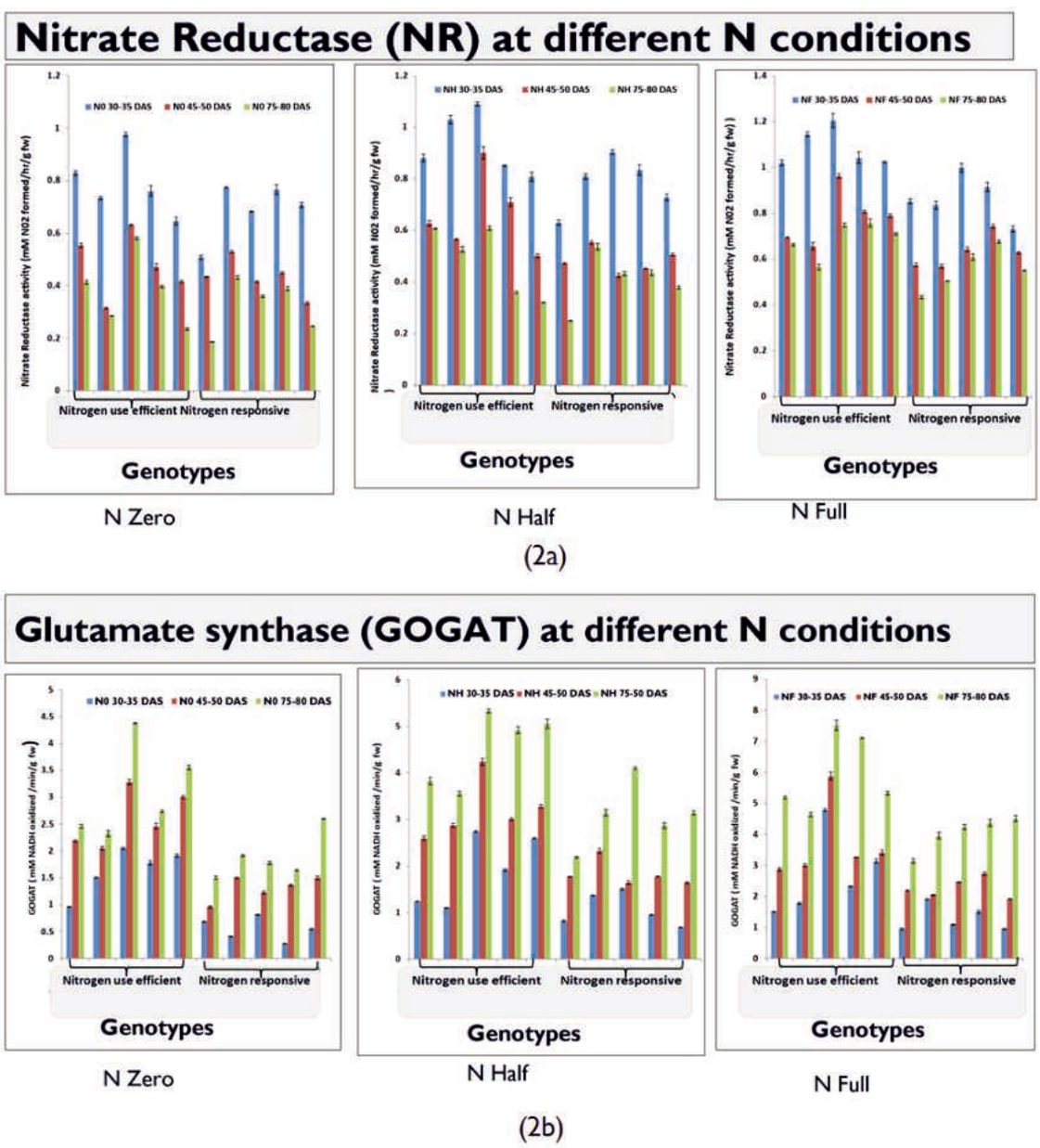



*Figure 2.5: Assessment of enzyme activity of nitrate reductase (2a) and glutamate synthase (2b). These two enzymes can be used as stage specific biochemical marker for screening of NUE efficient lines in future breeding programs.*

# CROP PRODUCTION

3 Chapter

Maize is increasingly emerging as a viable alternative crop in regions where traditional crops have become non-remunerative. To ensure the sustainability of maize cultivation in these new ecologies, it is essential to adopt scientifically proven, resource-efficient crop production technologies. Bridging the existing yield gaps requires focused efforts on developing and disseminating best practices tailored to both traditional and evolving maize-based cropping systems. Emphasis on sustainable intensification and precision agronomy will be key to enhancing productivity, profitability, and resilience in these systems.

## Assessment of conservation agriculture-based maize-wheat cropping system on soil health and input use efficiency

The rice–wheat (RW) cropping system in north-west India, while instrumental in ensuring national food security, has resulted in significant challenges such as soil degradation and over-exploitation of groundwater resources. Diversification of the RW system through maize-based cropping systems, along with the adoption of alternative soil and crop management practices, offers a promising pathway to address these concerns. Such diversification can enhance overall system productivity, conserve irrigation water, reduce labour costs, sustain soil health, improve environmental quality, and provide high-quality fodder. Moreover, it can help meet the rising demand for maize grains from the growing piggery and poultry sectors. In this context, a long-term experiment was initiated in 2017 to evaluate the benefits and viability of maize-based diversification strategies.

In seventh year significantly higher system productivity was obtained under maize-wheat system compared to rice-wheat. In comparison to the rice-wheat system, the system productivity was significantly higher in conservation and conventional maize-wheat system, respectively (Graph 1). Among different fertilizer management treatments, significantly higher system yield was obtained under RDF, 75% RDF and 150% RDF over farmers fertilizer practice. The maize-wheat system was also water-use efficient as it reduced water consumption by 84 % as compared to the rice-wheat system. Maize-wheat system can be grown 5-6 times, with the same amount of water that is used to grow one cycle of the rice-wheat system. So, replacement of the rice-wheat system with maize-wheat, with increased system productivity (up to 30%), profitability (up to 71 %) and also resulted in huge (80 %) water saving.

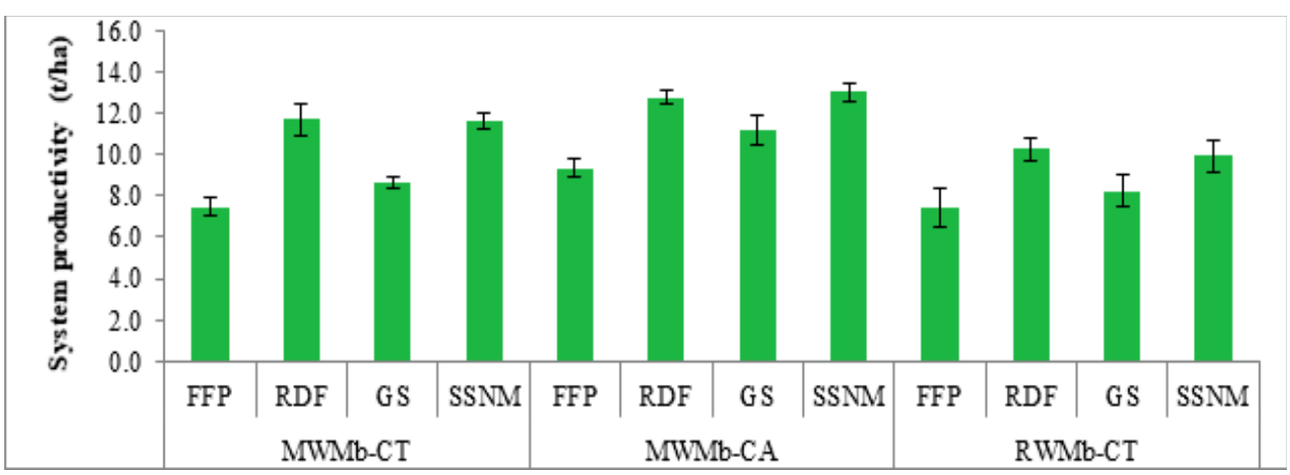



*Figure 3.1: System yield under different tillage and cropping system and nutrient management practices in 2023-24.*

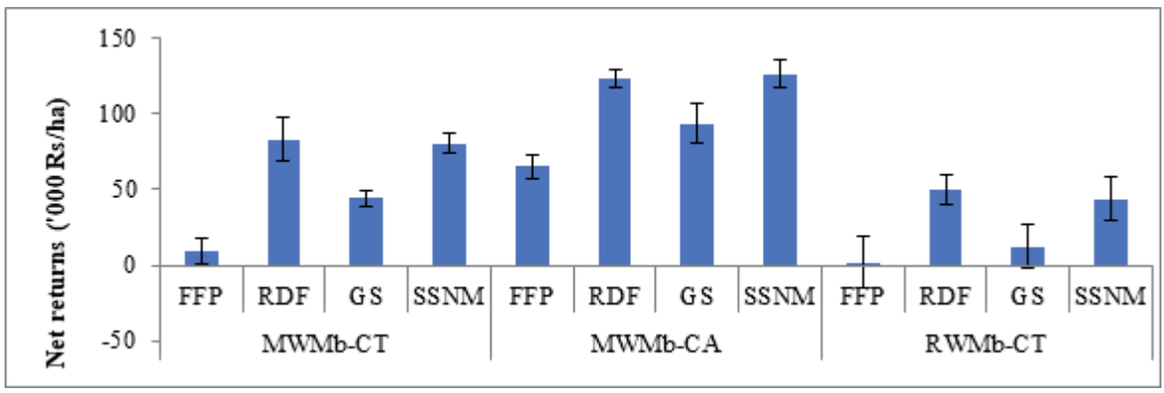



***Fig. 3.2.*** *Net returns under different tillage and cropping system and nutrient management practices in 2023-24.*

Net return and B: C ratio was also calculated and in sixth year significantly highest net return and B: C ratio was also found with conservation maize-wheat-mungbean (Graph 2) as compared to conventional maize-wheat-mungbean and rice-wheat-mungbean systems. Amongst fertilizer management practices use of green seeker sensors produced significantly higher net return over farmer fertilizer practice and RDF, however it remained at par with SSNM practice.

The soil organic carbon was also measured after completion of seven years. Highest soil organic carbon was built up in conservation agriculture maize-wheat system followed by CT maize-wheat and least soil organic carbon built-up was observed in puddled rice-wheat cropping system.

**Best production practices for enhanced productivity and profitability in maize-based cropping system**

Maize-based cropping systems hold immense potential for enhancing agricultural productivity, profitability, and sustainability, particularly in regions facing challenges with traditional crop rotations. Adoption of best production practices such as improved seed varieties, optimal sowing time, balanced nutrient management, conservation agriculture techniques, efficient water and weed management, and integrated pest control can significantly boost maize yields while reducing input costs and environmental impact. Tailoring these practices to specific agro-climatic conditions ensures resource-use efficiency and resilience, thereby making maize-based systems

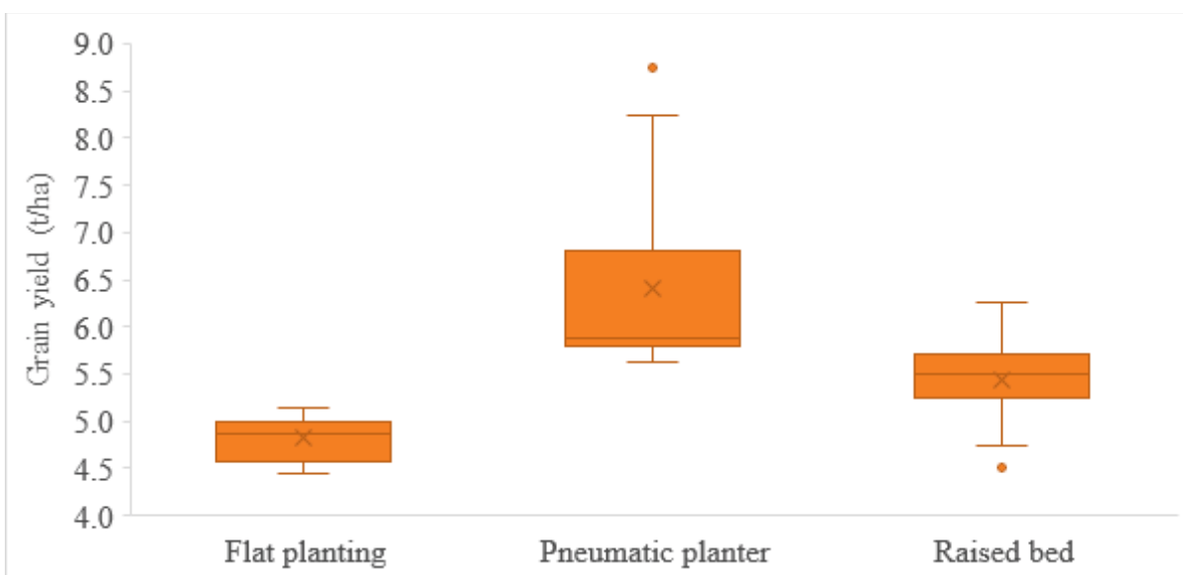


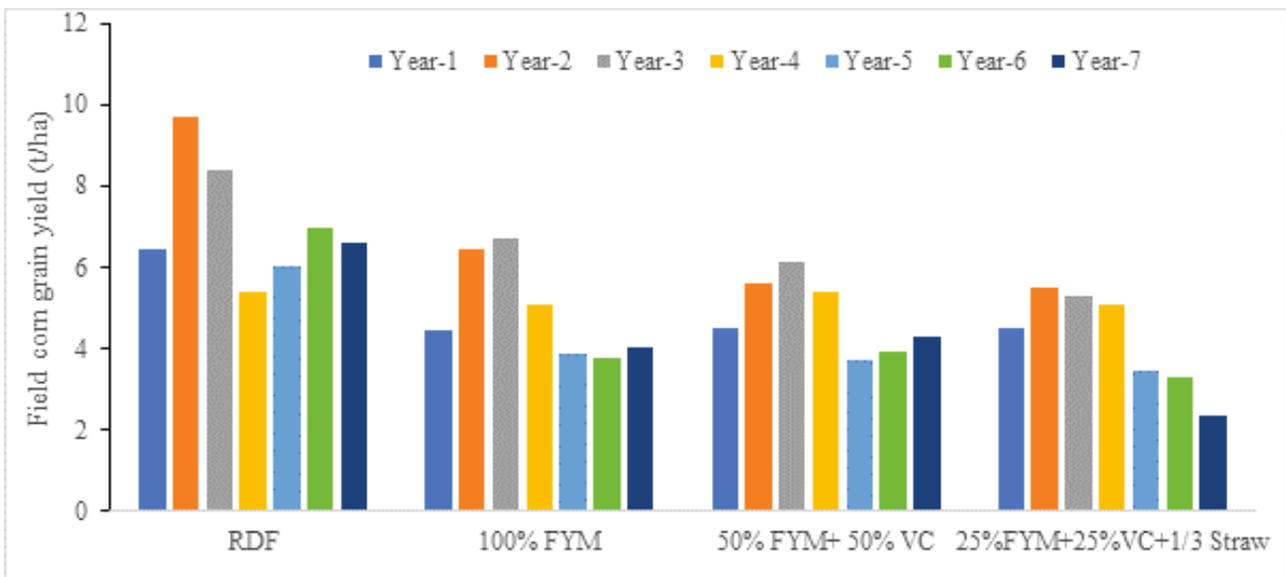

***Fig. 3.3.*** *On-farm assessment of different sowing practices on the yield of maize in western IGP*

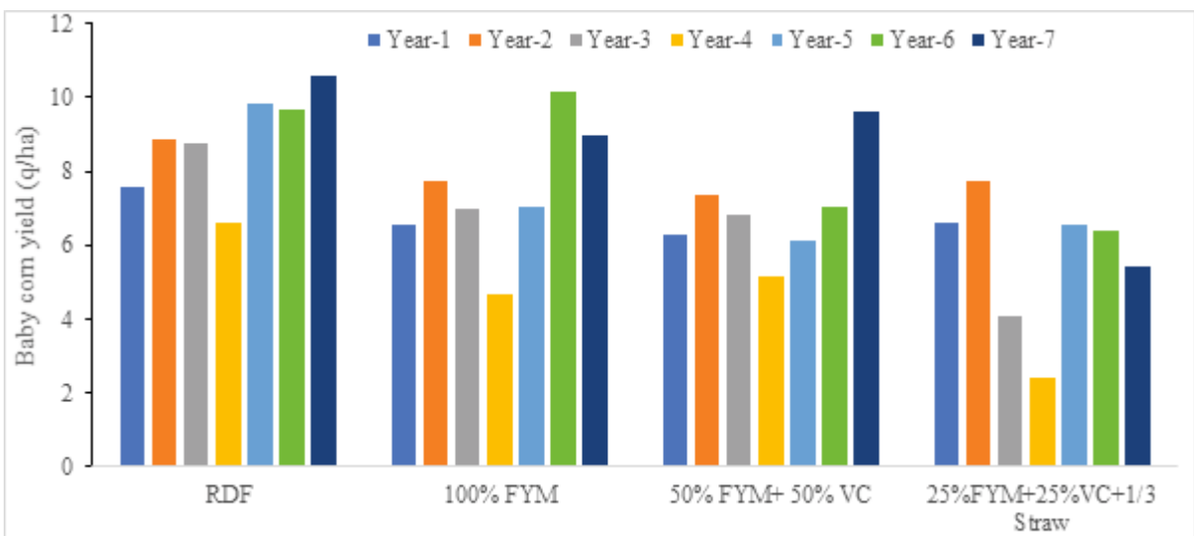
a viable option for farmers seeking higher returns and sustainable intensification.

The effect of crop establishment practices was assessed at the farmer's filed during *kharif* season in Punjab and Haryana (Fig. 3.3). The pneumatic planting increase yield by 18.5 and 33.3% over raised bed planting and flat planting. The yield enhancement of 12.5% was recorded with raised bed planting over flat planting. The yield under pneumatic planning touched up to 8.8 t/ha in kharif season with an average of 6.4 t/ha.

## Study of different organic nutrient sources in maize and spatiality corn

Presently, there is an increased demand for the organic product due to their better nutrition value and quality. However, no concrete information is available for organic maize production with special reference to different maize types. Hence, a long-term study conducted on fixed-site to measure the effect of fertilizer *vis-a-vis* different organic sources in maize and speciality corn i.e. baby corn and sweet corn *(Fig. 3.4)*. After completion of seven years, all the crops whether baby corn, sweet corn or field corn, the yield was significantly higher with RDF as compared to 100% FYM treatments. The yield trends in the 25%FYM+25%VC+1/3 Straw in specialty corn showed a sharp decline in 3rd and 4th year which started increasing afterwards.



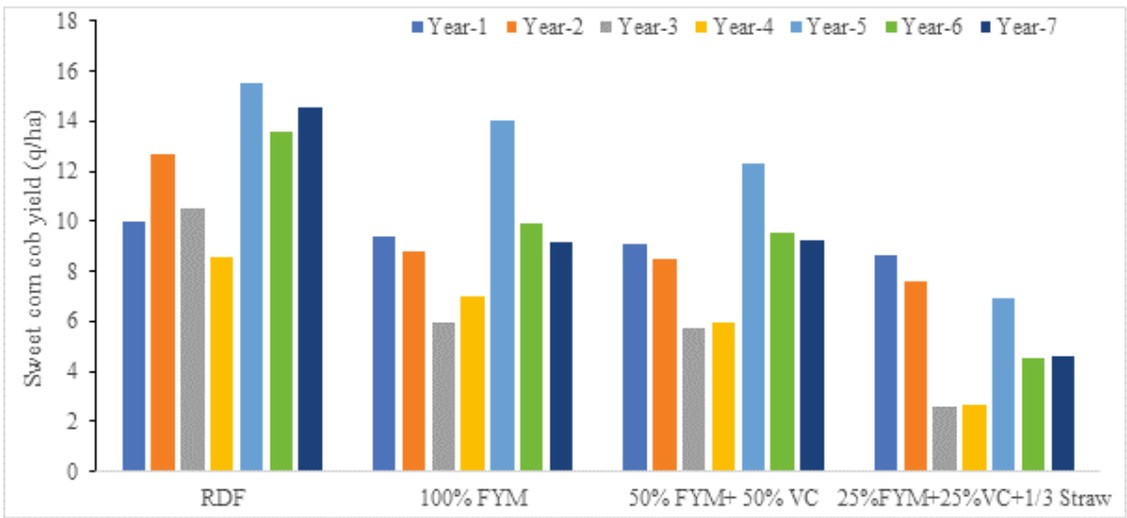



***Fig. 3.4.*** *Seven-year trends in yield of different corn types under organic and integrated nutrient management practices.*

## Application of image analysis for area, yield and stress estimation in maize

Accurate and timely estimation of maize area, yield, and crop stress is challenging due to the limitations of traditional ground-based surveys with non-geotagged data which are time-consuming, labor-intensive, and often lack spatial resolution. Variability in agro-climatic conditions, fragmented land holdings, and inconsistent data reporting further hinder effective monitoring and decision-making. The district-wise summary of maize area, production, and yield for 2022–23 provides critical insights into regional performance and productivity patterns across India. This data serves as a foundational resource for targeted interventions, precision farming, and the application of image analysis tools for improved yield estimation and stress monitoring in maize cultivation.

**Area**: In *kharif* season, maize was the most widely cultivated and spread in central and peninsular India *(Fig. 3.5)*. States like Madhya Pradesh, Maharashtra, Karnataka, Telangana, and Rajasthan reported large maize acreage districts with several districts exceeding 100 thousand hectares, and a few even surpassing 250 thousand hectares. However, in *Rabi* season, maize cultivation shifted predominantly to the southern and eastern regions with notable concentrations in Andhra Pradesh, Telangana, Karnataka, Tamil Nadu and some parts of Bihar and West Bengal. Several districts in these states recorded 10 to 50 thousand hectares area which is indicating increasing importance as a winter crop in these states. The summer/spring maize area was most prominent in eastern India, especially in Bihar, eastern Uttar Pradesh, and West Bengal, where many districts exceeded 20 thousand hectares. Central India (notably parts of Maharashtra and Madhya Pradesh) also contributed significantly, while southern states had limited coverage during this season. Overall, *kharif* maize dominates in terms of area, but *Rabi* and summer/spring maize is gaining ground, especially in eastern and southern India, as part of cropping system intensification and to meet rising demand for food, feed, and industrial use.

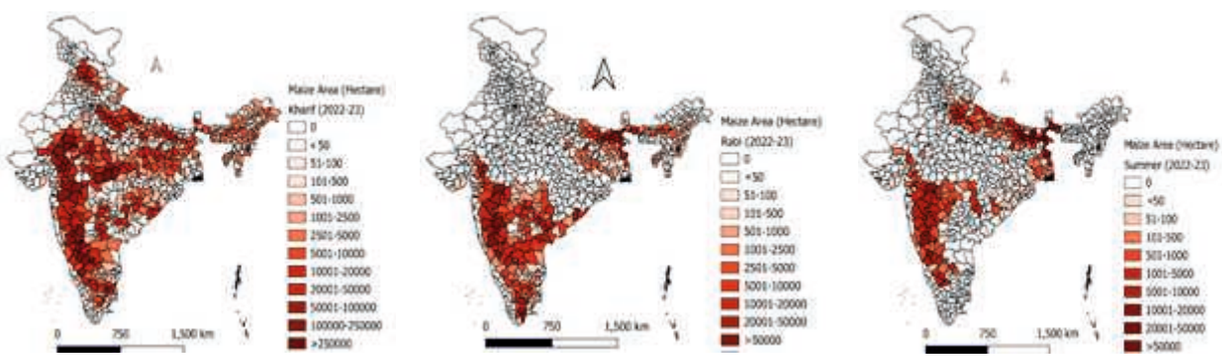


*Fig. 3.5. The district-wise maize acreage (ha) in different season in India during 2022-23.*

**Production**: Maize production was highest in Madhya Pradesh followed by Karnataka, Maharashtra, Rajasthan, and Telangana with several districts exceeding one million tonnes production, showcasing the dominance of rainfed maize cultivation in these ecologies (Fig. 3.6). In the *Rabi* season, production was concentrated in eastern and southern states such as Bihar, West Bengal, Andhra Pradesh, Telangana, Maharashtra, and Karnataka, where favourable winter conditions and irrigation enabled some districts to achieve >5 lakh tonnes production. The summer/spring season saw significant production in Indo-Gangetic plains areas of Bihar, Uttar Pradesh, West Bengal, Karnataka, and Maharashtra particularly with assured irrigated areas with medium/short-duration hybrids growing areas where some districts even producing >2 lakh tonnes.

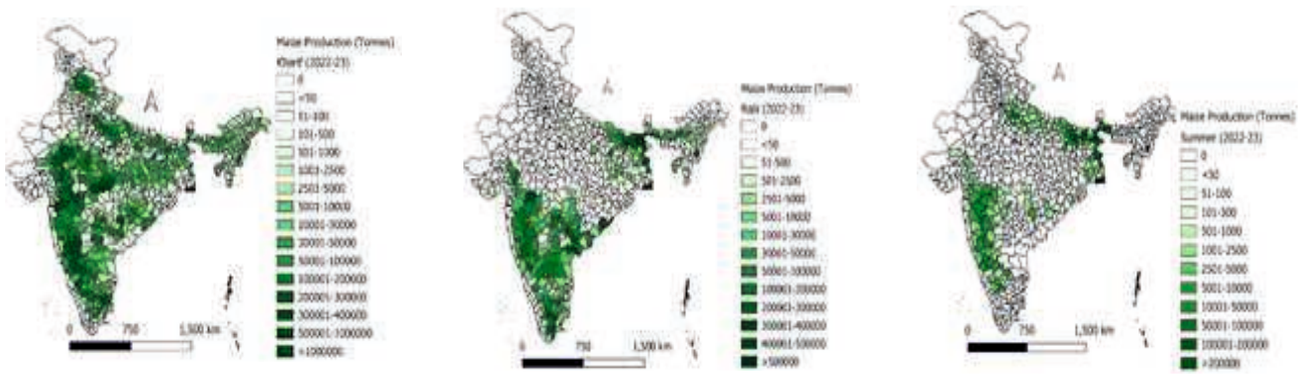


*Fig. 3.6. The district-wise maize production (t) in different season in India during 2022-23.*

**Yield**: During 2022–23, maize yield patterns across India varied significantly by season. In the *kharif* season, yields were generally moderate, with most of the districts producing between 3.0 to 7.0 (Fig. 3.7). However, southern states like Tamil Nadu, Andhra Pradesh, Karnataka, and some parts of Maharashtra reported higher yields touching to 9.0 t/ha. In contrast, central and northern districts experienced lower productivity often below 5.0 t/ha. In the *Rabi* season, maize recorded the highest productivity especially in Telangana, Andhra Pradesh, Karnataka, and Tamil Nadu where many districts achieved >9.0 t/ha yields, and some even surpassed 12.0 t/ha. The summer season showed mixed yield trends. The Eastern India, particularly Bihar and eastern Uttar Pradesh recorded impressive yields of >9.0 t/ha reflecting better suitable climatic conditions and crop management. Meanwhile, several parts of central and western India reported lower yields (below 3.0 t/ha) likely due to moisture stress, high temperatures, delayed sowing, etc.

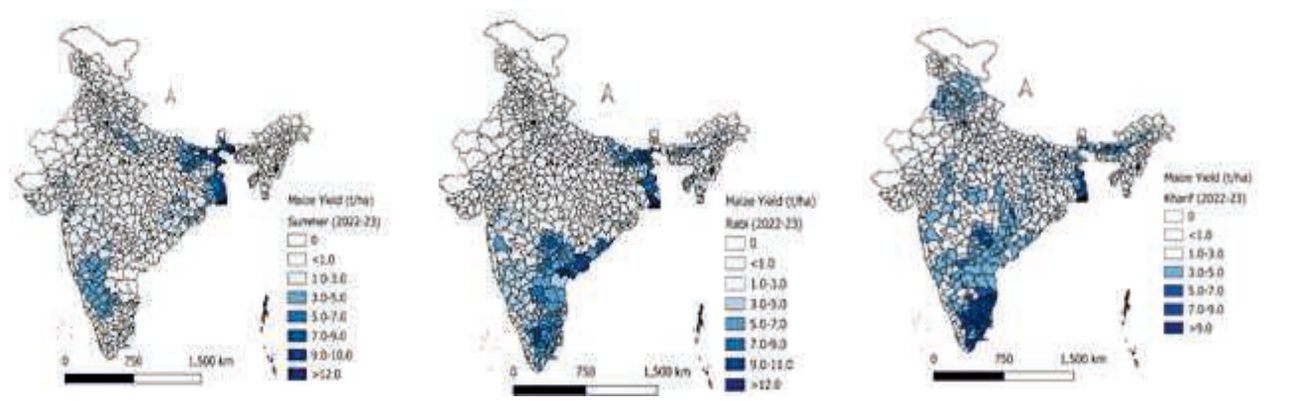


***Fig. 3.7.*** *The district-wise maize yield (t/ha) in different season in India during 2022-23.*

### Zinc uptake dynamics and hybrid response in maize

A comprehensive evaluation was conducted to assess the performance of 25 maize hybrids under three Zinc application strategies: no zinc (control), 5 kg/ha basal + 0.5% foliar spray, and 5 kg/ha basal + 1% foliar spray. The study measured plant zinc uptake at three key growth stages—8-leaf, tasseling, and post-harvest—alongside grain zinc concentration, plant height, and yield. The results showed a clear enhancement in zinc uptake and agronomic traits with zinc supplementation, especially under the 1% foliar treatment. Hybrid-wise comparisons revealed significant differences in total zinc uptake (sum of plant and grain uptake) and yield performance. Based on combined zinc uptake and yield, hybrids were grouped into three categories: high, medium, and low uptake classes, each intersected with their respective yield classes. This classification helps identify genotypes that are not only nutrient-efficient but also agronomically superior.

Among the hybrids, IMH 228 stood out as the most promising, exhibiting both high total Zinc uptake and high yield, making it ideal for biofortification and productivity improvement (Fig. 3.8). IMH 222 and IMH 224 demonstrated medium and low Zinc uptake, respectively, while still achieving high yield, suggesting efficient internal Zinc use and potential for cultivation in Zinc-deficient soils. Other high uptake hybrids such as BIO 605 and PAC-751 showed lower yield, indicating that high nutrient uptake does not always translate to productivity unless it is efficiently utilized. On the other hand, hybrids like Adv-759, PAC-741, and IMH 226 showed medium uptake and high yield, providing a balanced choice for farmers. Interestingly, DMRH 1306 and COH (M)-6 represented low uptake but high yield, potentially indicating inherent physiological efficiency in Zinc utilization. These insights will guide future breeding strategies focused on enhancing micronutrient use efficiency and form the basis for hybrid selection under varied environmental and nutrient management regimes. The seed of top-performing hybrids has been recommended for further evaluation and validation trials.

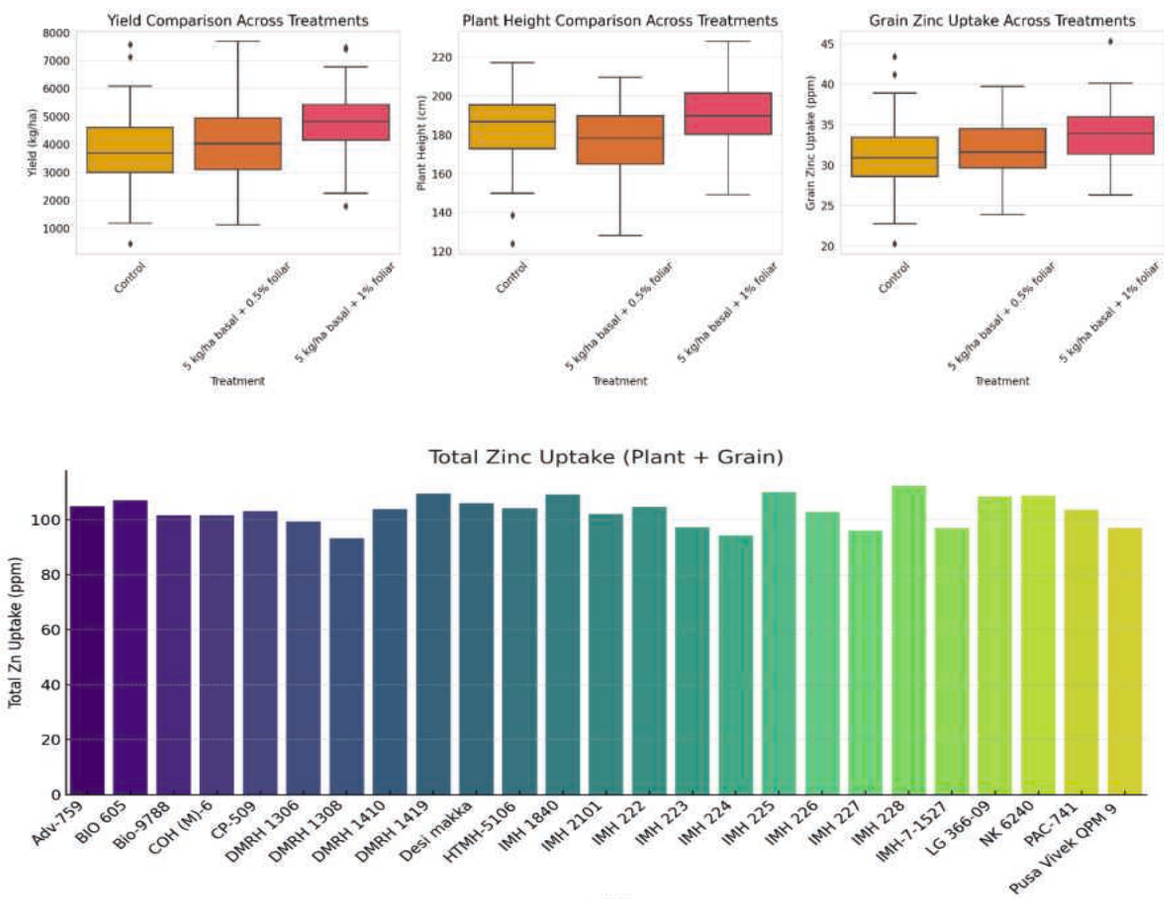



*Fig. 3.8. Variable response of treatments and hybrids in zinc fertilization.*

# CROP PROTECTION

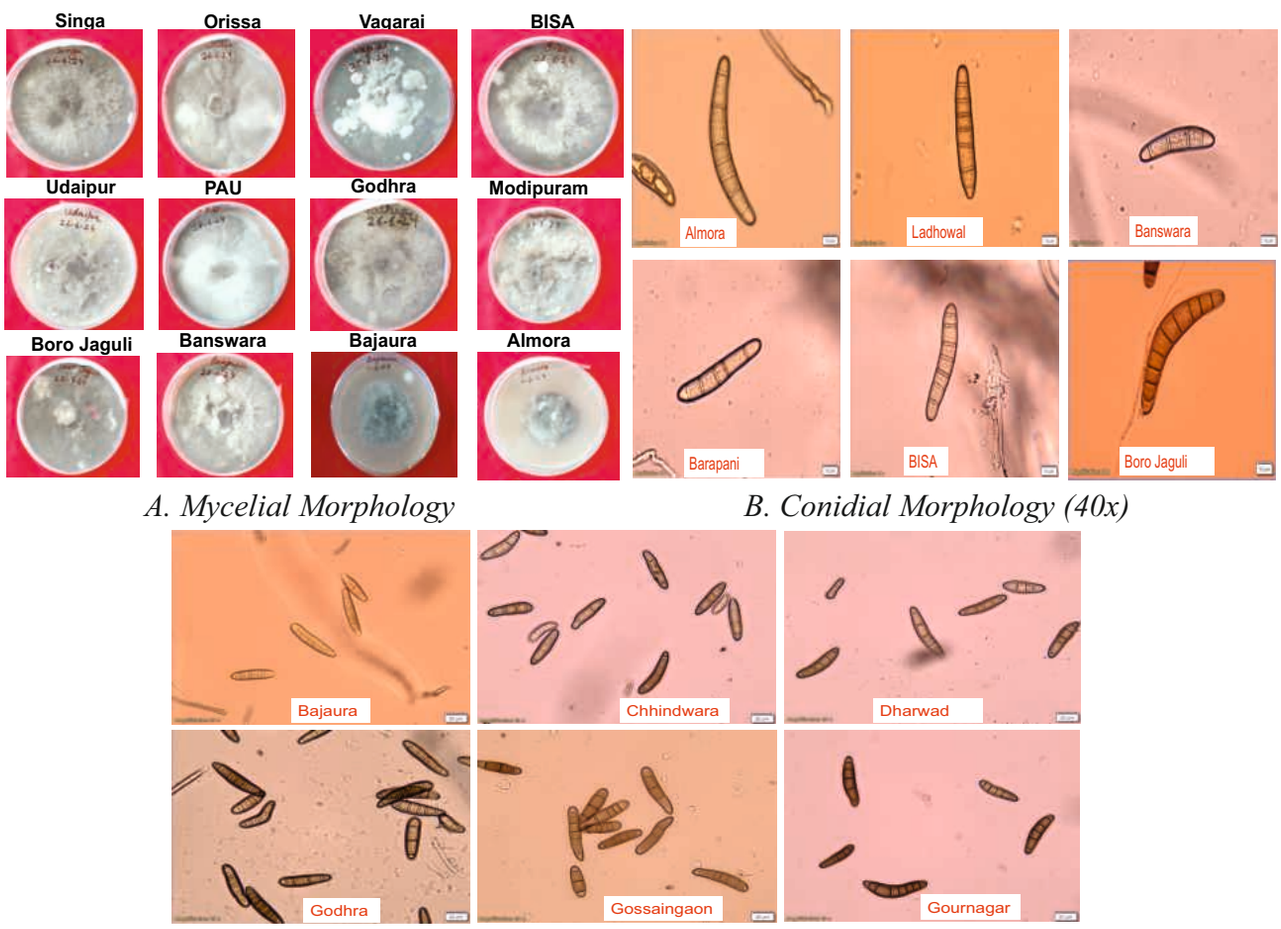
4 Chapter

## Maydis leaf blight (MLB)

For conducting morphological studies of MLB pathogen *Bipolaris maydis*, a total of 42 diseased leaf samples showing peculiar symptoms, were collected from 35 different locations of 18 maize growing states of India. Out of these, thirty isolates were obtained and purified by hyphal tip method. All the 30 isolates were preserved by different preservation techniques using Paper Disc Method, Glycerol (at -20°C) and PDA slants at 4°C for long term storage.

Morphological studies showed a significant variation in conidial length, width and number of septum per conidium. Average conidial length of MLB isolates was observed to be 58.8 µm with the smallest conidium in Bajaura isolate (30.4 µm) and the largest in Almora isolate (91.7 µm). Likewise, average conidial width of MLB isolates was observed to be 13.2 µm with the minimum in Udaipur isolate (9.1 µm) and the maximum in Godhra isolate (16.4 µm). Similarly, mean conidial septa was 5.6 with maximum number of septa was observed in Modipuram isolates. Additionally, hyphal width of MLB isolates varied from 4.4 - 8.5 µm as shown in Figure 4.1 (A,B,C).

The pathological variability among *B. maydis* isolates were tested using suitable set of susceptible and resistant genotypes of maize. Among these, ABSH 4, IML 103 and IMR 331 are the genotypes with different cytoplasmic male sterility germplasm background's *viz*., CMS T, CMS C and with CMS S, respectively. Moreover, six putative isolates have been bio prospected from different maize ecologies for identification of micro-organisms antagonistic against *B. maydis* as in Figure 4.2.




*A. Mycelial Morphology*

*B. Conidial Morphology (40x)*

*C. Conidial Morphology (20x)*

*Figure 4.1: Morphological characterization of MLB islolates*

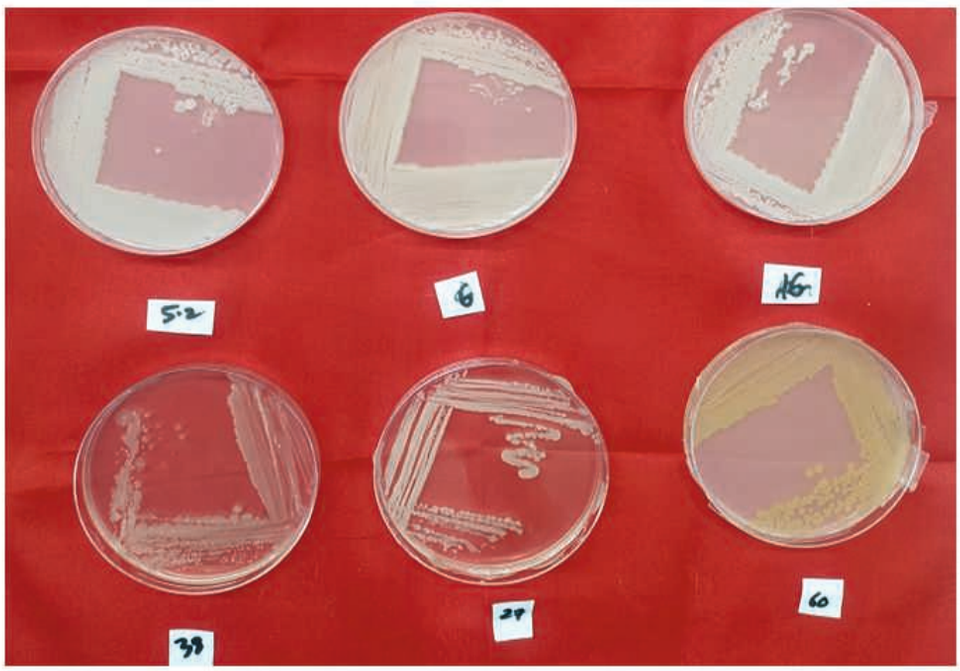


*Figure 4.2: Pure culture of potential antagonists against B. maydis.*

## Turcicum Leaf Blight (TLB)

Molecular study revealed that out of 61 isolates from infected samples, 30 isolates were confirmed to be *Exserohilum rostratum* instead of *Exserohilum turcicum*. ITS Profiling of *Exserohilum rostratum* isolates was carried out and phylogenetic analysis was conducted. Pathogenicity test of *E. rostratum* isolates was conducted (Figure 8). Morphological characters of *E. rostratum* isolates was validated by examine spore images. This concludes either mixed infection or complex infection.

## Development of sustainable management tools for major insect pests of maize

### 1. Identification of resistant sources against spotted stem borer, *Chilo partellus* (Swinhoe)

**Table 4.1: Morphological and pathological parameters of *E. rostratum* isolates .**

| S.No. | Isolate Code | Disease intensity | Latent period (Days) | Lesion Size (cm) | | Molecular Identification |
|---|---|---|---|---|---|---|
| | | | | Length | Breadth | |
| 1 | P-5 | 4 | 6.6 | 3.5 | 0.6 | *Exserohilum rostratum* |
| 2 | DWD-ET-27 | 9 | 2 | 9.6 | 2.3 | *Exserohilum rostratum* |
| 3 | DWD-ET-20 | 8 | 3.3 | 7.6 | 1.2 | *Exserohilum rostratum* |
| 4 | WBT 12 | 3 | 7.6 | 2.3 | 0.5 | *Exserohilum rostratum* |
| 5 | Mandya 1 | 3 | 7.6 | 3 | 0.5 | *Exserohilum rostratum* |
| 6 | Rahuri | 3 | 7 | 2.8 | 0.6 | *Exserohilum rostratum* |
| 7 | Dwd-Et-5 | 5 | 3.6 | 4.6 | 1 | *Exserohilum rostratum* |
| 8 | Dwd-Et-1 | 4 | 5.6 | 3.6 | 0.5 | *Exserohilum rostratum* |
| 9 | Mandya 2 | 2 | 9 | 2 | 0.4 | *Exserohilum rostratum* |
| 10 | Dwd-Et-19 | 5 | 4 | 4.2 | 1 | *Exserohilum rostratum* |

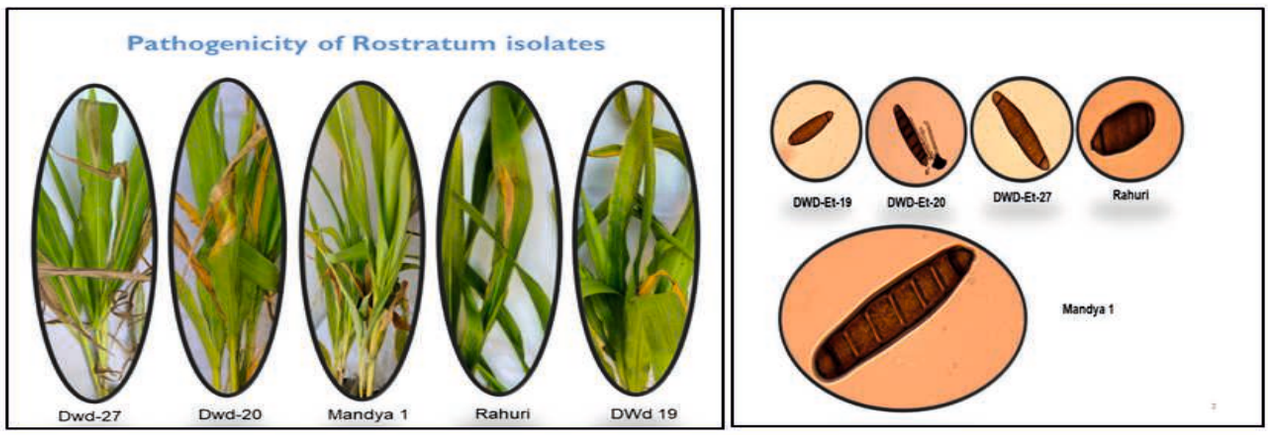



*Figure 4.3: Koch postulate studies at Larnoo centre using Larnoo Local cultivars*

Spotted stem borer, *Chilo partellus* (Swinhoe) is a serious pest of maize during *Kharif* season causing 26 to 80% yield losses in different agroecological regions of India (Panwar 2005). A total of 211 maize genotypes along with resistant and susceptible checks were screened under artificial infestation against spotted stem borer during *Kharif* 2024 at WNC, ICAR-IIMR Hyderabad. The resistant, moderately resistant, and susceptible genotypes were categorized by LIR 1.0-3.0, >3.1-6.0, and >6.1-9.0, respectively. Among the screened maize genotypes, only one genotype CML 60 was found resistant against SSB, while 121 genotypes were moderately resistant.

## 2. Identification of resistant sources against pink stem borer, *Sesamia inferens* Walker during Rabi 2023-24

Pink stem borer, *Sesamia inferens* Walker is the most important pest of *Rabi*/winter maize causing yield losses in the range of 25.7-78.9 % (Rao 1983). Two hundred two maize genotypes along with resistant (DMRE 63, CM 500) and susceptible checks (CM 202) were screened under artificial infestation against pink stem borer (SSB) during *Rabi* 2023-24. The resistant, moderately resistant, and susceptible genotypes were grouped based on LIR of 1-3, >3.1-6 and >6.1-9, respectively. The genotypes MIL-2-509-2 (3.50), (E-63×CML-71) @12 (3.52), and (E-63×CML-71) (3.90) were found promising against pink stem borer under artificial infestation (Figure 4.4) while 86 genotypes were moderately resistant.

