

# वार्षिक प्रतिवेदन *Annual Report* **2024**



भा कृ अनु प -राष्ट्रीय सोयाबीन अनुसन्धान सस्थान  
खडवा रोड, इंदौर-452001

ICAR-National Soybean Research Institute

Khandwa Road, Indore 452001



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## PREFACE



Soybean, a crop acknowledged as vehicle of socio-economic transformation of millions of small and marginal farmers of India contributed one third to total oilseeds produced in the country during 2023-24. It is therefore

playing a very crucial role in reducing edible oil imports and also supports various soy based industries by providing raw materials. Earlier estimates indicates 13.36 MT soybean production from 12.93 Mha area with an average yield of 1033 kg/ha during 2024. However, it is a matter of concern that the average national productivity is stagnant for the last few years. But it is noteworthy to mention that the yield levels of *khariif* 2024 has experienced adverse weather conditions. Similarly, the productivity of soybean in Madhya Pradesh which alone contribute (45.8% to the total area of the country) has affected due to disease incidences particularly anthracnose and Rhizoctonia Aerial Blight in addition to Yellow Vein Mosaic.

It is very important that there is a need of increasing the national average production and productivity of soybean crop to meet out the future demand which are the challenges before the scientists. The task is more difficult considering various biotic and abiotic stresses being frequently experienced now a days. The scientists of ICAR-National Soybean Research Institute (formerly ICAR-Indian Institute of Soybean Research) are actively working to tackle these challenges through their research programmes targeting to develop high-yielding, trait-specific varieties that are resistant or tolerant to biotic and abiotic stresses. The institute has tried to strengthen the seed production and its delivery mechanism for promoting the newly released soybean varieties through formal as well as informal ways. The institute has initiated distribution of minikits of soybean varieties on the occasion of Rashtriya Kisan Diwas being organized on 23rd December every year since 2023, a platform for soybean farmers of far-off areas to buy a quality seed of recently notified soybean varieties facilitating multiplication of the

same during summer for its use during main *khariif* season. It is a matter of appreciation that the soybean varieties developed by ICAR-NSRI like NRC 150, NRC 142, NRC 165, NRC 130, NRC 181 are gaining the popularity among the soybean growers of Central India.

Biotic and abiotic stresses remained the serious challenges in increasing productivity of soybean. Year 2024 witnessed release of two soybean varieties NRC 197 and NRC 149 released for northern plain zone and north eastern hill zone respectively as well as NRC 165 for Central Zone. Results of seven years of experiments under conservation agriculture were encouraging. Similarly, second year experimentation on soybean cultivation under natural farming were also promising raising hope for successful soybean production under prevalent cropping systems. Efforts were also initiated on standardization of date of sowing and plant geometry for seed multiplication during summer season. 1400 germplasm accessions of soybean were evaluated and multiplied during summer season. Few promising microbial strains were also evaluated for their performance.

I express my sincere gratitude to Dr. Himanshu Pathak, Secretary, DARE, and Director General, ICAR, for consistent support and guidance in soybean research and development. I also feel indebted to Dr. T. R. Sharma, Deputy Director General (Crop Science) for his constant mentoring, support and guidance in planning and execution of various research activities at the institute. I extend my deep appreciation to the Chairman and members of RAC for their guidance in strategic research planning. Special thanks go to Dr Sanjeev Gupta, ADG (Oilseed and Pulses) ICAR, New Delhi, for his valuable contributions to the progress of the Institute. I would also like to acknowledge the editorial committee, scientists and staff for their efforts in making this report comprehensive and informative. I trust that this Annual Report will prove valuable to researchers, policymakers, farmers, industries, and development functionaries involved in promoting soybean research and development.

**K.H.Singh**

Director - ICAR-NSRI, Indore

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## EXECUTIVE SUMMARY

- NRC 165 an early maturing variety (92 days) developed from JS 95-60 (photo-insensitive) x AGS 25 (long juvenile) notified for Central Zone. The average yield of the variety (1886 Kg) was 13% higher than the best check JS 20-34.
- NRC 197, an early maturing KTI free genotype has been released for cultivation in North Hill Zone by CVRC.
- NRC 268, lipoxygenase 2 free genotype has been promoted to AVT II in Central Zone in 2024.
- Two food grade entrais NRC 290 (KTI and Lipoxygenase 2), NRC 291 (KTI free), and high oil genotype NRC 292 promoted AVT I, 2025.
- A total of 157 soybean cultivars were genotyped with 32 traits associated SNP markers using KASP assay. Marker-trait association analysis using GLM procedure in TASSEL identified 4 markers associated with days to flowering, 3 markers with days to maturity, two with seed weight and six markers with yield traits.
- NRC 252 was registered with ICAR-NBPGR which is having extra early maturity trait. It's maturity duration is 71 days against 92 days maturity of check variety JS 20-34.
- NRC 285 derived from Da-da-cha-mame x NRC101 is Kunitz Trypsin Inhibitor (KTI) free and Black seed coat registered with ICAR-NBPGR as genetic stock
- The highest mean yield of 30.24 q/ha was recorded in 15 x 5 cm planting density as against 45 x 5 cm planting (17.84 q/ha).
- Based on yield and early maturity three entries YP 44, 49, and 42 were promoted to IVT early 2025 trial and two entries viz., YP 50 and YP 42 were promoted to IVT normal maturity trial 2025.
- NRC 270, a high yielding entry has produced 19 % high yield than best check JS 20-98 and again under AVT I it produced 18.2 % higher yield than best check variety JS 21-72 and promoted to AVTII 2025 in Central Zone.
- The genotype NRC 295 was evaluated in IVT 2024. It was drought tolerant genotype derived from the cross (JS 93-05 x JS 97-52). In station trial 2023, the genotype found 24.8% superior yielding (19.62 q/ha) than the best check RVS 24 (15.72 q/ha).
- NRC 294 derived from Hardee X NRC 7 promoted to AVT1 based on yield superiority of >10% over best check in central zone.
- Based on the yield reduction under waterlogging stress condition and waterlogging resistance index (WLRI), five promising genotypes viz., NRC 256, NRC 257, NRC 142, C 20-10-10, and EC 250591 were identified as donor parents for further breeding program.
- Permanent broad bed furrow with residue retention improved the yield (20%) and economics of *kharif* and *rabi* crops over conventional tillage without residue retention under a soybean-based cropping system.
- Standardized natural farming practices for soybean-based cropping systems.
- Initiated an experiment to develop the package of practices for summer soybean seed production.
- *Microbial consortia (Bacillus aryabhatai + Bradyrhizobium lioningense +AMF)* significantly improved enzymes and available nutrient content in soil over control.
- The phytohormones Tria 2ppm with AM inoculation found significantly higher nodule biomass, leghemoglobin content in nodules, and soybean yield.
- The seed inoculation of heterotrophic SOBs (H3) *Bacillus amyloliquefaciens* significantly enhanced soybean yield by 17 % over control.
- For the management of aerial blight disease of soybean, seed treatment with Thiophanate methyl + Azoxystrobin + Thiomethoxam @ 10ml/kg seed + spray of Fluxapyroxad 167 g/l + Pyraclostrobin 333 g/l SC @ 300 g/ha 30,45 and 65 DAS

produced lowest disease severity of 48.35%.

- Among the soybean varieties screened under field conditions, RSC 10-46, NRC SL-1, JS 21-72, JS 20-69, PK 308, JS 20-98, PS 1347 were found to be highly resistant against aerial blight disease of soybean.
- For isolation and identification of kairomones for soybean stem fly, *M. sojae*, eight soybean genotypes viz., F4P18, F4P21, JS 335, JS 9305, CAT47, G5P22, JS 9560 and CAT2503 were evaluated through air entrainment, olfactometer assays, GC EAD (Gas Chromatography Electroantennodetection) and GCMS (Gas Chromatography Mass Spectrometry).
- The GC-EAD analysis revealed that a total of 8 compounds were identified. Out of the eight compounds some are attractive and some are repellants in nature for stem fly.
- Under the ICT initiatives, a total of 145 videos comprising different playlist groups has been produced including 7 live webcast of the events as well as 64 shorts have been uploaded on the YouTube channel. Similarly, 64 reels on instagram reels and 18 on facebook page were uploaded during the year.
- The results of the sentiment analysis carried out for the institute YouTube channel showed that the VEDAR technique achieved the highest scores in analyzing the YouTube comments. Vedar gave 94.4% accuracy with the best result as compared to other techniques viz. TextBlob 86.6% and SentiWordNet 77.6% at the level of micro text.
- A Three Day's National Training Programme on "Climate Smart Production Technologies to Enhance Soybean Productivity Under Changing Climate" during 6-8 February 2024 was organized. Also 6 trainers' training programs for input dealers were successfully organized.
- A total of 1040 FLDs were conducted across the country out of which 250 FLDs were conducted in M.P. Similarly, 180 demonstrations each on Soybean (*kharif*) and Wheat (*rabi*) were conducted in 18 districts of M.P under ICAR-NSRI-MP Govt Project.
- The yield data of a demonstration plot involving newly released 11 soybean varieties revealed the highest yield of (30.91q/ha) under JS 21-72 followed by NRC 142 (22.78 q/ha) and NRC 165 (19.27 q/ha).
- A total of 33 one-day training programmes were conducted with the participation of 972 farmers including 55 women farmers
- The institute ABI centre has conducted 7 training programmes of 3 days' duration on "Soy food processing techniques and utilization of soy for food products" for the FPOs of Maharashtra. In addition, 2 more trainings were conducted for upcoming entrepreneurs.
- Bilingual weekly advisories were issued (18 Nos.) during the *kharif* season highlighting agronomic and plant protection measures to be followed by the soybean growers.
- Under the SCSP component, 22 trainings for 2218 beneficiary farmers along with 320 demonstrations were conducted for the farmers of Sehore, Ujjain and Khargone Districts of Madhya Pradesh.
- Similarly, 13 trainings were organized for Schedule tribe (ST) farmers and distributed agricultural inputs to them under Tribal sub-plan (TSP) scheme.





## कार्यकारी सारांश

- एनआरसी 165 मध्य क्षेत्र के लिए अधिसूचित जेएस 95-60 (फोटो-असंवेदनशील) X एजीएस 25 (लम्बी युवावस्था) से विकसित एक जल्दी पकने वाली किस्म (92 दिन) है। किस्म की औसत उपज (1886 किग्रा) जो सर्वश्रेष्ठ चेक जेएस 20-34 की तुलना में 13% अधिक थी।
- एनआरसी 197 को सीवीआरसी द्वारा उत्तरी पहाड़ी क्षेत्र में खेती के लिए एक शीघ्र पकनेवाली केटीआई मुक्त किस्म जारी किया गया है।
- एनआरसी 268, लिपोक्सिजेनेज 2 मुक्त जीनोटाइप को 2024 में मध्य क्षेत्र में एवीटी II में पदोन्नत किया गया है।
- दो खाद्य ग्रेड लाइने एनआरसी 290 (केटीआई और लिपोक्सिजेनेज 2), एनआरसी 291 (केटीआई मुक्त), और उच्च तेल जीनोटाइप एनआरसी 292 एवीटी I, में पदोन्नत किया गया।
- कुल 157 सोयाबीन किस्मों को केएसपी परख का उपयोग करके 32 लक्षणों से जुड़े एसएनपी मार्करों के साथ जीनोटाइप किया गया था। टासेल में जीएलएम प्रक्रिया का उपयोग करके मार्कर-विशेषता एसोसिएशन विश्लेषण ने फूलों के दिनों से जुड़े 4 मार्करों, परिपक्वता के दिनों के लिए 3 मार्करों, बीज वजन के लिए दो और उपज लक्षणों के लिए छह मार्करों की पहचान की।
- एनआरसी 252 को आईसीएआर-एनबीपीजीआर के साथ पंजीकृत किया गया था जिसमें अतिरिक्त शीघ्र पकने वाली विशेषता है। इसकी परिपक्वता अवधि चेक वैरायटी जेएस 20-34 92 दिनों में पकने मुकाबले 71 दिन है।
- DA-DA-CHA-MAME NRC101 से प्राप्त NRC 285 KT1 मुक्त और ब्लैक सीड कोट है जो आनुवंशिक स्टॉक के रूप में ICAR NBPGR के साथ पंजीकृत किया गया।
- एक अन्य परिक्षण में कतार से कतार की दूरी 15X5 सेमी. के रोपण से अधिकतम औसत उपज (30.24 क्विंटल/हे) प्राप्त हुआ जबकि 45X5 सेमी रोपण से 17.84 क्विंटल/हे उत्पादन प्राप्त हुआ।
- उपज और शीघ्र परिपक्वता के आधार पर तीन प्रविष्टियों YP 44, 49 और 42 को 2025 IVT early परीक्षण में पदोन्नत किया गया और दो प्रविष्टियों अर्थात् YP 50 और YP 42 को IVT सामान्य परिपक्वता परीक्षण 2025 में पदोन्नत किया गया।
- एनआरसी 270, एक उच्च उपज वाली प्रविष्टि का उत्पादन जेएस 20-98 श्रेष्ठ चेक की तुलना में 19% अधिक उत्पादन प्राप्त हुआ और फिर एवीटी I के तहत इसने सर्वश्रेष्ठ चेक किस्म जेएस 21-72 की तुलना में 18.2% अधिक उत्पादन प्राप्त किया एवं मध्य क्षेत्र के लिए एवीटी II 2025 में पदोन्नत किया गया।
- जीनोटाइप एनआरसी 295 का मूल्यांकन आईवीटी 2024 में किया गया था। यह क्रॉस (जेएस 93-05 x जेएस 97-52) से प्राप्त सूखा सहिष्णु जीनोटाइप था। स्टेशन ट्रायल 2023 में, जीनोटाइप को सर्वश्रेष्ठ चेक आरवीएस 24 (15.72 कि प्रति हैक्टर) की तुलना में 24.8% बेहतर उपज (19.62 कि प्रति हैक्टर) मिली।
- मध्य क्षेत्र में सर्वश्रेष्ठ चेक पर >10% की उपज श्रेष्ठता के आधार पर HARDEEXNRC 7 से प्राप्त एनआरसी 294 को AVT-I 2025 में पदोन्नत किया गया।
- जलभराव तनाव की स्थिति और जलभराव प्रतिरोध सूचकांक (डब्ल्यूएलआरआई) के तहत उपज में कमी के आधार पर, पांच जीनोटाइप जैसे, एनआरसी 256, एनआरसी 257, एनआरसी 142, सी 20-10-10, और ईसी 250591 को भविष्य के प्रजनन कार्यक्रम के लिए दाता के रूप में पहचाना गया था।
- अवशेष प्रतिधारण के साथ स्थायी ब्रॉड बेड फरो के अपनाने से सोयाबीन आधारित फसल प्रणाली के अंतर्गत अवशेष प्रतिधारण के स्थान पर पारंपरिक जुताई करने से खरीफ और रबी फसलों में 20% अधिक उत्पादन प्राप्त हुआ।
- सोयाबीन-आधारित फसल प्रणालियों के लिए प्राकृतिक खेती प्रथाएं मानकीकृत किया गया।
- ग्रीष्मकालीन सोयाबीन बीज उत्पादन के लिए प्रथाओं के पैकेज को विकसित करने के लिए एक प्रयोग शुरू किया।
- माइक्रोबियल कंसोर्टिया (बैसिलस आर्यभट्ट + बैडिरिजोबियम लियोनिंगेंस + एएमएफ) के उपयोग से एंजाइम में काफी सुधार पाया गया और मिट्टी में उपलब्ध पोषक तत्वों की सामग्री में सुधार हुआ।
- एएम इनोक्यूलेशन के साथ फाइटोहार्मोन ट्राया 2पीपीएम के उपयोग से अधिक नोड्यूल बायोमास, नोड्यूल्स में लेघमोग्लोबिन सामग्री तथा अधिक सोयाबीन उत्पादन मिला।
- हेटरोट्रोफिक एसओबी (एच3) बैसिलस एमाइलोलिकेफेशियंस के बीज उपचार ने सोयाबीन की उपज में 17% की वृद्धि की।



- स्थानीय परिस्थिति में सोयाबीन किस्मों के मूल्यांकन में, आरएससी 10-46, एनआरसी एसएल-1, जेएस 21-72, जेएस 20-69, पीके 308, जेएस 20-98, पीएस 1347 को सोयाबीन की एरिअल ब्लाइट बीमारी के खिलाफ अत्यधिक प्रतिरोधी पाया गया।
- सोयाबीन स्टेम फ्लाई के लिए कैरोमोन के अलगाव और पहचान के लिए, एम. सोजे, आठ सोयाबीन जीनोटाइप अर्थात, एफ4पी18, एफ4पी21, जेएस 335, जेएस 9305, कैट47, जी5पी22, जेएस 9560 और कैट2503 का मूल्यांकन एयर एंटेमेंट, ओल्ट्रैक्टोमीटर असेज, जीसी ईएडी (गैस क्रोमेटोग्राफी इलेक्ट्रोएंटेनोडिटेक्शन) और जीसीएमएस (गैस क्रोमेटोग्राफी मास स्पेक्ट्रोमीट्री) के माध्यम से किया गया था।
- जीसी-ईएडी विश्लेषण से पता चला कि कुल 8 यौगिकों की पहचान की गई थी। आठ यौगिकों में से कुछ आकर्षक हैं और कुछ स्टेम फ्लाई के लिए प्रकृति में रिपेलेंट हैं।
- सूचना एवं संचार प्रौद्योगिकी बाबत की किये गए नए कार्यों में संस्थान के यूट्यूब चैनल पर 7 लाइव वेबकास्ट सहित विभिन्न श्रेणियों की प्लेलिस्ट पर कुल 145 वीडियो एवं 64 शार्ट रील अपलोड किए गए हैं। इसी तरह, वर्ष के दौरान इंस्टाग्राम पर 64 रील और फेसबुक पेज पर 18 रील अपलोड किए गए।
- संस्थान द्वारा उपयोग किये जा रहे 6 मुख्य सोशल मीडिया में से संस्थान के यूट्यूब चैनल पर अपलोड किये गए विडियोज का दर्शकों में प्रभाव एवं भावनात्मक विश्लेषण किया गया। इसके लिए उपयोग किये गए तीन प्रमुख विधियाँ (वेदार, टेक्स्टबलॉब एवं सेंटीवर्डनेट) में से वेदार पद्धति से सर्वाधिक 94.4% सटीक प्रभावकारिता देखी गयी।
- 6-8 फरवरी 2024 के दौरान बदलती जलवायु के तहत सोयाबीन उत्पादकता को बढ़ाने के लिए जलवायु स्मार्ट उत्पादन प्रौद्योगिकियों पर तीन दिवसीय राष्ट्रीय प्रशिक्षण कार्यक्रम का आयोजन किया गया था। इसके अलावा इनपुट

डीलरों के लिए 6 प्रशिक्षक प्रशिक्षण कार्यक्रम सफलतापूर्वक आयोजित किए गए।

- देश भर में कुल 1040 अग्रिम पंक्ति प्रदर्शन आयोजित किये गए जिनमें से 250 एफएलडी मध्य प्रदेश में आयोजित किये गए। इसी तरह, आईसीएआर-एनएसआरआई-एमपी सरकारी परियोजना के तहत मध्य प्रदेश के 18 जिलों में सोयाबीन (खरीफ) और गेहूँ (रबी) पर 180 प्रदर्शन आयोजित किए गए।
- नई जारी की गई 11 सोयाबीन किस्मों से जुड़े एक प्रदर्शन प्लाट के उपज डेटा विश्लेषण से प्राप्त जानकारी के अनुसार जेएस 21-72 (30.91 कि प्रति हैक्टर) की उच्चतम उपज, एनआरसी 142 (22.78 कि प्रति हैक्टर) और एनआरसी 165 (19.27 कि प्रति हैक्टर) उत्पादन प्राप्त किया।
- वर्ष के दौरान कुल 33 एकदिवसीय प्रशिक्षण कार्यक्रम आयोजित किए गए जिसमें 55 महिला सहित 972 किसानों की भागीदारी रही।
- संस्थान के एबीआई केंद्र ने महाराष्ट्र के एफपीओ के लिए सोया खाद्य प्रसंस्करण तकनीकों और खाद्य उत्पादों के लिए सोया के उपयोग पर 3 दिनों की अवधि के 7 प्रशिक्षण कार्यक्रम आयोजित किये। इसके अलावा, आगामी उद्यमियों के लिए 2 और प्रशिक्षण आयोजित किए गए।
- खरीफ के मौसम के दौरान सोयाबीन उत्पादकों द्वारा पालन किए जाने वाले कृषि विज्ञान और पौध संरक्षण उपायों पर 18 द्विभाषी साप्ताहिक सलाह जारी किए गए।
- एससीएसपी उपयोजना के अंतर्गत, मध्य प्रदेश के सीहोर, उज्जैन और खरगोन जिलों के किसानों के लिए 320 प्रदर्शनों के साथ 2218 लाभार्थी किसानों के लिए 22 प्रशिक्षण आयोजित किए गए थे।
- अनुसूचित जनजाति (एसटी) किसानों के लिए 13 प्रशिक्षण आयोजित किए गए और आदिवासी उप-योजना (टीएसपी) योजना के तहत उन्हें कृषि इनपुट वितरित किए गए।





## INTRODUCTION

### Background

The Indian Council of Agricultural Research has initiated All India Coordinated Research Project on Soybean way back in 1967 when there was hardly any area under soybean in the country. However, the varietal development work carried out under AICRPS has led to development of number of soybean varieties suiting to different agro climatic conditions. Consequently, the area under the crop started increasing when more and more AICRPS centres started functioning. Further, to take up the centralized research to support soybean production systems with basic information and breeding material, the ICAR established then National Research Centre for Soybean at Indore in 1987. It was re-designated as Directorate of Soybean Research in 2009 and as Indian Institute of Soybean Research in 2016. Recently, it was renamed as National Soybean Research Institute. Coordinating unit of AICRPS, Soybean Breeder Seed Production (SBSP) and National Active Germplasm Site (NAGS) for soybean germplasm are also situated at ICAR-NSRI, Indore. The research plan and policies of ICAR-NSRI are guided by the recommendations of the Research Advisory Committee (RAC), Quinquennial Review Team (QRT) and the Institute Research Council (IRC). The Institute Management Committee (IMC) supports implementation of its plans and programs. Institute had also setup an Agribusiness Incubation Centre (ABI) for training and support of start-ups in the area of soybean food processing and production technologies.

### Location

ICAR-NSRI campus is located at Khandwa Road near Crystal IT Park in Indore city of Madhya Pradesh state, which lies in Vidhyanchal range of Malwa Plateau at 22° 43'7"N latitude and 75° 52'7"E longitude. It is positioned at an altitude of 550 meter above the mean sea level. The institute has an area of 58.05 hectares with 42.7 ha cultivable land for research and seed production. ICAR-NSRI is situated at a distance of 12 Km from Devi Ahilya Bai Holkar International Airport, Indore and 6 Km from railway station, Indore.

### Soil

The soil of ICAR-NSRI research farm is deep black cotton soil with pH 7.6 to 8.1 (basic / alkaline), low to medium in organic carbon, available phosphorus, and high in potassium. Taxonomically it is classified as fine, montmorillonitic, hyperthermic family of typic chromusterts and fine clay loam, montmorillonitic family of lithic vertic ustochrepts.

### Climate

The climate of the *Malwa* Plateau of Madhya Pradesh is semi-arid with a growing period of 150-180 days. As such, the climate of this region is characterized by 3 distinct agricultural seasons. These are: (a) rainy season, also known as monsoon or *kharif*, usually begins from mid-June and extends up to early October. Generally, duration of monsoon is approximately 98 days with about 800 mm mean annual rainfall and soybean is grown during this season as a rainfed crop. (b) post-rainy season which runs from mid-October to March, also known as *rabi*, is dry and cool and, (c) warm and dry season, which begins in February and lasts until April called *zaid* or summer/spring and any crop grown during this season requires irrigation.

### Past achievements

Major achievements of the institute include maintenance of a vast collection of soybean germplasm comprising exotic, indigenous, breeding lines and wild species. Currently, 6221 germplasm accessions are maintained at ICAR-NSRI. A number of genetic resources have been identified for various traits like photoperiod insensitivity, long juvenility, extra early maturity, drought and waterlogging tolerance, heat stress tolerance and resistance to diseases such as charcoal rot, anthracnose, rust and yellow mosaic and some insects. Twenty-two high yielding varieties having resistance to various biotic and abiotic stresses and food grade characters have been bred by Institute and released for cultivation in different agro-ecological regions of the country. The institute has done significant efforts in development and release of food grade varieties such as NRC 127,

NRC 132, NRC 147, NRC 142, NRC 150, NRC 152, NRC 181, NRC 197 and NRC 188 (Vegetable type). NRC 142, a high yielding variety free from KTI and Lipoxygenase 2, has been released for Central and Southern Zone. First high oleic acid variety NRC 147, has been released for cultivation in Eastern and Southern Zone.

Four germplasm accessions EC 390977, EC 34101, JS 20-34 and MACS 330 having photoperiodic genes and early maturity traits, EC34372 for anthracnose resistance, AGS 25 having long juvenile trait and JS 20-38 having water logging traits have been registered at ICAR-NBPGR, New Delhi. Similarly, two genetic stocks NRCSL-8 having Yellow Mosaic Disease resistance, NRC 254 with extra early maturity traits have also been registered. Molecular markers have been identified for maturity, 100-seed weight and yellow mosaic disease resistance traits.

In the field of crop production, *in situ* moisture conservation technology and the associated mechanization for soybean-based cropping system (BBF, FIRBS, R&F, Sub-soiler) have been developed and commercialized. Remunerative soybean based intercropping systems (Soybean + Pigeonpea, Soybean + Maize and Soybean + Sugarcane) with suitable cultivars under soybean + sugarcane intercropping were identified. Integrated nutrient and weed management for soybean based cropping system have been developed. Soil health enhancing microbes including Zn, Fe solubilizing bacteria and native rhizobia have been identified. Foliar application of Thiourea was recommended to alleviate drought stress in soybean. Efficient micronutrient's agronomic bio-fortification methods to improve soybean yield and quality aspects under soybean-wheat cropping system were identified. Microbial inoculation (*Bacillus aryabhattai*, *Burkholderia arboris*) + mycorrhizal fungi increased the productivity of soybean and wheat crop. Microbial consortia (*Bradyrhizobium daqingense* + *Bacillus aryabhattii*) was identified to save 25% of Nitrogen & Phosphorous fertilizers in soybean.

In the area of plant protection, integrated management schedule for major soybean insect pests have been worked out. Studies on epidemiology of rust occurrence in soybean

revealed that the source of rust inoculum for south India lies in the Krishna valley. The economic benefit of adoption of rust resistant varieties in rust prone districts of Maharashtra and Karnataka states were estimated which showed that widespread adoption of rust resistant varieties significantly contributed to farm income and crop stabilization in the region. Among the soybean varieties screened under field conditions, RSC 10-46, NRC SL-1, JS 21-72, JS 20-69, PK 308, JS 20-98, PS 1347 were found to be highly resistant against aerial blight disease of soybean.

For isolation and identification of kairomones for soybean stem fly, *M. sojae*, eight soybean genotypes viz., F4P18, F4P21, JS 335, JS 9305, CAT47, G5P22, JS 9560 and CAT2503 were evaluated through air entrainment, olfactometer assays, GC EAD (Gas Chromatography Electroantennodetection) and GCMS (Gas Chromatography Mass Spectrometry). The GC-EAD analysis revealed that a total of 8 compounds were identified. Out of the eight compounds some are attractive and some are repellants in nature for stem fly.

Web-based expert systems for varietal and disease identification and data management systems for AICRPS have been developed. Soybean Gyan - a mobile app for soybean farmers, developed by the institute, provides information on different aspect of cultivation viz., agronomic package of practices, insect and disease management etc. It also gives information about selection of suitable varieties; seed treatment, seed rate and seed storage.

The institute has adopted village Memdi as ICAR Model Village and promoting the frontline technologies for their wider dissemination. The institute is also making use of popular social media (YouTube, Instagram, Facebook, X, Telegram and WhatsApp) for promotion of soybean production technologies. Under this, initiatives, videos comprising different topics including weekly advisories has been regularly produced and uploaded on the YouTube channel. In addition, conventional methods like training of soybean farmers. All the flagship programmes of GOI/ICAR like Swachhata Abhiyan, SCSP/TSP, MGMG etc have been implemented in letter and spirit.



### Mandate of ICAR-NSRI

To spearhead the research, give direction and support production systems' research, following mandates have been laid out:

- Basic, strategic and adaptive research on soybean for improving productivity and quality
- Provide access to information, knowledge and genetic material to

develop improved technology and enhanced soybean production.

- Coordination of applied research to develop location specific varieties and technologies;
- Dissemination of technology and capacity building

### Organizational set-up

For efficient functioning of institute and to achieve the mandate and objectives, the organizational pattern of the Institute has been evolved and depicted below:



Organogram of ICAR-NSRI

### Financial Statement and Budget

#### Abstract of Expenditure of ICAR-NSRI for 2023-2024 (₹ in lakhs)

Head	R.E.	Actual expenditure
Grant in Aid-Pay & Allowances	1171.60	1171.60
Grant in Aid-Capital	150.00	150.00
Grant in Aid-General	595.00	595.00
Pension & Retirement Benefits	167.97	167.97
NEH (General)	55.00	55.00
NEH (Capital)	20.00	20.00
TSP (General)	18.00	18.00
TSP (Capital)	10.00	10.00
SCSP (General)	47.00	47.00
SCSP (Capital)	40.00	40.00
<b>Total</b>	<b>2274.57</b>	<b>2274.57</b>
<b>Revenue Generated</b>		<b>41.16</b>

#### Budget of ICAR-NSRI for 2024-2025 (₹ in lakhs)

Head	B.E.
Grant in Aid-Pay & Allowances	1242.00
Grant in Aid-Capital	140.00
Grant in Aid-General	529.00
Pension & Retirement Benefits	151.00
NEH (General)	50.00
TSP (General)	16.00
TSP (Capital)	9.80
SCSP (General)	43.00
SCSP (Capital)	37.00
<b>Total</b>	<b>2217.80</b>

**Staff Position**

The total sanctioned staff position of ICAR-NSRI as on 31<sup>st</sup> December 2024 is 101 comprising 35 scientific, 22 technical, 17 administrative and 27 supporting staff

positions. Out of which 70 are in position as on 31<sup>st</sup> December 2024. The budget and expenditure during 2023-2024, and budget for 2024-25 is given below.

S.No	Designation	Level in Pay Matrix	Sanctioned strength	In position	Vacant post
	<b>I Scientific RMP</b>		<b>01</b>	<b>01</b>	<b>-</b>
1.	Principal Scientist	Level 14	03	02	01
2.	Senior Scientist	Level 12	06	03	03
3.	Scientist	Level 10	25	20	05
	<b>Total</b>		<b>35</b>	<b>26</b>	<b>09</b>
	<b>II Technical</b>				
4.	T-6	Level 10	02	01	01
5.	T-3	Level 5	11	04	07
6.	T-1	Level 3	09	09	00
	<b>Total</b>		<b>22</b>	<b>14</b>	<b>08</b>
	<b>III Administration</b>				
7.	Sr. Administrative Officer	Level 10	01	01	-
8.	Sr. Finance &Accounts Officer	Level 10	01	-	01
9.	Finance &Accounts Officer	Level 10	00	01	- 01
10.	Assistant Administrative Officer	Level 7	03	01	02
11.	Private Secretary	Level 7	01	-	01
12.	Personal Assistant	Level 6	01	-	01
13.	Assistant	Level 6	07	04	03
14.	UDC	Level 5	02	00	02
15.	LDC	Level 2	01	-	01
	<b>Total</b>		<b>17</b>	<b>07</b>	<b>10</b>
	<b>Skilled Support Staff</b>	Level 2	<b>27</b>	<b>23</b>	<b>04</b>
	<b>Total</b>		<b>101</b>	<b>70</b>	<b>31</b>





## RESEARCH ACHIEVEMENTS

### 3.1 CROP IMPROVEMENT

#### 3.1.1 Genetic Resources: Conservation, Procurement, Quarantine clearance, Rejuvenation, Evaluation, Characterization, Distribution and Utilization

##### NRCS1.1/87 Augmentation, management and documentation of soybean germplasm

PI: Dr. Sanjay Gupta, Co-PIs: Drs. Vangala Rajesh, Giriraj Kumawat, Gyanesh K. Satpute, Lokesh Kumar Meena, Vennampally Nataraj, Shivakumar M, Savita Kohle and Ram Manohar Patel

##### Augmentation and conservation of germplasm

6120 germplasm including 2309 exotic collections were maintained in the mid-term storage of the institute. Institute collaborated with ICAR-NBPGR for quarantine of 749 exotic soybean varieties and harvested 260 were cleared for use. Quarantine of 200 *G soja* accessions and 55 wild (tertiary gene pool) is being undertaken at ICAR-IISR Indore. In 2022, 168 *G soja* accessions were cleared from quarantine and 25 of these accessions were evaluated and screened at Palampur, Almora, Ludhiana, Raipur, Imphal, Indore, Jabalpur and Dharwad under AICRP on Soybean. At Ludhiana, 5 YMD resistant accessions (EC 1165824, EC 1165787, EC 1165822, EC 1165849, EC 1165923) were identified. Among these accessions accession EC 1165787 is very high yielding at Imphal

(33g/plant) and EC 1165824 & EC 1165822 very early maturing at Indore, Ludhiana and Palampur (81-107 days). Presently available YMD resistant *G soja* accession (PI 393551) in India matures in 110 to 115 days.

##### Germplasm Rejuvenation

2350 germplasm accessions (990 exotic and 1360 indigenous) were grown. Severe disease pressure of Anthracnose, Rhizoctonia Aerial Blight and Bacterial Pustule was observed. Among the surviving germplasm 50 Accessions yielded 100-150 g; 25 Accessions: 150-200 g and 1 Accession: > 210 g / 1 meter row (Fig 3.1.1).

##### Germplasm Evaluation

Under the multi-location germplasm evaluation programme of AICRP on soybean, 221 germplasm accessions were evaluated at 8 centres including ICAR-IISR Indore. Total 20 checks were used among which 7 varieties were from the Central Zone (JS 20-116, JS 20-34, JS 93-05, JS 95-60, NRC 130, NRC 138, RSC 10-52) were used as the check. Mean and range of different yield contributing traits is given in Table 3.1.1. Yield superiority of seven accessions was >10% from the best check JS 93-05 (Table 3.1.2).

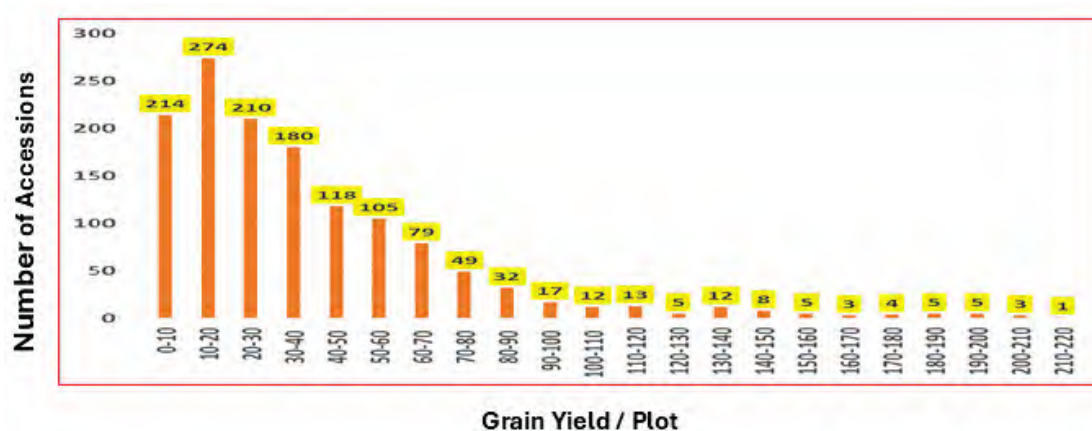


Fig 3.1.1: Grain yield / plant distribution in accessions surviving during rejuvenation.

14 promising RILs from the cross of JS 95-60 x AGS 25 and JS 93-05 x AGS 25 were

evaluated with 4 check varieties of central zone (JS 2022-12, NRC 138, NRC 165, NRC

258). JS 2022-12 was the highest yielding check with 1532 Kg/ha grain yield. Five NILs LJ 108, LJ 121, LJ 122, LJ 130 and LJ 134 out-yielded the best check by more than 10% (11-22%) (Table 3.1.3).

### Identification of promising RILs for Delayed Sowing Conditions

A trial involving a long juvenile breeding line and 6 checks was conducted under delayed sown conditions (25/07/2023). Checks involved photo-insensitive (JS 20-34, NRC 130, NRC 131, JS 95-60), long juvenile variety (NRC 165) and high yielding variety (JS 20-116). Under delayed sown conditions, NRC 164 had the highest grain yield and surpassed all checks by 36% or more. It had highest plant height and 100 seed weight and

other traits were comparable to checks. Short day condition hastened the maturity of all the entries (74.0 to 95.0 days) and NRC 164 matured in second lowest duration (77 Days) (Table 3.1.4).

### Maintenance and Evaluation of Genetic Stocks

112 Recombinant inbred lines (F11) for photo-insensitivity and long juvenility from the crosses of JS 95-60 x AGS 25 and JS 93-05 x AGS 25 were maintained by single plant progeny. Six varieties of Central Zone and one long juvenile parent AGS 25 were included in the evaluation. AGS 25 is a source of reduced reproductive period (42%) and its RILs had less reproductive period (49%) than soybean varieties.

**Table 3.1.1: Mean and range for grain yield and its contributing traits in 221 germplasm lines of soybean evaluated at Indore during 2023.**

Trait	Mean	Range
Days to maturity	108.5	91.5-119.5
Plant height (cm)	66.4	26.4-104.6
Number of pods / plant	13.0	6.0 - 25.2
100 seed weight (g)	8.01	2.7-15.2
Grain yield/plot (g)	83.8	10.0 - 317.1

**Table 3.1.2: High yielding germplasm identified from evaluation of 221 germplasm at Indore.**

Accession	Row Yield (g/plot)	100 Seed Weight (g)	Days to Maturity	Plant Height (cm)	Branches / Plant	Pods/ Plant
EC 0456620	317	9.7	105	99.4	4.4	13.4
IC 0243043	302	7.4	109	84.4	5	16.4
IC 202	256	9.2	105	104.2	1.6	14.6
EC 0016729	244	7.3	109	98.6	5.4	13.8
IC 0501967	243	7.1	109	79.6	3.4	14.2
IC 0243688	190	7.1	113	102	5.8	19.6
EC 172654	165	7.8	113	83.8	7.2	17.6
JS 93-05 (check)	142	10	97	65.6	3.4	16

**Table 3.1.3: Yield performance of high yielding RILs in station trial**

Entry	DTF (Days)	DTM (Days)	Plant Height (cm)	Number of Nodes	100 SW (g)	Grain Yield (Kg/ha)	% Superiority over the best check
LJ 108	51.0	101.0	74.8	13.0	9.5	1735	13
LJ 121	45.0	92.7	71.2	13.3	9.7	1713	12
LJ 122	41.0	92.7	61.8	11.7	9.2	1779	16
LJ 130	41.0	87.7	58.9	11.0	8.5	1697	11
LJ 166	36.0	91.6	47.1	12.2	10.8	1810	18
LJ 134	42.0	91.0	71.9	10.9	8.7	1874	22
JS 2022-12 (check)	43.0	97.0	50.3	12.7	10.6	1532	

AGS 25 (264 g / 3-meter row) was one of the highest yielder and 11 NILs surpassed it (271-

359 g). None of the checks was superior to NILs and AGS 25 (Table 3.1.6). The highest



AGS 25 (264 g / 3-meter row) was one of the highest yielder and 11 NILs surpassed it (271-359 g). None of the checks was superior yielding check was JS 95-60 (204 g) and 35 NILs surpassed it by more than 10% in grain yield. A few of the promising RILs are LJ 121, LJ 31, LJ 124, LJ 148, LJ 164, LJ 142, LJ 126, LJ 113, LJ 108, LJ 156, LJ 70, LJ 23, LJ 28.

F<sub>5</sub> of 110 RILs from a cross of SL 958 x AGS 25 and 23 of NILs (e3, e4 and e3e4 alleles in the background of JS 97-52) were maintained by single plant to progeny and evaluation for grain yield was conducted with 4 checks of the Central Zone (NRC 130, NRC 138, RSC 10-46, RSC 10-52). AGS 25 was the highest yielder with 535 g yield / plot. None of the NILs were superior to check varieties in grain yield but 22 of the SL 958 x AGS 25 lines were more than 10% superior (250-390 g / 3 mt row) to the highest yielding check JS 95-60 (Table 3.1.5).

### Evaluation of Germplasm for Resistance to Anthracnose, Rhizoctonia Aerial Blight and Bacterial pustule

253 newly introduced germplasm were screened for resistance to Anthracnose, Rhizoctonia Aerial Blight and Bacterial Pustule. Resistant plants were identified in 20 accessions for anthracnose, 11 accessions for RAB, one accession for BP, 11 accessions for RAB and anthracnose and one accession for all the three diseases (Table 3.1.7).

### Distribution of soybean germplasm

5430 Germplasm were distributed to AICRP centres, scientists of ICAR-IISR Indore, private organizations and other government institutes (Table 3.1.8).

### Evaluation of Germplasm for Resistance to Anthracnose, Rhizoctonia Aerial Blight and Bacterial

253 newly introduced germplasm were screened for resistance to Anthracnose, Rhizoctonia Aerial Blight and Bacterial Pustule. Resistant plants were identified in accessions given in (Table 3.1.7).

