ICAR IARI-Jharkhand

Volume 2, No. 1 | NEWSLETTER | January 2022-December 2022

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Dr. Himanshu Pathak, joined as Secretary (DARE) & Director General (ICAR)

The Indian Council of Agricultural Research (ICAR) has, Dr Himanshu Pathak as its new Secretary, Department of Agriculture Research and Education (DARE) cum Director General (DG), ICAR. Dr Pathak took over the charge on 1st August 2022. Dr. Himanshu Pathak was serving as the Director, ICAR-National Institute of Abiotic Stress Management, Baramati, Maharashtra before which he was the Director of ICAR-NRRI, Cuttack, Odisa. He is a scientist of global repute working in the area of Abiotic stress, Climate change and Soil science. He has worked as a visiting scientist in the University of Essex, United Kingdom; International Rice Research Institute (IRRI), Philippines; CSIRO Land and Water, Australia and Institute of Meteorology and Climate Research, Germany. During 2007-2009, he worked as the Co-Facilitator, Rice-Wheat Consortium (RWC), IRRI-India, New Delhi. He was the Lead Author of an 5th Assessment Report, Inter-Governmental Panel on Climate Change (IPCC). Currently he is the Coordinator of DARE/ICAR for the climate negotiations in the United Nation Framework Convention on Climate Change. Dr. Pathak is Fellow of the Indian National Science Academy (FNSA), National Academy of Agricultural Sciences (FNAAS) and West Bengal Academy of Science and Technology (FWAST). He is the recipient of the Alexander von Humboldt Fellowship (FAvH) of Germany, Dr. BC Deb Memorial Award of the Indian Science Congress Association (ISCA), Golden Jubilee Commemoration Young Scientist Award of the Indian Society of Soil Science, BOYSCAST Fellowship of Department of Science and Technology, Govt. of India, Young Scientist Award and Prof. SK Mukherjee Commemoration Award of ISCA. He was the President of Agriculture and Forestry Sciences Section of Indian Science Congress. Currently, he is the Editor-in-Chief, Current Advances in Agricultural Sciences, Editor, Greenhouse gases: Science and Technology and Editor, Indian Journal of Agronomy. He has published more than 200 research papers and 10 books and has h-index of 41, i10-index of 85 with more than 5500 citations in international literature.

From the Directors Desk...

I am delighted to present the second edition of our newsletter, which highlights the latest research achievements and outreach activities of the ICAR-IARI Jharkhand. Our major research highlights include screening of maize inbred lines under acidic soil condition , evaluation of papaya genotypes under Jharkhand condition, study of phosphorus use efficiency in Wheat, functional characterization of flowering repressor gene homolog for determinate flowering pattern in pigeon pea (*Cajanus cajan*), Anjan (*Cenchrus ciliaris*)- a potential grass for pasture development in semi-arid regions of Jharkhand, productivity of rice-wheat system under biochar amended soil, effect of row arrangements in maize based intercropping system on productivity and profitability in Eastern India, experiments on natural farming, mapping of natural resources of IARIJ, influence of rhizobacterial inoculant and lime application on plant growth and yield of chickpea under different irrigation regimes in acidic soils, effect of planting density and nitrogen management on hybrid maize (*Zea mays*) in Eastern India, effect of Nano-Urea spray with different percent level of RDN on Maize productivity in Rainfed soil of Eastern India, GIS and GPS based soil fertility mapping of Agriculture Research Farm, ICAR-IARI Jharkhand, nitrogen management in wheat (*Triticum aestivum* L.) for acid soils of Jharkhand, greenhouse and ammonia gas emissions from cattle manure management systems, soil carbon, nitrogen pools and GHG emission under different land use systems.

Seed is a critical input in agriculture. We believe that access to high-quality seeds is essential for the success of any farming venture, and we are committed to providing farmers with the resources they need to thrive. Hence, the institute has distributed a variety of crop seeds to the tribal and scheduled caste farmers of Jharkhand. We have also made great strides in capacity building, training extension personnel and farmers through training programs and visits. Institute has also organized various events such as World Soil Day, Hindi Rajbhasa Diwas, and International Yoga Day during this period. Institute operates its PG course in 14 discipline and 32 students have been admitted for M.Sc. Agriculture and M.Tech.

Lastly, I would like to congratulate our scientists and staff for their hard work and dedication in bringing out this newsletter. I am confident that the information presented in this newsletter will be useful to farmers and stakeholders.

Research Highlights

Crop Sciences

Papaya gene pool collected from Hot spot area

Papaya gene pool is spread in few hot spot regions of Jharkhand dominated by missionaries in district of Simdega, Saraikela, Karsanwa, Khunthi and West Singhbhum. These areas have been identified for papaya grown in natural form mainly in back yard gardens by the tribal. Different shape, size, and color of fruits have been noticed with enormous variability in plant characteristics. Team of scientists made fine grid survey of Bandgaon, Murhu, Karra, Khunt pani area and identified 28 various types of papaya. Fruits were collected and in situ plant observations were recorded. The shape of fruit varied as round, oblong, oblong ellipsoid, elongate, club, pear shaped, lengthened cylindrical, and deformed too depicting the diversity among the collected materials (Fig.1). The weight of the single fruits varied from 0.76 kg to 3.9 kg whereas the TSS ranged from 10^0 to 15^0 brix. The data on parameters like fruit length, fruit width, fruit girth, fruit skin color, fruit flesh color, stalk end shape of the fruit, seed color, fruit skin texture, shape of central cavity of the fruit, thickness of fruit skin, flesh aroma, flesh density, eating quality, number of seeds and pulp thickness have also been recorded. The plants in situ observation were from medium small to multi-branched tall. The seeds from these fruits have been extracted and seedlings are being raised in the nursery for large scale evaluation of single fruit progeny. The block for papaya has been identified and lay out has been developed. Planting will be done in this season.

Fig.1: Collected Papaya from Hot spot area

(Vishal Nath, Santosh Kumar, Krishna Prakash)

Evaluation of Papaya genotypes

The progeny raised from JHP-4, JHP-5, JHP-6 along with 14 other materials (Fig-2) collected from different locations of Jharkhand during 2021 were planted in a marginal plot in nursery area. Initial growth of plants has been recorded which depicted considerable variability. The data on the strength of the plants

Fig.2: Evaluation of Papaya genotypes

were recorded 25 days after transplanting and it varied from small and poor stem strength to tall and good stem strength of the plants. During flowering stage, it was observed that all the strengthened plants recorded earlier were male plants while the poor and medium strengthened plants were female or hermaphrodite type. The data on the days to 50% flowering were recorded and it ranged between 82 days to 113 days after transplanting. The crop is in fruiting stage and data on yield and other parameters will be recorded during fruit maturity stage.

(Vishal Nath, Santosh Kumar, Krishna Prakash)

QPM+ provit A. enriched composite variety development

For the development of QPM+ provit A enriched composite variety, a half-diallel cross was made between ten elite QPM+ provit. A enriched inbred lines procured from ICAR-IARI, New Delhi (Rabi 2020-21). The 45 F1s were raised during Kharif 2021 and again bulk pollination was made to set the seeds. During Rabi 2021-22, open pollination was used to raise the S1 generation. It has been advanced to the next generation through open pollination in isolation during Kharif 2022. The selfed seeds of the selected 120 plants have been sent for evaluation for the presence of CrtB1 gene. The half of the seeds have been kept for further sowing after getting the confirmation of the presence of CrtB1 gene. These plants after have to be sown during spring 2023 for further evaluation and maintenance under open pollination in isolation.

(Santosh kumar, Preeti Singh)

Establishment of mother plants

Mother plants are key for any nursery operations. The institute has developed a mother blocks of various fruit crops in an area of approx. 6 Ha land as per the approved plan. Plant saplings of promising varieties/hybrids of various fruit crops have been collected from their place of development/authenticated nurseries. All together more than 700 fruit plants have been planted in mother block which are mainly suitable for the Eastern region of the country (Table 1).