## 3. Identification of resistant sources against fall armyworm, *Spodoptera frugiperda* (J.E.Smith)

Fall armyworm *Spodoptera frugiperda* (J.E.Smith) is the most destructive invasive insect pest of maize causing yield losses in the range of 20-50% (Murua et al. 2006). A total of 224 and 179 maize genotypes were evaluated for foliar

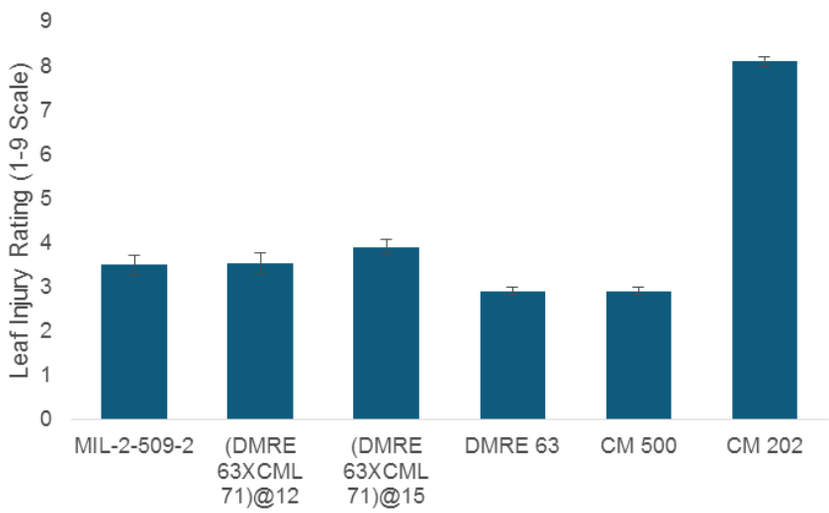



*Figure 4.4: Promising maize genotypes along with checks against pink stem borer*

resistance at the V5 leaf stage under artificial infestation against fall armyworm during *Rabi* 2023-24 and *Kharif* 2024, respectively. The resistant, moderately resistant, and susceptible genotypes were categorized by LDR 1.0-4.0, >4.1-6.0, and >6.1-9.0, respectively. Among 224 genotypes screened, three genotypes , i.e. DHO-82-7 (2.6), DHO-82-2 (3.1) and MIL-2-280-1 (2.4) were found resistant while 129 were moderately resistant. Out of 179 maize genotypes screened, none of the lines were found resistant while 88 were moderately resistant against FAW.

### 4. Determination of morpho-biochemical traits conferring resistance to FAW

The pivotal morpho-biochemical traits associated with resistance to FAW were determined in selected resistant and susceptible genotypes. Resistant genotypes namely CML 67, DMRE 63, CML 72, and CML 141 possessed high trichome density and leaf thickness, along with low leaf length, leaf width, plant height, number of nodes, and internodal distance, compared to susceptible genotypes such as MIL 6-2123711, NAI 178A, MIL 6-2124407, MIL 6-2124409, and MIL 6-117. Further more, it was observed that resistant genotypes had elevated levels of potassium, acid-detergent fiber, acid-detergent lignin, total phenol content, and total tannin content while higher amounts of nitrogen, phosphorous, protein, total soluble sugar content, and total amino acid contents were observed in susceptible genotypes. Trichome density, and leaf thickness, demonstrated negative correlations with leaf damage rating among the various maize genotypes. On the other hand, leaf morphology including leaf length, leaf width and plant architecture such as plant height, number of nodes per plant, and internodal distance exhibited positive correlations with leaf damage rating (Table 1). Nitrogen, phosphorous, protein, total soluble sugars, and amino acids contents were positively correlated with leaf damage rating, while potassium, acid detergent fiber, acid detergent lignin, total phenol, and total tannin contents exhibited negative correlations (Table 2). These results suggest that specific traits, including trichome density, leaf thickness, and biochemical traits significantly contribute to resistance to fall armyworm in maize.

### 5. Assessment of the phytohormone profile of the susceptible and resistant maize genotypes against fall armyworm

Phytohormones play a pivotal role in shaping maize's defense mechanisms against fall armyworm. The phytohormone profile of the susceptible and resistant maize genotypes revealed that at the initial measurement (zero hours) and after 24 hours of fall armyworm feeding, the concentration of jasmonic acid (JA) was notably higher in the resistant genotype CML 67, measuring 293.99 ng/g and 470.19 ng/g respectively, compared to the susceptible genotype MIL6-2123711, which recorded levels of 177.12 ng/g and 262.51 ng/g respectively (Figure 4.5). Regarding jasmonic isoleucine (JA-Ile) content, at the initial measurement (zero hours) and after 24 hours of fall armyworm feeding, the levels were higher in the resistant genotype CML 67,

**Table 4.2. Pearson's correlation coefficients among leaf damage rating and morphological parameters of different maize genotypes**

| S.No | Morphological traits | Leaf damage rating (LDR) |
|---|---|---|
| 1 | Trichome density | -0.86245** |
| 2 | Leaf length | 0.93591** |
| 3 | Leaf width | 0.95792** |
| 4 | Leaf thickness | -0.44534* |
| 5 | Plant height | 0.86216** |
| 6 | Number of nodes per plant | 0.90243** |
| 7 | Internodal distance | 0.80125** |

***Correlation coefficients significant at P=0.01; *Correlation coefficients significant at P=0.05*

**Table 4.3: Pearson's correlation coefficients among leaf damage rating and biochemical parameters of different maize genotypes**

| S.no | Biochemical constituents | Leaf damage rating (LDR) |
|---|---|---|
| 1 | Nitrogen (%) | 0.94947** |
| 2 | Phosphorous (%) | 0.95081** |
| 3 | Potassium (%) | -0.93453** |
| 4 | Protein (%) | 0.94912** |
| 5 | Total soluble sugars (TSS) | 0.91444** |
| 6 | Total amino acids | 0.97179** |
| 7 | Acid detergent fiber (%) | -0.69908* |
| 8 | Acid detergent lignin (%) | -0.95655** |
| 9 | Total phenol content (mg/gm) | -0.97623** |
| 10 | Total tannin content (mg/gm) | -0.95529** |

***Correlation coefficients significant at P=0.01; *Correlation coefficients significant at P=0.05*

measuring 17.55 ng/g and 120.32 ng/g respectively, compared to the susceptible genotype MIL6-2123711, which recorded levels of 12.58 ng/g and 92.48 ng/g respectively (Figure 4.6). It can be concluded that resistant genotypes showed higher levels of phytohormones (jasmonic acid and jasmonic isoleucine) compared to susceptible genotypes, indicating a potential role of these hormones in the resistance mechanism against fall armyworm.

## AICRP on Maize

### *Kharif* 2023

Maize AICRP Entomology *Kharif* 2023 experimental trials aim mainly at the resistance screening for spotted stem borer (SSB) [*Chilo partellus* (Swinhoe)] and fall armyworm (FAW), [*Spodoptera frugiperda* (J. E. Smith)] at hot spot locations. Post-screening, the genotypes were categorized as resistant, moderately resistant andsusceptible based on leaf injury rating on a 1-9 scale (Resistant 1.0-3.0, Moderately resistant >3.1-6.0 and Susceptible >6.1-9.0) for stem borers. During *Kharif* 2023, a total of 108 maize entries belonging to four AICRP trials of early (12), medium (22), late (31) maturity groups, OPV (3), sweet corn (5), baby corn (8) and QPM (27) were evaluated against spotted stem borer *Chilo partellus* (Swinhoe) and fall armyworm (FAW) under artificial infestation and none of the entries were found resistant to both the pests. Population dynamics of FAW and *Helicoverpa armigera* were monitored indifferent AICRP locations. The

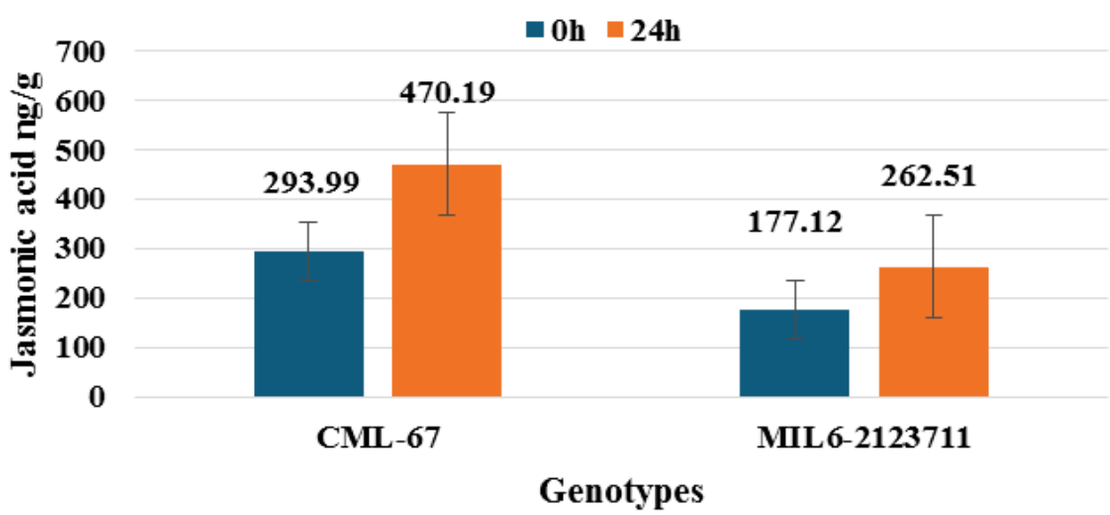



*Figure 4.5: Jasmonic acid content in different genotypes at two different intervals*

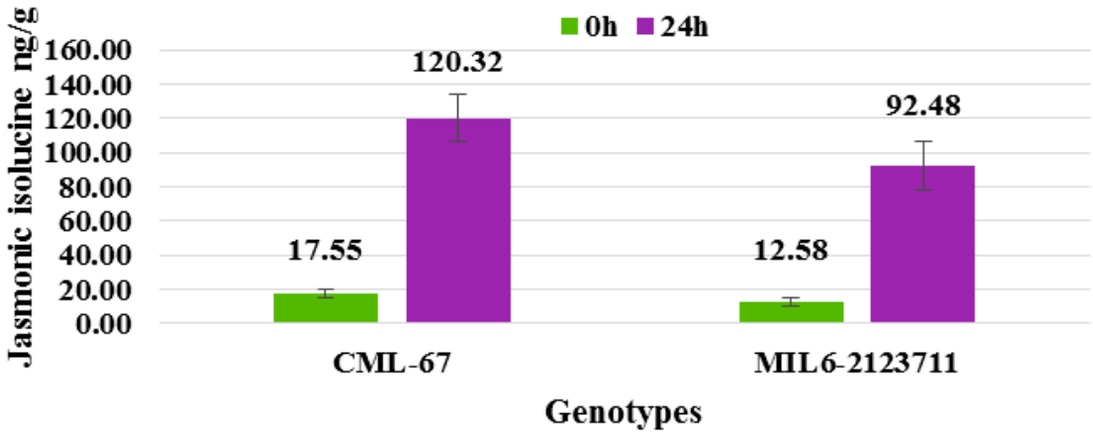



*Figure 4.6: Jasmonic isoleucine content in different genotypes at different intervals*

efficacy of different insecticides as seed treatment and foliar spray, ITK practices and non-chemical methods were evaluated for the management of FAW. Seed treated with Cyantraniliprole + Thiamethoxam 19.8% @ 6 ml/kg in combination of foliar spray with Chlorantraniliprole 18.5% SC @0.4 ml/ litre was found effective against FAW. Among the ITK practices evaluated the most effective treatments against FAW were soil + insecticide (Chlorantraniliprole 18.5% SC) followed by Bait + Chlorantraniliprole 18.5% SC. Maize intercropped with cowpea and EPN Spray @ 10 & 20 DAS recorded minimum per cent plant infestation compared to untreated control.

Maize AICRP Entomology *Rabi* 2023-24 and spring 2024 experimental trials aim mainly at screening for pink stem borer (PSB) [*Sesamia inferens* Walker], spotted stem borer (SSB), [*Chilo partellus* (Swinhoe)], fall armyworm (FAW) [*Spodoptera frugiperda* (J. E. Smith)] and shoot fly [*Atherigona* sp.] at hot spot locations to identify resistant entries against these insect pests. Post-screening, the genotypes are categorized as resistant, moderately resistant, and susceptible based on leaf injury rating on a 1-9 scale (Resistant 1.0-3.0, Moderately resistant >3.1-6.0 and Susceptible >6.1-9.0) for stem borers. For shoot fly, the genotypes were categorized based on the mean percent dead hearts (DH) as resistant- <10% DH, moderately resistant>10-20% DH, moderately susceptible >20-30% DH, susceptible >30-50% DH and highly susceptible >50% DH (Sharma et al. 1992). A total of 32 maize entries of different maturity groups and specialty corn were screened for resistance under artificial infestation against PSB and SSB at Hyderabad and Kolhapur locations, respectively, and none of the entries were found to be resistant against both the pests. Out of 33 maize entries of different maturity group and specialty corn, were screened under artificial infestation against FAW at Hyderabad and Coimbatore none of the entries were found resistant to FAW. A total of 22 maize entries of medium maturity group were screened against shoot fly and none of the entries were found resistant to shoot fly.

## Management of fall armyworm

Field experiments on the evaluation of different bio-pesticides and ITK practices were carried out at different AICRP locations for FAW management during *Rabi* 2023-2024. All the bio-pesticides evaluated were found effective against FAW. Among the ITK practices evaluated, soil + insecticide (Chlorantraniliprole 18.5% SC) followed by Bait + Chlorantraniliprole 18.5% SC were found effective against FAW.

During *Kharif* 2024, maize AICRP entries (AVT I and II) were evaluated against SSB, FAW under artificial infestation at different AICRP locations. Monitoring of *Helicoverpa armigera* through pheromone traps was done. Different newer insecticide molecules as foliar spray, and non-chemical methods were evaluated for the management of FAW. Studies on Pest succession, incidence, and estimation of yield losses were also conducted at different locations.

# EXTENSION AND OUTREACH

5 Chapter

## Extension and Outreach programmes

ICAR-IIMR, Ludhiana have a dynamic extension and outreach programme aimed at engaging stakeholders and complementing its research mandate. The institute reaches farmers and other beneficiaries through several initiatives, including Frontline Demonstrations (FLDs) under the National Food Security Mission (NFSM), supported by the Department of Agriculture and Cooperation, Government of India. Other key programmes include the Scheduled Tribe Component (STC), North Eastern Hill (NEH) Component, Scheduled Caste Sub Plan (SCSP), the Agribusiness Incubation Centre (ABI), and the Agri-Drone project.

In addition, the institute is implementing various national projects such as Enhancement of Maize Production in Catchment Areas of Ethanol Industries, Upscaling of Maize-Based Silage Value Chain in Punjab and Haryana, the District Mineral Foundation (DMF) project in Koraput, and the DBT-KISAN project, among others, covering diverse regions across the country.

Frontline demonstration under NSFM

During the 2023-24, rabi season, 15 centers across 10 states implemented Front line Demonstrations (FLDs) on 764.5 hectares, benefiting a total of 1820 farmers (Table 5.1 & fig 1 & 2). The average yield increase compared to farmer practices during the season was 16.7%, ranging from 1.7% in Begusarai to 42.0% in Chhindwara. In the spring of 2024, FLDs were conducted on 136.4 ha, benefiting 281 farmers, and resulted in a recorded mean yield increase of 18.0%. In the kharif season of 2024, FLDs were expanded to cover 1339.4 ha, benefiting 3207 farmers across 12 states. These demonstrations exhibited a yield increase of 30.7 % over farmer practices, attributed to the adoption of improved technologies, with variations observed from 9.7% in Ludhiana to an impressive 80.2% in Jhansi. Overall, FLDs covered 2315.4 ha, benefiting 5308 farmers.

The FLDs also showcased recently released public sector hybrids such as IMH 222, IMH 223, IMH 225, IMH226, PHM 3, NK 30, JK 502, SQPMH 1, DMRH1301, CO6, DHM 117, DMRH1308 etc.

**Table 5.1 Centre-wise, season-wise NFSM FLD conducted in maize during 2024**

| Centre | Area (ha) | Yield (q/ha) | | Diff. +/- (q/ha) | Yield Gain (%) | No. of beneficiary |
|---|---|---|---|---|---|---|
| | | FLD | FP | | | |
| AAU, Gossaingaon | 34.9 | 61.9 | 48.2 | 13.7 | 28.4 | 159 |
| BCKV, Kalyani | 50 | 80.3 | 72.7 | 7.6 | 10.5 | 100 |
| DrRPCAU, Dholi | 60 | 76 | 67.1 | 8.9 | 13.3 | 138 |
| RMRSPC, Begusarai | 100 | 84.3 | 82.9 | 1.4 | 1.7 | 254 |
| MPKV, Kolhapur | 90 | 64 | 47.2 | 16.8 | 35.6 | 256 |
| PJTSAU, Karimnagar | 100 | 95 | 75.8 | 19.2 | 25.3 | 250 |
| ANGRAU, Peddapuram | 100.6 | 76 | 73.2 | 2.8 | 3.8 | 126 |
| TNAU, Coimbatore | 50 | 77.7 | 68.9 | 8.8 | 12.8 | 125 |
| UAS, Dharwad | 32 | 48.8 | 41.2 | 7.7 | 18.7 | 32 |
| UAS, Mandya | 10 | 71.3 | 63.8 | 7.5 | 11.8 | 25 |
| WNC, IIMR, Hyderabad | 20 | 70.4 | 63.5 | 6.9 | 10.9 | 50 |
| TNAU, Vagarai | 45 | 72.3 | 62.9 | 9.4 | 14.9 | 125 |
| AAU, Godhara | 16 | 48 | 40.3 | 7.7 | 19.1 | 40 |
| JNKVV, Chhindwara | 26 | 53.1 | 37.4 | 15.7 | 42.0 | 65 |
| ARS, Banswara | 30 | 80.1 | 62.2 | 17.9 | 28.8 | 75 |
| **Total/mean (Rabi 2023-24)** | **764.5** | **70.6** | **60.5** | **10.1** | **16.7** | **1820** |
| IIMR, Ludhiana | 30.4 | 67.6 | 61.6 | 5.4 | 8.8 | 70 |
| GBPUAT, Pantnagar | 20 | 86.2 | 80.3 | 5.9 | 7.3 | 20 |

| | | | | | | |
|---|---|---|---|---|---|---|
| CCSHAU, Karnal | 50 | 77 | 52 | 25 | 48 | 119 |
| DrRPCAU, Dholi | 36 | 55.1 | 48.5 | 6.6 | 13.6 | 72 |
| **Total/mean (Spring 2024)** | **136.4** | **71.5** | **60.6** | **10.9** | **18.0** | **281** |
| CAU, Imphal | 50.2 | 40 | 30.1 | 9.9 | 32.9 | 124 |
| VPKAS, Almora | 10 | 41.8 | 24.5 | 17.3 | 70.4 | 69 |
| SKUAST, Srinagar | 110 | 51.9 | 35 | 16.9 | 48.3 | 240 |
| IIMR, Ludhiana | 100.8 | 56.3 | 45.5 | 15.5 | 38.0 | 178 |
| PAU, Ludhiana | 100 | 47.4 | 43.2 | 4.2 | 9.7 | 250 |
| BCKV, Kalyani | 112 | 58.6 | 43.1 | 15.5 | 35.8 | 224 |
| BHU, Varanasi | 62.4 | 63.3 | 45.7 | 17.6 | 38.5 | 233 |
| RLBCAU, Jhansi | 100 | 43.8 | 24.3 | 18.8 | 77.2 | 250 |
| RMD College, Ambikapur | 80 | 43.7 | 26.4 | 17.3 | 65.5 | 200 |
| DrRPCAU, Dholi | 10 | 60.2 | 53.1 | 7.1 | 13.4 | 25 |
| MPKV, Kolhapur/Rahuri | 100 | 32.4 | 25.3 | 7.1 | 27.9 | 250 |
| TNAU, Coimbatore | 20 | 60.2 | 53.1 | 7.1 | 13.4 | 25 |
| UAS, Dharwad | 151.6 | 55.4 | 48.9 | 6.5 | 13.3 | 174 |
| AAU, Godhara | 42 | 33 | 28 | 5 | 17.9 | 105 |
| JNKVV, Chhindwara | 70 | 58 | 45.1 | 12.9 | 28.7 | 175 |
| MPUAT, Banswara | 20 | 44.7 | 34.6 | 10.1 | 29.1 | 65 |
| MPUAT, Udaipur | 200.4 | 78.7 | 59.5 | 19.2 | 32.3 | 620 |
| **Total/mean (Kharif 2024)** | **1339.4** | **51.1** | **39.1** | **12** | **30.7** | **3207** |

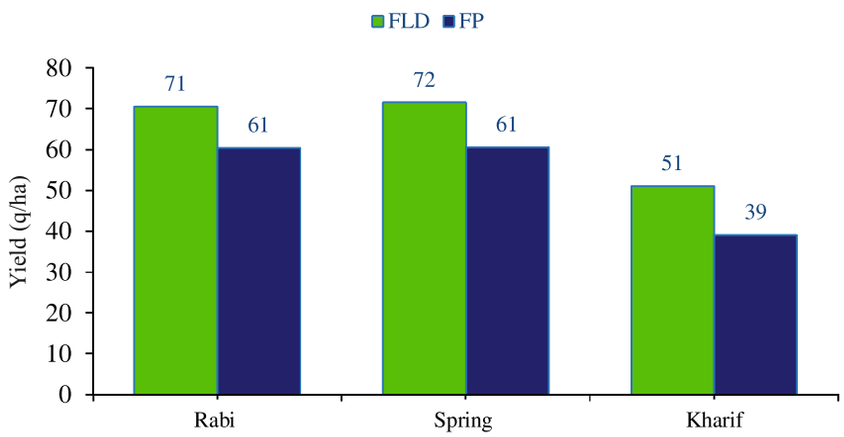



*Fig 5.1: Average maize yield during across season in FLDs (in green) and farmers' Practices (in blue)*

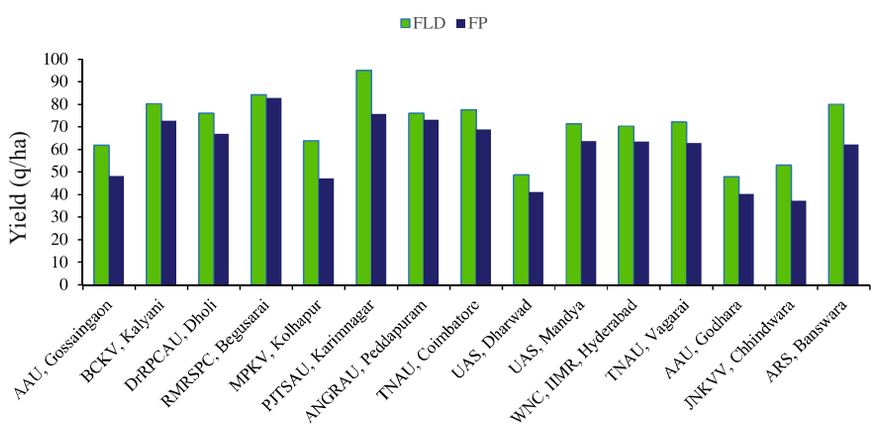



*Fig 5.2: Maize Yield during rabi 2023-24 In FLDs (in green) and farmers' Practices (in blue)*

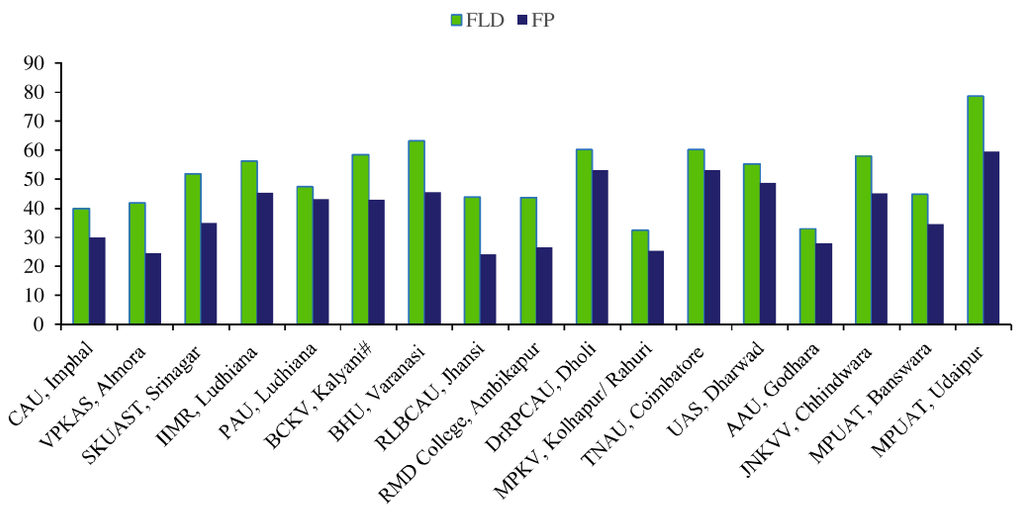



*Fig 5.3: Maize Yield during kharif 2023-24 in FLDs (in green) and farmers' Practices (in blue)*


Input Distribution for FLD by AAU, Godhara | Field visit by Gossaingaon centre

FLD organized by Karimnagar centre | Interaction programme organized by Srinager centre

## Scheduled Tribe Component (STC)

Under STC, in rabi season 2023-24, FLDs were taken up on 134 ha of land benefitting 373 farmers (Table 5.2). An average yield gain of 18.2 % (6.7% in Kalyani to 42.0% in Chhindwara) was observed. During spring 2024, FLDs were conducted on 18 ha area and benefited 42 farmers. An average yield gain of 9.6 % was observed. During kharif 2024, 234.8 ha FLDs were conducted and benefitted 686 farmers. An average yield gain of 26.8 % was recorded over farmers' practices which varied from 8.3% in Kalyani 91.2% in Ranchi. Under the STC, 44 farmers' training/field day/awareness programmes were conducted in different parts of the country on various aspects of scientific maize cultivation, benefiting 2328 tribal farmers which include 480 women farmers (Table 5.3). More than 2024 households also benefitted from the input distributions (Table 5.4).

**Table 5.2: Centre-wise, season-wise TSP FLD conducted in maize**

| Centre | Area (ha) | Yield (q/ha) | | Yield Gain (%) | No. of beneficiary |
|---|---|---|---|---|---|
| | | FLD | FP | | |
| ***Rabi 2023-2024*** | | | | | |
| AAU, Gossaigaon | 20 | 64.5 | 50.2 | 28.5 | 63 |
| BCKV, Kalyani | 10 | 80.0 | 75.0 | 6.7 | 50 |
| MPUAT, Banswara | 30 | 80.1 | 62.2 | 28.9 | 75 |
| JNKVV, Chhindwara | 26 | 53.1 | 37.4 | 42.0 | 65 |
| PJTSAU, ARS, Karimnagar | 20 | 81.4 | 74.9 | 8.6 | 50 |
| Dr. RPCAU, Dholi | 8 | 64.3 | 56.3 | 14.2 | 20 |
| MRS, TNAU, Vagarai | 20 | 60.0 | 53.0 | 13.1 | 50 |
| **Total/mean (*Rabi 2023-24*)** | **134** | **69.1** | **58.4** | **18.2** | **373** |
| ***Spring (2024)*** | | | | | |
| GBPUAT, Pantnagar | 10 | 87.8 | 82.2 | 6.8 | 22 |
| Dr. RPCAU, Dholi | 8 | 61.7 | 54.1 | 14.0 | 20 |
| **Total/mean (*Spring 2024*)** | **18** | **74.7** | **68.2** | **9.6** | **42** |
| ***Kharif 2024*** | | | | | |
| SKUAST, Srinagar | 32 | 47.0 | 30.0 | 56.7 | 80 |
| Dr. RPCAU, Dholi | 10 | 56.8 | 49.8 | 14.1 | 25 |
| PJTSAU, ARS, Karimnagar | 14.4 | 69.1 | 62.2 | 11.1 | 36 |
| BAU, Ranchi | 18 | 41.5 | 21.7 | 91.2 | 50 |
| BCKV, Kalyani | 20 | 65.0 | 60.0 | 8.3 | 100 |
| KVK, Pratapgarh | 20 | 35.5 | 23.7 | 49.7 | 54 |
| IGKV, Ambikapur | 20 | 46.6 | 26.4 | 76.5 | 50 |
| OUAT, Bhubaneswar | 30 | 53.9 | 49.6 | 8.8 | 75 |
| AAU, Godhra | 20.4 | 33.1 | 28.2 | 17.2 | 51 |
| BHU Varanasi | 10 | 55.0 | 50.0 | 10.0 | 50 |
| MPKV, Kolhapur | 20 | 62.9 | 45.6 | 37.9 | 50 |
| MPUAT, Banswara | 20 | 45.0 | 35.0 | 28.6 | 65 |
| **Total/mean (*Kharif 2024*)** | **234.8** | **51.0** | **40.2** | **26.8** | **686** |

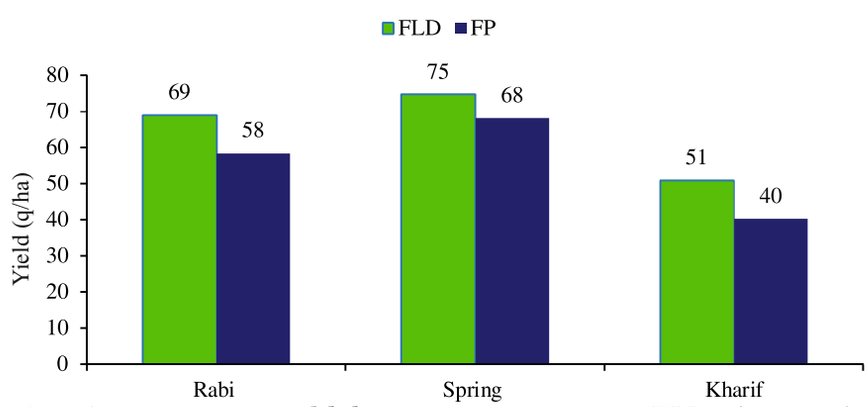



*Fig 5.4: Average maize yield during across season in FLDs (in green) and farmers' Practices (in blue)*

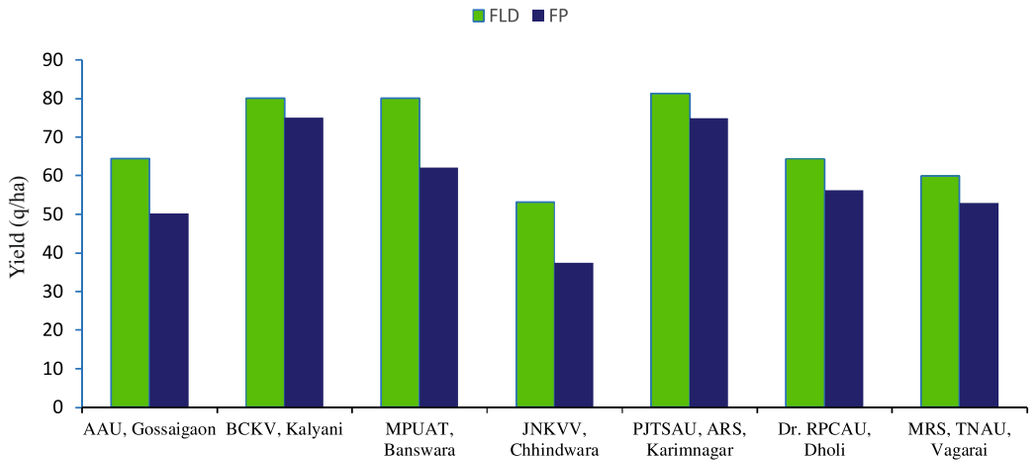



*Figure 5.5: Maize Yield during Rabi 2023-24 in FLDs (in green) and farmers' Practices (in blue under TSP)*

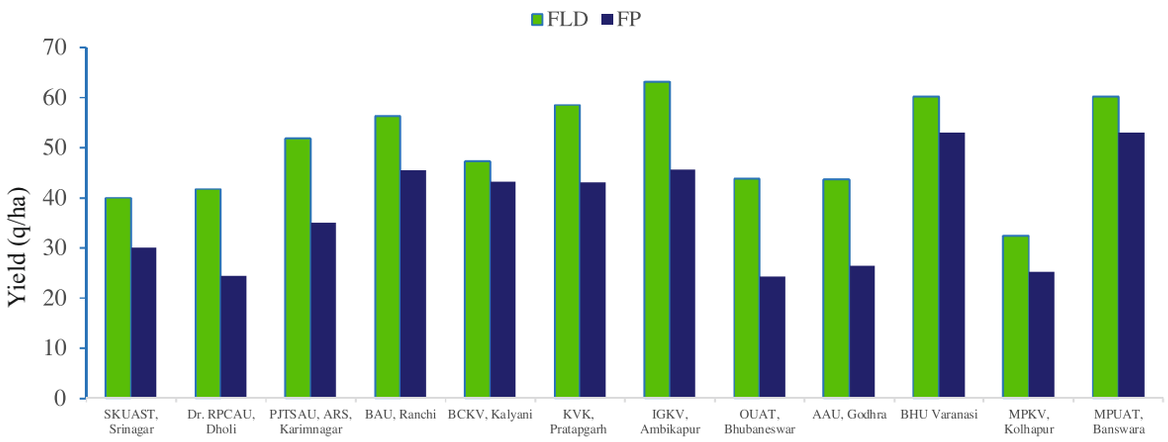



*Figure 5.6: Maize Yield during Kharif 2024 in FLDs (in green) and farmers' Practices (in blue) under TSP*

Input Distribution for FLD by AAU, Godhara

Training programme by Gossaigaon centre

Input distribution/Training programme organized by Ambikapur centre

Field day organized by Karimnagar centre


Field day organized by Vagarai centre

Input Distribution for FLD by OUAT centre

Training programme organized by Srinager centre

Field Day programme organized by KVK, Pratapgarh

**Table 5.3: Details of training programme conducted under TSP**

| SI. No. | Centre | Date of training | Place (village, Block, District) | Programme type | Training/ programme name | No. of Participant | No. of female participants |
|---|---|---|---|---|---|---|---|
| 1. | Main Maize Research Station, AAU,Godhra | 25.10.2024 | Main Maize Research Station, AAU,Godhra | T | Scientific cultivation of maize | 25 | 0 |
| 2. | AAU, Gossaigaon | 11.01.2024 | Telipara, Gossaigaon block and Kokrajhar district | T | Improved production technology of Hybrid maize | 25 | 2 |
| 3. | AAU, Gossaigaon | 12.01.2024 | Telipara, Gossaigaon block and Kokrajhar district | T | Improved production technology of Hybrid maize | 25 | 5 |
| 4. | AAU, Gossaigaon | 29.03.2024 | Kapurgaon, Dotma Block and Kokrajhar district | FD | Scientific cultivation of maize | 50 | 14 |
| 5. | GBPUAT, Pantnagar | 20.02.2024 | Khirana | T | Cultivation practices of spring maize | 22 | 2 |
| 6. | GBPUAT, Pantnagar | 25.05.2024 | Ajania | T | Pest management in Spring Maize | 50 | 8 |
| 7. | BCKV, Kalyani | 07.06.2024 | Lokat, Binpur, Jhargram | T, ID | Maize cultivation under upland rainfed condition | 100 | 100 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 8. | Dr. RPCAU, Dholi | 15.03.2024 to 17.03.2024 | Laxmipur Sauraha, Dist. West Champaran | T | Scientific cultivation of Spring maize and it's management | 36 | 25 |
| 9. | Dr. RPCAU, Dholi | 12.12.2024 to 14.12.2024 | Laxmipur Sauraha, Dist. West Champaran | T | Rabi maize QPM cultivation to enhance food security, increase farmers' income, and address malnutrition in tribal communities | 45 | 33 |
| 10. | SKUAST, Srinagar | 16.07.2024 | Dawar, Gurez, Bandipora | A & ID | Improved Technologies for Higher Maize Production | 30 | 4 |
| 11. | SKUAST, Srinagar | 16.10.2024 | Mulnar, Harwan, Srinagar | T & ID | Popularizatio n of Maize Hybrids | 50 | 15 |
| 12. | KVK, Pratapgarh | 04.10.2024 | Umerda, Devgarh | ID, FD,A | Field Day on Maize | 54 | 17 |
| 13. | SKAUST, Srinagar | 16.07.2024 | Dawar, Gurez, Bandipora | A & ID | Improved Technologies for Higher Maize Production | 30 | 4 |
| 14. | SKAUST, Srinagar | 16.10.2024 | Mulnar, Harwan, Srinagar | T & ID | Popularizatio n of Maize Hybrids | 50 | 15 |
| 15. | BHU Varanasi | 14.06.2024 | Bharhari, Chopan, Sonbhadra | T & ID | Training and input distribution programme | 150 | 20 |
| 16. | OUAT, Bhubaneswar | 29.02.2024 | Conference Hall, Balel, Lantapur, Koraput | T, ID | Farmers' Training & Farm Tool Distribution Programme; Training Topic: Scientific Crop Production Technology in Maize | 25 | 5 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 17. | OUAT, Bhubaneswar | 03.01.2024 | KVK, Umerkote, Nabarangapur | T, ID | Scientific Crop Production Technology & FAW Management in Maize | 25 | 7 |
| 18. | JNKVV, Chhindwara (M.P.) | 01.06.2024 | Mohkhed, Chhindwara | ID | Scientific cultivation of maize | 87 | 23 |
| 19. | JNKVV, Chhindwara (M.P.) | 20.10.2024 | Mohkhed, Chhindwara | FD | Maize for doubling farmers income | 92 | 12 |
| 20. | AAU, Godhara | 25.10.2024 | AAU, Godhara | T | Scientific cultivation of maize | 25 | 0 |
| 21. | MRS, TNAU, Vagarai | 11.03.2024 | Oonanthangal, Rasipuram taluk, Namakkal district | T | Maize Production technologies | 25 | 5 |
| 22. | MRS, TNAU, Vagarai | 11.03.2024 | Oonanthangal, Rasipuram taluk, Namakkal district | FD | Hybrid Maize/ weed Management | 25 | 5 |
| 23. | MRS, TNAU, Vagarai | 11.03.2024 | Soolaikalputhur, Rasipuram taluk, Namakkal district | FD | Hybrid Maize/ weed Management | 25 | 7 |
| 24. | MPUAT, Banswara | 08.02. 2024 | Borwat, Talwara, Banswara | ID & T | Nano-urea distribution and training on FAW | 41 | 0 |
| 25. | MPUAT, Banswara | 28.03.2024 | Jakta rawat ka parda, Banswara | FD | Farmer's awareness to technologies | 50 | 0 |
| 26. | MPUAT, Banswara | 05.10.2024 | Bajakhara, Garhi, Banswara | FD | Farmer's awareness to technologies | 80 | 0 |
| 27. | PJTSAU, ARS, Karimnagar | 31.03.2024 | Ballunayak thanada,mirza pur, Husnabad mandal,Das thanda, Chapagani thanda,Katkur of Siddipet district | ID | Zero tillage maize manageme nt practices | 50 | 11 |
| 28. | PJTSAU, ARS, Karimnagar | 17.09.2024 | Degavaththan da and Chintamani thanda of Manala, Rudrangi mandal, Rajanna siricilla District, Telangana | ID; FD | Awareness on *Kharif* maize production techniques | 36 | 9 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 29. | MPKV, Kolhapur | 25.06.2024 | Vikhale, Tal: Khatav, Dist: Satara | T,ID,FD,A | Improved Maize cultivation practices | 69 | 6 |
| 30. | MPKV, Kolhapur | 07.02. 2024 | Chinake, Tal: Sangola, Dist: Solapur | T,ID,FD,A | Improved Maize cultivation practices | 132 | 11 |
| 31. | MPKV, Kolhapur | 07.04. 2024 | Vhatfali, Tal: Malshiras, Dist: Solapur | T,ID,FD,A | Improved Maize cultivation practices | 49 | 4 |
| 32. | MPKV, Kolhapur | 12.06. 2024 | Chinchani, Tal: Tasgaon, Dist: Sangli | T,ID,FD,A | Improved Maize cultivation practices | 33 | 0 |
| 33. | MPKV, Kolhapur | 12.07.2024 | Bastwade, Tal: Tasgaon, Dist: Sangli | T,ID,FD,A | Improved Maize cultivation practices | 35 | 2 |
| 34. | MPKV, Kolhapur | 07. 0.2024 | Vhatfali, Tal: Malshiras, Dist: Solapur | T,ID,FD,A | Improved Maize cultivation practices | 22 | 3 |
| 35. | MPKV, Kolhapur | 14.12.2024 | Vharnul fata | T,ID,FD,A | Improved Maize cultivation practices | 133 | 27 |
| 36. | MPKV, Kolhapur | 07.12.2024 | Dhonaje, Tal: Dhadgaon,Dist: Nandurbar | T | Improved Maize cultivation practices | 50 | 3 |
| 37. | MPKV, Kolhapur | 14.10.2024 | Dhanaje (Bk), Tal: Dhadgaon, Dist: Nandurbar | T,ID,FD,A | Improved Maize cultivation practices | 34 | 6 |
| 38. | MPKV, Kolhapur | 15.10.2024 | Somana, Tal:Agreni, Dist:Nandurbar | T,ID,FD,A | Improved Maize cultivation practices | 26 | 3 |
| 39. | MPKV, Kolhapur | 12.06.2024 | Lavhali-Otur, Tal: Akole, Dist:Ahmednagar | T | Improved Maize cultivation practices | | |
| 40. | IGKV, RMD CARS Ambikapur | 11.01.2024 | RMD College of Agriculture and Research station Ambikapur | T | Improved Maize Production Technology | 37 | 0 |
| 41. | IGKV, RMD CARS Ambikapur | 29.01.2024 | RMD College of Agriculture and Research station Ambikapur | T | Improved Maize Production Technology | 35 | 0 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 42. | IGKV, RMD CARS Ambikapur | 30.01.2024 | Village Mendhrakhurd, District-Surguja (CG) | FD | Maize Day | 45 | 3 |
| 43. | IGKV, RMD CARS Ambikapur | 12.02.2024 | RMD College of Agriculture and Research station Ambikapur | T | Improved Maize Production Technology | 43 | 0 |
| 44. | Birsa Agricultural University, Ranchi | 03.07.2024 | Birsa Agricultural University, Ranchi | ID | Improved Maize Production Technology | 232 | 62 |
| **Total** | | | | | | **2328** | **480** |

**T-Training; ID-Input Distribution; FD-Field Days; A-Awareness**

### Table 5.4:Input distribution under STC

| Particulars | Unit | Quantity | Beneficiaries |
|---|---|---|---|
| Maize Seeds | Tonnes | 6.12 | 646 |
| Tarpaulins, Sickels, Winnowing tool (Supa), Irrigation pipe, Sprayer, Garden tools etc. | No. | 593 | 593 |
| Hand Operated Maize Sheller | No. | 240 | 240 |
| Fertilizers (Urea, MOP, SSP) | Tonnes | 26.8 | 100 |
| Biofertilizer Culture (Solid & Liquid) Formulation | Kg | 340 | 150 |
| Plant protection chemicals | Kg | 210 | 340 |
| Distribution of literature | No. | 825 | 825 |

## SCSP programme

Under the SCSP, improved technologies of maize were demonstrated in 190ha of the farmer's field and benefitted 618 farmers (Table 5.5). During spring 2024, FLDs were conducted on 40 ha area and gives 5.2% yield and benifited 100 farmers. The result of the rabi FLDs showed that an average yield of 10.6% was recorded over farmers' practices, while kharif FLD showed an average yield gain of 27.5 % (9.1% in West Bengal to 93.7 % in Kolhapur). 15 trainings/agricultural inputs distributions/ awareness/field day programmes were organized benefitting 926 farmers (Table 5.7). The capacity building programmes also benefited 517 women farmers. Various inputs including seed, fertilizers, chemicals, small farm implements and farm literature were also distributed to 1420 households under the SCSP programme (Table 5.7). 6 maize shellers were also distributed by ICAR-IIMR(2) and AICRP centre(4).