**Table 3.1.4: Performance of long juvenile breeding lines under late sown conditions**

S. No	Entries	Days to Flower	Days to Maturity	Plant Height (Cm)	Branch / Plant	Nodes / Plant	Pods / Plant	Yield Kg / Ha	100 Seed WT(g)
1	NRC 164	37.3	77.3	50.8	1.7	10.8	20.1	700	12.0
2	JS 95-60 (check)	28.3	74.0	41.1	0.3	8.6	12.8	515	8.6
3	JS 20-34 (check)	30.0	79.3	26.7	1.7	7.1	17.9	349	9.8
4	NRC 130 (check)	31.7	82.0	42.3	2.3	11.4	20.0	99	8.9
5	NRC 131 (check)	36.3	83.0	49.9	2.0	11.6	19.1	72	6.3
6	JS 20-116 (check)	41.3	95.0	42.0	3.6	10.6	20.8	170	8.2
7	NRC 165 (check)	41.0	90.0	33.9	3.7	8.6	27.6	154	7.6

**Table 3.1.5: Grain yield of genetic stocks during maintenance**

Genetic Stock / Population	Grain Yield (g)/ 3 meter row		
	Minimum	Maximum	Average
SL 958 x AGS 25	94	390	184
NILs for e3, e4 and e3e4	9	135	58.0
Check Varieties	38	231	145
AGS 25	-	-	535

**Table 3.1.6: Performance of RILs for flowering, maturity and reproductive period**

Traits	Recombinant Inbred Lines			Soybean Varieties (6)			AGS 25
	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean
Days to flower	51.5	42	61	42.3	35	55	63
Days to maturity	101	89	116	92.8	87	108	108
Yield / plot (gm)	184.9	20	359	116.3	59	201	264
Reproductive period %	49%			54%			42%

**Table 3.1.7: Field Resistant Germplasm Identified at ICAR-NSRI, Indore**

Disease	HR	MR	R
<b>Anthracnose</b>	CAT 153 A, EC 1037655, EC 1037679, EC 1037711, EC 1037715, EC 1037745, EC 1037749, EC 1075827, EC 1075864, EC 18646 B, EC 574364, EC 993294, EC 993445, EC 993618, EC 993726, EC 993929 B, EC 993961, EC 993967, EC 993992, IC 195 B, IC 281609, IC 501867, IC 501927, IC 567292	EC 993171, EC 993739, EC 993758, EC 993782, EC 993946, EC 993992, IC 501888	EC 993943, EC 993986, EC 994001
<b>RAB</b>	CAT 153 A, EC 1037711, EC 1037745, EC 1075864, EC 993294, EC 993618, EC 993726, EC 993992, EC 994001,B, IC 501867, IC 501927	EC 1037655, EC 1037679, EC 1037715, EC 1037749, EC 1039145, EC 993171, EC 993445, EC 993946, EC 993967	EC 1075827, EC 993961, EC 993986
<b>Bacterial Pustule</b>	-	EC 1037745, EC 1039082, EC 1039117, EC 1075827, EC 574364, EC 993171, EC 993294, EC 993739, EC 993758, EC 993782, EC 993929 B, EC 993943, EC 993961, EC 993986, EC 993992, IC 281609, IC 501888, IC 567292	EC 993992
<b>Anthracnose and RAB</b>	CAT 153 A, EC 1037711, EC 1037745, EC 1075864, EC 18646 B, EC 993294, EC 993618, EC 993726, EC 993992, IC 195 B, IC 501867, IC 501927	EC 993871, EC 993946	EC 993986
<b>Anthracnose, RAB and Bacterial Pustule</b>	-	-	EC 993986

\*HR – Highly Resistant, MR – Moderately Resistant, R – Resistant

**Distribution of soybean germplasm:** 5515 germplasm were distributed to AICRP centres, scientists of NSRI, Indore, Private organizations and other govt. institutes (Table 3.1.8).

**Table 3.1.8: Number of Germplasm Distributed During 2023-24**

Name of the Organization	Number of Germplasm Distributed
VPKAS, Almora	266
Central Agriculture University, Imphal	324
Eagle Seed Company, Indore	72
Geeta University Panipat	50
UAS, Bangalore	100
CSK HPKV, Palampur	316
ICAR-IARI, New Delhi	50
ICAR-IISR, Indore	2437
Indira Gandhi Agriculture University, Raipur	277
JNKV, Jabalpur	127
ARS, MPKV, Kasbe Digraj	49
Kannur University, Kerala	10
Kota Agricultural University, Rajasthan	50
Agharkar Research Institute, Pune	221



GBPUA & Tech Pantnagar	308
VNMKV, Parbhani	271
PJTSAU, Adilabad	102
Punjab Agriculture University, Ludhiana	137
Shri Vaishnav Vidhyapeeth, Indore	50
UAS, Dharwad	163
UAS, Raichir Bidar	50
<b>Total</b>	<b>5430</b>

### IISR4.6/23: Pre breeding for broadening of genetic base in soybean

PI-Dr Vangala Rajesh, Co-PIs Dr Sanjay Gupta, Dr. Shivakumar M, Dr. Vennampally Nataraj

Evaluation of crop wild relatives (Glycine soja) for various yield attributing traits

Twenty-five Glycine soja were evaluated at ICAR- IISR, Indore for various yield and yield attributing traits. The same 25 Glycine soja were distributed to 10 AICRP centres viz., Almora, Palampur, Dharwad, Imphal, Jabalpur, Kasbe Digraj, Ludhiana, Pantnagar and Raipur (Table 3.1.9).

**Table 3.1.9: Summary of yield traits in *Glycine soja***

Range	Days to Flowering	Plant Height (cm)	Grain yield per plant (g)	Row yield (g)	Days to Maturity
Min	35.00	17.00	0.02	0.10	73.00
Max	83.00	140.00	5.15	30.90	133.00
Mean	54.32	87.28	1.95	11.34	99.00



**Fig 3.1.2: Field view of *Glycine soja* and advancement of generation**

**Table 3.1.10: Rate of germination in *Glycine soja* vs *Glycine max* after scarification**

S.No	<i>Glycine soja</i>	Days to germination	Germination percentage
1	EC1165822	1	100
2	EC1165863	1	100
3	EC1165892	1	100
4	EC1165826	1	100
5	EC1165897	1	100
6	PI549046	1	100
7	EC1165820	2	100
8	EC1165928	2	100
9	EC1165891	3	100
10	EC1165824	3	100
11	EC1165850	3	100
12	EC1165879	3	100
13	EC1165791	3	100
14	EC1165914	3	100
15	EC1165789	3	100
16	EC1165790	4	100
17	EC1165842	4	98
18	EC1165814	4	98
19	EC1165787	5	98
20	EC1165808	5	100
21	EC1165839	5	100
22	EC1165933	6	96
23	EC1165813	6	96
24	EC1165807	6	96
25	EC1165923	6	96
26	EC1165849	7	96
<b><i>Glycine max</i></b>			
27	JS 20-34	4	96
28	NRC 150	4	90
29	VLS 63	4	88
30	DSb 34	4	96
31	JS 95 -60	5	84
32	NRC 130	6	88
33	NRC 142	6	88



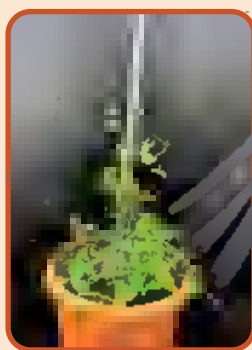
### Interspecific Hybridization (*Glycine max* x *Glycine soja*)

A total of 21 successful interspecific crosses were made following Line x Tester Mating design. The details of the parents used are given below.

S.No	Lines ( <i>Glycine max</i> )	S.No	Testers ( <i>Glycine soja</i> )
1	JS 335	1	EC 1165824
2	JS 93-05	2	EC 1165891
3	JS 95-60	3	PI 549046
4	JS 97-52		
5	KDS 753		
6	MACS 1460		
7	NRC 138		

**Table 3.1.11 List of Successful back cross of inter-specific hybridization**

S.NO.	Back cross (BC3)
1	[JS 20-34X PI 407170] X JS 20-34
2	[JS 20-34X PI 593983] X JS 20-34
3	[JS 20-98 X PI 549046] X JS 20-98
4	[JS 335 X PI 549046] X JS 355
5	[JS 9560 X PI 407170] X JS 9560
6	[JS 9560 X PI 549046] X JS 9560
7	[JS 9560 X PI 593983] X JS 9560



*Glycine latifolia*



*Glycine tabacina*

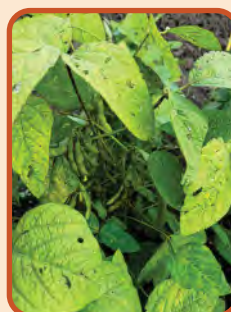
**Fig 3.1.3 Soybean crop wild relatives under multiplication**



JS 20-34 x PI 593983  
(BC1F2)



JS 20-34 x JS 20-34  
PI 593983  
(BC1F2)

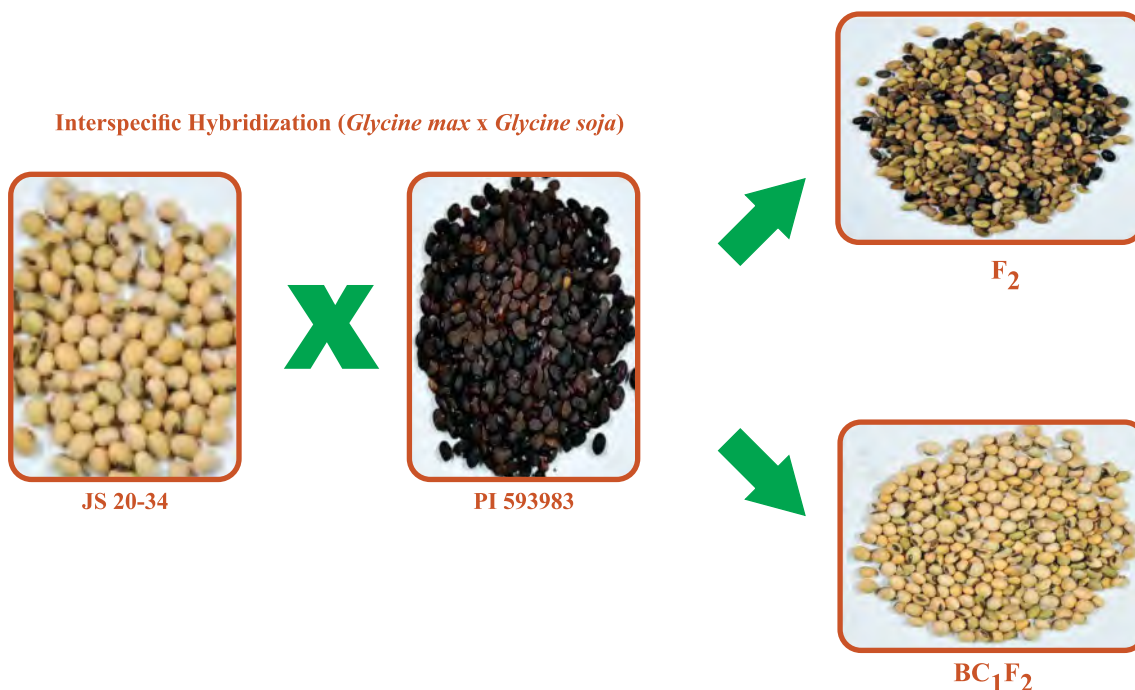


JS 20-34



PI 593983

**Fig 3.1.4. Comparison of parents involved in interspecific hybridization and back cross segregating population**



**Fig. 3.1.5: Comparison of F<sub>2</sub> and BC<sub>1</sub>F<sub>2</sub> seeds derived from interspecific cross**

**Institute Station Trial (Dr Vangala Rajesh & Dr. Sanjay Gupta)**

Institute Station trial was conducted for the promising entries contributed by scientists of ICAR-IISR, Indore. It comprises of 3 categories viz., Early maturity trial, Normal Maturity trial and Vegetable trial. In case of early maturity trial, 24 entries were evaluated in RBD and 3 entries viz., YP 44, NRC 267 (LJ 164) and YP 49 were

found promising and promoted to IVT Early 2025 (Table 3.1.12). In case of Normal maturity trial, 38 entries were evaluated in RBD and 5 entries viz., AVKS 231, AVKS 223, YP 50, YP 56 and YP 42 were found promising and promoted to IVT Normal 2025 (Table 3.1.13) In case of vegetable trial, 8 entries were evaluated in RBD and data recorded for fresh pod weight (R6).





**Table 3.1.12: Institute station trial conducted for early maturing entries**  
Net plot size: 6.75 m<sup>2</sup> (5m, 3 rows)

S.No	Code	Genotype	Pedigree	Seed Yield		Days to Maturity	Oil Content (%)	Oil Yield Kg/ha
				g/plot	kg/ha			
1	STE-24-01	VRJ 6	JS 20-34 x EC 538828	283	419	100	20	83
2	STE-24-02	AVKS 237	NRCSL 2 x NRC 142	861	1276	102	20	250
3	STE-24-03	EC JS 34- 21	EC538828 x JS 20-34	768	1137	102	21	235
4	STE-24-04	AVKS 236	BC2 (JS95-60 X SL525) X NRC142	979	1450	94	21	309
5	STE-24-05	VRJ 8	AKSS 67 x AGS 155	692	1025	101	21	218
6	STE-24-06	AVKS 234	JS335 X SL525 X NRC142	607	900	90	19	169
7	STE-24-07	NRC 152	Check	316	469	90	20	95
8	STE-24-08	JS CAT -14	JS 20-69 x EC538828	423	626	100	21	130
9	STE-24-09	EC JS 69 -86	EC538828 x JS 20-69	590	874	99	20	177
10	STE-24-10	AVKS 238	NRCSL2 X NRC 142	343	508	94	20	103
11	STE-24-11	YP 44	EC 457254 x JS 9560	1242	1840	90	20	361
12	STE-24-12	NRC 267 (LJ 164)	JS 95-60 x AGS 25	1219	1806	91	20	370
13	STE-24-13	AVKS 239	JS335 X SL525 X NRC142	739	1094	93	22	237
14	STE-24-14	YP 49	EC 457254 x JS 9560	1119	1658	89	18	301
15	STE-24-15	AVKS 235	JS95-60 X SL525 X NRC142	894	1324	99	19	256
16	STE-24-16	EC JS 34- 83	EC538828 X JS 20-34	559	828	92	20	168
17	STE-24-17	JS CAT -19	JS 20-69 x EC538828	607	900	101	20	178
18	STE-24-18	EC JS 69 -95	EC 538828 x JS 20-69	555	822	102	20	162
19	STE-24-19	NRC 165	Check	626	927	89	19	178
20	STE-24-20	JS 20-34	Check	366	542	104	22	120
21	STE-24-21	LJ 166	JS 95-60 x AGS 25	1049	1554	93	19	300
22	STE-24-22	NRC 150	Check	1140	1689	92	18	311
23	STE-24-23	VRJ 7	JS 20-34 x G5P22	455	674	103	20	133
24	STE-24-24	JS 22-12	Check	1271	1883	99	19	358
			Mean	737.61		96.14		217
	<b>CD@5%</b>	<b>229</b>	<b>C.V.</b>	<b>18.96</b>		<b>1.32</b>		



**Table 3.1.12: Institute station trial conducted for normal maturing entries**

Net plot size: 6.75 m <sup>2</sup> (5m, 3 rows)								
S. No	Code	Genotype	Pedigree	Seed Yield		Days to Maturity	Oil Content (%)	Oil Yield Kg/ha
				g/plot	kg/ha			
1	STN-24-01	VRJ 9	JS 9560 x RSC 10-46	601	890	96	19	169
2	STN-24-02	YP 55	JS 97-52 x 8-94-4	530	785	98	19	147
3	STN-24-03	AVKS 233	NRC105 X NRC101 X NRC142	692	1025	98	20	200
4	STN-24-04	AVKS 223	JS 9560 x SL 525 x NRC 142	1413	2093	97	19	391
5	STN-24-05	HN7 3-1-5.2-2	Hardee x NRC 7	828	1227	98	20	245
6	STN-24-06	NRC 142	Check	481	713	97	21	147
7	STN-24-07	HN 7-114-1-14-1-1	Hardee x NRC7	676	1001	104	21	213
8	STN-24-08	MACSNRC 1900	EDV of JS 93-05	30	45	94	20	9
9	STN-24-09	MACS 1407	Check	447	662	99	21	137
10	STN-24-10	YP 50	NRC 128 x JS 95-60	1334	1976	97	20	390
11	STN-24-11	JS 335	Check	253	375	106	21	77
12	STN-24-12	AVKS229	BC1 (JS95-60 X SL 525) X NRC142	930	1377	94	20	281
13	STN-24-13	AVKS230	JS95-60 X SL525 X NRC142	1017	1506	93	19	292
14	STN-24-14	ECHR 2-1-2-4-2-2	Hardee X EC 538828	982	1455	101	21	300
15	STN-24-15	JS 20-98	Check	373	553	101	19	105
16	STN-24-16	PK 472	Check	278	412	106	20	83
17	STN-24-17	VRJ 11	F3P18 x JS 9305	356	528	98	20	104
18	STN-24-18	AVKS 231	BC3 (JS 95-60 X SL 525) XNRC 142	1518	2249	99	19	431
19	STN-24-19	YP 56	JS 20-69 x NRC 128	1267	1877	105	21	397
20	STN-24-20	YP 54	NRC 128 x JS 20-69	699	1036	103	20	211
21	STN-24-21	AVKS 232	BC2 (JS95-60 X SL 525) X NRC142	923	1367	98	19	261
22	STN-24-22	VRJ 10	JS 335 x AKSS 67	312	463	99	20	93
23	STN-24-23	A(E) -30	(Young x JS 335) x (JS 97-52 x JS 90-41) x (PK 472 x JS 335) x (EC 602288 x EC 390977)	149	221	98	21	45
24	STN-24-24	AVKS 228	BC1 (JS95-60 X SL525) X NRC142	498	738	99	19	140
25	STN-24-25	JSN7-259-4-8-2	JS 20-116 X NRC 7	477	707	97	22	153
26	STN-24-26	YP 57	JS 9752 x AMS 5-18 x JS 20-69 x NRC 128	728	1078	97	21	225
27	STN-24-27	YP 52	NRC 128 x JS 95-60	1039	1540	97	20	304
28	STN-24-28	A(M/L)-II-16	(Young x JS 335) x (JS 97-52 x JS 90-41) x (PK 472 x JS 335) x (EC 602288 x EC 390977)	0	0	0	0	0
29	STN-24-29	PS 1029	Check	48	71	98	19	14
30	STN-24-30	JS 93-05	Check	183	271	97	19	50
31	STN-24-31	Hardee	Check	1069	1583	105	20	319
32	STN-24-32	YP 42	EC 457254 x JS 9560	1096	1624	96	21	333
33	STN-24-33	JS 21-72	Check	978	1449	97	19	277
34	STN-24-34	JSN7-118-1	JS 20-116 X NRC 7	660	978	91	20	194
35	STN-24-35	YP 51	NRC 128 x JS 95-60	986	1460	98	19	283
36	STN-24-36	YP 53	JS 95-60 x JS 20-98	799	1183	93	20	233
37	STN-24-37	LJ 108	JS 93-05 x AGS 25	694	1029	93	19	194
38	STN-24-38	EC HAR 95-2-2-5-2	EC538828 X Hardee	803	1189	97	20	243
			Mean	706.64		98.14		202
	<b>CD@5%</b>	<b>206</b>	<b>C.V.</b>	<b>17.92</b>		<b>1.12</b>		



### 3.2 Breeding for Early maturity, High Yield, Wider Adaptability and Food-grade Characteristics

#### IISR4.4/23 Breeding for High Grain and Oil Yield for Different Maturity duration in Soybean

PI-Dr Shivakumar M.

Co-PIs- Drs V. Nataraj, V. Rajesh. N. Raghavendra, Giriraj Kumawat

#### Evaluation advanced breeding lines(F<sub>7</sub>)

A total of 42 advanced breeding lines including two checks; JS 20-34 and NRC 142 were evaluated for yield and yield attributing traits. Entries 146 (3805 kg/ha), 151 (3348 kg/ha), 152 (3836 kg/ha), 154 (3647 kg/ha) performed better than check varieties. The details of each genotypes along with check varieties performance were presented in the below table 3.2.2.

**Table 3.2.1 Following nine crosses for specific objectives as indicated below were attempted and F<sub>1</sub> seeds are harvested.**

Objectives	Name of Crosses
High yield	Hardee × NRC 252
	JS 20-98 × JS 95-60
	JS 20-34 × JS 20-98
	JS 335 × AGS 25
	NRC 270 × F6-24
High yield and oil content	NRC 270 × EC 357998
	NRC 270 × EC528622
High yield and early maturity	YP 50 × NRC 252
High yield and diversity	AGS 25 × NRC 252

**Table 3.2.2: Performance of selected advanced breeding lines for yield and its component traits.**

Genotypes Codes	Seed yield (Kg/ha)	100 SW (g)	Days to Maturity	Per day productivity
14	1757	13.37	79	22.24
16	1769	13.87	88	20.10
21	2431	16.81	79	30.77
22	2356	20.93	86	27.39
24	2222	19.00	86	25.83
25	1933	16.87	79	24.46
30	1968	19.80	84	23.42
35	2032	14.83	90	22.57
36	2700	13.23	89	30.33
38	1802	15.37	90	20.02
58	1801	13.23	95	18.95
63	2468	19.03	87	28.36
107	2732	15.43	91	30.02
108	2490	15.63	98	25.40
109	2389	13.83	99	24.22
119	1938	12.83	101	19.18
146	3805	16.43	108	35.23
149	2503	15.27	106	23.61
150	3100	16.10	108	28.70
151	3348	17.16	111	30.16
152	3836	15.73	111	34.55
154	3647	16.20	109	33.45
NRC 142	1604	14.00	98	16.36
JS 20-34	1600	11.90	101	15.84
CV	22.8	10.3	-	

**Evaluation of early maturing Soybean Genotypes under different planting densities**

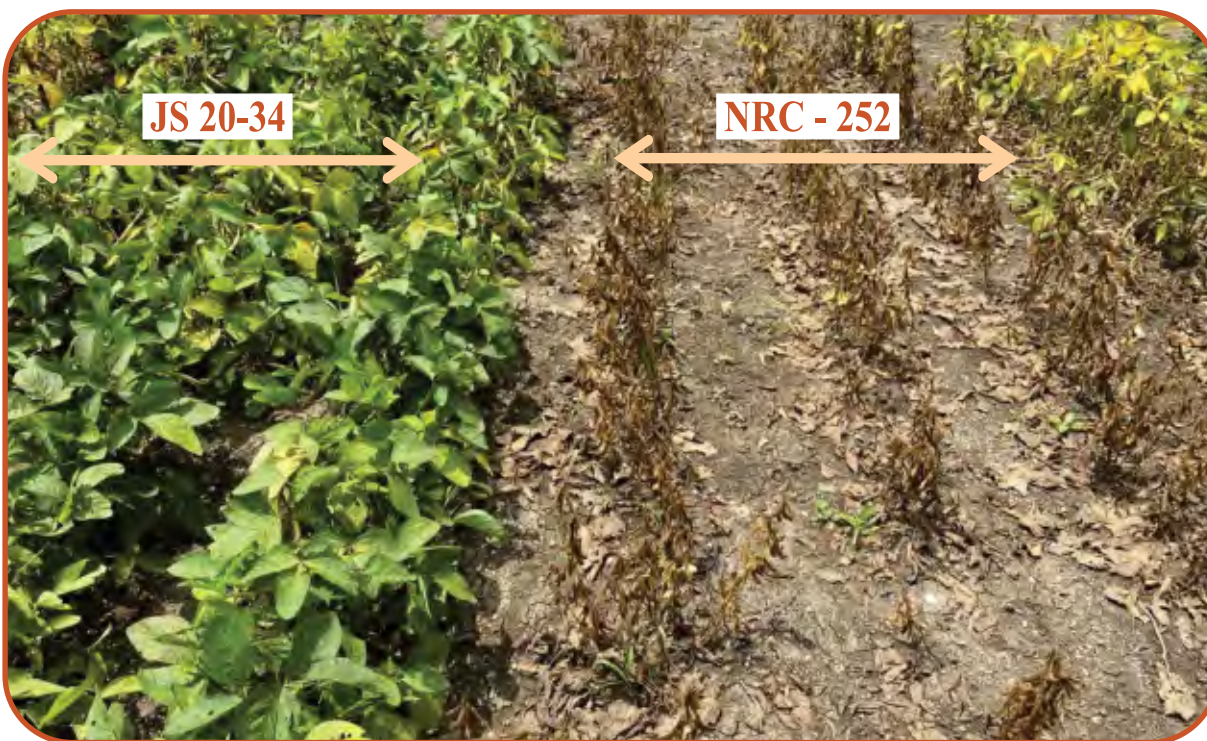
A set of 20 early maturing genotypes including check NRC 150 with erect plant (single culm) type and bold seeded were evaluated under different planting density. NRC 150 was used as check variety in four different planting densities viz., 45 × 5, 30 × 5, 20 × 5 and 15 × 5 cm. The highest mean yield of 30.24 q/ha was recorded in 15 × 5 cm planting density as against 45 × 5 cm planting (17.84 q/ha).

The details are presented as below (Table 3.2.3).

**Genetic stock registered:** NRC 252 was registered with ICAR-NBPGR which is having extra early maturity trait. Its maturity duration is 71 days against check variety JS 20-34 took 92 days to mature. It produced significantly higher yield (554 kg/ha) than JS 20-34 (475 kg/ha) but average grain yield of 877 kg/ha was less than early maturing check variety JS 20-34 (1171 kg/ha) across the seasons. (Fig. 3.2.1)

**Table: 3.2.3. Comparison yield potential of early maturing advanced breeding line under different planting densities.**

Row Spacing (cm)	Yield q/ha
45 × 10	17.84
30 × 5	26.03
20 × 5	30.04
15 × 5	30.24



**Fig 3.2.1: Field Comparison of early maturing genetic NRC 252 and early check JS 20-34**



### Performance of promising advanced breeding lines in station trial and AICRPs trials.

A total of six advanced breeding lines were evaluated in station trial 2024. Based on yield and early maturity three entries YP 44, 49, and 42 were promoted to IVT early 2025. Similarly, two entries viz.,

YP 50 and YP 42 were promoted to IVT normal maturity trial 2025. NRC 270, an high yielding entry was produced 19 % high yield than best check JS 20-98. Again under AVT I it produced 18.2 % higher yield than best check variety JS 21-72 and promoted to AVTII 2025 in Central Zone (Table 3.3.4 to 3.2.6)

**Table 3.2.4: Evaluation of promising early maturing material in station trials 2024**

Genotypes	Yield (q/ha)	Maturity (days)	100-SW (g)	% gain
YP 44	18.40	90	11.33	9.0
YP 49	16.57	89	11.05	-
YP 42	16.25	95	11.03	-
NRC150 (C)	16.88	92	10.05	-
CV	18.95	CD @ 5%	229.59	

**Table 3.2.5: Evaluation of promising medium maturing material in station trials 2024**

Genotypes	Yield (q/ha)	Maturity (days)	100-SW (g)	% gain
YP 50	19.76	97	10.51	24.8
YP 42	16.24	95	11.03	2.5
Hardee (C)	15.83	105	10.51	-
CV	17.92	CD @ 5%	206.02	

**Table 3.2.6: Evaluation of NRC 270 in AICRP trials in Central Zone.**

Trial	Genotypes/check	Yield (q/ha)	Oil (%)	Maturity (days)	100-SW (g)	Rank	% gain
IVT 2023	NRC 270	2836	19.7	104	12.6	I	19.0
	JS 20-98 (Check)	2383	19.8	106	10.1	-	-
AVT I 2024	NRC 270	2559	21	101	12.0	II	18.2
	JS 21-72 (Check)	2165	20	97	12	III	-



**DBT funded project “Marker assisted introgression of seed weight, early maturity and photoperiod response genes in a multiple stress tolerant climate smart soybean variety JS 97-52 and KTI free variety NRC 127”**

*PI-Dr Shivakumar Co-PIs-M., Dr Giriraj Kumawat, Dr V. Nataraj, Dr Sanjay Gupta*

- A total of 124 BC3F2 plants were subjected to fore ground selection using gene specific markers linked to e3, e4, e2, and SSR 10\_1408 linked to 100 seed weight. 20 plants carrying e3, e4, e2, Sdwtq10.1 and KTI free alleles were identified. Based on background selection using 30 polymorphic markers plants with >94 % recurrent parent genome in both JS 97-52 and NRC 127 background were selected.
- Seeds of 124 genetic stocks carrying different combination of alleles including 20 homozygous genetic stocks carrying early maturity, photoperiod response and seed weight QTL alleles were multiplied at Pune. 10 genetics stocks which matured in 95 days as against the recurrent parents (NRC 127 & JS 97-52) which matured in 110 days were identified. Similarly, 11 genetic stocks matured in 100 days. A total of 250-300 g seeds were obtained for each 124 genetic stocks.

**NRCS1.12/02 : Breeding for food grade characters and high oil content**

*PI: Dr. Anita Rani, Co-PI: Dr. Vineet Kumar*

- Four hundred individual plants of segregating populations developed for KTI free genotypes were tested for presence/absence of kunitz trypsin inhibitor peptide using PAGE and PCR amplification of gene specific primers. Out of 400 plants , 140 plants were observed to be homozygous for null allele of KTI gene.
- Five hundred individual plants of segregating populations developed for Lox 2 free genotypes for presence/absence of lipoxygenase activity using PCR amplification of gene specific primers and rapid bleaching test. Out of 500 plants , 220 plants were observed to be homozygous for null allele of Lox2 gene.
- Seeds of one hundred advance breeding lines were tested for oil content . A range of 18 to 24 % oil content was observed in these lines.
- NRC 197, an early maturing KTI free genotype has been released for cultivation in North Hill Zone by CVRC.
- NRC 268, lipoxygenase 2 free genotype has has been promoted to AVT I in Central and Eastern Zone.
- NRC 290 , genotype free from KTI and Lipoxygenase 2, has entered IVT,2024.
- NRC 291 , genotype free from KTI , has entered IVT,2024.
- NRC 292 , high oil genotype , has entered IVT, 2024.

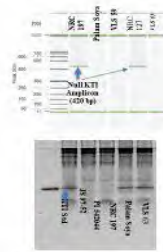




**NRC197 KTI free** developed from JS97-52 x PI542044 identified for release for North Hill zone.. Maturity :112 days  
Weighted Yield: 1624 kg / ha



Field view, single plant, and seeds of NRC 197



Upper gel shows the amplicon generated by KTI Null allele specific marker deployed for the development while lower plate shows the absence KTI polypeptide in NRC 197 and PIS2044 (donor of wildKTI) through western blot.

**NRC 268** Lipoxygenase 2 free genotype developed from NRC142 x NRC SL2 has been promoted to AVT 1 in Central and Eastern Zone



	Central Zone	Eastern Zone
Yield/ha	26.08	23.53
Days-to maturity	100	95
100-SW (g)	9.7	9.7

**NRC 290 : Kti & Lox2 free genotype entered IVT**



	Station trial	Breeders' field
Yield/ha	20.17	29.26
days-to maturity	99	95
100-SW (g)	13.5	13.2



**NRC 292 : genotype high oil entered IVT**



	Station trial	Breeders' field
Yield/ha	20.81	26.59
days-to maturity	92	95
100-SW (g)	13.4	12.7
Oil	19.8	21.6

**NRC291 : Lipoxygenase-2 free genotype entered IVT**

	Station trial	Breeders' field
Yield/ha	20.78	21.45
days-to maturity	103	106
100-SW (g)	12.1	11.80

Fig. Performance of promising entries under AICRP Trials

**DBT funded Project: Developing food-grade soybean using CRISPR/Cas9 mediated multiplex genome editing (PI-Dr Vineet Kumar, Co-PI Dr Anita Rani)**

*Agrobacterium tumefaciens* - mediated transformation was performed. For the transformation of soybean using *Agrobacterium tumefaciens*, sterilization of approximately 50 sets of 100 seeds of JS 20-98 was done by exposing them to chlorine gas in a vacuum desiccator and allowed them to germinate on MS media for 5 days. Cotyledons from five-day-old germinated soybean seeds were isolated and infected with a culture of *Agrobacterium tumefaciens* containing constructs for gRNAs against Lox1, Lox2 and Lox3 individually. After this, the explants were transferred to co-cultivation media layered with sterile filter paper and incubated for 4 days under a 16h light/8h dark cycle at 24°C followed by a 15-day period for shoot induction in Shoot Induction media enriched with BAP (1.69 mg/l), cefotaxime (250 mg/l), carbenicillin (250 mg/L) and glufosinate ammonium (2 mg/l). Shoots were observed in 12.5% of the total explants. All the resulting shoots were then transferred to two different shoot elongation media, each containing GA3 (0.5 mg/l), carbenicillin (50 mg/l),

cefotaxime (100 mg/l), and glufosinate (3.5 mg/l) and maintained for 15 days each. The explants that thrived on the second elongation medium and grew to a length of 2-3 cm, were subsequently moved to rooting induction media with IBA (0.5 mg/l). After roots developed, the T<sub>0</sub> plants underwent primary hardening, followed by secondary hardening in a soil and cocopeat peat mixture with a 1:0.5 ratio, under a photoperiod of 13h light and 11h dark. The identification of positive transgenic soybean plants (T<sub>0</sub>) was carried out through PCR assay which involved extracting total genomic DNA using the CTAB method and employing gene-specific primers targeting the Lox1, Lox2, and Lox3 genes, Cas9 and BLPR genes. Flowering was noted and subsequently pod formation was observed in T<sub>1</sub> plants. T<sub>1</sub> generation plants were screened for the presence of the Cas9, BLPR genes and gene-specific primers for Lox1, Lox2 and Lox3 genes through PCR analysis. The T<sub>2</sub> generation plants were examined using PCR analysis to check for the presence of the Cas9 and BLPR genes. Currently T<sub>2</sub> generation plants are in the flowering stage (see figures 3.2.2(a) to 3.2.3).



**Fig. 3.2.3 (a)** Seeds harvested from T<sub>0</sub> plants were sown, T<sub>1</sub> plants were obtained; (b) Pod formation was observed in T<sub>1</sub> generation plants



**Fig. 3.2.3 (b)** Seeds harvested from T<sub>1</sub> plants were sown, T<sub>2</sub> plants were obtained; (b) Flowering observed in T<sub>2</sub> generation plants



**Fig. 3.2.3 (c)** : Representative image of PCR amplification of T<sub>0</sub> plants (negative control ddH<sub>2</sub>O Lane 1); (Cas9: Lane 2, 3, 4, 5 and BLPR: lane 6, 7, 8, 9) and T<sub>1</sub> generation plants (Cas9: Lane 10, 11, 12 and 13 and for BLPR: Lane 14, 15, 16 and 17), lane L: Ladder 50 Bp in 2% agarose gel



**Fig. 3.2.3 (d)** : Representative image of PCR amplification of T<sub>0</sub> plants using gene-specific markers for Lox1, Lox2 and Lox3; (DNA extracted from T<sub>0</sub> plants: Lane 2, 3, 4, 5 and 6 (negative control ddH<sub>2</sub>O Lane 1, 2, 7, and 8); lane 9: Ladder 50 Bp in 2% agarose gel.



Fig. 3.2.4: Representative image of PCR amplification of T2 generation plants: lane L: Ladder 50 Bp, (negative control ddH<sub>2</sub>O Lane 1,2 and 3), (BLPR: lane 4, 5,6 7 and 8) (Cas9: Lane 9, 10, 11 12 and 13 in 2% agarose gel.

### 3.3 Breeding for Abiotic Stress Tolerance DSR 5.6a/08: Breeding for drought tolerant varieties in soybean

PI: Dr. Gyanesh Kumar Satpute, CoPIs: Drs. Sanjay Gupta, Milind Ratnaparkhe, Giriraj Kumawat, Prince Choyal, Rakesh Kumar Verma, Vangala Rajesh and Sanjeev Kumar

Single plant selections in F<sub>2</sub>, F<sub>3</sub> and F<sub>4</sub> generations:

184 single plant selections were made in the F<sub>2</sub>, F<sub>3</sub> and F<sub>4</sub> generation breeding populations during *Kharif* 2024. A high range of variation was found in F<sub>2</sub> and F<sub>3</sub> generation selections for plant height, number of branches, number of seeds/ pod and seed yield/ plant. High seed yield of 45.3 gm/plant and 66.9 gm/plant was recorded in F<sub>2</sub> and F<sub>3</sub> generation populations, respectively.

Table 3.3.1: Bi-parental crosses were achieved for their advancement and attempting 4-way crosses.

S.No.	Cross combinations	No of seeds	S.No.	Cross combinations	No of seeds
1	NRC 150 x NRC 157	23	9	KDS 992 x TGX 709-50E	8
2	NRC 150 x M-23-2	13	10	KDS 992 x J 732	4
3	NRC 150 x PI 159923	11	11	KDS 992 x AGS 25	3
4	NRC 150 x JS 95-60	4	12	KDS 992 x PI 159923	2
5	NRC 150 x NRC 295	4	13	RS 11-42 x J 732	2
6	JS 22-12 x JS 95-60	12	14	RS 11-42 x PI 159923	1
7	JS 22-12 x NRC 295	6	15	PS 1670 x J 732	5
<b>Total number of seeds : 104</b>					

Table 3.3.2 Multi-parent crosses were achieved for introgression of the high drought resistance index.

S.No.	Cross combinations	No of seeds
1.	(JS 20-34 x PI 159923) X (AMS 100-39 x NRC 257)	14
2.	(JS 20-34 x PI 159923) X (DSb 34 x EC 107407)	6
3.	(JS 20-34 x PI 159923) X PI 159923	3
4.	(JS 20-34 x PI 159923) X NRC 295	3
5.	(JS 20-34 x PI 159923) X JS 95-60	1
<b>Total number of seeds</b>		<b>27</b>

Table 3.3.3: Descriptive statistics for yield traits in single plant selection

Gen.	Parameter	Plant Height (cm)	No. of Branches	No. of seeds /pod	Seed Yield (gm)
F <sub>2</sub>	Mean	68.90	5.67	2.60	24.37
	Range	45 - 100	02 - 10	2 - 3	6.8 - 45.3
	SD	10.94	1.49	0.34	8.84
F <sub>3</sub>	Mean	67.70	5.98	2.63	26.50
	Range	48 - 115	2 - 11	2 - 3.5	6.2 - 66.9
	SD	10.78	1.79	0.36	10.29
F <sub>4</sub>	Mean	82.5	4.33	3.00	18.23
	Range	71.5 - 93	3 - 6	3 - 3	16.1 - 21.8
	SD	10.76	1.53	0.00	3.11

**Table 3.3.4: Single plant selections in the breeding populations Kharif 2024**

Gen.	Cross	No. of SPS		
		Normal	Desiccation stress	Total
<b>F<sub>2</sub></b>				
24F <sub>2</sub> -1	(AMS-MB-5-18xJS95-60)x(PI159923xJS71-05)/ (38-11-265xJS95-60)x(JS71-05xNRC37)	18	7	25
24F <sub>2</sub> -2	(JS71-05xNRC37)x(Drt2-TGX328-049)/ (AMS-MB-5-18xJS95-60)x(PI159923xJS95-60)	9	3	12
24F <sub>2</sub> -4	(AMS-MB-5-18xJS95-60)x(PI159923xJS95-60)/ (PI159923xNRC37)x(PI159923xJS95-60)	2	-	2
24F <sub>2</sub> -5	(JS71-05xNRC37)x(Drt2-TGX328-049)/ (PI159923xNRC37)x(PI159923xJS95-60)	3	1	4
<b>F<sub>3</sub></b>				
24F <sub>3</sub> -1	(AMS MB 5-18xJS 95-60)x(PI 159923xJS 95-60)	3	1	4
24F <sub>3</sub> -4	(JS 71-05xNRC 37)x(PI 159923xNRC 37)	27	8	35
24F <sub>3</sub> -5	JS 71-05xNRC 37	40	17	57
23F <sub>2</sub> -1	(AMS-MB-5-18xJS95-60)x(PI 159923xJS71-05)	7	-	7
23F <sub>2</sub> -7	(AMS-MB-5-18xJS95-60)x(PI 159923xJS95-60)	2	-	2
23F <sub>2</sub> -8	(JS71-05xNRC37)x(AMS-MB-5-18xJS95-60)	26	-	26
23F <sub>2</sub> -9	(JS71-05xNRC37)x(EC602288)	9	-	9
23F <sub>2</sub> -10	(AMS-MB-5-18xJS95-60)x(PI 159923xJS71- 05)/(38-11-265xJS95-60)x(JS71-05xNRC37)	12	-	12
23F <sub>2</sub> -11	(JS71-05xNRC37)x(Drt2(TGX328-049)/ (AMS-MB-5-18xJS95-60)x(PI159923xJS95-60)	6	-	6
23F <sub>2</sub> -13	(JS71-05xNRC37)x(PI159923xNRC37)	3	-	3
<b>F<sub>4</sub></b>				
24F <sub>4</sub> -3	NRC 137 X GKS 21-4	1	2	3
<b>Total SPS</b>				<b>182</b>

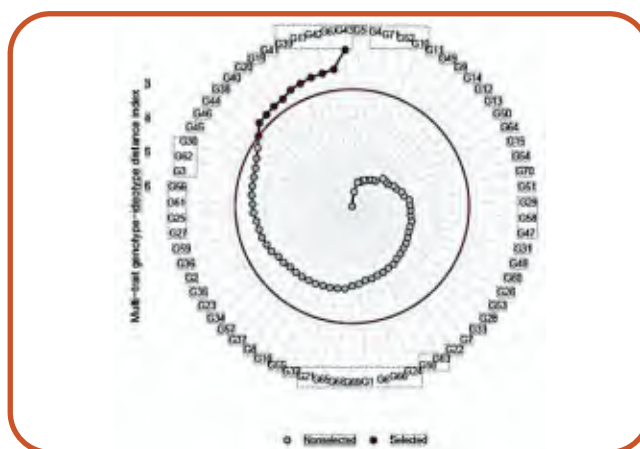
### Evaluation of soybean genotypes under low soil moisture stress conditions:

In a field trial conducted during the summer of 2024, 71 advanced breeding lines including 4 checks were evaluated under soil moisture stress at the reproductive stage. The ideotype genotypes were analysed by MGIDI (R-Metan package) for phenological traits i.e. days to emergence, days to 1<sup>st</sup> trifoliolate, days to 2<sup>nd</sup> trifoliolate, days to 3<sup>rd</sup> trifoliolate, days to 4<sup>th</sup> trifoliolate, days to bud initiation, days to R1, days to 50% flowering, days to R3, days to R4 and days to R5 stages and for physiological traits viz. delayed leaf senescence, SPAD chlorophyll meter reading, canopy temperature depression and relative water content. The genotypes

G43 (M-54-4A-8), G67 (116-136), G42 (M-54-3B-2), G17 (M-27-4), G39 (M-53-4-6), G41 (M-53-4-24), G19 (M-24-1), G20 (M-29-9), G40 (M-53-4-9), G38 (M-52-2-12), and G44 (C-8-2) were found suitable and will be utilised in the breeding programme for drought tolerance.

### Evaluation of varieties for low rainfall situations:

In the multi-location yield trial at Baramati, Kota, and Indore 16 genotypes including two checks i.e. NRC 136 and NRC 37 were evaluated in *kharif* 2023. Two genotypes NRC 131 at Baramati and NRC 157 at Kota did not germinate. The rainfall during the season recorded was 286.2 mm in Baramati, 671.9 mm in Kota and 1155 mm in Indore center.