Table 1 : Mother plant strength of ICAR-IARIJ

Sl No.	Fruits	No. of Varieties & Hybrids
1	Mango	15
2.	Litchi	8
3.	Guava	6
4.	Jackfruit	5
5.	Ber	8
6.	Bael	6
7.	Aonla	4
8.	Citrus	6
9.	Custard apple	3
10.	Jamun	3
11.	Avocado	2
12.	Minor and underexploited fruits	30

(Vishal Nath, Krishna Prakash, Dipak Kumar Gupta, Pankaj Kumar Sinha)

Genetic diversity analysis in Okra

Owing to the realized potential and significant area of okra in the country, hybridization-based breeding strategy is being followed to break the yield barriers and development of virus resistance improved varieties suitable for different geographic locations. A research programme on heterosis breeding in okra is formulated and 60 germplasm of *Abelmoschus* sp. is collected from various parts of the country including 20 genotypes from ICAR-IARI New Delhi for its performance evaluation in the Eastern plateau region of India (Fig.3). Morphological, qualitative and molecular data is being recorded for genetic diversity analysis in okra. Based on the field performance and previous reports, 15 identified parental lines were selected for crossing in Line x Tester mating design (15 x 3) and 45 successful crosses were made with sufficient quantity of seeds. Selfing was also conducted to obtain true parental seeds. The crosses will be evaluated in the next growing season for morphological, qualitative, YVMV disease resistance and yield related traits in the Chhotanagpur plateau region.

Fig.3: Field view of Okra experiment

(Krishna Prakash, Vasavi Devi, Vishal Nath)

Evaluation of Basella genotypes

A preliminary evaluation was conducted with 18 genotypes of Basella (Poi or Malabar Spinach) which includes both green as well as red colour types. The genotypes include collection of 12 genotypes from ICAR- Indian Institute of Vegetable Research, Varanasi and 6 local genotypes collected from the farmer's field (Fig.4). Morphological and yield related data is being recorded for various traits like plant spread, stem colour, stem diameter, number of leaf/ plant, leaf length, leaf width, leaf weight, leaf colour, petiole length, petiole diameter, number of flower/inflorescence, flower length, fruit diameter, yield/ plant etc.

Fig.4: Field view of Basella evaluation

(Krishna Prakash, Vishal Nath)

Dolichas bean collection and evaluation of genotype

Enormous variability of sem (Indian bean, Dolichos bean) exist in Eastern and Southern India in terms of fruit shape, size, colour, number of fruits per bunch, flower and leaf characteristics and yield. There are many local types grown in different pockets of Jharkhand. Despite having many horticultural and nutritional importance of the crop, it has remained unexploited owing to low productivity, long crop duration, photosensitivity and indeterminate growth habit. With an objective of tapping the enormous potential of the crop, promising germplasm of sem have been collected from the farmer's field of Hazaribagh, Ramgarh and Ranchi districts of Jharkhand during the fruiting season of the 2020. A total of 30 genotypes have been collected and a set of 11 genotypes have also been procured from ICAR- Indian Institute of Vegetable Research, Varanasi including three released cultivars. All the genotypes were grown in the field for preliminary evaluation and seed multiplication.

(Krishna Prakash, Vishal Nath, Dipak Kumar Gupta)

Germplasm Management in Horticultural crops

Horticultural crop improvement programmes as well as continuous production system is dependent upon collection and optimization of locally available diverse genetic resources to identify suitable genotypes to obtain uniform, high quality products as per the changing environmental constraints and emerging market demands. During the last two years we have collected cultivated and wild species germplasm of various fruits, vegetables, spices, medicinal and aromatic plants from Jharkhand and adjoining states. (Table 2)

Table - 2: Collected germplasm of horticultural crops

Crop species	Germplasm collection
Mango	4
Jackfruit	4
Guava	2
Bael	2
Papaya	4
Jamun	2
Ber	2
Grapes	1
Custard Apple	2
Avocado	2
Dragon fruit	2
Moringa	2
Bhindi	10
Malabar Spinach	4
Sem	18
Gourds	12
Solanaceous crops	10
Spices	4
Medicinal & Aromatic Plants	6

(Vishal Nath, Krishna Prakash, Dipak Kumar Gupta, Pankaj Kumar Sinha)

Evaluation of maize hybrids under Jharkhand condition

The bio-fortified maize genotypes (621) including the hybrids for normal as well as the speciality corn sent by ICAR-IARI, New Delhi have been evaluated for their yield performance under Jharkhand condition and the data have been submitted for the statistical analysis. The selfed seeds have also been sent for the biochemical study. The biofortified maize hybrids (31) developed by ICAR-IIMR, Ludhiana were tested under Jharkhand condition for their yield performance and data have been submitted for further statistical analysis. The selfed seeds have also been sent for the biochemical study.

The inbred lines were also crossed with three elite inbred lines BML 6, UMI1200 and LM13 in L X T fashion during Rabi 2020-21 and the 75 F1s were evaluated during Kharif-2021. The same hybrids were also evaluated during Kharif 2022 under the acidic soil condition and result obtained revealed that the four cross combinations identified superior during Kharif 2021 were also performing better than the check during Kharif 2022 too. The seed of these crosses will be produced in the next generation and will be submitted for evaluation in the AICRP trial. **(Santosh Kumar, Preeti Singh)**

Procurement and development of maize inbred lines

As results of active participation in field day during March, 2022 at WNC (ICAR-IIMR) and IMIC, Hyderabad, procurement of 200 inbred lines having drought tolerance and drought+heat tolerance. A total of 93 elite maize inbred lines have been received from the ICAR-IIMR, Ludhiana and 101 maize inbred lines with different abiotic stress tolerance traits have been received from the CIMMYT India, Hyderabad. All these lines are being multiplied during the Rabi 2022-23. In order to develop new inbred lines, the selection was made from the F_2 materials generated (Rabi 2021-22) from selfing of the materials received from the NBPGR, New Delhi, private sector hybrids and few locally collected landraces and these materials were selfed again to advance it to F_3 generation (Kharif 2022) and the F_4 generation obtained through selfing from the previous generation will be raised during spring 2023 for generation advancement and again selfing among the almost fixed elite genotypes.

(Santosh Kumar, Preeti Singh, Priya Ranjan Kumar)

Multi-location testing of maize hybrids in Jharkhand

Nine maize hybrids (normal as well as QPM) performing superior to the check during Kharif 2021 at ICAR-IARI, Jharkhand have been evaluated for their yield performance at five locations in Jharkhand i.e. Hazaribagh, Ranchi, Dumka, East Singhbhum and Palamu during Kharif 2022. The data obtained will be statistically analysed and it will be again evaluated during Kharif 2023 for its yield performance and other traits. These hybrids have already been tested up to the advance stage of AICRP trials. The proposal for the state release of hybrids performing better under Jharkhand state will be submitted after the second year of evaluation.

(Santosh Kumar, Preeti Singh, Vishal Nath)

Screening of maize inbred lines under acidic soil condition

The 58 inbred lines received earlier from SKUAST, Kashmir; ICAR-IIMR, Ludhiana and CIMMYT India, Hyderabad have been maintained and evaluated under the soil condition of normal and low pH. The data have been analyzed, and as per the scoring of performance of the lines, out of 58 lines, 11 lines were found to be performing well in soil with a low pH and 28 lines were also performing well with moderate effect of soil acidity. These lines have to be evaluated again for their performance in field as well as hydroponic conditions to confirm the result, and the biochemical analysis has to be done (Fig-5). These lines have also been sown in normal soil conditions with a normal pH at ICAR-IARI, Regional station, Pusa, Samastipur during Rabi 2022-23 and the data obtained will be statistically analyzed.

(Santosh Kumar, Preeti Singh)

Fig.5 : Evaluation of maize hybrids and inbred lines under acid soilat ICAR-IARI, Jharkhand

AICRP Maize trial

ICAR-IARI, Jharkhand as the voluntary center of AICRP-Maize successfully conducted four AVT trials during Kharif-2022. Data recorded from the trials were submitted to the nodal institute (ICAR-IIMR, Ludhiana) of AICRP-Maize and as per the data, the trails have been appreciated and data have been included in AICRP maize Kharif report-2022.

(Santosh Kumar, Preeti Singh)

Hybrid seed production of Pusa HQPM 5 Improved under NABARD funded project

Hybrid seed of Pusa HQPM5 improved have been produced at ICAR-IARI, Jharkhand under NABARD funded project and the parental lines of hybrid have also been multiplied. The hybrid has high lysine and tryptophan content in addition to the high proVitA. Content. The hybrid is being popularized among the farmers to adopt it for farming to improve the nutritional security and better health. Demonstration of the hybrid had been conducted on the farmers' field during Kharif 2022 under NABARD funded project and the farmers were highly satisfied with the performance of the hybrid as yield was superior to the other varieties grown by them. The hybrid seed is again being produced during Rabi 2022-23 and the demonstration will again be conducted during Kharif 2023 to convince the farmers regarding its yield performance.