## Table 5.5: Centre-wise,season-wise SCSP FLD conducted in maize

| Centre | Area (ha) | Yield (q/ha) | | Yield Gain (%) | No. of beneficiary |
|---|---|---|---|---|---|
| | | FLD | FP | | |
| ***Rabi 2023-2024*** | | | | | |
| Kalyani, West Bengal | 20 | 82.0 | 72.0 | 13.9 | 100 |
| PJTSAU, ARS, Karimnagar | 34 | 89.8 | 83.7 | 7.4 | 85 |
| ***Total/mean (Rabi 2024)*** | **54** | **85.9** | **77.8** | **10.4** | **185** |
| ***Spring 2024*** | | | | | |
| IIMR, Ludhiana | 40 | 61.4 | 58.3 | 5.2 | 100 |
| ***Total/mean (Spring 2024)*** | **40** | **61.4** | **58.3** | **5.2** | **100** |
| **Kharif 2024** | | | | | |
| JNKVV, Chhindwara (M.P.) | 8 | 44.9 | 32.4 | 39.0 | 20 |
| MPKV, Kolhapur | 20 | 46.8 | 36.3 | 28.8 | 50 |
| Kalyani, West Bengal | 10 | 60.0 | 55.0 | 9.1 | 50 |
| IIMR, Ludhiana | 38 | 45.2 | 41.3 | 9.5 | 67 |
| CAU, Imphal | 20 | 39.2 | 20.2 | 93.7 | 46 |
| ***Total/mean (Kharif 2024)*** | **96** | **47.2** | **37.0** | **36.0** | **233** |

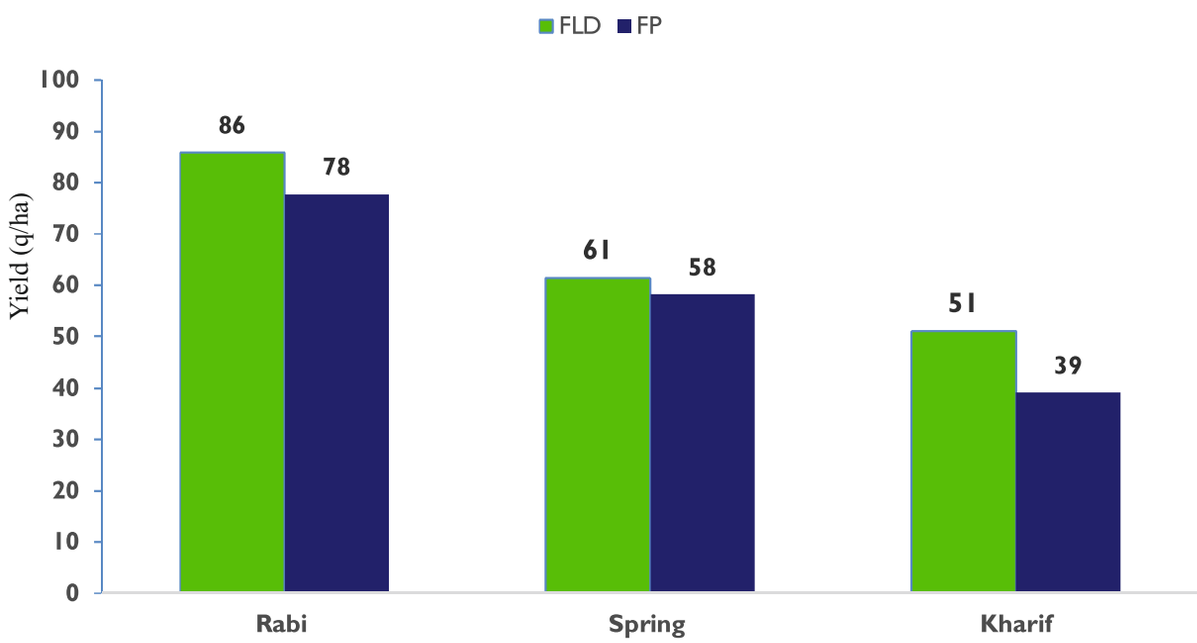



*Fig 5.7: Average maize yield during across season in FLDs (in green) and farmers' Practices (in blue)*

| S.No | Centre | Date of training | Place (village, Block, District) | Type of programme | Training/ programme name | Beneficiary | No. of female participants |
|---|---|---|---|---|---|---|---|
| 1. | PJTSAU, ARS, Karimnagar | 16.12.2023 & 31.12.2024 | PJTSAU, ARS, Karimnagar | ID | Zero tillage maize management practices | 85 | 16 |
| 2. | GBPUAT, Pantnagar | 18.12.2024 | Rudrapur | A | Spring Maize as an alternative of summer rice | 40 | 0 |
| 3. | Kalyani, West Bengal | 28.05.2024 | Simlapal, Bankura & Binpur, Jhargram | T, ID | Maize in upland | 100 | 50 |
| 4. | JNKVV, Chhindwara (M.P.) | 02.06.2024 | Amarwara, Chhindwara | ID | Scientific maize cultivation | 25 | 4 |
| 5. | JNKVV, Chhindwara (M.P.) | 27.10.2024 | ZARS chhindwara | A | Scientific weed and FAW management | 52 | 3 |
| 6. | MPKV, Kolhapur | 21.06.2024 | Agran Dhulgaon, Kavathemahankal, Samgli | T, ID, A, FD | Improved production Technology of Maize | 50 | 8 |
| 7. | ICAR-IIMR, Ludhiana | 12.02. 2024 | Mahesh Nagar, Barnala, Punjab | T, ID | Improving the livelihood of schedule caste farmers through improve maize technologies | 50 | 44 |
| 8. | ICAR-IIMR, Ludhiana | 22.02. 2024 | KokriKalan, Moga, Punjab District, Punjab | T, ID | Improving the livelihood of schedule caste farmers through improve maize technologies | 95 | 95 |
| 9. | ICAR-IIMR, Ludhiana | 23.03.2024 | Balliewa village, Ludhiana, Punjab | T, ID | Improving the Livelihood of Schedule Caste Farmers through Improve Maize Technologies | 100 | 91 |
| 10 | ICAR-IIMR, Ludhiana | 09.03.2024 | Chokkar Village, Ludhiana, Punjab | T, ID | Improving the livelihood of schedule caste farmers through improve maize technologies | 50 | 39 |
| 11 | ICAR-IIMR, Ludhiana | 25.04.2024 | Gehlewal, Machiwara Sahib, Ludhiana | ID | Promotion of mechnization in maize | 43 | 37 |
| 12 | ICAR-IIMR, Ludhiana | 25.04. 2024 | Pahadpur, Ropar | ID | Promotion of mechnization in maize | 56 | 50 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 13 | WNC, Hyderarab | 25.06.2024. | Velijerla, Kollapadakal, Y RangaReddy, Telangana | ID | Improving the livelihood of schedule caste farmers | 100 | 56 |
| 14 | CAU, Imphal | 29.02.2024 | Andro Manchengpat, Imphal East district | T | Scientific cultivation of maize in Manipur | 38 | 13 |
| 15 | CAU, Imphal | 08.03.2024 | Kakching Wairi Sabal leikai, Kakching district | T | Scientific cultivation of maize in Manipur | 42 | 11 |
| Total | | | | | | 926 | 517 |

*T-Training; ID-Input Distribution; FD-Field Days; A-Awareness*

*Table 5.7: Majors Inputs distributed under SCSP*

| Particulars | Unit | Quantity | Beneficiaries |
|---|---|---|---|
| Maize Seeds | Kg | 3015 | 355 |
| Neem Oil | L | 10 | 10 |
| Small equipment's | No. | 381 | 381 |
| Fertilizers (DAP, MOP, Urea) | Tonnes | 14 | 150 |
| Pheromone Traps | No. | 150 | 20 |
| Plant protection chemicals | Kg | 185 | 50 |
| Any other (tarpaulins etc. ) | No | 85 | 85 |
| Distribution of Literature | No. | 243 | 243 |

Hybrid maize promotion among SC farmers by Chhindwara centre

Training programme for farmers by Mandya centre

Maize sheller distribution by Imphal Centre

Maize sheller distribution by Imphal Centre

Input distribution by IIMR, Ludhiana

Maize sheller distribution by IIMR, Ludhiana

**Promotion of Maize in North Eastern Hill Region under NEH component**

In rabi season 2023-24 FLD was conducted in 65 ha, in which a yield gain of 37.09% was observed (Table 5.8). In Spring season FLD was conducted in 35ha, in which a yield 49.16% was observed. In kharif season, FLD under the NEH component benefited 483 farmers. 21training/ input distribution programmes/ field days/ awareness programmes were also organized benefitting 2946 beneficiaries including 1877 women (Table 5.9). Besides these, 529 rural households also benefitted from input distribution programmes (Table 5.10).

ICAR- Indian Institute of Maize Research, Ludhiana in collaboration with CAU, Imphal also organized two days Workshop on "Maize for North East Hill Region: Challenges and Opportunities" from 11-12 March, 2024.

Training cum input distribution programme by Barapani centre

Training cum input distribution programme by Imphal Centre

Training cum input distribution programme by NRC on Yak Centre

Training programme by CAU, Nofra, AP


Two days Workshop organized by Imphal Centre

## Table 5.9: Details of training programme conducted under NEH

| Sr. No | Centre | Date of training | Place (village, Block, District) | Type of programme | Training/ programme name | Total no. of person benefitted | No. of female participants |
|---|---|---|---|---|---|---|---|
| 1. | AAU, Gossaigaon | 01.03.2024 | Teliprara, Kochugaon, Kokrajhar | T | Training on scientific cultivation of Maize | 25 | 0 |
| 2. | AAU, Gossaigaon | 02.03.2024 | Teliprara, Kochugaon, Kokrajhar | T | Training on scientific cultivation of Maize | 25 | 0 |
| 3 | AAU, Gossaigaon | 03.03.2024 | Matiajuri, Gossaigaon, Kokrajhar | T | Training on scientific cultivation of Maize | 25 | 7 |
| 4 | AAU, Gossaigaon | 04.3.2024 | Matiajuri, Gossaigaon, Kokrajhar | T | Training on scientific cultivation of Maize | 25 | 10 |
| 5 | AAU, Gossaigaon | 05.03.2024 | Amritpur, Kochugaon, Kokrajhar | T | Training on scientific cultivation of Maize | 25 | 11 |
| 6 | AAU, Gossaigaon | 07.03.2024 | Teliprara, Gossaigaon | FD | Field Day on Maize | 50 | 0 |
| 7 | AAU, Gossaigaon | 08.03.2024 | Matiajuri, Gossaigaon | FD | Field Day on Maize | 50 | 14 |
| 8 | AAU, Gossaigaon | 09.3.2024 | Amritpur, Kochugaon | FD | Field Day on Maize | 50 | 15 |
| 9 | AAU, Gossaigaon | 10.3.2024 | Kayetpara, North Salmora | FD | Field Day on Maize | 50 | 4 |
| 10 | AAU, Gossaigaon | 12.03.2024 | Lakhiganz | FD | Field Day on Maize | 50 | 5 |
| 11 | AAU, Gossaigaon | 14.03.2024 | Kusumbil | FD | Field Day on Maize | 50 | 25 |
| 15 | CAU, Nafra | 10 to 12.11.2024 | Sika-bamin, East Siang | T | Scientific cultivation and hybrid seed production techniques of Maize | 35 | 15 |
| 16 | CAU, Nafra | 04.02.2024 | Jampani, East Siang | A, ID | Input distribution cum awareness programme on advantages of line sowing of maize | 25 | 18 |
| 17 | CAU, Nafra | 8 to 13.03.2024 | Sikabamin, East Siang | T | Empowering tribal farmers through maize cultivation and value addition | 30 | 25 |
| 18 | CAU, Nafra | 14.03.2024 | Naku-Nachibon, Bichom | T, ID | Good agricultural Practices for in QPM cultivation | 50 | 30 |
| 19 | CAU, Nafra | 19 to 21.03.2024 | Runne, East Siang | T | Demonstartion on value addition of Maize | 25 | 25 |
| 20 | CAU, Nafra | 31.03. 2024 | COA, Pasighat, East Siang | T, ID | Revitalizing maize cultivation in North east region | 200 | 160 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 21 | CAU, Nafra | 23.04.2024 | Parbuk, Lower Dibang Valley | T, ID | Improvement of livelihood and nutrition through cultivation of QPM maize | 35 | 30 |
| 22 | CAU, Nafra | 29.04.2024 | Manigong, Shiyomi | T, ID | | 30 | 26 |
| 23 | CAU, Nafra | 20to21.05.2024 | Ziro, Lower Subansiri | ID | Baby corn and QPM deed distribution | 10 | 10 |
| 24 | CAU, Nafra | 29.07.2024 | Pasighat | T | Improvement of livelihood and nutrition through cultivation maize | 30 | 26 |
| 25 | CAU, Nafra | 23.08.2024 | Wakro, Lohit | A, ID | Awarenss cum input distribution | 20 | 12 |
| 26 | CAU, Nafra | 26.10. 2024 | Sigar, East Siang | T, ID | Scientific cultivation of Speciality Corn | 40 | 32 |
| 27 | NRC on Yak, Dirang, Arunachal Pradesh | 25 to 27.03.2024 | Sangti | T, ID | Three days training programme on scientific maize cultivation cum input distribution | 69 | 33 |
| 28 | NRC on Yak, Dirang, Arunachal Pradesh | 09 to 11.05.2024 | Dirang, Dirang, West Kameng | T, ID | Three days training programme on scientific maize cultivation cum input distribution | 24 | 9 |
| 29 | NRC on Yak, Dirang, Arunachal Pradesh | 03to05.06.2024 | Dirang, Dirang, West Kameng | T, ID | Three days training programme on scientific maize cultivation cum input distribution | 96 | 43 |
| 30 | NRC on Yak, Dirang, Arunachal Pradesh | 06.06.2024 | Dirang, Dirang, West Kameng | A, ID | Awareness on specified maize cultivation for better economic up-lift of the farmers | 25 | 6 |
| 31 | NRC on Yak, Dirang, Arunachal Pradesh | 16.07.024 | Dirang, Dirang, West Kameng | FD | Field Day programme on silage making with locally available forages and tree foliages using polybags | 16 | 5 |
| 32 | CAU (Imphal), Kyrdemkulai, Meghalaya | 16.03.2024 | Mawlein Mawkhan Sohkyndur Ri-Bhoi | T & ID | Cultivation practices of specialty corn & FAW management" and Input distribution programme | 31 | 26 |
| 33 | CAU (Imphal), Kyrdemkulai, Meghalaya | 28.03.2024 | Umdiker, Ri-Bhoi | T & ID | Cultivation practices of specialty corn& FAW management" and input distribution programme | 36 | 32 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 34 | CAU (Imphal), Kyrdemkulai, Meghalaya | 27.03.2024 | Lum-mynri, Ri-Bhoi | T & ID | Cultivation practices of specialty corn& FAW management" and input distribution programme | 33 | 31 |
| 35 | CAU (Imphal), Kyrdemkulai, Meghalaya | 30 & 31.03.2024 | COA, Kyrdemkulai | T & ID | Cultivation practices of specialty corn& FAW management" and input distribution programme | 201 | 150 |
| 36 | CAU (Imphal), Kyrdemkulai, Meghalaya | 31.03.2024 | COA, Kyrdemkulai | A | Awareness cum motivational talk on promotion of Maize as food and fodder | 210 | 160 |
| 37 | CAU (Imphal), Kyrdemkulai, Meghalaya | 13.06.2024 | Mawlyngkhung, Ri-Bhoi | T, ID | Cultivation practices of sweet corn & FAW Management | 30 | 29 |
| 38 | CAU (Imphal), Kyrdemkulai, Meghalaya | 26.06.2024 | Jukiang village, Ri-Bhoi | T, ID | Cultivation practices of sweet corn & FAW Management | 30 | 25 |
| 39 | CAU (Imphal), Kyrdemkulai, Meghalaya | 11.07.2024 | Karbalu village, Ri-Bhoi | T, ID | Cultivation practices of specialty corn & FAW Management | 65 | 31 |
| 40 | CAU (Imphal), Kyrdemkulai, Meghalaya | 15.07.2024 | Pynursla village, East Khasi Hills | T, ID | Cultivation practices of specialty corn & FAW Management | 54 | 32 |
| 41 | CAU (Imphal), Kyrdemkulai, Meghalaya | 19.05.2024 | COA, Kyrdemkulai, Ri-Bhoi | T, ID | Popularization of Specialty Corn in Meghalaya | 44 | 29 |
| 42 | CAU (Imphal), Kyrdemkulai, Meghalaya | 19.06.2024 | Thad & Nongbah Myrdo, Ri-Bhoi | FD, A, ID | Seed distribution, farmers field visit & monitoring of FLDs | 30 | 19 |
| 43 | CAU (Imphal), Kyrdemkulai, Meghalaya | 22.06.2024 | Umksih, Ri-Bhoi | T, ID | Cultivation practices of sweet corn & FAW Management | 30 | 27 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 44 | CAU (Imphal), Kyrdemkulai, Meghalaya | 27.06.2024 | Rtiang, Ri-Bhoi | T, ID | Cultivation practices of sweet corn & FAW Management | 31 | 31 |
| 45 | CAU (Imphal), Kyrdemkulai, Meghalaya | 28.06.2024 | Umkei, Ri-Bhoi | T, ID | Cultivation practices of sweet corn & FAW Management | 45 | 20 |
| 46 | CAU (Imphal), Kyrdemkulai, Meghalaya | 31.07.2024 | Kyrdemkulai, Ri-Bhoi | T, ID, A | Training on Cultivation practices of Specialty corn cum FPOs/ Farmers/ Dealers Meet | 55 | 34 |
| 47 | CAU (Imphal), Kyrdemkulai, Meghalaya | 13.08.2024 | KVK Jaintia Hills, West Jaintia Hills | T, ID, A | Cultivation practices of specialty corn & FAW management cum students, scientist, farmers interaction | 78 | 51 |
| 48 | CAU (Imphal), Kyrdemkulai, Meghalaya | 07.11.2024 | Lad Umpih, Ri-Bhoi | T, ID | Training & Input Distribution Programme on Cultivation Practices of Specialty Corn & FAW Management | 30 | 27 |
| 49 | CAU (Imphal), Kyrdemkulai, Meghalaya | 08.11.2024 | Mawknor, Ri-Bhoi | T, ID | Training & Input Distribution Programme on Cultivation Practices of Specialty Corn & FAW Management | 30 | 21 |
| 50 | CAU (Imphal), Kyrdemkulai, Meghalaya | 09.11.2024 | Umtham, Ri-Bhoi | T, ID | Training & Input Distribution Programme on Cultivation Practices of Specialty Corn & FAW Management | 40 | 36 |
| 51 | CAU (Imphal), Kyrdemkulai, Meghalaya | 10.11.2024 | Byrwa, Ri-Bhoi | T, ID | Training & Input Distribution Programme on Cultivation Practices of Specialty Corn & FAW Management | 48 | 46 |
| 52 | CAU, Imphal | 11-12.2024 | Iroisemba, Imphal city Imphal West | Work shop, ID | Regional workshop on Maize for North East- Opportunities and challenges | 200 | 131 |
| 53 | CAU, Imphal | 28.03. 2024 | Andro, Keirao Bitra, Imphal East | T, ID | Sustainable maize based intercropping system under Manipur condition | 50 | 39 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 54 | CAU, Imphal | 29.03. 2024 | Chanung, Sawombung , Imphal East | T | Sustainable maize based intercropping system under Manipur condition | 50 | 27 |
| 55 | CAU, Imphal | 30.03. 2024 | Keirak, Kakching, Kakching | T | Sustainable maize based intercropping system under Manipur condition | 50 | 29 |
| 56 | CAU, Imphal | 29.06. 2024 | Iroisemba, Imphal city, Imphal | ID | Input Distribution Programme under NEH | 60 | 42 |
| 57 | CAU, Imphal | 01.06. 2024 | Kakching Khunou, Kakching | ID | Input Distribution programme under NEH | 30 | 21 |
| | | | | | | 2946 | 1877 |

**Table 5.10: Majors Inputs distributed under NEH**

| Particulars | Unit | Quantity | Beneficiaries |
|---|---|---|---|
| Maize seed | Tonnes | 7.7 | 964 |
| Fertilizers (DAP,MOP, SSP, Urea) | Tonnes | 33.6 | 660 |
| Liquid Biofertilizer | L | 10 | 20 |
| Plant protection chemicals | Kg | 105.5 | 333 |
| Vermicompost unit | No. | 6 | 6 |
| Pheromone trap | No. | 8 | 2 |
| Neem Oil | L | 70 | 120 |
| Sprayer, Spade, Khurpi, Tarpaulin etc. | No. | 3363 | 2992 |
| Distribution of Literature | No. | 905 | 905 |

**Enhancement of maize production in catchment areas of ethanol industries**

Demonstrations of improved package of practices for catchment area development around industries: 1515 demonstrations were conducted during the kharif (788) and rabi (727) seasons of 2024-25 in 15 catchment area clusters of ethanol industries across 15 states. Awareness on improved package of practices of maize was emphasized to adopt by the farmers through maize flyer and leaflets in different languages.

Training and awareness programme on maize in ethanol industries catchment areas: The training/awareness/exposure programme were conducted for the various stakeholders across country for quality maize production towards profitable ethanol production. Till December 2024, 65 awareness programmes, 51 trainings and 10 field day organised in which involving 3582 stakeholders.

| Program | Number of Program | Number of farmers' Participation |
|---|---|---|
| Awareness Campaign | 65 | 1908 |
| Training Program | 51 | 1161 |
| Field Day | 10 | 513 |
| **Total** | **126** | **3582** |





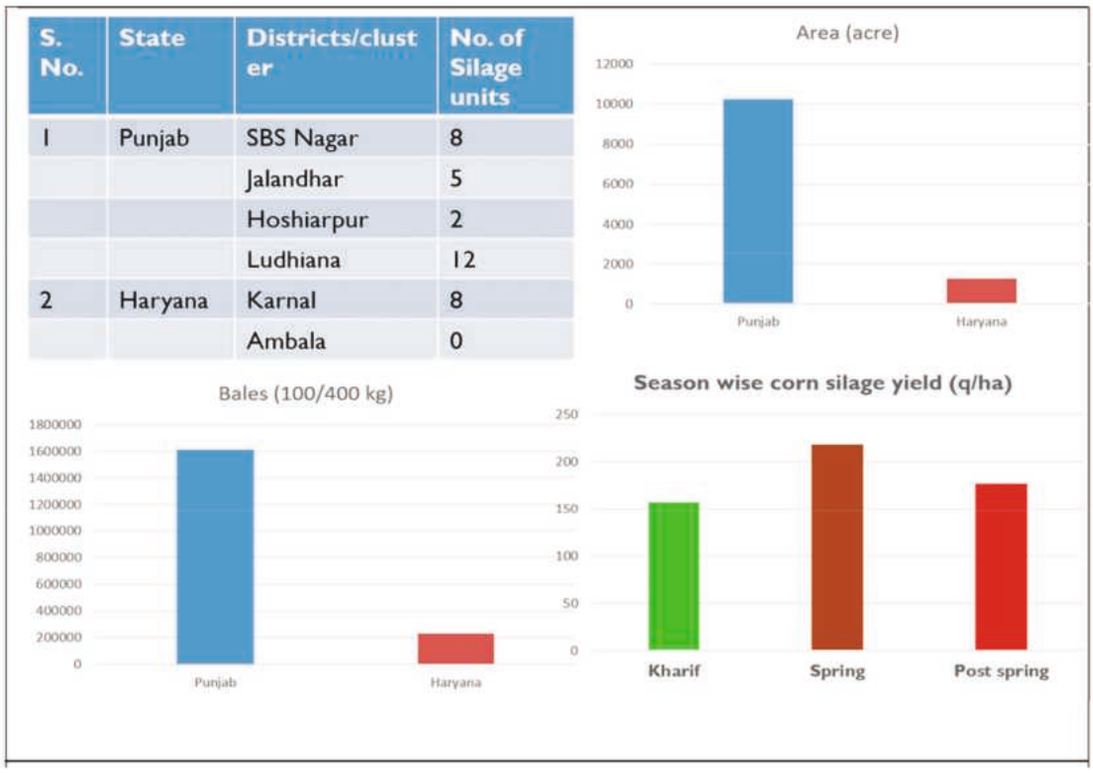

## Upscaling maize-based silage value chain in Punjab and Haryana

**Maize Silage Trial:** A total of 150 maize hybrids released by the public and private sectors from last five years were evaluated for silage purpose in the kharif season, 2024 in alpha lattice design with two replication and two rows (3 meters each) and spacing 65x20 cm (row to row and plant to plant respectively). The silage data including quality are under process to find out the promising hybrids for silage. Other than these we have developed some leafy lines having high biomass to develop the silage specific hybrids.

**FLDs under maize silage:** As per the proposed project, 52-hectare FLDs were conducted at 79 farmers' fields for silage purposes at Jalandhar, Ludhiana, SBS Nagar, Ambala and Karnal and data under analysing phase. The overall average silage yield reported for FLDs trial was 130 quintal per acre.

**Base line survey of maize silage:** To know the overall scenario of maize silage a baseline survey was conducted in two clusters each in Punjab and Haryana includes, four districts of Punjab (Ludhiana, SBS Nagar, Jalandhar and Hoshiarpur) and two district of Haryana (Karnal and Ambala). The survey aimed to identify and collect primary data pertaining to maize crop and the operational silage processing units within these regions. A total of 10000-acre area under silage in Punjab and 1500 acres in Haryana. Further, based on the season wise yield, spring season reported highest yield 220 quintal/acre and 150 in kharif season.

| S. No. | State | Districts/cluster | No. of Silage units |
|---|---|---|---|
| 1 | Punjab | SBS Nagar | 8 |
| | | Jalandhar | 5 |
| | | Hoshiarpur | 2 |
| | | Ludhiana | 12 |
| 2 | Haryana | Karnal | 8 |
| | | Ambala | 0 |




**Field day cum training:** A total of three field day cum training were organised, each one at Ludhiana, SBS Nagar and Jalandhar for upscaling the silage and sharing the new silage technologies among the farmers for higher income. Details of trainings as given belows:

| S. No. | Date | Place | No. of Beneficiary | Organizers | Remarks |
|---|---|---|---|---|---|
| 1. | 23.10.2024 | Gallewal, Ludhiana | 100 | Dr. Pardeep Kumar (PI)<br>Co-PI: Drs. Seema Sepat, BS Jat and Romen Sharma<br>SRF (Taranveer Singh & Tajinder Singh) | Dr. Seema Sepat, delivered a lecture on weed management in maize<br>Dr. BS Jat, delivered lecture on seed production in maize<br>Dr. Pardeep Kumar, overall objectives of the project |
| 2. | 25.10.2024 | Bachhuari, SBS Nagar | 100 | Dr. Pardeep Kumar (PI)<br>Co-PI: BS Jat, Romen Sharma<br>SRF (Taranveer Singh & Tajinder Singh) | Field visit and overall feedback from the farmers side regarding the demonstration and project |
| 3. | 13.11.2024 | Lallian Kalan, Jalandhar | 94 | Dr. Pardeep Kumar (PI)<br>Co-PI: Drs. BS Jat, Romen Sharma, Deep Mohan Mahala<br>SRF (Taranveer Singh) | Field visit and overall feedback from the farmers side regarding the demonstration and project |





**Consulting services for technical advisory support in Augmenting Maize Production in Assam Farmers**

A total of 72 field days were conducted across 12 districts of Assam (Table & Picture 1), engaging 1712 farmers in maize demonstrations during May to June 2024 under APART Consultancy project. The average grain yield across all districts was 10.94 t/ha, with the highest mean yield recorded in Barpeta (12.81 t/ha) followed by Darrang (12.05 t/ha) and Nalbari (11.88 t/ha). Maximum yield variation was observed in Sonitpur (5.30-12.40 t/ha) indicating significant scope for agronomic improvement. The highest maximum yield (14.07 t/ha) was recorded in Darrang, while the lowest minimum yield (5.30 t/ha) was observed in Sonitpur. The data clearly demonstrate the positive impact of training and field demonstrations on enhancing maize productivity and narrowing yield gaps in Assam.

Table 1. District-wise details of field days and grain yield of maize in demonstrations during rabi season of 2023-24.

**Table 1. District-wise details of field days and grain yield of maize in demonstrations during rabi season of 2023-24.**

| Districts | No. of Field Days | No. of Participants | Date of field days organized | Average grain yield (t/ha) | Max. grain yield (t/ha) | Min. grain yield (t/ha) |
|---|---|---|---|---|---|---|
| Barpeta | 07 | 151 | 17 May- 30 May 2024 | 12.81 | 13.72 | 10.65 |
| Bongaigaon | 07 | 177 | 14 May- 19 May 2024 | 9.84 | 11.40 | 8.07 |
| Darrang | 07 | 200 | 18 May- 31 May 2024 | 12.05 | 14.07 | 10.50 |
| Dhemaji | 03 | 71 | 13 May- 20 May 2024 | 10.02 | 11.92 | 7.25 |
| Dhubri | 06 | 183 | 13 May- 20 May 2024 | 10.23 | 11.80 | 8.30 |
| Kamrup | 03 | 79 | 9 May- 21 May 2024 | 11.26 | 12.08 | 10.35 |
| Karbi Anglong | 04 | 102 | 19 May- 23 May 2024 | 10.49 | 11.72 | 9.04 |
| Kokrajhar | 08 | 204 | 24 May- 28 June 2024 | 10.97 | 12.00 | 10.01 |
| Morigaon | 07 | 136 | 19 May- 27 May 2024 | 11.07 | 13.28 | 8.40 |
| Nagaon | 07 | 136 | 24 May- 15 June 2024 | 11.28 | 13.38 | 7.65 |
| Nalbari | 06 | 151 | 15 May- 24 May 2024 | 11.88 | 13.14 | 9.27 |
| Sonitpur | 07 | 122 | 16 May- 1 June 2024 | 9.42 | 12.40 | 5.30 |
| **Total/Average** | **72** | **1712** | **-** | **10.94** | **12.58** | **8.73** |


*Picture 1. Activities of field days on maize demonstrations in target districts of Assam.*

## Improving the Farmers' Livelihood of Koraput district, Odisha

Under the project of "Improving the livelihood and nutritional security through scientific maize cultivation and maize based entrepreneurship development in Koraput District, Odisha". Demonstration of improved technologies was conducted in the Jeypore and Pottangi Blocks, covering the villages of Anta, Perahandi, Sundhiguda, and Maliguda. A total of 65 beneficiaries were selected for this demonstration, with 34 from Jeypore and 31 from Pottangi, covering a total area of 18 hectares (45 acres). Beneficiaries were given a total of 360 Kg of Kalingaraj variety seeds for a total of 45 acre which included (8 kg / acre). MOP and DAP were also distributed to the farmers. Agri equipment like sprayers (75 nos.), khurpi (97 nos.), spades (97 nos.) and tarpaulin (30 nos.) were distributed at Jeypore , Pottangi and Borigumma during various input distribution programme. A sensitization meeting cum input distribution program was organised by ICAR-IIMR, Ludhiana on at Block Agriculture Office, Jeypore on July 3, 2024. Altogether 34 beneficiaries participated in the programme. A training program was organised by ICAR-IIMR, Ludhiana on "Best management practices on Maize Cultivation and Entrepreneurship Development to Enhance Farmer Livelihoods in Koraput District, Odisha" at High Altitude Research Station, OUAT, Pottangi on July 4 , 2024. Altogether 48 beneficiaries participated the programme. A training cum input distribution program was organized by ICAR-IIMR, Ludhiana on "Awareness on Entrepreneurship development in maize to enhance farmers livelihood" at Maa Tarini SHG Office, Jujhari, Borigumma on July 5, 2024. Altogether 15 beneficiaries participated in the programme.

## Training programmes under DBT Biotech Kisan Project

ICAR-IIMR, Ludhiana had conducted four training programmes under the DBT project on "*Popularization of bio-fortified maize hybrids in Himalayan states and Central India with special reference to North Eastern Region for Sustainable Nutritional Security*". Four training programmes on were organized at Village Mehatpur, Una district (on 21.12.2024), Village Khandoor, Ludhiana district (on 25.02.2025), Village Wadda Ghar, Moga District (on 27.02.2025) and Village Shamspur, Ludhiana district (on 10.03.2024) respectively. The training programmes aimed to promote bio-fortified maize hybrids for nutritional and livelihood security among different stakeholders. The participants received hands-on training in making different value-added products from bio-fortified maize.

During the training sessions, staff of ICAR-IIMR, Agri-business Incubation Centre unit ICAR-IIMR, Ludhiana, and official from various line departments of Govt of Punjab participated the programme. During the programmes, the experts emphasized the importance of bio-fortified maize for both nutritional enhancement and livelihood security, encouraging farmers to adopt this technology. They highlighted the significance of mobilizing farmers into Farmer Producer Companies (FPCs) and urged women farmers to explore entrepreneurship opportunities through maize value addition with emphasized of using bio-fortified maize. ABI Unit of ICAR-IIMR demonstrated the preparation of various maize-based products from bio-fortified maize. Total 260 participants (including 233 women participants) benefitted from the training programme.

### Details of the training programme:

| Sr. No. | Date | Programme | Village, district | No. of participants | No of women participants |
|---|---|---|---|---|---|
| **1.** | 18.03.2024 | Promotion of Bio-fortified Maize for Entrepreneurship Development through Value Addition for Nutritional and Livelihood Security | Mehndali, Ropar | 100 | 100 |
| **2.** | 19.03.2024 | Promotion of Bio-fortified Maize for Entrepreneurship Development through Value Addition for Nutritional and Livelihood Security | Bhotna Barnala | 100 | 100 |
| **3.** | 20.03.2024 | Promotion of Bio-fortified Maize for Entrepreneurship Development through Value Addition for Nutritional and Livelihood Security | Lapon Village, Moga | 100 | 100 |
| **4.** | 27.03.2024 | Promotion of Bio-fortified Maize for Entrepreneurship Development through Value Addition for Nutritional and Livelihood Security | ICAR-CIPHET, Ludhiana | 46 | 27 |
| **5.** | 21.12.2024 | Bio-fortified Maize: Bridging Nutrition and Economic Oppurtunities | Mehatpur, Una, Himachal Pradesh | 70 | 43 |

# Glimpses of the training programmes

**Training programme at Mehndali Village, Ropar**

**Training programme at Bhotna Village, Barnala**


**Training programme at Lapon Village, Moga**


**Training programme at ICAR-CIPHET, Ludhiana**

**Training programme at Mehatpur, Una, Himachal Pradesh**

## Agri-Business Incubation Activities

During 2024, a total of 15 incubatees were onboarded, each working on diverse segments of the maize value chain. Two Entrepreneurship Development Programmes (EDPs) were organized, benefiting 91 aspiring entrepreneurs. In addition, the ABI staff conducted five training programmes focused on value addition and entrepreneurship development, reaching out to 384 farmers. Various maize-based products developed under the initiative were also showcased at multiple platforms.


**Glimpse of the ABI-Incubation Activities**

# AICRP ON MAIZE

6 Chapter

## Breeding (Kharif 2023)

During Kharif 2023, a total of 369 entries were received for multi-location evaluation in AICRP early, late, medium maturity of normal corn and quality protein maize (QPM), Sweet Corn, Baby Corn trials, popcorn and OPV trials. Out of 369 test entries, Field Corn (252), QPM (59), Sweet corn (20), Baby corn ()21 and popcorn (15)entries were received for testing and all these entries were tested in different trials during Kharif 202. The detailed report is given below:

## Promotion of entries

### Field Corn

Identification of varieties: 31 proposals were received and out of 31, 30 entries were identified. Out of 30, three hybrids were identified for *Rabi* season whereas, 12 field corn; three sweet corn and five hybrids under QPM category were identified.

**Trial No. 1115 NIVT (Early) NHZ**

In this trial, 16 new entries along with three checks, viz., BIO 605, DKC 7074, and LQMH 1 were evaluated in the north hill zone (NHZ) at six locations namely Bajaura, Barapani, Imphal, Kangra, Srinagar and VPKAS. Out of the 3 test entries, two entries namely AHD 1639 and LMH2342 were considered for promotion as they outperformed the best check BIO 605 with yield superiority of 6.4% and 2.3% respectively.

**Trial No. 1118 AVT I (Early) NHZ**

In this trial, 2 new entries along with four checks, viz., BIO 605, DKC 7074, LQMH 1, and Vivek Hybrid 51 were evaluated at seven locations namely Bajaura, Barapani, Imphal, Kangra,Medziphema, Srinagar and VPKAS. One entry namely IX 7851 was considered for promotion due to its superior performance.

**Trial No: 1123 OPV I, II, III NHZ**

In this trial, ten entries along with two checks, viz., Bajaura Makka, and Vijay were evaluated at six locations namely Bajaura, Barapani, Imphal, Kangra, Srinagar, and VPKAS. All 4 test entries namely ADC 9, PFM 14, APC 10, and PFM 12 were considered for promotion to AVT I as they outperformed the best check. Only one entry namely ADC 4 was promoted to AVT II due its superiority.

**Trial No: 1137 AVT I (Early) NWPZ**

In this trial, two test entries along with two checks, viz., BIO 605 and DKC 7074 were evaluated in the North West Plain Zone (NWPZ) at eight locations namely Gurdaspur, Hoshiarpur, IARI, Kannauj, Kapurthala, Karnal, Ludhiana and Pantnagar. Two entries namely IX 7851 and SRMH 99M66 were promoted against the best check DKC 7074.

**Trial No: 1138 AVT II (Early) NWPZ**

In this trial, three new entries along with two checks, viz., BIO 605 and DKC 7074 were evaluated in the North West Plain Zone (NWPZ) at nine locations namely Gurdaspur, Hoshiarpur, IARI_ND, Jalandhar, Kannauj, Kapurthala, Karnal, Ludhiana and Pantnagar. Out of 3 test entries, only two namely SMH 4555, and CP 111 were promoted against the best check DKC 7074

**Trial No: 1139 AVT I (Early) CWPZ**

In this trial, 6 new entries along with two checks, viz., BIO 605 and DKC 7074 were evaluated in CWZ at 9 locations namely Ambikapur, Banswara, Bhiloda, Chindwara,Chitrakoot, Dahod, Godhra, Menar and Udaipur. Three test entries namely SRMH 99M66, SMH9099, and IX 7851 were considered for promotion due to their superiority over the best check DKC 7074.

**Trial No: 1140 AVT II (Early) CWZ**

In this trial, 4 new entries along with two checks, viz., BIO 605 and DKC 7074 were evaluated in the CWZ at 9 locations namely Ambikapur, Banswara, Bhiloda, Chindwara, Chitrakoot, Dahod, Godhra, Menar and Udaipur. Three entries namely SMH 4555, AH8323, and JH 32487 were considered for promotion as they outperformed the best check DKC 7074.

**Trial No: 1147 NIVT (Early) All Zone**

In this trial, 23 entries along with three checks

*viz.*, BIO 605, DKC 7074, and VIVEK HYBRID 51 evaluated across all zones in CWZ (Ambikapur, Banswara, Godhra, Chindwara & Udaipur); NEPZ (BHU, Bhubaneswar, Dholi, Ranchi & Sabour); NWPZ (IARI, Karnal, Ludhiana and Pantnagar). Three test entries from NWPZ namely CP 418, AH 4727, and CP 589 showed yield superiority of 19.3%, 17.6%, and 11.5% respectively over best-check DKC 7074 and were considered for promotion to AVT-I; 10 test entries from NEPZ namely CP 418, FH 4154, CP 589, AHD 2109, BAUMH 22-2, EH3926, AHD 2035, EH 3881, EH 3907, and JH 32890 showed yield superiority of over best check DKC 7074 & promoted to AVT-I; and 10 test entries from CWZ namely CP 589, CP418, AH 4727, BAUMH 22-2, FH 4154, FH 4162, DH 371, DH 358, AHD 2109, and JH 32890 performed over best check DKC 7074 promoted to AVT-I.

**Trial No. 1116 NIVT (Medium) - NHZ**

In this trial, 30 new entries along with two checks, viz., BIO 9544 and CHM 08-292 were evaluated in the NHZ at five locations namely Bajaura, Barapani, Imphal, Kangra, and Srinagar.All four test entries namely IMH2-23K-6, DKC 9256, DKC 9254, and DKC 7250 showed yield superiority of 4.1%, 3.0%, 2.1%, and 2.1% respectively over best-check BIO-9544 were considered for promotion to the AVT-I medium.

Trial No. 1117 AVT I (Medium) NHZ

In this trial, 1 new entry along with Four checks viz. BIO 9544, CMH 08-292, HTMH 5402, and LG 34.05 were evaluated in the north hill zone (NHZ) at 7 locations namely Bajaura, Barapani, Imphal, Kangra, Medziphema, Rajouri, and Srinagar. This test entry was not found superior over the check and therefore was not considered for promotion to AVT-II.

**Trial No: 1141 AVT I-II (Medium) NWPZ**

In this trial, 8 new entries along with two checks viz. BIO 9544 and CMH 08-292 were evaluated in NWPZ at eight locations namely Gurdaspur, Hoshiarpur, IARI_ND, Kannauj, Kapurthala, Karnal, Ludhiana, and Pantnagar. Seven test entries namely PM 22101, CP 509, IW 8477, JKMH 4823, BH 417189, IMH 2-22K-7, and IQ 8393 found superior over best check CMH 08-292 and were considered for promotion to the AVT-II medium.

**Trial No: 1144 AVT I (Medium) CWZ**

In this trial, 7 new test entries along with three checks viz. BIO 9544, CMH 08-292, and LG 34.05 were evaluated in the Central West Zone (CWZ) at 9 locations namely Ambikapur, Banswara, Bhiloda, Chindwara, Chitrakoot, Dahod, Godhra, Menar and Udaipur. Four entries namely BH 417189, BH 417144, RCRMH 20, and JH 20088 were considered for promotion to AVT-II as these entries recorded superior grain yield over the best check BIO 9544.

**Trial No: 1155 NIVT (Medium) All Zone S1**

In this trial, 59 test entries along with three checks viz. BIO 9544, HTMH 5402 and LG 34.05 were evaluated across all zones at 23 locations which covered five locations in CWZ (Ambikapur, Banswara, Chindwara, Godhra & Udaipur); five locations in NEPZ (BHU, Bhubaneswar, Dholi, Ranchi & Sabour); four locations in NWPZ (IARI, Karnal, Ludhiana, and Pantnagar) and nine locations in Peninsular Zone, PZ (Coimbatore, Dharwad, Hyderabad, Karimnagar, Kolhapur, Mandya, Peddapuram, Rahuri, and Vagarai).Out of 43 test entries, five entries namely IX 8466, IX 8441, BS 602, PM 23105M and ADV 7060 for CWZ with yield superiority of 16.8%, 14.6%, 11.4%, 9.7% and 8.0%, respectively; ten entries namely IX 7841, IX 8466, IX 8441, PM 23101M, IX 8455, BS 600, PM 23104M, FSMH 23-2, PMH 23-1910 and KMH 2 for NEPZ with yield superiority of 9.0%, 8.9%, 5.8%, 4.2%, 4.0%, 3.8%, 2.3%, 1.8%, 1.2%, and 1.0% respectively; twenty entries namely NMH 4754, FSMH 23-2, IX 8466, PM 23105M, PH 421343, PM 23104M, HARLAL VITTHAL-3456, SRMH 33M66, IX 7841, PM 23101M, RCRMH 23, MAH 20-527, PH 421098, GH 22336, PMH 23-1910, IX 8455, ADV 7060, BH 419500, PM 23102M, and BS 600 for NWPZ with yield superiority of 10.6%, 10.3%, 9.9%, 9.8%, 8.9%, 7.6%, 7.3%, 7.1%,

7.0%, 6.1%, 5.4%, 5.3%, 4.0%, 2.6%, 2.5%, 2.1%, 1.3%, 1.2%, 1.1%, and 0.1% respectively; out of eight test entries only 7entries namely IX 8466, IX 8441, IX, 8455, BS 602, ADV 7060, NMH 4754 and PM 23105M for PZ with yield superiority of 12.7%, 9.0%, 7.8%, 7.7%, 7.3%, 7.2%, and 5.9% respectively over best check HTMH 5402, were considered for promotion to AVT-I.

**Trial No: 1156 NIVT (Medium) All Zone S2**

In this trial, 42 new test entries along with three checks viz. BIO 9544, HTMH 5402, and LG 3405 were evaluated across all zones at 24 locations which covered five locations in CWZ namely Ambikapur, Banswara, Chindwara, Godhra & Udaipur; five locations in NEPZ namely BHU, Bhubaneswar, Dholi, Ranchi & Sabour; four locations in NWPZ namely IARI, Karnal, Ludhiana and Pantnagar and nine locations in Peninsular Zone, namely Coimbatore, Dharwad, Hyderabad, Karimnagar, Kolhapur, Mandya, Peddapuram, Rahuri, and Vagarai. Out of 22 test entries, one entry namely H23M302 was promoted in CWZ with yield superiority of 1.6%; five entries namely H23M302, AH 4725, TMMH 8842, ADH 2130, and IMH 2-23K-6 for NEPZ with yield superiority of 5.7%, 3.1%, 3.0%, 2.7%, and 2.0% respectively; seven entries namely TMMH 8842, CMH 19015, IMH 2-23K-5, AH 4724, INDAM 1253, ADH 8721 and H23M302 for NWPZ with yield superiority of 2.8%, 2.3%, 1.4%, 0.9%, 0.6%, 0.6%, and 0.4% respectively; nine entries namely IMH 2-23K-3, ADH 8721, TMMH 8842, AH 4725, H23M302,ADH 2130, AH 4726, IMH 2-23K-6 and ADH 8722 for PZ with yield superiority of 8.9%, 6.2%,5.3%, 5.3%,4.3%, 4.3%, 4.1%, 2.7%, and 2.3% respectively over best check BIO 9544, were promoted to AVT-I.

**Trial No: 1146 AVT I (Medium) NEPZ**

In this trial, 11 new entries along with three checks viz. BIO 9544, CMH 08-292, and LG 34.05 were evaluated in NEPZ at eleven locations namely BHU, BISA, Baharaich, Begusarai, Bhubaneswar, ooch, Dholi, Gossaigoan, IARI, Ranchi and Sabour. All four entries namely CP 509, IQ 8393, PM 22101, and IW 8477 outperformed the best check LG 34.05 with yield superiority of 9.4%, 5.2%, 4.4%, and 4.2% respectively, therefore were considered for promotion to AVTII.

**Trial No: 1142 AVT I (Medium) PZ**

In this trial, 6 new entries along with four checks viz. BIO 9544, CMH 08-292, HTMH 5402,and LG 34.05 were evaluated in the Peninsular Zone (PZ) at 13 locations namely Buldana, Coimbatore, Devihosur, Dharwad, Hyderabad, Karimnagar, Kolhapur, Mandya, Parbhani, Peddapuram, Rahuri, VRDC and Vagarai. Three test entries namely JKMH 4059, IW 8477, and RCRMH 20 outperformed the best check HTMH 5402 and promoted to AVTII.

**Trial No: 1143 AVT II (Medium) PZ**

In this trial, two new entries namely IMHSB 20K-10 and JKMH 4546 along with four checks viz. IO 9544, CMH 08-292, HTMH 5402, LG 34.05, and one Filler DHM 121 were evaluated in Peninsular Zone (PZ) at 13 locations namely Buldana, Coimbatore, Devihosur, Dharwad, Hyderabad, Karimnagar, Kolhapur, Mandya, Parbhani, Peddapuram, Rahuri, VRDC and Vagarai. Only one test entry was promoted due to its superiority best check BIO 9544 .

**Trial No: 1145 AVT II (Medium) CWZ**

In this trial, three new test entries HM 21204, JKMH 4546, and PM 21103 along with four checks viz. BIO 9544, CMH 08-292, HTMH 5402, and LG 34.05 were evaluated in CWZ at nine locations namely Ambikapur, Banswara, Bhiloda, Chindwara, Chitrakoot, Dahod, Godhra, Menar, and Udaipur. Out of two test entries namely PM 21103 and JKMH 4546 both were found superior (with a mean yield of 9.109 t/ha and 8.937 t/ha, respectively) over the best check BIO 9544 with a mean yield of 8.864 t/ha.

Late Maturity

**Trial No. 1130 AVT (Late) NWPZ**

In this trial, 6 new entries along with two checks viz. BIO 9682 and NK 6240 were evaluated at eight locations namely Gurdaspur, Hoshiarpur, IARI_ND, Kannauj, Kapurthala, Karnal,

Ludhiana, and antnagar. Only one test entry namely PM 21111L (AVT II), was promoted due its superiority over the best check NK 6240.

**Trial No: 1136 AVT I (Late) PZ**

In this trial, 19 new entries along with two checks, viz., CMH 08-287 and NK 6240 were evaluated in Peninsular Zone at 13 locations namely Buldana, Coimbatore, Devihosur, Dharwad, Hyderabad, Karimnagar, Kolhapur, Mandya, Parbhani, Peddapuram, Rahuri, VRDC, and Vagarai. 13 test entries namely SRM 999, HM 22201, KMH 8208, HARLAL 24, PM 22106, SYN 221610L, KMH 8206, VNR 4324, ADV 7434, BIO 9766, KMH 8388, SYN 223671L, and IQ 8701 were considered for promotion to AVT-II due to superiority over the check NK 6240.

**Trial No: 1134 AVT II (Late) PZ**

In this trial, 3 new entries along with four checks, viz., BIO 9682, CMH 08 287, CP 858, and NK 6240 were evaluated in the PZ at 13 locations namely Buldana, Coimbatore, Devihosur, Dharwad, Hyderabad, Kolhapur, Mandya, Parbhani, Peddapuram Rahuri, VRDC, and Vagarai. Out of the three test entries, only one entry namely KMH 8333 (with a mean yield of 10.429 t/ha) was found superior over the best check BIO 9682 (with a mean yield of 9.682).

**Trial No: 1133 AVT I (Late) CWZ**

In this trial, eight new entries along with two checks, viz., BIO 9682 and CMH 08-282 were evaluated in the Central West Zone (CWZ) at eight locations namely Ambikapur, Banswara, Bhiloda, Chindwara, Chitrakoot, Godhra, Menar, and Udaipur. All seven test entries, namely PM 22117, HARLAL 24, KMH 8206, SYN 223671L, IQ 8701, ADV 7434, and NZ 8007 were considered for promotion to AVT-II with yield superiority of 5.2%, 4.9%, 4.7%, 4.7%, 3.5%, 0.8% and 0.0% respectively, over the best check BIO 9682.