**Fig. 3.3.1: Soybean genotypes rankings showing selected accessions using MGIDI index**

Varieties viz. RVSM 2011-35 (35.8%), AMS 100-39 (30.6%) and AMS MB 5-18 (28.5%) were high yielders as compared to the tolerant check NRC 136. AMS MB 5-18 had increased root: shoot ratio (0.23), root surface area (3001 cm<sup>2</sup>), thickness (2.1 mm), volume (178 cm<sup>3</sup>) which is a drought avoidance strategy. These traits in AMS MB 5-18 were comparable to the tolerant check NRC 136. In a multilocation trial conducted at four centers viz. Indore, Baramati, Kota and Jodhpur during *khari* 2024, 14 advanced breeding lines including 5 checks viz. JS 97-52, JS 335, NRC 142, JS 93-05 and JS 20-69 were evaluated.

**Germplasm evaluation for desiccation tolerance:** 67 soybean germplasm (Origin IITA, Nairobi) were evaluated in a field trial, of which only 22 accessions survived

the RAB disease infestation. Under desiccation stress two accession viz. TGX 1895-6F (98.9%) and TGX 293-71E (91.8%) expressed high stem reserve mobilization.

The checks JS 335 (79.4%), JS 20-34 (73.9%), and NRC 150 (73.2%) recorded high SRM values. Stem reserve mobilization of sensitive check JS 20-98 was low (37.3%).

**Evaluation of advanced breeding lines:**

33 lines including four checks viz. JS 21-72, JS 20-98, NRC 142 and JS 335 were evaluated in a yield trial. Check JS 21-72 was the highest yielding check (21.6 q/ha). Four lines viz. M-27-1 (11.1%), M-10-2A-18 (7.8%), M-23-2 (5.4%) and M-52-2-2 (5.0%) showed yield superiority as compared to the best check.

**Table 3.3.5: Better performing varieties under low rainfall situations**

S.No.	Genotype	Baramati (1)	Indore* (2)	Kota (3)	Mean Yield (kg/ha) (1,3)
1	RVSM 2011-35	1501	260	1449	1475
2	AMS 100-39	1587	804	1248	1418
3	AMS MB 5-18	2101	1133	691	1396
4	NRC 136 (C)	928	95	1245	1086
5	NRC 37 (C)	1221	313	866	1043
	Mean	1079	520	1083	
	CV (5%)	8.8	9.4	15.3	

\*Data of Indore center was rejected due to poor plant stand and high disease pressure (anthracnose and RAB).



Fig3.3.2: Stem reserve mobilization efficiency of soybean germplasm

Table 3.3.6. Advanced breeding lines and checks with high yield attributes

Genotypes	Seed Yield (q/ha)	Pl. height (cm)	No. of Nodes	No. of Pods	Biomass (g)	100Sd Wt. (g)
M-27-1	24.0	56.0	13.1	100.0	41.0	9.4
M-10-2A-18	23.3	60.8	13.5	68.9	28.7	9.1
M-23-2	22.8	57.9	13.8	88.6	39.9	12.1
M-52-2-2	22.7	72.7	13.1	54.7	26.2	7.7
JS 21-72 (C)	21.6	55.9	13.1	87.5	46.9	11.4
JS 20-98 (C)	11.2	56.1	13.9	57.3	29.5	7.2
NRC 142 (C)	8.7	61.2	15.9	79.2	42.3	8.3
JS 335 (C)	1.6	52.3	13.0	41.1	21.4	8.3
Mean	16.7					

Elite lines evaluated in Multilocation trials of AICRP on Soybean:

**NRC 295:** The genotype NRC 295 was evaluated in IVT 2024 and promoted to AVT-1 in Central Zone. It was drought tolerant genotype derived from the cross (JS 93-05 x JS 97-52). In station trial 2023, the genotype found 24.8% superior yielding (19.62 q/ha) than the best check RVS 24 (15.72 q/ha).

**NRC 190:** It is a high-yielding drought-tolerant entry derived from a cross (JS 97-52 x JS 355). The genotype NRC 190 was evaluated in AVT-I 2024 of the North Eastern Hill Zone. It yielded 2971 kg/ha as compared to the best check KDS 753 (2617 kg/ha) in IVT 2023 in the zone.



Fig. 3.3.3 Field view of NRC 295 and NRC 190



### ISSR3.16/21 Identification of genes/loci for better root system in soybean

PI-Dr. Giriraj Kumawat, Co-PIs Drs M. B. Ratnaparkhe, Gyanesh K. Satpute, Shivakumar M., Prince Choyal

#### Candidate gene mining for GWAS loci

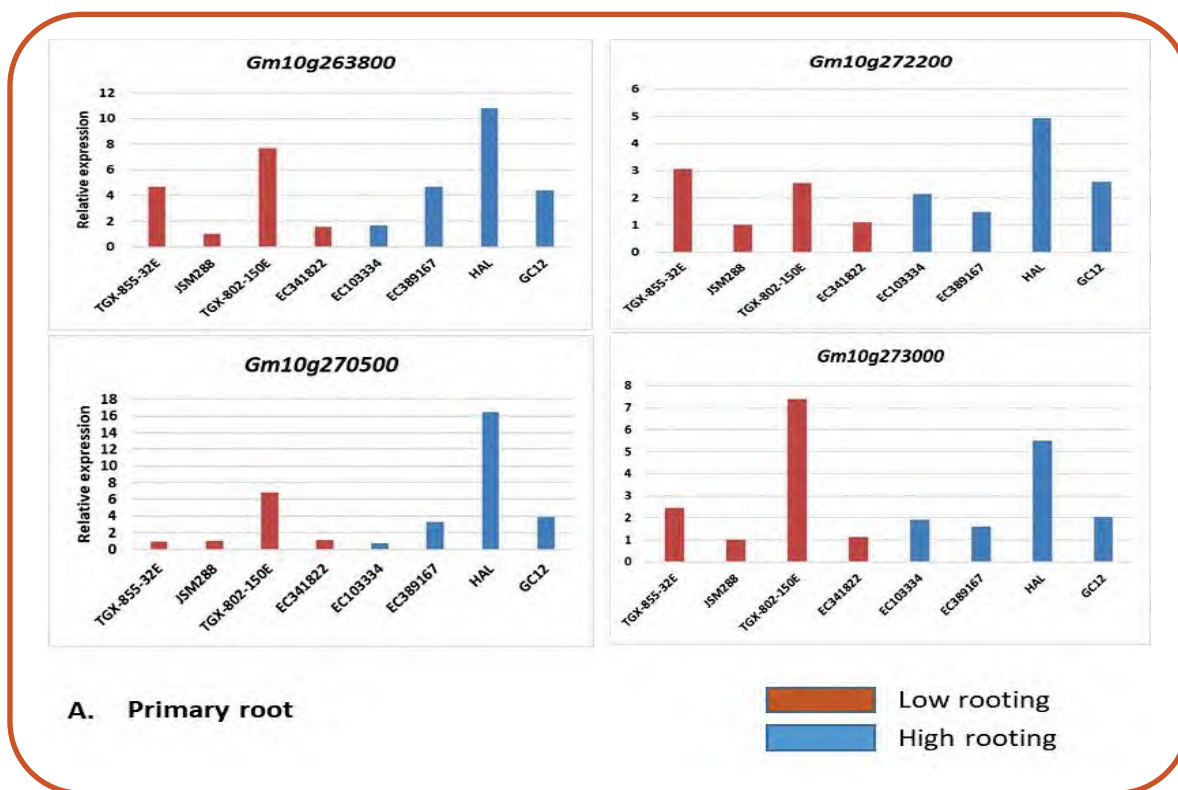
The two significant genomic region on Chr05 and Chr10, associated with multiple root traits were searched for candidate gene mining. The 500 Kb genomic region flanking most significant SNP was analyzed for gene models and annotations. For Chr05, SNP S5\_34293785, 77 genes were present in flanking region. Four genes Glyma.05G118800, Glyma.05G120500, Glyma.05G122800 and Glyma.05G123200, were annotated for root development / gravitropism, in gene ontology biological process descriptions. For loci on Chr10, 190 genes were present in 1800 kb genomic region spanning three significant SNPs associated with root volume, primary root length and total root length. Four candidate genes Glyma.10g263800, Glyma.10g270500, Glyma.10g272200 and Glyma.10g273000, were present in this region with annotation for root traits or root development pathway.

### Differential gene expression analysis for candidate genes of significant loci

Four high rooting GW40 (HAL), GW208 (GC 12), GW258 (EC 103334), and GW271 (EC 389167), and four low rooting genotypes GW141 (TGX 802-150 E), GW180 (TGX 855-32 E), GW108 (JSM 288) and GW218 (EC 341822), were selected based on hydroponic root culture of 220 germplasm at 3-week stage for differential expression studies. Four candidate genes (Glyma.10g263800, Glyma.10g270500, Glyma.10g272200 and Glyma.10g273000) on Chr10 were analyzed for differential expression in contrasting lines. GmActin was used as normalizer. Differential gene expression analysis identified Gm10g270500 expresses differentially in primary roots of high rooting and low rooting germplasm set (Fig 3.3.4).

### Differential gene expression analysis of SOR1-like genes in contrasting germplasm

Gene expression analysis of seven GmSOR1-like genes revealed differential expression of four genes among contrasting germplasm. Glyma.01g097900 and Glyma.06g091651 showed differential expression in primary root, while, Glyma.02g218200 and Glyma.14g185600 showed differential expression for lateral roots in eight contrasting genotypes (Fig 3.3.5).



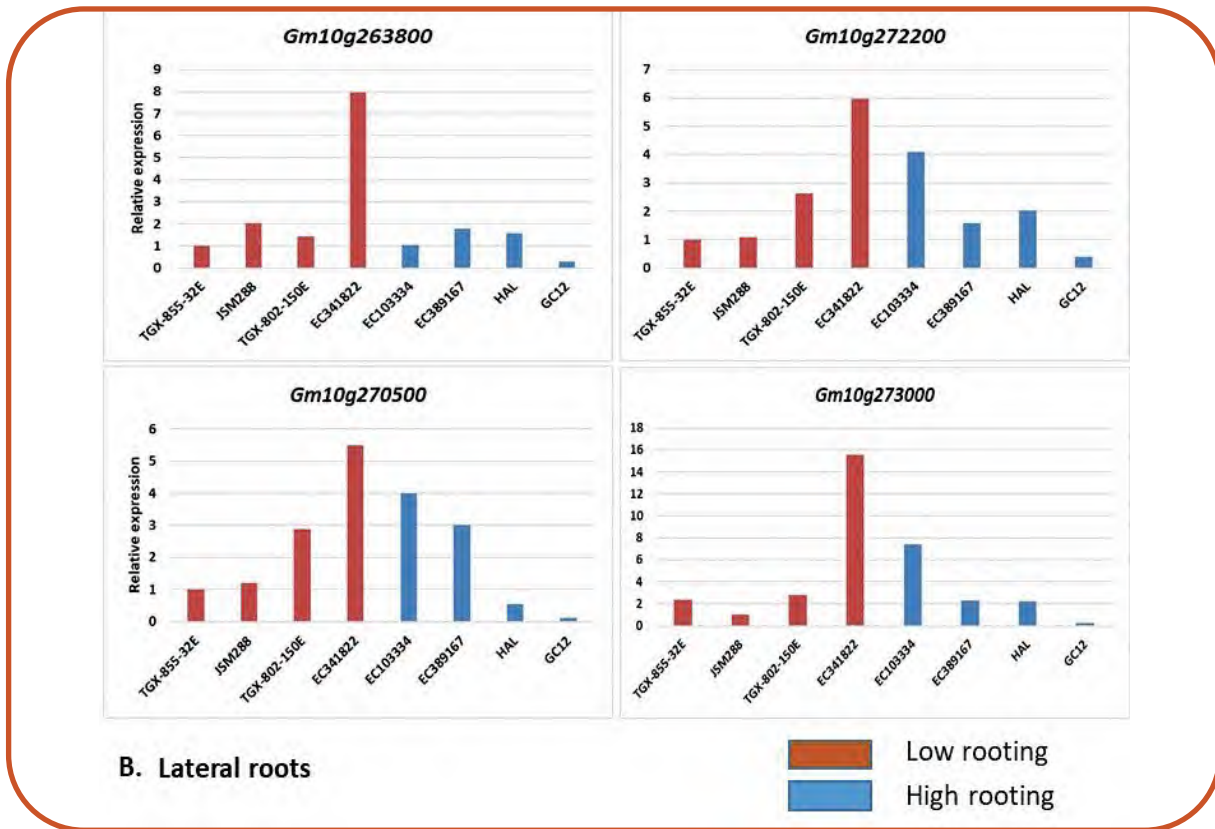


Fig. 3.3.4: Expression analysis for candidate genes of Chr10 (*Glyma.10g263800*, *Glyma.10g270500*, *Glyma.10g272200* and *Glyma.10g273000* ) in contrasting root trait germplasm. A. Primary root, B. Lateral roots.

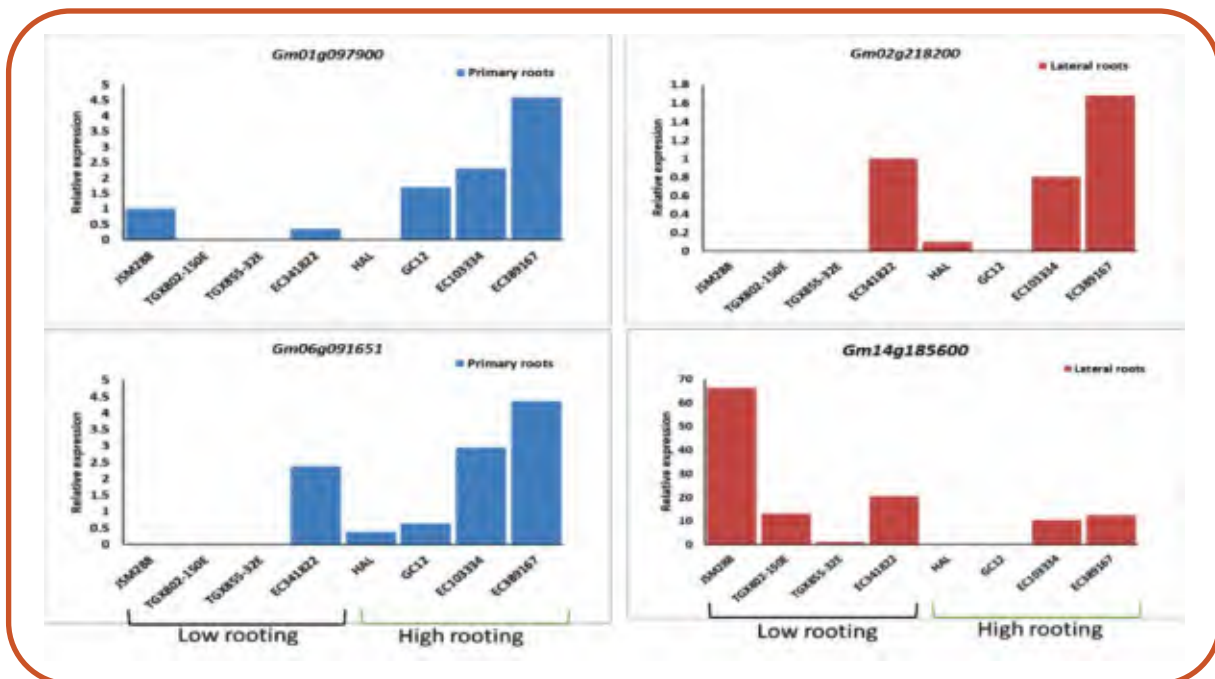


Fig. 3.3.5: *SOR1*-like genes showing differential expression in contrasting germplasm for primary roots and total root length



### IISR7.8/23 Trait identification and physiological breeding for waterlogging tolerance in soybean

PI: Dr. Prince Choyal, Co-PI: Drs. Gyanesh Kumar Satpute, Giriraj Kumawat and Nataraj V.

The field screening of 62 soybean genotypes (25 advanced breeding lines, RILs, germplasm, and 4 checks) was done for waterlogging tolerance at the reproductive stage by using a randomized block design with three replications in a

flooded field during *Kharif* 2023. The plant growth and yield parameters in both control and waterlogging conditions were recorded at harvest (Table 3.3.6 and 3.3.7). Further, based on the yield reduction under waterlogging stress condition and waterlogging resistance index (WLRI), 7 promising genotypes (NRC 256, NRC 257, NRC 142, C 20-10-10, JS 97-52 × NRC 130, JS 97-52 × EC 546882 and EC 250591) were selected as donor parent for further breeding program.

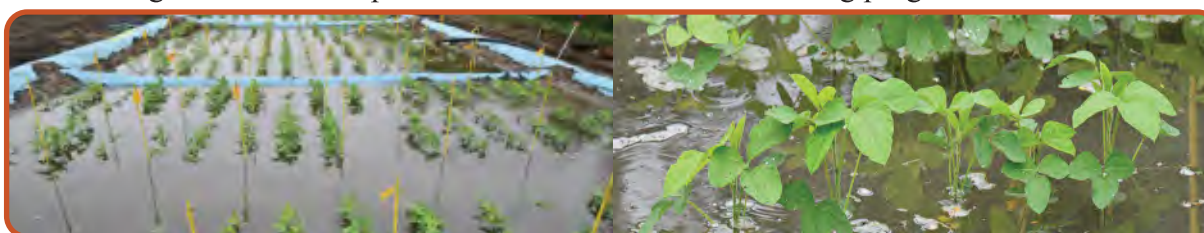


Figure 3.3.6 Evaluation of soybean genotypes under waterlogging stress at reproductive stage (R2 stage)

Table 3.3.6 Parameters of variation in a set of 62 genotypes

Traits	MSS		CV		Mean	
	Control	WL	Control	WL	Control	WL
Plant Height	389***	729***	7.79	6.91	51.3	47.4
No. of Pods	833***	964***	6.63	8.20	79.6	48.8
Seed yield plant <sup>1</sup>	92.2***	54.6***	7.35	12.6	12.2	5.51
Test weight	16.6***	46.8***	5.47	9.93	10.8	7.56
Oil content (%)	91.5	88.8	1.4	1.35	17.7	17.3

During *Kharif* 2024, the identified 7 genotypes were further re-evaluated for waterlogging tolerance potential at the R2 stage for 15 days. Results revealed that NRC 256, NRC 257, C 20-10-10, EC 457564, F6-22(JS 97-52× EC 546882), F6-1(JS 97-52× NRC 130), RIL 104-3 recorded minimum yield reduction under waterlogging stress as compared to

tolerant checks (JS 97-52, JS 20-38 and JS 2098). These genotypes can be considered in future breeding programs for the development of waterlogging-tolerant soybean varieties. The tolerant genotypes showed a very dense network of surface rooting under waterlogging conditions, which could be adventitious (Fig. 3.3.7).

Table 3.3.7 Descriptive statistics of various growth and yield parameters in 62 genotypes under control and waterlogging stress

	Plant Height		No. of pods		Seed Yield		Test Weight	
	Control	WL	Control	WL	Control	WL	Control	WL
Minimum	51.3	47.3	79.6	48.8	12.2	5.5	10.8	7.7
Maximum	88.1	91.7	131.9	91.1	24.9	19.5	15.4	13.8
Mean	35.1	25.8	54.4	16.2	4.1	0.5	4.8	2.2



**Fig 3.3.7 Dense surface rooting in selected soybean genotypes under waterlogging stress**

### Phenotyping of root traits at four weeks after sowing in soil culture

The 50 accessions with extreme root phenotype for total root length (10% from both ends) identified from set of 220 accession panel were phenotyped again in hydroponic culture at three-week stage. There was a good agreement between two experiments for root phenotypes except few. Top fifteen genotypes showing highest total root length (TRL) and fifteen genotypes showing lowest TRL in confirmation experiment in hydroponic culture were phenotyped in soil medium using root study structure (80 cm x 100 cm x 9 m) filled with field soil supplied with NPK (Figure 3.3.8) Observations on primary root length (PRL), TRL, root diameter (RDM), Surface area (SA), root volume (RV) and root tips (RT), were recorded from roots harvested at four-weeks growth of plants and analyzed using WinRHIZO software for both experiments. Average of TRL, PRL and root volume phenotype in two hydroponic cultures and two soil cultures, was used to identify contrasting genotypes. Based on four root phenotyping experiments, genotypes GW-167, GW-76, GW-10, GW-40 shown high TRL and root volume, while genotypes GW-95, GW-144, GW-38, GW-92, GW-66 shown lower TRL and root volume among set of 30 accessions. These contrasting germplasm will be further used in gene expression profiling and NIL development



**Figure 3.3.8:** Root phenotyping experiment in soil culture using root study structures

### DBT funded Project: Characterization of saponin polymorphism in irradiation-induced TILLING population of soybean cultivar NRC-142.

PI- Dr. Vinit Kumar

E- beamed M2 population of NRC 142 was raised in the field and M2:3 seeds from 300 plants and were analysed for saponins through thin layer chromatography (TLC).(Fig. 3.3.9)



**Figure 3.3.9 :** Chromatogram depicting saponin profiling of M2:3 seeds as analysed through TLC.

### ICAR EFC project: Enhancing climate resilience and ensuring food security with genome editing tools

PI: Dr Milind B. Ratnaparkhe, CO-PIs: Drs Sanjay Gupta, Giriraj Kumawat, Shivakumar M, Prince Choyal, Lokesh Kumar Meena

Gene editing is powerful approach which can quickly address the problem of low productivity, tolerance to biotic stresses and improved seed composition traits. To explore new approach of gene editing in soybean improvement, six genes were selected. These genes are: GmGA3ox1 for seed yield, GmSDP1 for seed and oil yield, UDP-glycosyltransferase (UGT) for insect resistance against leaf chewing insects, Pod dehiscence 1 (PDH1) for pod shattering resistance and GmFAD2- 1A and GmFAD2-1B for oleic acid content. Sequence of these genes in the target genotypes has been confirmed by sanger sequencing. To knockout these genes using CRISPR/Cas9 gene editing method, guide RNAs for each of these genes have been designed and cloned in pBlu/gRNA shuttle vector.



### 3.4 Breeding for Management of biotic stresses

#### IISR1.33/16 Development of YMV resistant Soybean varieties using marker assisted selection.

PI- Dr. Anita Rani, Co-PI-Dr. Vineet Kumar

- NRC 149 (NRCSL 3), Yellow Mosaic resistant variety developed in the project using MAS has been released for cultivation in North Plain Zone by CVRC.
- Advance lines developed from NRC142 (double null) x BC<sub>3</sub> of JS95-60 X(JS95-60XSL525) (YMV resistant) possessing YMV resistance gene were tested at Hot spot Ludhiana and evaluated for yield.
- Twenty advance breeding lines developed from NRC142 (double null) x NRCSL 2 (YMV resistant) possessing YMV resistance gene were tested at Hot spot Ludhiana and evaluated for yield. Seven lines were killed due to charcoal rot and ten lines were found to be resistant to yellow mosaic disease. Out of ten lines 4 lines showed grain yield > 2 tons at Indore.
- Progeny rows of BC<sub>2</sub>F<sub>2</sub> of AMS 100-39 X (NRC149 x AMS100-39) were raised in Kharif in the field for yield evaluation. Ten progeny rows showed grain yield > 2 tons.



**NASF funded project:** Marker assisted stacking of yellow mosaic disease resistance, null Kunitz trypsin inhibitor, null lipoxygenase-2 genes, and broadening the genetic base of soybean.

PI- Dr. Vineet Kumar; Co-PIs-Drs Anita Rani, Sanjay Gupta, and Rajesh Vangala

- Putative BC<sub>1</sub>F<sub>1</sub> seeds for NRC142 × SL955 were sown and 23 true BC<sub>1</sub>F<sub>1</sub> plants were confirmed. BC<sub>1</sub>F<sub>1</sub> plants of all the crosses were backcrossed with their respective recurrent parent i.e. NRC142 to obtain BC<sub>2</sub> generation. BC<sub>2</sub>F<sub>0</sub> seeds have been planted on 15th Nov 2024 and the DNA of the plants extracted and marker assisted confirmation of BC<sub>2</sub>F<sub>1</sub> is underway.
- Putative F<sub>1</sub> plants for the cross AVSB 2012 × NRC 142 and AVSB 2013 × NRC 142 were raised and 13 and 12 true F<sub>1</sub> plants were confirmed using trait linked SSR marker for the cross AVSB 2012 × NRC 142 and AVSB 2013 × NRC 142, respectively. True F<sub>1</sub> plants of all the crosses were backcrossed with their respective recurrent parent i.e. AVSB2012 and AVSB2013 to obtain BC<sub>1</sub> generation. BC<sub>1</sub>F<sub>0</sub> seeds have been planted on 15th Nov 2024 and the DNA of the plants extracted and marker assisted confirmation of BC<sub>1</sub>F<sub>1</sub> is underway. Using MYMIV and MYMV specific primers, YMV infected plants at IISR, Indore field were genotyped. Only primers specific to MYMIV were amplified.
- Based on the *kharif* 2023 evaluation data of 4958 accessions at Bengaluru centre, a core collection of 1000 accessions were formed. Between core set and the whole germplasm collection, the range of all the 8 traits was same, mean was not significantly different and the CV was higher in core set. Core set is under multiplication at Bengaluru and Indore for distribution to centers for evaluation under multi-locations.
- 63 F<sub>3</sub>s were shared with AICRP centers and are under evaluation in kharif 2024 and 16 promising F<sub>2</sub> were advanced to F<sub>3</sub> at Bengaluru and F<sub>4</sub>s are under evaluation at IISR.

**IISR 4.5/23: Breeding for resistance against charcoal rot and anthracnose diseases in soybean**

PI: Dr. V. Nataraj, Co-PIs: Drs Pawan Kumar Amrate, Sanjeev Kumar, Shivakumar M, M.B Ratnaparkhe and Vangala Rajesh

1. Hybridization: Crosses were made aiming at high-yielding, charcoal rot and anthracnose resistance
2. A RIL population (JS 20-98 × JS 95-60) of size 200 was evaluated for charcoal rot at Jabalpur under sick plot

conditions and resistant lines were identified

3. A RIL population (NRC 150 × NRCSL 8) of size 350 was advanced from F<sub>2:3</sub> to F<sub>2:5</sub> generation
4. In institute’s station trial (CV = 17.92, CD 5% = 206.02) YP 56 (1876 Kg/ha) has shown 18.5% superiority over the best check Hardee (1583 Kg/ha) and is promoted to IVT
5. In individual station trials, genotypes Code 30 (2331 Kg/ha) found superior to the best check JS 22-12 (1751 Kg/ha).

**Table 3.4.1: List of crosses made for high yielding, charcoal rot and anthracnose resistance**

Objective: Grain Yield and charcoal rot resistance	Objective: Grain Yield and anthracnose resistance
Hardee × JS 95-60	Hardee × NRC 150
Hardee × 2023-37	NRC 150 × AGS 25
Hardee × NRC 166	EC 34372 × X-67
Hardee × X-67	NRC 252 × EC 528623
NRC 252 × NRC 166	
NRC 270 × JS 94-67	
NRC 252 × EC 572136	
JS 90-41 × JS 21-05	
AGS 25 × JS 95-60	
NRC 166 × JS 22-12	
NRC 252 × JS 20-98	
2023-37 × AGS 25	
JS 20-98 × (JS 20-98 × PP6)	
JS 20-98 × K53	
JS 20-98 × LJ 119	
NRC 181 × AGS 25	
2023-37 × JS 95-60	
EC 572136 × NRC 152	
2023-37 × K 53	

**DST-SERB project: Genomic Strategies for Improving Anthracnose Resistance in Soybean (*Glycine max* L.)**

PI- Dr. M. B. Ratnaparkhe, Co-PIs- Dr. V. Nataraj, Dr. Shivakumar M, Dr Sanjeev Kumar, Dr. Giriraj Kumawat

A total of 320 soybean germplasm lines were screened for anthracnose resistance at the adult plant stage under a Randomized Complete Block Design (RCBD) at ICAR-NSRI, Indore. In addition, in-vitro leaf and

pod inoculations were conducted on all 320 genotypes. Disease evaluation was performed in terms of Percent Disease Index (PDI) and Area Under Disease Progress Curve (AUDPC).

For GWAS analysis, a panel consisting of diverse soybean accessions was genotyped using the GBS platform. Genotypic data consisting of approximately 66,300 SNPs distributed across all 20 chromosomes was used in the association study. GWAS



analysis was conducted for various AUDPC and PDI values derived from field evaluations, in-vitro pod, and leaf inoculations. Advanced statistical models were employed using the GAPIT tool in R. GWAS analysis revealed a significant locus on chromosome 16, spanning from 36,960,762 to 37,987,683 bp, named Lee\_Gm16-1. Lee\_Gm16-1 uncovered a set of 14 NB-ARC and TIR domain-containing genes (Glyma.16G214200, Glyma.16G213800, Glyma.16G215400,

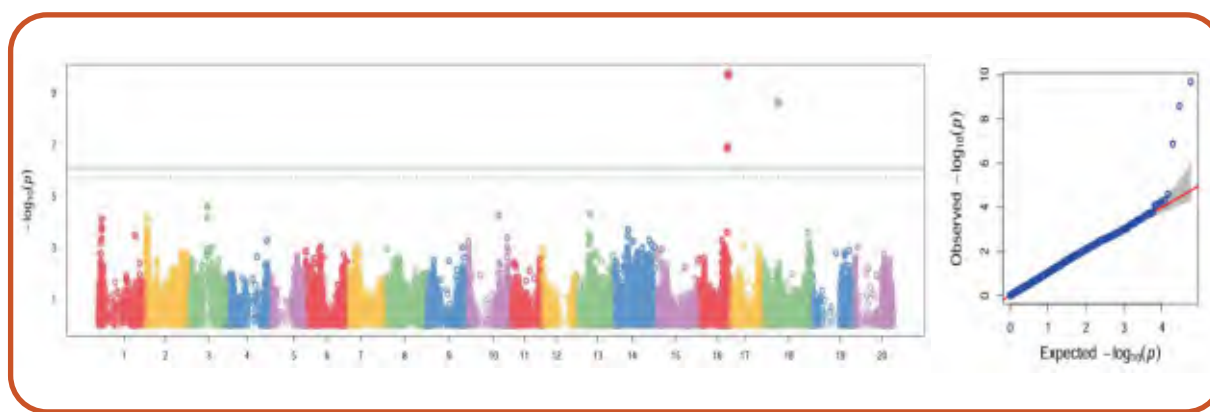
development of resistant cultivars.(3.4.1)

### IISR 3.12/19: Soybean Improvement against defoliating insects

PI: Dr Vangala Rajesh, CO-PI: Drs Lokesh Kumar Meena, Shivakumar M, Vennampally Nataraj, MilindRatnaparkhe

#### Screening of soybean accessions for defoliating insects resistance

GWAS soybean germplasm lines (292) were screened in field and lab conditions against defoliating insects (*Spodoptera litura*) in RBD. In



**Fig.3.4.1: Manhattan and QQ plot showing association with post 48 h of anthracnose artificial infection.** GWAS was conducted by employing Fixed and random model Circulating Probability Unification (FARMCPU) in GAPIT implemented in R.

**Table. 3.4.2: SNP identified for Anthracnose resistance in soybean for pod inoculation data after 48 h of Artificial infection**

SNP	Chr	LEE	WM 82	P.value
S16_36960762	16	36960762	35809371	1.35 E-07
S16_37987683	16	37987683	37029641	2.06 E-10
S18_19305912	18	19305912	19306112	2.56 E-09

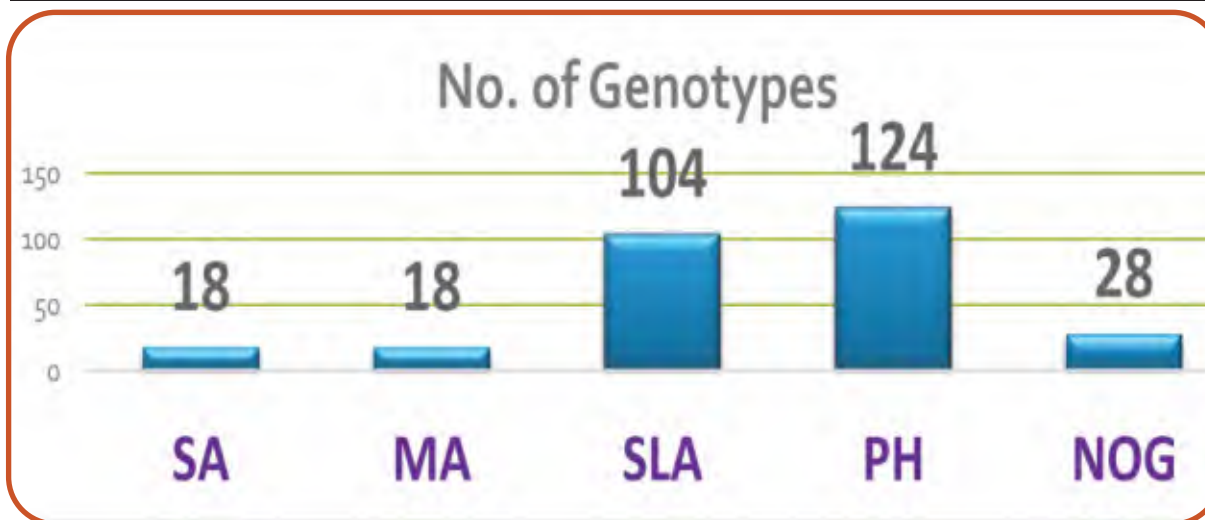
Glyma.16G214500, Glyma.16G215200, Glyma.16G214500, Glyma.16G214100, Glyma.16G213700, Glyma.16g214100, Glyma.16g215000, Glyma.16G211000, Glyma.16G210500). NB-ARC and LRR domains are well known for their roles in disease resistance in plants and play crucial roles in fungal defense. These genes will be further validated with real time PCR to confirm their role in resistance. These genes and markers will be used for the

lab conditions, based on preference index (C) of antixenosis for *Spodoptera litura*, soybean accessions were categorized based on the resistance with susceptible check as JS 335. Eighteen genotypes exhibited strong antixenosis and also showed resistance reaction in field condition (Table 3.4.3)



**Table: 3.4.3 Screening of soybean accessions for defoliating insects resistance**

S.No.	Genotype	'C' Values	Interference
1	EC 538802	0.4	Strong antixenosis
2	JS 79-82	0.41	Strong antixenosis
3	CAT 47 (AGS 155)	0.41	Strong antixenosis
4	TGX 1016-19 F	0.42	Strong antixenosis
5	NRC 2007-1-3	0.42	Strong antixenosis
6	P 318	0.42	Strong antixenosis
7	LEE	0.43	Strong antixenosis
8	JS 20-69 (Check)	0.43	Strong antixenosis
9	TGX 239-43 D	0.44	Strong antixenosis
10	AKSS 67 (Check)	0.45	Strong antixenosis
11	PS 1225	0.46	Strong antixenosis
12	EC 389179	0.46	Strong antixenosis
13	TGX 302A-68 D	0.47	Strong antixenosis
14	M 1085	0.47	Strong antixenosis
15	F4P21 (Check)	0.47	Strong antixenosis
16	F3P18 (Check)	0.47	Strong antixenosis
17	G5P22 (Check)	0.49	Strong antixenosis
18	CAT 2503 (Check)	0.49	Strong antixenosis
19	JS 335 (Susceptible check)	1.17	Highly Susceptible



**Fig 3.4.2. Classification of GWAS panel Soybean germplasm by Antixenosis against *Spodoptera litura* SA-Strong Antixenosis, MA-Moderate Antixenosis, SLA-Slight Antixenosis, PH-Preferred Host, NOG-No germination/Disease Hybridization**

**Table: 3.4.4 The following 18 intraspecific and five interspecific crosses were attempted**

S.No.	Crosses	S. No.	Crosses
1	NRC 150 X SHALIMAR SOY-1	10	BASARA X NRC 188
2	NRC 150 X NRC 157	11	EC 457254 X EC 915908
3	JS 355 X NRC 138	12	NRC 138 X AGS 155
4	NRC 138 X CAT 146	13	NRC 150 X SKAUS 3
5	NRC 181 X AGS 25	14	F4P21 X JS 335
6	KARUNE X NRC 188	15	NRC 181 X SKAUS-3



7	NRC 150 X AGS 25	16	NRC 181 X SHALIMAR SOY 1
8	LINE 202 X AGS 25	17	EC 34372 X SKAUS
9	NRC 188 X AGS 25	18	NRC 181 X AGS 25
<b>Interspecific cross (<i>Glycine max</i> x <i>Glycine soja</i>)</b>			
1	JS 95-60 X PI 549046		
2	NRC 150 X PI 549046		
3	JS 20-34 X PI 549046		
4	JS 93-05 X PI 549046		
5	JS 97-52 X PI 549046		

**Table: 3.4.5 Performance of resistant soybean lines against insect pest at multi-locations**

S.No	Genotype	Indore		Parbhani		Kota		Imphal	Dharwad
		LAB	Field	LAB	Field	LAB	Field	Field	Field
1	CAT 146 (AKSS 67)	SA	HR	SA	HR	SA	HR	MR	MR
2	CAT 47 (AGS 155)	SA	HR	SA	HR	SA	HR	MR	MR
3	CAT 2503	SA	HR	SA	HR	SA	HR	HR	HR
4	F4P21	SA	HR	SA	HR	SA	HR	HR	HR
5	G5P22	SA	HR	SA	HR	SA	HR	HR	HR
6	F3P18	SA	HR	SA	HR	SA	HR	HR	HR

SA-Strong Antixenosis, HR-Highly Resistant, F4P21: PS 564 X TGX 855-53 D, F3P18: JS 335 XDS 396, G5P22: MACS 330 X L 129

### 3.4.6. Advancement of generation:

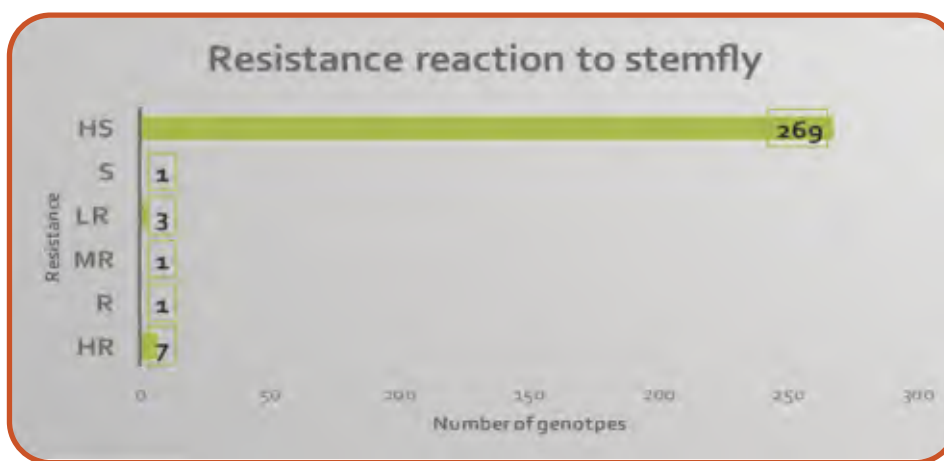
Selections were done for the following crosses based on field resistance followed with lab screening

S.No	F <sub>3</sub> Cross combinations	S.No.	F <sub>3</sub> Cross combinations
1	F <sub>3</sub> P18 X JS 9305	21	HARASOYA X EC 915908
2	JS 20-34 X G5P22	22	AMS-MB-5-18 X EC 915908
3	AKSS 67 X G5 P22	23	JS 20-34 X (JS 20-24 X 000 (3))
4	F <sub>4</sub> P21 X LINE 220	24	JS 20-34 X AGS 25
5	G5P22 X JS 335	25	Harasoya x RSC 10-46
6	F <sub>4</sub> P21 X JS 95-60	26	Hardee x Karune
7	JS 97-52 X (JS 20-34 X LINE 202)		F <sub>4</sub> Cross combinations
8	Harasoya x JS 93-05	27	AGS 155 X AKSS 67
9	F <sub>3</sub> P18 X DLSB 1	28	JS 20-34 X G5P22
10	F <sub>3</sub> P18 X JS 335	29	JS 20-34 X EC 538828
11	F <sub>3</sub> P18 X LINE 220	30	JS 335 X CAT 146
12	HARASOYA X (F <sub>4</sub> P21 X LINE 220)		<b>Interspecific cross combinations (<i>Glycine max</i> x <i>Glycine soja</i>)</b>
13	JS 95-60 X (CAT 146 X G5P22)	31	JS 335 x PI 549046
14	JS 95-60 X LINE 220	32	EC 538828 X PI 549046
15	JS 20-34 X LINE 202	33	JS 20-34 X PI 407170
16	JS 95-60 X G5P22	34	JS 20-34 X PI 593983

17	JS 95-60 X AKSS 67	35	JS 95-60 X PI 593983
18	AKSS 67 X G5P22	36	JS 335 X PI 407170
19	EC 457254 X RSC 10-46	37	JS 95-60 X PI 549046
20	HARDEE X EC 915965	38	EC 538828 X PI 593983
21	HARASOYA X EC 915908	39	JS 95-60 X PI 407170
22	AMS-MB-5-18 X EC 915908	40	JS 20-98 X PI 549046

### Screening of GWAS Panel for stem fly and girdle beetle resistance

GWAS soybean germplasm lines (292) were screened in field for stem fly resistance.