(Santosh Kumar, Preeti Singh, Vishal Nath)

Station trial of mustard

Exploratory trial on mustard is going on at ICAR-IARI, Jharkhand. Mustard station trial of 89 elite advanced lines along with 45 elite lines (evaluated during 2021-22) along with four checks were conducted during 2022-23. The data has been recorded for the traits days to 50% flowering, days to 50% maturity, plant height, number of primary branches, number of secondary branches, number of siliqua, siliqua length and grain yield. The selected F3 generation from the eight F_2 materials procured from ICAR-IARI, New Delhi were also advanced during 2022-23. The selections have been made from them and the seeds have been harvested from the selected lines for generation advancement. Along with the station trial, 10 local materials collected from Jharkhand and west Bengal during 2021 were also evaluated for the second season during 2022-23. The F_2 & F_3 generations respectively from the crosses made between some good performing lines during 2020-21 & 2021-22 were also evaluated and selections were made among them and seeds from the selected plants have been harvested for generation advancement.

(Santosh Kumar, Preeti Singh)

Phosphorus Use Efficiency in Wheat

An experiment has been conducted on "Phosphorus use efficiency" of Wheat (*Rabi*-2021) at ICAR-IARI, Jharkhand experimental field. The soil samples were first collected and available phosphorus levels were analyzed. Based on the soil parameters obtained, initially, 20 genotypes were screened for high phosphorus content both at field and lab. The important parameters studied were grain and straw P content, total P uptake, yield attributes etc.

(Asha Kumari, Priyaranjan Kumar, Monu Kumar)

Functional characterization of flowering repressor gene homolog for determinate flowering pattern in pigeon pea (*Cajanus cajan*)

A study on a pigeon pea flowering repressor gene (from PEPB family) characterization through over-expression in tobacco using constitutive promoter along with down-regulation through RNAi (RNA Interference) based silencing in pigeon pea is going on. During 2022, over-expression construct was made and confirmed by sequencing. Overexpressing tobacco lines (T_0; around 20 one-step PCR-positive transgenic events were selected and each one having 6-8 plants) are growing at Net House, IARI, New Delhi for further phenotypic evaluation and downstream molecular analysis. In case of Pigeon pea, a detail gene expression profiling of 12 flowering related genes had been carried out to understand the co-expression pattern of major reported floral homologous regulators. Besides, RNAi mediated silencing of the above mentioned gene was carried out in pigeon pea through both *In-Planta* as well as tissue culture based plant transformation method using pBI121 as binary vector under antibiotic based selection. In-planta T0 plants (~70) are standing at net house. A detail In-silico analysis was also executed for characterizing the protein of the candidate gene along with cis-element identification. To investigate whether any sequence variability exists or not among determinant (DT) and indeterminate (IDT) genotypes, a total of 10 genotypes were sampled, cloned and sequenced which reflected the conserveness of the translated protein sequences though genic sequences has dissimilarities. Moreover, a sub-cellular localization study was also performed through preparing construct of candidate gene-GFP (pCAMBIA 1302) and candidate gene-GUS (pCAMBIA 2301) respectively using transient expression on *N. bethamiana* and transgenic *N. tabaccum* (wild) genotypes.

(Sougata Bhattarcharjee)

Animal Sciences

Anjan (*Cenchrus ciliaris*)- a potential grass for pasture development in semi-arid regions of Jharkhand

Anjan *(Cenchrus ciliaris)* grass also known as Buffel grass or African Foxtail, is a native of tropical and subtropical Africa, India and Indonesia. It is widespread in arid hot, drier areas of the world and used as cultivated or rangeland pasture. In India, it is considered excellent for pasture as highly nutritious grass and is widely distributed in hotter and drier parts in grasslands. It is found as a natural grass in *Dichanthium-Cenchrus-Elyonurus* cover between 23° N and 32° N latitude and 60° E and 80° E longitude. It is distributed from sea level to 2000 m altitude. Anjan grass is largely apomictic with occasional facultative sexuality. Plants can be propagated vegetatively. This species represents three ploidy (diploid, tetraploid, hexaploid) levels and two life spans (annual/ perennial). It was observed that perennial tetraploid and hexaploid are more suited to drought conditions in comparison to annual diploid. Indeed, it is drought resistant, a good soil binder and can also grow very well under irrigation. It utilizes C_4 photosynthetic pathway, which provides an advantage under hot and dry growing conditions. It produces 15 to 40 tons of green biomass per hectare, which is rich in protein (7-11% crude protein).

The total geographical area of Jharkhand state is 79714 sq. km, which includes around 25% grazing lands and waste lands. These lands can be converted into good pasture lands or grass lands with proper exploitation of perennial grass species like *Cenchrus ciliaris*, which can support a good number of livestock. Jharkhand state possesses 23.61 million heads of livestock and they need proper feeding and nutrition to contribute substantially in milk and meat production at national level. Studies conducted at ICAR-IARI, Jharkhand indicated that *Cenchrus ciliaris* can be grown and exploited for good biomass production.

(S.K. Mahanta, Shilpi Kerketta, Manoj Chaudhary and Pankaj Kumar Sinha)

Forage yield performance of Bajra x Napier hybrid fodder variety in Jharkhand

Bajra x Napier hybrid are perennial fodder variety suitable for different agro climatic conditions. The fodder variety is best suited for round the year forage system for Jharkhand. It possesses more tillers and leaves than Napier grass and is more vigorous and higher in fodder yield and quality. For one hectare area 40,000 slips are required to plant. Different varieties of Bajra Napier hybrid i.e, Kamdhenu, Co1, Co5, IGFRI-10 were cultivated in a 5x10 m area for each variety. Row to row spacing of 1 m and plant to plant spacing of 50 cm maintained for all varieties. First harvest was done on 75 to 80 days after planting and subsequent harvests at intervals of 45 – 60 days. Till date 6 cuts have been taken but fodder crop was not harvested during winter months due to lesser growth when compared to other season. The green fodder weight after harvesting for each variety was recorded and dry sample of each cut for each variety was stored for further analysis.

(Shilpi Kerketta, S.K.Mahanta, Manoj Chaudhary and Pankaj Kumar Sinha)

Multiplication of different fodder cowpea (Vigna unguiculata) variety in acidic soil condition of Jharkhand

Fodder cowpea is an annual crop predominantly grown under rain fed conditions. The foliage, green pods, immature seeds and flowers are fed to animals. The fodder is rich in proteins and other nutrients like fat, carbohydrates, calcium and iron making it excellent forage. Cultivation practice of fodder cowpea varieties i.e, UPC-9202, UPC-628, UPC-622, Kohinoor, MFC-08-14, MFC-09-1, Bundel Lobia and Bundel Lobia-2 was done at 10x10 m plot for each variety with spacing of 30 cm row to row and 10 cm plant to plant. Vigna unguiculata is harvested at 60-80 days after sowing for green foliage but here it was mainly cultivated for seed production so it was harvested after 60-80 days until the pods become dry for seed collection. Vigna unguiculata can be cultivated as fodder to meet the nutritional demand of livestock and to narrow the gap of demand and supply of green fodder in Jharkhand.

(Shilpi Kerketta, S.K. Mahanta, Manoj Chaudhary and Pankaj Kumar Sinha)

Natural Resource Management

Productivity of rice-wheat system under biochar amended soil

The second year experiment on biochar was conducted during 2021-22 to evaluate the impact of rice straw derived biochar on productivity of rice-wheat system in acidic soil (Fig-6), the highest grain yield was obtained under biochar amended soil followed by treatments with recommended dose of fertilizer and farmer's practices. The obtained highest wheat (PBW 154) yield was about 2572±20 kg/ha under treatment with biochar@10 t/ha + recommended dose of NPK while under treatment with recommended dose of NPK without biochar, the yield was 1512±22 kg/ha. The yield of rice crop (Arize 6444 Gold) was evaluated under various water regime condition i.e. continuously flooded rice (CFR), intermittent wetting and drying (IWD) and rain fed condition (RF). Rice yield was found slightly higher (3950-5800 kg/ha) under biochar amended soil as compared to recommended practices (3200-4700 kg/ha) under all the three water regime conditions. Among water regime conditions, highest rice yield was obtained under flooded treatment followed by IWD (intermittent wetting and drying) and rainfed treatments.