**Trial No: 1153 NIVT S1 (Late) All Zone**

In this trial, 30 new entries along with four checks, viz., BIO 9682, CMH 08-282, CMH 08-287,and CP 858 were evaluated in all zones at twenty locations which covered 5 locations in CWZ namely Ambikapur, Banswara, Chindwara, Godhra, and Udaipur; 5 locations in NEPZ namely BHU, Bhubaneswar, Dholi, Ranchi, Sabour; 4 locations in NWPZ at IARI, Karnal, Ludhiana, Pantnagar; 8 locations in PZ at Coimbatore, Dharwad, Hyderabad, Karimnagar, Mandya, Peddapuram, Rahuri, and Vagarai. Out of the 49 test entries, twenty one entries namely PM 23116, SRIKAR AADI, IM 38619, PM 23113, AJEET 479, GH 20113, PM 23112, PM 23106, PM 23107, PM 23114, PM 23109, SUPER 8181, PM 23108, HT 523002, PM 23110, PM 23111, GH 20115, SUN 126 GOLD, SRMH 66M33, HT 523069 and NMH 4786 for NWPZ outperformed over the best check CP 858 , hence considered for promotion to AVT I; Six entries namely PM 23114, PM 23112, HT 523002, PM 23106, IM 38619 and SRIKAR AADI for NEPZ outperformed over the best check CMH 08 287 promoted to AVT I; five entries namely PM 23111, PM 23116, PM 23113, SRIKAR AADI and PM 23114 for PZ outperformed the best check CMH 08 287 and promoted to AVT I; seventeen entries namely SRIKAR AADI, PM 23115, PM 23111, IM 38619, PM 23114, AJEET 479, HT 523002, PM 23113, PM 23116, SUPER 8181, PM 23112, PA 6354, PM 23108, SRMH 66M33, PM 23110, PM 23106, and HT 523069 for CWZ outperformed the best check BIO 9682 and were considered for promotion to AVT I.

**Trial No: 1154 NIVT S2 (Late) All Zone**

In this trial, 28 new entries along with five checks viz. BIO 9682, CMH 08-282, CMH 08-287, CP 858, and NK 6240 were evaluated across all zones i.e. CWZ (Ambikapur, Banswara, Chindwara, Godhra &Udaipur); NEPZ( BHU, Bhubaneswar, Dholi, Ranchi & Sabour); NWPZ( IARI, Karnal, Ludhiana, and Pantnagar) and PZ(namely Coimbatore, Dharwad, Hyderabad, Karimnagar, Kolhapur, Mandya, Peddapuram, Rahuri and Vagarai). Out of 17 test entries, five entries were promoted for CWZ namely ADV 7454, HARLAL1001, CT 2011312, CT 2211002, and ADV 7405 due to superiority over best check

entries for NWPZ namely ADV 7405, ADV 7454, HARLAL 1001, and VNR 32583 were promoted over best check CP 858; eight entries for PZ namely ADV 7405, HARLAL 1001, CT 2211002, KH 2196, VNR 32583, SRIKAR 3699, ADV 7454, and BH 418103 were promoted over best check NK 6240.

**Trial No: 1131_AVT-I (Late) NEPZ**

In this trial, six new test entries along with two checks viz., CMH 08-287 and CP 858 were evaluated in NEPZ at eleven locations namely BHU, BISA, Baharaich, Begusarai, Bhubaneswar, Cooch, Dholi, Gossaigoan, IARI, Ranchi and Sabour. No test entry was considered for promotion to AVT-II.

**Trial No: 1130_AVT II (Late) NWPZ**

In this trial, 6 new entries along with two checks viz., BIO 9682 and NK 6240 were evaluated in NWPZ at eight locations namely Gurdaspur, Hoshiarpur, IARI, New Delhi, Kannauj, Kapurthala, Karnal, Ludhiana, and Pantnagar. Out of 2 test entries, only one entry namely PM 21111L (AVT II) (mean yield of 9.152 t/ha) was found superior over the best check NK 6240.

**Trial No: 1135_AVT II (Late) CWZ**

In this trial, two new entries along with three checks viz., BIO 9682, CMH 08-282, and CP 858 were evaluated in CWZ (Ambikapur, Banswara, Bhiloda, Chindwara, Chitrakoot, Godhra, Menar and Udaipur). Both test entries namely R 8050 and PM 21111L (mean yield of 9.374 t/ha and 9.078 t/ha, respectively) were considered for promotion as they were found superior over the best check CMH 08-282 (with mean yield of 8.938 t/ha).

## Quality Protein Maize (QPM)

The Quality Protein Maize (QPM) trials comprised of two trials, trial no. 1127 for Zone I (NHZ) and trial no.1157 for remaining zones (NWPZ, NEPZ, PZ and CWZ). The total no. of entries tested in trial no. 1127 were 23 including checks whereas, the no. of entries in trial no. 1157, were 63 including checks and one filler entry. The trial no. 1127 was conducted at Almora, Bajaura, Kangra, Gossaigoan, Imphal and Barapani. The trial no. 1157 was conducted at New Delhi, Karnal, Ludhiana, Pantnagar, Varanasi, Baharaich, Bubhneshwar, Dholi, Ranchi, Sabour, Coimbatore, Vagarai, Dharwad, Mandya, Kolhapur, Rahuri, Hyderabad, Karimnagar, Peddapuram, Ambikapur, Banswara, Udaipur, Godhra and Chindwara. Out of 23 test entries in trial no. 1127, 04 were EDV's; 03 IDV's; 02 entries for high Fe & Zn and remaining 06 were conventionally bred QPM entries. Similarly in trial no. 1157 also, 27 were conventionally bred entries; 03 were IDV's; 13 were EDV's and 05 were for high Fe & Zn. In trial no. 1127, for high Fe and Zn FMH 66(6.59 t/ha) and FMH 24(6.98t/ha) were promoted against best check HQPM 5(6.48 t/ha) from NIVT to AVTI and AVTI to AVT II, respectively. For Pro-vit. A in QPM background, two IDV's namely, APH 7(5.85 t/ha) & APH 8(5.56 t/ha)) were promoted from NIVT to AVT I against check APH 1(5.82 t/ha). Under EDV category, for high lysine and tryptophan content, FBH 101(6.40t/ha) was promoted from QPM II to QPM III against the original hybrid CMVL 45 (6.54 t/ha) whereas, another EDV for Low Phytic Acid, FLPH 45 (5.88 t/ha) was promoted against its original hybrid Vivek QPM 9(5.23t/ha).

**Trial No. 1157**

In trial no. 1157, In NWPZ, two entries namely, IQPMH 2310(8.31 t/ha) abd BRMQ20-1(8.25t/ha) were promoted from NIVT to AVT I against the best check IQMH 202 (8.14t/ha) whereas, IQPMH 2205(8.68 t/ha) was promoted from AVT I to AVT II against IQMH 202 (8.14 t/ha).In Zone III (NEPZ) 11 conventionally bred entries for high lysine and tryptophan namely, FQH 160 (5.99 t/ha), IQPMH 2307(5.95 t/ha), , BRMQ 20-1 (5.88 t/ha),IQPMH 2310 (5.78 t/ha),IQPMH 104 (5.77 t/ha),IQPMH 2303(5.72 t/ha),, IQPMH 2302(5.5.62 t/ha), IQPMH 2311(5.61 t/ha); for Fe & Zn IQH 7-219(5.92) t/ha)IQH 7-225 (5.73 t/ha),IQH 7-215(5.5.62 t/ha) were promoted against best check HQPM 5 (5.60t/ha) for testing in AVT I during Kharif,2024. IQPMH 2114 (5.6.23 t/ha), IQPMH 2205 (5.5.93 t/ha), IQPMH 2113(5.67 t/ha), were

promoted from AVT I to AVT II for high lysine and tryptophan content for testing during Kharif, 2024. Similarily, in Zone IV (PZ) IQPMH 2204 (10.15 t/ha) and IQPMH 2205(9.86 t/ha) were promoted for high lysine and tryptophan content were promoted against best check IQMH 203(9.43t/ha) for testing in AVT II during Kharif, 2024. In Zone V (CWZ) the entries namely, FQH 160 (8.46t/ha), IQPMH 2311 (8.16 t/ha), IAQPMH 104 (8.02t/ha), BRMQ 20-1 (7.94 t/ha),IQPMH 2305(7.72 t/ha) for high lysine and tryptophan content and IQH 7-219 (8.45 t/ha) for high Fe & Zn were promoted against best check LQMH 1(7.69t/ha) for testing in AVT I during Kharif, 2024. Four entries namely, IQPMH 2204(9.07 t/ha), IQPMH 2113(8.53 t/ha), IQPMH 2114(8.09 t/ha) and IQPMH 2203(7.69 t/ha) were promoted for high lysine and tryptophan content against the best check LQMH1(7.69 t/ha) for testing in AVT II during Kharif, 2024. Under IDV category, APH 8 was promoted from NIVT to AVT I for testing in Zone III (5.68 t/ha), zone IV (8.36t/ha) and zone V (7.97 t/ha) against APH 1(Check). APH 7 (8.05 t/ha) was also promoted from NIVT to AVT I in Zone V (CWZ) for testing in AVT I during Kharif, 2024 whereas another IDV, APH 6 was promoted for testing in zone IV (8.47 t/ha) and zone V (7.07) against APH 1. Under EDV category in Zone II, APQWH 8 for high Pro-VitA, waxy content in QPM background was promoted from QPM II to QPM III against the original hybrid HM 8 (6.62 t/ha) for testing during Kharif, 2024. Similarily for high waxiness in QPM background another EDV was promoted from QPM II to QPM III in zones II, III, IV & V for testing during Kharif, 2024 AICRP trials.

## Specialty Corns

The specialty corn comprises three types namely baby corn, sweet corn and popcorn. There were five specialty corn trials during Kharif 2023 which included two trials each of baby corn (Trial No. 1120 and Trial No. 1151) and sweet corn (Trial No. 1119 and Trial No. 1150) and one trial of popcorn (Trial No. 1122). The trial 1119, 1120 and 1122 were conducted at six locations namely Srinagar (Jammu & Kashmir), Bajaura and Kangra (Himachal Pradesh), Almora (Uttarakhand), Barapani (Meghalaya), and Imphal (Manipur) in northern hill zone (NHZ). A total of ten entries each in 1119 and 1120 and five entries in 1122 were tested which includes four, three and three check entries, respectively. In trial 1119, the six test entries comprised three test entries each of AVT-I and NIVT; out of six test entries, five entries were promoted to the next stage of testing. The five test entries promoted in trial 1119 include three entries of AVT-I (APTSKH 1, CP Golden, and FSCH 131) and two entries of NIVT (CP Sweet King and FSCH 266). Trial 1120 comprises seven test entries which include four AVT-II, two AVT-I and one NIVT entry. Out of three entries which were either in NIVT or AVT-I, only one entry of AVT-I (IBH 11-223) was promoted to AVT-II. The trial 1122 comprises two test entries and both were in NIVT stage of testing and none of the test entries were promoted. Trial No. 1150 was conducted across four agro-climatic zones of the country at 25 locations which includes four locations namely New Delhi (Delhi), Karnal (Haryana), Ludhiana (Punjab), Pantnagar (Uttarakhand) in northwestern plains zone (NWPZ), eight locations namely Varanasi and Baharaich (Uttar Pradesh), Bhubaneswar (Odisha) Dholi and Sabour (Bihar), Gossaigoan (Assam), Kalyani (West Bengal), Ranchi (Jharkhand) in northeastern plains zone (NEPZ), eight locational namely Coimbatore (Tamil Nadu), Dharwad and Mandya (Karnataka), Hyderabad and Karimnagar (Telangana) Kolhapur and Rahuri (Maharashtra), Peddapuram (Andhra Pradesh) in peninsular zone (PZ), five locations namely Ambikapur (Chattishgarh), Chindwara (Madhya Pradesh), Godhra (Gujarat), Udaipur and Banswara (Rajasthan) in central western zone (CWZ). In Trial No. 1150, the total number of entries tested was 18 which includes four check entries. Out of 14 test entries, one entry was in AVT-II and the remaining entries were either in

AVT-I (4) or in NIVT (9). Out of 13 entries of AVT-I or NIVT, three entries of AVT-I namely PTSKH 1 (in NWPZ, NEPZ, and PZ), FSCH 131 (in NWPZ and PZ), ISH 6-2104 (in NWPZ, PZ and CWZ) were promoted to AVT-II. Whereas, out of nine entries of NIVT, four entries namely CP Sweet King and FSCH 266 in NWPZ and PZ, ISH 6-2101 in NEPZ and PZ, and ISH 6-2107 in NEPZ, PZ and CWZ were promoted to AVT-I. Trial No. 1151 was also conducted in the same locations as that of Trial No. 1150 except Gossaigoan. In Trial 1151, 17 entries were tested which includes three check entries. Out of 14 entries, five entries were in AVT-II and the remaining 9 entries were in either AVT-I (3) or NIVT (6). Out of three AVT-I entries, two entries namely IBH11 223 and IBH11 227 were promoted in NEPZ, PZ and CWZ to AVT-II. Out of six NIVT entries, two entries namely EH 3954 and IBH9 231 were promoted in CWZ.

## Baby corn

The baby corn trial comprises two entries namely Trial No. 1120 (conducted in NHZ) and Trial No. 1151 (conducted in four zones named, NWPZ, NEPZ, PZ, and CWZ). The details of entries promoted in each trial in different zones are given below.

**Trial No. 1120**

The trial comprises ten entries which include seven test entries and three check entries (AH 7043, CMVL Baby Corn 2, IMHB 1539). Seven test entries include four entries of AVT-II(IMHSB 19B-2, JH 32048, JH 32484, IBH 11-227 (an EDV of IMHB 1539)) and two entries of AVT-I (LBCH 2321, IBH 11-223) and one entry of NIVT (IBH 9-231). Out of all the test entries of NIVT and AVT-I, IBH 11-223 (1957 kg/ha) was promoted to AVT-II based on the superiority over the best check entry CMVL Baby Corn 2 (1800 kg/ha). All the entries in the trial have baby corn diameter <1.5 cm and baby corn length <10 cm, the most desirable quality parameters of baby corn.

**Trial No. 1151**

The trial comprises 17 entries which include 14 test entries and three check entries (ABSH4-1, AH 7043 and CMVL Baby Corn 2). The test entries comprise five AVT-II (ABHS 27, IMHSB 19KB-2, JH 32048, JH 32434 and JH 32484), three AVT-I (IBH11 223, IBH11 227 and LBCH2321) and six NIVT (BAUMH 22-1-1, EH 3899, EH 3954, IBH9 231, IMH 2-23KB-1 and MBC 23-4) entries. In NWPZ, one entry (ABHS 27) of AVT-II was marginally numerically superior (2085 kg/ha) over the highest yielding check entry CMVL Baby Corn 2 (2080 kg/ha) hence, no test entries of AVT-I and NIVT were promoted. In NEPZ, the highest yielding check was CMVL Baby Corn 2 (2205 kg/ha) and two entries of AVT-I namely IBH 11-223 (2521 kg/ha) and IBH 11-227 (2331 kg/ha) were promoted to AVT-II, whereas no NIVT entries were promoted in NEPZ. In PZ, two AVT-I entries, namely IBH 11-223 (1944 kg/ha) and IBH 11-227 (1920 kg/ha) were promoted to AVT-II over the highest yielding check entry AH 7043 (1847 kg/ha) and no NIVT entries were promoted in PZ. In CWZ, two entries each of AVT-I (IBH 11-223 with 1742 kg/ha and IBH 11-227 with 1671 kg/ha) and NIVT (EH 3954 with 1602 kg/ha and IBH 9-231 with 1513 kg/ha) were promoted to AVT-II and AVT-I, respectively over the highest yielding check entry AH 7043 (1504 kg/ha).

## Sweet corn

The sweet corn trial comprises two trials namely, Trial No. 1119, conducted in NHZ and Trial No. 1150, conducted in four zones namely NWPZ, NEPZ, PZ, and CWZ. The details of entries promoted in different trials in different zones are given below.

**Trial No. 1119**

The trial comprises ten entries, which include six test entries and four check entries (ASKH 1, ASKH 4, Misthi, and VL Sweet Corn 1). The test entries include three entries each of AVT-I (APTSKH 1, CP Golden, FSCH 131) and NIVT (CP Sweet King, FSCH 218, FSCH 266). Out of three entries of AVT-I, one entry APTSKH 1 was

entries include three entries each of AVT-I (APTSKH 1, CP Golden, FSCH 131) and NIVT (CP Sweet King, FSCH 218, FSCH 266). Out of three entries of AVT-I, one entry APTSKH 1 was an EDV of ASKH 1 and was biofortified with high lysine and tryptophan, Provitamin A and toco-pherol. APTSKH 1 (9185 kg/ha) was promoted from AVT-I to AVT-II based on the comparable performance with ASKH 1 (9806 kg/ha with a CD of 795 kg at 5%) in green ear yield without husk. The other two entries of AVTI namely CP Golden (11054 kg/ha) and FSCH 131 (11309 kg/ha) were also promoted to AVT-II based on the superiority over the best check entry VL Sweet Corn 1 (10602 kg/ha) in green ear yield without husk. Out of three NIVT entries, two entries namely CP Sweet King (10923 kg/ha) and FSCH 266 (11008 kg/ha) were promoted to AVT-I based on the superiority over the best check entry VL Sweet Corn 1 (10602 kg/ha) in green ear yield without husk. The total soluble solids (TSS) level in all entries of the trial was ?15%, the threshold level parameter to consider the entry as sweet corn.

**Trial No. 1150**

The trial comprises 18 entries which include 14 test entries and four check entries (ASKH 1, ASKH 4, CMVL Sweet Corn 1, Misthi). The 14 test entries comprise one entry of AVT-II (APSKH 1), four entries of AVT-I (APTSKH 1, CP Golden, FSCH 131, and ISH 6-2104), and nine entries of NIVT (BSCH 419200, CP Sweet King, CSCH 18001, CSCH 18006, CSCH 19010, FSCH 218, FSCH 266, ISH 6-2101, and ISH 6-2107). Two entries, one each of AVT-II (APSKH 1) and AVT-I (APTSKH 1) are an EDV of ASKH 1. The entry APSKH 1 was biofortified with high-lysine and -tryptophan and Provitamin A, whereas APTSKH 1 is biofortified with high-lysine and -tryptophan, Provitamin A and toco-pherol. In NWPZ, two AVT-I entries FSCH 131 (12458 kg/ha), and ISH 6-2104 (12295 kg/ha) and two NIVT entries namely, CP Sweet King (12499 kg/ha) and FSCH 266 (12169 kg/ha) were promoted to AVT-II and AVT-I, respectively over best check entry Misthi (11883 kg/ha). In addition, one AVT-I EDV, APTSKH 1 (11944 kg/ha) was promoted to AVT-II over its initial hybrid ASKH 1 (11653 kg/ha). In NEPZ, one AVT-I EDV, APTSKH 1 (7210 kg/ha) was promoted to AVT-II over its initial hybrid ASKH 1 (6876 kg/ha). Two NIVT entries namely ISH 6-2101 (10242 kg/ha), and ISH 6-2107 (10879 kg/ha) were promoted to AVT-I over the highest yielding check entry CMVL Sweet Corn-1 (9326 kg/ha). In PZ, one AVT-I EDV, APTSKH 1 (9331 kg/ha) was promoted to AVT-II over its initial hybrid ASKH 1 (9128 kg/ha). In addition, two AVT-I entries namely FSCH 131 (12214 kg/ha) and ISH 6-2104 (12828 kg/ha) and four NIVT entries namely CP Sweet King (13051 kg/ha), FSCH 266 (12228 kg/ha), ISH 6-2101 (12184 kg/ha) and ISH 6-2107 (12733 kg/ha) were promoted to AVT-II, and AVT-I, respectively over the highest yielding check entry Misthi (11513 kg/ha). In CWZ, one each of AVT-I (ISH 6-2104 with 11867 kg/ha) and NIVT (ISH 6-2107 with 13216 kg/ha) entries were promoted to AVT-II and AVT-I, respectively over the highest yielding check entry CMVL Sweet Corn 1 (9833 kg/ha).

## Popcorn

The popcorn trial, Trial No. 1122 was conducted in NHZ comprising six locations. The trial comprises two test entries (DPC 319 and IPH7-205) and three check entries (BPCH 6, DMRHP 1402, LPCH 3) and both the test entries in the trial were in NIVT. The check entry BPCL 6 was found superior with 3966 kg/ha with threshold expansion ratio of ?15. Thus, none of the test entries were promoted in the trial.

## Release and Notification of Hybrids:

### Cultivars Notified during 2024

51 hybrids were notified for commercial cultivation during 2024. Out of 51 hybrids, 32 hybrids were from field corn group (18 Public& 14 private); 08 biofortified, 04 baby corn , four were pop corn and three sweet corn hybrids.

**Table 6.1: The details of the notified hybrid are given below:**

| S. No | Cultivar | Developer /Institute/ Unicersity / AICRP Centre/ Private Organization | Notification Date | Notification No. | Maturity | Area of adaptation | Average Yield (t/ha) | Cropping season | Type |
|---|---|---|---|---|---|---|---|---|---|
| 1. | IBCH 402 (IBH 11-227) | ICAR-IIMR, Ludhiana | 08.10.2024 | SO 4388 (E) | Early (57-60 days) | Uttarakhand, Himachal Pradesh, Meghalaya, Manipur, Jammu Kashmir | 1.8 | Kharif | Baby corn |
| 2. | IMH 229 (DMRH-1410) | ICAR-IIMR, Ludhiana | 08.10.2024 | SO 4388 (E) | Medium | West Bengal | Grains: 9.0-9.5 Fodder: 44.88 Silage: 53.7 | Rabi | Field Corn |
| 3. | IMHSB 20R-6 | ICAR-IIMR, Ludhiana | 08.10.2024 | SO 4388 (E) | Medium (142-148 days) | Eastern UP, Bihar, Jharkhand, Odisha and West Bengal. | 9.2 | Rabi | Field Corn |
| 4. | IMHSB 20K-10 | ICAR-IIMR, Ludhiana | 08.10.2024 | SO 4388 (E) | Medium (84-92 days) | Eastern UP, Bihar, Jharkhand, Orissa, West Bengal and Assam | 7.0 | Kharif | Field Corn |
| 5. | Pusa HM 4 (Male Sterile Baby Corn-2) (ABSH4-2) | ICAR-IARI, New Delhi | 08.10.2024 | SO 4388 (E) | - | Bihar, Jharkhand, Odisha, Uttar Pradesh (Eastern region), West Bengal, Maharashtra, Karnataka, Andhra Pradesh, Telangana, Tamil Nadu, Gujarat, Madhya Pradesh, Chattisgarh and Rajasthan. | 1.7 | Kharif | Baby corn |

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|---|---|---|---|---|---|---|---|---|---|
| 6. | Pusa Biofortified Maize hybrid-4 (APH 4) | ICAR-IARI, New Delhi | 08.10.2024 | SO 4388 (E) | Medium (86 days) | Punjab, Haryana, Delhi, Uttarakhand (Plain), Uttar Pradesh (Western region), Maharashtra, Karnataka, Andhra Pradesh, Telangana, Tamil Nadu, Gujarat, Madhya Pradesh, Chattisgarh and Rajasthan. | 7.1 | Kharif | Biofortified |
| 7. | Pusa Biofortified Maize hybrid-5 (APTQH-5) | ICAR-IARI, New Delhi | 08.10.2024 | SO 4388 (E) | Medium (93 days) | Punjab, Haryana, Delhi, Uttarakhand (Plain), Uttar Pradesh (Western region), Bihar, Jharkhand, Odisha, Uttar Pradesh (Eastern region), West Bengal, Maharashtra, Karnataka, Andhra Pradesh, Telangana, Tamil Nadu, Gujarat, Madhya Pradesh, Chattisgarh and Rajasthan. | 6.8 | Kharif | Biofortified |
| 8. | Pusa Pop Corn Hybrid-1 (APCH-2) | ICAR-IARI, New Delhi | 08.10.2024 | SO 4388 (E) | Late to Medium (120 days) | Punjab, Haryana, Delhi, Uttarakhand (Plain), Uttar Pradesh (Western region), Maharashtra, Karnataka, Andhra Pradesh, Telangana, Tamil Nadu | 4.7 | Rabi | Pop corn |
| 9. | Pusa Pop Corn Hybrid-2 (APCH-3) | ICAR-IARI, New Delhi | 08.10.2024 | SO 4388 (E) | Medium (102 days) | Maharashtra, Karnataka, Andhra Pradesh, Telangana, Tamil Nadu | 4.5 | Rabi | Pop corn |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 10. | VNR 4597 | VNR Seeds Pvt. Ltd. Raipur | 08.10.2024 | SO 4388 (E) | Late (125-130 days) | Karnataka, Andhra Pradesh, Telangana, Maharashtra and Tamil Nadu | 10.8 | Rabi | Field Corn |
| 11. | PM 20205L | Pioneer Hi-Bred Pvt. Ltd., Karnataka. | 08.10.2024 | SO 4388 (E) | Late | Karnataka, Andhra Pradesh, Telangana, Maharashtra and Tamil Nadu | 10.8 | Rabi | Field Corn |
| 12. | P 34407 (PM 21111L) | Pioneer Hi-Bred Pvt. Ltd., Karnataka. | 08.10.2024 | SO 4388 (E) | Late (125-135 days) | Punjab, Haryana, Delhi, UP (western region), Uttarakhand (Plain), Karnataka, Andhra Pradesh, Telangana, Maharashtra and Tamil Nadu | 9.0 | Kharif | Field Corn |
| 13. | Bio 207 | Bioseed Research India (Ltd.), Hyderabad | 08.10.2024 | SO 4388 (E) | Late (100-105 days) | Maharashtra, Karnataka, Andhra Pradesh, Telangana, Tamil Nadu | 10.3 | Kharif | Field Corn |
| 14. | CP 999 | Charoen Pokphand Seeds (India) Pvt. Ltd. Bangalore | 08.10.2024 | SO 4388 (E) | Early (11-110 days) | Punjab, Haryana, Delhi, Uttarakhand (Plain), Uttar Pradesh (Western region) | 10.8 | Kharif | Field Corn |
| 15. | Rajendra baby corn-1 (MBC-11-15) | TCA, Dholi | 08.10.2024 | SO 4388 (E) | Early | Bihar | 1.15 | Kharif | Baby corn |
| 16. | Rajendra pop corn- 1 (MpC-1-15) | TCA, Dholi, Bihar | 08.10.2024 | SO 4388 (E) | Medium | Bihar | 2.5 | Kharif | Pop corn |
| 17. | Phule Umed (QMH-1701) | MPKV, Rahuri | 08.10.2024 | SO 4388 (E) | Medium | Maharshtra | 8.7 | Kharif | Biofortified |
| 18. | Phule Champion( QMH-1819) | MPKV, Rahuri | 08.10.2024 | SO 4388 (E) | Early | Maharshtra | 9.1 | Kharif | Biofortified |
| 19. | VL poshika (FQH-160) | ICAR-VPKAS, Almora | 08.10.2024 | SO 4388 (E) | Early | Uttarakhand | 5.4 | Kharif | Biofortified |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 20. | VL Triposhi (FQPLH-20) | ICAR-VPKAS, Almora | 08.10.2024 | SO 4388 (E) | Early | Uttarakhand | 4.9 | Kharif | Biofortified |
| 21. | PMH 14 (JH-17011) | PAU, Ludhiana | 08.10.2024 | SO 4388 (E) | Late | Punjab | 6.8 | Kharif | Field Corn |
| 22. | Pusa jahawar hybrid maize-3 (AH-8181) | ICAR-IARI, New Delhi | 08.10.2024 | SO 4388 (E) | Medium | Madhya Pradesh | 8.2 | Rabi | Field Corn |
| 23. | Pusa Shalimar Maize Hybrid-1 (AH-7154) | SKUAST-K, Srinagar & IARI, New Delhi | 08.10.2024 | SO 4388 (E) | Early | Jammu and Kashmir | 8.0 | Kharif | Field Corn |
| 24. | VL shikhar (FLPH-19) | ICAR-VPKAS, Almora | 08.10.2024 | SO 4388 (E) | Early | Uttarakhand | 5.2 | Kharif | Field Corn |
| 25. | Maize VGIH(M) 2 (VaMH-12013) | TNAU, Coimbatore | 08.10.2024 | SO 4388 (E) | Medium | Tamil Nadu | 6.3 | Rabi | Field Corn |
| 26. | MAH 14-138 | ZARS, Mandya (UAS, Banglore) | 08.10.2024 | SO 4388 (E) | Medium | Karnataka | 9.0 | Kharif | Field Corn |
| 27. | J 1008 (PFM-12) | PAU,Ludhiana | 08.10.2024 | SO 4388 (E) | Medium | Punjab | 6.9 | Kharif | Field Corn |
| 28. | ISCH 601 (ISCH 1901) | ICAR-IIMR, Ludhiana | 26.03.2024 | SO 1560 (E) | Medium (90-95 days) | Eastern Uttar Pradesh, Bihar, Jharkhand, Odisha, and West Bengal. | 10.5 | Kharif | Sweet Corn |
| 29. | IBCH 401 (IMHSB 19KB-2) | ICAR-IIMR, Ludhiana | 26.03.2024 | SO 1560 (E) | Medium (silking at 57 days in PZ and 53 days in CWZ) | Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu, Telangana, Rajasthan, Gujarat, Madhya Pradesh and Chhattisgarh | 1.6 | Kharif | Baby Corn |

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|---|---|---|---|---|---|---|---|---|---|
| 30. | QPMH 6 (EDV of PMH 6) | ICAR-IIMR, Ludhiana | 26.03.2024 | SO 1560 (E) | Medium (95-105 days) | Bihar, West Bengal, Jharkhand, Odisha and Uttar Pradesh (Eastern region) | 6.4 | Kharif | Biofortified |
| 31. | IMH 225 (IMHSB 17R-16) | ICAR-IIMR, Ludhiana | 26.03.2024 | SO 1560 (E) | Medium (rabi 155-160 days) / (Spring 120-125 days) | Punjab, Haryana, Uttar Pradesh (Western region), Uttarakhand (Plains) and Delhi | 10.3 | Rabi/ Spring | Field Corn |
| 32. | IMH 226 (IMHSB 17R-17) | ICAR-IIMR, Ludhiana | 26.03.2024 | SO 1560 (E) | Medium (rabi 154-157days) / Spring 115-120 days) | Punjab, Haryana, Uttar Pradesh (Western region), Uttarakhand (Plains) and Delhi | 9.9 | Rabi/ Spring | Field Corn |
| 33. | IMH 227 (IMHSB 19R-2) | ICAR-IIMR, Ludhiana | 26.03.2024 | SO 1560 (E) | Medium maturity (143-150 days) | Eastern Uttar Pradesh, Bihar, Jharkhand, Orissa and West Bengal | 10.9 | Rabi | Field Corn |
| 34. | IMH 228 (IMHSB 19R-10) | ICAR-IIMR, Ludhiana | 26.03.2024 | SO 1560 (E) | Medium (rabi 143-150 days) | Eastern Uttar Pradesh, Bihar, Jharkhand, Orissa West Bengal and Telangana | 10.6 | Rabi | Field Corn |
| 35. | VL VitA (FPVH 1) | ICAR-VPKAS, Almora | 26.03.2024 | SO 1560 (E) | Early (95-100 days) | Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura | 6.9 | Kharif | Biofortifird |
| 36. | Pant Composite Maize 4 (PCM-4) (DOP-339) | GBPUA&T, Pantnagar | 26.03.2024 | SO 1560 (E) | Early (90-95days) | Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura | 5.9 | Kharif | Field Corn |

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|---|---|---|---|---|---|---|---|---|---|
| 37. | Shalimar Kishengang a -3 (KDM-30) | SKUAST, Srinagar | 26.03.2024 | SO 1560 (E) | Early (100 days) | Jammu and Kashmir, Himachal Pradesh, Uttrakhand, Manipur Meghalaya and Assam | 5.4 | Kharif | Field Corn |
| 38. | DHM 206 ((Telangan a MAKKA-3) (BH 417206) | PJTSAU, Hyderabad | 26.03.2024 | SO 1560 (E) | Late (105-110 days) | Punjab, Haryana, Uttarakhand, plains Uttar Pradesh Western region, Delhi, Bihar, Jharkhand, Odisha, Uttar Pradesh (Eastern region) and West Bengal | 8.5 | Kharif | Field Corn |
| 39. | IPCH 501 (IPCH 1901) | ICAR-IIMR, Ludhiana | 26.03.2024 | SO 1560 (E) | Medium (90-95 days) | Tamil Nadu, Andhra Pradesh, Telangana, Maharashtra, Karnataka and Kerala | 4.4 | Kharif | Pop corn |
| 40. | VL Madhurima (FSCH 144) | ICAR-VPKAS, Almora | 26.03.2024 | SO 1560 (E) | Early (95-100 days) | Eastern Uttar Pradesh, Bihar, Jharkhand, West Bengal, Maharashtra, Karnataka, Tamil Nadu, Telangana, Andhra Pradesh, Rajasthan, Gujarat, Madhya Pradesh, Odisha and Chhattisgarh | 6.9 | Kharif | Sweet Corn |
| 41. | Pratap Hybrid-6 (EH- 2936) | MPUAT, Udaipur | 26.03.2024 | SO 1560 (E) | Early (85 days) | Rajasthan, Gujarat, Madhya Pradesh and Chhattisgarh | 6.2 | Kharif | Field Corn |
| 42. | JKMH 4243 | JK Agri Genetics Limited, Hyderabad | 26.03.2024 | SO 1560 (E) | Medium (96-98 days) | Maharashtra, Karnataka, Andhra Pradesh, Telangana and Tamil Nadu | 9.5 | Kharif | Field Corn |
| 43. | ADV 768 (ADV 7251) | Advanta Seeds, Hyderabad | 26.03.2024 | SO 1560 (E) | Late (110-115 days) | Karnataka, Maharashtra, Tamil Nadu, Telangana, Andhra Pradesh, Rajasthan, Madhya Pradesh, Gujarat, and Chhattisgarh | 95.0 | Kharif | Field Corn |

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|---|---|---|---|---|---|---|---|---|---|
| 44. | R 3414 (RMH 3414) | Rasi Seeds Private Limited, Tamil Nadu | 26.03.2024 | SO 1560 (E) | Late (120-130 days) | Maharashtra, Telangana, Andhra Pradesh, Karnataka, Tamil Nadu | 101.6 | Kharif | Field Corn |
| 45. | CP Sweet 2 | CP Seeds, Karnataka | 26.03.2024 | SO 1560 (E) | Late maturity (Sowing to green ear harvest: 70-75 days) | Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Meghalaya, Sikkim, Assam, Tripura, Nagaland, Manipur, Arunachal Pradesh | 146.9 | Kharif | Sweet Corn |
| 46. | KMH 8121 (HM 20105) | Kaveri Seeds, Telangana | 26.03.2024 | SO 1560 (E) | Medium (89 - 93 days) | Uttar Pradesh, Bihar, West Bengal, Odisha, Chhattisgarh and Jharkhand | 69.5 | Kharif | Field Corn |
| 47. | KMH 8577 (KMH 018) | Kaveri Seeds, Telangana | 26.03.2024 | SO 1560 (E) | Late (106-110 days) | Andhra Pradesh, Telangana, Maharashtra, Karnataka and Tamil Nadu | 69.5 | Rabi | Field Corn |
| 48. | DKC 8211 (IU8229) | Bayer Crop Science Limited, Karnataka | 26.03.2024 | SO 1560 (E) | Medium (104 days) | Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Meghalaya, Sikkim, Assam, Tripura, Nagaland, Manipur, Arunachal Pradesh | 83.1 | Kharif | Field Corn |
| 49. | DKC 9215 (IU8636) | Bayer Crop Science Limited, Karnataka | 26.03.2024 | SO 1560 (E) | Late (115-20 days) | Rajasthan, Madhya Pradesh, Chhattisgarh and Gujarat | 83.1 | Kharif | Field Corn |
| 50. | GK 3302 | GK Seeds Pvt Ltd, Hyderabad | 26.03.2024 | SO 1560 (E) | Late (130-135 days) | Punjab, Haryana, Delhi, Uttarakhand, Western Uttar Pradesh | 91.2 | Kharif | Field Corn |
| 51. | GK 3303 | GK Seeds Pvt Ltd, Hyderabad | 26.03.2024 | SO 1560 (E) | Late (130-135 days) | Punjab, Haryana, Delhi, Uttarakhand (Plain), Uttar Pradesh | 88.6 | Kharif | Field Corn |

## Plant pathology

### *Kharif* 2023

During *Kharif* 2023, AICRP Plant Pathology trials were conducted in five zone, *viz.,* NHZ (Northern Hill Zone), NWPZ (North West Plain Zone), NEPZ (North East Plain Zone), PZ (Peninsular Zone) and CWZ (Central Western Zone) against major maize diseases of that particular region. In NHZ, a total of 90 entries comprising different maturity groups were evaluated against TLB, BLSB and BSR whereas, a set of 320 entries belonging to different maturity groups were tested in each of NWPZ, NEPZ, PZ and CWZ zone. These entries were screened at different hot spot locations under artificial epiphytotic conditions against MLB, BLSB, ChR and BSR in NWPZ; MLB, BLSB in NEPZ; TLB, BLSB, ChR and SDM in PZ; and RDM, FSR, MCN and CLS in CWZ zone. The promising resistant entries of different maturity groups in different zones are mentioned in Table 6.2.

**Table 6.2: Summarized list of resistant genotypes in different zones during *Kharif* 2023**

| Zone | Maturity group | Trials | Disease | Resistant |
|---|---|---|---|---|
| NHZ | Medium | NIVT | TLB | AH 4672, DH 372, IMH2-23K-10, IMH2-23K-3, IMH2-23K-7, DKC 9254 (IX 8455), DKC 9256 (IX 8466) |
| NWPZ | Medium | AVT I | MLB | AHD 2077 |
| | Speciality corn | QPM I | ChR | APH 7, IAQPMH 104, IQPMH 2301 |
| | | QPM III | ChR | IQPMH 2108 |
| NEPZ | Early | NIVT | BLSB | AHD 2050, CP 418, CP 589, EH 3926, JH 32890 |
| | | AVT I | BLSB | AHD 2008, AHD 8751, OMH 22-4, SMH 9099 |
| | | AVT II | BLSB | CP 999 |
| | Medium | AVT I | MLB | JH20088 |
| | | NIVT | BLSB | SMSX 22300 |
| PZ | Early | NIVT | TLB | AHD 2035, AHD 2048, AHD 2050, AHD 2109, DH 358, DH 371, EH 3899, EH 3906, EH 3907, PH 42122 |
| | | AVT I | TLB | AHD 8751, SRMH 99M66 |
| | | AVT II | TLB | AH 8323, JH 32662 |
| | Medium | NIVT | TLB | AHD 2130, AHD 8721, AHD 8722, AH 4717, BAUMH 22-1, BAUMH 22-4, BH 418205, BH 419500, BMH 487, BRM 17-4, BRM 20-2, BRM 20-6, BRM 20-8, DH 362, DH 367, GH 18173, GH 22336, H23M302, IMH 2-23K-8, IMH 2-23K-9, IMH 8-228, KMH 2, KMH 23-3, LMH 1223, LMH 1923, MAH 20-527, PH 421343, PMH 23-1910, RCRMH 23 |

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|---|---|---|---|---|
| | | | ChR | IX 8455 |
| | | | SDM | KMH 23-2 |
| | | AVT I | TLB | AHD2077, IMH2-22K-6, IQ8393, JKMH4059, |
| | | | | RCRMH20 |
| | Late | NIVT | TLB | GH 20113, H23M301, HARLAL 1001, JH 21022, KMH 23-1, PM 23108, PM 23111, PM-23117, SRIKAR AADI, SUPER 8181 |
| | | AVT I | TLB | HARLAL 24 |
| | | AVT II | TLB | BIO 207, PM 21111L |
| | Speciality corn | SC I | TLB | FSCH 218, ISH 6-2107 |
| | | BC I | TLB | BAUMH 22-1-1, EH 3954, IBH9 231, IMH 2-23KB-1 |
| | | QPM | TLB | QPMMH 23-22 |
| CWZ | Early | NIVT | CLS | CP 589, FH 4154, JH 32890 |
| | | AVT I | CLS | SMH 9099, SRMH 99M66 |
| | | AVT II | CLS | CP 999, JH 32487, JH 32662 |
| | Medium | NIVT | FSR | AH 4725, INDAM 1252, IX 7841, IX 8441, KMH 2, LMH 1223, RMH 21008 |
| | | AIVT I | FSR | IMH2-22K-6 |
| | Late | NIVT | CLS | ADV 7405, GK 3263, HARLAL 1001, PM 23106, PM 23107, PM 23111, PM 23113 |
| | | | FSR | HARLAL 1001, HKH 385, KMH 23-4, PA 6401, PM 23112, SRIKAR 3699 |
| | | AVT I | CLS | KMH 8206, PM 22106, PM 22112 |
| | | | FSR | KMH 8388, PM 22117 |
| | | AVT II | CLS | PM 21111L, R 8050 |
| | Speciality corn | QPM I | FSR | BRMQ 20-1, IQPMH 2308 |
| | | QPM II | CLS | IQPMH 2111 |
| | | SC II | CLS | CP GOLDEN |

## Entomology

### *Kharif* 2023

Maize AICRP Entomology *Kharif* 2023 experimental trials were aimed at the resistance screening for spotted stem borer (SSB) [*Chilo partellus* (Swinhoe)] and fall armyworm (FAW), [*Spodoptera frugiperda* (J. E. Smith)] at hotspot locations. Post-screening, the genotypes were categorized as resistant, moderately resistant and susceptible based on leaf injury rating on a 1-9 scale (Resistant 1.0-3.0, Moderately resistant >3.1-6.0 and Susceptible >6.1-9.0) for stem borers. During *Kharif* 2023, a total of 108 maize entries belonging to four AICRP trials of early (12), medium (22), late (31) maturity groups, OPV (3), sweet corn (5), baby corn (8) and QPM (27) were evaluated against spotted stem borer *Chilo partellus* (Swinhoe) and fall armyworm (FAW) under artificial infestation and none of the entries were found resistant to both the pests. Population dynamics of FAW and *Helicoverpa armigera* were monitored indifferent AICRP locations. The efficacy of different insecticides as seed treatment and foliar spray, ITK practices and non-chemical methods were evaluated for the management of FAW. Seed treated with Cyantraniliprole + Thiamethoxam 19.8% @6 ml/kg in combination of foliar spray with Chlorantraniliprole 18.5% SC @ 0.4 ml/litre was found effective against FAW. Among the ITK practices evaluated the most effective treatments against FAW were soil + insecticide (Chlorantraniliprole 18.5% SC) followed by Bait + Chlorantraniliprole 18.5% SC. Maize intercropped with cowpea and EPN Spray @ 10 & 20 DAS recorded minimum per cent plant infestation compared to untreated control.

## Crop production

### *Kharif* 2023

The major agronomic research trials on maize-based systems during *kharif* 2023, rabi season of 2023-24 and spring 2024 were focused on nutrients for different maturity pre-released maize hybrids, precision nutrient management, tillage optimization, integrated nutrient management, development of best weed management practices, crop residue management in traditional and emerging systems, sustainability of the baby corn-based system, optimization of sowing window for spring maize, enhancing water use efficiency in spring maize, and best water management in maize systems.

**Response of *Kharif* pre-release genotypes to nutrient levels:** In *Kharif* 2023, experiments were conducted on the agronomy of pre-release genotypes of long/medium/short duration field corn hybrid/OPV, QPM, sweet corn and baby corn in different zones. The yield of long duration field corn hybrid was increased significantly with 125% RDF in PZ and with 150% RDF in CWZ. In the PZ, none of the tested genotypes were significantly superior over check (NK 6240) but these were at par to check. However, in CWZ, R 8050 performed significantly better over check (Bio 9862).

In medium duration genotypes, JKMH 4546 and check LG 34.05 were at par with the check (Bio 9544) but PM 21103 was significantly inferior to check in PZ. In PZ, 150% RDF was significantly superior over 100% RDF. Grain yield in short duration genotype CP 999 was significantly superior to over check DKC 7074 in NWPZ while SMH 4555 and CP 111 were at par with check.

**Nutrient management under different tillage practices**

The conventional tillage (CT) practices had significantly higher wheat grain and straw yields including net returns but the maize equivalent yield (MEY) of maize-wheat-cowpea system and system net returns were significantly higher with CT over permanent beds (PB) but at par with zero tillage (ZT) at Pantnagar. In nutrient management, green seeker (GS) gave significantly higher wheat grain and straw yield which was at par with 100% RDF in terms of net returns and both were superior to SSNM. The system net returns were significantly higher with 100% RDF over GS and SSNM. At Dholi, significantly higher wheat and maize grain, straw/stover and system equivalent yield of maize, and net returns obtained with 60% RDN+GS which was at par with SSNM. Among tillage practices, PB gave significantly higher maize and system equivalent yield over ZT and

tillage practices, PB gave significantly higher maize and system equivalent yield over ZT and CT. However, at Udaipur, significantly higher wheat, green gram, system yield and system net return recorded with CT over ZT and PB, and also 33% RDN+GS gave significantly higher yield over RDF and SSNM.

The experiment was conducted at Dholi and Kalyani for find out best nutrient management and tillage practices for rice-maize system in the region. At Dholi, permanent bed and 60% RDN+GS gave significantly higher grain, system yield and net return while at Kalyani, significantly higher yield and net return were with ZT and RDF. Significantly higher maize and chickpea grain yield including maize equivalent system yield was observed with ZT over CT and PB. Similarly, RDN + GS gave significantly higher maize grain and equivalent system yield over RDF, where chickpea yield was significantly higher with SSNM and at par with RDN + GS at Banswara.

**Long-term trial on integrated nutrient management in maize system**

Significantly higher grain yield of wheat and maize, system maize equivalent yield and net returns of wheat was recorded with 100% RDF + 5 t/ha FYM over rest of other nutrient management practices at Pantnagar and Banswara. At Peddapuram, significantly higher yield was observed with 100% RDF + 5 t/ha FYM + 5 kg Zn/ha and at par with 100% RDF, 100% RDF and 100% RDF + 5 t/ha FYM.

**Efficacy of nano urea in maize-wheat cropping systems**

Significantly highest yield was found with 100% RDN at all locations except at Karaikal and Udaipur. However, this treatment was at par with 75% RDN + 1 Nano Urea spray (Srinagar), 75% RDN + 1 or 2 Nano Urea spray (Chitrakoot), 75% RDN, 50% RDN and 2/3rd RDN + 1 Urea spray (Bhubaneswar), 2/3rd RDN + 1 Nano Urea spray, 1/3rd RDN + 2% Urea two spray and 2/3rd RDN + 1 Urea spray(Ludhiana), 75% RDN + 1 Nano Urea spray, 75% RDN + 2 Nano Urea spray (Vagarai), 75% RDN + 2 Nano Urea spray and 2/3rd RDN + 1 Nano Urea spray(Banswara and Buldana), 75% RDN, 75% RDN + 1 or 2 Nano Urea spray, 2/3rd RDN + 1 Nano Urea spray and with 2/3rd RDN + 1 Urea spray (Dharwad and Kolhapur).