**Fig3.4.3. Screening of GWAS Panel for stem fly and girdle beetle resistance**

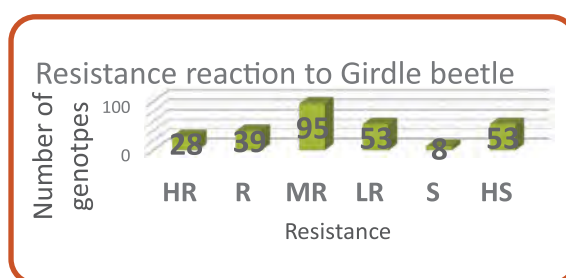
HS-Highly susceptible, S-Susceptible, LR-Less resistant, MR-Moderately Resistant, R-Resistant, HR-Highly Resistant

**Table 3.4.7: List of soybean GWAS Panel germplasm with resistance reaction to stem fly**

Genotype	Stem tunneling (%)	Transformed	Resistance reaction
KHSB 2	13.42	21.49	HR
EC 343312	14.17	22.11	HR
TGX 780-5A	14.94	22.74	HR
EC 456613	15	22.79	HR
EC 341115	15.33	23.05	HR
AKSS 67 (Check)	16.84	24.23	HR
JS 20-116 (Check)	16.92	24.29	HR
EC 274713	17.46	24.7	R
NRC 128 (Check)	18.38	25.39	MR
AGS 156	19.83	26.44	LR
JS 20-34	20.12	26.65	LR



EC 457280	20.29	26.77	LR
TGX 885-44 E	20.95	27.24	S
PUSA 37	21.69	27.76	HS
TGX 312-012 E	22.22	28.12	HS
EC 589409	22.73	28.47	HS
JS 20-29	22.81	28.53	HS
EC 287457	23.5	29	HS
AGS 155 (Check)	24.47	29.65	HS
EC 241310	24.7	29.8	HS



**Fig. 3.4.4 GWAS soybean germplasm lines (292) were screened in field for girdle beetle resistance.** -Highly susceptible, S-Susceptible, LR-Less resistant, MR-Moderately Resistant, R-Resistant, HR-Highly HS Resistant

**Table 3.4.8: List of soybean GWAS Panel germplasm with resistance reaction to Girdle beetle**

S. No	Genotype	Girdle beetle damage (%)	Transformed	Resistance reaction
1	PI 340900	0.7	45.4	HR
2	TGX 780-5A	0.88	45.5	HR
3	SL-295	0.88	45.5	HR
4	EC 457475	0.88	45.5	HR
5	MACS 1034	0.9	45.52	HR
6	CO-SOYA-2	1.05	45.6	HR
7	EC 390977	1.15	45.66	HR
8	AMS-MB-5-18	1.15	45.66	HR
9	BR 15	1.15	45.66	HR
10	EC 457052	1.15	45.66	HR
11	ALANKAR	1.15	45.66	HR
12	EC 274711	1.15	45.66	HR
13	EC 538807	1.15	45.66	HR
14	EC 528622	1.15	45.66	HR
15	NRC 86	1.19	45.68	HR
16	KALITUR	1.3	45.74	HR
17	ICS 84/86-85B-41	1.3	45.74	HR
18	TGX 854-429	1.45	45.83	HR

19	JS 20-73	1.49	45.85	HR
20	PUSA 37	1.7	45.97	HR
21	TGX 1016-19 F	1.7	45.97	HR
22	HIMSO 175	1.74	45.99	HR
23	PI 200465	1.85	46.06	HR
24	EC 251498	1.85	46.06	HR
25	SL 142	1.85	46.06	HR
26	ADT-1	1.85	46.06	HR
27	EC 538802	1.85	46.06	HR
28	EC 456613	1.89	46.08	HR

### 3.5 Seed quality characteristics

#### IISR 4.3/23 Enhancement of seed longevity of vegetable soybean (*Glycine max* L. Merr.) genotype.

PI: Dr. Punam Kuchlan, Co-PI: Drs Mrinal Kuchlan; Co-PI: Milind Ratnaparke

To enhance the seed germination potential and adaptability of vegetable soybean (*Glycine max* L. Merr.), 'Karune' has been crossed with better germination line. Selected lines from the RIL's were sown for generation advancement (F<sub>6</sub>) of crosses (Karune x EC 538828), (Karune x VC111) (F<sub>5</sub>) and Karune X VC109 (F<sub>5</sub>) in Kharif 2024. These RILs were evaluated for disease resistance, seed size at both vegetative and mature stages, and seed germination potential. High germination lines were identified on the basis of field emergence rate. Additionally, screening of the vegetable breeding lines focused on seed boldness, days to pod picking, total soluble sugar content (%) at the green stage, presence or absence of pubescence on pods, pod size, protein

content at the green stage (R<sub>6</sub>), disease resistance or tolerance, and taste after cooking. The immature pods of vegetable soybean are picked when the plants reach approximately 80% of maturity (between reproductive stages of R<sub>6</sub> and R<sub>7</sub>) and still retain about 65% moisture content. At picking stage, 100 seed weight among the RIL's ranged from 25.54 -70.01 g as compared to vegetable type parent Karune with 55 g. 200 lines were found with puberlent pod (pubescence absent) which is mostly 3 seeded preferable for vegetable soybean. Pod size at green stage varied from 5.0-7.5 cm as compared to vegetable variety Karune 7.4 cm. During the process of testing of selected sweet lines as food these vegetable pods were roasted just like green chick pea. It was found that roasted green soybean was more delicious than boiled one as remarks given by every person who tasted it. 68 lines were observed with TSS with more than 30% brix. At R<sub>6</sub> stage lines were evaluated for protein content on fresh wt. basis and the range was found 34-40 percent. (Table 3.5.1 to 3.5.3)

**Table 3.5.1 Characteristic features of promising sweetest Vegetable lines of cross Karune × EC538828 during Kharif 2024**

Line	Field emergence	Moisture % At picking stage	TSS (Brix index %)	Days to flowering	Days to picking	Protein (%) at R <sub>6</sub> stage on fresh wt basis	Protein (%) mature seed)	Pubescence	Yield (q/ha)
CK-59	74	74.75	29.00	39	70-86	37.76	39.42	Absent	24.84
CK-152	70	64.69	26.67	34	76-90	39.79	40.19	Absent	15.66
CK-134	76	68.05	24.00	37	71-84	39.38	41.82	Absent	18.82
CK-335	81	65.32	34.00	35	75-90	30.93	35.32	Absent	30.07
CK-328	84	67.68	33.00	31	76-95	38.76	40.19	Present	18.46
CK-333	85	66.09	31.00	35	79-92	33.29	40.19	Absent	15.14
CK-6	65	68.05	28.33	37	72-85	34.10	36.94	Absent	20.74
CK-178	73	72.12	27.67	39	79-95	30.45	37.35	Absent	25.41
CK-177	75	67.70	27.00	37	81-98	34.10	38.46	Absent	15.66
CK-64	71	71.95	26.00	34	70-88	36.93	37.76	Absent	27.74
CK-146	72	53.77	21.33	34	75-91	36.13	36.54	Absent	20.17
CK-355	70	72.84	20.00	38	74-98	36.94	37.35	Absent	17.53



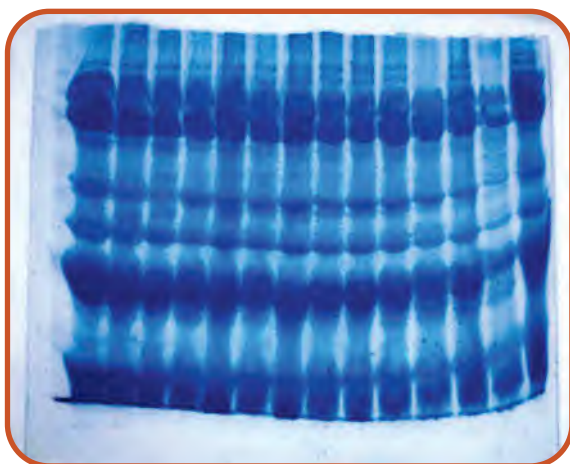
**Table 3.5.2 Best performing lines from cross Karune X VC 109 on the basis of edible taste, brix index, field emergence rate and mature seed yield**

TRAITS	Name of lines population size
Based on edible Taste and Brix index % (Range of TSS 25-33%)	KVC109-6, KVC109-7, KVC109-8, KVC109-9, KVC109-12, KVC109-13, KVC109-15, KVC109-16, KVC109-22, KVC109-24, KVC109-27
High field emergence rate > 80%	KVC109-1, 2,11,12,14,20,21,22,23,28,29,30,32,33,34,39,40,41,43 44,45,46,47,53,58,61,65,70,71,73,74,75,76,79,80,88,89,90,91, 94,&95
High yield (2636 q/ha)	KVC109-1, 2,11,12,14,20,21,22,23,28,29,30,32,33,34,39,40,41,43 44,45,46,47,53,58,61,65,70,71,73,74,75,76,79,80,88,89,90,91, 94,&95

**Table 3.5.3 Best performing lines from cross KARUNE × (VLS 1XEC538838) 111**

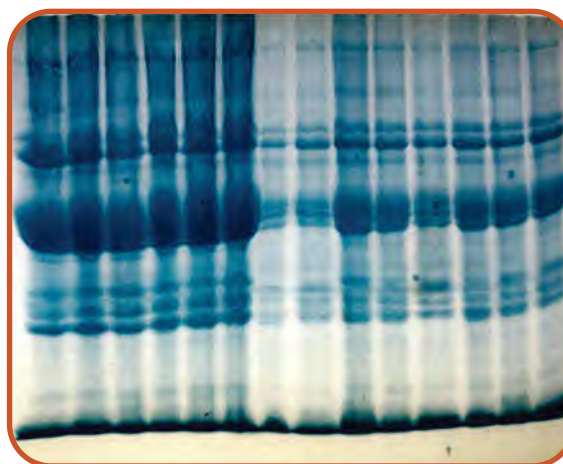
Traits	Name of lines population size
Based on edible Taste and Brix index % (Range of TSS 25-33%)	KVC111-3, KVC111-7, KVC111-10, KVC111-18, KVC111-25, KVC111-26, KVC111-27, KVC111-28,
Lines having more than 40% protein at R6 stage (fresh wt basis)	KVC111-4, KVC111-6, KVC111-14, KVC111-15, KVC111-16, KVC111-18, KVC111-19, KVC111-20, KVC111-22, KVC111-23, KVC111-25
Lines have high field emergence >80 %, with no disease infection	KVC111-3, KVC111-6, KVC111-7, KVC111-10, KVC111-18, KVC111-25, KVC111-29

Protein profile of vegetable soybean revealed that the proportion of low molecular weight protein is comparatively high at R6



**Fig.3.5.1 Seed protein profile of vegetable lines at R6 stage**

stage and proportion of high molecular weight protein is comparatively high at maturity (Fig. 3.5.1 - 3.5.2)



**Fig 3.5.2 Seed protein profile of vegetable lines at maturity**



Fig 3.5.3 Fresh Harvested vegetable soybean



Fig 3.5.4 Boiled vegetable Soybean

Sensory Testing by RAC Chairman



Fig 3.5.6 Vegetablesoybean at picking(R6) stage

Fig 3.5.5 Roasted vegetable soybean



### Soybean seed production and marketing during 2023-24 under AICRP Seed (Crops) and Seed Hub Project on Oil seeds

PI: Dr. MK Kuchlan, Co-PI: Dr. Punam Kuchlan

#### Nucleus and Breeder Seed Production:

Nucleus and breeder seed production of different varieties namely NRC 150, NRC 157, NRC 165, NRC 181, NRC 131, NRC 152, NRC 142, NRC 138 and NRC 130 were undertaken under AICRP Seed (Crop) at Institute, ICARDA and in farmers field in an area of around 80 ha. during *khariif* 2024. The variety wise details of nucleus and breeder seed production are as presented ( Table 3.5.4) .

### Foundation, Certified and TL seed production

Seed production of Foundation, Certified and TL classes for NRC 142, NRC 150, NRC 138 and RVS 24 was taken up under Seed Hub Project in collaboration with progressive farmers of Indore, Dhar and Ujjain.

Table 3.5.5



**Table 3.5.4 Details of breeder seed and nucleus production of soybean varieties.**

S. No.	Variety	Production (quintal)	Sale	S. No.	Variety	Production (quintal)	Sale
<b>Breeder seed production</b>				<b>Nucleus seed production</b>			
1.	NRC 150	146.0	120.7	1	NRC 150	51.87	26.37
2.	NRC 130	145.8	144.3	2	NRC 157	2.40	1.2
3.	NRC 138	125.7	125.7	3	NRC 165	2.10	-
4.	NRC 142	111.78	110.4	4	NRC 142	11.50	4.5
5.	NRC 165	19.32	15.4	5	NRC 152	0.30	-
6.	NRC 157	28.5	27.9	6	<b>Total</b>	<b>68.17</b>	<b>32.07</b>
7.	NRC 127	37.2	35.4				
8.	NRC 181	6.0	5.1				
9.	NRC 152	4.3	3.9				
10.	NRC 131	3.3	3.05				
	<b>Total</b>	<b>627.9</b>	<b>591.4</b>				
	<b>G. Total</b>	<b>696.07</b>	<b>623.47</b>				

**Table 3.5.5 The details certified and TL seed production of soybean varieties.**

S. No.	Variety	Production (quintal)	Sale
1.	NRC 142	21.3	21.3
<b>Certified Seed Production and marketing</b>			
S. No.	Variety	Production (quintal)	Sale
1.	NRC 138	112.5	112.5
	NRC 142	254.35	254.35
	<b>Total</b>	<b>366.85</b>	<b>366.85</b>
<b>TL Seeds Production and marketing</b>			
S. No.	Variety	Production (quintal)	Sale
1.	RVS 24	98.70	98.7
2.	NRC 150	11.35	11.35
3.	NRC 142	17.45	17.45
4.	JS 20-69	-	19.85
	<b>Total</b>	<b>127.5</b>	<b>147.35</b>
	<b>Grand Total</b>	<b>515.65</b>	<b>535.5</b>

**Project: Central Sector Scheme for Protection of Plant Varieties and Farmers Right Authority - Distinctiveness, Uniformity and Stability Testing of Soybean Varieties**

PI: Dr. MK Kuchlan, Co-PI: Dr. Punam Kuchlan, Co-PI: Dr. Vineet Kumar

**The maintenance of soybean released and notified varieties as reference collection at IISR-Nodal Centre of DUS Testing**

164 released and notified soybean varieties were maintained during *kharif* 2024 at ICAR-NSRI, Indore. The varieties were characterized for 20 DUS Test characteristics. Due to adverse climatic condition inducing occurrence of diseases affected performance of soybean varieties significantly. The effect of climatic factors is reflected in terms of yield. The yield performance varied from 0.0 q to 30.42 q. One variety namely JS 23-03 yielded above 30q/ha, 2 varieties yielded at the range of 25-30q/ha, 4 varieties yielded at the range of 20-25q/ha, 16

varieties yielded at the range of 15-20q/ha, 20 varieties yielded at the range of 10-15q/ha and rest all the varieties yielded less than 10q/ha. (Fig. 3.5.7)

**DUS Testing of soybean candidate varieties:**

Total 21 varieties including 10 candidate and 11 reference varieties were tested. Out of 10 candidate varieties 4 were tested for second season and 6 for first season. 19 morphological and 3 biochemical characteristics namely Peroxidase activity of seed coat, seed protein and oil content have been recorded for study of distinctiveness, uniformity and stability test.

**Sharing of seeds of soybean varieties to different research institutes:**

The seeds of soybean varieties were shared on request basis to different research institute for their research purposes. The details are as follows:

Sl. No.	Institute or University	No. of varieties	Name of variety
1.	Bidhan Chandra Krishi Vishwavidyalaya, Mohanpur, WB	15	RSC 10-71, RSC 10-52, AMS 2014-1, RSC 10-46, MACS 1460, NRC 147, NRC SL 1, NRC 132, NRC 128, JS 20-116, NRC 142, NRC 150, NRC 165, JS 21-72, RVS 2002-4
2.	ICAR -VPKAS, Almorah	4	JS 93-05, MACS 1281, RSC 11-07, NRC 7, KB 79
3.	ICAR -CIPHET, Ludhiana	3	NRC 130, NRC 138, NRC 142
4.	ICAR-NIASM, Baramati, Pune	9	JS 71-05, NRC 7, Indira Soya 9, MACS 450, MAUS 47, NRC 37, JS 93-05, JS 95-60, JS 80-21

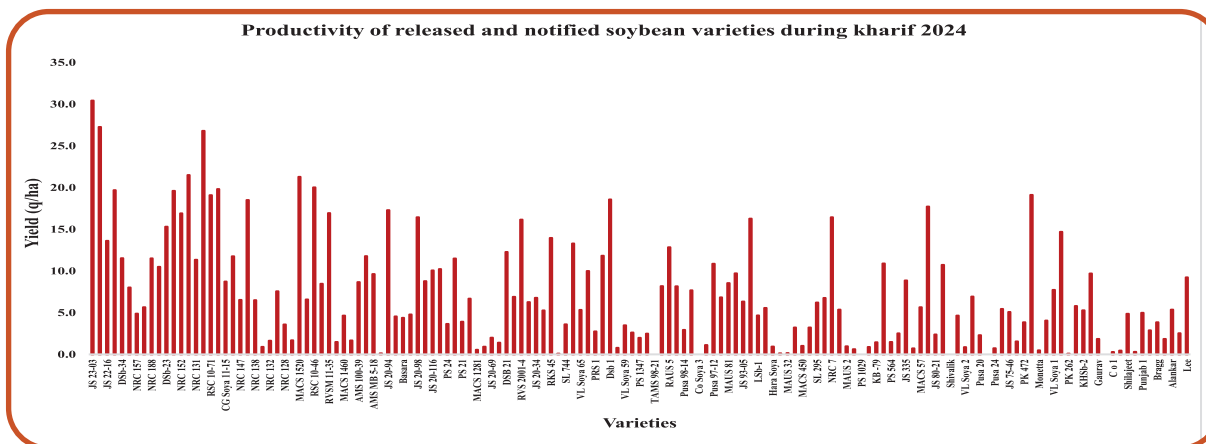


Fig. 3.5.7 The performance of released and notified Soybean varieties during *kharif* 2024



### 3.2 CROP PROTECTION

#### Management of Biotic Stresses

#### IISR/3.11/22: Soybean improvement against *Rhizoctonia* aerial blight disease

PI-Dr Sanjeev Kumar; Co-PIs: Drs (V. Nataraj, Shivakumar M, M.B. Ratnaparkhe, K.P. Singh, Pezangulie Chakruno, Pawan Amrate, H.Maheshwari)

#### Activity 1: Integrated management of major diseases of soybean

For the integrated management of *Rhizoctonia* aerial blight disease of soybean, previously evaluated best seed treatment fungicide i.e., Thiophanate methyl + Azoxystrobin + Thiomethoxam @10 ml/kg of seed was used in combination with four spray fungicides (label claimed) registered in India, namely, Fluxapyroxad 167 g/l + Pyraclostrobin 333 g/l SC @ 300 g/ha, Pyraclostrobin 133 g/l + Epoxiconazole 50g/l SE @ 750 ml/ha, Carbendazim12% + Mancozeb 63%WP @ 1250 g/ha, Tebuconazole 25.9%EC @ 625 ml/ha with JS 335 variety as the susceptible variety sown in 5 rows of 3m length. Among all 8 treatments, treatment T1, i.e., ST with Thiophanate methyl + Azoxystrobin + Thiomethoxam @ 10ml/kg seed + spray of Fluxapyroxad 167 g/l +

Pyraclostrobin 333 g/l SC @ 300 g/ha produced lowest disease severity of 48.35% 75 days after sowing and minimum AUDPC of 331.48. The control in this experiment T8, i.e., Untreated (No ST, No spray) produced maximum disease severity of 72% with highest AUDPC of 542.50 (Fig: 3.2.1 a & b ). Similarly, the yield obtained in the best treatment (T1) was higher i.e., 8.6 q/ha compared to check variety having 5.79 q/ha.

#### Activity 2: Development of sick plot for RAB disease

For the development of sick plot, an artificial plot of size 20m<sup>2</sup> were created in NSRI residential colony to avoid the spread of the fungal inoculum to the main crop field. The pure culture of *R. Solani* was isolated and multiplied on the sorghum grains.

The inoculum was created in batches and added to the field followed by sole cropping of highly susceptible soybean cultivar, JS 95-60. During maturity of soybean about 20% soybean plants were found to be infected by RAB disease (Fig: 3.2.2 a & b) Thereafter, RAB infected soybean plants were chopped and incorporated in the plot.

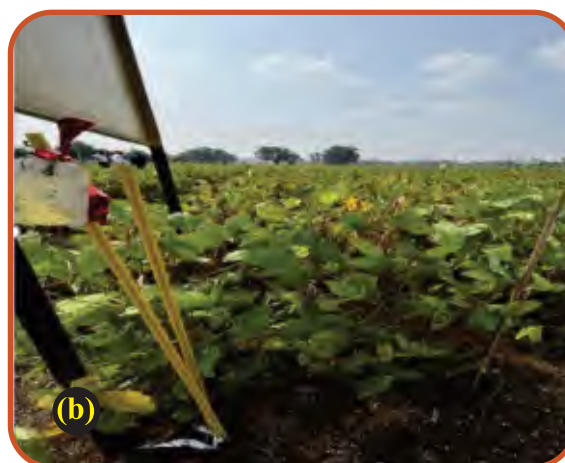
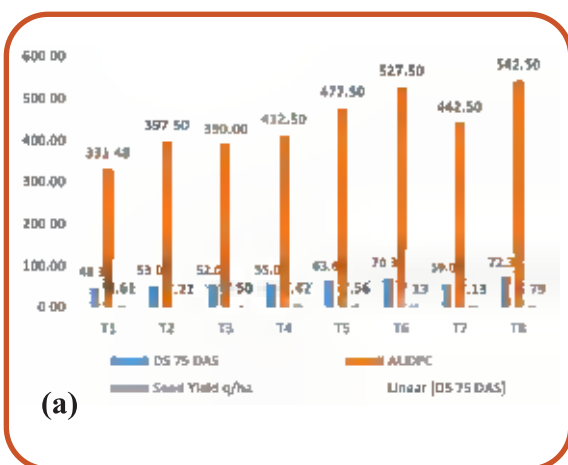


Fig: 3.2.1(a) Mean PDI and AUDPC in different fungicidal treatments for RAB disease management. Fig: 3.2.1(b) Lowest disease severity in T1 treatment.


**(a)**

**(b)**
**Fig: 3.2.2(a) Inoculum development on sorghum grains 3.2.2(b) RAB disease initiation in the sick plot**

### Activity 3: Screening Soybean Genotypes and varieties Against Rhizoctonia aerial blight disease Under Field Conditions

A total of 81 genotypes including check JS 95-60 were screened under field conditions and result showed varying range of different resistance for potential soybean genotypes against the RAB disease. At 75 DAS, the highest PDI of 92.59% was observed in the susceptible check genotype JS 95-60 followed by 77.78% and 70.37% respectively in 97-52x5-18 and 97-52x5-18. Similarly, the lowest PDI and AUDPC at 0 was recorded in genotype (R-39) 128x5-18, (R-59)481x NRC128 and the highest AUDPC of 2277.78 was observed in the susceptible check variety JS 95-60 (R-81). Lower AUDPC values indicating higher resistance to the disease.

Similarly, a set of 25 soybean varieties in chain were screened under field conditions alongwith JS 95-60 as susceptible check. Among the varieties screened, RSC 10-46, NRCSL-1, JS 21-72, JS 20-69, PK 308, JS 20-98, PS 1347 were found to be highly resistant against aerial blight disease of soybean.



### IISR/3.14/24: Standardization of package of practises for soybean production using drone technology

PI: Dr. Sanjeev Kumar,

CO-PIs: Drs Raghvendra Nargund, Savita Kolhe

During the *Kharif* 2024 season, an experiment on the standardization of practices for soybean production using drone technology was conducted. The study involved growing of soybean on 1632 m<sup>2</sup> with two treatments: conventional soybean cultivation (T1) and soybean cultivation using drone technology (T2). The spraying schedule includes spray of PE herbicide Diclosulum and recommended fungicide Tebuconazol 25.9% w/w, insecticide cloranthraniliprol 85.5% SC both at 45 DAS (Fig. 3.2.3) In both the treatments recommended package of practices for soybean cultivation was adopted. Standard operating procedures were strictly adhered for T2, including a drone flying speed of 4.0 m/s, a height of 2 meters above the crop canopy, and a water volume of 20 L/ha during spraying. Key results of the trial included:

- Soybean cultivation by using drone technology: (T2) Improved Soybean yield as compared to conventional practices(T1)
- Disease Incidence: the % disease severity of RAB was marginally low in T2. It was reduced from 45% in (T1) to 40% in (T2), and % disease severity in anthracnose from 52% to 48%.



**Fig. 3.2.4: Field Operations carried out using drone technology**

### **IISR 3.1/21 Isolation and identification of kairomones and sex pheromones components for soybean stem fly, *Melanoagromyza sojae* management**

*PI: Dr. Lokesh Kumar Meena Co-PIs: Dr. Vangala Rajesh and Dr. Kamala Jayanthi*

The stem fly (*Melanagromyza sojae*) is a widely distributed and highly damaging soybean pest globally as well as in India. It is regular and major pests of soybean and found to infest stem region of plant by making tunnel in the stem. It is more dominant in *kharif* season in India, with high devastating potential resulting in 18-39% yield reduction. In seedling stage infestation plants will die and during vegetative growth severe infestation will cause stunted growth, yellowing and necrosis in plant. For isolation and identification of kairomones for soybean stem fly, *M. sojae*, we evaluated eight soybean genotypes viz., F4P18, F4P21, JS 335, JS 9305, CAT47, G5P22, JS 9560 and CAT2503 through air entrainment, olfactometer assays, GC EAD (Gas Chromatography Electroantennodetection) and GCMS (Gas Chromatography Mass Spectrometry). Whole plant volatiles were collected using headspace analysis and four-arm olfactometer assays were carried out to assess the attraction/repulsion of

different soybean genotype plant volatiles to gravid female *M. sojae*. (Fig. 3.2.4)

The results revealed that the time spent by stem fly in F4P21, CAT47 and G5P22 treated arms was significantly less as compared to control indicating the non-preference of stem fly females towards these genotypes. In case of CAT2503, the flies spent significantly more time in treated arm compared to the control. The GC-EAD analysis revealed that a total of 8 compounds viz., methyl salicylate, Undecane, 3,7-dimethyl-, Dodecane, 2,6,11-trimethyl-, decanoic acid, ethyl ether, cyclododecanol, Pentadecane, 2,6,10,14-tetramethyl, Heptadecane, 2,6,10,15-tetramethyl- and Heptadecane, 2,6,10,15-tetramethyl- d in CAT2503 volatiles. Likewise, in F4P21 genotype, a total of 6 compounds, namely, p-Xylene, Ethane, 2-chloro-1,1-diethoxy-, Octane, 2,4,6-trimethyl-, (+)-Cyclosativene, Hexadecane, 1-chloro- and 7,7-Diethylheptadecane were found; similarly in G5P22, a total of 7 compounds namely 2-Propanol, 1-propoxy-, bornyl acetate, Tetradecane, Tetradecane, 2-methyl-, Pentadecane, 2,6,10,14-tetramethyl-, Heptadecane, 2-methyl- and Heptadecane, 2-methyl-, hexafarnesyl acetone were found; and in CAT47 (5 compounds) soybean genotype, Ethane, 2-chloro-1,1-diethoxy-, trans-2-Hexenyl acetate, Nonane, 4,5-dimethyl-, Decane, 2,3,5,8-tetramethyl- and 2-Hexyl-1-decano were found (Fig. 3.2.5).

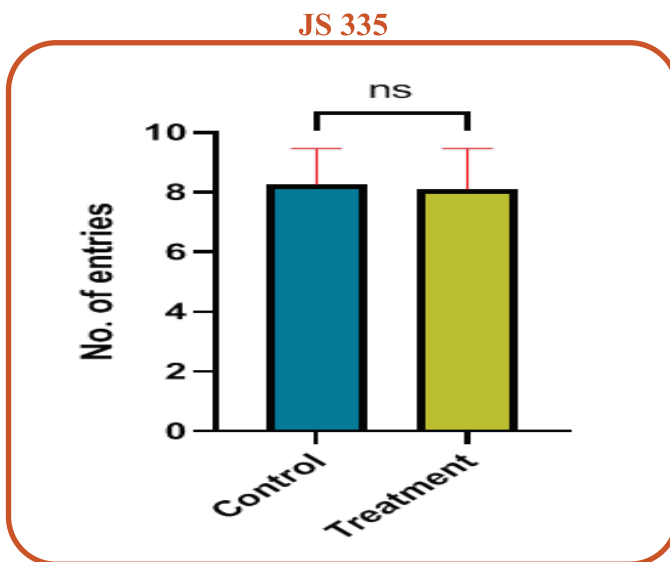


Figure 1: Olfactometer bioassays of volatiles collected from JS 335 soybean genotype against stem fly

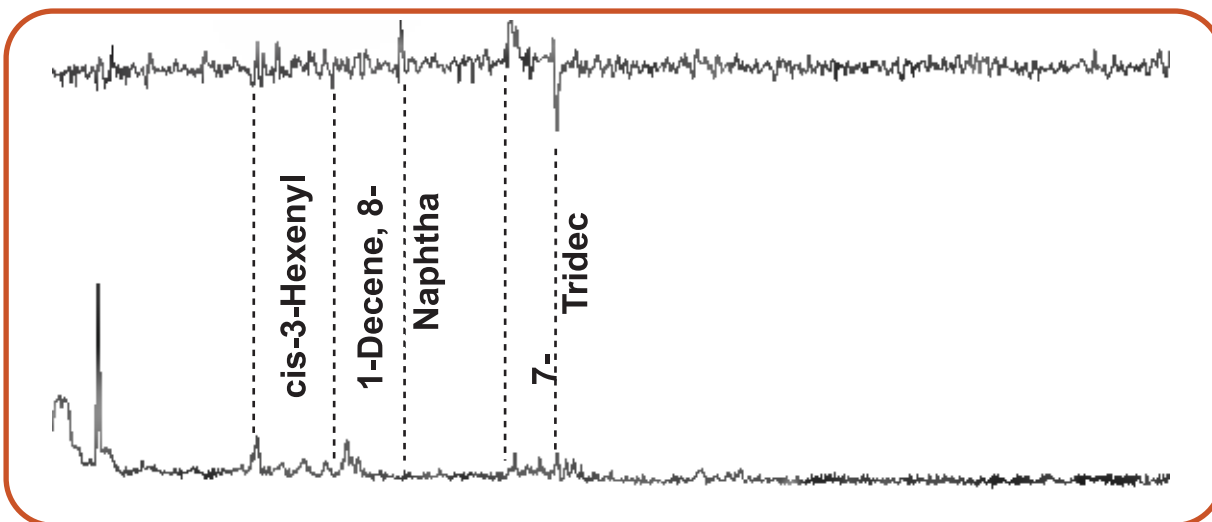


Figure 2: GC-EAD analysis of volatiles collected from JS335 soybean genotype



### 3.3 CROP PRODUCTION

#### IISR4.13/17 Evaluation of residue management practices under permanent broad bed furrow as well as conventional tillage practices for sustaining/improving resources use efficiency, soil quality, and crop productivity in soybean-based cropping systems

PI: Dr. Rakesh K. Verma

Co-PIs: Drs Raghavendra Nargund, A. Ramesh, M. P. Sharma and Prince Choyal

The field experiment was conducted in *Kharif*-2024 to evaluate the effect of cropping systems, crop establishment method/land configuration, and residue management practices on the yield of soybean-based cropping systems. The experiment was laid out in split plot design with three cropping systems (soybean-potato-wheat, soybean-wheat and soybean-chickpea) in main plot and four crop establishments method [permanent broad bed furrow with residue (PBBF + R), permanent broad bed furrow without

residue (PBBF + WR), conventional tillage as per farmer's practices with residue (CTFP + R), and conventional tillage as per farmer's practices without residues (CTFP + WR)] in subplot. The 50% of the soybean crop residue was retained in the field to subsequent *rabi* crops, 50% of the gram, and 30% of the wheat crop residue to subsequent *kharif* crops. The results indicated that the highest soybean yield was found under the soybean-chickpea cropping system followed by the soybean-potato-wheat system. Among the different land configurations and residue management practices, significantly more soybean yield was registered under PBBF + R (20%) fb PBBF + WR (10%) as compared to CTFP +WR. The highest soybean gross returns and B: C ratio were reported under the soybean-chickpea cropping system. Among land configurations, more gross returns and B: C ratio were registered under PBBF + R and PBBF + WR (Table 3.3.1).

**Table 3.3.1 Effect of cropping systems and crop establishment method/land configuration with residue management practices on yields and economics of soybean**

Treatment	Seed yield (kg/ha)	Cost of cultivation (Rs/ha)	Gross Return (Rs/ha)	B:C Ratio
<b>Cropping systems</b>				
Soybean-potato-wheat	2756 <sup>b</sup>	30742	136627	4.46
Soybean-chickpea	2970 <sup>a</sup>	30742	142550	4.65
Soybean-wheat	2455 <sup>c</sup>	30742	131299	4.28
<b>Crop establishment methods/land configurations (LC)</b>				
PBBF + R	2994 <sup>a</sup>	30337	151060	4.98
PBBF + WR	2740 <sup>b</sup>	29347	140829	4.80
CTFP + R	2685 <sup>b</sup>	32137	130273	4.05
CTFP + WR	2492 <sup>c</sup>	31147	125140	4.02
<b>ANOVA</b>				
CS	<.0001			
LC	<.0001			
CS*LC	<.0001			

The *Rabi* season (2023-24) crop results revealed that significantly more yield of timely sown wheat, potato, chickpea, and late sown wheat after potato were registered under PBBF+R as compared to CTFP +WR (Table 3.3.2).

**Table 3.3.2 Effect of cropping systems and crop establishment method/land configuration with residue management practices on yield of *rabi* season crops**

Treatment	<i>Rabi</i> season crop yields (q/ha)			
	Potato	Timely sown wheat	Late sown wheat after potato	Chickpea
<i>Land Configurations and residue management practices</i>				
<b>PBBF + R</b>	225.3 <sup>a</sup>	59.56 <sup>a</sup>	72.00 <sup>a</sup>	14.46 <sup>a</sup>
<b>PBBF +WR</b>	162.0 <sup>b</sup>	58.58 <sup>ab</sup>	66.19 <sup>b</sup>	14.21 <sup>a</sup>
<b>CTFP + R</b>	148.1 <sup>c</sup>	57.60 <sup>bc</sup>	65.14 <sup>b</sup>	13.69 <sup>b</sup>
<b>CTFP + WR</b>	132.7 <sup>d</sup>	56.73 <sup>c</sup>	62.11 <sup>c</sup>	10.26 <sup>c</sup>

The highest soybean equivalent yield, cost of cultivation, and net returns were registered under soybean-potato-wheat system as compared to other cropping systems. Among the different land configurations with residue management

practices, the higher cost of cultivation was associated with the CTFP+R. However, significantly the highest soybean equivalent yield, net returns, and B: C ratio were found under PBBF+R as compared to other land configuration practices (Table 3.3.3).

**Table 3.3.3 Effect of cropping systems and crop establishment method/land configuration with residue management practices on system economics and soybean equivalent yield.**

Treatment	System cost of cultivation (₹)	Gross returns (₹/ha)	Net returns (₹/ha)	B: C ratio	Soybean equivalent yield (t/ha)
<i>Cropping Systems</i>					
Soybean-Potato-Wheat	165587	542877	377291	3.28	11.53 <sup>a</sup>
Soybean-Wheat	62657	204199	141542	3.25	5.42 <sup>b</sup>
Soybean-Chickpea	59071	168232	109161	2.84	4.93 <sup>c</sup>
<i>Land Configurations and residue management practices</i>					
PBBF + R	94364	336726	242362	3.48	8.28 <sup>a</sup>
PBBF +WR	92530	311291	218760	3.32	7.44 <sup>b</sup>
CTFP + R	100063	302132	202069	2.93	6.96 <sup>c</sup>
CTFP + WR	96128	270262	174134	2.80	6.50 <sup>d</sup>





### IISR6.10/23 Standardization of natural farming practices for soybean-based cropping systems

PI: Dr. Raghavendra Nargund

Co-PIs: Drs. R. K. Verma, A. Ramesh, M. P. Sharma, L.K. Meena, Sanjeev Kumar and Hemant S Maheshwari

ICAR-NSRI, Indore, initiated field experiments on natural farming in soybean-based cropping systems during *Kharif* 2023 using a split-plot design. The study evaluated five sustainable agriculture management practices: natural farming (NF), organic farming (OF), integrated crop management (ICM), conservation agriculture (CA), and conventional

practices (Con.) in the main plots, combined with three cropping systems: soybean-chickpea, soybean-wheat, and soybean-mustard in the subplots. The initial findings revealed the standardization of natural farming practices for soybean-based systems. Among the practices, ICM and the soybean-chickpea cropping system proved superior in terms of crop yield and economic parameters. Additionally, organic farming, natural farming, ICM, and CA practices significantly improved soil health. However, insect pest and disease incidence were notably higher under natural and organic farming practices. (Fig. 3.3.1 & Fig. 3.3.2)

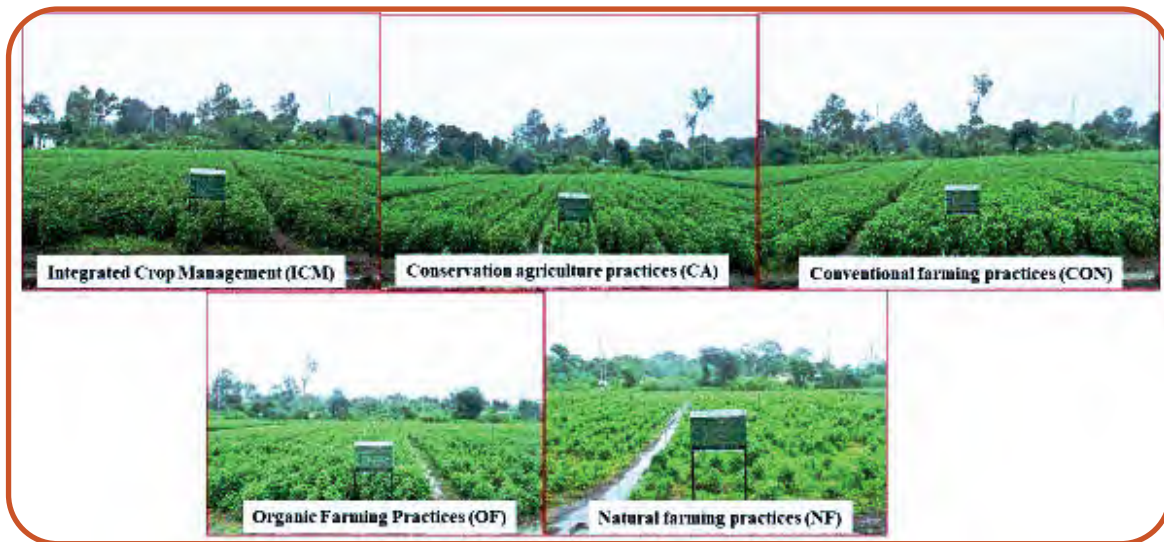


Figure 3. 3.1 Overview of Kharif crop (Soybean) experimental field

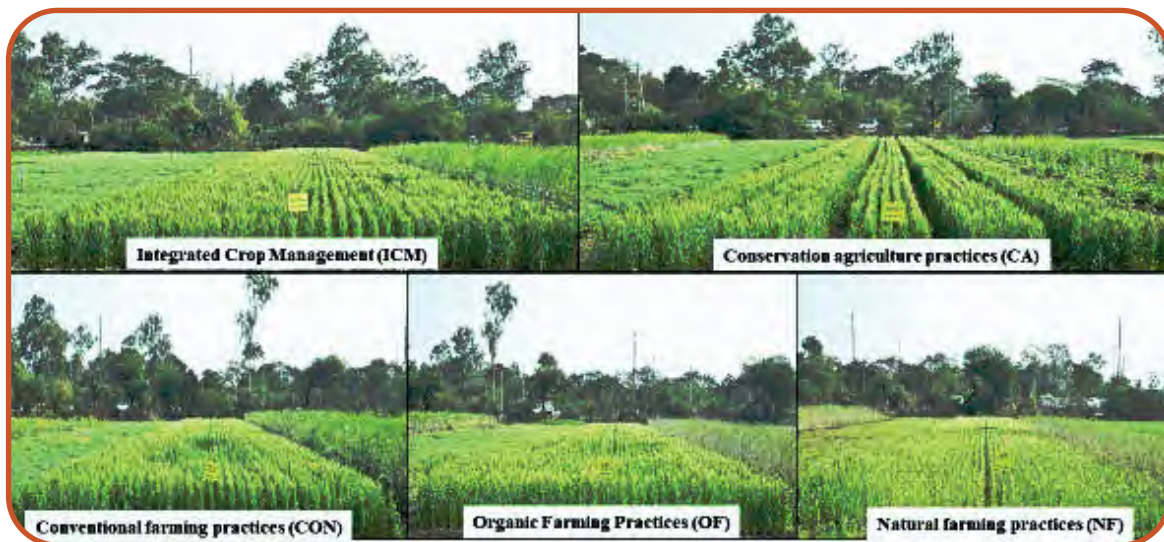


Figure 3.3.2 Overview of Rabi crops (Chickpea, wheat, and Mustard) experimental field

**NSRI Activity: Development of a standard package of practices for spring/summer soybean production**

PI: Dr. Raghavendra Nargund

Co-PIs: Drs R. K. Verma and Prince Choyal

The field experiment was initiated during the spring/summer of 2024 to standardize soybean seed production practices for the off-season. The experiment was conducted using a split-split plot design. The main plots consisted of two spacing treatments: 45 × 5–10 cm and 30 × 5–10 cm. The sub-plots included three sowing dates: 10th January, 25<sup>th</sup> January, and 5<sup>th</sup> February. The sub-sub plots comprised different nutrient management practices, namely: 100% RDF

and 5<sup>th</sup> February, under a spacing of 30 × 5–10 cm, combined with 100% RDF + Brassinosteroid spray at 30–35 DAS and 60–65 DAS, significantly improved soybean yield compared to other treatments (Fig. 3.3.3).

**IISR9.11/20 Field evaluation of potential plant growth promoting *Rhizobacteria* (Microbial Consortia) and AM fungi on nutrient dynamics and mineral biofortification under soybean –wheat cropping system**

PI: A. Ramesh, Co-PI: M.P. Sharma and Raghavendra Nargund

A field experiment was conducted with co-inoculation of promising plant growth rhizobacteria with AM fungi to know the



**Figure 3.3.3 Overview of spring/summer soybean experimental field**

(Recommended Dose of Fertilizer), 100% RDF + GA<sub>3</sub> spray at 30–35 days after sowing (DAS) and 60–65 DAS, 100% RDF + Brassinosteroid (Br.) spray at 30–35 DAS and 60–65 DAS, 100% RDF + Thiourea spray at 30–35 DAS and 60–65 DAS and 125% RDF with 100% N and 125% P/K applied as basal + 25% RDN at 60 DAS. The experiment was replicated three times to ensure statistical validity. The results indicated that sowing between 25<sup>th</sup> January

changes in soil enzymes and available nutrient content under the soybean-wheat system. Results found that soil enzymes (Dehydrogenase, Acid phosphatase, Alkaline phosphatase, Phytase, FDA, β-glucosidase and Aryl sulphatase) activates and soil-available nutrients were significantly increased with inoculation of *Bacillus aryabhatai* + *Bradyrhizobium lioningense* +AMF as compared to control (Table 3.3.4 & 3.3.5).