(Dipak Kumar Gupta and Arti Bhatia)

Fig.6: Biochar applied wheat field

Row arrangements in maize based intercropping system on productivity and profitability

A field experiment entitled, "Effect of row arrangements in maize based intercropping system on productivity and profitability in Eastern India" was conducted at the research farm of ICAR-Indian Agricultural Research Institute, Jharkhand during *kharif* season (2022-23).The experiment was designed with treatments namely, T_1- pure stand of Maize, T_2- pure stand of Green gram, T_3- pure stand of Cowpea, T_4- Maize + Green gram (Additive stand),T_5- Maize + Green gram (Replacement stand-I),T_6- Maize + Green gram (Replacement stand-II),T_7- Maize + Cowpea (Additive stand),T_8- Maize + Cowpea (Replacement stand-I) and T_9- Maize + Cowpea (Replacement stand-II).

Results showed that grain yields at pure stand of maize, green gram and cowpea were 7.03 t/ha, 1.84 t/ha and 1.25 t/ha respectively; while, the system productivity in terms of maize equivalent yield was maximum of 10.70 t/ha at the 'Additive stand of maize + cowpea' (T_7) followed by 'Additive stand of maize + green gram'(T_4) (10.63 t/ha). Performance of intercrops at different cropping geometries showed maximum yield benefit at the 'Replacement stand-II stands accounting 1.85 t/ha of cowpea (T_9) followed by 1.58 t/ha of green gram (T_6). Therefore, the study could suggest intercropping maize with cowpea at 'Additive stand' of cropping geometry for higher system productivity at the Eastern India.

(K. Inuganti, A. Ghosh, R. K. Singh, D. Mohanta, Preeti Singh and K. Aditya).

Natural farming

Natural farming block comprising of about 2.3 hectares of land for conducting various natural farming experiments has been demarcated in Block B (Fig-7). The layout and measurement of the plots has been completed. The evaluation of varietal performance of Wheat, Chick Pea and Mustard under natural farming practices has been started during Rabi season 2022. Beejamrit, Ghanjeevamrit and Jeevamarit were prepared at IARIJ for their application in Rabi season experiment

1. Demarcated area	2. Jeevamrit	3. Field view of varietal trial experiment

Fig.7: Natural Farming Block (1) and activities (2,3).

(Dipak Kumar Gupta, Vishal Nath, Krishna Prakash, Anima Mahato, Manoj Chaudhary, Himani Priya, Pankaj Kumar Sinha, Shilpi Kerketta and Shannon N Sangma)

Mapping of natural resources of IARIJ

A shape file for delineating IARIJ farm boundary has been developed using QGIS and its administrative boundary for the preparation land resource map. The google earth Map of IARIJ for the year 2019 and 2022 has been developed. The map of IARIJ with administrative plot/khasara numbers, electricity line,

water ponds and channels and various blocks has been developed. The map of proposed road and existing electricity line has been developed. The soil profile study of Block A, B and E has been started. The width of each horizon have been recorded and soil sample has been collected (Fig-8). A preliminary survey was done in Block F1 to identify existing tree and shrub diversity and demarcation of land for Arboretum (Fig-9).

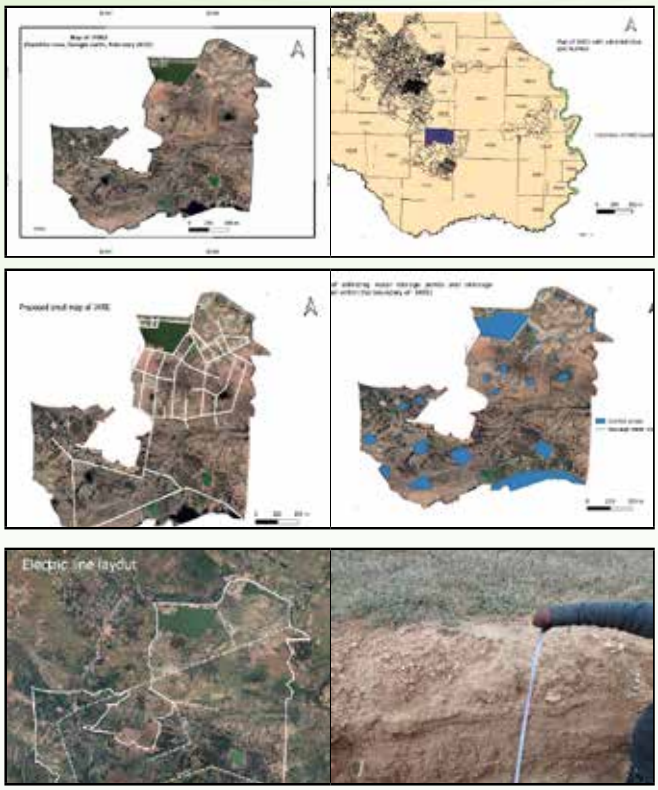


Fig.8: Farm area outline map and soil profile of block A

Fig.9: Identification and shaping of tree and shrub diversity

(Dipak Kumar Gupta, Vishal Nath, Manoj Chaudhary, Preeti Singh, Krishna Prakash, Pankaj Kumar Sinha and Shilpi Kerketa)

Vermicomposting experiment

A small scale vermi-composting unit has been set up at IARIJ for student research trial and composting of institute generated crop residues (Fig.10). The chopped rice straw mixed with cow dung (4:1 ratio) was successfully vermicomposted using *Eisenia foetida.* After vermicomposting of chopped rice straw, the body weight of adult *Eisenia foetida* varied from 28.5-32.6 g/100 worms.

Fig.10: Vermicompost preparation

Influence of rhizobacterial inoculant and lime application on plant growth and yield of chickpea under different irrigation regimes in acidic soils

Climate change prediction indicates an increased likelihood of precipitation variability and droughts. Drought stress is most important yield limiting factor for crops in eastern India. Chickpea is the most important pulse crop of India occupying an area of 46% of total pulses area. It is comparatively a hardy crop but water deficit has significant consequences on the growth, development and yield of chickpea. Previous studies demonstrated that microbial symbionts combined with supplementary irrigation along with lime application could mitigate climate change effects and boost chickpea production in low-fertile acidic soils. Therefore, the aim of the study was to assess the effects of selected rhizobacterial (*MKS 6*) inoculation with and without lime application on growth, yield and protein content of chickpeas grown in acidic soil (pH 5.7) in combination with three levels of irrigations (1 irrigation; 2 irrigations; 3 irrigations) conditions. Inoculation has considerably improved the plant pigments and other biochemical parameters proline, ascorbic acid, phenols, total sugars and soluble proteins content. No. of branches and pods per plant no. of seeds per pod, test weight and grain yield were recorded higher in inoculated treatments

Fig.11: Schematic illustration of the experiment

over the control. Inoculation had a positive effect on plant growth and yield attributes. Higher levels of irrigations (3 irrigations) along with lime application showed positive effect on biomass and grain yields (Fig.11).

(Himani Priya, Ranjit Singh, Manoj Chaudhary, Priya Ranjan Kumar)

Effect of planting density and nitrogen management on hybrid maize (*Zea mays*) in Eastern India

The study was conducted to optimize planting density and nutrient management in hybrid maize for yield maximization towards improved profitability and resource use efficiency in Eastern India. A field experiment entitled, "Effect of planting density and nitrogen management on hybrid maize (*Zea mays*) in Eastern India" was conducted at the research farm of ICAR-IARI, Jharkhand during Kharif season (2022-23). The field experiment was laid-out in split-plot design in fixed layout with 15 treatment comprising 3 combination of planting density(7.4, 6.7 and 5.9 plants/m²) and 5 combination of nitrogen management(Control (only P and K),Farmers practice, RDN-conventional (Band placement of 33% N as basal + 33% N surface band placement along crop rows at V_6 stage in maize + 33% N surface band placement along crop rows at tasseling stage.), 75%-RDN-improved(Band placement of 30% N as basal + 40% N sub-surface band placement along crop rows in maize (at V_6 stage+ 30% N surface band placement along crop rows at tasseling stage), RDN-improved**(** Band placement of 30% N as basal + 40% N sub-surface band placement along crop rows in maize (at V_6 stage) + 30% N surface band placement along crop rows at tasseling stage)]. The planting of hybrid maize with 67 thousand plants per ha with improved N placement (application of first split of N at knee high stage as sub surface banding) gave significantly higher yield and net returns over farmer practice and recommended surface banding (Fig- 12). This treatment combination resulted in significantly higher resource use efficiency as well.