At Karaikal grain yield was significantly superior with 75% RDN + 2 Nano Urea spray over the rest of the N application. At Udaipur significantly higher yield with 1/3rd RDN basal + 2 Nano Urea spray over the rest of the nutrient application and at par with 100% RDN, 2/3rd RDN + 1 Nano Urea spray, 1/3rd RDN or 2/3rd RDN + 2% Urea two spray. At Pantnagar, Banswara and Udaipur, the RDN (3 split N application) gave higher system maize equivalent yield and system net returns compared to treatments. However, RDN (3 split N application) treatment was at par with 75% RDN (3 split N application) + two nano urea spray (Pantnagar and Banswara), 1/3rd RDN basal + nano urea two spray (Udaipur) in system maize equivalent yield.

**Crop residue management in traditional and emerging maize systems**

These experiments were started in 2020 to assess the effect of crop residue in traditional and emerging maize systems at 10 locations. At Karnal and Banswara, grain yield and net returns was significantly superior with Zero tillage (ZT) + spray of microbial consortia on residue over the rest of residue management. However, this treatment was at par with residue incorporation + spray of microbial consortium on residue. The grain yield was significantly superior with residue incorporation + spray of microbial consortium on residue over the rest of residue application at all remaining locations (Ludhiana, Pantnagar, Dholi, Kalyani, Hyderabad, Karimnagar and Peddapuram), and also in terms of net returns except Karimnagar. Grain yield was non-significant with residue and nutrient management at Vagarai. Similarly, at Pantnagar, Dholi, Hyderabad and Banswara, Residue incorporation + spray of microbial consortium on residue had a significant effect on equivalent yield of maize including system net returns (Pantnagar), system equivalent yield (Dholi), system productivity and soybean yield (Hyderabad), and wheat and soybean yield (Banswara) over the residue management practices. With aspect to the nutrient

(Banswara) over the residue management practices. With aspect to the nutrient management, 100% RDF of NPK gave significantly higher yield to over 100% recommended dose of N & P and 50% K at Karnal, Dholi, Hyderabad, Karimnagar, and Peddapuram. However, at Kalyani, significantly higher grain yield was recorded with 100% recommended dose of N & P and 50% K to over rest of nutrient application.

**Enhancing sustainability of baby corn-based intensive cropping system**

An experiment was conducted at Kalyani for enhancing sustainability of baby corn based intensive cropping system. Significantly higher baby corn yield with and without husk including net return was observed with application of 20 t FYM/ha/year + RDF and it was at par with application of 15 t FYM/ha/year + RDF in continuous baby corn system.

**Weed management in maize system:** Weed management plays a crucial role in the higher grain yield of maize hence trial was conducted at 22 locations of across India. The grain yield was significantly superior with a weed-free check over a weedy check and at par with all treatments at Hyderabad, Dholi, Ambikapur, Vagarai and Pantnagar locations. However, this treatment was at par with pyroxasulfone @ 127 g/ha fb mesotrione + atrazine @ 300 g/ha (Imphal), atrazine 500 g/ha fb tembotrione @ 120 g/ha or topramezone @ 25 g/ha or mesotrione + atrazine @ 300 g/ha and pyroxasulfone @ 127 g/ha fb halosulfuron methyl @ 67 g/ha or tembotrione @ 120 g/ha or topramezone @ 25 g/ha or mesotrione + atrazine @ 300 g/ha (Ludhiana), atrazine 500 g/ha + hand weeding or halosulfuron methyl @ 67 g/ha or mesotrione + atrazine @ 300 g/ha and pyroxasulfone @ 127 g/ha fb topramezone @ 25 g/ha (Bahraich), atrazine 500 g/ha + hand weeding or halosulfuron methyl @ 67 g/ha or tembotrione @ 120 g/ha or topramezone @ 25 g/ha and pyroxasulfone @ 127 g/ha fb topramezone @ 25 g/ha (Bhubaneswar), atrazine 500 g/ha fb halosulfuron methyl @ 67 g/ha or tembotrione @ 120 g/ha or topramezone @ 25 g/ha or mesotrione + atrazine @ 300 g/ha (Ranchi), atrazine 500 g/ha + hand weeding and pyroxasulfone @ 127 g/ha + hand weeding or mesotrione + atrazine @ 300 g/ha (Chhindwara and Varanasi), atrazine 500 g/ha + hand weeding and pyroxasulfone @ 127 g/ha + hand weeding or tembotrione @ 120 g/ha or topramezone @ 25 g/ha or mesotrione + atrazine @ 300 g/ha (Karimnagar). At Kolhapur and Bajaura, grain yield was significantly higher with pyroxasulfone @ 127 g/ha fb mesotrione + atrazine @ 300 g/ha, which was at par with weed-free check. At Karnal, significantly higher with pyroxasulfone @ 127 g/ha fb tembotrione @ 120 g/ha which was at par with weed-free check, atrazine 500 g/ha fb tembotrione @ 120 g/ha or topramezone @ 25 g/ha and pyroxasulfone @ 127 g/ha fb halosulfuron methyl @ 67 g/ha or topramezone @ 25 g/ha or mesotrione + atrazine @ 300 g/ha. At Chitrakoot, yield significantly higher with pyroxasulfone @ 127 g/ha fb + topramezone @ 25 g/ha which was at par with weed-free check, atrazine 500 g/ha fb + tembotrione @ 120 g/ha or topramezone @ 25 g/ha and pyroxasulfone @ 127 g/ha fb + halosulfuron methyl @ 67 g/ha or tembotrione @ 120 g/ha or mesotrione + atrazine @ 300 g/ha. At Dharwad, yield was significantly superior with pyroxasulfone @ 127 g/ha + hand weeding to over weed check and at par with across all treatments.

In rabi season, Grain yield of maize was significantly superior with weed-free check to over rest of weed management treatments at Kalyani, Karimnagar and Peddapuram locations. However, it was at par with Atrazine 500 g/ha + h8929and weeding at 25-30 DAS at Bahraich, Pyroxasulfone @ 127 g/ha fb topramezone @ 25 g/ha at 25-30 DAS at Kalyani, Pyroxasulfone @ 127 g/ha + hand weeding at 25-30 DAS at Karimnagar, and Atrazine 500 g/ha fb topramezone @ 25 g/ha at 25-30 DAS at Peddapuram. At Pantnagar and Banswara, grain and maize equivalent yield were significantly higher with weed-free check and at par with Pyroxasulfone @ 127 g/ha fb mesotrione + atrazine @ 300 g/ha at 25-30 DAS at Banswara. There was no significant effect on yield was observed at Dholi and Udaipur locations.

## Breeding

### *Rabi* 2023-24/Spring 2024

**Trial No. 1183 NIVT (Late)**

Twenty-six test entries along with three checks namely KMH 25K25, NMH 713 and P 3522 were evaluated in this trial across the country at 22 locations i.e. in NEPZ (Varanasi, Baharaich, Begusarai, Bhubaneshwar, Dholi, Nadia, Ranchi & Sabour); PZ (Coimbatore, Dharwad, Hyderabad, Karimnagar, Kolhapur, Mandya, Peddapuram Rahuri and Vagarai) and in CWZ (Ambikapur, Banswara, Chindwara, Godhra and Udaipur). Considering the promotion criteria six entries ADV 7440, PM 23206L, PM 23209L, ADV 7394, ADV 7515, NMH 4519 were promoted in NEPZ; eight entries PM 23204L, ADV 7440, PM 23209L, PM 23202L, PAC 649, PM 23205L, RMH 4623, ADV 7515 were promoted in PZ and nine entries PM 23205L, PM 23209L, PM 23207L, PM 23204L, PM 23202L, ADV 7440, PM 23203L, PAC 649, NMH 4519 were promoted in CWZ to AVT-I (Late).

**Trial No. 1180 AVT I (Late)**

In this trial, eight entries along with three checks viz., KMH25K25, NMH 713 and P 3522 were evaluated in different zones. Due to a smaller number of entries in a particular zone the trial was conducted across the country by clubbing entries of all zones. The trial was conducted at 23 locations i.e. NEPZ (BHU, Baharaich, Bhubaneswar, Coochbehar, Dholi, Kolkata, Nadia, Ranchi and Sabour); PZ (Coimbatore, Dharwad, Hyderabad, Karimnagar, Kolhapur, Mandya, Parbhani, Peddapuram, and Rahuri) and CWZ (Ambikapur, Banswara, Chindwara, Godhra and Udaipur). One test entry (PM 22207L) in NEPZ, eight entries (DM 9445, KMH 8333, ADV 7126, PM 22201L, PM-22203L, SMH 6222, SMH 6333, PM 22204L) in PZ and three entries (ADV 7126 PM 22207L, PM 22201L) in CWZ were evaluated. Considering the promotion criteria, only one entry (PM 22207L) in NEPZ; two entries (DM 9445, PM-22203L) in PZ and two entries (PM 22207L, ADV 7126) in CWZ, were promoted to AVT-II.

**Trial No. 1179 AVT II (Late)**

In this trial three entries along with three checks viz. KMH25K25, NMH 713, P 3522 and one filler CMH 08-287 were evaluated i.e. NEPZ (BHU, Baharaich, Bhubaneswar, Dholi, Kolkata, Nadia, Ranchi and Sabour); PZ (Coimbatore, Dharwad, Hyderabad, Karimnagar, Kolhapur, Mandya, Parbhani, Peddapuram, and Rahuri) and CWZ (Banswara, Chindwara, Godhra and Udaipur). Due to a smaller number of entries in a particular zone the trial was conducted across the country by clubbing entries of all zones. There was only one entry (PM 21204L) for NEPZ, two entries (PM21204L, BH 417193) for PZ and two entries (PM21204L, TMMH 2845) for CWZ for evaluation. All the entries for the respective zones were found superior to the best check excluding TMMH 2845 in CWZ.

### QPM

Six entries namely APQH 1, APQH 5, IQH 7-219, QPMMH 22-35, QPMMH 23-25and MQH 21-51 were tested against five checks (HQPM 1, HQPM 5, LQMH 1, IQMH 202, IQMH 203 & Bio 9544 (Field Corn) and in four zones during *Rabi* 2023-24. These entries were evaluated at Karnal, Ludhiana, Delhi and Pant Nagar in NWPZ (Zone II); Varanasi, Baharaich, Bhubaneswar, Dholi, Sabour, Nadia and Ranchi in NEPZ (Zone III); Coimbatore, Dharwad, Karimnagar, Kolhapur, Mandya and Rahuri in PZ (Zone IV) and Udaipur, Banswara, Ambikapur and Godhra in CWZ (Zone V). In this trial the entries namely IQH 7-219 outperformed the best check LQMH 1 in NEPZ and CWZ.

### Specialty Corns

Specialty corn trials include Trial No. 1189 (baby corn), Trial No. 1190 (popcorn), Trial No. 1191 (sweet corn). These trials were conducted across four agro-climatic zones namely north western plains zone (NWPZ), north eastern plains zone (NEPZ), peninsular zone (PZ), and central western zone (CWZ). Trials 1189, 1190, and 1191 were conducted at 22, 24, and 23 locations, respectively. The number of test entries evaluated was 7, 4, and 2 entries in 1189, 1190 and 1191, respectively against 3 check entries in each trial. The number of test entries in national initial variety trial (NIVT) and advance variety trial-I

(AVT-I) were 4 and 1, 2 and 2, and 2 and 0 in 1189, 1190, and 1191, respectively; whereas 2 entries were in advance variety trial-II (AVT-II) in 1189; rest other two trial do not had any entries in AVT-II stage. Out of 11 entries evaluated in NIVT (8) and AVT-I (3), 3 and 1 NIVT entries in 1189 and 1190, respectively were promoted in one or the other zones to AVT-I (50%) and 2 AVT-I entries in 1190 were promoted in one or the other zones to AVT-II (66%) and no entries were promoted in 1191.

**Trial No. 1189 - Testing of baby corn I-II-III entries for yield across NWPZ, NEPZ, PZ, and CWZ zones**

The baby corn trial comprises of four, one and two entries in NIVT (AHD 2754, GDH 23 GY 3, IMH 2-23KB-1, and MBC 23-8), AVT-I (IIVRBCH 1613), and AVT-II (MBC 21-10 and PAC 571), respectively. The entries were evaluated at Karnal, Ludhiana, and Pantnagar in NWPZ (3); Varanasi, Bahraich, Bhubaneswar, Dholi, Gossaigoan, and Sabour in NEPZ (6); Coimbatore, Dharwad, Hyderabad, Karimnagar, Kolhapur, Mandya, Peddapuram, and Rahuri in PZ (8); Ambikapur, Banswara, Chhindwara, Godhra, and Udaipur in CWZ (5) against three check entries namely ABSH 4-1, AH 7043, CMVL BABY CORN 2. Out of four NIVT entries, three entries namely AHD 2754 in NWPZ (0.96 MT/ha) and NEPZ (1.16 MT/ha), IMH 2-23KB-1 in PZ (0.77 MT/ha), MBC 23-8 in NEPZ (1.23 MT/ha) and PZ (0.74 MT/ha) were promoted to AVT-I based on superiority in baby corn yield without husk over best check AH 7043 in NWPZ (0.92 MT/ha) and PZ (0.67 MT/ha) and CMVL BABY CORN 2 in NEPZ (1.15 MT/ha). No entries from NIVT were promoted to AVT-I in CWZ; similarly no entries from AVT-I were promoted to AVT-II in any of the zones. The two entries which were tested in AVT-II have completed three years of testing, which later would be considered for release by the variety identification committee based on three years weighted average over the best check entry.

Trial No. 1190 - Testing of popcorn I-II-III entries for yield across NWPZ, NEPZ, PZ, and CWZ zones

The popcorn trial was conducted across 24 locations at New Delhi, Karnal, Ludhiana, and Pantnagar in NWPZ (4); Varanasi, Bahraich, Bhubaneswar, Dholi, Gossaigoan, Nadia, Ranchi, and Sabour in NEPZ (8); Coimbatore, Dharwad, Hyderabad, Karimnagar, Kolhapur, Mandya, Peddapuram, and Rahuri in PZ (8); Ambikapur, Banswara, Chhindwara, and Udaipur in CWZ (4) against three check entries namely BPCH 6, DMRHP 1402, and LPCH 3. The trial comprises two test entries each in NIVT (IPH 2-23R-1 and MPC 23-40) and AVT-I (PP-09 and PP-11). Out of two test entries in NIVT, one entry, IPH 2-23R-1 was promoted based on superiority in grain yield to AVT-I in three zones namely NEPZ (6.34 MT/ha), PZ (7.74 MT/ha), and CWZ (5.80 MT/ha) over the best check entries BPCH 6 in all three zones viz., NEPZ (5.19 MT/ha), PZ (6.62 MT/ha), and CWZ (4.54 MT/ha). Whereas both AVT-I entries were promoted to AVT-I; however, PP-09 was promoted in two zones namely NEPZ (6.30 MT/ha) and PZ (7.09 MT/ha), and PP-11 in CWZ (5.44 MT/ha). No entries of either NIVT or AVT-I were promoted in NWPZ.

**Trial No. 1191 - Testing of sweet corn I-II-III entries for yield across NWPZ, NEPZ, PZ, and CWZ zones**

The sweet corn trial comprising of two test entries (GDH 23 GS 11 and MSC 23-61) and three check entries (Misthi, CMVL Sweet Corn 1, and Pusa Super Sweet Corn 1) was conducted at 23 locations namely Karnal, Ludhiana, and Pantnagar in NWPZ (3); Varanasi, Bahraich, Bhubaneswar, Dholi, Gossaigoan, Nadia, and Sabour in NEPZ (7); Coimbatore, Dharwad, Hyderabad, Karimnagar, Kolhapur, Mandya, Peddapuram, and Rahuri in PZ (8); Ambikapur, Banswara, Chhindwara, Godhra, and Udaipur in CWZ (5). Both entries were in NIVT stage of testing but none of the entries were promoted to next stage of testing (AVT-I) as no entries were found superior in sweet corn yield without husk over check entry Misthi in NWPZ (11.14 MT/ha), NEPZ (12.30 MT/ha), PZ (12.85 MT/ha), and CWZ (13.67 MT/ha).

## Plant Pathology

### *Rabi* 2023-24/Spring 2024

During *Rabi* 2023-24, AICRP Plant Pathology trials were conducted in three zones *viz.*, NEPZ (North East Plain Zone), PZ (Peninsular Zone) and CWZ (Central Western Zone) against major maize diseases of that particular region. A set of 114 entries belonging to different maturity groups were tested at different hot spot locations under artificial epiphytotic conditions against MLB and TLB in NEPZ; TLB, FSR, ChR and SDM in PZ; and FSR in CWZ. The promising entries are listed in Table 6.1. During spring 2024, a total of 85 entries comprising different maturity groups were evaluated against ChR in NWPZ and PZ zones. Out of these, only one promising resistant entry named IMH 2-24S-3 was observed in NIVT trial of medium maturity group from NWPZ zone. Under ICAR-CIMMYT collaboration program, a total of 120 inbred lines were evaluated for disease resistance against charcoal rot (ChR) disease at Dharwad centre. Out of these, four lines *viz.,* SN622-29, AP22R-005-0019, AP22R-004-0010 and AP22R-004-0016 were found to be moderately resistant.

**Table 6.1 Summarized list of resistant genotypes during *Rabi* 2023-24**

| Zones | Maturity group | Trials | Disease | Resistant |
|---|---|---|---|---|
| NEPZ | Medium | NIVT | MLB | BH 417144, DKC 9225 |
| PZ | Medium | NIVT | TLB | AH 4142, AH 4152, AH 4673, AH 4724, AHD 2030, AHD 2100, BH 417144, BH 417189, BRM 18-14, DKC 9225, DKC 9250, GH 22515, GH 22517, GH 22602, IM 19355, IM 19389, IMH 2-23R-10, IMH 2-23R-11, IMH 2-23R-3, IMH 2-23R-4, IMH 2-23R-5, IMH 2-23R-6, IMH 2-23R-8, IMH 2-23R-9, INDAM 1202, KMH 23-6,MAH 19-2, MAH 20-53, MMH 23-21, MMH 23-32, PH 1534, PH 421266, SYN SRE 923 |
| | | AVT I | TLB | AHD 2065, BS 652, Ellora virat-12, IMH 2-22R-10, IMH 2-22R-4 |
| | | AVT II | TLB | BH 417182, BH 417206, IMHS-20R-11, IMHSB 20R-15, IMHSB 20R-3, SYN 217806 |

## Entomology

### *Rabi* 2023-24/Spring 2024

Maize AICRP Entomology *Rabi* 2023-24 and spring 2024 experimental trials were aimed at screening for resistance against pink stem borer (PSB) [*Sesamia inferens* (Walker)], spotted stem borer (SSB) [*Chilo partellus* (Swinhoe)], fall armyworm (FAW) [*Spodoptera frugiperda* (J. E. Smith)] and shoot fly [*Atherigona* spp.] at hot spot locations. Post-screening, the genotypes were categorized as resistant, moderately resistant, and susceptible based on leaf injury rating on a 1-9 scale (Resistant 1.0-3.0, Moderately resistant >3.1-6.0 and Susceptible >6.1-9.0) for stem borers. For shoot fly, the genotypes were categorized based on the mean percent dead hearts (DH) as resistant- <10% DH, moderately resistant >10-20% DH, moderately

percent dead hearts (DH) as resistant- <10% DH, moderately resistant >10-20% DH, moderately susceptible >20-30% DH, susceptible >30-50% DH and highly susceptible >50% DH (Sharma et al. 1992). A total of 32 maize entries of different maturity groups and specialty corn were screened for resistance under artificial infestation against PSB and SSB at Hyderabad and Kolhapur locations, respectively, and none of the entries were found to be resistant against both the pests. Out of 33 maize entries of different maturity group and specialty corn, were screened under artificial infestation against FAW at Hyderabad and Coimbatore none of the entries were found resistant to FAW. A total of 22 maize entries of medium maturity group were screened against shoot fly and none of the entries were found resistant to shoot fly.

### Management of fall armyworm

Field experiments on the evaluation of different bio-pesticides and ITK practices were carried out at different AICRP locations for FAW management during *Rabi* 2023-2024. All the bio-pesticides evaluated were found effective against FAW. Among the ITK practices evaluated, soil + insecticide (Chlorantraniliprole 18.5% SC) followed by Bait + Chlorantraniliprole 18.5% SC were found effective against FAW.

During *Kharif* 2024, maize AICRP entries (AVT I and II) were evaluated against SSB, FAW under artificial infestation at different AICRP locations. Monitoring of *Helicoverpa armigera* through pheromone traps was carried out. Different noble insecticide formulations as foliar spray, and non-chemical methods were evaluated against FAW. Studies on Pest succession, incidence, and estimation of yield losses were also conducted at different locations.

## Crop Production

### *Rabi* 2023-24/Spring 2024

### Response of pre-release *Rabi* genotypes to nutrient levels

The long duration hybrids were evaluated at two fertility levels in the North Eastern Plain Zone (NEPZ; Kalyani and Ranchi), the Peninsular Zone (PZ; Coimbatore, Dharwad, and Peddapuram), and the Central Western Zone (CWZ; Ambikapur, Banswara, and Udaipur) areas. The yield of long duration genotypes increased significantly with 150% RDF and tested genotype was at par to check in NEPZ. In CWZ, none of the tested genotypes were significantly superior over check (NMH 713) but genotype TMMH 2845 was at par to check. However, either fertility levels or genotypes had a significant effect on stover, and cob yields at Peddapuram in PZ, and Udaipur in CWZ, respectively. Regarding net returns, in NEPZ, fertilization levels show a significant influence at Kalyani, where increased fertility levels significantly enhanced the net returns. In the PZ, genotypes at Peddapuram center responded positively to fertilizer application rate in terms of net returns. Conversely, no such effect was observed for net returns in CWZ, except at Udaipur, where the fertilizer application rate and both genotypes TMMH 2845 and PM21204L had significantly higher returns. Moreover, both the genotypes also observed significantly higher the net returns at Banswara but not at the Ambikapur.

Four medium duration genotypes were tested at NWPZ in spring season, i.e., Karnal and Pantnagar, revealing a significant impact of fertilizer application rates on yields. The genotype SYN 217806 had significantly higher grain yield than the best check at Karnal, whereas at Pantnagar, JH 18026 outperformed significantly to the check in spring season. At the NEPZ in rabi season, the grain and stover yields of all medium duration genotypes were higher at Bahraich, whereas grain yields of all genotypes were significantly at par to the check. In the PZ during rabi season, the genotypes and rate of fertilizer application had a significant effect on grain and stover yields including net returns at all three centers except Karimnagar for fertility levels. Similarly, the yields including cob yield at Udaipur were significantly higher at all locations in CWZ during rabi season except Godhara for rate of fertilizer application. Regarding net returns, in NWPZ, fertilization levels and genotypes had a significant influence at both locations except Pantnagar for different genotypes. All medium maturity genotype were significantly superior compared to check at Bahraich. However, in CWZ, the net returns were significantly influenced with the rate of fertilizer application.

### Enhancing water use efficiency in spring maize

An experiment was planned to generate water management practices in this irrigated crop for enhancing water use efficiency in fast expanding spring maize at Karnal, Ludhiana and Pantnagar. At Karnal, the grain yield was significant effect with zero till flat planting, whereas bed planting method found superior at Ludhiana. However, organic mulching under residue management significantly gave higher grain and cob yield over no mulching at Karnal and Ludhiana. At Pantnagar, significantly higher yield with ridge slope planting over conventional till flat and zero till flat planting.

### Optimization of sowing window for spring maize

The window of sowing had a significant effect on grain and cob yield. Sowing on 10th February sowing had significantly higher yield over the rest of planting dates at Karnal and Ludhiana. However, it was at par with 17th February sowing at both the locations. Similarly, the net return was significantly higher on 10th February and at par with 17th February over the other sowing windows. The sowing beyond 17th February had decreasing yield and returns trends.

# SIGNIFICANT EVENTS

7 Chapter

## INSTITUTE EVENTS

### Republic Day Celebrations

The staff of the institute celebrated 75th Republic Day at ICAR-IIMR, Ladhowal, Ludhiana with great with great enthusiasm hoisting of the National Flag, reflecting a remarkable spirit of unity and patriotism. Simultaneously, the respective In-charges at various centers conducted the flag-raising ceremony with deep respect and dedication. In his address, the Director emphasized the importance of upholding our constitutional duties and responsibilities. He encouraged every member of the institute to commit themselves to the upliftment and progress of the farming community and highlighting the importance of collective efforts in fostering national growth.

Flag Hoisting Ceremony on the 75th Republic Day

### 10th Foundation Day Celebrations of ICAR-IIMR, Ludhiana

ICAR-Indian Institute of Maize Research, Ludhiana celebrated its 10th foundation day on February 9, 2024. Sh. BS Sidhu, Former Agriculture Commissioner, Govt. of Punjab, graced the occasion as chief guest and Dr. Nachiket Kotwaliwale (Director, CIPHET, Ludhiana), Dr. Parvender Sheoran (Director, ATARI, Ludhiana) and Dr. Rajbir Singh (ADG, AAF&CC, ICAR) were guests of honor on this occasion. During the event, Dr. H.S. Jat, Director of ICAR-IIMR, Ludhiana, highlighted the institute's achievements and emphasized the growing importance of maize in both crop diversification and meeting industrial demand.
Sh. BS Sidhu, chief guest of the event, lauded the efforts made by the institute for providing technology-based solution for making maize as a competitive crop. The guests of honor emphasized the need for government policies for maize procurement, highlighted the role of climate-smart technologies, value addition, role of AI in maize research, significance of assured markets prices, and collaboration with agricultural universities to promote diversification of rice with maize.



Independence Day Celebrations

The ICAR-Indian Institute of Maize Research, Ludhiana, proudly celebrated India's 78th Independence Day on 15th August, 2024, with the hoisting of the national flag and inspiring speeches. The event featured inspiring speeches highlighting the nation's progress and the institute's dedication to agricultural innovation. Researchers and staff reaffirmed their commitment to advancing maize research for a self-reliant and prosperous India. The celebrations reflected the spirit of unity and progress in strengthening the nation's food security.

## Parthenium Awareness Week

The ICAR-Indian Institute of Maize Research, Ludhiana observed Parthenium Awareness Week from 16-22nd August, 2024, with the participation of 30 staff members. The initiative aimed to address the growing threat of this invasive weed to agriculture, biodiversity, and human health. Participants learned about timely weed management practices and discussed effective control strategies, including manual removal, biological agents, and chemical methods. They were encouraged to implement these measures in their respective fields, ensuring the practical application of the knowledge gained.

## National Conferences on Maize-2024

The Maize Technologists Association of India (MTAI), in collaboration with ICAR-Indian Institute of Maize Research (IIMR) and Punjab Agricultural University (PAU) jointly organized a three-day National Conference on Maize from 23-25th August 2024, at PAU, Ludhiana. Honorable Vice Chancellor of PAU Dr. S.S. Gosal was the chief guest in the plenary function, while Dr. S.K. Vasal World Food Laureate had chaired the plenary session and Dr. Rajbeer Singh, ADG, ICAR was the guests of honor. Dr. S.S. Gosal congratulated the presenters and award winners, emphasizing the conference's role in idea-sharing and collaborations. Dr. Rajbeer highlighted maize's potential in distilleries and silage units, noting Punjab's influence on national farming practices. Dr. H.S. Jat outlined six key themes for maize sectors growth, stressing ethanol recovery and genetic diversity. Dr. Vasal underscored youth involvement, speed breeding, and farmer-friendly technologies. Dr. Sain Dass praised ongoing efforts but urged soil and plant health conservation practices for sustainable growth. The event saw active participation from 400 scientists, students, farmers, entrepreneurs, and industry representatives, fostering collaboration for maize growth in food, feed, and fuel sectors.

## Ek Ped Maa Ke Naam Campaign

ICAR-IIMR, Ludhiana, proudly participated the Ek Ped Maa Ke Naam campaigns on 2nd and 17th September 2024, honoring our mothers and Mother Nature. As a tribute, the team planted trees on campus, promoting a greener future. This initiative reflects our commitment to environmental sustainability and a lasting legacy for future generations.

## Swachhta Hi Seva-2024 Pledge

On 17th September 2024, the Swachhta Hi Seva-2024 pledge was taken by ICAR-IIMR, Ludhiana, reaffirming its commitment to cleanliness and sustainability. Efforts are being made to keep the surroundings clean and green while promoting responsible waste management and eco-friendly agricultural practices. By adopting sustainable solutions, contributions are being made toward a pollution-free environment for a healthier India. They encourages collective actions for a cleaner and greener tomorrow.


## Rajbhasha Fortnight

The closing ceremony of Rajbhasha Fortnight (held from 13-27th September, 2024) at ICAR-IIMR, Ludhiana, took place on 1st October, 2024, in the presence of Dr. Hanuman Sahai Jat, Director, ICAR-IIMR. Shri Navdeep Singh, the chief guest, emphasized Hindi as a symbol of culture and national identity, encouraging its use in daily life and official work. He discussed the nuances of essay writing, speech, and poetry, urging greater interest in the language. Dr. Jat encouraged employees to actively participate in Hindi competitions and incorporate practical Hindi in government work. He highlighted that promoting Hindi strengthens national identity and enriches cultural heritage. The event concluded with enthusiasm, reaffirming the institute's commitment to promoting the Hindi language.

## Participation in Pau Kisan Mela

ICAR-IIMR, Ludhiana participated in the Kisan Mela organized by Punjab Agricultural University, held during 13-14th September, 2024 and showcased innovations in maize research, various IIMR maize hybrids, sustainable farming approaches and value-added products of maize.


## Participation in CIPHET Mela

ICAR-IIMR Ludhiana Participated in the IIFA CIPHET-2024 Food processing Fair organized at CIPHET, Ludhiana from 3-5th October, 2024 and showcased various maize technologies and value added maize products.

## Inauguration of Newly Established Glass and Polyhouse Facilities

On 21st October, 2024, Dr. T. R. Sharma, DDG (Crop Science), ICAR, New Delhi, inaugurated the newly established glasshouse and polyhouse facilities at ICAR-IIMR, Ladhowal. The event was honored by the presence of esteemed dignitaries, including Dr. R. K. Singh, Dean, College of Agriculture, Rani Lakshmi Bai Central Agricultural University (RLBCAU), Jhansi; Dr. P. K. Singh, Agriculture Commissioner, Government of India, New Delhi; and Dr. H. S. Jat, Director, ICAR-IIMR, Ludhiana. The dignitaries participated in a ceremonial tree-planting event at the institute's new campus, marking a significant milestone in its development. They also visited various experimental plots and discussed ongoing research activities with the institute's scientists. Dr. Sharma took the opportunity to interact with the staff members, gaining insight into their work and offering valuable feedback for the institute's continued growth.

## Vigilance Awareness Week

Vigilance Awareness Week was observed at ICAR-IIMR, Ludhiana from 28th October to 3rd November, 2024, under the theme "Culture of Integrity for Nation's Prosperity." The institute's staff collectively pledged to uphold transparency and integrity in the growth of the institute. The event aimed to foster a culture of integrity and accountability. During the week, the significance of these values in contributing to national prosperity was strongly emphasized.


## Inauguration of AICRP on Maize CELL and Entomology Lab

On 28th November, 2024, the AICRP on Maize CELL and Entomology Lab at the Winter Nursery Centre, ICAR-IIMR, Hyderabad, were inaugurated by Dr. T.R. Sharma, Deputy Director General (Crop Science). The event was graced by the presence of Dr. H.S. Jat, Director, ICAR-IIMR, Ludhiana. This milestone marks a significant step forward in enhancing maize research and pest management strategies, paving the way for innovation and excellence in maize cultivation.

## SIGNING OF MoU'S FOR RESEARCH COLLABORATIONS

Signing of MoU's for Research Collaborations, Startups and extension activities ICAR-IIMR signed a Memorandum of Understanding (MoU) with a startup,

Yamdagnipuram Farmer Producer Company limited, Jaunpur, Uttar Pradesh on March 15, 2024, to promote value addition in maize. Following this, an agreement was formalized on April 4, 2024, with Shunya Fodder and Forage Agritech Private Ltd, a New Delhi based pioneering startup committed to addressing India's fodder shortage and providing essential animal nutrition solutions to farmers.

On May 3, 2024, ICAR-IIMR, Ludhiana, signed another MoU with Bionex Agrigenetics Private Ltd. for the seed production of DMRH 1305 and LQMH 1. On the same day, ICAR-IIMR also entered into a collaborative partnership with Agrowin Agri Solution Pvt. Ltd. to focus on research related to production of the IMH 224 hybrid.

**Exchange of MOU's**

## MoU with Ambra Agritech Private Limited, New Delhi

On 6th August 2024, ICAR-IIMR, Ludhiana, signed a MoU with Ambra Agritech Private Limited, New Delhi, for the production and sale of "Maize Hybrid IMH 224". This collaboration aims to enhance the availability and distribution of the hybrid seed.

## MoU with Farmer Producer Organizations (FPOs), Karnal & SBS Nagar

ICAR-IIMR, Ludhiana has signed an MoU with Farmer Producer Organizations (FPOs) from Karnal and SBS Nagar on 8th August, 2024, to establish silage units under the Silage Project, an initiative supported by the Ministry of Agriculture & Farmer's Welfare, Government of India. This collaboration marks a significant step towards enhancing maize-based silage production and empowering the maize growing farmers.

## MoU with Bhartiya Beej Sahakari Samiti Ltd. (BBSSL)

An important MoU was signed on 10th September, 2024 between ICAR-IIMR, Ludhiana and Bhartiya Beej Sahakari Samiti Ltd. (BBSSL) for collaborative efforts in seed production and the popularization of high-yielding maize hybrids suitable for ethanol production. This collaboration will play a significant role in meeting the growing demand for hybrid maize seeds in the country.

## MOU with Corteva Agriscience

ICAR-IIMR, Ludhiana and Corteva Agriscience have come together for their collaboration on maize through signing of a Memorandum of Understanding (MOU) on 26th September 2024. The two organizations aim to boost the maize sector by working together to disseminate pre-harvest and post-harvest technologies, providing training and capacity building programs, and promote the maize and maize-based value chain in the country.

## Mou with Indo Maize and Millet Development Association, Pune

ICAR-IIMR, Ludhiana signed a Memorandum of Understanding (MoU) with the Indo Maize and Millet Development Association, Pune, on 18th October, 2024, to collaborate on research and extension activities. As part of this initiative, exposure visits were organized for 10 experts, providing them with insights into various aspects of maize cultivation, silage production, value addition, and the evolving dynamics of maize use for ethanol production.

# WORKSHOP/MEETINGS

## Workshop on Promotion of Climate Resilient Technologies

On April 25, 2024, ICAR- Indian Institute of Maize Research organized a workshop on "Promotion of Climate Resilient Technologies of Maize" among the farmers of Punjab. The programmes were conducted as a part of the Awareness/Campaign Programs under Mission

LiFE (Lifestyle for Environment) aligning with the theme of World Environment Day, 2024.


## Annual Maize Workshop

The 67th Annual Maize Workshop-2024 was jointly organized by ICAR-Indian Institute of Maize Research (IIMR) and Professor Jayashankar Telangana State Agricultural University (PJTSAU) from May 8-10, 2024, at the PJTSAU campus in Rajendranagar, Hyderabad. The workshop brought together leading maize researchers, agricultural scientists and policymakers across the country to discuss advancements in maize cultivation. Participants focused on key challenges such as climate resilience, productivity enhancement market diversification and future directions in expanding the area under maize crop. The event also highlighted collaborative efforts to promote sustainable maize production for food security and economic growth.


**Glimpses of Annual Maize Workshop held at PJTSAU Campus, Hyderabad**

## Stakeholders Meeting for Catchment Area of Ethanol Industries

ICAR-IIMR Ludhiana organized a stakeholder meeting on June 21, 2024, to promote the project entitled "Enhancement of Maize Production in the Catchment Area of Ethanol Industries". The meeting brought together representatives from distilleries, seed industries, farmer producer organizations (FPOs), farmers, and experts from PAU, ICAR-CIPHET and IIMR. This initiative, sponsored by the Ministry of Agriculture and Farmers Welfare, Government of India, aims to boost the target of achieving 20% Ethanol Blended Petrol (EBP) by 2025-26.

Sh. K S Pannu, retired IAS and Chief Guest, highlighted the growing significance of maize in the ethanol sector and emphasized to address the challenges and concerns raised by various stakeholders. Dr. H.S. Jat, Director of ICAR-IIMR, underscored the importance of strengthened collaboration among stakeholders to achieve 20% EBP target by 2025-26, and address the concerns raised by participants. Dr. S.L. Jat, Senior Scientist and Principal Investigator of the project, provided a comprehensive overview of the project. Additionally, inputs were also distributed to the farmers. The meeting saw the active participation of over 86 individuals, both in-person and offline.

**Glimpses of Stakeholders Meeting conducted at ICAR-IIMR, Ludhiana**

## Meeting with Odisha Governments on Mukhyamantri Maka Mission

The Director of Agriculture & Farmers Welfare chaired the inaugural meeting of the Knowledge Secretariat at Krushi Bhawan, conducted on February 20, 2024 to strategize on fulfilling the objectives of the Mukhyamantri Maka Mission (MMM). The meeting included participation from key members of the Knowledge Secretariat, such as representatives from IARI, ICAR-Indian Institute of Maize Research, the International Maize and Wheat Improvement Center (CIMMYT) and International Crops Research Institute for the Semi-Arid Tropics (ICRISAT).
During the meeting, the Director, ICAR-IIMR, highlighted the crucial role of the Knowledge Secretariat member's technical expertise in advancing the mission's goals. Key focus was given to areas such as enhancing seed production, hybrid seed production, farm mechanization, and addressing the growing demand for ethanol production from maize.

**Scientific Discussion During Interactive Meet**

## Workshop on "Maize for North East Hill Region: Challenges and Opportunities"

The Workshop on 'Maize for North East Hill Region: Challenges and Opportunities' was held from 11-12 March, 2024 at College of Agriculture, CAU, Imphal. The event was graced by Dr. Lalita Mohan Garnayak (Director of Research), Dr. L. Nabachandra Singh (Dept. of Agronomy) and Dr. Shankar Lal Jat (Senior Scientist, ICAR-IIMR, Ludhiana), and Dr. N. Brajendra Singh (Dept. of Genetics & Plant Breeding), who served as presidium members. The workshop was organised to disseminate recent advances in maize production, promote maize-based entrepreneurship and strengthen the maize value chain.


**Inauguration Ceremony of Maize Workshop Organized at CAU, Imphal**

## Institutional Research Committee meeting

The Institutional Research Committee (IRC) Meeting of ICAR-Indian Institute of Maize Research (ICAR-IIMR), Ludhiana, was successfully conducted from 9th to 11th July 2024. During the three-day meeting, all ongoing and proposed research projects of the institute were comprehensively reviewed. Scientists and experts engaged in detailed discussions, evaluating the progress, challenges, and future directions of various research initiatives aimed at advancing maize research and development.

## Research Advisory Committee (RAC) Meeting

ICAR-Indian Institute of Maize Research (IIMR) conducted its Research Advisory Committee (RAC) meeting under the Chairmanship of Dr. Satbir Singh Gosal, Vice Chancellor, Punjab Agricultural University, Ludhiana, from 5-6th September, 2024. The meeting focused on reviewing and guiding Institute's ongoing research initiatives to further strengthen maize-based innovations and strategies across India.

## Interaction Meeting

On 28th November, 2024, the ICAR-Indian Institute of Maize Research (IIMR), Ludhiana, hosted a one-day interaction meeting on "Licensing of Public Sector Maize Hybrids to Small and Medium Enterprises in Hybrid Seed Production." The event saw active participation, with 60 representatives from 39 companies attending. Private sector participants expressed significant interest in licensing public sector maize hybrids, highlighting the potential for strengthening collaborations in the maize seed sector. The meeting was graced by Dr. T.R. Sharma, Deputy Director General (Crop Science), as the Chief Guest, underscoring the importance of such partnerships in advancing agricultural innovations. The program was well received and initiative taken by ICAR-IIMR was well appreciated by the private partners.

# EXTENSION AND OUTREACH ACTIVITIES

## Extension And Outreach

Training cum input distribution programme

One-day training cum input distribution program was held on February 12, 2024, at Mahesh Nagar, Barnala, under the Scheduled Caste Sub Plan (SCSP) programme of ICAR-IIMR, Ludhiana. This collaborative effort between ICAR-IIMR, Grant Thornton Bharat, and the HDFC Parivartan Project was aimed to enhance the livelihood of SC farmers through maize technology based interventions. A total of 50 progressive SC women farmers from four Farmer Producer Companies (FPCs) in Kotduna, Bhotna, Rureke Kalan, and Sehna clusters of Barnala District participated in the event. Each beneficiary received improved maize hybrid seed covering a total of 40 acres.

## Agri Drone Demonstrations

ICAR-IIMR, Ludhiana, conducted an agricultural drone demonstration on farmer's field under Agri-Drone Project.

**Demonstration on Drone Technology**

## Training Cum Input Distribution at Kokri Kalan, Moga

In a significant step towards enhancing the livelihoods of Scheduled Caste farmers, a one-day training cum input distribution program was successfully held in Kokri Kalan, Moga, on February 22, 2024. This initiative, organized under the Scheduled Caste Sub Plan (SCSP) programme of the ICAR-Indian Institute of Maize Research (ICAR-IIMR), Ludhiana was conducted in collaboration with Grant Thornton Bharat and the HDFC Parivartan Project. A total of 95 progressive SC women farmers from three Farmer Producer Companies (FPCs) in the Moga1, Moga 2, and Bhagapurana clusters of Moga District actively participated in the event and each beneficiary received a spray pumps as part of the program.

The training program was designed to empower these women farmers by providing them with knowledge on advanced maize cultivation techniques, with a special focus on promoting value addition in maize crop. Dr. Bharat Bhusan, senior Scientist at ICAR-IIMR, Ludhiana, highlighted the institute's commitment to fostering sustainable livelihood creation and socio-economic transformation in rural communities. He also expressed his gratitude to Dr. H S Jat, Director, ICAR -IIMR, Ludhiana for his guidance and support in implementing the programme. Dr. Ph Romen Sharma, Scientist at ICAR-IIMR, Ludhiana, shared valuable insights on adopting best practices to optimize crop yields with minimal expenditure, ensuring profitable crop outcomes for the farmers.

**Distributing Spray Pumps to Farmers of Kokri Kalan, Moga**

## Three days training in Koraput District, Odisha

The ICAR-IIMR Successfully conducted a three day training program entitled "Best Management Practices in Maize Cultivation and Entrepreneurship Development to Enhance Farmer Livelihoods" in Koraput District, Odisha from February 26-28, 2024. This event took place in the Conference Room, MS Swaminathan RF Centre, Jeypore, Koraput. The training was organized as part of the DMF funded project "Improving the livelihood and nutritional security through scientific maize cultivation and maize based entrepreneurship development in Koraput District, Odisha".


## Farmer's Awareness Cum Training

ICAR-IIMR organized a farmer's awareness cum training program on "Farmer's Rights and scientific maize cultivation". The event took place at RMR&SPC in Begusarai on March 3, 2024. The program aimed to educate farmers about their rights and promote best practices in maize cultivation. All participants received valuable information to enhance their farming techniques and awareness of their rights.

## Farmers awareness programme on Farmer's right under PPV&FR

A Farmer Awareness Programme on Farmers' Rights under the PPV&FRA, along with training on scientific maize cultivation, was conducted at RMR&SPC, Begusarai, on March 3, 2024. Dr. S. B.Singh highlighted the importance of conserving germplasm and the various benefits associated with it.

## Training cum Input Distribution

One-day training cum input distribution program aimed at improving the livelihood of Schedule Caste farmers through improved maize technologies was successfully conducted in Chokkar Village, Ludhiana on March 9, 2024. This initiative was held under the Scheduled Caste Sub Plan (SCSP) programme of ICAR-

Indian Institute of Maize Research, Ludhiana, in collaboration with the Grant Thornton Bharat, and HDFC Parivartan Project. The program focused on enhancing the livelihoods of Scheduled Caste farmers through interventions based on improved maize technologies. A total of 38 progressive Scheduled Caste women farmers attended the event, and each beneficiary received improved maize hybrid seeds, covering for a total of area of 38 acres.

**Distribution of maize hybrid seeds in Chokkar Village, Ludhiana**

## Promotion of Bio-fortified Maize through Value Addition

Three training programmes under the title "Promotion of Bio-fortified Maize for Entrepreneurship Development through Value Addition for Nutritional and Livelihood Security" were conducted from March 18-20, 2024, at three different locations viz., Mehndali village (Block Anandpur Sahib), Bhotna village (Barnala District) and Lopon village (Moga District). This collaborative event between ICAR-IIMR, Grant Thornton Bharat, and HDFC Parivartan Project was organized under the DBT Biotech Kisan project, with a primary focus on empowering women farmers through value addition using bio-fortified maize.

## Distribution of Tarpaulins to women farmers under SCSP programme

On March 23, 2024, a tarpaulin distribution event was organized at Balliewal village, Ludhiana, benefiting 100 women farmers under the SCSP (Scheduled Caste Sub Plan) program. This initiative aimed to support marginalized communities by providing essential agricultural resources. The tarpaulins will help the women farmers in protecting their crops and produce from adverse weather conditions, thereby enhancing their livelihood and boosting productivity. This distribution marks a significant step towards empowering women in agriculture and promoting sustainable farming practices in the region. Dr. Pardeep Kumar, Scientist and Dr. Ph. Romen Sharma also encourage the farmers to adopt improved technologies of Maize technologies to improve the livelihood of the farmers.

## Training for New Agribusiness Incubates at ICAR-IIMR, Ludhiana

The ICAR-IIMR, Ludhiana successfully conducted training for newly admitted incubates under its Agribusiness Incubation Centre on March 27, 2024. As part of the induction process, ICAR-IIMR formalized Memorandums of Understanding (MoU's) with 12 Farmer Producer

Companies (FPOs), marking their entry into the ABI unit. These incubates will focus on various aspects of the maize value chain, including seed production, maize value addition, and agri-drone technologies. These MoU's aim to enhance the capacities of both the FPOs and incubates through targeted interventions related to maize. Dr. H S Jat, Director of ICAR-IIMR, encouraged FPO members to actively engage in seed production and highlighted the importance of value addition through bio-fortified maize. The participants were also enlightened about the benefits of bio-fortified maize. Around 47 participants took part in the program.

**Training for Newly Admitted Agribusiness Incubates**

## Development of Custom Hiring Centre under SCSP

On April 25, 2024, ICAR- Indian Institute of Maize Research provided two multi-crop threshers to two Farmer Producer Companies (FPCs) in Punjab. The recipients were Mnumeh Farmer Producer Company Limited in Ropar and Sutluj Women Farmer Producer Company in Gehlewal Machiwara Sahib, Ludhiana. This initiative aims to enhance livelihoods by strengthening Custom Hiring Centers for Scheduled Caste farmers in Punjab, thus empowering their agricultural activities. Drs. M C Dagla, Pardeep Kumar, Ph. Romen Sharma and Deep Mohan Mahala hand over the machineries to the FPOs members.

## Field visits

Following the success of hybrid seed production in West Bengal, the production of IIMR hybrid DMRH 1308 is also thriving in Telangana state as well. During an extensive two-day visit from March 6-7, 2024, our Director, Dr. H.S. Jat, and Dr. Bhupender Kumar visited several production sites in Telangana, where they identified over 2,500 quintals of hybrid seed production. Representatives from seed companies, cooperatives, and Farmer Producer Organizations (FPO's) also visited the sites and expressed great excitement after hearing farmers' feedback on the hybrid. They highly praised IIMR's efforts in successfully implementing large-scale seed production in a participatory manner and expressed their interest in signing MoU's with IIMR for hybrid seed production.