Table 3.3.4: PGPR and AMF on changes on enzymatic activity in soybean rhizospheric soil at maximum flowering

Treatment	DHA (µg triphenyl formazon g <sup>-1</sup> soil 24h <sup>-1</sup> )	Acid phosphatase (µg p-nitrophenol g <sup>-1</sup> soil h <sup>-1</sup> )	Alkaline phosphatase (µg p-nitrophenol g <sup>-1</sup> soil h <sup>-1</sup> )	Phytase (µg pi g <sup>-1</sup> soil h <sup>-1</sup> )	FDA (µg fluorescein g <sup>-1</sup> soil h <sup>-1</sup> )	β-glucosidase activity (µg p-nitrophenol g <sup>-1</sup> soil h <sup>-1</sup> )	Aryl sulphatase (µg p-nitrophenol g <sup>-1</sup> soil h <sup>-1</sup> )
Control	93.37g	259.58ef	332.10f	7.79g	58.80g	148.06g	50.99e
<i>Burkholderia arboris</i>	103.02ef	273.38d	378.20d	8.54f	65.53e	167.65de	54.45d
<i>Bacillus aryabhatai</i>	112.47c	277.40cd	398.05c	9.12de	66.70de	176.89bc	57.24c
<i>Bradyrhizobium lioningense</i>	98.56f	250.11f	346.70e	7.90g	62.10f	156.71f	51.75e
<i>Burkholderia arboris</i> + <i>Bradyrhizobium lioningense</i>	110.89cd	273.38d	403.68c	9.41d	66.42de	168.78cde	56.16cd
<i>Bacillus aryabhatai</i> + <i>Bradyrhizobium lioningense</i>	122.43b	286.02c	422.83b	10.07c	68.49cd	173.13cd	59.40b
<i>Burkholderia arboris</i> + AMF	111.61cd	276.81cd	400.35c	10.37c	65.79e	174.63cd	56.76c
<i>Bacillus aryabhatai</i> + AMF	124.26b	316.34b	430.48b	11.59b	70.95b	184.50ab	60.96ab
<i>Bradyrhizobium lioningense</i> +AMF	107.11de	271.69de	432.95b	9.07e	62.17f	165.32e	56.01cd
<i>Burkholderia arboris</i> + <i>Bradyrhizobium lioningense</i> +AMF	120.01b	308.13b	430.55b	11.35b	70.55bc	183.37ab	61.31ab
<i>Bacillus aryabhatai</i> + <i>Bradyrhizobium lioningense</i> +AMF	129.08a	329.47a	455.88a	12.32a	74.44a	188.06a	63.01a
<b>LSD(p=0.05)</b>	<b>4.62</b>	<b>12.56</b>	<b>10.45</b>	<b>0.34</b>	<b>2.12</b>	<b>8.50</b>	<b>2.08</b>

Data are mean values of four replicates; means with different letters in the same row differ significantly at P=0.05 according to Fisher LSD

Table 3.3.5: PGPR and AMF on changes in available nutrient content (ppm) in soil at harvest of soybean

Treatment	N	P	K	S	Zn	Fe
Control	139d	9.29e	249f	6.79d	0.56f	2.36f
<i>Burkholderia arboris</i>	148bcd	10.34d	258f	7.45b	0.72b	2.64d
<i>Bacillus aryabhatai</i>	154bcd	11.04cd	277cde	7.99a	0.76a	2.79c
<i>Bradyrhizobium lioningense</i>	152bcd	9.03e	255f	7.61d	0.58ef	2.54e
<i>Burkholderia arboris</i> + <i>Bradyrhizobium lioningense</i>	163ab	11.17c	274de	7.73c	0.61de	2.67d
<i>Bacillus aryabhatai</i> + <i>Bradyrhizobium lioningense</i>	171a	11.97ab	286bcd	7.68b	0.75ab	2.91b
<i>Burkholderia arboris</i> + AMF	146cd	11.17c	281bcd	7.22c	0.66c	2.70d
<i>Bacillus aryabhatai</i> +AMF	163ab	11.65bc	293ab	7.59b	0.75ab	3.03a
<i>Bradyrhizobium lioningense</i> +AMF	161ab	9.35e	266ef	7.42d	0.60e	2.63d
<i>Burkholderia arboris</i> + <i>Bradyrhizobium lioningense</i> +AMF	159b	12.21ab	291ab	7.28c	0.65cd	2.79c
<i>Bacillus aryabhatai</i> + <i>Bradyrhizobium lioningense</i> +AMF	173a	12.61a	301a	7.49b	0.76ab	3.08a
<b>LSD(p=0.05)</b>	<b>15.08</b>	<b>0.70</b>	<b>13.92</b>	<b>0.35</b>	<b>0.04</b>	<b>0.08</b>

Data are mean values of four replicates; means with different letters in the same row differ significantly at P=0.05 according to Fisher LSD

**IISR 3.12/2020. Interaction effect of phytohormones and AMF for enhanced nodulation, growth, yields of soybean with improved AMF symbiosis in the rhizosphere** (PI-Dr M.P. Sharma, Co-PIs-Dr A. Ramesh, Dr Prince Choyal and Dr Hemant S. Maheshwari)

**Field evaluation of Triacantanol with AM fungi at reduced doses of NPK fertilizers for maximizing the soybean productivity:**

A field experiment was conducted during kharif 2024 on soybean (Cultivar NRC 150) in a randomized block design with nine treatments consisting combination of biostimulant (Triacantanol-Tria @ 2 ppm as foliar application at 25 days after sowing and AM fungi @ 150 spores/m<sup>2</sup> area as soil application along with 25% reduction of NPK fertilizers i.e., 75% of recommended dose of fertilizers (RDF) and compared with 100% RDF (20, 60, 40 Kg/ha N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O) and absolute control without any application. The role of triacantanol with and without AM fungi for enhanced nodulation, nutrient uptake, grain yield, AM root colonization, and spore density was assessed. The salient findings are provided below-

**Soybean nodulation, leghaemoglobin content in nodules and chlorophyll content in fresh leaves:**

The plants applied with Tria-triacantanol and AM fungi along with 75% RDF has significantly increased the leghemoglobin content, nodule dry weight, nodule number and chlorophyll in fresh leaves, as compared to other combinations and absolute control. The control plants showed the least and significantly lower values against all the applied treatments (Fig.3.3.4).

**Shoot dry weight, nutrient uptake and grain yield:**

- The application of triacantanol with AM fungi to soybean (soil application) has improved the nodulation, nutrient uptake and shoot biomass and significantly

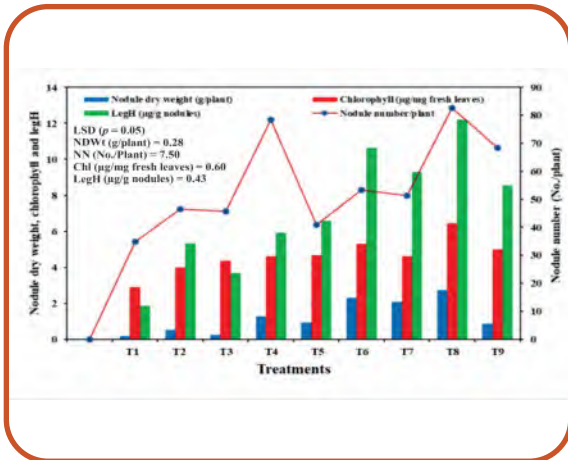
enhanced yield when compared to absolute control. However, when triacantanol (2ppm) was applied with AM Fungi and 75 % RDF have further improved the yield (Fig. 3.3.4, 5 &6).

- Interestingly, plants applied with 100 % RDF followed by Tria+AMF+75% RDF showed significantly higher N and P uptake in the shoot as compared with absolute control and all other treatments, whereas 100 % RDF and Tria+AMF+75% RDF revealed non-significant to each other Shoot dry weight was found significantly higher in Tria+AMF+75% RDF followed by Tria+75% RDF as compared with 100 % RDF and absolute control (Fig.3.3.4 and 3.3.5).
- The application of triacantanol and AM fungi with 75% RDF (3025 kg/ha) followed by 100% RDF (2790 kg/ha) showed significantly higher grain yield over the absolute control (1912 kg/ha) (Fig.3.3.5).

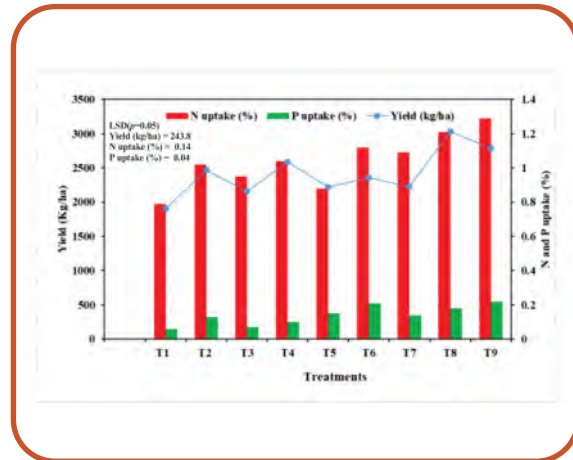
**Mycorrhizal colonization in soybean roots and spore density in the rhizosphere**

- AM root colonization percent and spore density were recorded significantly higher in Tria+AMF+75%RDF as compared with 100% RDF and absolute control (Fig 3.3.6).
- Combination of triacantanol and AM fungi with a recommended dose of fertilizer was recorded to be better than other treatment and their combination with the parameters recorded such as nodulation, biomass, chlorophyll, leghemoglobin, spore density, root colonization and yield, whereas N and P uptake were recorded maximum when applied with a recommended dose of fertilizer without the application of growth hormone and AM fungi inoculant.

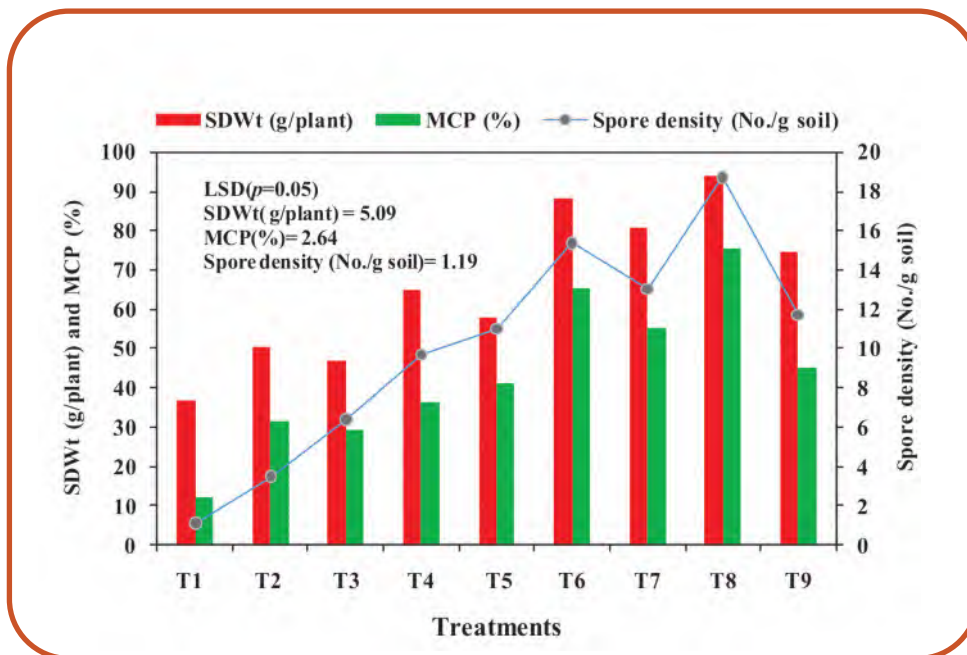
It is concluded that the combination of triacantanol and AM fungi recover 25 % of fertilizer application and can be used as potential plant growth promoters to enhance soybean yield when compared with 100% recommended dose of fertilizer.



**Fig. 3.3.4: Evaluation of triacontanol and AM fungi for enhanced soybean nodulation, Chlorophyll, and Leghemoglobin in a field trial during Kharif 2024**  
 Data are means of three replications. LSD: least significant difference at  $p = 0.05$  for comparing the treatment means using Duncan's multiple range test; legHb: leghemoglobin, NDWt: nodule dry weight, NN: nodule number, Chl: chlorophyll  
 Treatment where, T1-Absolute control; T2-Triacontanol (Tria); T3-AMF; T4-Tria+AMF; T5-75% RDF; T6-Tria+75% RDF; T7-AMF+75% RDF; T8-Tria+AMF+75% RDF; T9-100% RDF



**Fig. 3.3.5: Evaluation of triacontanol and AM fungi for enhanced soybean yield, nitrogen and phosphorous uptake in shoot under field trial during Kharif 2024**  
 Data are means of three replications. LSD: least significant difference at  $p = 0.05$  for comparing the treatment means using Duncan's multiple range test ns (non-significant), N: nitrogen, P: phosphorous  
 Treatment where, T1-Absolute control; T2-Triacontanol (Tria); T3-AMF; T4-Tria+AMF; T5-75% RDF; T6-Tria+75% RDF; T7-AMF+75% RDF; T8-Tria+AMF+75% RDF; T9-100% RDF



**Fig. 3.3.6: Evaluation of triacontanol and AM fungi for enhanced soybean shoot dry weight, spore density, and mycorrhiza colonization percent under field trial during Kharif 2024**  
 Data are means of three replications. LSD: least significant difference at  $p = 0.05$  for comparing the treatment means using Duncan's multiple range test ns (non-significant), SDWt: shoot dry weight, MCP: mycorrhiza colonization percent

**IISR 6.9/17 Bacterial mediated sulfur bioavailability in soybean**  
**Activity: Siderophorogenic - PGPR for iron nutrition in soybean**

*PI - Mr. Hemant Maheshwari, CO-PI's- Drs M.P. Sharma, A.Ramesh, Raghvendra Nargund, and Sanjeev Kumar*

**Isolation of Sulfur Oxidizing bacteria (SOB) from extreme habitats**

In the present investigation, we explored Tatapani hot water spring, South-Eastern Coal Fields Limited (SECL) located in Bhatgaon, Bishrampur, Jaampali, Garepema III and IV, and National Mineral Development Corporation, Bailadila. We used Starkey, Thiosulfate, and NCL media with and without amendment of glucose for isolation of SOBs. Further we isolated SOB bacteria from the tube showing discoloration from purple (pH 8.0) to yellow (<4.5 pH). Serially diluted samples were plated on Thiosulfate medium and unique colonies were isolated. We found 13 Heterotrophic SOBs. Further these SOBs were characterized based on qualitatively plant growth promotion potential and biochemical test. We have conducted pH reduction essay and quantitatively sulfate production potential were assessed.

**Isolation of SOBs with multiple plant growth promotion properties from crop rhizosphere**

Alliaceae family plants releases relatively higher sulphur compounds in therhizosphere. Hence, explored rhizosphere soil of garlic & onion along with soybean.

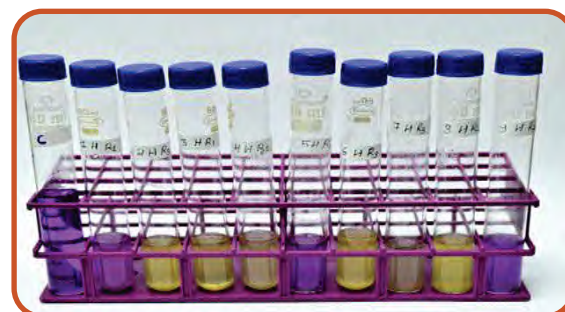
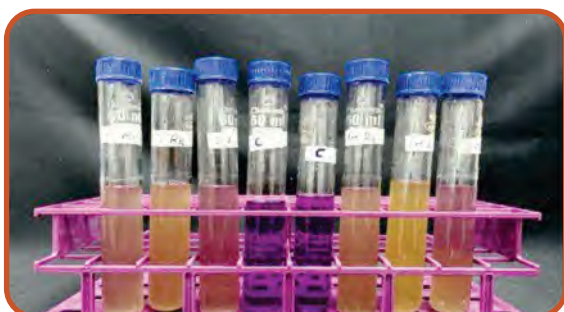
It was found that the pH reduction activity in less than a 24 hr in garlic and onion soil samples in glucose amended tubes. Similarly, in without glucose amended tube showed in 15 days indicating the chemoautotrophic SOBs. We isolated two bacterium each from onion and garlic which showed the pH reduction to <4.5 within 1 days of inoculation. Further both the bacteria showed multiple plant growth promoting traits viz, solubilization of phosphorus, zinc, potassium, and phytate mineralization. These were further characterized for biochemical parameters, sulfate essay and pH reduction essay. We failed to isolated SOBs from soybean rhizosphere. (Fig. 3.3.7)

**Isolation of siderophorogenic bacteria**

As symptoms of interveinal chlorosis were seen in the soybean plants in the initial stages, therefore SPB isolation were carried out. A total of 15 siderophore producing bacteria (SPB) were obtained from the extreme habitats. These were isolated using enrichment technique and by growing in a common nutrient agar medium. These SPBs were further evaluated qualitatively and quantitatively. (Fig. 3.3.8)

**Isolation of Multiple PGPB from extreme habitats**

Firstly, we serially diluted all the samples and plated them in a nutrient agar medium. Further unique colonies were taken and purified. We isolated 81 bacteria from all the explored sites and characterized them for the plant growth promotion test.



**Fig 3.3.7: Heterotrophic sulfur oxidizing bacteria (SOBs) from extreme habitat and crop rhizosphere**



Two bacteria, namely *Bacillus subtilis* and *Cytobacillus oceanisediminis*, showed multiple plant growth-promoting traits (Table 3.3.6). These two were further characterized biochemically. Here, we took *Burkholderia arboris*, an already proven multiple PGPB trait, and validated it in the soybean field as a positive control.



**Fig 3.3.8: Isolation of Siderophore Producing Bacteria (SPB) from coal**

**Table 3.3.6: Isolation of multiple plant growth promoting bacteria from extreme habitats**

Sr NO	Culture name	Siderophore essay	Phosphorus solubilization	Phytate Mineralization	Zinc solubilization	Potassium solubilization	Sulfur oxidation
1	<i>Bacillus subtilis</i>	+	+	+	+	-	-
2	<i>Cytobacillus oceanisediminis</i>	-	+	+	+	+	-

#### Isolation of zinc solubilizing bacteria

Zinc solubilizing bacteria (ZSBs) were isolated from these extreme habitats, and a total of seven ZSBs were recovered, which also showed multiple plant growth-promoting attributes. Molecular characterization showed that recovered isolates belonged to Enterobacteriaceae and Bacillaceae.

#### Unique bacterium

We came across a unique bacterium similar to *Bacillus mycoides*, which is proven as plant growth promotion and disease suppression in the literature. Therefore, activities will be carried out for its effect in the upcoming season.

#### Pot and field studies

Pot and field studies of recovered microbes (SOBs, ZSBs, SPBs, and PGPB) were carried out in *kharif* 2024. The application of elemental sulfur (20 Kg/ha) in soybeans did not enhance soybean grain yield in uninoculated treatment. However, treatment with heterotrophic SOBs (H3) *Bacillus amyloliquefaciens* significantly enhanced yield by 17 % (Fig 3.3.9). It showed that inoculation of SOBs may enhance the soybean yield. Further validation will be carried out in the upcoming *kharif* 2025.



**Fig 3.3.9: Pot and field trials of SOBs recovered from extreme habitats and crop rhizosphere**

### IISR 7.7/23 Development of seed and product sale portal for e-marketing in soybean

PI- Dr Savita Kolhe, Co-PIs Drs Mrinal Kuchlan, M.P Sharma, BU Dupare

A Web-based seed and product sale portal for soybean has been developed (3.3.10) to promote online marketing using the potential of information technology. The system is developed using ASP.NET at front end and SQL Server at back end. The system has provision for selling Breeder Seed, Foundation Seed, Truthfully Labeled (TL) Seed and Certified Seed. 3.3.11 It also has a separate facility for selling different Soya based food products viz Tofu, Milk, Upma mix, Cookies, Sev, Laddu etc. The user can initially book the items to purchase. The booking is then confirmed by the authorized official and after this he can complete the payment process with the generation of payment receipt. The system is linked to E-payment gateway implemented at the institute to ease the financial transaction. It has a separate module to enter different products, its packaging size, cost, availability status etc. Thus, it can be easily customized for any crop. The system is functional and is available at institute website <https://iisrindore.icar.gov.in>. The user needs to complete the registration process to get login details for using the system. Farmers and different clienteles are using the system across the country and they are satisfied with the easy-to-use system interface. The

development of the system has promoted the soya food uses among different clientele across India which was a bigger challenge earlier. Moreover, the seed sale platform has opened a single window for farmers to get a good quality seed of different popular varieties and thus led to a transparent seed distribution system. (Fig. 3.3.10 & 3.3.11)

### IISR 7.9/24 SoyAI –Transforming soybean cultivation through advanced AI modelling

PI - Dr Savita Kolhe, Co-PI Drs Sanjeev Kumar, Lokesh K. Meena, Raghavendra Nargund, Punam Kuchlan and B.U. Dupare

Under this project, a total of 11,110 images (JPEG) of soybean diseases infected leaves are collected from the fields of ICAR-NSRI, Indore (Table 3.3.7). The soybean image data was pre-processed to develop soybean disease identification model using Deep Learning techniques. The Deep learning model was developed for six soybean diseases viz Anthracnose, Purple Seed Stain, RAB, Yellow Mosaic Virus, Frogeye Leaf Spot, Bacterial Pustule) using the DL technique. The performance of the model was evaluated and the results are shown in table 3.3.8.

An application user interface is developed using Flask to facilitate farmers to diagnose the disease occurrence in their fields using mobile phones or any device connected with Internet (Fig. 3.3.12).

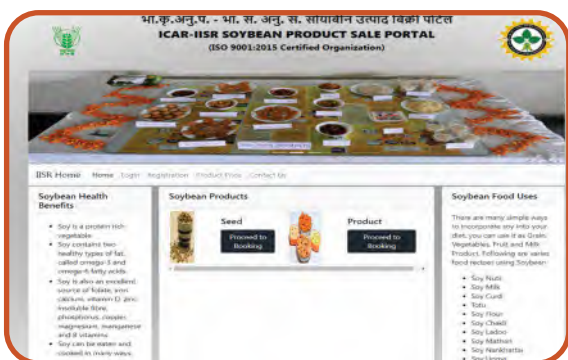


Fig 3.3.10 Home page of Soybean seed and product sale portal

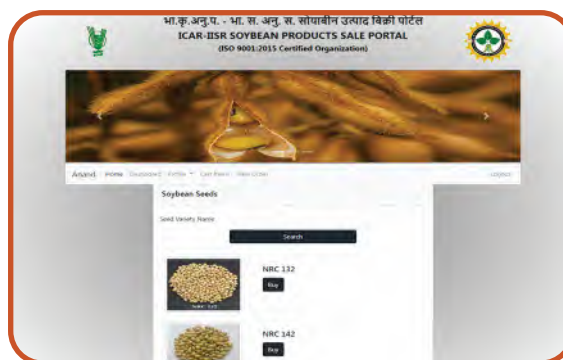


Fig. 3.3.11 User interface for seed purchase



**Table 3.3.7: Disease-wise number of infected leaf images collected for model development**

Diseases	Total No. of Images
Anthracnose	1242
SMV	93
Iron Deficiency	1406
Collar Rot	02
RAB	2244
BP	2500
FLS	1500
PSS	1765
Sulfur Deficiency	210
YMV	148
<b>TOTAL Number of Images</b>	<b>11110</b>

**Table 3.3.8: Performance evaluation results of the developed disease model**

Diseases Name	Precision	Recall	Accuracy
Anthracnose	97.0%	96.8%	97.0%
Purple Seed Stain	95.3%	95.0%	93.3%
RAB	94.6%	94.0%	93.7%
Yellow Mosaic Virus	90.2%	89.8%	94.8%
Frogeye Leaf Spot	93.4%	93.1%	93.2%
Bacterial Pustule	92.0%	91.2%	93.1%



**Fig. 3.3.12 User Interface for disease identification using the disease model**

**Soybean Gyan- AI Powered Mobile App** is developed for farmer community. Fig. 3.3.13 It is developed using Flutter Framework and Dart Programming Language and compilation work done on Android Studio. It includes information about different aspects of soybean farming viz. agronomic practices, production technology, crop management, insect

management, disease management, weed management, food uses & health benefits, farm machinery and daily Mandi rates of different commodity. Direct navigation to institute YouTube channel is provided for better practical experience of soybean technologies through videos. It also provides expert's recommendations about important aspects viz. land preparation,

suitable selection of promising soybean varieties, seed treatment, fertilizer doses, sowing, seed-rate, harvesting, seed storage etc. It has intelligent features like AI based Disease and Pest diagnosis system and Chatbot. Farmers can submit photos of infected plants and get disease and insect diagnosis with high accuracy. The Chatbot facility helps soybean farmers to get answers

accuracy. Leveraging the pre-trained ResNet50 model, it diagnoses major soybean diseases and pests. The model is trained with High-resolution images to enhance accuracy and the custom layers fine-tuned the model for this application. The code for model development is written using Python language. The system is deployed on a GPU-based server at NSRI using Flask API.

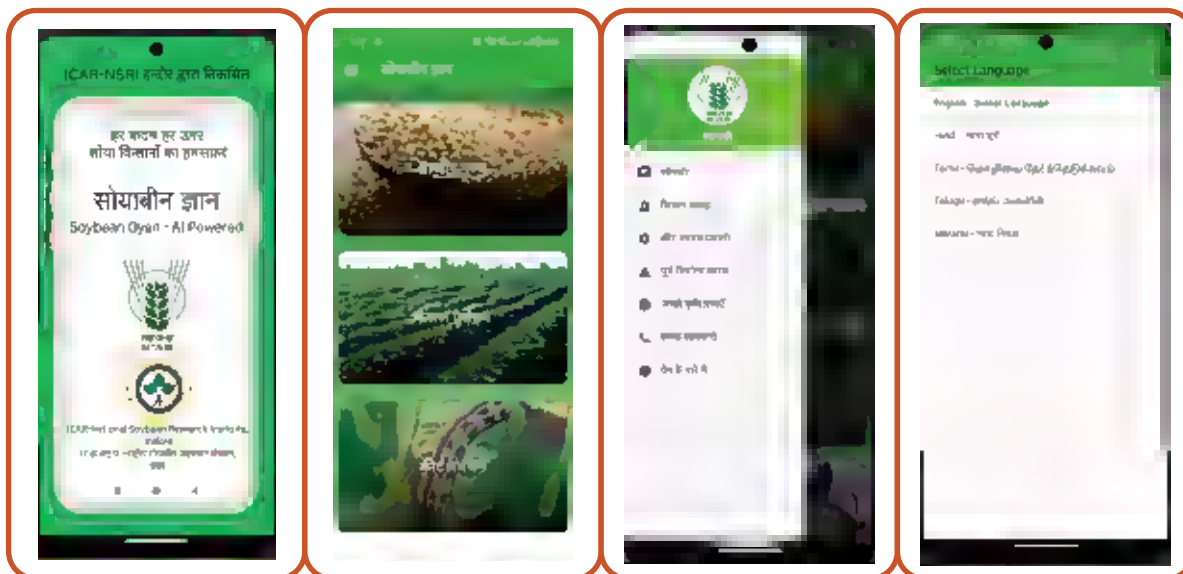


Fig. 3.3.13: User Interface of Soybean Gyan AI powered Mobile App

for all their farm related queries about the problems faced by them in real-time field conditions. The contents in the App are in Five languages viz. Hindi, English, Marathi, Tamil and Telugu looking to the farmers' understandability. The App is regularly updated with new scientific recommendations generated under different research programs from time to time.

SmartSoy delivers efficient, real-time disease and pest diagnosis and provide real-time control measures for efficient crop management. Its outstanding performance empowers farmers to manage pests and diseases effectively, boosting productivity and crop health. It also has a chatbot facility that helps soybean farmers to get answers for all their farm related queries about the problems faced by them in real field conditions. SmartSoy is also linked to Soybean Gyan-AI Powered Mobile App for wider application.

**3.3.8.3 SmartSoy:** AI-Powered Disease and Pest Diagnosis System is developed Fig. 3.3.14 that utilizes deep learning to detect soybean diseases and pests with high

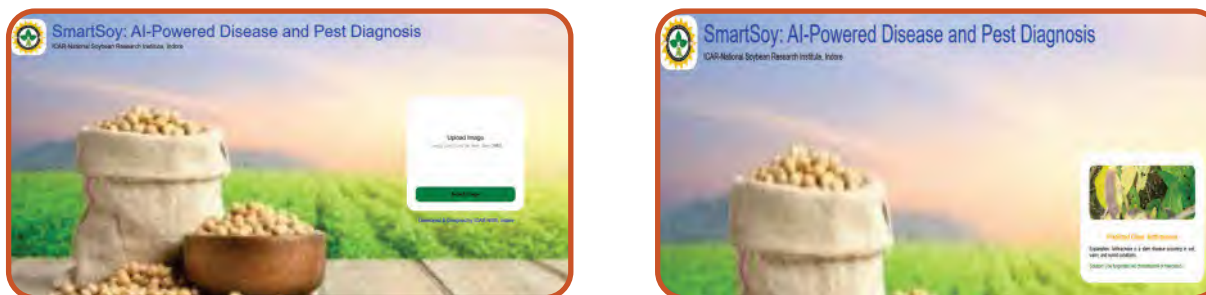


Fig. 3.3.14: User interface for Smartsoy: AI Powered Disease and Pest Diagnosis System



**INFORMATION, COMMUNICATION & TECHNOLOGY TRANSFER**

**IISR 8.17/20 Development and evaluation of ICT tools and media for TOT of Soybean**

PI: Dr B U Dupare, Co-PI: Dr Savita Kolhe

Under the ICT initiatives, the institute is making use of six social media such as YouTube Channel, Facebook Page, Instagram, Twitter, Telegram channels and WhatsApp groups (Figure 1) for the flow of information and interaction/feedback technologies among the different stakeholders. A total of 145 videos comprising different themes has been produced including 7 live webcast of the events have been uploaded on the YouTube channel (Table 4.1.1) of the institute and were popularized by sharing on other social media. The playlist includes ICAR-Madhya Bharat Samachar, Weekly Soybean Advisories, Soya Samvad with Progressive

Soybean Growers and Soy Scientists, Improved Soybean Varieties developed by ICAR-NSRI, Indore as well as by other AICRPS centers. Similarly, 64 reels on instagram reels and 18 on facebook page were uploaded during the year. Our viewers/subscribers/followers have given tremendous response to the institute social media as has been reflected in increase of subscribers as well as total views and reach. It is very interesting to see the geographical distribution of YouTube viewers spread across the continents (Nepal, Saudi Arabia, Russia, Pakistan, Singapore, Turkey etc.) beside Indians. Similarly, the reels on Facebook and Instagram also watched by the views from Nigeria, Pakistan, Nepal, Bangladesh, Ethiopia, Ghana, Phillipines, Saudi Arabia and USA (Table 4.1.2 and Fig 4.1.1 & 4.1.2).

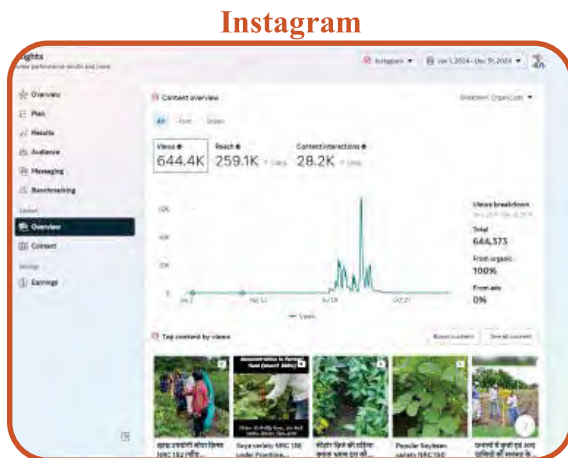
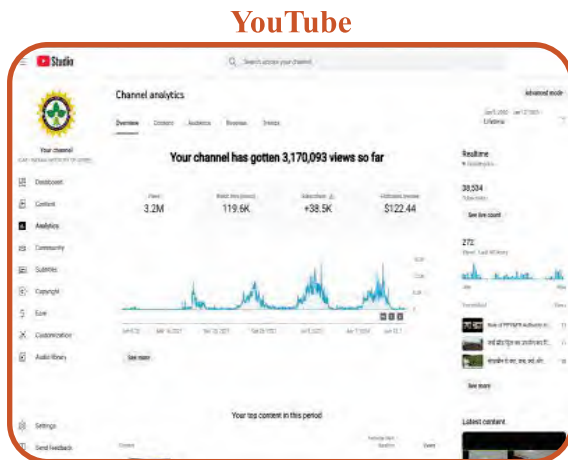
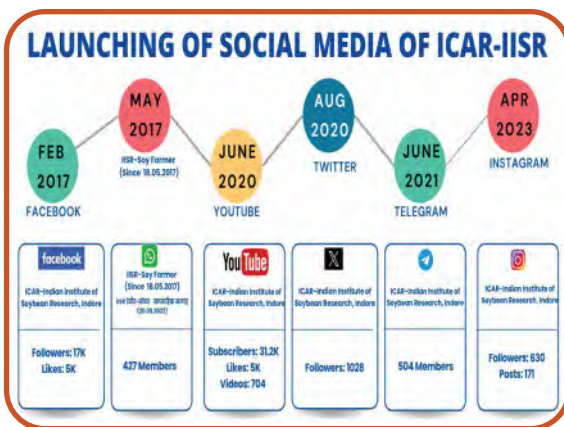


Fig. 4.1.1: Use of Social Media and their performance

**Table 4.1.1: The details of content produced and uploaded on YouTube, Facebook and Telegram channels of the institute**

Content	YouTube	Uploads (Nos) and total views during 2024					
	Lifetime	YouTube		Instagram		Facebook	
		Uploads	Views	Uploads	Views	Uploads	Views
Videos	611	145	6.08M	-	-	-	-
Shorts	211	55	2.96M	64	6.4M	18	2.2M
Live stream	93	7	7.1K	-	-	-	-
Others	5	0	-	-	-	-	-
<b>Total</b>	<b>920</b>	<b>207</b>	<b>9.12 M</b>	<b>64</b>	<b>6.4M</b>	<b>18</b>	<b>2.2M</b>

**Table 4.1.2: Percent change in viewers/subscribers of major social media channels**

Channel/subscribers	% change than previous year		
	Subscribers	Total Views	Total Reach
YouTube (385K)	+7.67	9.12 M	9.12M
Instagram (10.9K)	+1.16	6.44 M	3.4K% Increase
Facebook (24.3K)	+1.04	2.2 M	87.4% Decrease

### Sentiment Analysis of the Institute YouTube Channel

Sentimental Analysis of ICAR- NSRI Indore YouTube Channel was undertaken using YouTube API for collection of datasets. The data were collected from ICAR-NSRI YouTube channel from the year 2017 upto 2023. The channel has 676 videos with Watch Time 2218363 and 31000 Number of Subscribers. The process of Collecting comments using Google APIs typically involves interacting with various Google services and their APIs. A detailed workflow has been introduced namely Data Collection using Google API, Data pre-processing using cleaning the text, removing unwanted columns for decreasing computational time, Tokenization for dividing our comments into a smaller unit, tagging using Part of Speech Tagging

(POS-Tag) for YouTube comments and we removed some unnecessary words from sentences. The collected data set consists of more than 10000 comments for analyzing Channel. Sentiment analysis was performed on YouTube comments about popular topics using NLP Rules-based techniques viz. TextBlob, VEDAR and SentiWordNet. Determined the classification of sentiments using TextBlob, VEDAR and SentiWordNet and evaluated the score of polarity of comments. The results showed that the VEDAR technique achieved the highest scores in analyzing the YouTube comments. Vedar gave 94.4% accuracy with the best result as compared to other techniques viz. TextBlob 86.6% and SentiWordNet 77.6% at the level of micro text.

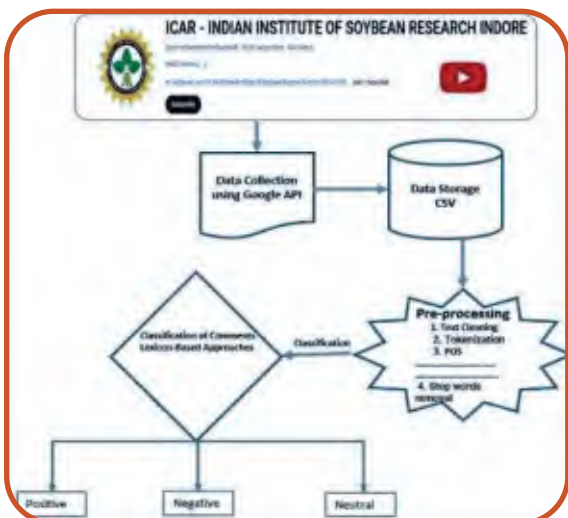


Fig 4.1.3 Methodology used for sentiment analysis

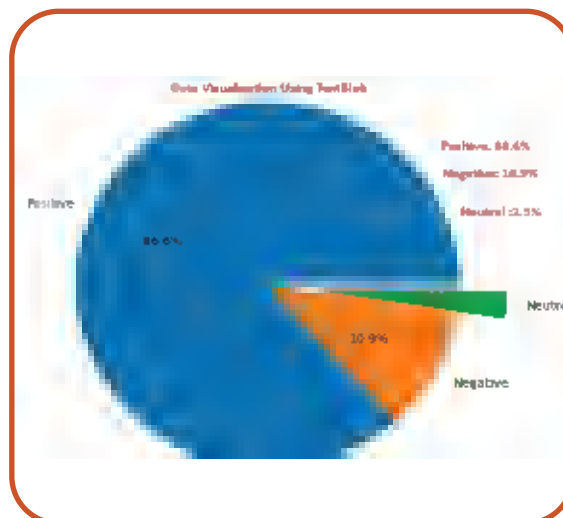


Figure 4.1.4: Score visualization for all the Comments Using TextBlob Techniques

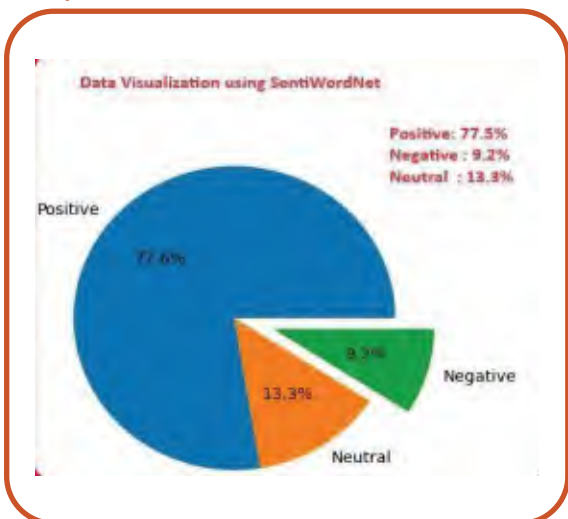


Figure 4.1.5: Score visualization for all the Comments Using SentiWordNet Techniques

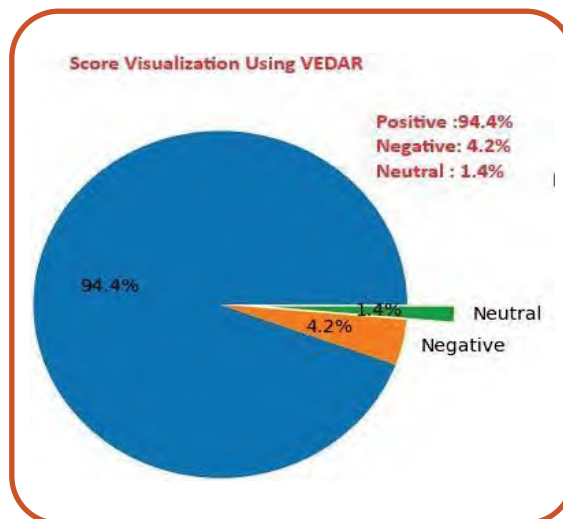


Figure 4.1.6 Using Vedar Techniques

Table 4.1.3: TextBlob, SentiWordNet and VEDAR results of the polarity

Sr. No.	Techniques	Positivity	Negativity	Neutrality	Outcome
1.	TextBlob	86.6%	2.5%	10.9%	TextBlob analysis resulted in 86.6% positivity with very less negativity as 2.5% and Neutrality as 10.9%.
2.	VEDAR	94.4%	4.2%	1.4%	For our outcomes, VEDAR offers the best and most reliable results on the YouTube channel. It provides positivity 94.4%, Negativity 4.2% and Neutrality 1.4%.
3.	SentiWordNet	77.6%	9.2%	13.3%	SentiWordNet not provided good results as compared to other Lexicon approaches. It provides positivity 77.6%, Negativity 9.2% and Neutrality 13.3%.

### IISR 8.18/23 Transfer of Improved Soybean Production Technologies for Increasing Soybean Production

PI: Dupare B.U., R.K. Verma, Raghavendra N., Lokesh K. Meena, Sanjeev Kumar, Mrinal Kuchlan and Savita Kolhe

This mega project, as a compliance to the RAC recommendation was initiated since 2023 involving all round efforts directed for strengthening the Research-Extension-Farmer (R-E-F) interface and efficient technology transfer for increase in soybean productivity at farm level. The project includes coordination of various extension activities like organization of on and off-campus training programmes, conduct of demonstrations at Institute farm as well as on farmers fields through various schemes like *Mera Gaon Mera Gaurav*, Model ICAR-Soybean village, Tribal Sub Plan, Scheduled Caste Sub Plan, publication of literature and use of print/electronic/social media for dissemination of information etc.

### Organization of National Training Programmes

The institute organized Three Day's National Training Programme on "Climate Smart Production Technologies to Enhance Soybean Productivity Under Changing Climate" during 6-8 February 2024 on hybrid mode attended by 72 officers/scientists form Krishi Vigyan Kendra, All India Coordinated Research Project on Soybean and Department of Agriculture of Soybean growing states like Madhya Pradesh, Maharashtra, Rajasthan, Telangana, Karnataka and Chhattisgarh.

### Organization of Trainers' Training Programmes:

The institute has conducted one day trainers' training programme on "Improved Soybean Production Technologies" imparting knowledge to 250 participants (newly recruited Rural Agricultural Extension Officers) and Input Dealers registered under DAESI Scheme implemented by the State Agricultural Department of Madhya Pradesh (Table 4.2.1).