Fig.12: View of maize experiment

(Indrani Saha, S.L. Jat, C.M. Parihar, Preeti Singh, S. Kumar, D. Kumar)

Establishment of Blue green algae/Cyanobacterial culture growth room facility

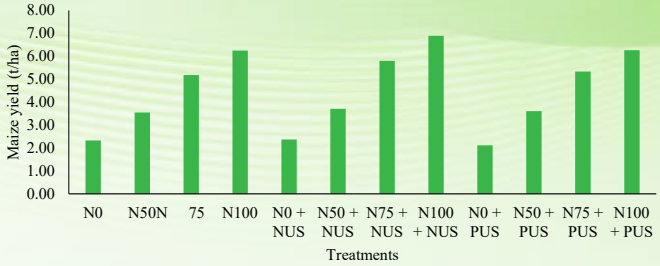
Blue green algae/Cyanobacterial culture growth room facility has been established to maintain and conserve the germplasms of blue green algae (BGA) in Microbiology section of NRM, IARI Jharkhand. Cyanobacteria commonly known as blue-green-algae are Gram-negative prokaryotes, perform oxygenic photosynthesis, and also fix atmospheric N_2. They are ubiquitous in ponds, lakes, water streams, rivers, and wetlands. They are potentially useful organisms that can be used as food, feed, and fuel. They are also used in the treatment of industrial and domestic wastewater to use or remove ammonia, phosphates, and other heavy metals. Biomasses of cyanobacteria are used as biofertilizers for the improvement of nutrient or mineral status and water-holding capacity of the soil. Cyanobacteria in rice fields are important microbial members that are employed as bio-inoculants for enhancing fertility, improving structure of soils and crop yields. Altogether,40 cyanobacterial strains in the culture room facility of ICAR- IARI Jharkhand are being maintained (Fig.13).

Fig.13: Cyanobacterial strains growing in BG-11 (-N) & (+N) medium on the culture rack fitted with light

(Himani Priya, Ranjit Singh and Manoj Chaudhary)

Effect of Nano-Urea spray with different percent level of RDN on Maize productivity in Rainfed soil of Eastern India

Nano fertilizers minimize the potential adverse effects associated with the over dosage of fertilizers and thus reduce their toxicity in soil, besides minimizing the frequency of the application and maximizing net monetary returns. The response of Nano-urea to maize was validated under field conditions during *kharif* 2022 in Randomized Block design (fixed layout) with 12 treatments comprising 4 rates of N (0, 50, 75 and 100% of recommended N) and 3 combinations of spray (no spray, Nano-N and Prilled-Urea) with 3 replications. Recommended dose of Nitrogen was applied in split 1/3 at basal, 1/3 at 32 DAS top-dressed and 1/3 at 50 DAS top-dressed. Spray of Nano-N and Prilled urea was coincide with top dressing *i.e.*, 32 DAS and 50 DAS. From the results it was found that fertilizer N rates and Nano-fertilizers influenced significantly on grain yields of maize. Averaged over fertilizers, grain yield under control was 2.33 t/ha, which was increased to 6.78 t/ha with the application of 120 kg/ha + 2 spray of Nano-fertilizer. Yield increased due to incremental N was significant up to the highest application rate (Fig.14). One-season results indicated the possibility of increasing grain yield in maize consequent to use of Nano-urea (2 Sprays) over and above of recommended dose of nitrogen application through prilled urea.



*NUS=2% sprays of Nano-urea, PUS=2% sprays of prilled-urea
*Recommended dose of nitrogen 120 kg/ha

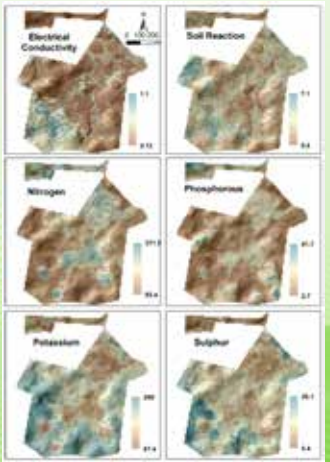
Fig.14: Effect of Nano-Urea an maize grain yield

(Satyam Rawat, Rajiv Kumar Singh, P.K. Upadhyay, Kapila Shekhawat, Preeti Singh, Shashank Patel, Harendra Chappali and Rajan Shukla)

GIS and GPS based soil fertility mapping of ICAR-IARI Jharkhand Agriculture Research Farm

A study was carried out at Research Farm under Indian Agricultural Research Institute, Gauria Karma, Jharkhand. Soil samples (> 200) were collected from the selected area of agricultural research farm of ICAR-IARI, Jharkhand. Sampling of the surface soil (0-15cm) was done using GPS after harvesting of Kharif crops and from uncultivated soils. The coordinates of the sample points were taken using GPS. A total of 51 representative soil samples were retained on grid basis for soil analysis. Samples were air dried in the soil lab of the institute and ground to pass through 2mm sieve. Soil samples so processed were analyzed for different physico-chemical parameters at ICAR-IARI, New Delhi. From the results it was found that majority of the selected study area has higher bulk density, low pH and EC, low organic carbon, low available nitrogen, available phosphorus, available potassium, total carbon and nitrogen. Soil texture varies from sandy loam, silty loam, loam to sandy clay loam. Therefore, it can be concluded that the majority of the farm area under the study is poor in soil fertility. The random forest regression algorithm was used for classification. In the random forest regression algorithm, soil properties were predicted for each 10x10 m grid using satellite derived images as proxy of soil forming factors (terrain, climate, and vegetation).

ALOS PALSAR DEM (12.5 m) and it's derivatives such as elevation, slope, valley depth, distance to channel network, multi resolution valley bottom flatness, slope length factor, etc were used as terrain predictors. Sentinel 2A images (10m) with 11 bands and vegetation indices derived from them were used as vegetation predictors. Since the area is small, climate data were not used and it was assumed that climate for the entire study area is same. The random forest model was developed using "random Forest" package. For training the model, a total of 200 samples were collected randomly in the study area and 51 soil samples analyzed for different soil properties (EC, pH, OC, Avl. N, P, K, S). For each property separate models were created. A tenfold cross validation was used to check the accuracy of the model. For organic carbon, the r-squared was 0.88 and Lin's concordance correlation coefficient was 0.92. We understood from the study that random forest model, developed using mentioned bands and indices in combination, was able to provide acceptable level of accuracy. Also, it will help in studying long term effects of different crop management practices on soil properties. Providing better soil fertility map, based on spatial-temporal sampling, will improve the soil management outcome and assume the detection of the spread patterns of different nutrients and soil characteristics (Fig.15).



A

B C

Fig.15: (A) Spatial distribution of EC, pH, Avl. N, P, K, S identified by random forest technique. (B) Spatial distribution of soil organic carbon as identified by random forest technique. C) Study area of C block with Google earth image and Spatial distribution of soil organic carbon as identified by random forest technique for C block.

(Preeti Singh, Nirmal Kumar (ICAR-NBSSLUP, Nagpur), Dipak Gupta, Manoj Chaudhary)

Development of 1.5 hectare IFS model

An Integrated farming system model for one-hectare area has been planned. The model induces aquaculture (1800 m^2); animal, mushroom and apiculture component (1000 m^2), fruit trees (1200 m^2); vegetable (1000 m^2), Upland crops (1500 m^2), Medium Land crops area (3500 m^2); Spices (500 m^2) and Low land crops area (4500 m^2). The master plan and lay out of model has been developed and land development has been under process. Water body has been partially developed and shed for ducks, poultry, small ruminant and large animals are under development from available resources (Fig.16). Fruit plants have been planted and vegetable and crops are being planted.