The Director of ICAR-IIMR extended an invitation to the representatives to witness live demonstrations of IIMR's hybrids, alongside those from other public and private sectors. He also expressed sincere gratitude to the dedicated farmers and officials from various cooperatives and FPOs for their active contributions to the program.

## Participation in PAU Kisan Mela

ICAR-IIMR showcased improved maize hybrids, value-added products, and advanced technologies during the PAU Kisan Mela, held from March 14-15, 2024. During the two-day event, scientists from ICAR-IIMR addressed the various queries raised by farmers and explained advanced techniques to reap better harvests. They also engaged in meaningful interaction with the maize growing farmers from different districts of the state.

## Front Line Demonstration

A field visit was conducted by Dr. S L Jat (Senior Scientist) and team from ICAR-IIMR, Ludhiana, under the Maize APART project to assess various maize demonstrations in the Hajo development block of Kamrup district, Assam. The team healthy crops that were free from pests and diseases, indicating the successful transfer of technology by IIMR, Ludhiana. Farmers from the area expressed their satisfaction with the techniques implemented, signaling the potential for a bumper maize harvest in Assam. This success highlights the critical role of effective technology dissemination in agricultural development.


## Exposure Visits

ICAR-IIMR, Ludhiana Host various exposures visits, 23 students of BFIT University, Dehradun visited and interacted with the scientist of ICAR-IIMR at Ladhowal Farm on 4th May, 2024. On June 6, 2024, 16 students from Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut visited the ICAR-IIMR Ladhowal farm for an educational tour.

## Input Distribution at Pattangi, Koraput

On 4th July 2024, ICAR-IIMR, Ludhiana organized an input distribution and awareness program titled "Enhancing Kharif Maize Yields: Advanced Production & Post-Harvest Technologies" for Koraput farmers at the High Altitude Research Station, OUAT, Pattangi, under the DMF-funded project aimed at improving livelihoods and nutritional security through scientific maize cultivation. A total of 41 farmers from three Gram Panchayats attended the program, where inputs like Kalinga Raj Maize Hybrid seeds, sprayers, spades, and khurfis were distributed.

## Training on Scientific Maize Cultivation and Seed Production

ICAR-Indian Institute of Maize Research, Ludhiana, organized a training program on "Scientific Maize Cultivation and Seed Production for Enhancing Farmers' Income" from 28-30th August, 2024 at ICAR-CIPHET, Ludhiana, under the project "Enhancement of Maize Production in Catchment Area of Ethanol Industries" funded by the Ministry of Agriculture and Farmers Welfare. The program aimed to equip farmers with knowledge on best practices in maize cultivation, seed production, nutrient management, mechanization, pest and disease management, and storage. A total of 25 farmers from Telangana's Mulkanoor Co-operative Society participated in the training. In the valedictory session, Dr. H.S. Jat, Director, ICAR-IIMR, stressed the need for collaboration to achieve the 20% Ethanol Blended Petrol (EBP) target by 2025-26 and encouraged participants to work together to address challenges in the sector.

## Training on Best Management Practices for Maize Productivity in Bihar

A training program on "Best Management Practices for Higher Productivity and Income in Maize in Bihar" was held from 3-5th September 2024 at the Vishnupur campus of the Regional Maize Research and Seed Production Center, ICAR-IIMR, Begusarai. The program was inaugurated by Dr. Chikkappa Gan Karjagi, Principal Scientist, and Mr. Ajit Kumar Yadav, District Agriculture Officer, Begusarai, who shared their invaluable experiences with the trainees. The program also included various sessions by experts from ICAR-IIMR and other agricultural institutions.

## Training on Maize for Enhancing Food, Fodder, Fuel, and Emerging Food Products

A training program on "Maize: Food Production, Fodder, Fuel, and Emerging Food Products" was held from 10-12th September, 2024 at the Vishnupur campus of the Regional Maize Research and Seed Production Center, ICAR-IIMR, Begusarai. The program was inaugurated by Dr. Chikkappa Gan Karjagi, Principal Scientist, and Mr. Ajit Kumar Yadav, District Agricultural Officer, Begusarai, who shared valuable insights with the participants. The training, attended by 25 farmers from six districts, covered key topics related to maize,

including its use for food, fodder, fuel, and emerging food products.

## Training on Scientific Maize Cultivation for Enhanced Productivity in Bihar

Training program on "Scientific Maize Cultivation Practices for Enhancing Productivity and Income in Bihar" was organized by ICAR-Indian Institute of Maize Research (IIMR), Ludhiana, Punjab, in collaboration with ATMA, Lakhisarai, Bihar, from September 23-25th, 2024, at PAMETI, Ludhiana. The program was designed to provide farmers with comprehensive knowledge on best practices in maize cultivation, aimed at increasing productivity and improving their livelihoods. A total of 21 farmers participated the training programme.

## Farmer Scientist Interaction Meet

On 20th September 2024, ICAR-IIMR's Regional Maize Research and Seed Production Centre (RMRSPC), Begusarai, in collaboration with ATMA Begusarai, organized a "Farmer-Scientist Interaction Meet" for 46 farmers at the RMRSPC campus. The program, focused on "Prospective Commercial Maize Farming through Emerging Baby Corn, Sweet Corn, Popcorn, and Quality Protein Maize," and the event was chaired by Dr. Chikkappa G. Karjigi, Principal Scientist, with Dr. Alok Kumar Sahoo, Scientist, Agricultural Extension, and Sri Ajit Singh, Deputy Project Director, ATMA Begusarai. The session provided an opportunity for farmers to interact with experts, address farming challenges, and gain insights on cultivation techniques for various maize types, hybrid seed production, and integrated pest management.

## Training on Professional Maize Production and Processing

A training program on "Professional Maize Production and Processing" was held from 27-29th September, 2024 at the Vishnupur campus of the Regional Maize Research and Seed Production Center, Begusarai. The program, attended by 21 farmers from Sitamarhi district, was inaugurated by Dr. Alok Kumar Sahu and Dr. Shankar Lal Jat, who emphasized coordinated maize cultivation for increased production. Experts covered various aspects of maize farming, including weed control, hybrid varieties for animal fodder, and processing techniques for producing nutritious food products like biscuits, cakes, and baby corn. The training also focused on maize's potential in bioethanol production and the importance of scientifically managing maize farming for better yields.

## Training on Scientific Maize Cultivation for Higher Productivity in Bihar

ICAR-Indian Institute of Maize Research (IIMR), Ludhiana, in collaboration with ATMA, Khagaria, Bihar, organized a training program on "Scientific Maize Cultivation Practices for Enhancing Productivity and Income in Bihar" from 17-19th September, 2024, at PAMETI, Ludhiana. The program aimed to provide farmers with comprehensive knowledge on maize cultivation, covering topics such as hybrid selection, seed production techniques, nutrient management, mechanization, pest control, and post-harvest storage. Twenty-four farmers from Khagaria district actively participated, engaging in discussions and sharing knowledge. At the valedictory session, Dr. H.S. Jat, Director of ICAR-IIMR, emphasized collaboration to achieve the 20% Ethanol Blended Petrol target by 2025-26 and encouraged overcoming challenges in the maize sector through collective efforts.

## Field Day cum Training Program on Maize

ICAR-IIMR, Ludhiana organized a Field Day cum Training Program on 23rd October, 2024, in Machhiwada village, Punjab, under the project "Upscaling of Maize-Based Silage Value Chain in Punjab and Haryana." The event aimed to raise awareness about best practices for maize cultivation for silage production, introduce advanced silage technology and promote kharif maize to enhance feed security and support farmers' livelihoods. The event saw over 100 farmers participating in discussions, and the project, funded by the Ministry of Agriculture, supports the expansion of maize cultivation for silage across over 50 hectares in Punjab and Haryana.


## Enhancing Food, Nutrition, and Fuel Security through Scientific Maize Cultivation:

A training program on "Best Management Package for Food, Nutrition, and Fuel Security in Bihar" was organized by the Regional Maize Research & Seed Production Center, ICAR-IIMR, Begusarai, from 22-24th October, 2024, at Vishnupur, Begusarai. Twenty progressive farmers and consultants from multiple districts participated in the evnt. Experts from ICAR-IIMR provided insights on maize-based food processing, bio-ethanol production, and hybrid fodder varieties. Farmers were also introduced to the concept of Farmer Producer Organizations (FPOs) and natural farming techniques. The program was supported by BAMETI, Patna.


## Advancing Maize Silage Production for Sustainable Farming

On 25th October, 2024, ICAR- IIMR, Ludhiana, organized a field day cum Training Program in Bachhodi village, SBS Nagar, Punjab, under the project "Upscaling of Maize-Based Silage Value Chain in Punjab and Haryana." The event aimed to educate farmers on maize silage production, advanced technology, and the benefits of kharif maize for feed security and sustainability. Interactive sessions allowed farmers to engage directly with experts and the event witnessed active participation of 100 farmers in discussions and knowledge transfer.


## Training on Climate-Friendly Maize Production in Bihar

A three-day training program on "Climate-Friendly Maize Production Technology" was held from 27-29th October, 2024, at the Regional Maize Research and Seed Production Center, ICAR-IIMR, Begusarai, funded by BAMETI, Patna. Farmers and consultants from 11 districts of Bihar participated, discussing solutions to climate challenges such as floods, droughts, extreme temperatures, and soil fertility issues. Demonstrations on hybrid seed production were conducted at the Kushmahat campus, and farmers received training kits and certificates.


## Awareness on Farmer Rights and Seed Preservation Programme

One-day Farmer Rights Awareness Program was held at the Regional Maize Research and Seed Production Center, Begusarai, on 12th November, 2024. Forty farmers from eight districts of Bihar participated in the event, and learned about seed preservation, multiplication, and registration under PPVFR.

## Field Day cum Training Programme at Lallya Kallan (Vil.), Jalandhar

ICAR-IIMR, Ludhiana, organized a Field Day Cum Training Programme at Lallya Kallan Village, Jalandhar, on 13th November, 2024, under the project "Upscaling of Maize-Based Silage Value Chain in Punjab and Haryana." The event aimed to enhance farmers' knowledge of maize silage production, silage technology, and the promotion of kharif maize. Dr. Pardeep Kumar, Senior Scientist and Project PI, emphasized the role of maize in environmental sustainability and encouraged farmers to adopt kharif maize alongside spring maize. Over 100 farmers actively participated and engaged in discussions and knowledge exchange to advance maize-based silage practices.

## Training on Maize Value Addition for Entrepreneurship Development

ICAR-Indian Institute of Maize Research (ICAR-IIMR), Ludhiana, organized a residential training programme on "Entrepreneurship Development through Value Addition in Maize for Livelihood Security" from 7-9th November, 2024. The training was attended by eight participants and aimed at equipping them with skills and knowledge to enhance value addition in maize to foster entrepreneurship and ensure livelihood security. The programme was funded by Dharmapur Krishak Producer Company (KPC) Limited, Harjupur, Jaunpur, Uttar Pradesh, and sponsored by Yamdagnipuram Farmer Producer Company (FPC) Limited, Jaunpur, Uttar Pradesh. It was organized by the Agri-Business Incubation (ABI) Unit of ICAR-IIMR, Ludhiana.

## Field Day on Maize to Boost Ethanol Production at Abohar (Fazilka)

ICAR-IIMR, Ludhiana, in collaboration with KVK Fazilka, organized a "Field day on Maize" on 14th November, 2024, at Bazidpur Kattinwali village, Tehsil Abohar, District Fazilka, under "Enhancement of Maize Production in Catchment Areas of Ethanol Industries" project. During event, experts disseminated knowledge on advanced maize farming techniques, including mechanized cultivation, zero tillage, and aflatoxin-free maize production for bioethanol and poultry feed. The event marked a key step toward enhancing maize production for ethanol and sustainable agriculture.

## Participation in Global Soils Conference

ICAR-IIMR, Ludhiana participated and showcased the institute's technologies at "Global Soils Conference", organised at NASC Complex, New Delhi from 19-22nd November, 2024. Various researchers and farmers visited and interacted the stall to gather maize technology-based information.


## Field Day on Maize to Boost Ethanol Production at Ajnala (Amritsar)

ICAR-IIMR, Ludhiana, in collaboration with KVK Amritsar, the RGR initiative, and the Department of Agriculture, organized a "Field Day on Maize" on 28th November, 2024, at Village Awan, Ajnala Tehsil, Amritsar District. The event was conducted under the project "Enhancement of Maize Production in Catchment Areas of Ethanol Industries" and funded by the Ministry of Agriculture and Farmers' Welfare, aimed to boost maize production and empower farmers with essential knowledge. Experts emphasized maize's role in India's ethanol production targets, environmental sustainability, and local economic growth. Over 100 farmers took active participation the event

offered valuable insights on cultivation practices and Promising regions like Amritsar, Gurdaspur, and Pathankot were identified as key clusters for expanding maize cultivation.

## Field Day on Maize to Boost Ethanol Production at Moga (Ludhiana)

ICAR- IIMR, Ludhiana; KVK, Moga; IFFCO; and Grant Thornton, collectively organized a field day on 12th December, 2024 at village Kokri Kalan, Moga district (Punjab) for promotion of maize crop under the project "Enhancement of Maize Production in Catchment Areas of Ethanol Industries" The event provided a platform for direct interaction between farmers and experts, addressing farmers queries and fostering a collaborative learning environment. The enthusiastic participation of over 100 farmers demonstrated the programme's success and its potential to drive agricultural innovation in the region.

## Training programme on Value Addition

ICAR-IIMR, Ludhiana, organized two training program on Value Addition on 4th and 21st December, 2024 to the members of Farmer Producer Organizations (FPOs) at Barundi Village, Pakhowal, Ludhiana. The event was organized in collaboration with Grant Thornton and the event witnessed enthusiastic participation of 50 women. The training aimed to empower participants with skills and knowledge related to maize-based value addition, emphasizing opportunities in processing, product diversification, and income generation through innovative maize products.

## Training programmes on value addition in maize

ICAR-IIMR, Ludhiana, conducted three training programs entitled "Bio-fortified Maize Innovations: Bridging Nutrition and Economic Opportunities," under the DBT Biotech-Kisan project on 4th, 21st and 23rd December, 2024. The first training was held at Vil. Barundi, Pakhowal, Ludhiana, in collaboration with Grant Thornton, engaged 50 women from Farmer Producer Organizations (FPOs). Second training was organized at Vil. Mehatpur, Una district, Himachal Pradesh, benefiting 70 participants, while the third training conducted at Vil. Latala, Ludhiana involving 36 participants. All these trainings equipped the participants with skills in maize processing, product diversification, and income generation. These initiatives emphasized capacity building, rural empowerment, and the potential of maize in enhancing nutrition and economic growth.

**Training at Barundi (Vill)
Ludhiana**

**Training at Mehatpur (Vill)
Himachal Pradesh**

**Training at Latala (Vill)
Ludhiana**

## STUDENT'S EXPOSURE VISITS TO ICAR-IIMR, LUDHIANA

On 27th September 2024, 58 final-year B.Sc. (Agriculture) students from the University of Agricultural & Horticultural Sciences, Shivamogga, Karnataka, visited ICAR-IIMR, Ludhiana. The exposure visit provided the students with insights into the institute's research and maize cultivation practices. The visit aimed to enhance their practical knowledge and understanding of agricultural advancements in maize research.

On 12th July 2024, ICAR-IIMR, Ludhiana hosted students for exposure visits under the SERB project. The visit offered the students a valuable opportunity to learn about the latest agricultural research and innovations. It was an engaging experience that allowed them to interact with experts and gain practical insights into agricultural advancements.


## हिंदी पखवाडा 2024

राजभाषा विभाग, गृह मंत्रालय, भारत सरकार के नीतिगत निर्देशों के अनुरूप, भारतीय मक्का अनुसंधान संस्थान, लुधियाना की राजभाषा कार्यान्वयन समिति द्वारा प्रतिवर्ष आयोजित होने वाली हिंदी प्रचार–प्रसार गतिविधियों की श्रृंखला में इस वर्ष भी दिनांक 13 से 27 सितम्बर, 2024 तक 'हिंदी पखवाड़ा 2024' का सफल आयोजन किया गया। यह आयोजन संस्थान मुख्यालय सहित इसके क्षेत्रीय केंद्रों में ऑफलाइन एवं ऑनलाइन दोनों माध्यमों से सम्पन्न हुआ। हिंदी पखवाड़ा का शुभारंभ 13 सितम्बर को संस्थान के निदेशक डॉ. एच. एस. जाट की गरिमामयी उपस्थिति में हुआ। हिंदी पखवाड़ा के उद्घाटन अवसर पर संस्थान के निदेशक महोदय ने सभी अधिकारियों एवं कर्मचारियों को हिंदी दिवस की हार्दिक शुभकामनाएं और अपने संबोधन में हिंदी भाषा के महत्व पर प्रकाश डाला। उन्होंने कहा कि हिंदी केवल राजभाषा नहीं, बल्कि हमारे प्रशासनिक दायित्वों की प्रभावी अभिव्यक्ति का माध्यम भी है। निदेशक महोदय ने सभी कर्मचारियों से आग्रह किया कि वे कार्यालयीन कार्यों में अधिक से अधिक हिंदी का प्रयोग सुनिश्चित करें तथा सरकार द्वारा समय–समय पर जारी राजभाषा संबंधी निर्देशों एवं आदेशों का पालन पूरी निष्ठा से करें। उन्होंने यह भी कहा कि वर्ष भर आयोजित होने वाले हिंदी से संबंधित कार्यक्रमों में सक्रिय भागीदारी के माध्यम से हम न केवल भाषा के प्रचार–प्रसार में योगदान दे सकते हैं, बल्कि आमजन को इसकी महत्ता और उपयोगिता के प्रति भी जागरूक बना सकते हैं।

इस वर्ष हिंदी पखवाड़ा के अंतर्गत कुल छह प्रतियोगिताओंकृहिंदी टिप्पण एवं प्रारूप लेखन, आशुभाषण, हिंदी निबंध लेखन, हिंदी काव्य पाठ, प्रश्नोत्तरी, तथा हिंदी सुलेख, अनुलेख एवं श्रुतलेखकृका आयोजन ऑफलाइन एवं ऑनलाइन माध्यमों से सफलतापूर्वक किया गया। इन प्रतियोगिताओं में संस्थान के वैज्ञानिक, तकनीकी, प्रशासनिक कर्मचारी तथा आरए, एसआरएफ, जेआरएफ, वाईपी सहित अन्य संविदा कार्मिकों ने अत्यंत उत्साह एवं सक्रिय भागीदारी के साथ सहभागिता की। हिंदी पखवाड़ा का समापन समारोह दिनांक 01 अक्टूबर, 2024 को आयोजित किया गया, जिसमें आकाशवाणी, लुधियाना के सेवा–निवृत्त कार्यक्रम प्रमुख श्री नवदीप सिंह ने मुख्य अतिथि के रूप में उपस्थित होकर कार्यक्रम की गरिमा को बढ़ाया।

हिंदी पखवाड़ा 2024 के समापन समारोह में मुख्य अतिथि श्री नवदीप सिंह, कार्यक्रम प्रमुख (सेवानिवृत्त), आकाशवाणी लुधियाना ने अपने संबोधन में राजभाषा हिंदी के महत्व पर प्रकाश डालते हुए कहा कि हिंदी मात्र अभिव्यक्ति का माध्यम नहीं, बल्कि हमारी सांस्कृतिक पहचान, भावनात्मक एकता और राष्ट्र की आत्मा है। उन्होंने कहा कि हिंदी ने विभिन्न भाषाई और सांस्कृतिक विविधताओं को जोड़ने का कार्य किया है तथा यह संपूर्ण देश में संवाद और समरसता का सेतु है।

मुख्य अतिथि महोदय ने यह भी उल्लेख किया कि वैश्वीकरण के इस युग में जब अनेक भाषाएं विलुप्त होने की कगार पर हैं, ऐसे में हिंदी जैसी समृद्ध और व्यापक भाषा को सशक्त बनाना हम सभी की सामूहिक जिम्मेदारी है। उन्होंने संस्थान में हिंदी पखवाड़ा जैसे आयोजनों को सराहनीय पहल बताया और कहा कि इस प्रकार की गतिविधियाँ न केवल भाषा के प्रति जागरूकता बढ़ाती हैं, बल्कि सरकारी कार्यों में राजभाषा के प्रभावी उपयोग को भी प्रोत्साहित करती हैं। अंत में उन्होंने प्रतिभागियों की सक्रिय सहभागिता की सराहना की और सभी को हिंदी के प्रचार–प्रसार में निरंतर योगदान देने के लिए प्रेरित किया।

हिंदी पखवाड़ा 2024 के अवसर पर भारतीय मक्का अनुसंधान संस्थान, लुधियाना के निदेशक डॉ. एच. एस. जाट ने अपने उद्बोधन में राजभाषा हिंदी के महत्व को रेखांकित करते हुए कहा कि हिंदी केवल एक भाषा नहीं, बल्कि यह हमारी राष्ट्रीय एकता, सांस्कृतिक विरासत और भावनात्मक समरसता की सशक्त अभिव्यक्ति है। उन्होंने कहा कि प्रशासनिक और वैज्ञानिक कार्यों में हिंदी के प्रयोग से कार्य की सहजता, पारदर्शिता और जनसामान्य से जुड़ाव को बल मिलता है।

निदेशक महोदय ने यह भी उल्लेख किया कि तकनीकी संस्थानों में हिंदी के प्रभावी प्रयोग से शोध और नवाचार जनसामान्य तक सरल भाषा में पहुँचते हैं, जिससे विज्ञान एवं कृषि क्षेत्र में व्यापक जागरूकता और भागीदारी संभव हो पाती है। उन्होंने सभी अधिकारियों, वैज्ञानिकों, तकनीकी व प्रशासनिक कर्मियों को प्रेरित किया कि वे अपने दैनिक कार्यों में अधिक से अधिक हिंदी का प्रयोग करें और इसे कार्य संस्कृति का अभिन्न हिस्सा बनाएं।

उन्होंने संस्थान में हिंदी पखवाड़ा के आयोजन को न केवल राजभाषा नीति के अनुपालन का माध्यम, बल्कि भाषाई गर्व और प्रेरणा का उत्सव बताया। अंत में, उन्होंने सभी प्रतिभागियों और आयोजन समिति को सफल आयोजन हेतु बधाई दी तथा हिंदी भाषा को कार्यशील, जीवंत और प्रभावी बनाए रखने हेतु निरंतर प्रयास करने का आह्वान किया।

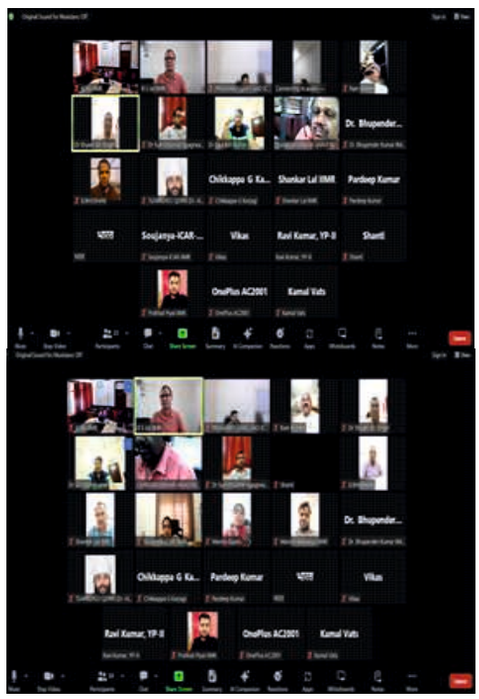
हिंदी पखवाड़ा 2024 के अंतर्गत आयोजित सभी प्रतियोगिताओं का समन्वय एवं समापन समारोह का सफल संचालन राजभाषा प्रभारी डॉ. बहादुर सिंह जाट द्वारा संस्थान के निदेशक डॉ. एच. एस. जाट के मार्गदर्शन में किया गया। उनके कुशल संयोजन एवं नेतृत्व में कार्यक्रम की सभी गतिविधियाँ सुचारु रूप से सम्पन्न हुईं।



**भारतीय मक्का अनुसंधान संस्थान में आयोजित हिंदी पखवाड़ा की झलकियाँ**

## हन्दी कार्यशाला

संस्थान द्वारा हिंदी को राजभाषा के रूप में बढ़ावा देने और सरकार की आधिकारिक भाषा नीति की अनुपालना हेतु, भारतीय मक्का अनुसंधान संस्थान, लुधियाना द्वारा स्टाफ सदस्यों को प्रशिक्षित करने के लिए में वर्ष 2024 के दौरान ऑफलाइन एवं ऑनलाइन माध्यम से चार हिंदी कार्यशालाओं: संवैधानिक प्रावधान दृसरकारी कार्यालयों में हिंदी के उपयोग को बढ़ावा देने वाले संवैधानिक प्रावधानों को समझना (27 जून, 2024), हिंदी लेखन में शुद्धता एवं प्रभावशीलता (20 अगस्त, 2024), हिंदीः राजभाषा से जन भाषा की और (25 सितम्बर, 2024) एवं राजभाषा हिंदीः प्रशासनिक कार्यों में उपयोगिता (23 दिसंबर, 2024) विषयों पर आयोजित की गयी उपरोक्त कार्यशालाओं के दौरान संस्थान में 65 स्टाफ सदस्यों को प्रशिक्षित किया गया।



**भारतीय मक्का अनुसंधान संस्थान में आयोजित हिन्दी कार्यशाला की झलकियाँ**

## भा.कृ.अनु.प.–भारतीय मक्का अनुसंधान संस्थान में की गई अन्य राजभाषा कार्यान्वयन गतिविधियाँ

राजभाषा कार्यान्वयन समिति (ओएलआईसी) बैठकें: संस्थान में वर्ष 2024 के दौरान राजभाषा कार्यान्वयन समिति की तीन बैठकें (21 जून, 2024 ; 04 सितम्बर, 2024, 24 अक्टूबर, 2024) आयोजित की गयी।

राजभाषा हिंदी की त्रैमासिक प्रगति रिपोर्ट: राजभाषा हिन्दी के प्रगतिशील प्रयोग के संबंध में भा.कृ.अनु.प.–भारतीय मक्का अनुसंधान संस्थान की तिमाही प्रगति रिपोर्ट की सूचना राजभाषा विभाग, गृह मंत्रालय, भारत सरकार, नई दिल्ली, भारतीय कृषि अनुसंधान परिषद, नई दिल्ली और टॉलिक–लुधियाना को भेजी जा रही है ।

हिंदी संस्करण: भारतीय मक्का अनुसंधान संस्थान की वार्षिक रिपोर्ट 2023 एवं छः माही समाचार पत्र हिंदी में प्रकाशित किया गया ।

नराकास स्तर पर प्रतियोगिताओं में सहभागिता: संस्थान के अधिकारियों ध्कर्मचारियों ने वर्ष 2024 के दौरान नराकास स्तर पर आयोजित विभिन्न हिंदी प्रतियोगिताओं में भाग लिया।

# प्रशिक्षण और क्षमता निर्माण
# TRAINING AND CAPACITY BUILDING

8 Chapter

## A. Training and Capacity Building of ICAR Employees

### A 1. Under approved HRD Annual Training Plan (ATP) 2024

### A 1.1: Scientific

| वैज्ञानिक का नाम /Name of the Scientist | भाग लेने वाले प्रशिक्षण कार्यक्रम का नाम / Name of the training program attended | कार्यक्रम का स्थान /Venue | तारीख /Date |
|---|---|---|---|
| Seema Sepat | Current methodological for water footprint estimation and techniques for water saving | ICAR-IIWM, Bhubaneswar, Odisha (Online) | March 18-20, 2024 |
| Seema Sepat | Climate Smart Agricultural Practices for System Resilience in Cereal Based Cropping Systems | ICAR-CSSRI, Karnal | February 15- March 6, 2024 |
| Seema Sepat | Professional Attachment Training | Punjab Agricultural University, Ludhiana | October 10, 2023- January 4, 2024 |
| Shyam Bir Singh | Analysis of Experimental Data using R | ICAR-NAARM, Hyderabad | October 21-25, 2024 |
| | Orientation Training Programme for ICAR-ZTMCs/ITMU's | NAAS Complex, New Delhi | January 17-19, 2024 |
| Shanti Devi Bamboriya | Climate Smart Agricultural Practices for System Resilience in Cereal Based Cropping Systems | ICAR-CSSRI, Karnal | February 15- March 6, 2024 |
| Abhijit Das | Workshop on Generative AI tool for Agriculture | ICAR-NAARM, Hyderabad | June 26-28, 2024 |
| Alok Kumar Sahoo | Advances in Mobile Application Development | ICAR-NAARM, Hyderabad | August 5-9, 2024 |
| Alok Kumar Sahoo | Developing Simulation Model of Technology Diffusion( Tech SIM), Adoption & Impact for Forecasting Using Techno-Socio-Psycho-Economic-Ecological Factors | ICAR-NRRI, Cuttack | September 30- October 6, 2024 |
| Krishan Kumar | Hands-on training "Genome editing: Basic Principles and practices" | ICAR-IARI, Pusa New Delhi | December 2-6, 2024 |
| Mukesh Choudhary | ITU/FAO Workshop on "Cultivating tomorrow: Advancing digital agriculture through IoT and AI" | NASC, New Delhi | March 18-19, 2024 |
| N Sunil | Smart Digital Tools for Sustainable Agriculture | ICAR-CRIDA, Hyderabad | October 15-24, 2024 |
| Yathish K R | Workshop on Generative AI tool for Agriculture | ICAR-NAARM, Hyderabad | June 26-28, 2024 |

### A. 1.2: Others

| कर्मचारी का नाम /Name of the Staff | भाग लेने वाले प्रशिक्षण कार्यक्रम का नाम / Name of the training program attended | कार्यक्रम का स्थान /Venue | तारीख /Date |
|---|---|---|---|
| | | | |

### A 2.1 अन्य /Others

### A 2.1: वैज्ञानिक /Scientific

| वैज्ञानिक का नाम / Name of the Scientist | भाग लेने वाले प्रशिक्षण कार्यक्रम का नाम / Name of the training program attended | कार्यक्रम का स्थान /Venue | तारीख /Date |
|---|---|---|---|
| Deep Mohan Mahala | 21 Days Winter School on "Climate Smart Agricultural Practices for system Resilience in Cereal-Based Cropping Systems | ICAR-CSSRI, Karnal | February 15-March 6, 2024 |
| Deep Mohan Mahala | Online MOOC on "ArtificialIntelligence in Agriculture | ICAR-NAARM, Hyderabad | March 1-31, 2024 |
| Deep Mohan Mahala | Online training program on "**Cyber Crisis Management Plan (CCMP)**" organised by Indian Computer Emergency Response Team (CERT-In), | Ministry of Electronics and Information Technology | **December 20, 2024** |

### B. Trainings Organized

| Sl no | Name of Event/Activity | Date | Location | Organizing Team | Under Project/ scheme/ Institute activities | Type of programme | Total Participants | Women participants |
|---|---|---|---|---|---|---|---|---|
| 1 | Improving the livelihood of schedule caste farmers through improve maize technologies | February 12, 2024 | Mahesh Nagar, Barnala, Punjab | Pardeep Kumar, Ph Romen Sharma & Bharat Bhushan | SCSP | Training cum input distribution programme | 50 | 44 |
| 2 | Improving the livelihood of schedule caste farmers through improve maize technologies | February 22, 2024 | Kokri Kalan, Moga, Punjab District, Punjab | Pardeep Kumar, Ph Romen Sharma & Bharat Bhushan | SCSP | Training cum input distribution programme | 95 | 95 |
| 3 | Best Management Practices in Maize Cultivation and Entrepreneurship Development to Enhance Farmer Livelihoods in Koraput District, Odisha | February 26-28, 2024 | Jeypore district, Odisha | SL Jat, Ph Romen Sharma, Alok Kumar Sahoo, Parshuram Sial & Digbijiaya Swain | DMF Project | Training | 44 | 12 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 4 | Farmer awarness on Farmer's right under PPV&FR and training on scientific maize cultivation | March 3, 2024 | RMR&SPC, Begusarai | S B Singh | PVFRA | Training/Awareness programme | 35 | 24 |
| 5 | Improving the livelihood of schedule caste farmers through improve maize technologies | March 9, 2024 | Chokkar Village, Ludhiana, Punjab | Pardeep Kumar, Ph Romen Sharma & Bharat Bhushan | SCSP | Training cum input distribution programme | 50 | 39 |
| 6 | Promotion of Bio-fortified Maize for Entrepreneurship Development through Value Addition for Nutritional and Livelihood Security | March 18, 2024 | Mehndali village, Ropar, Punjab | SL Jat & Ph Romen Sharma | Biotech Kisan | Training | 100 | 100 |
| 7 | Promotion of Bio-fortified Maize for Entrepreneurship Development through Value Addition for Nutritional and Livelihood Security | March 19, 2024 | Bhotna Village, Barnala, Punjab | SL Jat & Ph Romen Sharma | Biotech Kisan | Training | 100 | 100 |
| 8 | Promotion of Bio-fortified Maize for Entrepreneurship Development through Value Addition for Nutritional and Livelihood Security | March 20, 2024 | Lapon Village, Moga District, Punjab | SL Jat & Ph Romen Sharma | Biotech Kisan | Training | 100 | 100 |
| 9 | Improving the Livelihood of Schedule Caste Farmers through Improve Maize Technologies | March 23, 2024 | Balliewa village, Ludhiana, Punjab | Pardeep Kumar, Ph Romen Sharma & Bharat Bhushan | SCSP | Training cum input distribution programme | 100 | 91 |
| 10 | Promotion of Bio-fortified Maize for Entrepreneurship Development through Value Addition for Nutritional and Livelihood Security | March 27, 2024 | ICAR-CIPHET, Ludhiana District, Punjab | SL Jat & Ph Romen Sharma | Biotech Kisan/ ABI | Training | 46 | 27 |
| 11 | Workshops on “Promotion of Climate resilient technologies of maize among the farmers of Punjab” | April 25, 2024 | Pahadpur, Ropar | MC Dagla, Ph. Romen Sharma, Deep Mohan Mahala, Pardeep Kumar | Institute actvities under Life | Workshop | 56 | 50 |

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| 12 | Workshops on "Promotion of Climate resilient technologies of maize among the farmers of Punjab | April 25, 2024 | Gehlewal, Machiwara Sahib, Ludhiana | MC Dagla, Ph. Romen Sharma, Deep Mohan Mahala, Pardeep Kumar | Institute actvities under Life | Workshop | 43 | 37 |
| 13 | Exposure visit of students of BFIT University, Dehradun | May 4, 2024 | Ladhowal Farm | Ph Romen | Institute activities | Exposure visit | 23 | 7 |
| 14 | Enhanching *Kharif* Maize yields: advanced production & post-harvest technologies among Koraput farmers | July 3-5, 2024 | Jeypore, Borigumma& High Altitude Research Station, OUAT, Pattangi, Odhisa | SL Jat, Ph Romen Sharma, Alok Kumar Sahoo, Parshuram Sial & Digbijiaya Swain | DMF Project | Training cum input distribution | 62 | 35 |
| 15 | Exposure visits of students from SardarVallabhbhai Patel University of Agriculture and Technology, Meerut for an educational tour the ICAR-IIMR | June 6, 2024 | ICAR-IIMR, Ladhowal farm | Ph Romen, MC Dagla | Institute Project | Exposure visit | 16 | 0 |
| 16 | Enhancement of Maize Production in Catchment Areas of Ethanol Industries | June 21, 2024 | Ludhiana | SL Jat, Ph Romen Sharma & BS Jat | Catchment area project | Stakeholder Meet | 86 | 27 |
| | Exposure visits of students under the SERB project | July 12, 2024 | ICAR-IIMR, Ludhiana | Abhijit Kumar Das | SERB project | Exposure visit | 25 | 12 |
| 17 | Best Management Practices for Cultivation and Processing of Maize in Odisha | August 12-14, 2024 | ICAR-IIMR, Ludhiana | Bhupender Kumar | Catchment area project | Farmers and Officers | 75 | 0 |
| 18 | Scientific Maize Cultivation and Seed Production for Enhancing Farmers' Income | August 28-30, 2024 | ICAR-CIPHET, Ludhiana | SL Jat, Bhupender Kumar, Ph Romen Sharma , BS Jat& Deep Mohan Mahala | Catchment area project | Training | 25 | 0 |
| 19 | ''बिहार में मक्का में उच्च उत्पादकता और आय के लिए सर्वोत्तम प्रबंधन पद्धतियाँ प्रशिक्षण | September 3-5, 2024 | RMR&SPC, Begusarai | H. S. Jat , Chikkappa G. Karjagi, Bhupender Kumar, Ph. Romen & Alok Kumar Sahoo | ATMA funded | Training | 22 | 0 |

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| 20 | ‘‘मक्का खाद्यउत्पादन चारा, ईधन और उभरते खाद्य उत्पादों के रूप मक्का | September 10, 2024 | RMR&SPC, Begusarai | H. S. Jat, Chikkappa G. Karjagi, S. L. Jat, . Ph. Romen & Alok Kumar Sahoo, | ATMA funded | Training | 24 | 0 |
| 21 | Scientific Maize Cultivation Practices for Enhancing Productivity and Income in Bihar | September 17-19, 2024 | PAMETI, Ludhiana | HS Jat, MC Dagla, Ph Romen, Deep Mohan Mahala, Alok Kumar Sahoo | ATMA funded | Training | 25 | 0 |
| 22 | Farmers scientist interaction meet | September 20, 2024 | ICAR-IIMR, Begusarai | Chikkappa G. Karjagi & Alok Kumar Sahoo, | ATMA funded | Training /Farmers scientist interaction meet | 46 | |
| 23 | Scientific Maize Cultivation Practices for Enhancing Productivity and Income in Bihar” | September 23-25, 2024 | PAMETI, Ludhiana | Ramesh Kumar, MC Dagla, Ph Romen Sharma, Alok Kumar Sahoo, Deep Mohan Mahala | ATMA funded | Training | 21 | 3 |
| 24 | Exposure visit of B. Sc. Ag. Final Year from University of Agricultural & Horticultural Sciences, Shivamogga, Karnataka | September 27, 2024 | ICAR-IIMR, Ludhiana | Ph Romen Sharma | Insitute actvity | Exposure vist | 56 | 27 |
| 25 | ‘‘व्यावसायिक मक्का उत्पादन एवं प्रसंस्करण / Commercial maize Production & Processing in Bihar | September 27-29, 2024 | RMR&SPC, Begusarai | H S Jat , Chikkappa G Karjagi, Bhupender Kumar, Ph. Romen & Alok Kumar Sahoo, | ATMA funded | Training | 21 | 0 |
| 26 | Exposure visits organized for experts of Indo Maize and Millet Development Association, Puneon | October 18, 2024 | Pune, Maharashtra | Ph Romen Sharma & MC Dagla | Insitute actvity | Exposure Visit | 10 | 1 |
| 27 | Organized field day on maize under the “Enhancement of maize production in Catchment area of Ethanol Industries” | October 18, 2024 | Uttar Pradesh | SL Jat, Ph Romen Sharma & BS Jat | Catchment area project | Training | 100 | 0 |

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|---|---|---|---|---|---|---|---|---|
| | Field Day cum Training Program under silage Project | October 23, 2024 | Machhiwada Village, Ludhiana | Pardeep Kumar, B S Jat, Ph. Romen Sharma, Alla Singh & Deep Mohan Mahala | Silage Project | Training/Field day | 114 | 82 |
| 28 | Field Day cum Training Program under silage Project | October 25, 2024 | Bachhuari , SBS Nagar | Pardeep Kumar BS Jat & Ph. Romen Sharma | Silage Project | Training/Field day | 100 | 0 |
| 29 | जलवायु अनुकूल मक्का उत्पादन प्रौद्योगिकीया | October 27-29, 2024 | RMR&SPC, Begusarai | Chikkappa G. Karjagi, S. L. Jat, Manesh Chandra Dagla & Alok Kumar Sahoo, | ATMA funded | Training | 24 | 0 |
| 30 | Awareness training cum Maize Seed Distribution Programme | November 7, 2024 | Telangana | SL Jat, Ph Romen Sharma | Catchment area project | Training | 100 | 32 |
| 31 | Entrepreneurship Development through Value Addition in Maize for Livelihood Security | November 7-9, 2024 | ICAR-IIMR, Ludhiana | SL Jat, Ph Romen Sharma & Bhpuender Kumar | ATMA funded | Training | 9 | 8 |
| 32 | दिन दिवसीय किसान अधिकार सचेतनताकार्यक्रम | November 12, 2024 | RMR&SPC, Begusarai | Chikkappa G. Karjagi, Seema Sepat & Alok Kumar Sahoo, | ATMA funded | Training | 40 | 0 |
| 33 | Field Day Cum Training Programme silage technology, and the promotion of kharif maize. | November 13, 2024 | Lallya Kallan Village, Jalandhar, Punjab | Pardeep Kumar, B S Jat, Ph. Romen Sharma, Alla Singh & Deep Mohan Mahala | Silage Project | Field day | 100 | 0 |
| 34 | Field Day on Maize Programme | November 14, 2024 | Bazidpur Kattinwali, Abohar, Fazilka | SL Jat, Ph Romen Sharma & BS Jat | Catchment area project | Field day | 100 | 0 |
| 35 | Field Day on Maize Programme | November 28, 2024, | Village Awan, Ajnala Tehsil, Amritsar District. | SL Jat, Ph Romen Sharma & BS Jat | Catchment area project | Field Day on Maize Programme | 100 | 4 |
| 36 | Entrepreneurship development through Value addition in maize | December 4, 2024 | Barundi Village, Pakhowal, Ludhiana | MC Dagla, Ph. Romen Sharma & Mamta Gupta | ABI | Training | 55 | 55 |
| 37 | Field Day on Maize Programme | December 12, 2024 | Kokri Kalan, Moga district | SL Jat, Ph Romen Sharma & BS Jat | Catchment area project | Field day | 100 | 56 |
| 38 | Bio-fortified Maize Innovations: Bridging Nutrition and Economic Opportunities | December 21, 2024 | Mehatpur, Una, Himachal Pradesh | SL Jat & Ph Romen Sharma | DBT Biotech Kisan | Training | 70 | 43 |
| 39 | Value addition on maize for Entrepreneurship Development | December 23 , 2024. | Latala village, Ludhiana | MC Dagla, Ph. Romen Sharma & Mamta Gupta | ABI | Training | 36 | 36 |

## C. Participation in conferences/Seminar/Workshop/Important meetings

| Name of the Scientist | Name of conferences /Seminar /Workshop / Important meetings attended | Venue | Date |
|---|---|---|---|
| All Scientist of ICAR-IIMR | Maize: A Crop for Food, Feed, Nutritional and Bioenergy Security with Environmental Sustainability' | ICAR-IIMR, PAU Campus, Ludhiana | August 23-25, 2024 |
| Bhupender Kumar | Workshop Maize for North East Hill Region: Challenges and Opportunities | Central Agricultural University (CAU), Imphal | March 11-12, 2024 |
| Deep Mohan Mahala | Workshop on "Cultivating tomorrow: Advancing digital agriculture through IoT and AI" organised by International Telecommunication Union; FAO; ICAR, DoT; DARE | NASC Complex, New Delhi | March 18, 2024 |
| Deep Mohan Mahala | Webinar on API SETU: Enabling Seamless Digital Integration | Ministry of Electronics and Information Technology | November 12, 2024 |
| Deep Mohan Mahala | Global Soils Conference 2024 Caring Soils Beyond Food Security: Climate Change Mitigation & Ecosystem Services;; Venue: by Indian Society of Soil Science | NASC Complex, New Delhi | November , 19-22 2024 |
| Deep Mohan Mahala | Focus group on Artificial Intelligence (AI) and Internet of Things (IoT) for Digital Agriculture" (FG-AI4A) by International Telecommunication Union; FAO; ICAR, DoT; DARE | NASC Complex, New Delhi | March 19, 2024 |
| B. S. Jat | Global Soils Conference 2024 Caring Soils Beyond Food Security: Climate Change Mitigation & Ecosystem Services;; Venue: by Indian Society of Soil Science | NASC Complex, New Delhi | November , 19-22 2024 |
| B. S. Jat | Attended 39th Annual group meeting of AICRP on Seeds (Crops) organised by ICAR- IISS, MAU | University of Agricultural Sciences, Bangalore | May 2-3, 2024 |
| बी. एस. जाट | नगर राजभाषा कार्यान्वयन समिति, लुधियाना की 86वीं बैठक | आयकर भवन, लुधियाना | 30 जनवरी, 2024 |
| बी. एस. जाट | नगर राजभाषा कार्यान्वयन समिति, लुधियाना की 86वीं बैठक | आयकर भवन, लुधियाना (ऑनलाइन) | 28 अगस्त, 2024 |

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|---|---|---|---|
| P.Lakshmi Soujanya | Attended 20th International Plant Protection Congress-Healthy plants support human welfare organized by International Association for Plant Protection Sciences in collaboration with Hellenic Society of Phytiatry and Agricultural University of Athens and gave oral presentation on "The potential of intercrops against fall armyworm Spodoptera frugiperda (J.E.Smith) on maize under field conditions in India | Athens, Greece | July 1-5, 2024 |
| Manesh Chander Dagla | Strategy Workshop on Maize to Ethanol in India: Prospects and Strategies | Online | April 1, 2024 |
| Manesh Chander Dagla | Meeting on Ecoregional Working Group Programme | Online | April 12, 2024 |
| Manesh Chander Dagla | Meeting on Viksit Bharat | Online | April 16, 2024 |
| Manesh Chander Dagla | Public-Private-Partnership Workshop cum Interaction Meet | ICAR-IIOR, Hyderabad | November 28, 2024 |
| Yathish K R | Public-Private-Partnership Workshop cum Interaction Meet | ICAR-IIOR, Hyderabad | November 28, 2024 |
| Shyam Bir Singh | Attended IXth International Conference on Global Research Initiatives for Sustainable Agriculture & Allied Sciences (GRISAAS-2023) on December 10-12, 2024 at SKNAU-RARI, Durgapura, Jaipur, Rajasthan, India | SKNAU-RARI, Durgapura, Jaipur, | December 10-12, 2024 |
| Shyam Bir Singh | Attended National Conference on Maize: A Crop for Food, Feed, Nutritional and Bioenergy Security with Environmental Sustainability | ICAR-IIMR, Ludhiana | August 23-25, 2024 |
| Shyam Bir Singh | Attended online International Conference on Innovative and Current Advances in Agriculture and Allied Sciences (ICAAAS-2024) | Online | July 10-15, 2024 |
| Shyam Bir Singh | Attended (Online) HTMA Project Meeting Country Report presentation on Annual Review | Online | July 25, 2024 |
| Shyam Bir Singh | Attended (Online) HTMA Project Annual Review Meeting held Bhairawa Nepal | Online | August 20-21, 2024 |
| Shyam Bir Singh | Attended a Special meeting at District collector office Rudrapur regarding hybrids and technologies for summer maize cultivation for replacement of summer rice crop | Rudrapur | May 16, 2024 |