Table 4.2.1 : Trainers' training programmes on improved soybean production technology

S. No.	Date	Type of participants	No. of Participants	Scheme
1	05.04.24	Rural Agril. Extension officers	40	Agar Malwa
2	01.08.24	KVK Agronomists	50	ATARI Jabalpur
3	10.09.24	Input Dealers	40	Ujjain
4	13.09.24	Input Dealers	40	Indore
5	26.09.24	Input Dealers	40	Shajapur
6	26.09.24	Input Dealers	40	Agar Malwa



### Frontline Demonstrations under National Mission on Edible Oil

In order to demonstrate the productivity potential of research emanated technologies, frontline demonstrations involving different component i.e. full package, IPNS, IPM, Intercropping, BBF etc. are conducted on 4000 sqm area in real farm situations. During the year 2024, a total of 1135 frontline demonstration were allotted across the country out of which 1040 were successfully conducted. This included 250 frontline demonstrations conducted in 25 villages selected under *Mera Gaon Mera Gaurav* programme of the ICAR-NSRI as well as ICAR-Model Village Memdi. Out of 4 soybean varieties demonstrated, NRC 142 and NRC 150 realized high yield levels.

### Frontline Demonstrations under under ICAR-NSRI MP Govt. Project

PI: Dr B.U. Dupare, CO PIs: Drs.R.K. Verma & Raghavendra Nargund

During 2024, the institute has initiated a project funded by Department of Agriculture, Madhya Pradesh which is executed in 18 districts of viz. Indore, Ujjain, Devas, Shajapur, Dhar, Sehore, Rajgarh, Bhopal, Jhabua, Mandasaur, Khandwa, Khargone, Alirajpur, Burhanpur, Neemuch, Ratlam, Agrar Malwa and Barwani. Farmers of Madhya Pradesh particularly Central India prefer to grow short duration (<90 days) soybean

varieties as it fits in soybean-wheat cropping system. Short duration varieties of soybean are more prone to aberrant weather conditions, pest and diseases whereas medium duration (95-105 days) soybean cultivars are more suitable to enhance soybean productivity in Malwa region. Therefore, medium duration soybean varieties like NRC 142 and JS 20-69 were demonstrated to those who grows only two crops in succession (Soybean-Wheat/chickpea) and recently notified short duration varieties like NRC 150, NRC 130, NRC 131 were demonstrated to the farmers who grow three crops in a year (soybean-potato/onion/garlic-wheat/chickpea). During *kharif* 2024, a total of 180 demonstrations were laid out in the project locations. The data gives indication of an edge of medium duration variety NRC 142 performing better (20-23 q/ha) over the short duration varieties like NRC 130 (15-17 q/ha).

### Demonstration of Improved soybean varieties and new agronomic practices at Institute Experimental Farm:

In order to show the worth of new soybean varieties and practices to the visiting farmers, a demonstration plot containing Eleven Soybean varieties was conducted during *kharif* 2024. The sowing was completed on 24<sup>th</sup> June whiel the maturity duration ranged from 100-115 days. Out of these, the highest yield (30.91q/ha) was obtained from JS 21-72 followed by NRC 142 (22.78 q/ha) and NRC 165 (19.27 q/ha).



### Organization of One Day Farmers' Training Programmes

Normally, the farmers keep visiting the institute throughout the year to seed the information and to visit the institute demonstration plot. Their visits are conducted by the state agriculture Departments, NGOs, Nationalized banks and other agencies through their ongoing schemes. The institute scientists make these

visitors aware about the technologies developed and recommended for their area, control of biotic and abiotic factors followed by an interaction on pertinent issues. The institute has successfully conducted 33 one-day training programmes thereby updating the technical know-how of 1027 farmers including 55 women farmers who visited the institute during the year 2024 (Table 4.2.2).

**Table 4.2.2: One Day Farmers' training programmes on "Improved soybean production technology"**

S. No	Date	District	State	Male	Female	Total
1	05.01.24	Dausa	Rajasthan	45	0	45
2	10.01.24	Bundi	Rajasthan	45	0	45
3	11.01.24	Beed	Maharashtra	25	0	25
4	30.01.24	Chittorgarh	Rajasthan	45	0	45
5	04.02.24	Satara	Maharashtra	10	0	10
6	06.02.24	Bara	Rajasthan	45	0	45
7	07.02.24	Jhalawad	Rajasthan	40	0	40
8	08.02.24	Kolhapur	Maharashtra	42	8	50
9	14.02.24	Odisha	Orissa	25	0	25
10	14.02.24	Dhar	Madhya Pradesh	75	0	75
11	14.02.24	Udaypur	Rajasthan	50	0	50
12	15.02.24	Khandwa	Madhya Pradesh	0	25	25
13	21.02.24	Ujjain	Madhya Pradesh	15	0	15
14	23.02.24	Ratlam	Madhya Pradesh	40	0	40
15	27.02.24	Mandsaur	Madhya Pradesh	18	22	40
16	28.02.24	Dhar	Madhya Pradesh	10	0	10
17	28.02.24	Udaipur	Rajasthan	35	0	35
18	28.02.24	Odisha	Orissa	25	0	25
19	04.03.24	Satara	Maharashtra	10	0	10
20	05.03.24	Udaipur	Rajasthan	46	0	46
21	11.03.24	Neemach	Madhya Pradesh	35	0	35
22	10.07.24	Ujjain	Madhya Pradesh	40	0	40
23	31.07.24	Bhopal	Madhya Pradesh	40	0	40
24	06.08.24	Indore	Madhya Pradesh	50	0	50
25	29.08.24	Betul	Madhya Pradesh	25	0	25
26	30.08.24	Sehore	Madhya Pradesh	25	0	25
27	15.09.24	Ujjain	Madhya Pradesh	15	0	15
28	20.09.24	Indore	Madhya Pradesh	25	0	25
29	23.09.24	Khargone	Madhya Pradesh	33	0	33
30	27.09.24	Jhabua	Madhya Pradesh	13	0	13
31	04.10.24	Jhabua	Madhya Pradesh	16	0	16
32	04.10.24	Jhabua	Madhya Pradesh	9	0	9
33	13.12.2024	Jhabua	Madhya Pradesh	16	0	16
				972	55	1027



### Organization of Three Day Farmers' Training Programmes and online Seminars

A total of 9 training programmes of 3 days duration each were conducted during 2024 as requested by different districts of Maharashtra state Department of Agriculture, through the Agri-Business Incubation Centre of the institute. This training entitled "Soy Food Processing Techniques and Utilization of soy for Food

Products" is specially organized involving members/office bearers of Farmer Producer Organizations constituted under the SMART project (Table 4.2.3). In addition, two online webinars have been organized during 2024 through which 4270 viewers have been made aware about the institutional activities, programmes and issues of national importance in addition to ways and means of soybean production and protection from insect-pests and diseases (Table 4.2.4).



**Table 4.2.3: Three days training program on Soy Food Processing Techniques and Utilization of soy for Food Product organized by Agri. Business Incubation Center of ICAR-NSRI, Indore**

S. No.	Name of trainee/ institution / FPOs	Date	Numbers of participant
1	District Implementation Unit (SMART) FPO of <b>Latur</b> , Maharashtra	4-5 January 2024	40
2	District Implementation Unit (SMART) FPO of <b>Jalna</b> , Maharashtra	16-18 January 2024	37
3	District Implementation Unit (SMART) FPO of <b>Dharashiv</b> , Maharashtra	22-24 August 2024	81
4	District Implementation Unit (SMART) FPO of <b>Dharashiv</b> , Maharashtra	28-30 August 2024	80
5	District Implementation Unit (SMART) FPO of <b>Latur</b> , Maharashtra	25-27 September 2024	90
6	District Implementation Unit (SMART) FPO of <b>Latur</b> , Maharashtra	16-18 October 2024	87
7	District Implementation Unit (SMART) FPO of <b>Yavatmal</b> , Maharashtra	17-19 December 2024	30
	<b>Total Farmers</b>		<b>445</b>
8	Entrepreneurs training	22-24 April 2024	11
9	Entrepreneurs training	22-24 July 2024	11
	<b>Total entrepreneurs</b>		<b>22</b>
	<b>Total 22 Entrepreneurs</b>		<b>22</b>

**Table 4.2.4: Details of Online programmes and Seminars organized during 2024**

S. No.	Title	Date	No. of participants
1	खरीफ पूर्व कृषक ऑनलाइन संगोष्ठी : सोयाबीन की उन्नत खेती	14.06.2024	2997
2	Celebration of world Intellectual Property Management	26.04.2024	197
<b>Total participants</b>			<b>4270</b>

### Weekly advisory for soybean farmers

Institute also circulated weekly advisory (हिंदी and English) for soybean farmers (text and video form) through various media platforms, email as well as the Institute and ICAR website. The list of weekly advisory for soybean farmers is given below:

Issue of Soybean advisories started with Pre-Sowing Soybean Advisory (May 2024 )		
Weekly Advisory 3 <sup>rd</sup> -9 <sup>th</sup> June 2024	Weekly Advisory 10 <sup>th</sup> -16 <sup>th</sup> June 2024	Weekly Advisory 17 <sup>th</sup> -23 <sup>rd</sup> June 2024
Weekly Advisory 24 <sup>th</sup> -30 <sup>th</sup> June 2024	Weekly Advisory 1 <sup>st</sup> -7 <sup>th</sup> July 2024	Weekly Advisory 8-14 <sup>th</sup> July 2024
Weekly Advisory 15 <sup>th</sup> -21 <sup>st</sup> July 2024	Weekly Advisory 22 <sup>nd</sup> -28 <sup>th</sup> July 2024	Weekly Advisory 29 <sup>th</sup> July-4 <sup>th</sup> August 2024
Weekly Advisory 5 <sup>th</sup> -11 <sup>th</sup> August 2024	Weekly Advisory 12 <sup>th</sup> -18 <sup>th</sup> August 2024	Weekly Advisory 19 <sup>th</sup> -25 <sup>th</sup> August 2024
Weekly Advisory 26 <sup>th</sup> August-1 <sup>st</sup> September 2024	Weekly Advisory 2 <sup>nd</sup> -8 <sup>th</sup> September 2024	Weekly Advisory 9 <sup>th</sup> -15 <sup>th</sup> September 2024
Weekly Advisory 16 <sup>th</sup> -22 <sup>nd</sup> September 2024	Weekly Advisory 23 <sup>rd</sup> -29 <sup>th</sup> September 2024	Weekly Advisory 30 <sup>th</sup> September-6 <sup>th</sup> October 2024

### Organization of Field Days:

1. Soybean Diwas at Agera, Sonkachh on 27<sup>th</sup> September 2024 (Rishabh Gupta, Collector Dewas)
2. Farmers' Training-cum-Soybean Diwas at Memdi, Sonkachh on 14<sup>th</sup> September 2024 (Rishabh Gupta, Collector Dewas)



Soybean Divas Organised under FLD scheme at ICAR Model Village - Memdi



Soybean Divas Organised under ICAR-NSRI: MP Govt. Project at Village - Agera, Dewas

#### Farmers training and input distribution under schedule caste sub-plan

*Nodal officer: Dr. Rakesh Kumar Verma, Co-Nodal officers: Drs B.U. Dupare, Prince Choyal and, Raghavendra Nargund*

The ICAR-NSRI, Indore organized farmers training and input distribution programmes under Schedule Caste Sub Plan (SCSP) scheme. Under this scheme distribution of Soybean Seed, Wheat Seed, NPK Fertilizer, Plant Growth Promoting Rhizobacteria (PGPR), Battery Operated Sprayer Pump, Brush Cutter, Chain Saw, Spiral Grader, Tarpaulin, Storage Bin, Monoblock Water Pump, Hand Hoe etc., inputs were distributed among the eligible beneficiaries. The total number of 2218 farmers from the Sehore, Khargone, Khandwa, Ujjain, Dewas, Indore and Badwani districts of the

Madhya Pradesh were benefited from the scheme. Similarly, trainings were also conducted for the farmers and trained them to use the new technologies, diversified crops and value addition for improving the farm productivity. Emphasis was also laid on use of climate smart technologies. Total number of 22 trainings were conducted under the SCSP scheme and a total number of 2218 farmers were benefited from the training programmes (Table 4.2.5). A total number of 320 demonstrations were conducted on soybean crop during Kharif, 2024 at Sehore, Ujjain and Khargone Districts of Madhya Pradesh. Similarly, wheat seed and PGPR culture were also distributed to the 113 farmers for demonstrations on wheat crop during *rabi*, 2024-25.

**Table 4.2.5: Name of inputs and number of beneficiaries under Scheduled Caste Sub Plan in year 2024-25.**

S. No.	Name of District	Name of inputs distributed	Number of beneficiaries
1	Sehore, Ujjain and Khargone , Indore	Soybean seed (96 quintals) and Fertilizer( NPK)	320
2	Sehore, Ujjain and Khargone	Battery Operated Power Sprayer	240
3	Sehore, Khargone and Ujjain	Wheat Seed (90 quintals) and PGPR	113
4	Sehore, Khargone, Khandwa and Ujjain	1 Hp Monoblock pump	95
5	Khandwa, Sehore and Khargone	Mung Seed (45 quintals)	486
6	Sehore, Khargone and Dewas	Brush Cutter	41
7	Sehore, Khargone and Dewas	Chain Saw	47
8	Sehore, Khargone and Ujjain	Tarpaulin	400
9	Sehore	Spiral grader	121
10	Sehore	Storage bin	185
11	Sehore, Indore and Ujjain	Hand Hoe	170
	<b>Total Beneficiaries</b>		<b>2218</b>

**Training and input distribution programme under SCSP at ICAR-NSRI, Indore**



**Training Programmes organized under Tribe sub-plan**

There were total 13 trainings organized for Schedule tribe (ST) farmers and distributed agricultural inputs to them under Tribal sub-plan (TSP) scheme. During these programmes, soybean seed (variety- NRC-142), Maize Seed (variety- NRC-142), green gram (variety- NRC-142) seeds, Vegetable kit, Wheat seed (variety- NRC-

142), NPK (12:32:16) and DAP fertilizer, insecticide (Emamectin Benzoate), Liquid Bio Fertilizer of NSRI, Indore for soybean seed treatment, Battery operated sprayer pump, Brush Cutter, Hasiya and Irrigation Pipes were distributed among the eligible beneficiaries. The total 1100 number of farmers belonging to Dhar, Khargone, Khandwa and Indore districts of the Madhya Pradesh were benefited from the



scheme. Similarly, trainings were also conducted for the farmers and trained them to use the new production technologies of different crops, diversified crops and value addition for improving the farm productivity. Emphasis was also laid on use

of climate smart technologies. Total of 13 trainings were conducted under the TSP scheme and a total number of 1100 farmers were benefited from the training programmes (Table 4.2.6).

**Table 4.2.6: Details about training programmes and input distribution under TSP schemes in 2024**

Sr. No.	Date of Training and Distribution	Title of training	Name of inputs distributed	Location	No. of Beneficiaries
1	18.01.2024	Improved crop production technology of soybean and other crops	Spray Pump	Zirniya Block, District Khargone (M.P.)	120
2	18.01.2024	Improved crop production technology of green gram and vegetable crops	Mung , Vegetable Kit Fertilizers (NPK :12:32:16)	Zirniya Block, District Khargone (M.P.)	50
3	08.04.2024	Improved crop production technology of soybean and other crops	Brush Cutter	Zirniya Block, District Khargone (M.P.)	26
4	06.06.2024	Improved crop production technology of maize	Maize Seed, NPK (12:32:16) DAP (18:46:0) fertilizers, Emamectin benzoate insecticides	Zirniya Block, District Khargone (M.P.)	200
5	13.06.2024	Improved crop production technology of soybean and other crops	Mung Seed, NPK (12:32:16) DAP (18:46:0) fertilizers, Hasiya	Zirniya Block, District Khargone (M.P.)	200
6	20.06.2024	Improved crop production technology of soybean	Soybean Seed, Bio Fertilizer	Mhow Block, District Indore (M.P.)	25
7	26.06.2024	Improved crop production technology of soybean	Soybean Seed, Bio Fertilizer	Zirniya Block, District Khargone (M.P.)	75
8	25.07.2024	Improved crop production technology of soybean and other crops	NPK-12:32:16 Sprayer Pump	Mhow Block, District Indore (M.P.)	25
9	18.09.2024	Improved crop production technology of soybean and other crops	Sprayer Pump	Zirniya Block ,District Khargone (M.P.)	111
10	21.10.2024	Improved crop production technology of wheat	Wheat Seed	Mhow Block ,District Indore (M.P.)	25
11	24.10.2024	Improved crop production technology of wheat	Wheat Seed	Zirniya Block ,District Khargone (M.P.)	175

12	18.11.2024	Improved crop production technology of soybean and other crops	Pipe	Zirniya Block, District Khargone (M.P.)	8
13	17.12.2024	Improved crop production technology of soybean and other crops	Sprayer Pump	Manawar ,Block District Dhar (M.P.)	60

4.2.7 : Participation in Agricultural Exhibitions

S. No	Event	Venue	Dates
1	All India Farmers' Fair and International Agricultural Technology Exhibition	RVSKVV, Gwalior	03-06 Feb, 2024
2	ICAR-NSRI Research-Industry Interface Meet	ICAR – NSRI, Indore	23 <sup>rd</sup> Feb, 2024

4.2.8 : Radio/Television Talk

Date	Channel	Expert	Type of programme	Title
03.07.2024	DD Kisan Chanel	Dr B. U. Dupare	Live-Phone In	सोयाबीन की खेती
04.09.24	DD Kisan Chanel	Dr B. U. Dupare	Live-Phone In	सोयाबीन फसल में समसामयिक कार्य
26.08.24	DD Kisan Chanel	Dr K. H. Singh	Live-Phone In	सोयाबीन की आधुनिक उत्पादन तकनीक





## EDUCATION

**Table 5.1: List of registered Ph.D Scholars undergoing dissertation programme at ICAR-NSRI**

S. No	Name of the Scholar	Guide	Discipline	University affiliation	Title of the dissertation
1	Abhishek Bharti Ph.D Microbiology	Dr M.P. Sharma	Microbiology	Barkatullah University, Bhopal	Identification and characterization of soybean rhizobia and their integration with AM fungi for enhance drought tolerance in soybean ( <i>Glycine max</i> (L.) Merrill)
2	Dipanti Chourasiya	Dr M.P. Sharma	Microbiology	Barkatullah University, Bhopal	Optimizing the production of native AM fungi with <i>Burkholderia arboris</i> and phytohormones in substrate based pot cultures and its quality assessment through AM-signature fatty acids
3	Purva Dubey	Dr M.P. Sharma	Microbiology	IGKVV, Raipur	Evaluation of ACC deaminase producing bacterial endophytes and their integration with AM fungi and <i>Bradyrhizobium sp</i> to enhance drought tolerance in soybean
4	Prem Ranjan	Dr M.P. Sharma	Microbiology	IGKVV, Raipur	Unravelling the rhizosphere soil microbiome and enzyme activities in soybean based cropping system cultivated under different crop and soil management practices
5	Raksha Vishwakarma	Dr Sanjeev Kumar	Plant Pathology	RVSKVV, Gwalior	Studies on Rhizoctonia aerial blight of Soybean caused by <i>Rhizoctonia solani</i> .
6	Priya Meghwal	Dr Shivakumar M.	Biochemistry	DAVV, Indore	Marker assisted introgression of early maturity alleles in soybean variety JS 20-98
7	Ms Aashima Mukati	Dr Sanjay Gupta	Biotechnology	DAVV, Indore	Combining photoperiod and long juvenile alleles for wider adaptation
8	Ms. Rucha Kavishwar	Dr Milind Ratnaparkhe	Biotechnology	DAVV, Indore	Identification of Genes associated with Drought tolerance in soybean ( <i>Glycine max</i> (L.) Merr)

**Table 5.2: Details of registered M.Sc. students undergoing dissertation programme at ICAR-NSRI**

S. No.	Name of the student	Guide	Discipline	University affiliation	Title of the dissertation
1	Khushbu Kumawat	Dr Lokesh K. Meena	Entomol.	RVSKVV, Gwalior	Bio-physical and bio-chemical basis of host plant resistance of soybean [ <i>Glycine max</i> (L.) Merrill] genotype against <i>Spodoptera litura</i> (Fabricius).

2	Deepika Parmar	Hemant Maheshwari	Micro.	IPSA college University-DAVV, Indore	Isolation and characterization of sulfur-oxidizing bacteria and Plant growth-promoting bacteria from extreme habitats.
3	Vedansh Gupta	Dr Vangala Rajesh	Plant Breeding	Institute of Agricultural Sciences, Bundelkhand University, Jhansi,UP	Studies on genetic diversity and character association for yield traits and pod shattering in soybean ( <i>Glycine max L.</i> ) genotypes
4	Falguni Bajpayee	Dr G.K. Satpute	Life Sciences	Devi Ahilya Vishwavidyalaya, Indore	Characterization of advanced breeding lines for phenological traits and physiological traits under low soil moisture stress in soybean ( <i>Glycine max L.</i> Merrill)
5.	Anukul Nokwal	Dr Sanjeev Kumar	Plant Pathology	RVSKVV, Gwalior	Virulence profiling of <i>Rhizoctonia solani</i> isolates Causing aerial blight of soybean
6	Srishti Duggad	Dr Giriraj Kumawat	Biotechnology	Vikram University, Ujjain	Assessing regeneration efficiency in the soybean variety JS 335 and NRC130
7	Shreya Chauhan	Dr Giriraj Kumawat	Biotechnology	Banasthali Vidyapith, Niwai	Assessing regeneration efficiency in the soybean variety JS 20-34
	Pooja Dhaka	Dr Giriraj Kumawat	Plant Pathology	RVSKVV, Gwalior	Studies on genetic and molecular Characterization n of Anthracnose disease in Soybean [ <i>Glycine max (L.) Merrill</i> ]
8	Ms Tanya Ranjan	Dr Sanjay Gupta	Plant Breeding and Genetics	Bundelkhand University	Evaluation and Characterization of Soybean Germplasm ( <i>Glycine max L.</i> )
9	Ms. Yashashwi	Dr Vineet Kumar	Biotechnology	Barkatullah University, Bhopal	Kunitz Trypsin Inhibitor and Protein Content in two F2 population of Soybean
10	Arun Waktaliya	Dr Milind Ratnaparkhe	Plant Pathology	RVSKVV, Agri College, Indore	Genetic and phenotypic insights into anthracnose disease resistance in soybean ( <i>Glycine max (L.) Merr.</i> ).
11	Akanksha Dubey	Dr Punam Kuchlan	Life Sciences	Devi Ahilya Vishwavidyalaya, Indore	Morphological and biochemical characterization of vegetable soybean RILs of the cross Karune X (VL Soya 1 X EC538828).

**Table 5.3: Details of student visit conducted during 2024**

S. No.	Name of school/institution	Date of visit	No. of Students
1.	Eklavya Adarsh Aawasiya Vidyalaya, Bajana, Ratlam	10.01.2024	50
2	Rewa College, Sanawad, Dist. Khargone	11.01.2024	30
3.	Raisen	15.04.2024	20
4.	Visit to Soil Science Lab	23.04.2024	16
5.	Sambhaji Nagar, Maharashtra	17.09.2024	8
6.	Govt. Higher Secondary School, Dudhiya, Indore	09.10.2024	70
7.	Symbiosis University of Applied Sciences, Indore	11.11.2024	60
8.	Dr YSP University of Hort & Forestry, Solan, H.P.	07.12.2024	45
9.	Malwanchal University, Indore	23.12.2024	60
10.	Anand Agril. College, Anand, Gujarat	27.12.2024	15



## ALL INDIA COORDINATED RESEARCH PROJECT ON SOYBEAN

The 54th Annual Group Meeting of the All India Coordinated Research Project on Soybean (AICRPS) was held from March 13 to 14, 2024, at the University of Agricultural Sciences (UAS), Dharwad. The event was chaired by Dr. T.R. Sharma, with Dr. B.D. Biradar, Director of Research, as the chief guest. Notable attendees included Dr. Kunwar Harendra Singh, Director ICAR-NSRI, Indore; Dr. R.K. Mathur, Director ICAR-IIOR Hyderabad; Dr. Shekarappa, Professor and Head of the Department of Entomology, UAS Dharwad; and Dr. Sanjay Gupta, In-charge of AICRP on Soybean.

### Research Achievements

#### 1. Plant Breeding and Genetic Resources:

- Significant progress was made in pre-breeding, multi-location germplasm evaluation, the national hybridization program, breeder seed production, and offseason generation advancement at Bengaluru.
- Four variety proposals—JS 22-12, JS 22-16, RSC 11-72, and NRC 197—were discussed and accepted for identification.

#### 2. Technology Transfer and TSP Activities:

- Achievements in technology transfer and TSP initiatives under AICRP were presented

#### 3. Pathology and Entomology Recommendations:

- A collaborative trial was proposed for the integrated management of insect pests and diseases in soybean.
- Observations on natural enemies were recommended for the management of major defoliators through intercropping with Suva (*Anethum graveolens*).

#### 4. Breeder Seed Production

- Breeder seed production achieved 55% excess (7,522 quintals) over the DAC indent, though some varieties fell short of their targets.

- Varieties less than 10 years old constituted 85% of the seed indent (VRR is 85%).
- The SATHI portal was launched, and indent allotments were facilitated through it.

#### 5. Agronomy Recommendations

- Experts suggested including three treatments in the newly formulated experiment on yield maximization through improved nutrient management practices.
- Development of package of practices (POP) for rabi/summer soybean production at each center was recommended.
- Protection scientists were advised to be included in experiments on sustainable agronomic management practices, with modifications to the experimental design.

#### 6. Microbiology Recommendations

- Screening and selection of native *Bradyrhizobium* isolates based on N-fixing ability under microcosms were suggested for further field validation.
- The inclusion of the UASDAMF mycorrhizal consortium, developed at UAS Dharwad, was recommended to address moisture stress in soybean, alongside other microbial consortia.

#### 7. Food Production and Technology

- Emphasis was placed on developing new products using soy flour and green vegetable soybean.



- Swelling percentage of soaked beans was suggested as an evaluation parameter in AVT II entries.
- Product profiling of fermented soy products and collaboration with ICAR-CIAE Bhopal for product standard development were recommended.

### Concluding Remarks

The Director of ICAR-IISR, Indore, expressed his gratitude to UAS Dharwad for successfully hosting the annual group meeting, which concluded with a total of nine center-wise presentations.

### Glimpses of 54<sup>th</sup> AGM of AICRPS





## EVENTS, MEETINGS AND MEDIA COVERAGE **07**

**Republic Day:** To commemorate the day on which the Constitution of India came into effect, institute has celebrated country's 75<sup>th</sup> republic day on 26<sup>th</sup> January 2024. On this occasion, Dr. K.H Singh, Director, ICAR-NSRI addressed about the importance of the constitution of India and how Indian turned from a dominion country to a republic country.

**ICAR -NSRI Institute Industry Interface meet:** In an interactive program on "Research-Industry Interface-Meet on Opportunities for Agri start ups and entrepreneurs in soy food processing and production technologies" was organized on 23.02.2024 by the Agri Business Incubation Center of Indian Institute of Soybean Research, Indore, about 65 participants including about 40 entrepreneurs, innovators, soy scientists from different regions of the country participated. An exhibition was also organized on the occasion wherein the incubates who initiated start up programme under the overall guidance from ABI displayed their products. At the outset, Dr. Mahaveer Prasad Sharma, Principal

Investigator, delivered technical information on facilities and mentorship being offered by the institute ABI centre for different like soy products, liquid biofertilizer, seed production etc and appealed to entrepreneurs to invest in this area for entrepreneurship.

The Director of the ICAR-IISR, Dr. Kunwar Harendra Singh, on the occasion said that by gradually reducing the dependency and increasing domestic consumption of soybean meal/soy cake, there will be stability in the market price for the farmers. During the program, MOUs were signed with 4 Farmer Producers Organizations (FPOs) of Sangli and Latur districts of Maharashtra for exchange of advanced production technology of soybean. In this discussion program, Dr. Ms. Neeru Bhushan, Assistant Director General (Intellectual Property and Technical Management) from the ICAR headquarters New Delhi, said that the entrepreneurs taking training from the incubation center need to focus on processing methods as well as marketing and branding, promotion as well as industrial tie ups.



**38<sup>th</sup> Institute Research Council:** The meeting of the Institute Research Council (IRC) of ICAR-NSRI was held on April 29-30, 2024. Chairman of IRC & Director ICAR-NSRI, Dr K.H. Singh, chaired the session. The Member Secretary, Dr Punam Kuchlan presented the action taken report of

37<sup>th</sup> IRC. Principal investigators of projects presented activities and achievement of the respective project. Dr K.H. Singh appreciated the research activities going-on and emphasized the need to make plans for quick multiplication and distribution of seed of newly developed varieties. He added that

emphasis should be given on incorporating stress tolerance and disease resistance in varieties and on traits like photo-thermo-insensitivity and long juvenility. Further, he urged the scientists to deliver at least one product/technology/publication from each project as outcome and at least one mega product per year at the institute level. He emphasized on the precision of the field and lab experiments and proposed an internal monitoring committee to monitor the experiments. The IRC meet was again held on 18th June 2024 in which two new projects were finalized.

**Celebration of World Intellectual Property Day:** World Intellectual Property Day was celebrated at NSRI on 26th April 2024 in which Prof (Dr.) Ghayur Alam Senior Professor, National Law Institute University, Bhopal delivered an expert talk on Intellectual Property Management in Agriculture Related Inventions.

**Awareness Programme with NAARM:** The institute Organized a Collaborative Awareness Programme with a-IDEA, ICAR-NAARM, Hyderabad on 24th Call of BIRAC- Biotechnology Ignition Grant (BIG) for researchers / innovators / entrepreneurs / start-ups from ideation to Proof of Concept on 17th May, 2024.

**International Yoga Day:** Theme for International Yoga Day 2024 was “Yoga for

Vasudhaiva Kutumbakam”. The institute celebrated the International Yoga Day on June 21, 2024. The day is aimed to raise awareness worldwide of the many benefits of practicing yoga. A yoga session was organized under the guidance of Dr. Monika Parmar, Head and Yoga expert, Madhavbaug clinic, Indore who encouraged the staff to practice yoga. On this occasion, Dr. K.H Singh, Director, ICAR-IISR urged the staff to maintain physical health through practicing the yoga asanaas. Mr. Shyam Kishor Verma, ACTO, coordinated the event.

**Pre-Kharif Seminar**

Pre-Kharif online seminar on soybean farming was organized on June 24th 2024 100 farmers on zoom and nearly 500 farmers have attended this seminar. Beside Honbl’e Director Dr KH Singh, institute scientists Drs Mrinal Kuchlan, Dr RK Verma, Dr Lokesh Meena. Dr Sanjeev Kumar, Dr Raghavendra and Dr Anita Rani delivered relevant information to the participants. Coordinators Dr Savita and Dr Raghvendra needs special thanks.

**Annual Group Meet of AICRP on Soybean**

The 54th Annual Group Meet of AICRPS was organized at UAS Dharwad during 13-14 March, 2024 in the auspicious present of Dr Tilak Raj Sharma, Honbl’e DDG (CS), ICAR, Dr KH Singh, Director ICAR-NSRI, Dr RK Mathur, Director ICAR-IIOR, Hyderabad and Dr G. Somengouda, Organizing Secretary and other offices of UAS Dharwad.





### Submission of QRT Report

The QRT Chairman Dr Rajendra Prasad and Institute Director Dr K.H. Singh submitted QRT Report of NSRI Indore and AICRP Soybean to Honbl'e Secretary DARE and DG, ICAR today at Krishi Bhawan (April 18<sup>th</sup> 2024)

### Monitoring of field experiments during Kharif season

A committee representing the In-charge of all the three i.e. Dr Anita Rani (Crop improvement), Dr. B. U. Dupare (Crop production), Dr Mahaveer Prasad Sharma (Crop Protection) and PME cell In-charge, Dr Punam Kuchlan, monitored field experiments during 14<sup>th</sup> August, 2024 under the supervision and guidance of Director (In-charge) Dr Sanjay Gupta. Committee interacted with all scientists at their field experiment site and suggested measures for improvement. Objective of this internal monitoring was to enhance interaction among scientists and increase the precision in research experiments.

### Independence day

Institute has celebrated country's 78<sup>th</sup> independence day on 15<sup>th</sup> August 2024. On this occasion, Dr. Sanjay Gupta, In-charge Director, ICAR-NSRI, addressed about the importance of the day to the nation and remembered the sacrifices of the freedom fighters in getting the India free from the colonization. He also urged the institute's staff to serve the nation through enhancing the soybean production and to make India self-sufficient in edible oil.

### 18<sup>th</sup> 'Parthenium hysterophorus' awareness week

*Parthenium hysterophorus* is known by different names in different parts of the country. It is one of the most persistent weeds and the ill effects of which have been seen mainly in the form of reduction in crop production and diseases like eczema, asthma, and allergies etc. in humans. To get rid of the problems caused by this grass, a week-long awareness program was organized from August 16-22, 2024. In the week-long programme, a session was organized at the institute, in which Dr Raghavendra Nargund, Scientist (Agronomy) appraised the personnel about the problems caused by *Parthenium heterophorias*. Different events like "Parthenium Awareness Rally" cleaning of fields, cleaning of campus etc. The event was coordinated by Shri. S.K Verma, Estate officer.

### 28<sup>th</sup> Research Advisory Committee meeting

The meeting of the 28<sup>th</sup> Research Advisory Committee of ICAR-National Soybean Research Institute, Indore was held through hybrid mode on Sept. 13<sup>th</sup> - 14<sup>th</sup>, 2024. Dr. K. H. Singh, Director, extended a warm welcome to all the members and made a brief presentation on the current status of soybean crop, opportunities and constrains being faced. He presented salient achievements particularly with regard to identification of new varieties, germplasm conservation and utilization, breeding approaches, crop production and protection technologies and extension activities. Dr. Milind Ratnaparkhe, Member Secretary, presented the Action Taken Report of the previous RAC. Subsequently, Dr. Anita Rani, Principal Scientist & Incharge, Crop Improvement Section

presented the research status of soybean breeding, biotechnology, biochemistry and seed technology. Dr. B.U. Dupare, Principal Scientist & In-charge, Crop Production Section presented the research status on the soybean production technologies, while Dr. M.P. Sharma, Principal Scientist & Incharge, Crop Protection Section presented research on the soybean protection technologies. The RAC Chairman Dr. S. K. Datta and RAC members, Dr. Sanjeev Gupta, Dr. Dr, Masood Ali, Dr. S.R.Bhat, Dr. V.K. Baranwal and Dr. Ashutosh Upadhyay appreciated the

research program being conducted at NSRI, Indore. During interaction session, all the esteemed members appreciated the efforts made by the Institute in addressing the last RAC recommendations. The committee has visited the research fields of the institute and advised the scientists about the ways for the betterment of the research experiments. Further, a farmer's field to ICAR Model village-Memdi was also carried out to interact and to know the production problems at farmer's field level.



### Vigilance awareness week

On the directives of Central Vigilance Commission - Government of India, institute observed Vigilance Awareness Week-2024 from 30<sup>th</sup> October 2024 to 5<sup>th</sup> November 2024. All the scientific, administrative, and technical staff led by the Director of the institute, Dr K.H. Singh, took oath in this regard. Director called upon the employees to follow the office ethics, protocol, guidelines as well as the conduct rules and to work for the institute with full integrity and honesty. On 2<sup>nd</sup> November, all the staff members led by the Director, performed the walkathon within the institute. The program was concluded on 6<sup>th</sup> October with the valedictory-cum-prize distribution.

### ICAR Central Zone sports tournament

Ms. Seema Chouhan, Technical Assistant attended ICAR-Inter-Zonal Sports Meet organized at CAZRI, Jodhpur during 14<sup>th</sup>-

18<sup>th</sup> October 2024 under played Javelin Throw category.

### Organization of Brainstorming Session

The institute in collaboration with Society for Soybean Research and Development has conducted Brainstorming Session on “Strategies for developing for disease resistance in soybean” on 15<sup>th</sup> November 2024 in order to manage the problems of decreasing soybean yield caused by fungal and viral diseases. The renowned scientists from United States, Japan and India which included Prof. Roger Innes from Indiana University, USA, Dr. Anne E. Dorrance, from The Ohio State University, USA, Prof. K. Maredia, Michigan State University, USA, Dr. Sara Thomas-Sharma, Louisiana State University, USA and Dr. Naoki Yamanaka from JIRCAS, Japan. The programme was chaired by honourable Deputy Director General (Crop Science), ICAR, New Delhi, Dr T. R. Sharma, co-chaired by Dr Sanjeev Gupta, Assistant Director General (Oilseeds & Pulses), ICAR, New Delhi. The chief guest of the programme was Dr S.P.



Tiwari, former VC, SKRAU Bikaner & former DDG (Education and Crop Science), ICAR, New Delhi and the convener of the programme was Dr K.H. Singh, Director, ICAR-National Soybean Research Institute (NSRI), Indore. The session was moderated by Dr Milind Ratnaparkhe, Pr. Scientist (Plant Biotechnology), ICAR-NSRI, Indore.

Dr Sanjeev Gupta, on the occasion hoped to see progress in making the country as protein manufacturing hub for which soybean is best alternative and its increased productivity will realize the dreams of policy makers. The chief guest Dr Satya Prakash Tiwari, urged the soybean scientist to focus on translational research for the overall benefit of soybean farming community, in addition to research programmes on basic and fundamental research. In his address, Dr T.R. Sharma, Honble DDG, Crop Science, ICAR, New Delhi insisted the scientists to undertake a mega project on management of biotic stresses in soybean. He called the soybean scientists to use novel research approaches like GWAS, QTL Mapping, Haplotype based breeding and host pathogen interaction studies.

### Organization of Two- day's training on PGS for Extension officers

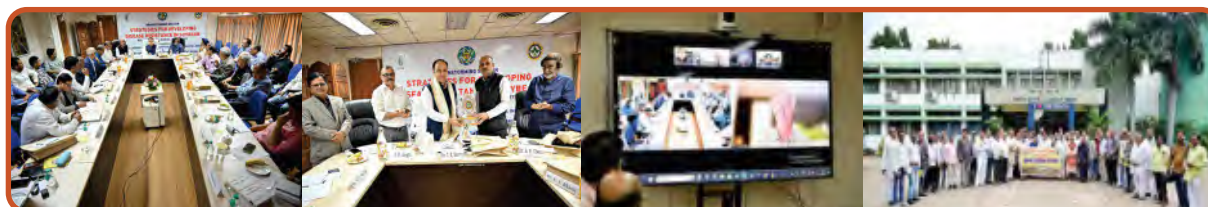
The two-day training on the Participatory Guarantee System (PGS) for extension officers was successfully conducted at ICAR-NSRI, Indore in collaboration with Regional Center for Organic and Natural Farming, Nagpur (GOI) with the involvement of 20 extension officers from various districts of Madhya Pradesh. Dr. Ragha vendra Nargund, a Scientist in Agronomy at ICAR-NSRI, Indore, and Dr. Swapnil Magar, Junior Scientific Officer at the Regional Center for Organic and Natural Farming, Nagpur, coordinated the event as a course coordinator.

### 38<sup>th</sup> Foundation day of ICAR-NSRI

The 38th foundation day of National Soybean Research Institute, Indore was organized on

11th Dec, 2024 in the presence of chief guest, Dr. Major Singh, Honorable Member, Agricultural scientist recruitment board, New Delhi. Dr Major Singh stressed on the development of varieties suitable for natural and organic farming. The Director of the institute Dr. K.H. Singh, while presenting the achievement of ICAR-NSRI during 2024, mentioned about the identification of four soybean varieties NRC 197, NRC 149 developed by Indian Institute of Soybean Research, Indore, JS 23-03 and JS 23-09 developed by Jawaharlal Nehru Agricultural University, Jabalpur He briefly highlighted the achievements of all three divisions of the institute, as well as new initiatives taken in the institute such as ICAR- Genome Editing Project, adopting Memdi as a model village, demonstration of early and medium duration soybean varieties in soybean-wheat cropping system etc. He also highlighted the recently developed infrastructure such as Mandap Parisar, sick plot for RAB disease of soybean, genome editing lab etc.

During the foundation day celebrations, beneficiary farmers who achieved higher production in the demonstrations conducted during *Kharif* 2024 under various projects implemented by the institute were awarded. The list includes Shri Kishor Patil (beneficiary of ICAR-NSRI-MP Govt Project), Shri Dilip Kher (beneficiary of Mera Gaon Mera Gaurav project, Indore district) Shri Anil Khajuriya (beneficiary of SCSP Programme in Sehore District), Shri Bhim Singh Chouhan (beneficiary of TSP program, in Khargone district) and Shri Bhim Singh Kelwa & Shri Ghanshyam Kelwa (beneficiary of Model ICAR Village Memdi, District-Indore).



On this occasion, five publications were released which include Rajbhasha Patrika fifth issue of “Soyvritika”, extension bulletin “Soybean ki Unnat Kheti evam Takniki Anushansayein”, technical bulletin “Soybean Krishakon ke liye Saptahik Salah” and Germplasm Catalogue were released. During the programme the employees who did excellent work during 2024 were honoured which include Dr. R.K. Verma (Scientific category), Ms. Priyanka Sawan (Administrative category) and Mrs. Phulki Bai and Mrs. Rumli Bai (supporting skilled staff category). The best team work award was given to Estate and Work Section Administration/Finance wing bagged team

award for 100 percent budget utilization. During the celebration, the scientists were also honoured for development of soybean varieties viz Dr Anita Rani (NRC 188 and NRC 149), Dr. Vineet Kumar (NRC 181 and NRC 197), and Dr. Sanjay Gupta and his team was felicitated for development of soybean variety NRC 165. Dr. M.P. Sharma, was honoured with for his research paper published in highly rated international journal. At the end, Shri Sanjay Kumar Pandey, Shree Francis Yunis, Shree Bilbar Singh and Smt Chunki Bai who are superannuating soon were felicitated for their contribution in institute development.



Organisation of Foundation Day and Rashtriya Kisan Diwas



### Rashtriya Kisan Diwas-cum-Soya Krishak Mela

The institute celebrated the birth anniversary of late Prime Minister Shri Chaudhary Charan Singh on 23rd December 2024 by organizing “Rashtriya Kisan Diwas evam Soya Krishak Mela” at the institute campus. The programme was organized under the aegis of various TOT programmes being executed at the institute like “Frontline Demonstrations on Soybean under National Mission on Vegetable Oil”, *Mera Gaon Mera Gaurav*, Seed Hub and Model ICAR village programme etc. A Farmer-Scientist Interaction was also conducted immediately after the brief talk by the institute scientists on the major issues of farmers’ significance like improved soybean varieties, their characteristics, new agronomic practices, insect-pest and disease management etc. During the occasion, the institute Director Dr K. H. Singh felicitated five soybean farmers, namely, Mr. Vijayendra Singh Chauhan, Mr. Yogendra Singh Chauhan (Village Panod, Indore), Mr. Mukesh Kamdar (Village Karod Kala, Dhar), Mr. Rohit Anjana (Village Vinayaga, Ujjain), Mr. Jitendra Patel (Village Bicholai Hapsi, Indore) who achieved the highest soybean production under the institute’s soybean seed production program. This year More than 650 farmers from Madhya Pradesh, Rajasthan and Maharashtra participated in this programme. A total of 1300 seed packets of NRC 150, JS 22-12, JS 22-16 and JS 23-03 were sold during this programme to make farmers self-sufficient for seeds of new varieties.