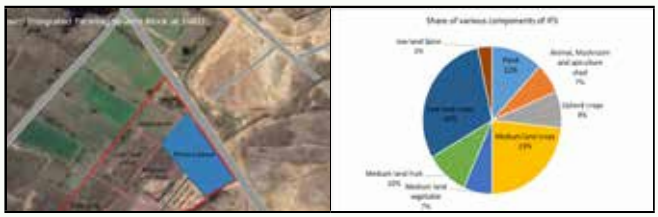


Fig.16: Development of IFS model and component share

(Vishal Nath, Dipak Kumar Gupta, Krishna Prakash, Pankaj Sinha and Manoj Chaudhary)

Nitrogen management in wheat (*Triticum aestivum* L.) for acid soils of Jharkhand

To quantify the advantage of using variable N sources and doses, a field experiment was conducted on "Nitrogen management in wheat (*Triticum aestivum* L.) for acid soils of Jharkhand" during *rabi* season, 2021-22. The experiment was laid out in a randomized block design (RBD) comprising of 12 treatments with 3 replications. A significant improvement in growth and yield attributing characters was recorded with the application of N_{160}+ FYM and N_{160}+ nano-urea spray over application of N_{160} through urea alone. The highest grain yield (4.05 t/ha), straw yield (5.70 t/ha), and biological yield (9.75 t/ha) were recorded under the treatment N_{160}+FYM. A 14% and 11% increase in the grain yield of wheat was recorded with application of N_{160}+FYM and N_{160}+nano-urea, respectively over application of N_{160} alone. The application of FYM in combination with urea increased the available soil nitrogen content as compared to application of urea alone. Highest gross return (1.04 × 10 /ha) and net return (0.60 × 10 /ha) were noticed under N_{160}+FYM while highest B:C ratio was seen in N_{160}+ nano-urea spray. The economic analysis of various N sources indicated that 23 kg of N applied through urea can be saved with the application of urea+ nano-urea over urea alone at 120 kg N/ha.

(Soumyadarshi Muduli, Kapila Shekhawat, Preeti Sing)

Greenhouse and ammonia gas emissions from cattle manure management systems

A study was conducted to quantify Greenhouse gas (GHG) and ammonia emissions from cattle manure management system i.e. static stockpiling

Ammonia trap on compost | Compost bins with acid trap | GHG sampling with closed chamber

Fig.17: Study of greenhouse gas experiment and samples collection

(common farmers practice) (SP), stockpiled manure with turning at regular interval (SPWT) and vermicomposting (VC) of manure obtained from indigenous breed (IB) cattle and cross breed (CB) cattle. The GHG and NH_3 emission was found significantly higher from CB manure compared to IB manure in all the composting treatments (Fig. 17). The global warming potential (GWP) was found 1.7-2.3 times higher due to GHG emission from CB cattle manure compared to IB cattle manure. Among manure management treatments, GWP was found lowest under SPWT followed by SP and VC. Present study concluded that crossbred manure had higher GHG and ammonia emission than indigenous cattle manure. Additionally, turning at regular intervals may be an effective GHG mitigation strategy to reduce the impact of global warming from manure management.

(Surendhar P, Dipak Kumar Gupta, Arti Bhatia, Dr.Soora Naresh Kumar, Sandeep Kumar, Rajeev Ranjan, Preeti Singh)

Soil Carbon, Nitrogen Pools and GHG Emission Under Different Land Use Systems

A study was conducted to assess effect of various land use systems [Native Forest (NF), Agroforestry (AGF), Agricultural upland (AU) and Agricultural lowland (AL)] on soil carbon and nitrogen pools and GHG emission over a period of three months in winter season. The soil samples were collected from three sites (Gauria Karma, Simarkurha, Kedarut) of Barhi Block. AGF showed the highest SOC concentration, C and TN (total nitrogen) stocks at surface depth (0-15 cm). However, higher SOC and C stock were observed in NF at subsurface depths (30-45 and 45-60 cm) than other land use systems (Fig.18).

Fig.18: View of GHG sample collection and analysis

Aggregate stability followed the trend NF>AGF>AU>AL and higher aggregate associated C and N were found in AGF. The N_2O and CH_4 emissions was found higher from low-land agricultural ecosystem compared to other system.

(Ankit Kumar Verma, Namita Das Saha, Dipak Kr. Gupta, Bhupinder Singh, Soora Naresh Kumar, Dr. Arti Bhatia, Rajeev Ranjan, Ranjan Bhattacharyya)

Water-use efficiency and soil nutrient dynamics under Moong cultivation through the use of straw mulch, Hydrogel, and nutrient management

An exploratory trial was conducted to investigate the water-use efficiency and soil nutrient dynamics of Moong crop through the use of straw mulch, Hydrogel, and nutrient management. The results of the trial revealed that the highest yield was obtained with a combination of 50% organic and 50% inorganic fertilizer application, along with 100% hydrogel application and straw mulch. This finding demonstrates the effectiveness of a comprehensive approach to crop management, which takes into account multiple factors such as soil health, water availability, and nutrient management. By adopting this

integrated approach, farmers in Jharkhand can potentially improve their crop yields, reduce water consumption, and maintain soil health, thereby ensuring long-term sustainability and economic viability. Overall, this study provides valuable insights into the benefits of using straw mulch, hydrogel, and nutrient management in moong cultivation, which can be useful for farmers.

(Preeti Singh, Santosh Kumar)

Education

Academic activities during sessions 2022-24

ICAR-IARI Jharkhand is running its academic programme as PG outreach institute under Post Graduate School, IARI New Delhi. During the academic sessions 2022-24, 21 students have been admitted to M.Sc./M.Tech. courses in 10 different disciplines, respectively.

Teachers Day

Teachers Day celebration conducted at institute by our M.Sc students on 5th Sept 2022. The whole function was planned by the students. All participated students were appreciated by giving snacks as our token of love. Students performed a scintillating cultural show to denote their love, respect, acknowledgement and recognition of the hard work put in by the teachers towards their development. The cultural show incorporated poems, songs, and dance. They also entertained teachers by arranging fun games for them. They indicated that, teachers play a vital role in making their pupil accountable citizens of tomorrow and wonderful human beings. They are the cornerstone of students' future and there's nothing worth enough to gratify them for their selfless service and commitment. All teachers enjoyed and appreciated the program. Program concluded with OSD's address. Dr. Vishal Nath extended his heartiest thanks to all students on behalf of staff.

Teachers Day Celebration

Hindi Day Celebration

On 14 September 2022, Hindi Day celebrations were organized at the Indian Agricultural Research Institute, Jharkhand under the chairmanship of Dr. Vishal Nath, Officer on Special Duty. Dr. Vishal Nath in his presidential speech described in detail the importance of Hindi in common life. He said that Hindi is such a language which binds all the sections of the society in one thread which gives pace in the development of the country. He urged all the scientists, officers and employees to teach Hindi to the students of those states who do not know Hindi or know less. The program was started with the welcome speech of Dr. Manoj Chaudhary, chairman of the official language section, who, explaining the importance of Hindi, stressed upon all the people present in the auditorium to use more and more Hindi language at the workplace. Sharing his experiences, Principal Scientist Dr. SK Mahanta said that Hindi should be taught in schools in remote areas of every state. With the help of committee member Dr. Shilpi Kerketta and Dr. Preeti Singh, organized quiz related to Hindi literature, Hindi essay and general Hindi vocabulary competition, in which all scientists and employees participated enthusiastically.

Inauguration of Hindi Diwas programme

Participants participating in competitions

World Soil Day Celebration

This year World Soil Day 2022 was celebrated in our institute under the theme "Soils: Where food begins" on 5th December 2022. A program was organized

World Soil Day Celebration

in the institute to raise awareness of the importance of maintaining healthy ecosystems and human well-being by addressing the growing challenges in soil management, increasing soil awareness and encouraging societies to improve soil health. On this occasion quiz competition was organized among the students**.** They were also taught about soil testing, importance of soil health cards, integrated nutrient management, *in-situ/ex-situ* decomposing of crop residues to produce high quality organic manure, biofertilizers to improve soil health. A total of 50 participants comprising of scientists, technical staff, and students attended the program.

Capacity Building

- A three days training was organised on the "Techniques of Vermicomposting of Cow Dung Manure" to the officials of Animal Husbandry Department, Gauria karma during 06-08 January, 2022.