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|---|---|---|---|
| Ramesh Kumar | Attended (Online) HTMA Project Meeting Country Report presentation on Annual Review | Online | July 25, 2024 |
| Ramesh Kumar | Attended (Online) HTMA Project Annual Review Meeting held Bhairawa Nepal | Online | August 20-21, 2024 |
| Dr. H. S. Jat | Workshop on Increasing Maize Production at Hall No. 1, NASC Complex, Pusa, New Delhi under the chairmanship of Prof. Ramesh Chand Member (NITI) Aayog) and give presentation on maize in workshop | NASC Complex, Pusa, New Delhi | January 24, 2024 |
| | Attended the International Salinity Conference as Co-Chairman on "Rejuvenating Salt Affected Ecologies for Land Degradation Neutrality under Changing Climate" at ICAR-CSSRI, Karnal | ICAR-CSSRI, Karnal | February 15, 2024 |
| | Attended the meeting of "Knowledge Secretariat" on "Mukhyamantri Maka Mission" under the Chairmanship of Principal Secretary, Department of Agriculture & Farners Empowerment. | Bhubaneswar | February 20, 2024 |
| | Attended the 55th meeting of the BoG, IISER, Mohali | IISER, Mohali | February 23, 2024 |
| | Attended the Annual Conference of Vice Chancellors and ICAR Directors at NASC Complex, New Delhi | NASC Complex, Pusa, New Delhi | February 26-27, 2024 |
| | Attended the Maize germplasm field day at Winter Nurser Centre, Hyderabad | Hyderabad | March 5, 2024 |
| | Attended the IMIC-Asia III field day by CIMMYT at ICRISAT, Hyderabad | Hyderabad | March 6, 2024 |
| | Organized workshop on "Maize for North east hill region: Challenges and opportunities" at College of Agriculture, CAU, IMPHAL, | Imphal | March 11-12, 2024 |
| | Attended the 67th Annual Maize Workshop to be held at PJTSAU, Hyderabad | Hyderabad | May 8-10, 2024 |
| | Interacted with Dr. Anand Kumar Singh Vioce-Chancellor C.S. Azad University of Agriculture & Technology, Kanpur and interact with farmers of district Kasganj, Kannauj, Aligarh, Kanpur and others for maize cultivation. | Kasganj, Kannauj, Aligarh, Kanpur | June 19, 2024 |
| | Visited the Karnal to attend the Syngeta TechFest | Karnal | September 2, 2024 |
| | Attended the round table discussion under Chattam House rules hosted by Byer to discuss resilient and sustainable corn ecosystem in India & enhance farmer yield and income | Delhi | September 9, 2024 |

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| | Training on “Maize as food, fodder, fuel and emerging”Sponsored by BAMETI, Government of Bihar, Organized by ICAR-IIMR, Regional Station RMR & SPC | Begusarai | September 10-12, 2024 |
| | Training on “Scientific Maize cultivation Practices for Enhancing Productivity and Income in Bihar”. Sponsored by ATMA-Khagaria, Bihar, Organized by ICAR-IIMR, Regional Station RMR & SPC, Begusarai | Begusarai | September 17-19, 2024 |
| | Attended the meeting with the representative of Corteva Agrisciences Seeds Pvt Ltd and signed MoU with them for pre harvest and post-harvest technology dissemination, training and capacity building for the promotion of maize and maize based value chain in the country. | New Delhi | September 26, 2024 |
| | Training on “Commercial Maize Production & amp; Processing”.Sponsored by ATMA-Sitamarhi, Bihar, Organized by ICAR-IIMR, Regional Station RMR & SPC, Begusarai | Begusarai | September 27-29, 2024 |
| | Attended the meeting on “Committee for research and development of water efficient crop cultivars” at Directors Board room, IARI, New Delhi | IARI, New Delhi | October 24, 2024 |
| | Attended the IMICA-Asia Technical Steering committee Meeting at CIMMYT office, ICRISAT campus Hyderabad | Hyderabad | November 8, 2024 |
| | To organize one day workshop cum interaction meet on “Licensing of Public Sector Maize Hybrids to private partners involved in Maize Hybrid Seed Production” & inauguration of AICRP cell and Entomology Lab at WNC, Hyderabad | Hyderabad | November 28, 2024 |
| | Attended workshop on Long Term Experiments (LTEs) in India, jointly hosted by Dr SK Chaudhari, ICAR DDG-NRM and CIMMYT India | New Delhi | December 19, 2024 |

## D. Organization/Particiaption of Kisan mela/Kishan Goshthi/Exhibition/Field day

| Name of the Scientist | Programme | Venue | Date |
|---|---|---|---|
| Bhupender Kumar | Field visit Jalandhar | Jalandhar, Punjab | Novenber 13, 2024 |
| Bhupender Kumar | Maize for North East Hill Region: Challenges and Opportunities | Central Agricultural University (CAU), Imphal | March 11-12, 2024 |

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| B. S.Jat, Deep Mohan Mahala, S.L.Jat, Bhupender Kumar & Ramniwas Bagaria | Exibition of Institutes Technologies in Global Soils Conference 2024 Caring Soils Beyond Food Security: Climate Change Mitigation & Ecosystem Services by Indian Society of Soil Science | NASC Complex, New Delhi | November , 19-22 2024 |
| Ph. Romen Sharma, S B Singh, Seema Sepat, MC Dagla, Mukesh Choudhary, Mamta Gupta, Shanti Devi Bamboriya, AK Singh, BS Jat, Pravin Bagaria Deep Mohan Mahala & Abhijit K Das | Exibition of Institutes Technologies in PAU Kisan Mela 2024 | Punjab agricultural University, Ludhiana | September 13-14, 2024 |
| Ph Romen Sharma, SB Singh, Seema Sepat, Alla Singh , Mukesh Choudhary, Mamta Gupta, BS Jat, Abhijit K Das, Pravin Bagaria , M C Dagla, Pardeep Kumar& Deep Mohan Mahala, | Exibition of Institutes Technologies in ICAR-CIPHET IIFA 2024 and Food processing Fair | ICAR-CIPHET , Ludhiana | October3-5, 2024 |

## E. Courses Attended on iGoT Karmayogi

| कर्मचारी का नाम /Name of the Staff | पदनाम Designation | भाग लेने वाले प्रशिक्षण कार्यक्रम का नाम / Name of the training program attended | कार्यक्रम का स्थान /Venue |
|---|---|---|---|
| Ajay Kumar Tandon | Finance and Accounts Officer | Yoga Break at Workplace | Online |
| Bharat Bhushan | Senior Scientist | Rajbhasha Hindi | Online |
| Bharat Bhushan | Senior Scientist | Green Revolution to Amrit Kaal | Online |
| Deep Mohan Mahala | Scientist | Code of Conduct for Government Employees | Online |
| Manesh Chander Dagla | Senior Scientist | Yoga Break at Workplace | Online |
| Manesh Chander Dagla | Senior Scientist | Stress Management | Online |
| Manesh Chander Dagla | Senior Scientist | Code of Conduct for Government Employees | Online |
| Manesh Chander Dagla | Senior Scientist | Introduction to E-Office | Online |
| Ravi Kumar | Technician | Code of Conduct for Government Employees | Online |
| Shyam Bir Singh | Principal Scientist | Critical Thinking | Online |
| Yathish K R | Scientist | Decision Making | Online |
| Yathish K R | Scientist | Yoga Break at Workplace | Online |

## Deputation

| Name of the Scientist | On Deputation | Venue | Date |
|---|---|---|---|
| Dr. H. S. Jat | Attended "CGIAR SI-MFS Stakeholder's Consultation and policy workshop on Enabling usstainabel transitioning of farming systems for resilience and food security in Malawi" Jointly organized by ICRISAT, Alliance Bioversity-CIAT,IITA, CIMMYT | Malawi | December 11, 2024 |

# SIGNIFICANT AWARDS AND RECOGNITIONS

9 Chapter

| Name of the Scientist | Name of Award | Society/Organization | Date |
|---|---|---|---|
| S B Singh | Scientist of the Year Award in the discipline of Genetics and plant breeding | The Society for Scientific Development in Agriculture and Technology on the occasion of IX$^{th}$ International Conference on Global Research Initiatives for Sustainable Agriculture & Allied Sciences (GRISAAS-2023) at SKNAU-RARI, Durgapura, Jaipur, Rajasthan, India | December 10-12, 2024 |
| Sunil Neelam | Certificate of Appreciation" for AICRP Trial Formulation | 10$^{th}$ Foundation Day of ICAR-Indian Institute of Maize Research, Ludhiana | February 9, 2024 |
| Sunil Neelam | Best Poster Award for the paper presented on " Evaluation of pipile in maize hybrids responses to elevated C02 levels-Studies with OTCs | National Conference on " Maize : A Crop for Food, Fee, Nutritional and Bioenergy Security with Environmental Sustainability held at Ludhiana | August 23-25, 2024 |
| Sunil Neelam | Best oral presentation award for the paper on" Quantifying maize GDD for efficient cropping system planning and enhancing system productivity | National Conference on " Maize : A Crop for Food, Fee, Nutritional and Bioenergy Security with Environmental Sustainability held at Ludhiana | August 23-25, 2024 |
| P.Lakshmi Soujanya | Fellow of Maize Technologist Association of India (MTAI) 2024 | National Conference on " Maize : A Crop for Food, Fee, Nutritional and Bioenergy Security with Environmental Sustainability held at Ludhiana | August 23-25, 2024 |
| P.Lakshmi Soujanya | Best research paper award titled “Role of morphological traits and cell wall components in imparting resistance to pink stem borer, *Sesamia inferens* Walker in maize published in Frontiers in Plant Science Journal | 10$^{th}$ Foundation Day of ICAR-Indian Institute of Maize Research, Ludhiana | February 9, 2024 |
| Bhupender Kumar | Fellow of Indian Society of Genetics and Plant Breeding (ISGPB) award 2023 | Indian Society of Genetics and Plant Breeding | August 7, 2024 |

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|---|---|---|---|
| Bhupender Kumar | Fellow of Maize Technologist Association of India (MTAI) 2024 | National Conference on " Maize : A Crop for Food, Fee, Nutritional and Bioenergy Security with Environmental Sustainability held at Ludhiana | August 23-25, 2024 |
| Bhupender Kumar | Best poster presentation awards | National Conference on " Maize : A Crop for Food, Fee, Nutritional and Bioenergy Security with Environmental Sustainability held at Ludhiana | August 23-25, 2024 |
| Bhupender Kumar | Best oral presentation awards | National Conference on " Maize : A Crop for Food, Fee, Nutritional and Bioenergy Security with Environmental Sustainability held at Ludhiana | August 23-25, 2024 |
| Bhupender Kumar | Life time Achievement Award for outstanding contribution in Maize Improvement | The Executive Council of Hindustan Agricultural Welfare Society in a 5th International conference | July 24-25, 2024 |
| Bhupender Kumar | Certificate of Appreciation for delivering invited talk on, title "Statistical tools for plant breeding and biotechnology Research in Training | Indian Society of Agronomy (ISA), Div. of Agronomy, ICAR-IARI New Delhi. | August 29, 2024 |
| Pravin Kumar Bagaria | ''जैविक खेतीः मृदा स्वास्थ्य हेतु एक विकल्प'' शीर्षक वाले हिंदी लेख के लिए प्रशंसा पत्र | गेहुं एवम जौ स्वरिन्मा – 14वाँ अंक में प्रकाशित | February 9, 2024 |
| Ramesh Kumar | Dr. Joginder Singh Memorial Best Scientist Award (2024) | Maize Technologists Association of India (MTAI), National Conference on " Maize : A Crop for Food, Fee, Nutritional and Bioenergy Security with Environmental Sustainability held at Ludhiana | August 23-25, 2024 |
| Krishan Kumar | Best paper award for the paper "Genome editing for banded leaf and sheath blight resistance in Indian maize genotypes | Maize Technologists Association of India (MTAI), National Conference on " Maize : A Crop for Food, Fee, Nutritional and Bioenergy Security with Environmental Sustainability held at Ludhiana | August 23-25, 2024 |

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|---|---|---|---|
| Krishan Kumar | Best poster award for the poster entitled "Evaluation of RILs for callus induction and regeneration using nodal explants | Maize Technologists Association of India (MTAI), National Conference on " Maize : A Crop for Food, Fee, Nutritional and Bioenergy Security with Environmental Sustainability held at Ludhiana | August 23-25, 2024 |
| S. L. Jat | Dr. B.K. Mukherjee Science Award, 2024 | Maize Technologists Association of India (MTAI), National Conference on " Maize : A Crop for Food, Fee, Nutritional and Bioenergy Security with Environmental Sustainability held at Ludhiana | August 23-25, 2024 |
| Chikkappa G.K. | Joginder Singh Memorial Award - 2023 | Indian Society of Genetics and Plant Breeding, New Delhi | August 7, 2024 |
| Chikkappa G.K. | Fellow of Indian Society of Genetics and Plant Breeding | Indian Society of Genetics and Plant Breeding, New Delhi | December 12, 2024. |
| Chikkappa G.K. | Fellow of Maize Technologist Association of India (MTAI) 2024 | National Conference on " Maize : A Crop for Food, Fee, Nutritional and Bioenergy Security with Environmental Sustainability held at Ludhiana | August 23-25, 2024 |
| Alla Singh | Best Poster Presentation Award on "*Connecting QPM produce to market through multiple assay options*" authored by Alla Singh*, Mamta Gupta, Gurpinder Singh, Abhijit K. Das, Bharat Bhushan and D.P. Chaudhary for the paper entitled | National Conference on "Maize: A Crop for food, Fee, Nutritional and Bioenergy Security with Environment Sustainability held at Ludhiana | August 23-25, 2024 |
| | Best poster presentation award on *"Immobilized yeast cells for continuous biotransformation of maize hydrolysate into bioethanol"* authored by Gurkanwal Kaur, Alla Singh and Dharam Paul Chaudhary | National Conference on Maize: A Crop for Food, Feed, Nutritional and Bioenergy Security with Environmental Sustainability held at Ludhiana | Aug 23-25, 2024 |

# ANNEXURES

## ANNEXURE-I

### List of cultivars identified during 67th Annual Maize Workshop

| S.No. | Cultivar | Contributing ICAR Institute/ AICRP Centre/ SAU/ Private Organization | Public/ Private | Maturity | Zone | Average Yield (t/ha) | Cropping season | Type |
|---|---|---|---|---|---|---|---|---|
| 1 | IBCH 402 (IBH 11-227) | ICAR-IIMR, Ludhiana | Public | Early (57-60 days) | I | 1.8 | Kharif | Baby corn |
| 2 | IMHSB 20R-6 | ICAR-IIMR, Ludhiana | Public | Medium (142-148 days) | III | 9.2 | Rabi | Field Corn |
| 3 | IMHSB 20K-10 | ICAR-IIMR, Ludhiana | Public | Medium (84-92 days) | III | 7.0 | Kharif | Field Corn |
| 4 | IQPMH 2109 | ICAR-IIMR, Ludhiana | Public | Medium (90 days) | II, III | 8.174 | Kharif | QPM |
| 5 | IQPMH 2108 | ICAR-IIMR, Ludhiana | Public | Medium (88 days) | II, III | 6.79 | Kharif | QPM |
| 6 | IQPMH 2012 | ICAR-IIMR, Ludhiana | Public | Medium (91 days) | V | 5.75 | Kharif | QPM |
| 7 | PVAPMH 1 | ICAR-IIMR, Ludhiana | Public | Late | II | 9.11 | Kharif | Biofortified |
| 8 | IMHSB 20R-10 | ICAR-IIMR, Ludhiana | Public | Medium | III | 9.826 | Rabi | Field Corn |
| 9 | IMHSB 20K-11 | ICAR-IIMR, Ludhiana | Public | Medium | III | 7.028 | Kharif | Field Corn |
| 10 | APQH 4 | ICAR-IARI, New Delhi | Public | Medium | II, V | 7.84 | Kharif | Biofortified |
| 11 | ABHS 27 | ICAR-IARI, New Delhi | Public | Medium | V | 1.4 | Kharif | EDV Baby corn |
| 12 | APTQH 1 | ICAR-IARI, New Delhi | Public | Medium | II, III, V | 7.426 | Kharif | Biofortified |
| 13 | ALPQH 1 | ICAR-IARI, New Delhi | Public | Medium | II, V | 7.25 | Kharif | Biofortified |
| 14 | ALQH 9 | ICAR-IARI, New Delhi | Public | Medium | III | 4.968 | Kharif | Biofortified |
| 15 | AQWH 4 | ICAR-IARI, New Delhi | Public | Medium | II | 7.26 | Kharif | Biofortified |
| 16 | ADC 3 | ICAR-IARI,New Delhi | Public | Early | I | 7.12 | Kharif | Field Corn |

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|---|---|---|---|---|---|---|---|---|
| 17 | AH 8323 | ICAR-IARI,New Delhi | Public | Early | IV | 8.18 | Kharif | Field Corn |
| 18 | HPC 4 | CCSHAU, Karnal | Public | Medium | II | 4.5 | Rabi | pop corn |
| 19 | APSKH-1 (APTSKH-1 2023) | ICAR-IARI,New Delhi | Public | Medium | II, III, IV, V | 11.74 | Kharif | Sweet corn |
| 20 | JH 32487 | PAU, Ludhiana | Public | Early | IV | 7.35 | Kharif | Field Corn |
| 21 | JH 32048 | PAU, Ludhiana | Private | Medium | I | 1.88 | Kharif | Baby corn |
| 22 | JH 32662 | PAU, Ludhiana | Private | Early | I | 8.08 | Kharif | Field Corn |
| 23 | VNR 4597 | VNR Seeds Pvt. Ltd. Raipur | Private | Late (125-130 days) | IV | 10.8 | Rabi | Field Corn |
| 24 | PM 20205L | Pioneer Hi-Bred Pvt. Ltd., Karnataka. | Private | Late | IV | 10.8 | Rabi | Field Corn |
| 25 | P 34407 (PM 21111L) | Pioneer Hi-Bred Pvt. Ltd., Karnataka. | Private | Late (125-135 days) | II, IV | 9.0 | Kharif | Field Corn |
| 26 | Bio 207 | Bioseed Research India (Ltd.), Hyderabad | Private | Late (100-105 days) | IV | 10.3 | Kharif | Field Corn |
| 27 | CP 999 | Charoen Pokphand Seeds (India) Pvt. Ltd., Bangalore | Private | Early (11-110 days) | II | 10.8 | Kharif | Field Corn |
| 28 | SMH 4555 | Invicta Agritech India Pvt Ltd., Secundrabad, Telengana | Private | Early | II, IV | 7.484 | Kharif | Field Corn |
| 29 | R 8050 | Rasi Seeds (P) Ltd., Bengaluru | Private | Late | IV | 9.11 | Kharif | Field Corn |
| 30 | JKMH 4546 | JK Agrigenetics Pvt Ltd., Hyderabad | Private | Medium | IV | 10.48 | Kharif | Field Corn |
| 31 | ADV 7211 | Advanata Enterprises Ltd, Hyderabad | Private | Late | IV | 10.23 | Kharif | Field Corn |

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|---|---|---|---|---|---|---|---|---|
| 32 | KMH 8333 | Kaveri Seed Company Ltd. Secundrabad, Hyderabad | Private | Late | IV | 10.558 | Kharif | Field Corn |
| 33 | TMMH 2882 | Trimurti Plant Science Pvt Ltd, Hyderabad | Private | Late | V | 10.62 | Rabi | Field Corn |
| 34 | SYN 207660 | Syngenta India Pvt Ltd., Maharashtra | Private | Medium | II, IV | 10.446 | Rabi | Field Corn |
| 35 | SYN 207884 | Syngenta India Pvt Ltd., Maharashtra | Private | Medium | II | 10.25 | Rabi | Field Corn |
| 36 | ADV 7733 | Advanata Enterprises Ltd, Hyderabad | Private | Late | III | 10.08 | Rabi | Field Corn |

## ANNEXURE-II

## Maize Hybrids/OPVs Notified during 2024 for commercial cultivation

| S.No. | Cultivar | Developer /Institute/ Unicersity / AICRP Centre/ Private Organization | Notification Date | Notification No. | Maturity | Area of adaptation | Average Yield (t/ha) | Cropping season | Type |
|---|---|---|---|---|---|---|---|---|---|
| 52. | IBCH 402 (IBH 11-227) | ICAR-IIMR, Ludhiana | 08.10.2024 | SO 4388 (E) | Early (57-60 days) | Uttarakhand, Himachal Pradesh, Meghalaya, Manipur, Jammu Kashmir | 1.8 | Kharif | Baby corn |
| 53. | IMH 229 (DMRH-1410) | ICAR-IIMR, Ludhiana | 08.10.2024 | SO 4388 (E) | Medium | West Bengal | Grains: 9.0-9.5 Fodder : 44.88 Silage: 53.7 | Rabi | Field Corn |

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|---|---|---|---|---|---|---|---|---|---|
| 54. | IMHSB 20R-6 | ICAR-IIMR, Ludhiana | 08.10.2024 | SO 4388 (E) | Medium (142-148 days) | Eastern UP, Bihar, Jharkhand, Odisha and West Bengal. | 9.2 | Rabi | Field Corn |
| 55. | IMHSB 20K-10 | ICAR-IIMR, Ludhiana | 08.10.2024 | SO 4388 (E) | Medium (84-92 days) | Eastern UP, Bihar, Jharkhand, Orissa, West Bengal and Assam | 7.0 | Kharif | Field Corn |
| 56. | Pusa HM 4 (Male Sterile Baby Corn-2) (ABSH4-2) | ICAR-IARI, New Delhi | 08.10.2024 | SO 4388 (E) | - | Bihar, Jharkhand, Odisha, Uttar Pradesh (Eastern region), West Bengal, Maharashtra, Karnataka, Andhra Pradesh, Telangana, Tamil Nadu, Gujarat, Madhya Pradesh, Chattisgarh and Rajasthan. | 1.7 | Kharif | Baby corn |
| 57. | Pusa Biofortified Maize hybrid-4 (APH 4) | ICAR-IARI, New Delhi | 08.10.2024 | SO 4388 (E) | Medium (86 days) | Punjab, Haryana, Delhi, Uttarakhand (Plain), Uttar Pradesh (Western region), Maharashtra, Karnataka, Andhra Pradesh, Telangana, Tamil Nadu, Gujarat, Madhya Pradesh, Chattisgarh and Rajasthan. | 7.1 | Kharif | Biofortified |
| 58. | Pusa Biofortified Maize hybrid-5 (APTQH-5) | ICAR-IARI, New Delhi | 08.10.2024 | SO 4388 (E) | Medium (93 days) | Punjab, Haryana, Delhi, Uttarakhand (Plain), Uttar Pradesh (Western region), Bihar, Jharkhand, Odisha, Uttar Pradesh (Eastern region), West Bengal, Maharashtra, Karnataka, Andhra Pradesh, Telangana, Tamil Nadu, Gujarat, Madhya Pradesh, Chattisgarh and Rajasthan. | 6.8 | Kharif | Biofortified |

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|---|---|---|---|---|---|---|---|---|---|
| 59. | Pusa Pop Corn Hybrid-1 (APCH-2) | ICAR-IARI, New Delhi | 08.10.2024 | SO 4388 (E) | Late to Medium (120 days) | Punjab, Haryana, Delhi, Uttarakhand (Plain), Uttar Pradesh (Western region), Maharashtra, Karnataka, Andhra Pradesh, Telangana, Tamil Nadu | 4.7 | Rabi | Pop corn |
| 60. | Pusa Pop Corn Hybrid-2 (APCH-3) | ICAR-IARI, New Delhi | 08.10.2024 | SO 4388 (E) | Medium (102 days) | Maharashtra, Karnataka, Andhra Pradesh, Telangana, Tamil Nadu | 4.5 | Rabi | Pop corn |
| 61. | VNR 4597 | VNR Seeds Pvt. Ltd. Raipur | 08.10.2024 | SO 4388 (E) | Late (125-130 days) | Karnataka, Andhra Pradesh, Telangana, Maharashtra and Tamil Nadu | 10.8 | Rabi | Field Corn |
| 62. | PM 20205L | Pioneer Hi-Bred Pvt. Ltd., Karnataka. | 08.10.2024 | SO 4388 (E) | Late | Karnataka, Andhra Pradesh, Telangana, Maharashtra and Tamil Nadu | 10.8 | Rabi | Field Corn |
| 63. | P 34407 (PM 21111L) | Pioneer Hi-Bred Pvt. Ltd., Karnataka. | 08.10.2024 | SO 4388 (E) | Late (125-135 days) | Punjab, Haryana, Delhi, UP (western region), Uttarakhand (Plain), Karnataka, Andhra Pradesh, Telangana, Maharashtra and Tamil Nadu | 9.0 | Kharif | Field Corn |
| 64. | Bio 207 | Bioseed Research India (Ltd.), Hyderabad | 08.10.2024 | SO 4388 (E) | Late (100-105 days) | Maharashtra, Karnataka, Andhra Pradesh, Telangana, Tamil Nadu | 10.3 | Kharif | Field Corn |
| 65. | CP 999 | Charoen Pokphand Seeds (India) Pvt. Ltd. Bangalore | 08.10.2024 | SO 4388 (E) | Early (11-110 days) | Punjab, Haryana, Delhi, Uttarakhand (Plain), Uttar Pradesh (Western region) | 10.8 | Kharif | Field Corn |
| 66. | Rajendra baby corn- 1 (MBC-11-15) | TCA, Dholi | 08.10.2024 | SO 4388 (E) | Early | Bihar | 1.15 | Kharif | Baby corn |

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|---|---|---|---|---|---|---|---|---|---|
| 67. | Rajendra pop corn- 1 (MpC-1-15) | TCA, Dholi, Bihar | 08.10.2024 | SO 4388 (E) | Medium | Bihar | 2.5 | Kharif | Pop corn |
| 68. | Phule Umed (QMH-1701) | MPKV, Rahuri | 08.10.2024 | SO 4388 (E) | Medium | Maharshtra | 8.7 | Kharif | Biofortified |
| 69. | Phule Champion(QMH-1819) | MPKV, Rahuri | 08.10.2024 | SO 4388 (E) | Early | Maharshtra | 9.1 | Kharif | Biofortified |
| 70. | VL poshika (FQH-160) | ICAR-VPKAS, Almora | 08.10.2024 | SO 4388 (E) | Early | Uttarakhand | 5.4 | Kharif | Biofortified |
| 71. | VL Triposhi (FQPLH-20) | ICAR-VPKAS, Almora | 08.10.2024 | SO 4388 (E) | Early | Uttarakhand | 4.9 | Kharif | Biofortified |
| 72. | PMH 14 (JH-17011) | PAU, Ludhiana | 08.10.2024 | SO 4388 (E) | Late | Punjab | 6.8 | Kharif | Field Corn |
| 73. | Pusa jahawar hybrid maize-3 (AH-8181) | ICAR-IARI, New Delhi | 08.10.2024 | SO 4388 (E) | Medium | Madhya Pradesh | 8.2 | Rabi | Field Corn |
| 74. | Pusa Shalimar Maize Hybrid-1 (AH-7154) | SKUAST-K, Srinagar & IARI, New Delhi | 08.10.2024 | SO 4388 (E) | Early | Jammu and Kashmir | 8.0 | Kharif | Field Corn |
| 75. | VL shikhar (FLPH-19) | ICAR-VPKAS, Almora | 08.10.2024 | SO 4388 (E) | Early | Uttarakhand | 5.2 | Kharif | Field Corn |
| 76. | Maize VGIH(M) 2 (VaMH-12013) | TNAU, Coimbatore | 08.10.2024 | SO 4388 (E) | Medium | Tamil Nadu | 6.3 | Rabi | Field Corn |
| 77. | MAH 14-138 | ZARS, Mandya (UAS, Banglore) | 08.10.2024 | SO 4388 (E) | Medium | Karnataka | 9.0 | Kharif | Field Corn |
| 78. | J 1008 (PFM-12) | PAU,Ludhiana | 08.10.2024 | SO 4388 (E) | Medium | Punjab | 6.9 | Kharif | Field Corn |
| 79. | ISCH 601 (ISCH 1901) | ICAR-IIMR, Ludhiana | 26.03.2024 | SO 1560 (E) | Medium (90-95 days) | Eastern Uttar Pradesh, Bihar, Jharkhand, Odisha, and West Bengal. | 10.5 | Kharif | Sweet Corn |
| 80. | IBCH 401 (IMHSB 19KB-2) | ICAR-IIMR, Ludhiana | 26.03.2024 | SO 1560 (E) | Medium (silking at 57 days in PZ and 53 days in CWZ) | Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu, Telangana, Rajasthan, Gujarat, Madhya Pradesh and Chhattisgarh | 1.6 | Kharif | Baby Corn |

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|---|---|---|---|---|---|---|---|---|---|
| 81. | QPMH 6 (EDV of PMH 6) | ICAR-IIMR, Ludhiana | 26.03.2024 | SO 1560 (E) | Medium (95-105 days) | Bihar, West Bengal, Jharkhand, Odisha and Uttar Pradesh (Eastern region) | 6.4 | Kharif | Biofortified |
| 82. | IMH 225 (IMHSB 17R-16) | ICAR-IIMR, Ludhiana | 26.03.2024 | SO 1560 (E) | Medium (rabi 155-160 days) / (Spring 120-125 days) | Punjab, Haryana, Uttar Pradesh (Western region), Uttarakhand (Plains) and Delhi | 10.3 | Rabi/ Spring | Field Corn |
| 83. | IMH 226 (IMHSB 17R-17) | ICAR-IIMR, Ludhiana | 26.03.2024 | SO 1560 (E) | Medium (rabi 154-157days) / Spring 115-120 days) | Punjab, Haryana, Uttar Pradesh (Western region), Uttarakhand (Plains) and Delhi | 9.9 | Rabi/ Spring | Field Corn |
| 84. | IMH 227 (IMHSB 19R-2) | ICAR-IIMR, Ludhiana | 26.03.2024 | SO 1560 (E) | Medium maturity (143-150 days) | Eastern Uttar Pradesh, Bihar, Jharkhand, Orissa and West Bengal | 10.9 | Rabi | Field Corn |
| 85. | IMH 228 (IMHSB 19R-10) | ICAR-IIMR, Ludhiana | 26.03.2024 | SO 1560 (E) | Medium (rabi 143-150 days) | Eastern Uttar Pradesh, Bihar, Jharkhand, Orissa West Bengal and Telangana | 10.6 | Rabi | Field Corn |
| 86. | VL VitA (FPVH 1) | ICAR-VPKAS, Almora | 26.03.2024 | SO 1560 (E) | Early (95-100 days) | Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura | 6.9 | Kharif | Biofortifird |
| 87. | Pant Composite Maize 4 (PCM-4) (DOP-339) | GBPUA&T, Pantnagar | 26.03.2024 | SO 1560 (E) | Early (90-95days) | Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura | 5.9 | Kharif | Field Corn |
| 88. | Shalimar Kishenganga-3 (KDM-30) | SKUAST, Srinagar | 26.03.2024 | SO 1560 (E) | Early (100 days) | Jammu and Kashmir, Himachal Pradesh, Uttrakhand, Manipur Meghalaya and Assam | 5.4 | Kharif | Field Corn |

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|---|---|---|---|---|---|---|---|---|---|
| 89. | DHM 206 ((Telangana MAKKA-3) (BH 417206) | PJTSAU, Hyderabad | 26.03.2024 | SO 1560 (E) | Late (105-110 days) | Punjab, Haryana, Uttarakhand, plains Uttar Pradesh Western region, Delhi, Bihar, Jharkhand, Odisha, Uttar Pradesh (Eastern region) and West Bengal | 8.5 | Kharif | Field Corn |
| 90. | IPCH 501 (IPCH 1901) | ICAR-IIMR, Ludhiana | 26.03.2024 | SO 1560 (E) | Medium (90-95 days) | Tamil Nadu, Andhra Pradesh, Telangana, Maharashtra, Karnataka and Kerala | 4.4 | Kharif | Pop corn |
| 91. | VL Madhurima (FSCH 144) | ICAR-VPKAS, Almora | 26.03.2024 | SO 1560 (E) | Early (95-100 days) | Eastern Uttar Pradesh, Bihar, Jharkhand, West Bengal, Maharashtra, Karnataka, Tamil Nadu, Telangana, Andhra Pradesh, Rajasthan, Gujarat, Madhya Pradesh, Odisha and Chhattisgarh | 6.9 | Kharif | Sweet Corn |
| 92. | Pratap Hybrid-6 (EH- 2936) | MPUAT, Udaipur | 26.03.2024 | SO 1560 (E) | Early (85 days) | Rajasthan, Gujarat, Madhya Pradesh and Chhattisgarh | 6.2 | Kharif | Field Corn |
| 93. | JKMH 4243 | JK Agri Genetics Limited, Hyderabad | 26.03.2024 | SO 1560 (E) | Medium (96-98 days) | Maharashtra, Karnataka, Andhra Pradesh, Telangana and Tamil Nadu | 9.5 | Kharif | Field Corn |
| 94. | ADV 768 (ADV 7251) | Advanta Seeds, Hyderabad | 26.03.2024 | SO 1560 (E) | Late (110-115 days) | Karnataka, Maharashtra, Tamil Nadu, Telangana, Andhra Pradesh, Rajasthan, Madhya Pradesh, Gujarat, and Chhattisgarh | 95.0 | Kharif | Field Corn |
| 95. | R 3414 (RMH 3414) | Rasi Seeds Private Limited, Tamil Nadu | 26.03.2024 | SO 1560 (E) | Late (120-130 days) | Maharashtra, Telangana, Andhra Pradesh, Karnataka, Tamil Nadu | 101.6 | Kharif | Field Corn |

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|---|---|---|---|---|---|---|---|---|---|
| 96. | CP Sweet 2 | CP Seeds, Karnataka | 26.03.2024 | SO 1560 (E) | Late maturity (Sowing to green ear harvest: 70-75 days) | Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Meghalaya, Sikkim, Assam, Tripura, Nagaland, Manipur, Arunachal Pradesh | 146.9 | Kharif | Sweet Corn |
| 97. | KMH 8121 (HM 20105) | Kaveri Seeds, Telangana | 26.03.2024 | SO 1560 (E) | Medium (89 - 93 days) | Uttar Pradesh, Bihar, West Bengal, Odisha, Chhattisgarh and Jharkhand | 69.5 | Kharif | Field Corn |
| 98. | KMH 8577 (KMH 018) | Kaveri Seeds, Telangana | 26.03.2024 | SO 1560 (E) | Late (106-110 days) | Andhra Pradesh, Telangana, Maharashtra, Karnataka and Tamil Nadu | 69.5 | Rabi | Field Corn |
| 99. | DKC 8211 (IU8229) | Bayer Crop Science Limited, Karnataka | 26.03.2024 | SO 1560 (E) | Medium (104 days) | Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Meghalaya, Sikkim, Assam, Tripura, Nagaland, Manipur, Arunachal Pradesh | 83.1 | Kharif | Field Corn |
| 100. | DKC 9215 (IU8636) | Bayer Crop Science Limited, Karnataka | 26.03.2024 | SO 1560 (E) | Late (115-20 days) | Rajasthan, Madhya Pradesh, Chhattisgarh and Gujarat | 83.1 | Kharif | Field Corn |
| 101. | GK 3302 | GK Seeds Pvt Ltd, Hyderabad | 26.03.2024 | SO 1560 (E) | Late (130-135 days) | Punjab, Haryana, Delhi, Uttarakhand, Western Uttar Pradesh | 91.2 | Kharif | Field Corn |
| 102. | GK 3303 | GK Seeds Pvt Ltd, Hyderabad | 26.03.2024 | SO 1560 (E) | Late (130-135 days) | Punjab, Haryana, Delhi, Uttarakhand (Plain), Uttar Pradesh | 88.6 | Kharif | Field Corn |

## ANNEXURE III

## Application Filed of Plant varieties during 2024 for registration under PPV&FR Act 2001.

| S.No. | Hybrid | Name of Centre | Date of Filing | Acknowledgement No. |
|---|---|---|---|---|
| 1 | IMH 222 | ICAR-IIMR, Ludhiana | 10-07-2024 | REG/2024/0377 |
| 2 | IMH223 | ICAR-IIMR, Ludhiana | 10-07-2024 | REG/2024/0378 |
| 3 | IMH 227 | ICAR-IIMR, Ludhiana | 03-10-2024 | PVP DL 031020240003 |
| 4 | IMH 228 | ICAR-IIMR, Ludhiana | 03-10-2024 | PVP DL 031020240002 |
| 5 | Karimnagar makka (KNMH-4010141) | PJTSAU, Karimnagar | 27-06-2024 | REG/2024/0355 |

## Hybrid registered during 2024 under PPVFR Act 2001

| S.No. | Hybrid | Name of Centre | Period of Protection |
|---|---|---|---|
| 1 | IMH 222 | ICAR-IIMR, Ludhiana | 06-12-2024 to 30-08-2037 |
| 2 | IMH223 | ICAR-IIMR, Ludhiana | 06-12-2024 to 30-08-2037 |
| 3 | Karimnagar makka (KNMH-4010141) | PJTSAU, Karimnagar | 06-12-2024 to 24-08-2032 |
| 4 | PMH 7 | PAU, Ludhiana | 17-10-2024 to 16-10-2039 |

## ANNEXURE IV

## DUS Trial details

| S. No | Name of Entry | Testing Year | Category | SCH/MPH/OPV |
|---|---|---|---|---|
| 1 | DKC8181 | First Year | Candidate | SCH |
| 2 | DKC8209 | First Year | Candidate | SCH |
| 3 | DKC9198 | First Year | Candidate | SCH |
| 4 | DKC9208 | First Year | Candidate | SCH |
| 5 | DKC9210 | First Year | Candidate | SCH |
| 6 | DKC9217 | First Year | Candidate | SCH |
| 7 | DKC9228 | First Year | Candidate | SCH |
| 8 | Ellora Commando 1112 | First Year | Candidate | SCH |
| 9 | GOLD1166 | First Year | Candidate | SCH |
| 10 | NMH-4786 | First Year | Candidate | SCH |
| 11 | P18245 | First Year | Candidate | SCH |
| 12 | P1890 | First Year | Candidate | SCH |
| 13 | P1891 | First Year | Candidate | SCH |
| 14 | P3312 | First Year | Candidate | SCH |
| 15 | P3319 | First Year | Candidate | SCH |
| 16 | P33309 | First Year | Candidate | SCH |
| 17 | P34104 | First Year | Candidate | SCH |
| 18 | P34407 | First Year | Candidate | SCH |
| 19 | P35105 | First Year | Candidate | SCH |
| 20 | P3524 | First Year | Candidate | SCH |
| 21 | P3532 | First Year | Candidate | SCH |
| 22 | QMH-1025 (Phule Maharshi) | First Year | Candidate | SCH |

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|---|---|---|---|---|
| 23 | QMHSC-1182 (Phule Madhu) | First Year | Candidate | SCH |
| 24 | TMMH 8418 | First Year | Candidate | SCH |
| 25 | Reg/2022/0157(2889/2176/HSMH 4636 | Second Year | Candidate | SCH |
| 26 | Reg /2022/10164H(2889/2183/H | Second Year | Candidate | SCH |
| 27 | Reg /2023/0030H(2890/2049/H) | Second Year | Candidate | SCH |
| 28 | Reg 2023/0039H(2890/2058/H) | Second Year | Candidate | SCH |
| 29 | Reg/2023/0070H(2890/2089/H) | Second Year | Candidate | SCH |
| 30 | Reg/2023/0071H(2890/2090/H) | Second Year | Candidate | SCH |
| 31 | BIO605 | First Year | Reference | SCH |
| 32 | BIO9544 | First Year | Reference | SCH |
| 33 | BIO9682 | First Year | Reference | SCH |
| 34 | CMH-08-282 | First Year | Reference | SCH |
| 35 | CMH-08-292 | First Year | Reference | SCH |
| 36 | CP858 | First Year | Reference | SCH |
| 37 | DHM117 | First Year | Reference | SCH |
| 38 | DHM121 | First Year | Reference | SCH |
| 39 | DHM206 | First Year | Reference | SCH |
| 40 | DKC7074 | First Year | Reference | SCH |
| 41 | DKC9144 | First Year | Reference | SCH |
| 42 | GK3237 | First Year | Reference | SCH |
| 43 | GK3266 | First Year | Reference | SCH |
| 44 | HQPM-1 | First Year | Reference | SCH |
| 45 | HQPM5 | First Year | Reference | SCH |
| 46 | LG3405 | First Year | Reference | SCH |
| 47 | NK6240 | First Year | Reference | SCH |
| 48 | P3396 | First Year | Reference | SCH |
| 49 | P3401 | First Year | Reference | SCH |
| 50 | PMH-1 | First Year | Reference | SCH |
| 51 | Pratap Hybrid Maize 3 | First Year | Reference | SCH |
| 52 | Shaktiman-1 | First Year | Reference | SCH |
| 53 | Shaktimann-4 | First Year | Reference | SCH |
| 54 | Vivek Hybrid-9 | First Year | Reference | SCH |
| 55 | AMH 3436(23MAAM3615H) | Second Year | Reference | SCH |
| 56 | 3033(23MA 303306 H) | Second Year | Reference | SCH |
| 57 | DMRH 1308 (23MADM0822H) | Second Year | Reference | SCH |
| 58 | TMMH826 (23MATM2613H) | Second Year | Reference | SCH |
| 59 | TMMH 844(23MATM4421H | Second Year | Reference | SCH |
| 60 | DEKLAB 9144(23MADE 4401H) | Second Year | Reference | SCH |
| 61 | Ajeet Surya (23MAAJYA 08H) | Second Year | Reference | SCH |
| 62 | BOND NMH007(23MAB00704H) | Second Year | Reference | SCH |
| 63 | 3499(23MA349917 H) | Second Year | Reference | SCH |
| 64 | GK 3155 | Second Year | Reference | SCH |

| S. No | Name of Entry | Testing Year | Category | INBRED |
|---|---|---|---|---|
| 1 | NM-1411 | First Year | Typical/Inbred | Inbred |
| 2 | HKI161 | First Year | Reference | Inbred |
| 3 | BML5 | First Year | Reference | Inbred |
| 4 | BML7 | First Year | Reference | Inbred |

| S. No | Name of Entry | Testing Year | Category | SCH/MPH/OPV |
|---|---|---|---|---|
| 1 | ADV 756 | First Year | Notified Hybrids | SCH |
| 2 | ADV 7132 (ADV 765) | First Year | Notified Hybrids | SCH |
| 3 | ADV 757 (ADV 7037) (Hybrid) | First Year | Notified Hybrids | SCH |
| 4 | ADV 759 (ADV 1390064) (Hybrid) | First Year | Notified Hybrids | SCH |
| 5 | ADV 764 (ADV 1390164) (Hybrid) | First Year | Notified Hybrids | SCH |
| 6 | AH 7043 | First Year | Notified Hybrids | SCH |
| 7 | Central Maize VL Sweet Corn 1 (FSCH18) | First Year | Notified Hybrids | SCH |
| 8 | COH(M)11 (CMH 12-686) | First Year | Notified Hybrids | SCH |
| 9 | CP. 838 | First Year | Notified Hybrids | SCH |
| 10 | CP. 999 | First Year | Notified Hybrids | SCH |
| 11 | GDYMH-101 (BYMH-13-5) | First Year | Notified Hybrids | SCH |
| 12 | GPMH- 1101 | First Year | Notified Hybrids | SCH |
| 13 | Hi-Brix 39 (ADVSW-1) | First Year | Notified Hybrids | SCH |
| 14 | Hi-brix 53 (ADVSW-2) | First Year | Notified Hybrids | SCH |
| 15 | JKMH 4222 | First Year | Notified Hybrids | SCH |
| 16 | Karimnagar Makka (KNMH4010141) | First Year | Notified Hybrids | SCH |
| 17 | PAC 751 | First Year | Notified Hybrids | SCH |
| 18 | Pusa Jawahar Hybrid Maize-2 | First Year | Notified Hybrids | SCH |
| 19 | RCRMH-4 | First Year | Notified Hybrids | SCH |
| 20 | RJ-2020 | First Year | Notified Hybrids | SCH |
| 21 | Shaktiman-5 (MHQPM 09-08) | First Year | Notified Hybrids | SCH |
| 22 | Sikkim Sankul Makka-1 | First Year | Notified Hybrids | OPV |
| 23 | SKMC-2 (SKMC-03) | First Year | Notified Hybrids | OPV |
| 24 | Vivek Hybrid 27 (Central Maize VL Baby Corn 2) | First Year | Notified Hybrids | SCH |
| 25 | VL QPM Hybrid 59 (FQH 106) | First Year | Notified Hybrids | SCH |
| 26 | VL Sweet Corn Hybrid-2 (FSCH 75) | First Year | Notified Hybrids | SCH |
| 27 | VLQPM Hybrid 61 | First Year | Notified Hybrids | SCH |
| 28 | VLQPM Hybrid 63 | First Year | Notified Hybrids | SCH |

## ANNEXURE-V

## Lectures/TV Talks/Radio Talks

| Sr. No. | Name of the Scientist | TITLE'S | | |
|---|---|---|---|---|
| | | **LECTURES** | **PLACE** | **DATE** |
| 1. | Dr S.L. JAT | Maize research and opportunities in Assam | Assam Agriculture Commission Meeting, Krishi Bhawan, Guwahati | 20th December, 2024 |
| | | Hybrid maize seed production: Seed village concept. Grant Thronton Bharat initiative for hybrid maize production in Maharashtra | District Collectorate, Aurangabad | 18th December, 2024 |
| | | Opportunities for FPOs and MSE entrepreneurs in maize processing. Webinar by Grant Thronton Bharat | Zoom online platform | 24 October, 2024 |
| | | Fall armyworm and aflatoxin management in maize, Workshop on 'Fall armyworm and aflatoxin management in maize' by MOAFW | Krishi Bhawan New Delhi | 2nd July, 2024 |
| | | Maize production road map for Odisha, FAO maize programme in Odisha | Online Zoom platform | 10th June, 2024 |
| | | Fuelling the future: bioethanol production for Viksit Bharat 2047, First Zonal Convention-North East Bharat by Agri-Vision and CAU Imphal | CAU, Barapani | 18th May, 2024 |
| | | Improved package of practices for yield maximization in maize. Scientific Maize Cultivation and Seed Production for Enhancing Farmers Income | ICAR-CIPHET, Ludhiana, | 28-30, August, 2024 |
| | | Improved package of practices for maize for yield maximization. In: Scientific Maize Cultivation Practices for Enhancing Productivity and Income in Bihar. Under ATMA-Lakhi Sarai, Bihar funded scheme. | Online at PAMETI, Ludhiana, | 23-25 September, 2024 |

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| 2. | Dr. Pardeep Kumar | Delivered a lecture on "Baby corn: a nutritious fodder for livstock on one day training programme for milk union officers of Bihar and West Bengal | IIMR, Ludhiana | 14th June .2024 |
| | | Delivered a lecture on “Speciality corn cultivation for improving farmer’s income” in training on Scientific Maize Cultivation and Seed Production for Enhancing Farmers' Income from 28-30, August, 2024 Under the Project “Enhancement of Maize Production in Catchment Area of Ethanol Industries” | IIMR, Ludhiana | 29th August, 2024 |
| | | Delivered a lecture on “Prospects and potential of Maize as Fodder and Silage in Bihar” in three Day Training Program for Farmers/Kissan Salahkar | Regional Maize Research & Seed Production Centre, Begusarai, Bihar | 10 -09-2024 to 12-09-2024 |
| | | Delivered a lecture on “Fodder maize cultivation” in raining on maize Scientific Maize Cultivation Practices for Enhancing Productivity and Income in Bihar Under ATMA-Khagaria, Bihar | IIMR, Ludhiana | 17-19, September 2024 |
| | | Delivered a lecture on “Prospects and potential of Maize as Fodder and Silage in Bihar” in three Day Training on Commercial Maize Production & Processing Program for Farmers/Kissan Salahkar | Regional Maize Research & Seed Production Centre, Begusarai, Bihar | 27 -09-2024 to 29-09-2024 |
| | | Delivered a lecture on “Prospects and potential of Maize as Fodder and Silage in Bihar” in three Day Training Program on Best Management Package for Maize Production in Bihar for food, nutritional and fuel security for Farmers/Kissan Salahkar | Regional Maize Research & Seed Production Centre, Begusarai, Bihar | 22 -10-2024 to 24-10-2024 |
| | | Deliver a oral presentation on “Morpho-biochemical based identification of superior diverse maize cultivars for quality silage” in National Conference ON Maize: A Crop for Food, Feed, Nutritional and Bioenergy Security with Environmental Sustainability during. | IIMR, Ludhiana | 23-25 August, 2024 |