### Cleanliness Activities during ‘Swachhata hi Sewa’ and ‘Swachta Pakhwada 2024’

The institute celebrated “Swachhata hi Sewa” during 14th September-2nd October 2024 by conducting various activities like Essay Competition for Shriram Convent School, Indore, Cleanliness at Regional Park, Indore, Gram Sanwad at village Katkatkhedi in addition to cleanliness drive at the Office building as well as residential campus.

Similarly, ‘Swachhta Pakhwada 2024’ was conducted during December 16-31, 2024, which began with the Swachhata Pledge administered by the Institute Director Dr K. H. Singh to the staff of the institute. During this fortnight, various competitions and activities like cleaning of institute premises as well as Residential Campus, cleaning of compost pits, drainage chambers etc. carried out by all the staff of the

institute. The programme was concluded with the prize and certificate distribution to the winners during the valedictory programme organized. Shri Shyam Kishore Verma, the Member Secretary of Swacch Bharat Abhiyaan organized various activities meticulously.

### Other important Meetings/events

- Institute Management Committee Meeting was organized on 27th May 2024.
- Soybean Stakeholders Consultations Workshop organized today at the institute (July 22, 2024).
- The Director Dr K.H. Singh Flagged -off Stem-fly Awareness program (under CSR program of Syngenta Ltd.).
- Advisory committee meet of NASF project organized at the institute (March 18th 2024).
- The institute organized “Intellectual Patent Day” wherein Dr Ghayur Alam, National Law Institute University, Bhopal delivered lecture on “IP and the SDGs: Building our common future with innovation and creativity” (April 26, 2024).
- Health Awareness Session Dr Ashish Bagdi, Senior Consultant, Neuro Science, CARE-CHL Hospital, Indore on 23rd Aug 2024.
- Oral health awareness check-up camp at the IISR Residential Campus.: Thanks to Tathastu super specialty Dental Clinic, Indore (19th May 2024).
- Today oral health awareness check-up camp was organized at the institute (courtesy Tathastu Super Specialty Dental Clinic, Indore (16th May 2024).
- Roadshow Program organized jointly by a-IDEA, ICAR-NAARM and ICAR-NSRI, Indore. Mr Paritosh Tripathy, COO, a-IDEA delivered excellent lecture and interactive session with incubates and upcoming entrepreneur (May 17th 2024).
- The institute, in association with ICAR-ATARI, Jabalpur, KVK, Indore organized Training-cum-Workshop of Agronomists of Madhya Pradesh and Chhattisgarh for finalization of various trials conducted by KVKs during Kharif 2024.
- The institute successfully conducted demonstration on use of drone for conducting the necessary plant protection measures.



### प्रशिक्षण कार्यक्रम का आयोजन

मध्य प्रदेश के अतिरिक्त मुख्य सचिव अशोक वर्नवाल एवं कृषि आर्यक एम. सोलंकेन्द्रण का भारतीय सोयाबीन अनुसंधान संस्थान, इंदौर में भ्रमण

भारतीय सोयाबीन अनुसंधान संस्थान (ICAR-NRSI) में अतिरिक्त मुख्य सचिव अशोक वर्नवाल और कृषि आर्यक एम. सोलंकेन्द्रण का भ्रमण। वे संस्थान के प्रमुखों और कर्मचारियों से मिलकर संस्थान की कार्यवाही और सोयाबीन अनुसंधान पर चर्चा की।

### उत्तर पूर्वी भारत में सोयाबीन है बहुत ही उपयुक्त फसल: सिंह

उत्तर पूर्वी भारत में सोयाबीन की खेती का प्रचार-प्रसार करने के लिए एक कार्यक्रम का आयोजन। डॉ. ए.पी. सिंह ने कहा कि सोयाबीन एक अत्यंत उपयुक्त फसल है जो किसानों को उच्च उत्पादन प्रदान करती है।

### भारतीय सोयाबीन अनुसंधान संस्थान द्वारा उत्तर पूर्वी क्षेत्र के 20 मुख्य उत्पादन राज्यों की विश्व प्रदर्शन का आयोजन

उत्तर पूर्वी क्षेत्र के 20 मुख्य उत्पादन राज्यों की विश्व प्रदर्शन का आयोजन। संस्थान द्वारा एक कार्यक्रम का आयोजन किया गया जिसमें उत्तर पूर्वी क्षेत्र के 20 राज्यों के प्रतिनिधियों का स्वागत किया गया।

### सोयाबीन उत्पादन में प्रगति

सोयाबीन उत्पादन में प्रगति। देश में सोयाबीन उत्पादन में लगातार वृद्धि देखी जा रही है।

### ICAR-NRSI holds training for farmers

ICAR-NRSI holds training for farmers. संस्थान द्वारा किसानों के लिए प्रशिक्षण कार्यक्रम आयोजित किया गया।

### भारतीय सोयाबीन अनुसंधान संस्थान, इंदौर प्रवेश कार्यक्रम का आयोजन

भारतीय सोयाबीन अनुसंधान संस्थान, इंदौर प्रवेश कार्यक्रम का आयोजन। संस्थान के प्रमुखों का इंदौर में प्रवेश कार्यक्रम आयोजित किया गया।

### भारतीय सोयाबीन अनुसंधान संस्थान, इंदौर प्रवेश कार्यक्रम का आयोजन

भारतीय सोयाबीन अनुसंधान संस्थान, इंदौर प्रवेश कार्यक्रम का आयोजन। संस्थान के प्रमुखों का इंदौर में प्रवेश कार्यक्रम आयोजित किया गया।

### सोयाबीन उत्पादन में प्रगति

सोयाबीन उत्पादन में प्रगति। देश में सोयाबीन उत्पादन में लगातार वृद्धि देखी जा रही है।

### Drones to help farmers secure crop, raise yield

Drones to help farmers secure crop, raise yield. ड्रोनों का उपयोग किसानों को फसल सुरक्षा में मदद करेगा और उत्पादन बढ़ाएगा।

### खेतों में सोयाबीन फसल का वैज्ञानिकों द्वारा निरीक्षण, किसानों को दी सलाह

खेतों में सोयाबीन फसल का वैज्ञानिकों द्वारा निरीक्षण, किसानों को दी सलाह। वैज्ञानिकों ने खेतों में सोयाबीन फसल का निरीक्षण किया और किसानों को सलाह दी।

### Monsoon break fuels fear of soyabean yield loss

Monsoon break fuels fear of soyabean yield loss. मonsoon ब्रेक सोयाबीन उत्पादन में ह्रास का डर पैदा कर रहा है।

### भारतीय सोयाबीन अनुसंधान संस्थान, इंदौर प्रवेश कार्यक्रम का आयोजन

भारतीय सोयाबीन अनुसंधान संस्थान, इंदौर प्रवेश कार्यक्रम का आयोजन। संस्थान के प्रमुखों का इंदौर में प्रवेश कार्यक्रम आयोजित किया गया।

### क्षेत्रीय राजभाषा पुरस्कार इंदौर के अनुसंधान संस्थान को मिला

क्षेत्रीय राजभाषा पुरस्कार इंदौर के अनुसंधान संस्थान को मिला। संस्थान को क्षेत्रीय राजभाषा पुरस्कार मिला।

### 'Develop soybean varieties suitable for natural and organic farming'

'Develop soybean varieties suitable for natural and organic farming'. सोयाबीन किस्मों का विकास जो प्राकृतिक और ऑर्गेनिक खेती के लिए उपयुक्त हों।

### Climate smart sowing methods to raise yield of soyabean cultivation

Climate smart sowing methods to raise yield of soyabean cultivation. जलवायु-समर्थ खेती विधियों का उपयोग सोयाबीन उत्पादन में वृद्धि के लिए।

### ग्रामीण सोयाबीन की खेती बन रही फायदे का सोदा उपलब्धि: किसान गर्मी में पैदा कर रहे पीला सोना

ग्रामीण सोयाबीन की खेती बन रही फायदे का सोदा उपलब्धि: किसान गर्मी में पैदा कर रहे पीला सोना। ग्रामीणों में सोयाबीन खेती का प्रचार-प्रसार हो रहा है।

### 5 किगो की दर पर 75 से 100 किगो तक

5 किगो की दर पर 75 से 100 किगो तक। सोयाबीन उत्पादन में वृद्धि।

### 100 दिन वाली किस्मों की उपरचक्रता देखी जा रही

100 दिन वाली किस्मों की उपरचक्रता देखी जा रही। 100 दिन वाली किस्मों की उपरचक्रता का परीक्षण किया जा रहा है।

EVENTS, MEETINGS AND MEDIA COVERAGE



## DISTINGUISHED VISITORS

- Mr. Ashok Barnwal, (Additional Chief Secretary) and Mr. M. Selvendran (Agriculture Production Commissioner), Department of Agril. & Farmers' Welfare, Madhya Pradesh visited on 21.02.2024.
- Dr R.C. Agarwal, Hon'ble DDG (Education) ICAR, New Delhi visited the institute on 04.03.2024.
- Hon'ble DDG (Crop Science) ICAR, New Delhi Dr T.R. Sharma visited the institute on 15.11.2024 and inaugurated the Mandap Parisar of the institute.
- Hon'ble Dr S.P. Tiwari, Ex Director and DDG (Edn & Crop Science, ICAR) visited on 15.11.2024.
- Dr R.K. Mathur, Director ICAR-IIOR, Hyderabad visited on 14th October 2024.
- Dr S.K. Datta, Ex DDG (Crop Science, ICAR), Dr Sanjeev Gupta, Hon'ble ADG (O&P, ICAR), Dr Masud Ali (Former Director ICAR-IIPR) and distinguished scientists Dr. S.R.Bhat, (ICAR-NIPB, New Delhi and Dr. V.K. Baranwal (National Professor, Virology, IARI, New Delhi visited on 13-14 September 2024 and attended the 28th Research Advisory Committee Meeting of ICAR-NSRI.
- Brazilian Delegation visited (18th September 2024)
- Dr Harihar Ram (Ex Head, Plant Breeding & Genetics, GBPUA&T), Dr J.S. Chauhan (Ex ADG Seed) as subject matter experts for 38th IRC of the institute.
- Dr Major Singh, Hon'ble Member, ASRB New Dehi visited during 10-11th December 2024 and delivered Foundation Day Lecture on the occasion of 38th Foundation Day of the institute



## ONGOING RESEARCH PROJECTS - 2024

Project No.	Years	Project Title	PI
NRCS 1.1/87	1987-LT	Augmentation, management and documentation of soybean germplasm	Dr Sanjay Gupta
IISR 1.33/16	2016-LT	Development of YMV resistant soybean varieties using marker assisted selection	Dr Anita Rani
NRCS 1.12/02	2002-LT	Breeding for food grade characters and high oil content	Dr Anita Rani
DSR 5.6a/08	2009-LT	Breeding for drought resistance / tolerance varieties in soybean	Dr G. K. Satpute
IISR4.6/23	2023 LT	Pre-breeding for broadening of genetic base in soybean	Dr V. Rajesh
IISR 3.12/19	2019-2024	Soybean Improvement against defoliating insects	Dr Vangala Rajesh
IISR4.4/23	2023-31	Breeding for high seed and oil yield for different maturity duration in soybean	Dr Shivakumar M.
IISR4.5/23	2023-31	Breeding for resistance against charcoal rot and anthracnose diseases in soybean	Dr Nataraj V
IISR4.3/23	2023-2028	Enhancement of Seed Longevity of Vegetable Soybean ( <i>Glycine max</i> L. Merr.) Genotype.	Dr Punam Kuchlan
IISR 3.15/2020	2020-2024	Development of genome edited soybean lines with improved oil quality	Dr Milind B. Ratnaparkhe
ISSR 3.16/21	2021-2026	Identification of genes/loci for better root system in soybean	Dr Giriraj Kumawat
<b>CROP PRODUCTION</b>			
IISR4.13/17	2022-27	Evaluation of residue management practices under permanent broad bed furrow as well as conventional tillage practices for sustaining/ improving resources use efficiency, soil quality and crop productivity in soybean-based cropping systems	Dr Rakesh Kumar Verma
IISR6.10/23	2023-2028	Comparative study on sustainable (Natural/Organic farming/Conservation agriculture) management practices for soybean yield maximization under soybean-based cropping systems	Dr Raghvendra Nargund
IISR 7.8/23	2023-2028	Trait identification and physiological breeding for water logging tolerance in soybean	Dr Prince Choyal
IISR 8.17/2020	2020-2025	Development and evaluation of ICT tools and medias for ToT of soybean	Dr B.U. Dupare
IISR 8.18/23	2023 LT	Transfer of Improved Soybean Production Technologies for Increasing Soybean Production	Dr. B.U. Dupare
IISR 7.7/23	2023-2025	Development of Seed and Product Sale Portal for Online marketing in Soybean	Dr Savita Kolhe
DSR4.11/20	2020-2024	Field evaluation of potential plant growth promoting rhizobacteria (microbial consortia) and AM fungi on nutrient dynamics and mineral biofortification under soybean-wheat cropping system	Dr A. Ramesh



CROP PROTECTION			
IISR3.11/22	2022-2027	Soybean Improvement against Rhizoctonia aerial blight disease	Dr Sanjeev Kumar
IISR 3.13/21	2021-2024	Isolation and identification of kairomones and sex pheromones components for soybean stem fly, <i>Melanoagromyza sojae</i> management	Dr Lokesh Kumar Meena
IISR 6.9/17	2017-2020	Bacterial mediated Sulphur bioavailability in soybean	Mr Hemant S. Maheshwari
IISR 3.12/2020	2020-2024	Interaction effect of phytohormones and AMF for enhanced nodulation, growth, yield of soybean with improved AMF symbiosis in the rhizosphere	Dr M. P. Sharma
IISR/7.9/24	2024-2029	Transforming Soybean Cultivation Through Advanced AI Modeling	Dr. Savita Kolhe
IISR/3.14/24	2024-2026	Standardization of package of practices for soybean production by using drone technology	Dr. Sanjeev Kumar

The details of various projects funded by the external agencies are given separately under the chapter 'Linkages and Collaborations' given on Page No. 99



## PUBLICATIONS, PATENTS, AWARDS AND RECOGNITION

## Research Papers

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- <https://doi.org/10.1007/s42729-024-01822-w> (press).
11. Kolhe S, Dupare BU, Kumbhkar M and Saxena A. 2024. Sentiment Analysis of ICAR-IISR Indore YouTube Channel Using Lexicon-based Approaches. *Soybean Research* 21(2):87-107.
  12. Kumawat G, Cao D, Park, C and Xu D. 2024 C-terminally encoded peptide-like genes are associated with the development of primary root at *qRL16.1* in soybean. *Front. Plant Science*. 15:1387954. doi: 10.3389/fpls.2024.1387954
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1. Agnihotri R, Mathimaran N, Sharma MP, Sahu A, and Bhattacharjya S. 2024 Production methods of arbuscular mycorrhizal fungal inoculum: Challenges and future perspectives In: *AM Fungi in Sustainable Agriculture: Inoculum Production and Application*, Parihar M, et al. (eds.). pp 381-399. Springer Nature Singapore Pte 381 Ltd. [https://doi.org/10.1007/978-981-97-0296-1\\_17](https://doi.org/10.1007/978-981-97-0296-1_17)
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  5. Gupta S and Kuchlan M. 2024. Climate smart soybean varieties of India. In Training Manual (eds. Dupare et.al.) of “National Training Course on Climate smart production technologies to enhance soybean productivity” organized by ICAR-Indian Institute of Soybean Research during 6-8 February 2024 at ICAR-IISR, Indore, pp 1-17



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  7. Kuchlan P and Kuchlan M. 2024. Quality seed production in Soybean. In Training Manual (eds. Dupare et.al.) of “National Training Course on Climate smart production technologies to enhance soybean productivity” organized by ICAR-Indian Institute of Soybean Research during 6-8 February 2024 at ICAR-IISR, Indore, pp 59-64
  8. Kuchlan, P. Kuchlan M K, Dupare B U and Khan I R. 2024. Edited Raajbhsha Patrika Soyvritika vol (5) special edition on secondary agriculture and value addition published by ICAR-Indian Institute of Soybean research Indore, M P, and India, pp 120
  9. Kumar S, Maheshwari H, Nataraj V and Meena L. 2024. Management of soybean diseases under changing climate scenario. In Training Manual (eds. Dupare et.al.) of “National Training Course on Climate smart production technologies to enhance soybean productivity” organized by ICAR-Indian Institute of Soybean Research during 6-8 February 2024 at ICAR-IISR, Indore, pp 35-41
  10. Kumawat, G, Raghuvanshi R, Vennampally N, Maranna S, et al. 2024. Integrating Germplasm Diversity and Omics Science to Enhance Biotic Stress Resistance in Soybean. In: Parihar A K, Bohra A, Lamichaney A, Mishra R, Varshney R K (eds.). Genomics-aided Breeding Strategies for Biotic Stress in Grain Legumes. Springer, Singapore. [https://doi.org/10.1007/978-981-97-3917-2\\_10](https://doi.org/10.1007/978-981-97-3917-2_10)
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  18. Tripathi R, Agrawal N, Shivakumar M, Nataraj V, Chandra S, Kumawat G, Meghwal P, Kumar A., Ratnaparkhe M B, Nagar S, and Gupta S. 2024. Speed Breeding: Rapid Method for Generation advancement. and Development of Crop Varieties. J. M. Al-Khayri et al. (eds.). *Plant Molecular Breeding in Genomics Era, Advances in Plant Breeding Strategies*, pp 111-128. [https://doi.org/10.1007/978-3-031-68598-9\\_4](https://doi.org/10.1007/978-3-031-68598-9_4)
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  20. Vangala R, Onkarappa T, Gupta S, Manasa N, Nataraj V, Satpute G, Shivakumar M, Kolhe S, Sowmya H and Praveen. 2024. Soybean Germplasm Catalogue. ICAR-NSRI, (India), Indore, pp 156.

### Publication of abstract in Seminar/Symposia

1. Agnihotri R, Prakash A and Sharma M P. 2024. Crop-Rhizosphere Microbiome Interactions and Soil Carbon Sequestration: Contributions of Arbuscular Mycorrhizal Fungi. Paper presented during National Conference on fungal frontiers: Biodiversity, Biomolecules, and Bioengineering applications and Sustainable Perspectives & 51<sup>st</sup> Annual Meeting of Mycological Society of India Organized by Department of Botany (Centre of Advanced Study) JN Vyas University, Jodhpur from November 27-29, 2024
2. Nargund R, Dupare B U, Verma R K and Singh K H. 2024. Standardization of natural farming practices for soybean based cropping systems. Book of Abstracts of National Conference on “Next Generation Agriculture-Organic and Natural Farming Pathways: Extension Strategies and Approaches” organized by International Society of Extension Education at ATARI, Jabalpur during January 28-30, 2024. Pp-119



## Popular articles

1. बी. यु. दुपारे, मृणाल कुचलान, पूनम कुचलान, राघवेन्द्र नर्गुद, राकेश कुमार वर्मा एवं के.एच. सिंह. 2024. सोयाबीन की उन्नत किस्मे, बीज गुणवत्ता परिक्षण एवं बोवनी की विधियां. किसान की गाथा 1-31 जुलाई 2024. पृष्ठ 16-17
2. बी. यु. दुपारे, वी. नटराज, एम. शिवकुमार एवं मृणाल कुचलान, 2024. सोयाबीन की 4 नई सोयाबीन की उन्नत किस्मों की पहचान. कृषक जगत. भोपाल 10 जून 2024. पृष्ठ 8
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4. बी. यु. दुपारे, राघवेन्द्र नर्गुद, राकेश कुमार वर्मा एवं के.एच. सिंह. 2024. सोया उत्पादकता में वृद्धि हेतु कृषकों को सामान्य दिशानिर्देश. की उन्नत किसान की गाथा 1-30 जून 2024. पृष्ठ 15
5. Verma, R. K., Nargund, R., & Singh, K. H. (2024). Permanent broad bed furrow technology for soybean-based cropping systems. Indian Farming, 74(9), 34-36.
6. श्याम किशोर वर्मा, नगर राजभाषा कार्यान्वयन समिति गृह पत्रिका दिशा वर्ष 2023-24 अंक - 17 आलेख भारतीय कृषि में मौसम आधारित परंपरागत देशज ज्ञान-उपज की प्रासंगिकता पृष्ठ क्र. 44 से 50
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9. श्याम किशोर वर्मा, राजभाषा पत्रिका - सोय वृतिका 2024 अंक 5 कविता - स्वच्छता पर संवाद पृष्ठ क्र. 74
10. श्याम किशोर वर्मा, राजभाषा पत्रिका सोय वृतिका 2024 अंक - 5 कविता - एक पेड़ माँ के नाम पृष्ठ क्र. 106

## Technical/Extension bulletins/Folders

1. Anita Rani and Vineet Kumar 2024. Specialty Soybean Varieties. Technical Bulletin. ICAR-Indian Institute of Soybean Research, Indore.
2. संजीव कुमार, वी. नटराज, हेमंत महेश्वरी, लोकेश कुमार मीना एवं बी. यु. दुपारे. 2024. सोयाबीन में उभरते रोग एवं उनके प्रबंधन के उपाय. तकनीकी बुलेटिन. 2024. भा.कृ. अनु. प.-भारतीय सोयाबीन अनुसन्धान संस्थान. पृष्ठ.24.
3. राकेश कुमार वर्मा, संजीव कुमार एवं नीता खांडेकर. (2024). सोयाबीन उत्पादन की उन्नत तकनीकी, तकनीकी विवरणिका, भा.कृ.अनु.प.-भारतीय सोयाबीन अनुसन्धान संस्थान, इंदौर (मध्य प्रदेश) पृष्ठ संख्या-प्रष्ठ संख्या 1-40.
4. दुपारे, बी.यू., राकेश कुमार वर्मा, राघवेन्द्र नर्गुद, लोकेश मीना, संजीव कुमार, मृणाल कुचलान, पूनम कुचलान एवं के.एच.सिंह. 2024 सोयाबीन की आधुनिक खेती: तकनीकी अनुशंसाएं. विस्तार बुलेटिन क्रमांक 20. भा.कृ.अनु.प.-भारतीय सोयाबीन अनुसंधान संस्थान प्रकाशन. पृष्ठ: 64
5. दुपारे, बी.यू., राकेश कुमार वर्मा, राघवेन्द्र नर्गुद, लोकेश मीना, संजीव कुमार, मृणाल कुचलान एवं के.एच.सिंह. 2024 सोयाबीन की आधुनिक खेती: तकनीकी अनुशंसाएं. विस्तार बुलेटिन क्रमांक 19. भा.कृ.अनु.प.-भारतीय सोयाबीन अनुसंधान संस्थान प्रकाशन. पृष्ठ: 74
6. दुपारे, बी.यू., राकेश कुमार वर्मा, लोकेश मीना, संजीव कुमार, मृणाल कुचलान एवं के.एच.सिंह. 2024 सोया कृषकों के लिए साप्ताहिक सलाह (खरीफ 2023). तकनीकी बुलेटिन 2024(4) भा.कृ.अनु.प. - भारतीय सोयाबीन अनुसंधान संस्थान प्रकाशन. पृष्ठ 84
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8. राकेश कुमार वर्मा, संजीव कुमार, डी. के. वाणी, एस. के. बडोदिया, भय्यालाल आँजना, सुनील दांगी, दीपिका गौर एवं शैलजा सरावगी. 2023. सोयाबीन उत्पादन की उन्नत खेती, विस्तार फोल्डर - 2023, पृष्ठ संख्या 1-06.



9. राकेश कुमार वर्मा, संजीव कुमार, डी. के. वाणी, एस. के. बडोदिया, भय्यालाल आँजना, सुनील दांगी, दीपिका गौर एवं शैलजा सरावगी. 2023. कपास उत्पादन की उन्नत खेती, विस्तार फोल्डर-2023, पृष्ठ संख्या 1-06.
10. राकेश कुमार वर्मा, संजीव कुमार, डी. के. वाणी, एस. के. बडोदिया, भय्यालाल आँजना, सुनील दांगी, दीपिका गौर एवं शैलजा सरावगी. 2023. ज्वार की विपुल उत्पादन तकनीकी, विस्तार फोल्डर-2023, पृष्ठ संख्या 1-06.

### Lectures Delivered:

- Dr B.U. Dupare delivered a lecture on improved soybean production technologies at the training program organized by AETC, Indore on 16th February 2024.
- Dr B.U. Dupare delivered a lecture on improved soybean production technologies at State Level Kisan Sammelan organized by Bank of India at Indore on 19th July 2024.
- Dr M.P. Sharma delivered lecture on Arbuscular Mycorrhizal Fungi: A Promising Biostimulant and Biofertilizer for Boosting Plant Growth and Soil Carbon Sequestration. Presented during International Science Day on "Green Sciences for Sustainable Ecosystem & Economy" organized by Department of Biosciences, Acropolis Institute of Management and Science, Indore on 22nd November, 2024.
- Dr M.P. Sharma delivered a lecture on AM fungi: A tool for sustaining agriculture, soil-ecosystem and environment talk delivered online during World Soil Day-December 5, 2024 organised by Cytolife Agritech Pvt Ltd. Mumbai.
- Dr Mrinal K. Kuchlan delivered a Lecture on "Soybean Research in India: Unveiling Five Decades of Remarkable Strides in Enhancing Soybean Production" in 12th Indian Seed Congress, on 29th Feb to 1st March, 2024 at The Westin, Koregaon Park, India.
- Dr Mrinal K. Kuchlan Lecture on " Quality seed production in Soybean" during 3 days training programme on "Climate smart production technologies to enhance soybean productivity under changing climate" 6-8th Feb, 2024
- Dr Mrinal K. Kuchlan Lecture on " Quality seed production in Soybean" during 3 days training programme on " Soybean food processing and Utilization" during 16-18th Jan, 2024
- Dr Mrinal K. Kuchlan Lecture on " Quality seed production in Soybean" during 3 days training programme on " Soybean food processing and Utilization" during 19-21st Dec, 2023
- Dr Sanjeev Kumar delivered a lecture on "सोयाबीन के प्रमुख रोगों की जानकारी" under 3 days training programme on "सोया खाद्य प्रसंस्करण और उपोत्पाद उपयोग" organized during 16-18 January 2024.
- Dr Sanjeev Kumar delivered a lecture on "Management of soybean diseases under changing climate scenario" under training programme on climate smart production technologies to enhance soybean productivity under changing climate organized during 06-06 Feb 2024.
- Dr Milind Ratnaparkhe delivered talk on "Recent developments in Soybean Genomics for biotic stress resistance" during National Conference: Novel Strategies for Mitigating Biotic and Abiotic Stresses for Agricultural and Environmental Sustainability' held during 28-29 February, 2024 at ICAR-National Institute of Biotic Stress Management, Raipur, Chhattisgarh.
- Raghavendra Nargund delivered a lecture on Awareness of Parthenium Eradication in 19th Parthenium Awareness Week 16-22 August 2024 held hybrid mode at ICAR-IISR, Indore.
- Raghavendra Nargund delivered a lecture on "Climate Smart Agronomic Practices for Soybean Production" in Training cum Workshop of Agronomy Experts" during August 1-2, 2024 organized by ICAR – Agricultural Technology Application Research Institute, Zone –IX, Jabalpur (M.P.) in collaboration with ICAR-IISR, Indore at ICAR-Indian Institute of Soybean Research, Indore (M.P.).
- Raghavendra Nargund Delivered invited lecture through virtual mode on "Crop Growth Simulation Models and their Applications" at FDP-2024 on "Revolutionizing Agriculture: Integrating AI, Nanotechnology, Biotechnology and Precision Agriculture" organized by Shri Vaishnav Institute of Agriculture, SVVV, Indore on November 11h -15th, 2024.
- Dr Savita Kolhe presented Invited Keynote Lecture entitled "ICT in Agricultural Sector and Government Initiatives." in 4th



- International Conference on ICT in Business Industry and Government ICT BIG 2024” held at Symbiosis University of Applied Sciences, Indore during 13-14 December, 2024.

#### **Awards/Expert panel/ Journal Editorial Board:**

1. Dr B.U. Dupare attended “Rural Innovation Enclave” organized by the Indian Institute of Technology, Indore on 5th January 2024 as Lead Panelist.
2. Dr Shivakumar M, Senior Scientist, (Genetics and Plant breeding) Awarded as Fellow ISGPB (Indian Society of Genetics and Plant Breeding) for the year 2024 for his contributions in application of genetics and plant breeding technique in improvement of soybean crop.
3. Dr Vineet Kumar was awarded Certificate of Merit for development of soybean varieties NRC181 and NRC197 and Co-developer of NRC149 and NRC188 in 2024 on 38th foundation day of the ICAR-NSUI
4. Dr Anita Rani was awarded Certificate of Merit for development of soybean varieties NRC188 and NRC149 and Co-developer of NRC181 and NRC197 in 2024 on 38th foundation day of the ICAR-Indian Institute of Soybean Research
5. Dr M.P Sharma selected as Associate Editor in Frontiers in Microbiology: Section Microbial Symbioses (Sept 2021 onwards).
6. Dr M.P Sharma selected as Associate Editor, European Journal of Soil Science (Nov 2021 onwards)
7. Dr M.P Sharma selected as Guest Editor in Frontiers in Agronomy: Soil-plant interactions for a special volume on Managing native AM fungi microbiome through crop and soil management practices in agro-ecosystems (other co-editors are from Spain, China, Switzerland, India).

8. Dr M.P Sharma selected as Guest Editor, Agriculture-MDPI journal on the role of AM fungi for crop growth.
9. Dr M.P Sharma Elected as Fellow, Mycological Society of India, Chennai (2020).
10. Dr M.P Sharma Acted as guest of honour during International Science day organized by Department of Biosciences, Acropolis Institute of Management and Science, Indore on 22nd November, 2024.
11. Best team award of the institute for development of NRC 131 and NRC 157 soybean varieties.

#### **Conference presentations / Exhibitions / Trainings attended.**

- Dr K.H. Singh participated in Agricultural Biotechnology, Crop Improvement, Biosafety and Technology Transfer Program organized by Michigan State University from August 4 – 17, 2024 at United States.
- Dr K.H. Singh participated in the Executive Development Programme (EDP) on 'Leadership Excellence' during 26-31 August, 2024 at ICAR-NAARM, Hyderabad.
- Dr K.H. Singh attended the 31st Zonal Workshop of KVKs of ICAR-ATARI, Jabalpur at IGKV Raipur on 30th June 2024.
- Dr K.H. Singh attended the inaugural function of the 29th Annual Group Meet of AICRP on Rabi Pulses on 2-4 September 2024 at ICARDA Food Legumes Research Platform at Amlaha.
- Dr Raghavendra Nargund attended International Webinar on Functional Phenomics for Improved Climate Resilience in Tropical Agriculture through virtual mode organized by ICAR-Central Tuber Crops Research Institute, Sreekariyam, Thiruvananthapuram, Kerala. On 01.01.2024.

- Dr Sanjeev Kumar, Dr V. Nataraj, Dr Shivakumar M., Mr. Hemant Maheshwari and Dr Raghavendra Nargund attended Short course on patents (Agri IP 2024) during 15th Jan-15th Feb 2024 (1 month) conducted by (IP&TM) unit ICAR New Delhi and ZTMU, ICAR - CIFT Cochin through online mode.
- Dr Vangala Rajesh attended Training on Statistical Tools and Techniques organized by Institute of secretariat training and management, department of personnel & training, New Delhi during 19th-20th February 2024 through online mode.
- Dr Mrinal K. Kuchlan attended 12th Indian Seed Congress organized at The Westin, Koregaon Park, India during 29th Feb to 1st March, 2024.
- The institute Director Dr K.H. Singh and scientists Dr Sanjay Gupta, Anita Rani, M.P Sharma, Punum Kuchlan, Mrinal Kuchlan, Shivakumar M, V. Nataraj, V. Rajesh, Rakesh Verma, Sanjeev Kumar, GK Satpute, BU Dupare and Prince Choyal attended the 54th Annual Group Meet (AICRP on Soybean, 2024) held at University of Agricultural Sciences, Dharwad, during March 13-14, 2024.
- Dr Punam Kuchlan attended Capacity building program on “Building Successful Incubation Ecosystem organized by ICAR-NAARM, Hyderabad during 3-5th July, 2024.
- Dr Punam Kuchlan and Dr M. Shivakumar attended online Meeting on ATR of ICAR Institutes under the Chairmanship of DG, ICAR organized on 01.08.2024.
- Dr Punam Kuchlan attended XXVII meeting of ICAR Regional Committee-II through online mode organized by ICAR-NRRI, Cuttack on 23.08.2024.
- The institute scientists attended Stakeholders’ Consultation Meet on “Transforming Agriculture Researching Enhancing Role of Private Sector organized by the Ministry of Agriculture & Farmers Welfare on 3rd September 2024 through online mode.
- Dr Punam Kuchlan attended XXVII ICAR-Regional committee No. IV meeting organized by ICAR-IIVR, Varanasi on 14.11.2024.
- Dr K.H. Singh, Dr Sanjay Gupta, Dr Anita Rani, Dr M.P Sharma, Dr Punum Kuchlan, Dr Mrinal Kuchlan, Dr Shivakumar M, Dr V. Nataraj, Dr V. Rajesh, Dr Rakesh Verma, Dr Sanjeev, Dr Savita Khole, Dr Giriraj Kumawat, Dr Lokesh Meena and Dr B.u. Dupare Dr. Raghvendra Nargund attended International webinar “Strategies for Developing Disease Resistance in Soybeans” organized jointly by ICAR-IISR and Society for Soybean Research & Development at ICAR- IISR Indore, India on 15.11.2024.
- Dr Sanjay Gupta attended National symposium on “R&D Strategies for sustainable production of pulses, oilseeds and millets for food security in central India” on 19-21 Nov.2023 at RLBCAU, Jhansi.
- Dr Punam Kuchlan attended 80th Meeting of Nagar Raajbhsha Karyanwayan Samiti organized at Income Tax office, Indore on 29.11.2024
- Dr Raghavendra Nargund participated in Panel Discussion of the International Conference on "Regenerative Agriculture for Improving Soil Health, Enhancing Carbon Sequestration and Building Climate Resilience" organized by ICAR-IISS, Bhopal on 6th December 2024.
- Mr. R.N. Singh participated in J-Gate@CeRA Regional Training cum Awareness Workshop for Western Region organized by Informatics Publishing Limited, Bangalore and Education Division of ICAR, New Delhi at Dr Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra on 12th December 2024.
- Dr M. Shivakumar attended Second National Genetic Congress organized by ISGPB, New Delhi during 12-13 December 2024
- Dr B. U. Dupare participated in National Conference on Digital Agriculture: Empowering Indian Farming organized by Indian Council of Agricultural Research, New Delhi, NAAS and ICRISAT at NASC Complex, New Delhi during 16-18 December 2024.

**Radio/Television Talk**

- Raghavendra Nargund Gave a radio talk on soybean sowing time and other agronomic management practices dated 29.05.2024. Akashwani Indore.
- Dr B.U. Dupare, Principal Scientist has participated in live phone-in programme “Hello Kisan” on Soybean ki kheti telecasted on DD Kisan Channel on 3rd July 2024.



- Dr B.U. Dupare, Principal Scientist has participated in live phone-in programme “Hello Kisan” on Soybean me samsamayik kary telecasted on DD Kisan Channel on 4th September 2024
- Dr K.H. Singh, Director participated in live phone-in programme “Hello Kisan” on Soybean ki aadhunik utpadan taknik telecasted on DD Kisan Channel on 26th August 2024.

#### Participation in Meetings by Dr. Kunwar Harendra Singh, Director, ICAR-IISR, Indore during 2024

Date	Details of Meeting
08.01.2024	Attended Annual Action Plan Proposal for the year 2024-25 for implementation of Frontline Demonstrations (FLDs)/ Cluster Frontline Demonstrations (CFLDs) programme under NFMS-OS to popularize the new Varieties among the farmers under NFSM-Oilseeds in virtual mode on 08/01/2024.
19.01.2024	Attended online Meeting under the chairmanship of Joint Secretary (Oilseeds) regarding finalize the Annual Action Plan Proposal for the year 2024-25 for implementation of Frontline Demonstrations (FLDs) programme to popularize the new varieties among the farmers under NFSM-Oilseeds on 19/01/2024.
03.02.2024	Visited and interacted with scientists at KVK Kalukheda, Jaora on 03.02.2024
06.02.2024 to 09.02.2024	Invited speaker during 5th National Brassica Conference (NBC-2024) “Oilseed Brassicas for Sustainability, Profitability and Nutritional Security” 06-09 Feb 2024 at the RARI, (SKNAU), Durgapura.
09.02.2024	Attended online meeting on A brain storming session on achieving "Atmanirbharta in Oil" under the Co-Chairmanship of Secretary, A&FW and Secretary DARE & DG, ICAR on 09/02/2024.
23.02.2024	Organized A “Research-Entrepreneurs/Start-up-Industry Interface Meet” (one day) was organized by IISR, Indore on 23/02/2024.
26-27 Feb 2024	Attended the VCs and Directors conference at Bharat Ratna C. Subramaniam Auditorium, NASC Complex, Pusa, New Delhi from 26-27 Feb, 2024.
13 <sup>th</sup> -14 <sup>th</sup> , March 2024.	Organized and participated in AGM at USA Dharwad from 13-14, March 2024.
13.03.2024	Attended Varietal Identification Committee (VIC) meeting held on 13th March, 2024 during 54th Annual Group Meet of AICRP on Soybean at University of Agricultural Sciences Dharwad.
16.03.2024	Attended the meeting related to enhancing soybean production in Assam called by the Chairman Agriculture Commission Government of Assam in Guwahati on 16/03/2024.
7 <sup>th</sup> -8 <sup>th</sup> April 2024	Attended the meeting under the chairmanship of Director General, ICAR for presentation the QRT final report of IISR Indore along with QRT Chairman on 7-8/4/2024 at New Delhi.
29 <sup>th</sup> -30 <sup>th</sup> , 2024.	Organized 38th Institute Research Council meeting (IRC) at Institute April 29-30, 2024.
17.05.2024	Organized A session on awareness program on BIRAC-Biotechnology Ignition Grant (BIG) for Individual Entrepreneurs/Start-ups/Innovators/R&D Innovators at ICAR in collaboration with a-IDEA, ICAR-NAARM, Hyderabad at IISR Indore on 17.05.2024.
22.05.2024	Attended online 52nd meeting of Plant Germplasm Registration committee on 22.5.2024.
27.05.2024	दिनांक 27.05.2024 को 33वीं संस्थान प्रबंधन समिति (IMC) की बैठक संस्थान में आयोजित की गयी।
20.06.2024	Attended online meeting on ‘Enhancing the Preparedness for Agricultural Contingencies during Kharif -2024’ on 20/6/2024.



	Attended 34th Scientific Advisory Committee Meeting of Agricultural Science Centre, Devas M.P. on 21.6.2024.
30.06.2024	Attended the 31 <sup>st</sup> Zonal Workshop of KVKs of ICAR-ATARI, Jabalpur at IGKV Raipur on 30 <sup>th</sup> June 2024.
15 <sup>th</sup> -16 <sup>th</sup> July 2024	Attended the 96th Foundation Day of ICAR and Technology Day on 15-16 July 2024 at NASC Complex New Delhi.
24.07.2024	Attended the SAC meeting of KVK, Anta Baran and monitoring of trials of KVK, Kota on 24.07.2024.
01.08.2024	Presented a presentation from ICAR-Indian Institute of Soybean Research, Indore in 2nd Round of Review of ICAR Institutes through virtual mode on 01/08/2024.
4 <sup>th</sup> -17 <sup>th</sup> August 2024	Participated in Agricultural Biotechnology, Crop Improvement, Biosafety and Technology Transfer Program organized by Michigan State University from August 4 – 17, 2024 at United States.
26 <sup>th</sup> -31 <sup>st</sup> August 2024	Participated in the Executive Development Programme (EDP) on 'Leadership Excellence' during 26-31 August, 2024 at ICAR-NAARM, Hyderabad.
2 <sup>nd</sup> -4 <sup>th</sup> September 2024	Attended the inaugural function of the 29th Annual Group Meet of AICRP on Rabi Pulses on 2-4 September 2024 at ICARDA Food Legumes Research Platform at Amlaha.
13 <sup>th</sup> -14 <sup>th</sup> September 2024	Organized RAC meeting of ICAR-Indian Institute of Soybean Research, Indore on 13-14th September 2024 at Institute.
14.09.2024	किसान दिवस दिनांक 14 सितम्बर 2024 को आदर्श ग्राम मेमदी में मनाया गया जिसमें RAC कमिटी के अध्यक्ष डॉ एस. के. दत्ता, सदस्य डॉ एस. आर. भट्ट एवं डॉ मसूद अली, निदेशक, भारतीय सोयाबीन अनुसन्धान संस्थान इंदौर एवं वैज्ञानिकों द्वारा किसानों के खेतों का भ्रमण किया गया और फसल संबंधित समस्या हेतु सुझाव दिए गये एवं किसानों से सम्वाद किया गया   इस कार्यक्रम में लगभग 150 किसानों ने भाग लिया
13 <sup>th</sup> -14 <sup>th</sup> October 2024	Attended 7th International Soy Conclave, The theme of the Conclave is “Edible Oil and Protein - Vision 2030” at Indore on 13-14 October, 2024.
15.11.2024	Organized Brainstorming Session: Strategies for developing disease resistance in soybeans under the chairmanship of Hon’ble Deputy Director General (Crop Science), Dr. Tilak Raj Sharma on 15.11.2024 at ICAR-IISR, Indore.
18.11.2024	Attended online meeting on rezonalization and hot spot identification for diseases in AICRP on soybean on 18.11.2024.
	Participated as a Guest Speaker in the Regional Consultation Meeting on "Productivity Enhancement of Oilseed Crops in the SAARC Member States on 19.11.2024.
19.11.2024	Visit of KVK Ujjain for deliver a lecture 19.12.2024.
23.12.2024	संस्थान में दिनांक 23.12.2024 को राष्ट्रीय किसान दिवस एवं सोया कृषक मेले का आयोजन किया गया जिसमे लगभग 650 किसानों को नई किस्मों के बीज उपलब्ध कराएँ गये
27.12.2024	Organized Zoom meeting on the topic of Rezonalization on 27.12.2024.
30.12.2024	Attended the Meeting under the Chairmanship of Secretary, DA&FW on December 30, 2024 at Krishi Bhavan, New Delhi to discuss on Implementation of National Mission on Edible Oils – Oilseeds.