- Canopy management training to the farmers and officials of Hazaribagh Agriculture Department was organised on 04th Feb. 2022. Under this training detailed operations on the above ground portion of the plant, aiming towards maximized production of quality fruits per unit canopy area were suggested.

- Rural Agriculture Work Experience (RAWE) program for B.Sc. (Agri) students of College of Agriculture, Ranchi of Birsa Agricultural University, Kanke, Ranchi was organised at the institute. The program was conducted for a period of 10 days, from 30th Nov. to 09th Dec., 2022, and aimed to provide the students with practical exposure to various aspects of agriculture. The program has included visits to farms, interaction with farmers, and hands-on training in agricultural practices.

- Rural Horticulture Work Experience (RHWE) Program for B.Sc. (Hort.) students of College of Horticulture, Khuntpani of Birsa Agricultural University, Kanke, Ranchi was organized at the institute during 09th – 24th December, 2022.

Extension Activities

- One day workshop on Doubling Farmers' Income through improved technologies of agri. & allied sectors for ATMs, BTMs & agri. officers of Hazaribagh district on 18th Feb. 2022.

- ICAR-IARI Jharkhand jointly organized Krishak Pathshala in Harilla village of Barhi with ATMA officials on the occasion of International Women's Day Celebration 08th March, 2022.

- The ICAR-IARI Jharkhand organized an "Agriculture Education Awareness and Sensitization Programme" on 28th April 2022, in collaboration with DAV, Hazaribagh. The program aimed to educate and sensitize students of 10th and 12th class about agriculture education and its importance. The event was organized in the context of Azadi ka Amrit Mahotasava, which commemorates India's 75 years of independence.

- The program was attended by Dr. Vishal Nath, Dr. Dipak Kumar Gupta, Dr. Shilpi Kerketta and Dr. P.K. Sinha from IARI-Jharkhand, who interacted with the students and provided them with valuable insights about agriculture education. The experts also shared their experiences and knowledge about the latest technologies and trends in the field of agriculture.

- Performance and evaluation of watermelon varieties/hybrids under climatic conditions of Hazaribagh and Ramgarh at Soil Conservation Training Center, Demotad, Hazaribagh organized on 27th April, 2022 on the occasion of Kisan Bhagidari, Prathmikta Hamari.

- ICAR-IARI, Jharkhand organized NGO's Refresher Meet on 19th Nov., 2022. The event was sponsored by NABARD (National Bank for Agriculture and Rural Development) and aimed to expose NGO representatives to the latest agricultural technologies and practices in the field. The meeting provided an opportunity for NGOs to learn about innovative approaches to agriculture and allied sectors, which can ultimately help improve the livelihoods of farmers and rural communities.

- ICAR-IARI-Jharkhand collaborated in organization of conference on "Landscape management for preventing flood and reservoir sedimentation" during 22-24 September, 2022 at BAU, Ranchi. This three-day conference was organized by Indian Association of Soil and Water Conservationists (IASWC), Dehradun.

Activities under Tribal Sub Plan

The **Tribal Sub-Plan** (TSP) is a planning concept to channelize the flow of benefits from the central government for the development of tribal populations. As part of TSP, the ICAR-IARI, Jharkhand is actively engaged in enhancing the standard of living of tribal farmers by increasing their income through increased agricultural productivity. Under TSP, ICAR-IARI, Jharkhand has conducted training programs on various topics for tribal farmers in the different blocks of Hazaribagh district. The objective of the training program was to provide insights of scientific package of practices of different crops for getting higher productivity and consequently higher income. Tribal farmers were also motivated for farming of rice, maize, specialty corn, vegetables, wheat, chickpea, green gram, horse gram and other crops of their region through adopting the improved practices. A total of around 2800 tribal farmers got benefitted from this training program. Seeds of improved varieties of rice, maize, vegetables, green gram and horse gram were also provided to the participants after the training programme.

Traings organised under TSP : The following training programmes have been organized during 2022.

S. No.	Training programme and Seed distribution programme	Target area	Date	Organizing committee
1	उच्च उत्पादकता हेतु वैज्ञानिक पद्धति द्वारा धान की खेती	Block: Barhi, Hazaribag, Jharkhand	20.06.22-22.06.22	**Co-ordinator**: Dr. Vishal Nath **Organizing secretary**: Dr. Santosh Kumar **Co-organizing secretary**: Dr. Preeti Singh, Dr. S. Kerketta, Dr. Ashok Kumar, Dr. Pankaj K. Sinha
2	उच्च उत्पादकता हेतु वैज्ञानिक पद्धति द्वारा धान की खेती	Block: Churchu, Hazaribag, Jharkhand	23.06.22-25.06.22	**Co-ordinator**: Dr. Vishal Nath **Organizing secretary**: Dr. Santosh Kumar **Co-organizing secretary**: Dr. Preeti Singh, Dr. Monu Kumar, Dr. S. Kerketta, Dr. Ashok Kumar

S. No.	Training programme and Seed distribution programme	Target area	Date	Organizing committee
3	उच्च उत्पादकता हेतु वैज्ञानिक पद्धति द्वारा धान की खेती	Block: Dadi, Barkagaon, Keredari, Hazaribag, Jharkhand	27.06.22-29.06.22	**Co-ordinator**: Dr. Vishal Nath **Organizing secretary**: Dr. Santosh Kumar **Co-organizing secretary**: Dr. S. K. Mahanta, Dr. Preeti Singh, Dr. Ashok Kumar
4	उच्च उत्पादकता हेतु वैज्ञानिक पद्धति द्वारा धान की खेती	Block: Barhi, Hazaribag, Jharkhand	04.07.22-06.07.22	**Co-ordinator**: Dr. Vishal Nath **Organizing secretary**: Dr. Santosh Kumar **Co-organizing secretary**: Dr. P. R. Kumar, Dr. Ashok Kumar
5	उच्च उत्पादकता हेतु वैज्ञानिक पद्धति द्वारा मक्का सब्जी एवं कुलथी की खेती	Block: Churchu, Hazaribag, Jharkhand	13.07.22-15.07.22	**Co-ordinator**: Dr. Vishal Nath **Organizing secretary**: Dr. Santosh Kumar **Co-organizing secretary**: Dr. Preeti Singh, Dr. Ashok Kumar, Dr. Krishna. Prakash
6	उच्च उत्पादकता हेतु वैज्ञानिक पद्धति द्वारा मक्का एवं सब्जी की खेती	Block: Dadi, Barkagaon, Keredari,, Hazaribag, Jharkhand	16.07.22-18.07.22	**Co-ordinator**: Dr. Vishal Nath **Organizing secretary**: Dr. Santosh Kumar **Co-organizing secretary**: Dr. Preeti Singh, Dr. Ashok Kumar, Dr. Asha Kumari, Dr. Krishna Prakash
7	उच्च उत्पादकता हेतु वैज्ञानिक पद्धति द्वारा मक्का सब्जी एवं कुलथी की खेती	Block: Tatijhariya, Hazaribag, Jharkhand	19.07.22	**Co-ordinator**: Dr. Vishal Nath **Organizing secretary**: Dr. Santosh Kumar **Co-organizing secretary**: Dr. Preeti Singh, Dr. Ashok Kumar
8	उच्च उत्पादकता हेतु वैज्ञानिक पद्धति द्वारा मक्का एवं सब्जी की खेती	Block: Vishnugarh, Hazaribag, Jharkhand	20.07.22-22.07.22	**Co-ordinator**: Dr. Vishal Nath **Organizing secretary**: Dr. Santosh Kumar **Co-organizing secretary**: Dr. Preeti Singh, Dr. Ashok Kumar, Dr. Krishna Prakash
9	उच्च उत्पादकता हेतु वैज्ञानिक पद्धति द्वारा मक्का सब्जी एवं कुलथी की खेती	Block: Barhi, Hazaribag, Jharkhand	23.07.22-25.07.22	**Co-ordinator**: Dr. Vishal Nath **Organizing secretary**: Dr. Santosh Kumar **Co-organizing secretary**: Dr. Preeti Singh, Dr. Ashok Kumar, Dr. Krishna Prakash
10.	उच्च उत्पादकता हेतु वैज्ञानिक पद्धति द्वारा कुलथी की खेती	Block: Barkagaon, Hazaribag, Jharkhand	20.08.22	**Co-ordinator**: Dr. Vishal Nath **Organizing secretary**: Dr. Santosh Kumar **Co-organizing secretary**: Dr. Preeti Singh, Dr. Ashok Kumar, Mr. Sushil Marandi
10	उच्च उत्पादकता हेतु वैज्ञानिक पद्धति द्वारा मूंग की खेती	Block: Dadi, Barkagaon, Keredari, Churchu, Hazaribag, Jharkhand	15.02.23-20.02.23	**Co-ordinator**: Dr. Vishal Nath **Organizing secretary**: Dr. Santosh Kumar **Co-organizing secretary**: Dr. P. R. Kumar, Dr. Preeti Singh, Dr. Ashok Kumar, Dr. Krishna Prakash, Dr. Shannon N Sangma

2. Seed distribution to selected beneficiaries :

- Seed distribution of 120 quintal paddy seeds (IR 64 & MTU 1010) to the tribal farmers under TSP
- Seed distribution of 25 quintal maize hybrid seeds (DHM121) to the tribal farmers under TSP
- Vegetable seed kit (1000 pkt.) distribution to the tribal farmers under TSP.
- Seed distribution of 200 Kg Kulthi seeds (Birsa Kulthi 1) to the tribal farmers under TSP.