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| 3. | Dr. S. B. Singh | Delivered a lecture on "Advanced Breeding Strategies for climate resilient cultivar development in maize" in 21 Days Winter School in Online Mode on Emerging Problems & Recent Advances in Applied Sciences : Traditional & Innovative Approaches (EPRAAS-2024) 08-28 February 2024 | ONLINE MODE | February 12, 2024. |
| | | Delivered an oral presentation on " Combining ability analysis and heterotic grouping of medium maturity maize inbreds under Non-stress and waterlogging stress" in the National Conference on Maize: A Crop for Food, Feed, Nutritional and Bioenergy Security with Environmental Sustainability | PAU, Ludhiana | August 23-25, 2024. |
| | | Delivered an invited lecture on " Advanced Breeding Tools and Strategies for the Development of Climate Resilient Maize cultivar" in the 9th International Conference on Global Research Initiatives For Sustainable Agriculture & Allied Sciences (GRISAAS-2024) | Maharana Pratap Auditorium, SKNAU-RARI, Durgapura, Jaipur, Rajasthan | December 10, 2024 |
| | | Delivered a lecture on "Role of farmers in Germplasm collection, conservation and multiplication" in the "Farmers Right Awareness Program cum Exposure Visit" | RMR&SPC, Begusarai | November 12, 2024 |
| | | Delivered a lecture on "Climate Resilient Maize Breeding Program and Suitable varieties development for farmers of Bihar" in the three days farmer training programme on "Climate Smart Maize Production Technologies" | RMR&SPC Begusarai | October 27, 2024. |
| | | Delivered a lecture on " Maize requirement in Bihar : Status, Challenges, Prospects and Strategies" in a three days farmer training programme for Farmers/Kissan Salahkar on "Best Management Practices for higher productivityand Income in Maize in Bihar" | RMR&SPC, Begusarai | September 03, 2024 |

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| | | Delivered a lecture on "Maize requirement in Bihar: Suitable Varieties for Bihar Agro-climatic situation" in a three Day Training Program for Farmers/Kissan Salahkar on “Maize as food, fodder, fuel and emerging food products” | RMR&SPC, Begusarai | September 10, 2024 |
| | | Delivered a lecture on "Maize requirement in Bihar: Suitable Varieties for Bihar Agro-climatic situation" in a three Day Training Program for Farmers/Kissan Salahkar on “Maize as food, fodder, fuel and emerging food products” | RMR&SPC, Begusarai | September 10, 2024 |
| | | Delivered a lecture on " Farme's Right under PPV&FR Act 2001" in Farmer training and awareness programme organized by Dr. S.B. Singh. | RMR&SPC, Begusarai | March 03,2024 |
| 4 | Dr. S. B. Singh/Dr. B. S. Jat | Delivered a lecture on Improved maize varieties for Bihar In: Scientific Maize Cultivation Practices for Enhancing Productivity and Income in Bihar. Under ATMA-Lakhi Sarai, Bihar funded scheme from 23-25th Sept 2024. | Online at PAMETI, Ludhiana, | September 23, 2024 |
| 5. | Dr. Mamta Gupta | Delivered lecture on "Diverse uses of Maize for Entrepreneurship Development " in training on Entrepreneurship development through Value Addition in Maize for Livelihood Security scheduled | ICAR-IIMR, Ludhiana. | 7th to 9th November 2024 |
| 6. | Dr. P.Lakshmi Soujanya | Delivered talk on “Maize insect pests and their management”on 29.8.2024 during 2 days training programme on “Scientific Maize Cultivation and Seed Production for Enhancing Farmers Income” | ICAR-IIMR at Ludhiana | 28th to 30th August, 2024 |
| | | Delivered talk on Maize storage pest and their management on ‘Scientific maize cultivation practices for enhancing productivity and income in Bihar from 17th to 19st September, 2024 under ATMA-Khagaria, Bihar funded Scheme | ICAR-IIMR at PAMETI, Ludhiana. | 18.9.2024 during two days training programme |

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| | | Delivered talk on IPM in maize on 23.10.2024 during three days training programme on Best Management package for maize production in Bihar for food, nutritional, and fuel security for farmers | RMRSPC, Begusarai | 22.10.2024 to 24.10.2024. |
| | | Delivered talk on Integrated pest management in maize for climate-smart maize cultivation on 28.10.2024 during a three-day training programme on climate-smart maize production technologies | RMRSPC, Begusarai | 27.10.2024 to 29.10.2024. |
| 7. | Dr. Krishan Kumar | Deliver a lead lecture on "Genome editing: prospects and strategy for maize improvement" at the National Conference on Maize: A Crop for Food, Feed, Nutritional and Bioenergy Security with Environmental | Ludhiana | 23-25 August 2024 |
| 8. | Dr. Deep Mohan Mahala, | Delivered a lecture on Nutrient deficiency disorder and their management In: Scientific Maize Cultivation Practices for Enhancing Productivity and Income in Bihar. Under ATMA-Lakhi Sarai, Bihar funded scheme from 23-25th Sept 2024. | Online at PAMETI, Ludhiana, | September 23, 2024 |
| 9. | Dr. Deep Mohan Mahala/Dr. Ph. Romen Sharma, | Front Line Demonstration (FLD) on Drone Technology in Maize Cultivation In: Scientific Maize Cultivation Practices for Enhancing Productivity and Income in Bihar. Under ATMA-Lakhi Sarai, Bihar funded scheme from 23-25th Sept 2024. | Online at PAMETI, Ludhiana, | 23-25 September, 2024 |
| 10. | Dr.Mukesh Choudhary | Fodder maize cultivation In: Scientific Maize Cultivation Practices for Enhancing Productivity and Income in Bihar. Under ATMA-Lakhi Sarai, Bihar funded scheme from 23-25th Sept 2024.. | Online at PAMETI, Ludhiana, | September 24, 2024 |
| 11 | Dr. Bhupender Kumar | Delivered invited lecture on Maize hybrid and seed production technologies for enhancing production and livelihood security in NEH region in a workshop on "Maize for North East Hill Region: Challenges and Opportunities" 11-12 March, 20 by CAU, Imphal | Central Agricultural University (CAU), Imphal | March 11-12, 2024 |

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| | | Delivered invited lecture on Hybrids and seeds production technologies for improving farmers income in a training programme of Scientific Maize Cultivation and Seed Production for Enhancing Farmers' Income organized by ICAR-IIMR Ludhiana 28-30 Aug., 2024 | ICAR-CIPHET, Ludhiana | August 28, 2024 |
| | | Delivered invited lecture on Hybrid Maize Seed Production Technology for Doubling Farmers' Income in a training programme ofBest Management Practicesfor Cultivation and Processing of Maize in Odisha organized by ICAR-IIMR | Odisha Rural Development & Marketing Society (ORMAS), Bhubaneswar | August 14, 2024 |
| | | Delivered lecture on -Seed production technique in maize for doubling farmers income in tarining programme of ''**बिहार में मक्का में उच्च उत्पादकता और आय के** | ICAR-IIMR RMR &SPC, Begusarai | September 3, 2024 |
| | | **लिए सर्वोत्तम प्रबंधन पद्धतियाँ प्रशिक्षण** organized by ICAR-IIMR RMR &SPC, Begusarai Bihra from 3rd-5th Sept 2024 | | |
| | | Delivered lecture on -Hybrid seed production technique for enhacing farmers income in a training programme of Scientific Maize Cultivation Practices for Enhancing Productivity and Income in Bihar organized by ICAR-IIMR RMR &SPC, Begusarai Bihra from 17-19th Sept 2024 | ICAR-IIMR RMR & SPC, Begusarai | September 18, 2024 |
| | | Delivered lecture on -Hybrid seed production technique for enhacing farmers income in a training programme of Scientific Maize Cultivation Practices for Enhancing Productivity and Income in Bihar" organized by ICAR-IIMR RMR &SPC, Begusarai Bihar from 23-25 th Sept 2024 | ICAR-IIMR RMR & SPC, Begusarai | September 24,2024 |

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| 12. | Dr. Alok Kumar Sahoo | Delivered a lecture on "Formation of FPO and its role in Entrepreneurship Development in Maize" on 05.09.2024 during a three-day training program on "Best Management Practices for higher productivity and Income in Maize in Bihar" | ICAR-IIMR, RMRSPC, Begusarai | 03rd March to 05th March 2024 |
| | | Given Practical on "Demonstration of Several technologies in Maize" on 12.09.2024 during a three-day training program on " Maize as Food, Fodder, Fuel and Emerging Food Products" | RMRSPC Begusarai | 10-12 September 2024 |
| | | Delivered a lecture on "Role of Group dynamics such as FPO, SHG in Maize value chain prospects " on 12.09.2024 during a three-day training program on " Maize as Food, Fodder, Fuel and Emerging Food Products" | RMRSPC Begusarai | 10-12 September 2024 |
| | | Given Practical on "Demonstration of Several technologies in Maize" on 23.10.2024 during three days training program on " Best Management Package for Maize Production in Bihar for food, nutritional and fuel security" | RMRSPC Begusarai | 22-24 October 2024 |
| | | Delivered lecture on "Role of Group dynamics such as FPO, SHG in Maize value chain prospects & commercialization" on 29.09.2024 during three days training program on "Commercial Maize Production & Processing" | RMRSPC Begusarai | 27-29 September 2024 |
| | | Delivered a lecture on "Role of Group dynamics such as FPO, SHG in Maize value chain prospects" on 24.10.2024 during three days training program on “Best Management Package for Maize Production in Bihar for food, nutritional and fuel security " | RMRSPC Begusarai | 22-24 October 2024 |
| | | Delivered a lecture on "Role of Group dynamics such as FPO, SHG in Maize value chain prospects & commercialization" on 29.10.2024 during three days training program on "Climate Smart Maize Production Technologies" | RMRSPC Begusarai | 27-29 October 2024 |

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| | | Participated and delivered a lecture on Diverse use of Specialty corn such as Sweet corn Baby corn and maize in Farmers' Scientist Interaction program | ATMA Begusarai | 20.09.2024 |
| 13. | Dr H.S. JAT | Delivered a plenary lecture on "Resilient Maize agri-food system for achieving industrial (feed and energy) security in changing environment" at Global Soils Conference organized by the Indian Society of Soil Scence at New Delhi | New Delhi | 19th November, 2024 |

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| **T.V. TALK** | | | | |
| 1. | Dr S.L. Jat | रबी मक्का की खेती, हेल्लो किसान लाइव कार्यक्रम | डीडी किसान | 23 दिसम्बर, 2024 |
| | | खरीफ मक्का की बुवाई, हेल्लो किसान लाइव कार्यक्रम | डीडी किसान | 26 जुलाई, 2024 |
| | | बसंत ऋतू में मक्का की खेती, हेल्लो किसान लाइव कार्यक्रम | डीडी किसान | 6 मार्च, 2024 |
| **RADIO TALK** | | | | |
| 1. | Dr S.L. Jat | रबी मक्का फसल की देखभाल, किसान की बात कार्यक्रम | ऍफ एम गोल्ड, | 26 दिसम्बर, 2024, |
| | | अगेती बेबीकार्न की खेती द्वारा दोहरा लाभ, किसान की बात कार्यक्रम | ऍफ एम गोल्ड, | 30 सितम्बर, 2024 |
| | | खरीफ मक्का की उन्नत किस्में एवं बुवाई, किसान की बात कार्यक्रम | ऍफ एम गोल्ड, | 2 जुलाई, 2024 |
| | | खरीफकालीन मक्का की किस्में एवं बुवाई, किसान की बात कार्यक्रम | ऍफ एम गोल्ड, | 7 जून, 2024 |
| | | जायदकालीन मक्का की खेती, किसान की बात कार्यक्रम | ऍफ एम गोल्ड, | 4 अप्रैल, 2024 |
| | | रबी मक्का की देखभाल और समसामयिक कार्य, किसान की बात कार्यक्रम | ऍफ एम गोल्ड, | 4 जनवरी, 2024 |
| | | Integrated Approach in Maize Cultivation | Odia | 17.12.2024 |

ANNEXURE VI

# PUBLICATION

## Research Articles :-

1. Mandal, A., Jat, S.L.*, Parihar, C.M., Padhan, S.R., Sarkar, A., Krishna, K.M., Glotra, A. and Kakraliya, M. 2024. Tillage, residue and nitrogen management influences growth attributes, biomass production and yield of maize in the Trans-Gangetic Plains of India. Maize Journal. 13(2): 94-101.
2. Yadav, K.K., Dash, S., Kumar, A., Mandal, A. and Jat, S.L. 2024. Application of Semi-Latin rectangles designs in maize experiments. Maize Journal. 13(2): 124-127.
3. Kumar, R., Rao, K. K., Mondal, S., Choudhary, J. S., Kumar, S., Jat, S. L., Mishra, J. S., Singh, A. K., Upadhyay, P. K., Das, A., Singh, V. K., Kumar, S., Jadhav, S. K., Sharma, N. K., Bhatt, B. P., Rakshit, S. and Chaudhari, S. K. 2024. A comprehensive analysis of resource conservation strategies: Impacts on productivity, energetics, and environmental footprints in rice-based systems of the Eastern Indo-Gangetic Plains. Current Research in Environmental Sustainability, 8:100271. https://doi.org/10.1016/j.crsust.2024.100271
4. Glotra, A., Jat, S.L.*, Singh, A.K., Parihar, C.M., Pooniya, V., Kumar, S., Meena, M.C., Padhan, S. R., Ramniwas, Kakraliya, M. and Mandal, A. 2024. Influence of till-age, residue, and nitrogen placement on maize growth and yield under conservation agriculture. Plant Science Today. 11 (sp2):01-07. https://doi.org/10.14719/pst.3662
5. Rajanikanth, E., Manjulatha, G., Sravani, D., Usharani, G., Jat, S.L. and Singh, A.K. 2024. Effect of Tillage Practices and Hydrogel Applications on Yield and Yield Attributing Traits of Maize (Zea Mays L.) over the Years. Journal of Experimental Agriculture International 46(9):1005-10. https://doi.org/10.9734/jeai/2024/v46i92897
6. Sujatha, V., Kumar, I.S., Jat, S.L. and Singh, A.K. 2024. Assessment of sensor based precision nitrogen management for enhancing productivity and profitability of maize in Godavari Delta of Andhra Pradesh. Maydica, 67(2): M16.
7. Radheshyam, Jat, S.L.*, Jat, M.L., Parihar, C.M., Jat, H.S., Singh, A.K., Bijarniya, D., Padhan, S.R., Kadam, P.V. and Kumar, M.. 2024. On-farm evidence on breaking yield barriers through optimizing wheat cropping system in Indo Gangetic Plain. European Journal of Agronomy, 159: 127256. https://doi.org/10.1016/j.eja.2024.127256
8. Dinesh GK, Sharma DK, Jat SL*, Venkatramanan V, Boomiraj K, Kadam P, Prasad S, Anokhe A, Selvakumar S, Rathika S, Ramesh T, Bandyopadhyay K, Jayaraman S, Ramesh KR, Sinduja M, Sathya V, Rao CS, Dubey R, Manu SM, Karthika S, Singh AK, Kumar B and Mahala DM (2024) Residue retention and precision nitrogen management effects on soil physicochemical properties and productivity of maize-wheat-mungbean system in Indo-Gangetic Plains Frontiers in Sustainable Food System. 8:1259607. doi: 10.3389/fsufs.2024.1259607
9. Kumar, K., Parihar, C.M., Nayak, H.S., Sena, D.R., Godara, S., Dhakar, R., Patra, K., Sarkar, A., Bharadwaj, S., Ghasal, P.C., Meena, A.L., Reddy, K.S., Das, T.K., Jat, S.L., Sharma, D.K., Saharawat, Y.S., Singh, U., Jat, M.L. and Gathala, M.K., 2024. Modeling maize growth and nitrogen dynamics using CERES?Maize (DSSAT) under diverse nitrogen management options in a conservation agriculture?based maize?wheat system. Scientific Reports, DOI;10.1038/s41598-024-61976-6.
10. Soujanya, P. L., VaniSree, K., Giri, G. S., Mahadik, S.S., Jat, S.L., Sekhar, J.C., & Jat, H.S. 2024. Intercropping in maize reduces fall armyworm Spodoptera frugiperda (J. E. Smith) infestation, supports natural enemies, and enhances yield. Agriculture, Ecosystems & Environment, 373, 109130. https://doi.org/10.1016/j.agee.2024.109130
11. Singh S.B., Kumar S., Kumar R., Kumar P., Yathish K.R., Jat B.S., Chikkappa G.K., Kumar B., Jat S.L., Dagla M.C., Kumar B., Kumar A., Kasana R.K. and Kumar S. 2024. Stability

analysis of promising winter maize (Zea mays L.) hybrids tested across Bihar using GGE biplot and AMMI model approach. Indian Journal of Genetics and Plant Breeding, 84(1): 73-80. https://doi.org/10.31742/ISGPB.84.1.6http://krishi.icar.gov.in/jspui/handle/123456789/84617

12. Salakinkop, S. R., Talekar, S. C., Patil, C. R., Patil, S. B., Jat, S.L., Iliger, K. S., Manjulatha, G., Harlapur, S. I., & Kachapur, R. M. (2024). Sustainable intensification of climate-resilient maize-chickpea system in semi-arid tropics through assessing factor productivity. Scientific Reports 14(1) https://doi.org/10.1038/s41598-024-53573-4 http://krishi.icar.gov.in/jspui/handle/123456789/84477
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14. Yon, H., Parihar, C.M., Mohammadi, N., Jat, S.L., Meena, B.R., Patra, K., Nayak, H.S., Kumar, K., Parihar, M.D., Makakzai, M.Y., Mandal, B.N. and Singh, T. 2024. Impact of irrigation and nitrogen management on crop performance, yield and economics of sorghum (Sorghum bicolor) in Kandahar region of Afghanistan. Indian Journal of Agricultural Sciences 94(1): 100-103. 10.56093/ijas.v94i1.123726 http://krishi.icar.gov.in/jspui/handle/123456789/84471
15. Bhushan, B., Kumar, S., Kaur, C., Devi, V., Choudhary, D.P., Singh, A., Dagla, M.C., Karjagi, C., Saleena, L.A.K., Chandran, D. and Kumar, M., 2024. Beyond colors: The health benefits of maize anthocyanins. Applied Food Research, p.100399.
16. Neelam, K., Aggarwal, S.K., Kumari, S., Kumar, K., Kaur, A., Babbar, A., Lore, J.S., Kaur, R., Khanna, R., Vikal, Y. and Singh, K., 2024. Molecular Mapping and Transfer of Quantitative Trait Loci (QTL) for Sheath Blight Resistance from Wild Rice Oryza nivara to Cultivated Rice (Oryza sativa L.). Genes, 15(7), p.919. http://krishi.icar.gov.in/jspui/handle/123456789/84707
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19. Hundal, J.S., Kumar, P.*, Brar, N.S., Choudhary, M., Sharma, A. and Rakshit, S., 2024. Quality and production potential of green fodder and silage for kharif maize hybrid under rainy season in Punjab. Range Management and Agroforestry, 45(01), pp.140-147. http://krishi.icar.gov.in/jspui/handle/123456789/84480
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# ANNEXURE-VII

## ON-GOING PROJECTS

### List of Ongoing Institute Projects

| Sr. No. | Project Code | Title of the Projects | Principal Investigator | CoPI/CCPI | Project Duration |
|---|---|---|---|---|---|
| 1. | AR:IIMR:19: MP-03 | Genetic enhancement of maize for the development of high yielding and climate resilient hybrids | Dr. S.B. Singh | Drs M.C. Dagla, Sunil Neelam, Bhupender Kumar, Pardeep Kumar, B.S. Jat, Suby, SB, Sumit K. Aggarwal, S.L. Jat, Krishan Kumar, AK Das, Dr. Ph Romen Sharma, H.S. Jat, Mukesh Choudhary, Seema Sepat | Oct 1, 2019 to Sept 30, 2024 |
| 2. | AR:IIMR:22: MP-02 | Improvement of quality traits in maize for nutritional security and industrial application including feed, starch and bioethanol | Dr. Ramesh Kumar | Drs. Sunil Neelam, Abhijit K Das, Alla Singh, LP Soujanya, SK Aggarwal, AK Singh, H.S. Jat, Dharam Paul | July 1, 2022 to June 30, 2027 |
| 3. | AR:IIMR:22: MP-04 | Application of informatics and decision support tools in maize improvement | Dr. Sunil N | Drs. H.S. Jat, SB Singh, Ramesh Kumar, Mukesh Choudhary, Pardeep Kumar, A. Dandapani from ICAR-NAARM and Bhadru, PJTSAU | July 1, 2022 to June 30, 2025 |
| 4. | AR:IIMR:22: MP-05 | Genetic improvement of specialty corns (sweet corn, baby corn and popcorn) for livelihood security | Dr. Chikkappa G.K. | Drs. JC Sekhar KR Yathish, MC Dagla, Pardeep Kumar, BS Jat, SL Jat, SK Aggarwal, Bharat Bhushan, H.S. Jat | July 1, 2022 to June 30, 2026 |
| 5. | AR:IIMR:21: MP-01 | Breeding for resistance to major insect pests and diseases in maize | Dr. Yathish K.R. | Drs Bhupender Kumar, J.C. Sekhar, S.B. Singh, Soujanya P.L., Suby S.B, H.S. Jat, Dr. N.K. Singh (AICRP Pantnagar) and Dr. Mahadevu (AICRP Mandya), Dr. Prema U (Dharwad, Mukesh Choudhary, Dr. Chikkappa G.K. | July 1, 2021 to June 30, 2026 |

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| **6.** | AR:IIMR:19-MP-03-SP-01 | Genetic enhancement of white maize for dual purpose | Dr. Abhijit K. Das | Drs. SB Singh, SB Suby and Mamta Gupta, Pravin Kumar Bagaria, Savita Sharma (PAU) and Bharat Bhushan | July 1, 2022 to June 30, 2027 |
| **7.** | AR:IIMR:22-FP-01 | Diversification of genetic base for stress tolerance and fodder traits in maize | Dr. Pardeep Kumar | Co-PIs: Drs.SB Singh, Bhupender Kumar, BS Jat, MC Dagla, Yathish KR, BS Jat, Krishan Kumar, PL Soujanya, Sumit Aggarwal, JS Hundal (GADVASU), Shanti Bamboriya, Mukesh Choudhary | July 1, 2022 to June 30, 2027 |
| **8.** | AR:IIMR:22: MP-09 | Assessment of conservation agriculture-based maize-wheat cropping system on soil health and input use efficiency | Dr. A.K. Singh | Drs. S L Jat, Seema Sepat, Ph. Romen Sharma, Sumit Aggarwal, Deep Mohan Mahala | July 1, 2022 to June 30, 2026 |
| **9.** | AR:IIMR:22-MP-09-01-SP-01 | Application of image analysis for area, yield and stress estimation in maize | Dr. S.L. Jat | Drs. AK Singh, Ph. Romen Sharma, Bhupender Kumar, Suby SB, Sumit Agarwal, Sunil Neelam, DM Mahala | July 1, 2022 to June 30, 2027 |
| **10.** | AR:IIMR:22-FP-02 | Best production practices for enhanced productivity and profitability in maize-based cropping system | Dr. AK Singh | Dr Seema Sepat, S L Jat, Ph Romen Sharma, PL Soujanya, Sumit Aggarwal | July 1, 2022 to June 30, 2027 |
| **11.** | AR:IIMR:22-MP-02-SP-02 | Exploring zinc supplementation in soil for potential enhancement of cellulosic ethanol | Dr. Deep M. Mahala | Drs Alla Singh, AK Singh, SL Jat, Seema Sepat, Shanti Devi Bamboriya, Mamta Gupta | Jul 1, 2023 to June 30, 2026 |
| **12.** | AR:IIMR:22-MP-09-02 | Weed management in maize systems | Dr. Seema Sepat | Drs AK Singh, Shanti Devi Bamboriya and Deep Mohan Mahala | Completed July 1, 2022 to June 30, 2024 |

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| **13.** | AR:IIMR:22-MP-09-02-SP-03 | Effects of maize-based intercropping on silage production and its quality | Dr. Seema Sepat | Drs Pardeep Kumar, SD Bamboriya, J.S. Hundal | Feb 1, 2024 to Apr 30, 2025 |
| **14.** | AR:IIMR:22: MP-08 | Studies on Variability of *Setosphaeria turcica* and *Bipolaris maydis*, the incitant of Leaf Blights of Maize in India | Dr. Sumit K Aggarwal | Drs. SI Harlapur, MA Ahangar, N Mallikarjuna, Srabani Debnath, Alla Singh, Mamta Gupta, Pardeep Kumar, PK Bagaria, Bharat Bhushan, Mukesh Choudhary, Prema U (Dharwad Centre) | July 1, 2022 to June 30, 2026 |
| **15.** | AR:IIMR:22: MP-07 | Development of Sustainable Management Tools for Major Insect Pests of Maize | Dr. P.L. Soujanya | Drs. SB Suby, J.C. Sekhar, Bhupender Kumar, K.R. Yathish, PG Padmaja and HS Jat | July 1, 2022 to June 30, 2026 |
| **16.** | AR:IIMR:22-MP-08-01 | Studies on variability of *Bipolaris maydis*, the incitant of Maydis Leaf Blight of maize in India | Dr. Pravin Kumar Bagaria | Drs. Alla Singh, Mamta Gupta and Pardeep Kumar | Feb 10, 2023 to June 30, 2026 |
| **17.** | AR:IIMR:23-FP-04 | Bio-ecology and eco-friendly management of Fall Armyworm (*Spodoptera frugiperda*) in Maize | Dr. Suby SB | Drs. Chikkappa GK, SL Jat, P.L. Soujanaya, P K Bagaria | Jul 2023 to Jun 2026 |
| **18.** | AR:IIMR:21-MP-1-SP-01 | Establishment of Agrobacterium mediated transformation and CRISPR-based genome editing system in tropical maize | Dr. Krishan Kumar | Drs. Mamta Gupta, Alla Singh | July 1, 2022 to June 30, 2027 |
| **19.** | AR:IIMR:22-MP-02-SP-01 | Identification of kernel modifiers associated with various quality traits in tropical maize for their utilization in multi trait stacking | Dr. Alla Singh | Dr. Ramesh Kumar, Dr. AK Das, Dr. Bharat Bhushan, Dr. Mamta Gupta | Oct 1, 2022 to Sept 30, 2027 |

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| **20.** | AR:IIMR:23: FP-03 | Exploring the potential of Vip3A-type proteins (vegetative insecticidal protein) for the management of fall armyworm *Spodoptera frugiperda* (J. E. Smith) | Dr. Mamta Gupta | Drs Alla Singh, Krishan Kumar, Suby S.B., Jawala Jindal, Sarvjeet Kaur | July 1, 2023 to June 30, 2027 |
| **21.** | AR:IIMR:22: MP-10 | Farmer led Innovations (FLI) in Maize and Mechanisms for their Scaling up | Dr. Alok Sahoo | Drs S.L. Jat, Ph Romen Sharma, Dr. Sapna Nigam | July 1, 2022 to June 30, 2027 |
| **22.** | AR:IIMR:22: MP-11 | Impact assessment of the improved maize technologies in various agro-ecologies | Dr. Ph. Romen Sharma | Drs. S.L. Jat, H.S. Jat, Alok Sahoo | July 1, 2022 to June 30, 2027 |
| **23.** | AR:IIMR:22: MP-11-SP-01 | Critical Analysis of Farmers Participatory Seed Production in Maize: Out scaling the model in Eastern India (Bihar & Odisha) through FPO | Dr.Alok Sahoo | Drs Ph Romen Sharma, Bhupender Kumar, Chikkappa GK, Sunil Neelam | 1st July, 2024 (Approved) |
| **24.** | AR:IIMR:19: MP-03-SP-01 | Genetic enhancement of maize germplasm for short duration | Dr. Manesh Chander Dagla | Drs B S Jat, Mukesh Choudhary, Soujanya PL, Sumit Kumar Aggarwal, Deep Mohan Mahala | 1st July, 2024 (Approved) |
| **25.** | AR:IIMR:19: MP-03-SP-02 | Breeding for high yielding drought tolerant maize germplasm | Dr. B. S. Jat | Drs Mukesh Choudhary, Chikkappa GK, MC Dagla, Shanti Devi Bamboriya, SR Karad (AICRP Kolhapur), SR Dhonde (AICRP Rahuri), Hargilas (AICRP Banswara) | 1st July, 2024 (Approved) |

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| **26.** | AR:IIMR:19: MP-03-SP-03 | Genomic selection for accelerated yield gains in maize | Dr. Mukesh Choudhary | Drs Bhupender Kumar, Pardeep Kumar; Mamta Gupta; Neeraj Budlakoti (IASRI- as need based) | 1st July, 2024-30th June 2029 |
| **27.** | AR:IIMR:22-FP-02- SP-01 | Designing sustainable, productive and profitable cropping systems in Western IGP | Dr. Shanti Devi Bamboriya | Drs H.S. Jat and Deep Mohan Mahala | 1st October 2024-30th September 2027 |
| **28.** | AR:IIMR:22-FP-02- SP-02 | Exploring the potential of natural farming for sustainable maize-based cropping system | Dr. Deep Mohan Mahala | Dr Shanti Devi Bamboriya | 1st July, 2024 (Approved) |
| **29.** | AR:IIMR:19: MP-02-SP-01 | Evaluation of maize germplasm for starch and associated traits | Dr. Bharat Bhushan | Dr Abhijit K Das | 1st July, 2024 (Approved) |

## Currently Running Externally Funded Projects of Institute

| Sr. No. | Scheme/Project | PI | CoPI/CCPI | Project-Duration | Funding Agency |
|---|---|---|---|---|---|
| 1. | Seed Production in Agricultural Crops | Dr. BS Jat | Drs. SB Singh, Bhupender Kumar | 2017-2026 Ongoing Project | ICAR Project |
| 2. | Heat Tolerant Maize for Asia | Dr. Ramesh Kumar | Dr. S.B. Singh & S.L. Jat | Jan 1, 2019 to Dec 31, 2024 | CIMMYT |
| 3. | Consortia Research Platform on Molecular Breeding | Dr. Chikkappa G.K. | Bhupender Kumar, Dharam Paul | 2015-2026 | ICAR |
| 4. | Consortia Research Platform on Agrobiodiversity | Dr. Bhupender Kumar | Drs.SB Singh, BS Jat | 2017-2026 Ongoing Project | ICAR |
| 5. | CRP on Biofortification | Dr. Ramesh Kumar | Dr. S.B. Singh and S.L. Jat | Jan 1, 2019 to Dec 31, 2024 | (ICAR |
| 6. | Maize Research for sustainable ethanol production in India | Dr. Chikkappa G.K. | Bhupender Kumar, Dharam Paul | 2015-2026 | (NFSM, MA&FW) |
| 7. | Development of amylopectin, lysine and tryptophan enriched maize hybrids and molecular tagging of genomic regions associated with high kernel starch in maize | Dr. Chikkappa G.K. | Dr Sunil Neelam | 2014-2026 | (SERB) |
| 8. | Improving rainfed (Kharif) maize productivity | Dr. Yathish K.R. | Drs. Ramesh Kumar and BS Jat | Dec 1, 2021 to Nov 30, 2024 Extension Received: Nov. 30, 2025 | (CIMMYT) |
| 9. | Strengthening of DUS test centres under central sector scheme for implementation of PVP legislation | Dr. Mukesh Choudhary | | 2007-2026 Ongoing project | PPVFRA, MoA&FW |
| 10. | Evaluation of Foliar Application of Coromandel Nano urea in Maize Crop | Dr. A.K. Singh | Dr. S.L. Jat, Deep Mohan Mahala, Shanti Devi Bamboriya | Jun 2023 to June 30, 2026 | Coromandel |
| 11. | Evaluation of Foliar Application of Rashtriya Chemical Nano urea in Maize Crop | Dr. A.K. Singh | Dr. S.L. Jat, Deep Mohan Mahala, Shanti Devi Bamboriya | Jun 2023 to June 30, 2026 | Rashtriya Chemical |
| 12. | Development and validation of IPM modules against Fall Army worm [*Spodoptera frugiperda* (J.E. Smith)] infestation on maize in India | Dr. P.L. Soujanya | Coordinator- Dr. J.C. Sekhar<br>Co-PI- Drs Vanishree, Gaurishankar Dhauli S.L. Jat | Nov 1, 2022 to Dec 31, 2024 | (CIMMYT) |

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| 13. | Up-scaling of chitosan and thymol based smart nano-formulations to control fungal diseases and fall armyworm in maize crop | Project Coordinator and PI: Dr Vinod Saharan, PI, MPUAT, Udaipur Principal Investigators: Dr Vinod Saharan, PI, MPUAT, Udaipur PI: Dr. PL Soujanya, ICAR-IIMR, Ludhiana PI: Dr. Poonam, ICAR-CIPHET, Ludhiana Dr. Paranidharan, TNAU, Coimbatore | Drs Ramesh Babu, Ram Narayan Bunker, (MPUAT, Udaipur); Drs SK Aggarwal, Suby S B (ICAR-IIMR, Ludhiana) Drs Sandeep Maan, Shrikrishna Srinivas (ICAR-CIPHET, Ludhiana) Dr. Srinivasan T, TNAU Coimbatore | April 2024 - March 2027 | (DBT) |
| 14. | First generation maize ethanol as a renewable energy source for climate change mitigation | Dr. Alla Singh | GS Kochhar (PAU), Dr. SeemaParoha and Vishnu Parbhakar (NSI Kanpur) | Jan 2022-March 2025 | (NICRA) |
| 15. | Enhancing climate resilience and ensuring food security with genome editing tool | Dr. Krishan Kumar (8 Crore) | Drs Mamta Gupta, Alla Singh, Bhupender Kumar, Mukesh Choudhary, AK Das and PK Bagaria | (2024-2027) | (ICAR) |
| 16. | Developing transgene free high-yielding and climate resilient tropical maize genotypes | Dr. Krishan Kumar | | (2024-2027) | (DBT) |
| 17. | Upscaling maize-based silage value chain in Punjab and Haryana | Dr. Pardeep Kumar | Drs. Seema Sepat, BS Jat, Alla Singh, Ph. Romen Sharma, Dharam Paul, DM Mahala, Bhupender Kumar, SL Jat, JS Hundal (GADVASU) and Manpreet Singh (PAU) | Oct 2023 to Sept 2026 | (NFSM, MA&FW) |
| 18. | Enhancement of maize production in catchment areas of ethanol industries | Dr. SL Jat | Drs. A.K. Singh, Alok Sahoo, Bhupender Kumar, B.S. Jat, Chikkappa GK, Deep Mohan Mahala, Mukesh Choudhary, N. Sunil, Pardeep Kumar, Ramesh Kumar, Romen Sharma, Seema Sepat, Suby SB | Apr 2024 to Mar 2027 | (NFSM, MA&FW) |

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| 19. | Popularization of Biofortified Maize Hybrids in Himalayan States and Central India with Special Reference to North Eastern Region for Sustainable Nutritional Security | Dr. SL Jat | Drs Ramesh Kumar, Bhupender Kumar and SB Singh, Romen Sharma | Mar 11, 2021 to Mar 10, 2025 | (DBT) |
| 20. | Consulting Services for Technical Advisory Support in Augmenting Maize Production in Assam Farmers for Sustainable Livelihood Security | Dr. SL Jat | Ramesh Kumar, Sumit Kumar, Aggarwal, Suby SB, Romen Ph. Sharma | Jan 1, 2023 to Sept 30, 2024 | (World Bank-APART) |
| 21. | Frontline Demonstration in Maize | Dr. SL Jat | Dr. Romen Sharma, Alok Sahoo and PK Bagaria | Apr 2014 onwards | NFSM |
| 22. | Agri Business Incubator | Dr. AK Singh | - | 2020 onwards | ICAR Scheme |
| 23. | Institute Technology Management Unit (ITMU) | Dr. Manesh C Dagla | - | Ongoing from 2007 | ICAR |
| 24. | Improving the livelihood and nutritional security through scientific maize cultivation and maize-based entrepreneurship development in affected areas of the Koraput district | Dr. Ph. Romen Sharma (Dr. Sujay Rakshit-Project Coordinator) | Drs. Ramesh Kumar, SL Jat, Bhupender Kumar, Alok Sahoo Collaborative: Dean of Research OUAT, Dr. Digvijay Swain (Breeder & I/c, AICRP Maize Centre, OUAT Bhubneshwar) Dr. Pramila Naik (Agronomist, AICRP Maize Centre, OUAT, Bhubneshwar) Dr. P. Sial (ADR, RRTTS, Semiliguda, Koraput), Dr. M.R. Mohanty (OIC, RRTTSS, OUAT, Jeypore, Koraput) | Oct 13, 2022 to Oct 12, 2024 | (Odisha Govt.) |
| 25. | Deployment & Scaling of high-yielding, climate-resilient maize hybrids to enhance the productivity of low-yielding districts in the Kharif season | Subgrantee Admin. Representative: Dr. H.S. Jat PI-Dr. S.L. Jat Dr. P.H. Zaidi Pr. Scientist, Global Maize Program, CIMMYT, Hyderabad | | November 2024 to March 2027 | BISA |

# Annual Financial Statement (2024-25)

**ANNEXURE-VIII**

## Expenditure Statement (2024-25)

(Amount in Lakhs)

| Head of Account | RE 2024-25 Institute Govt. Grant | RE 2024-25 Govt. Schemes | RE 2024-25 AICRP on `Maize | Actual Expenditure during 2024-25 Institute Govt. Grant | Actual Expenditure during 2024-25 Govt. Schemes | Actual Expenditure during 2024-25 AICRP on Maize |
|---|---|---|---|---|---|---|
| Grant in Capital | 970.00 | 320.72 | 18.00 | 970.00 | 300.00 | 18.00 |
| Grant in Salary | 1004.04 | 0.00 | 2727.69 | 1004.04 | 0.00 | 2727.69 |
| Grant in General including Pension | 716.00 | 231.88 | 415.00 | 716.00 | | 415.00 |
| TSP (General) | 15.00 | 0.00 | 70.00 | 15.00 | 216.46 | 70.00 |
| NEH (General) | 78.00 | 0.00 | 70.00 | 78.00 | 0.00 | 70.00 |
| NEH (Capital) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| SCSP (General) | 60.00 | 0.00 | 0.00 | 60.00 | 0.00 | 0.00 |
| SCSP (Capital) | 10.00 | 0.00 | 0.00 | 10.00 | | 0.00 |
| **Total** | **2853.04** | **552.60** | **3300.69** | **2853.04** | **517.18** | **3300.69** |

## Revenue Generation during the year 2024-25

| Particulars | Amount (in Lakhs) |
|---|---|
| Sale of Farm produce | 47.27 |
| Sale of vehicle, other machine tools | 0.00 |
| License Fee | 4.50 |
| Application fee from candidates | 0.60 |
| Analytical and testing fee | 15.66 |
| Receipts from Services rendered | 0.00 |
| Miscellaneous receipts | 2.03 |
| **Total** | **70.06** |

## Funds received for externally funded projects during the year 2024-25

| Particulars | Amount (in Lakhs) |
|---|---|
| DUS (Dr. Chikkappa) | 14.20 |
| FLD on Maize ( National Food Security Mission "NFSM") | 415.31 |
| SERB EEQ - Dr Abhijit Kumar Das | 2.00 |
| DBT Project | 32.00 |
| Upscaling maize based silage Value | 40.73 |
| Ethanol Production in India | 153.00 |
| E20 Ethanol From maize: Impact on food security | 3.14 |
| Creation of Seed Infrastructure Facilities of SMSP | 34.88 |
| Upscalling of Chitosan Thymol based smart | 4.54 |
| Catchment Area Project | 414.06 |
| CASMA Project | 14.20 |
| EMR-II (CSIR-HEDG) Scheme No 1827 | 0.63 |
| DMF (Livehood Corpus) | 22.40 |
| APART Project | 80.52 |
| Evaluation of Isoxaflutole (Bayer Crop) | 12.00 |
| CIMMYT (Improving Rainfed Maize Productivity) | 20.54 |
| CIMMYT FAW/IPM | 7.72 |
| CIMMYT Collaborative Programme | 0.86 |
| **Total** | **1272.73** |

## Financial targets and achievements (All employees)

(Amount in Lakhs)

| RE 2024-25 for HRD | Actual Expenditure up to 31st March 2025 for HRD | % Utilization of RE 2024-25 |
|---|---|---|
| 1.07 | 1.07 | 100% |

ANNEXURE-IX

# Personnel, Transfers, New Joining, Superannuation, Promotion

## Existing Staff in position

| Name | Designation | Discipline |
|---|---|---|
| **Indian Institute of Maize Research, PAU Campus, Ludhiana** | | |
| Dr. Hanuman Sahay Jat | Director | |
| Dr. Aditya Kumar Singh | Principal Scientist | Agronomy |
| Dr. Shyam Bir Singh | Principal Scientist | Plant Breeding |
| Dr. Ramesh Kumar | Principal Scientist | Plant Breeding |
| Dr Manesh Chand Dagla | Senior Scientist | Plant Breeding |
| Dr Seema Sepat | Senior Scientist | Agronomy |
| Dr. Bharat Bhushan | Senior Scientist | Biochemistry |
| Dr. Abhijit Kumar Das | Senior Scientist | Plant Breeding |
| Dr. Pardeep Kumar | Scientist | Plant Breeding |
| Dr. Mamta Gupta | Scientist | Agricultural Biotechnology |
| | | |
| Dr. Alla Singh | Scientist | Agricultural Biotechnology |
| Dr. Bahadur Singh Jat | Scientist | Plant Breeding |
| DR. Pravin Kumar Bagaria | Scientist | Plant Pathology |
| Dr.Mukesh Chaudhary* | Scientist | Plant Breeding |
| Dr. P.Romen Sharma | Scientist | Agricultural Extension |
| Dr.Deep Mohan Mahala* | Scientist | Soil Science |
| Dr. Shanti Devi Bamboriya* | Scientist | Agronomy |
| Shri B.C.Katoch | Senior Administrative Officer | |
| Sh. Sayed Mohsin Ali | Finance & Account Officer | |
| Sh. Prashant Garg | Assistant Administrative Officer | |
| Smt. Sandeep Kaur | Assistant Administrative Officer | |
| Smt. Prabhjot Kaur | Assistant | |
| Miss Usha Birdi | Assistant | |
| Mr. Tanuj | Assistant | |
| Miss Reena Nandal | Assistant | |
| Miss Sweta Kaim | Assistant | |
| Mr. Ravi Kumar | T-1 | |
| Mr. Virmani Kumar | T-1 | |

## Indian Institute of Maize Research, Unit Office, Delhi

| Name | Designation | Discipline |
|---|---|---|
| | | |
| Dr. Shankar Lal Jat | Senior Scientist | Agronomy |
| Dr. Suby Sulaikhabeevi B | Senior Scientist | Entomology |
| Dr. Bhupender Kumar | Senior Scientist | Plant Breeding |
| Dr. Krishan Kumar | Scientist | Agricultural Biotechnology |
| Sh. Anwar Ali | SSS | |

## Regional Maize Research and Seed production Centre, Begusarai, Bihar

| Name | Designation | Discipline |
|---|---|---|
| Dr. Chikkappa G. Karjagi | Principal Scientist | Plant Breeding |
| Dr. Alok Kumar Sahoo | Scientist | Agricultural Extension |
| Mr. Rahul | T3 | |
| Mr. Kamal Vats | T3 | |
| **Winter Nursery Centre, Hyderabad** | | |
| Dr. Neelam Sunil | Principal Scientist | Economic Botany |
| Dr. P. Laxmi soujanya | Senior Scientist | Entomology |
| Dr. K.R. Yatish | Senior Scientist | Plant Genetics |
| Ms. Susmita Cherukuri* | Scientist | Plant Breeding |
| Sh. Amar Nath | SSS | |

## New Joining

| Name & Designation | Time of Joining | Deputation Institute |
|---|---|---|
| Mr Tanuj, Assistant | 27.07.2023 | |
| Miss Reema Nandal, Assistant | 13.09.2024 | |
| Miss Sweta Kaim, Assistant | 02.09.2024 | |
| Mr. Ravi Kumar, T-1 | 09.05.2024 | |
| Mr. Virmani Kumar, T-1 | 07.05.2024 | |

## Transfer

| Name & Designation | Date of Transfer | Transferred to |
|---|---|---|
| Dr. Sumit Kumar Aggarwal, Scientist | 29.11.2024 | ICAR-IIPR, Regional Station, Bikaner |

## Transfer from

| Name & Designation | Date of Joining | Transferred from |
|---|---|---|
| Sh. Sayed Mohsin Ali, FAO | 12.08.2024 | ICAR-IVRI, Izzatnagar, Bareily |

## *Scientist on Study Leave

| Name | Time period of Study Leave | Institute Name |
|---|---|---|
| Mr. Vishal Singh | 18.12.2019 to 30.07.2024 | Utah State University (Since then on unapproved EOL) Logan, USA |
| Ms. Susmita Cherukuri | 23.01.2023 to 22.01.2026 | (PJTSAU), Rajendranagar, Hyderabad |

## Staff on Deputation

| Name & Designation | Time of Deputation | Deputation Institute |
|---|---|---|
| Dr. Dharam Pal | 03.11.2020 to 02.11.2022 | MHU, Karnal (Haryana) |

## Promotion

| Name & Designation | Date of Promotion | Promotion Post |
|---|---|---|
| Dr. Bharat Bhushan | 10.02.2023 | Senior Scientist Sr. Grade (RGP of Rs. 9000/- Revised Research Pay level 13A) |
| Dr. Pardeep Kumar | 01.01.2024 | Senior Scientist |
| Dr. Deep Mohan Mahala | 04.01.2023 | Senior Scientist Sr. Grade (RGP of Rs. 7000/- Revised Research Pay level 11) |
| Dr. Shanti Devi Bamboriya | 02.07.2023 | Senior Scientist Sr. Grade (RGP of Rs. 7000/- Revised Research Pay level 11) |

## Staff Positions of ICAR-IIMR

| Type of Post | Approved by D/O expenditure | In position | Vacant |
|---|---|---|---|
| Scientific | 42 | 26+2 | 14 |
| Administrative | 21 | 10 | 11 |
| Technical | 10 | 05 | 05 |
| Supporting | 03 | 03 | 0 |


*AICRP on Maize Centres*

हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद

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# ICAR-Indian Institute of Maize Research

Ladhowal, Chahar Village, Ludhiana-141004 (India)