## LINKAGES AND COLLABORATIONS

The institute has established linkages with various ICAR institutes as well as SAUs under All India Coordinated Research Project on Soybean in addition to other national & international organizations like DBT, DST/GOI, BARC, Department of Agriculture of GOI as well as Madhya Pradesh for strengthening the implementation of various activities for soybean research and development.

### Details of externally funded project executed at ICAR-NSRI, Indore during 2024

S.No.	Project title and Scientists Involved	Funding Agency	Total Outlay (Rs in Lakhs)
1.	Development of Environmentally Friendly Controlled-Release P-fertilizer and its Evaluation with Plant Growth Promoting Microbes on Soybean Productivity and Soil Microbial Health (collaborative project with IISER-Bhopal and TERI New Delhi) ICAR-IISR Centre <b>(PI: Dr Mahaveer P Sharma, Co-PI: Dr A Ramesh )</b>	DBT, Govt. of India	29.40
2.	Biopolymer coating of soybean seeds with microbial consortia for improved productivity of soybean and soil health: <b>AMAAS Network project. (PI: Dr Mahaveer P Sharma, Co-PIs: Dr A Ramesh &amp; Dr Punam Kuchlan)</b>	ICAR-NBAIM, Mau	15.55
3.	Intellectual Property Management and Technology Transfer/ Commercialization-Institute Technology Management Unit (ITMU) (National Agricultural Innovation Fund Scheme (NAIF Component I, IP& TM, ICAR HQ) <b>(PI: Dr Mahaveer P. Sharma, Co-PI: Dr Giriraj Kumawat)</b>	NAIF, ICAR	7.26
4.	Agribusiness Incubation Centre-National Agricultural Innovation Fund Scheme (NAIF Component-II, IP& TM, ICAR HQ) <b>PI: Dr Mahaveer P. Sharma, Co-PI Dr Punam Kuchlan)</b>	NAIF, ICAR	33.20
5.	Functional characterization of soil surface rooting (GmSOR) genes and development of their genic markers in soybean. <b>(PI: Dr Giriraj Kumawat, Co-PI: Dr Prince Choyal)</b>	DST-ANRF	49.48
6.	Genomics strategies for improving anthracnose resistance in soybean ( <i>Glycine max L.</i> ) <b>(PI: Dr Milind Ratnaparkhe, Co-PIs: Drs M. Shivakumar, G. Kumawat, and V. Nataraj)</b>	SERB, DST Govt. of India	42.36
7.	Enhancing climate resilience and ensuring food security with genome editing tools. <b>(PI: Dr Milind Ratnaparkhe, Co-PIs: Dr Sanjay Gupta, Dr Giriraj Kumawat, Co-PIs: Dr Shivakumar M, Dr Prince Choyal, Dr Lokesh Kumar Meena)</b>	EFC-ICAR Project	565.00
8.	Expansion of Activities of Biotech-KISAN Hub in Eight Aspirational Districts in Madhya Pradesh – Phase II. <b>(PI-Dr Rakesh Kumar Verma, Co-PI: Dr Sanjeev Kumar)</b>	DBT, Government of India	50.40
9.	Developing food-grade soybean using CRISPR / Cas9 mediated multiplex genome editing <b>(PI-Dr Vineet Kumar, Co-PI: Dr Anita Rani and Dr M. Ratnaparkhe)</b>	DBT Government of India	26.40
10.	Marker assisted stacking of yellow mosaic disease resistance, null Kunitz trypsin inhibitor, null lipoxygenase-2 genes, and broadening the genetic base of soybean <b>(PI-Dr Vineet Kumar, Co-PI: Dr Anita Rani, Dr Sanjay Gupta and Vangala Rajesh)</b>	NASF, ICAR	116.34
11.	Characterization of saponin polymorphism in irradiation-induced TILLING population of soybean cultivar NRC-142. <b>PI-Vineet Kumar, Co-PI: Dr Anita Rani</b>	DBT Government of India	30.25
12.	Marker assisted introgression of seed weight, early maturity and photoperiod response genes in multiple stress tolerant climate smart soybean variety JS97-52 and KTI free variety NRC 127 <b>(PI-</b>	DBT Government of India	52.59

	<b>Dr M. Shivakumar, Co-PI: Dr Giriraj Kumawat, Dr V. Nataraj &amp; Dr Sanjay Gupta)</b>		
13.	Targeted improvement of stress tolerance, nutritional quality and yield of crops by using genome editing ( <b>PI-Dr Anita Rani, Co-PI: Dr Vineet Kumar</b> )	NASF, ICAR	43.57
14.	ICAR – Seed Project: Seed Production in Agricultural Crops. ( <b>PI-Dr Mrinal Kuchlan, Co-PI: Dr Punam Kuchlan</b> )	ICAR	3.50
15.	Creation of Seed Hubs for enhancing quality seeds availability of major oil seed crops under NFSM-Oil Seeds ( <b>PI-Dr Mrinal Kuchlan, Co-PI: Dr Punam Kuchlan</b> )	DAC, MoA&FW	150.00
16.	DUS testing of soybean-central sector scheme for protection of plant varieties and farmers right. ( <b>Nodal Officer-Dr Mrinal Kuchlan, Co-PI: Dr Punam Kuchlan</b> )	PVPFRA India	8.10
17.	Demonstration of early and medium duration soy cultivars under soy-wheat cropping system in Madhya Pradesh ( <b>PI-Dr B.U. Dupare, Co-PIs: Dr RK Verma and Dr Raghavendra Nargund</b> )	DOA, Madhya Pradesh	159.12
18	Frontline Demonstrations under National Mission on Edible Oilseeds ( <b>Nodal Officer-Dr B.U. Dupare</b> )	DAC, MoA&FW	80.72
19	3S1Y model for rapid soybean seed multiplication for seed rolling: an initiative towards edible oil self-sufficiency. <b>PI : Dr Sanjay Gupta, Co-PIs: Dr Mrinal Kuchlan, Dr Punam Kuchlan, Dr Raghavendra Nargund, Dr Lokesh Kumar Meena, Dr. Vangala Rajesh)</b>	DAC, MoA&FW	450.00

In addition to above, the institute has structural linkages with following national and international agencies

- Asian Vegetable Research and Development Centre, Taiwan
- Japan International Research Centre for Agricultural Sciences, Tsukuba, Japan
- International Crop Research Institute for Semi-Arid Tropics, Hyderabad
- Borlaug Institute for South Asia (BISA), Jabalpur, India
- International Centre for Agricultural Research in the Dry Areas, Amlaha, India
- ICAR-National Bureau of Plant Genetic Resources, New Delhi
- ICAR-Central Research Institute for Dryland Agriculture, Hyderabad
- ICAR-Indian Institute of Pulses Research, Kanpur
- ICAR-Central Institute of Agricultural Engineering, Bhopal
- ICAR-National Research Centre for Plant Biotechnology, New Delhi
- ICAR-Indian Institute of Oilseed Research, Hyderabad
- ICAR-Indian Agricultural Research Institute, New Delhi and RS, Indore
- ICAR-Indian Institute of Horticultural Research, Bangalore
- ICAR-National Academy of Agricultural Research Management, Hyderabad
- ICAR-National Bureau of Soil Survey and Land Use Planning, Nagpur
- ICAR-National Institute of Abiotic Stress Management, Baramati, Maharashtra
- ICAR-Directorate of Groundnut Research, Junagadh, Gujarat
- National Bank for Agriculture and Rural Development
- Agharkar Research Institute, Pune
- Indian Institute of Technology, Indore

#### Functional Linkages at Regional Level

- Department of Agriculture of Madhya Pradesh, Chhattisgarh, Maharashtra, Himachal Pradesh, Uttar Pradesh, Uttarakhand, Rajasthan, Punjab, Haryana, Jharkhand, Tamil Nadu, Karnataka, Andhra Pradesh, West Bengal, North-Eastern States
- NGOs like SOPA, OILFED
- State Cooperative Development Banks of respective States.
- State Seed Corporation
- Department of Seed Certification



## CONSULTANCY SERVICES, INTELLECTUAL PROPERTY, TECHNOLOGY MANAGEMENT & COMMERCIALIZATION

### A. The institute ABI centre signed MoUs with following Farmer Producer Organizations of Maharashtra

S. No.	FPOs/ Company and Address	Type of organization	Area	Period of MOU
1.	Zucchini Farmer Producer Company Limited (FPO) Sangli (Maharashtra)	FPO	Training	12 months (wef. 23.02.2024)
2.	Shrikar Agro Producer Co. Ltd. Latur, Maharashtra	FPO	Training	12 months (wef. 23.02.2024)
3.	Farm Rich Producer Co. Ltd (FPO), Latur	FPO	Training	12 months (wef. 23.02.2024)
4.	Sita Mai Agro Producer Co. Ltd (FPO) Sangli, Maharashtra	FPO	Training	12 months (wef. 23.02.2024)
5.	Indo Soya Development Association, Pune	Company	Technical Support	5 years (wef.14.06.2024)
6.	SamVik Foods, 44/46, Suyash Vihar Colony, Indore - 452011	Incubatee	Soy food processing	12 months (wef. 23.02.2024)
7.	Morph Industries Pvt. Ltd., 111, Apollo tower 2 M.G. Road, Indore Madhya Pradesh, India - 452001	Incubatee	Micro-organisms	12 months (wef. 23.02.2024)
8.	Indo Agritech, Survey No.273/2/3, Seth Agro Ke Piche, Indore - Ujjain Road, Gram-Tarana, Sanwer, District - Indore (M.P.) 453551	Incubatee	Insect traps	12 months (wef. 23.02.2024)

### B. Revenue generated under contract research services (2024-2025)

No.	Title of Project	Name of Firm	Revenue (Rs. in lakhs)
1	Evaluation of Nano-enhanced 14:28:0 soil grade fertilizer on Soybean crop	Coromandel International Ltd., Secunderabad Telangana State	7,41,260
2	Evaluation of bio-efficacy & phytotoxicity CIX-4116 on Soybean	Coromandel International Ltd. Secunderabad Telangana State	13,65,300
3	Evaluation of Cromptek 11:30:14 on Soybean	Mahadhan Agritech Ltd. Pune, Maharashtra	6,74,190
4	Evaluation of Nano DAP on Soybean crop	Indian Farmers Fertiliser Cooperative Ltd, Bhopal (M.P)	7,49,100
		<b>Total</b>	<b>35,29,850</b>

## राजभाषा कार्यान्वयन

### संस्थान में जनवरी- दिसम्बर 2024 के दौरान राजभाषा - कार्यान्वयन सम्बन्धी विभिन्न गतिविधियाँ

भा.कृ.अनु.प.-भारतीय सोयाबीन अनुसन्धान संस्थान, इंदौर में राजभाषा हिन्दी के प्रचार-प्रसार हेतु अनेकानेक कार्यक्रम किये जा रहे हैं। जिनका स्वरूप भारतीय सोयाबीन अनुसन्धान संस्थान में राजभाषा कार्यान्वयन के क्षेत्र में उत्तरोत्तर प्रगति के साथ दृष्टिगोचर होते हैं, जो राजभाषा के प्रगामी प्रयोग में अत्यंत सार्थक सिद्ध हो रहे हैं। इस क्षेत्र में किये जा रहे क्रिया कलापों का संक्षिप्त विवरण निम्नवत है:

**(क) राजभाषा नियम 1976 के नियम का अनुपालन :** संस्थान के अधिकारी एवं कर्मचारी शासकीय कार्यों हेतु राजभाषा नियम 1976 के उपनियम (1) तथा (4) के अनुसार लिखे जाने वाली टिप्पणियों एवं अन्य कार्य हिन्दी में करते हैं।

**(ख) राजभाषा कार्यान्वयन समिति की तिमाही बैठक :**

- प्रथम बैठक : 8 जनवरी 2024
- द्वितीय बैठक : 8 अप्रैल 2024
- तृतीय बैठक : 10 जुलाई 2024
- चतुर्थ बैठक : 15 अक्टूबर 2024

**(ग) हिन्दी कार्यशालाएं :** संस्थान के अधिकारियों एवं कर्मचारियों की हिन्दी में कार्य

करने के दौरान होने वाली समस्याओं के निराकरण हेतु संस्थान में हिन्दी कार्यशालाओं का आयोजन किया जाता है। इसके अतिरिक्त कार्यशालाओं के आयोजन का मुख्य ध्येय यह भी होता है कि हिन्दी का प्रयोग किस प्रकार सरल से सरलतम की ओर बढ़ाया जा सकता है। इसलिए प्रत्येक तिमाही में कम से कम एक हिन्दी कार्यशाला का आयोजन किया जा रहा है। ताकि संस्थान के सभी संवर्गों में हिन्दी में कार्य संपन्न करने के रुझान में उत्तरोत्तर प्रगति हो सके। इस उद्देश्य हेतु सम्बंधित विषयानुसार कार्यशालाएं संपन्न की जाती हैं।

क्र.	दिनांक	विषय	अतिथि वक्ता
1.	22 मार्च 2024	हिन्दी में वर्तनी की समस्या	श्री राकेश शर्मा जी, सम्पादक वीणा" इंदौर
2.	24 जुलाई, 2024	राजभाषा हिन्दी के विकास में अधिकारियों तथा कर्मचारियों का दायित्व	सुश्री नाजमा खान, वरिष्ठ अधीक्षक भारतीय विमानपत्तन प्राधिकरण, देवी अहिल्या बाई होलकर विमानतल, इंदौर
3.	24 सितम्बर, 2024	हिन्दी की वैश्विक सम्प्रभुता	श्री प्रभु त्रिवेदी, श्री मध्यभारत हिन्दी साहित्य समिति, इंदौर के कार्यकारिणी सदस्य व मध्यप्रदेश लेखक संघ, इंदौर इकाई के अध्यक्ष हैं।
4.	4 दिसम्बर, 2024	राष्ट्रीय भाषा हिन्दी की वर्तमान में उपयोगिता	मोहन लाल रावल, सेवानिवृत्त प्राध्यापक केन्द्रीय विद्यालय, इंदौर



**(घ) राजभाषा पत्रिका "सोयवृतिका" का प्रकाशन :** संस्थान की राजभाषा पत्रिका "सोयवृतिका"-2024, अंक-5 का प्रकाशन "कृषि उत्पाद व मूल्य संवर्धन" विशेषांक के रूप में किया गया है। जिसके प्रत्येक अध्याय में तकनीकी नवाचार, स्थिरता प्रथाओं, आर्थिक निहितार्थ और खाद्य उत्पादन के वैश्विक परिदृश्य जैसे विषयों पर आलेख प्रस्तुत किया गया है। सोयवृतिका के इस अंक के प्रकाशन से हमारा इरादा है कि यह पत्रिका अभ्यासकर्ताओं, छात्रों और कृषि के भविष्य में रुचि रखने वाले किसी भी व्यक्ति के लिए एक व्यापक संसाधन और प्रेरणा स्रोत के रूप में कार्य करे यह पत्रिका पाठकों को वैज्ञानिक पद्धतियों व हिंदी साहित्य एवं कला की ओर सकारात्मक प्रेरणा एवं उत्साह प्रदान करे

**(च ) राजभाषा तिमाही रिपोर्ट का प्रेषण :** संस्थान में राजभाषा हिन्दी से सम्बंधित समस्त कार्यों का विवरण तिमाही हिन्दी रिपोर्ट के माध्यम से सम्बंधित विभागों को ऑनलाइन प्रेषित किया जाता है एवं राजभाषा विभाग के वेबसाइट पर रिपोर्ट अपलोड भी किया जाता है। इस कार्य को धरातलीय रूप प्रदान करने में संस्थान के समस्त सम्बंधित अनुभाग का सक्रिय एवं सराहनीय योगदान होता है।



**(छ ) राजभाषा अधिनियम, 1963 की धारा 3(3) :** संस्थान में राजभाषा अधिनियम, 1963 की धारा 3(3) से सम्बंधित दस्तावेजों जैसे : सामान्य आदेश, अधिसूचनाएं, प्रेस-विज्ञप्ति, संविदा, लाइसेंस, परमिट, टेंडर के फार्म और नोटिस, संकल्प, नियम इत्यादि को ( हिन्दी और अंग्रेजी) द्विभाषी रूप में जारी करने हेतु पूर्ण प्रयास किया जा रहा है, ताकि राजभाषा सम्बंधित दिशा-निर्देशों का पालन सतत होता रहे।

**(ज) यूनिकोड की सुविधा :** संस्थान के अधिकारियों तथा कर्मचारी की हिन्दी में कार्य करने की रूचि में वृद्धि करने हेतु समस्त कंप्यूटर में हिन्दी यूनिकोड की व्यवस्था प्रदान की गई है, जिससे एक सामान फॉण्ट के माध्यम से पूरा संस्थान एक ही दिशा की ओर अग्रसित हो सके।

**(झ) हिन्दी पखवाड़ा प्रतिवेदन :** 17-30 सितंबर 2024 .कृ.अनु.प. - भारतीय सोयाबीन अनुसंधान संस्थान, इन्दौर में हिन्दी पखवाड़ा का आयोजन दिनांक 17-30 सितंबर 2024 में किया गया। हिन्दी पखवाड़ा 2024 का उद्घाटन समारोह दिनांक 17 सितम्बर 2024 को संस्थान के निदेशक एवं अध्यक्ष, राजभाषा कार्यान्वयन समिति डॉ. कुँवर हरेन्द्र सिंह, डॉ. पुनम कुचलान, प्रधान वैज्ञानिक एवं प्रभारी अधिकारी राजभाषा;

अनुभाग प्रभारी - फसल उत्पादन, डॉ. बी.यू. दुपारे, प्रधान वैज्ञानिक तथा अनुभाग प्रभारी - फसल संरक्षण, डॉ. एम.पी. शर्मा, प्रधान वैज्ञानिक एवं डॉ. अनीता रानी, प्रधान वैज्ञानिक की उपस्थिति में भा.कृ.अनु.प.- भारतीय सोयाबीन अनुसंधान संस्थान, प्रेम स्वरूप भटनागर व्याख्यान कक्ष में कार्यक्रम का शुभारम्भ किया गया। सबसे पहले संस्थान के निदेशक महोदय, डॉ. कुँवर हरेन्द्र सिंह का पुष्पगुच्छ से स्वागत अनुभाग प्रभारी - फसल संरक्षण, डॉ. एम.पी. शर्मा, प्रधान वैज्ञानिक द्वारा किया गया। डॉ. पुनम कुचलान, प्रभारी अधिकारी राजभाषा ने हिन्दी पखवाड़ा में होने वाले विभिन्न प्रतियोगिता कार्यक्रम की विस्तृत जानकारी प्रदान की। इस समारोह के दौरान संस्थान के निदेशक महोदय, डॉ. कुँवर हरेन्द्र सिंह ने राजभाषा के प्रगामी प्रयोग के साथ ही साथ अनुसंधान के प्रचार-प्रसार, संप्रेषण एवं मौलिक लेखन सहित शोध-पत्रों तथा तकनीकी लेखन का कार्य शत-प्रतिशत हिन्दी में करने हेतु कर्मचारियों एवं अधिकारियों को स्वयं समर्पण करने की प्रेरणा प्रदान की। संस्थान में हिन्दी के निरंतर प्रयोग एवं उसके प्रति समर्पण के द्वारा उसे अत्यधिक समृद्ध बनाने एवं दैनिक काम-काज में हिन्दी के प्रयोग करने पर बल दिया। हिन्दी पखवाड़ा 2024 के अंतर्गत हिन्दी कार्यशाला का भी आयोजन किया गया जिसमें मुख्य अतिथि श्री प्रभु त्रिवेदी, मध्यभारत हिन्दी साहित्य समिति, इंदौर के कार्यकारिणी सदस्य व मध्य प्रदेश लेखक संघ, इंदौर इकाई के अध्यक्ष थे। उन्होंने "हिन्दी की वैश्विक सम्प्रभुता" विषय व्याख्यान दिया।

हिन्दी पखवाड़ा – 2024 के दौरान आयोजित होने वाली विभिन्न प्रतियोगिताएँ।

- दिनांक 17 सितंबर 2024 को अपराह्न 03.00 बजे संस्थान के कुशल सहायक ग्रेड के कर्मचारियों हेतु हिन्दी में 'श्रुतिलेखन-प्रतियोगिता' का आयोजन किया गया, जिसका निर्णय श्रीमती ज्योति मीना, तकनीकी अधिकारी सुश्री सीमा चौहान, तकनीकी ने किया।
- दिनांक 18 सितम्बर 2024 को अपराह्न 04.00 बजे मौलिक हिन्दी स्लोगन प्रतियोगिता' (विषय - चंद्रयान भारत गौरव") का आयोजन किया गया इस प्रतियोगिता के निर्णायक डॉ. अनीता रानी, प्रधान वैज्ञानिक एवं श्री श्याम किशोर वर्मा, सहायक मुख्य तकनीकी अधिकारी थे।
- दिनांक 19 सितम्बर 2024 को अपराह्न 04.00 बजे को संस्थान के समस्त कर्मचारियों के लिए टिप्पण लेखन प्रतियोगिता' का आयोजन किया गया। इस प्रतियोगिता के निर्णायक श्री अविनाश कलंके, सहायक एवं श्री अनिल क्रस्को, सहायक थे।
- दिनांक 23 सितम्बर 2024 को संस्थान के समस्त कर्मचारियों के लिए हिन्दी में निबंध लेखन विषय: "द्वितीयक कृषि एवं मूल्य संवर्धन") प्रतियोगिता' का आयोजन किया गया। इस प्रतियोगिता के निर्णायक डॉ. बी.यू. दुपारे, अनुभाग प्रभारी - फसल उत्पादन एवं प्रधान वैज्ञानिक और डॉ. विनीत कुमार, प्रधान वैज्ञानिक थे।



- दिनांक 24 सितम्बर 2024 को संस्थान में हिंदी कार्यशाला का आयोजन किया गया जिसमें मुख्य अतिथि श्री प्रभु त्रिवेदी, मध्यभारत हिंदी साहित्य समिति, इंदौर के कार्यकारिणी सदस्य व मध्य प्रदेश लेखक संघ, इंदौर इकाई के अध्यक्ष थे।
- दिनांक 25 सितम्बर 2024 को अपराह्न 03.00 बजे संस्थान के समस्त कार्मिकों हेतु प्रोत्साहन योजना के आवेदन का मूल्यांकन किया गया, जिसके निर्णायक समिति के सदस्य डॉ. सविता कोल्हे, प्रधान वैज्ञानिक डॉ पुनम कुचलान, प्रधान वैज्ञानिक एवं प्रभारी अधिकारी (राजभाषा); एवं डॉ. राकेश वर्मा, वैज्ञानिक थे।
- दिनांक 26 सितम्बर 2024 को संस्थान के समस्त कर्मचारियों हेतु प्रस्तुतीकरण कुशलता (कृत्रिम बुद्धिमता की आधुनिक दुनिया में हिंदी भाषा का महत्त्व या कृत्रिम बुद्धिमता की आधुनिक दुनिया में हिंदी का भविष्य "एक कल्पना") के विषय पर प्रस्तुतीकरण प्रतियोगिता का आयोजन किया गया इस प्रतियोगिता के निर्णायक डॉ.मिलिंद रत्नापरखे, प्रधान वैज्ञानिक एवं डॉ.ज्ञानेश सातपुते, प्रधान वैज्ञानिक थे।
- दिनांक 30 सितम्बर 2024 को हिंदी पखवाड़ा कार्यक्रम का समापन एवं पुरस्कार वितरण



- समारोह संपन्न हुआ, जिसमें सभी पात्र प्रतिभागियों को पुरस्कार देकर सम्मानित किया गया तथा इस कार्यक्रम के सफल संचालन एवं समापन पर संस्थान के निदेशक
- डॉ कुँवर हरेन्द्र सिंह द्वारा सभी प्रतिभागियों को बधाई एवं शुभकामनाओं के साथ हिंदी में अधिक से अधिक कार्य करने का अनुरोध किया गया।
- हिन्दी पखवाड़ा – 2024 का 'पुरस्कार वितरण एवं समापन समारोह' कार्यक्रम दिनांक 30 सितम्बर 2024 को पूर्ण हर्षोल्लास के साथ आयोजित किया गया।
- कार्यक्रम की अध्यक्षता संस्थान के निदेशक डॉ कुँवर हरेन्द्र सिंह द्वारा किया गया।
- कार्यक्रम में स्वागत भाषण एवं हिन्दी पखवाड़ा 2024 का संक्षिप्त प्रतिवेदन डॉ. पुनम कुचलान, प्रधान वैज्ञानिक एवं प्रभारी अधिकारी राजभाषा द्वारा प्रस्तुत किया गया।
- संस्थान के निदेशक के कर-कमलों द्वारा समस्त विजेता प्रतिभागियों को पुरस्कार व प्रमाण-पत्र प्रदान किया गया। उन्होंने विजेता प्रतिभागियों का उत्साह-वर्धन करते हुए हिन्दी के प्रगामी विकास एवं कार्यों के प्रति अधिकारियों एवं कर्मचारियों की सराहना की। 'पुरस्कार वितरण एवं समापन समारोह' कार्यक्रम का संचालन श्री श्याम किशोर वर्मा, ने द्वारा किया गया।



### हिंदी पखवाड़ा 2024 की झलक





## IMPORTANT COMMITTEES

### Institute Management Committee

Rule	Name & Designation	Designation
66 (a) 1	The Director, ICAR-NSRI, Indore	Chairman
66 (a) 2	Shri M Selvendran, Commissioner & Director, Department of Agriculture, Bhopal  <u>Nominated - Dr. Rajendra Prasad Parmar, Assistant Director Directorate of Farmer Welfare and Agricultural Development, Madhya Pradesh</u>	Member
66 (a) 3	Commissioner & Director, Office of Commissioner of Agriculture, Pune, Maharashtra. <u>Nominated - Shri Pramod Shinde Dy.Dir EXT. Commissionerate of Agriculture Pune</u>	Member
66 (a) 4	Vice Chancellor, Rajmata Vijay Raje Sindhiya Krushi Vishwavidhyalya, Race Course Road, Gwalior- 474002 <u>Nominated Dr K N Pathak, Dean, College of Agriculture, Indore</u>	Member
66 (a) 5	1.Shri Rajkumar Patel(Virendra) Add: Village Suratlai Janpad Panchayat, District: Jabalpur (MP) 2.Shri Chanbasappa (Ajit) Baburao Nadagadalli Add: Kasaba Nool, Taluka- Gadniglaj,Dist- Kolhapur – 416551 (Maharashtra)	Member
66(a) 6	1. Dr O.P.Premi Principal Scientist (Agronomy) ICAR -Indian Institute of Soil and Water Conservation Research Centre, 3-A Madhya Marg 27 a Sect-227 Chandigarh-160019. 2. Dr. S. K. Jha, Principal Scientist (Oilseed & Pulses), Crop Science division, Room no. 422, ICAR, Krishi Bhawan, New Delhi -110001 3. Dr. Naveen Singh, Principal Scientist (Plant Breeding), Division of Genetics, ICAR -IARI, New Delhi -110 012 4. Dr. Yashvir Singh Shivay, Principal Scientist, Agronomy, Division of Agronomy, ICAR -IARI, New Delhi -110 012 5. Dr. K. C. Sharma, Principal Scientist & Head, ICAR -IARI, RS, Indore	Member
66 (a) 7	The Assistant Director General (O&P) Krishi Bhawan ICAR, New Delhi	Member
66 (a) 8	Sh M.K.Mulani, Sr.Finance and Accounts Officer , ICAR-IISS, Nabibagh, Berasia Road, Bhopal(M.P.)	Member
66 (a) 9	The Sr. Administrative Officer, ICAR -NSRI, Indore	Member Secretary

**Research Advisory Committee (w. e. f. 07.06.2023)**

Chairman	Dr. S. K. Datta, Former DDG (CS), ICAR & Former VC, Visva-Bharti, University, Santiniketan, West Bengal
Member	Dr. S. R. Bhat, Retired Principal Scientist & Professor, ICAR-National Institute for Plant Biotechnology, New Delhi
Member	Dr. Masood Ali, Former Director Indian Institute of Pulse Research (ICAR-IIPR), Kanpur, UP
Member	Dr. V. K. Baranwal, National Professor (Virology), Division of Plant Pathology, IARI, New Delhi
Member	Dr. Ashutosh Upadhyay, Professor, Department of Food Science & Technology, NIFTM Industrial Estate, Kundli, Sonapat, Haryana
Member	Dr K. H. Singh, Director, ICAR-National Soybean Research Institute, Indore 452001 (M.P.)
Member	Dr Sanjeev Gupta, ADG. (Oil Seeds & Pulses), ICAR, Krishi Bhawan, New Delhi
Member Secretary	Dr. Milind Ratnaparkhe, Principal Scientist (Microbiology) ICAR-National Soybean Research Institute, Khandwa Road, Indore

**Other Committees of Institute**

1.	<b>Official Language Implementation Committee</b> Director, ICAR-NSRI (Ex-officio Chairman) Dr Punam Kuchlan Shri I. R. Khan Sr. Administrative Officer Sr. Finance & Accounts Officer	2.	<b>Institute Technology Management Committee (ITMC)</b> Director, ICAR-NSRI (Chairman) Dr J.B. Singh, IARI RS, Indore Dr Anita Rani Dr Savita Kolhe Dr Punam Kuchlan, I/c PME Dr Giriraj Kumawat Dr M.P. Sharma, Member secretary (I/c ITMU)
3.	<b>Priority Setting Monitoring and Evaluation (PME) Cell</b> Dr Punam Kuchlan (Chairperson) Dr. Raghvendra Nargund Dr Sanjeev Kumar Shri I. R. Khan Dr Shivakumar M. (Member Secretary)	4.	<b>Purchase Advisory Committee (PAC)</b> Dr. A Ramesh (Chairman) Dr Raj Pal Meena Dr Prince Choyal Dr Shivakumar M. Finance & Accounts Officer Sr. Administrative Officer (Member Secretary)



5.	<b>Human Resource Development Committee</b> Dr Milind Ratnaparkhe (Chairman) Dr Savita Kolhe Mr. Hemant Maheshwari Dr S. K. Pandey	6.	<b>Consultancy Processing Cell (CPC)</b> Dr M.P. Sharma (Chairman) Dr Mrinal Kuchlan Dr Savita Kolhe Finance & Accts. Officer Sr. Administrative Officer Dr Raghvendra Nargund (Member Secretary)
7.	<b>Student Affairs Committee &amp; Higher Study Committee</b> Dr Sanjay Gupta (Chairman) Dr Gyanesh Kumar Satpute Mrs. Jyoti meena	8.	<b>Technology Transfer and Extension Activities Committee</b> Dr B.U. Dupare (Chairman) Dr Rakesh Kumar Verma Dr Lokesh Meena Dr Sanjeev Kumar Mr. S.K. Verma (Member Secretary)
9.	<b>Estate and Guest House Management Committee</b> Dr Gyanesh Kumar Satpute (Chairman) Mr. S. K. Verma Shri S. P. Singh (upto 23.07.2024) Sh. R.C. Shakya Ms. Jyoti Meena Ms. Priyanka Sawan, (Member Secretary)	10.	<b>Publication Committee (Annual Report/Newsletter)</b> Dr. B. U. Dupare (Chairman) Dr Punam Kuchlan Dr Shivakumar M. Dr Raghavendra Nargund Dr. Sanjeev Kumar
11.	<b>Library Advisory Committee</b> Dr. Anita Rani (Chairperson) Dr Punam Kuchlan Dr V. Nataraj Sr Administrative Officer Finance & Accounts Officer Shri R. N. Singh, (Member Secretary)	12.	<b>Foreign Deputation and Higher Study Committee</b> Dr Milind B. Ratnaparkhe (Chairman) Dr Savita Kolhe Dr Raghavendra Nargund Sr Administrative Officer, (Member Secretary)
13.	<b>Works Committee</b> Dr G. K. Satpute (Chairman) Dr Raghvendra Nargund (Co-Chairman) Dr Vangala Rajesh Finance & Accounts Officer Sr. Administrative Officer Mr. S.K. Verma, Estate Officer (Member Secretary)	14.	<b>Agriculture Knowledge Management Unit</b> Dr Savita Kolhe (Chairperson) Dr B.U. Dupare Mr. I. R. Khan
15.	<b>Women's Complaint Committee on Sexual Harassment</b> Dr Punam Kuchlan (Chairperson) Ms. Priyanka Sawan Ms Jyoti Meena Third Party Representative (To be nominated as & when required) Administrative Officer	16.	<b>House Allotment Committee</b> Dr Gyanesh K. Satpute (Chairman) Dr Giriraj Kumawat Dr Rakesh Kumar Verma Shri S.K. Verma, Estate officer Finance & Accounts Officer Sr. Administrative Officer (Member Secretary)
17.	<b>Centralized Public Grievance Cell and Monitoring Systems (CPG,CMS)</b> Dr Vineet Kumar, Chairman	18.	<b>Store Management Committee</b> Dr Nikhlesh Pandya Chairman Ms. Seema Chouhan



19.	<b>Liaison Officer (SC/ST/OBC)</b> Dr. Punam Kuchlan (SC/ST) Dr. Savita Kohle (OBC)	20.	<b>Security Cell</b> S. P. Singh (upto 23.07.2024) Mr Ashutosh (Chairman, wef. 23.07.2024) Mr. Rishap Kumar Shri R. C. Shakya, (Member Secretary)
21.	<b>Farm Management, Price Fixation , Farm item Disposal Committee</b> Dr M.K. Kuchlan (Chairman) Dr Rakesh Kumar Verma Store Officer Finance & Accts. Officer S Administrative Officer Dr V.P.S. Bundela, (Member Secretary)	22.	<b>Sport and Staff Welfare Committee</b> Dr. Rakesh Kumar Verma (Chairman) Sh. S. K. Verma Shri. R. C. Shakya Ms. Seema Chouhan Ms. Priyanka Sawan, (Member Secretary)
23.	<b>Swachh Bharat Abhiyaan Committee</b> Sr Administrative Officer (Chairman) Mrs. Jyoti Meena Dr. D.N. Baraskar Shri R. C. Shakaya Finance & Account Officer Shri S.K. Verma, Estate Officer (Member Secretary)	24.	<b>Press &amp; Media Committee</b> Dr B.U. Dupare (Chairman) Dr Savita Kohle Dr Rajpal Meena Shri S.K. Verma (Member Secretary)
25.	<b>Vehicle Management Committee</b> Dr G. K. Satpute (Chairman) Dr Lokesh Meena Dr Sanjay Kumar Pandey (Member Secretary)	26.	<b>Physical Verification and Condemnation Committee</b> Dr. M. P. Sharma (Chairman) Dr Raghavendra Nargund Mr. S. K. Verma Mr. O.P. Vishwakarma Store Officer Ms. Priyanka Sawan, AAO ( Member Secretary)
27.	<b>Tender Committee</b> Dr Savita Kolhe (Chairperson) Dr Prince Choyal Shri Hemant Maheshwari		<b>Local Purchase Committee</b> Dr Raj Pal Meena (Chairman) Dr Rakesh Kumar Verma Mr. R. C. Shakya Indenter Sr. Administrative Officer (Member Secretary)



## PERSONNEL

S. No.	Name	Designation
<b>Director and Scientific staff</b>		
1.	Dr Kunwar Harendra Singh	Director
2.	Dr Sanjay Gupta	Principal Scientist
3.	Dr Anita Rani	Principal Scientist
4.	Dr Mahaveer P. Sharma	Principal Scientist
5.	Dr Vineet Kumar	Principal Scientist
6.	Dr A. Ramesh	Principal Scientist
7.	Dr Buddheswar U. Dupare	Principal Scientist
8.	Dr Savita Kolhe	Principal Scientist
9.	Dr Punam Kuchlan	Principal Scientist
10.	Dr M.B. Ratnaparkhe	Principal Scientist
11.	Dr Raj Pal Meena	Principal Scientist (W.e.f 29.4.2024)
12.	Dr Gyanesh Kumar Satpute	Principal Scientist
13.	Dr Mrinal K. Kuchlan	Senior Scientist
14.	Dr Giriraj Kumawat	Senior Scientist
15.	Dr M. Shivakumar	Senior Scientist
16.	Mr. Ram Manohar Patel	Senior Scientist (On study leave) SG
17.	Ms. Neha Pandey	Scientist SS (On study leave)
18.	Dr V. Nataraj	Scientist SS
19.	Dr Rajesh Vangala	Scientist SS
20.	Dr Raghavendra Nargund	Scientist SS
21.	Dr Lokesh Kumar Meena	Scientist SS
22.	Dr Rakesh Kumar Verma	Scientist SS
23.	Dr Prince Choyal	Scientist
24.	Mr. Sanjeev Kumar	Scientist
25.	Mr. Hemant Maheshwari	Scientist
26.	Mr. Viraj Gangadhar Kamble	Scientist (On study leave)
<b>Administrative Staff</b>		
27.	Mr. Saurabh Meena	Senior Administrative Officer
28.	Mr Ashutosh	Finance & Accounts Officer (wef. 01.05.2024)
29.	Mr Somnath Mukharjee	AFAO (upto 19.07.2024)
30.	Mr. Ajay Shrivastava	AAO (upto 31.01.2024)
31.	Ms. Priyanka Sawan	AAO
32.	Mr. S.P. Singh	Private Secretary (upto 31.07.2024)
33.	Mr. Ravi Shanker Kumar	Assistant
34.	Mr. Avinash Kalanke	Assistant
35.	Mr. Anil Carrasco	Assistant
36.	Ms. Diksha	Assistant (wef. 4 <sup>th</sup> November 2024)
<b>Technical Staff</b>		
37.	Sh. Raghu Nath Singh	T-9 (CTO)
38.	Dr Nikhilesh Pandya	T-9 (CTO)
39.	Dr V.P.S. Bundela	T-9 (CTO)
40.	Mr. Sanjay K. Pandey	T-9 (CTO)
41.	Mr. Shyam K. Verma	T-6 (ACTO)
42.	Mr. Om P. Vishwakarma	T-5 (T.O.)
43.	Mr. Rakesh C. Shakya	T-5 (T.O.)
44.	Mr. Irfanur R. Khan	T-5 (T.O.)
45.	Mr. Francis Yunis Damasus	T-5 (T.O.)
46.	Ms. Jyoti Meena	T-4 (S.T.A.)
47.	Mr. Bilbar Singh	T-2 (Sr. Technician)
48.	Ms. Seema Chouhan	T-2 (Sr. Technician)

49.	Mr. Anurodh Jain	Technician Trainee
50.	Mr. Rishap Kumar	Technician Trainee
<b>Skilled Supporting Staff</b>		
51.	Mr. Sanjeev Mishra	Duplicating officer
52.	Mr. Nirbhay Singh	Skilled Supporting Staff (upto 31.03.2024)
53.	Mr. Balbir Singh	Skilled Supporting Staff
54.	Smt. Fulki Bai	Skilled Supporting Staff
55.	Smt. Raida Bai	Skilled Supporting Staff
56.	Shri Mangilal	Skilled Supporting Staff
57.	Smt. Kamli Bai	Skilled Supporting Staff
58.	Shri Deepak	Skilled Supporting Staff
59.	Smt. Chunki Bai	Skilled Supporting Staff
60.	Smt. Sagri Bai	Skilled Supporting Staff
61.	Smt. Sagar Bai	Skilled Supporting Staff
62.	Smt. Rekha Bai	Skilled Supporting Staff
63.	Smt. Meera Bai	Skilled Supporting Staff
64.	Smt. Parvati Bai	Skilled Supporting Staff
65.	Smt. Romu Bai	Skilled Supporting Staff
66.	Smt. Teju Bai	Skilled Supporting Staff
67.	Smt. Surja Bai	Skilled Supporting Staff
68.	Smt. Rumli Bai	Skilled Supporting Staff
69.	Smt. Sarita Bai	Skilled Supporting Staff
70.	Smt. Sangeeta Bai	Skilled Supporting Staff
71.	Smt. Heera Bai	Skilled Supporting Staff (upto 30.06.2024)
72.	Smt. Antar Bai	Skilled Supporting Staff
73.	Smt. Mangi Bai	Skilled Supporting Staff
74.	Smt. Naki Bai	Skilled Supporting Staff
75.	Smt. Santo Bai	Skilled Supporting Staff (upto 31.07.2024)

## Joining, Promotions, Transfer, Superannuation

### Joining

S. No.	Name	Post	Date of Joining
1.	Dr Raj Pal Meena	Principal Scientist (Agronomy)	29.04.2024
2.	Shri Ashutosh	Finance & Accounts Officer	01.05.2024
3.	Shri Anurodh Jain	Technical Trainee	22.04.2024
4.	Shri Rishap Kumar	Technical Trainee	23.04.2024
5.	Ms Diksha	Assistant	04.11.2024

### Promotion

Mrs. Jyoti Meena promoted to the post of Sr. Technical Assistant.

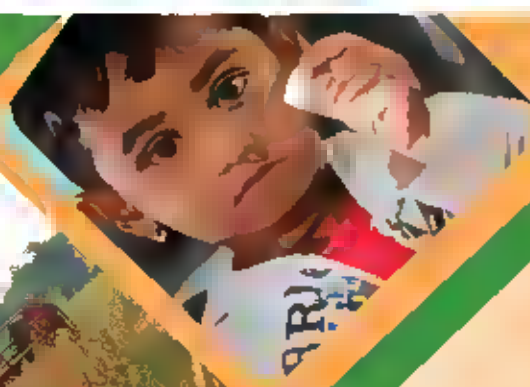
### Transfer

S.No.	Name of the employee	Post	Transferred to	Date of transfer
1	Shri Somnath Mukharjee	A.F.A.O.	ATARI, Kolkata	19 July 2024

### Superannuation

S.No.	Name of the employee	Post	Date of Retirement
1	Mr. Ajay Shrivastava	AAO	31.01.2024
2	Mr. S.P. Singh	Private Secretary	31.07.2024
3	Mr. Nirbhay Singh	Skilled Supporting Staff	31.03.2024
4	Smt. Heera Bai	Skilled Supporting Staff	30.06.2024
5	Smt. Santo Bai	Skilled Supporting Staff	31.07.2024

2024



# ANNUAL REPORT

भा.कृ.अनु.प -राष्ट्रीय सोयाबीन अनुसन्धान संस्थान  
खडवा रोड, इंदौर-452001

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Khandwa Road, Indore-452001