Seed distribution under TSP

Schedule Caste Sub Plan

ICAR-IARI, Jharkhand has implemented Schedule Caste Sub Plan (SCSP) for the benefit of schedule caste farmers of the state in an effective manner. It includes various developmental activities for creation of facilities, conducting training programmes and farm input supply for enhancing agricultural productivity. Under the farm-input supply component, seeds and planting materials of various agricultural and horticultural crops, fertilizers and

Seed distribution under SCSP

other required input is being procured and distributed among the selected beneficiaries of the community as per the baseline survey data and seasonal requirements. Direct input supply to the needy farmers help in enhancing the standard of living of scheduled caste farmers by increasing their income through increased agricultural productivity. Efforts of the institute in supplying quality seeds under SCSP is highly appreciated by the benefitted farmers and there is a great demand for the quality seeds of various crops in all seasons. During Kharif 2022, 30 Quintals of improved varieties of paddy seeds among 220 beneficiary farmers and during Rabi 2022-23, 24 Quintals of wheat seeds was distributed among 300 scheduled caste farmers of different villages of Gauria Karma and Kedarut panchayat. Six farmers training cum seed distribution program was also organized where farmers were actively interacted with crop-specific resource personnel of the institute. The aim of the farmer's training program was to provide brief insight into the scientific package of practices of different crops for higher productivity and consequently higher income. All the SCSP programmes got wide coverage in media news.

(Krishna Prakash, Vishal Nath, Dipak Kumar Gupta, Pankaj Kumar Sinha, Santosh Kumar, Monu Kumar. Priya Ranjan Kumar)

Training organized under NABARD project

A three day training program (30 May - 1 June 2022) on the topic "झारखण्ड में गुणवत्तायुक्त प्रोटीन मक्का के एकल संकर मक्का बीज उत्पादन की तकनीक विषय पर त्रिदिवसीय युवा कृषक प्रशिक्षण कार्यक्रम" was organized under NABARD funded project "Popularization of bio fortified maize hybrids (QPM+ProVit. A enriched) for sustainable nutritional security and upscaling entrepreneurship to boost up farmers' income in Jharkhand" to train and motivate the youth farmers to produce the hybrid seeds of maize as there is huge demand of quality hybrid seeds of maize among the farmers of Jharkhand. The training was attended by 60 farmers of 10 Farmer Producer Organizations of Hazaribag district.


भारतीय कृषि अनुसंधान संस्थान में किसानों को दिया गया तीन दिवसीय प्रशिक्षण, मक्का बीज उत्पादन की बारीकियों को जाना

Institute Building Activities

Republic Day and Independence Day celebrations

73th Republic Day and 75th Independence day was celebrated at ICAR-IARI campus with great enthusiasm among scientific, non-scientific staff and children. After flag hoisting, a small cultural event and sports activity were organised on this occasion, which was actively participated by both students, staff members and their family. A memento was distributed to all participant as a token of love and appreciation by respected OSD, ICAR-IARI Jharkhand.

Swachhta campaign 2.0

Swachhta campaign 2.0 was observed as a part of Swachh Bharat Abhiyan from 02/10/2022 to 31/10/2022 at ICAR-IARI, Jharkhand with an objective to bring intense focus on the issues and activities related to Swachhta. This Swachhta campaign was categorised into different activities daily to conduct the programme at institute successfully. On the first day all the scientists and staff of the office, took the "Swacchta" pledge led by Dr. Vishal Nath, OSD, ICAR-IARI, Jharkhand regarding cleanliness of institute farm and campus. In the supervision of Officer on Special Duty (OSD), the activity schedule for Swachhta Action Plan- 2022. Following activities were organized in the institute-cleaning of administrative-cum-academic building premises, cleaning of guest house premises, debushing of unwanted trees, cleaning of weeds, pruning of hedge plants, cleaning of plastic wastes and making the campus plastic free and plantation in the main campus.

Cleaning of Institute premises Vermicomposting of farm wastes

International Yoga Day Celebration

International Yoga Day Celebration

International Yoga Day was celebrated on 21st June, 2022 at IARI-Jharkhand. The theme of this year's Yoga Day celebrations was 'Yoga for Humanity' and all the scientists, technical and administrative staff and students take part in various events, doing yoga in unison towards better health and wellness for all.

8th Institute Foundation Day celebration

On 28th June, 2022, the foundation day programme of ICAR-Indian Agricultural Research Institute Jharkhand, was celebrated. Dr. Onkar Nath Singh, Vice Chancellor, Birsa Agriculture University, Ranchi and Newton Tirki, District Animal

Launch of Bhadrika poonj and Institute Newsletter

Husbandry Officer was the Chief Guest and Special guest on this occasion. Dr A K Singh, Director, ICAR-IARI, New Delhi welcomed the chief guest, and all the dignitaries and presented the brief report about the institute and progress of work. All the scientists, students and selected farmers of Jharkhand were present during the programme. Dr Vishal Nath, OSD extended hearty welcome to all and congratulated IARI Jharkhand on this foundation day. He introduced the Chief guest of the function. He highlighted the mandate of IARI Jharkhand for bringing the benefits of improved agricultural research, education and extension to the region. Dr. O.N Singh delivered the foundation day lecture

and stressed upon the role of institute in food and nutritional security of the country. On this occasion, tree plantation was done at various places on the institute campus. The Chief guests also released the "Newsletter Vol. 1", Hindi Magazine "Bhadrika Poonj" and Training Manual on "Hybrid Seed Production Technique in Maize for Jharkhand" on the occasion.

Project Review Meeting

The projects review meeting was held under the Chairmanship of Dr. Vishal Nath, OSD, ICAR-IARI, Jharkhand during September 27-28, 2022. At the outset Dr. S.K. Mahanta, Principal Scientist and Chairman,PME cell, welcomed the house and started the meeting by briefing the approved ongoing projects, whose progress were reviewed in this meeting. He also welcomed the new research proposals for discussion in the house. The Chairperson of the house, Dr. Vishal Nath, OSD, IARI, Jharkhand, addressed the meeting and acknowledged the constraints related to laboratory as well as other research facilities in the institute and stressed on the greater cooperation and continued efforts in smoothly leading the projects under difficult situations.

Farm developmental activities

- About 80 ha farm area has been cleaned and plotting has been done. Out of these areas, in about 52 ha area, primary level of (bush cleaning, layout, marking with trench) has been carried out while in about 30 ha area up to secondary level work (Bush cleaning, layout, trench cutting, bund formation, soil cutting and filling and levelling) has been carried out in the various blocks of the IARIJ farm
- About 6 km of approach path has been made in the various blocks of the IARIJ farm
- About 0.6 km length of a natural drain coming from bahadur Dam has been guided and reshaped
- Four ponds have been rejuvenated
- Six new ponds are under developmental stage
- The proposed site of KVK was cleaned and demarcated
- Layout for writing name (English and Hindi) of IARIJ on the east facing slop of Bhadur Dam was prepared
- Three culvert on the approach roads has been constructed by CPWD to cross channels and pass the runoff
- Following farm machinery and implements has been purchased
  - (i) Three tractors
  - (ii) Two disk harrow
  - (iii) One land leveller
  - (iv) One lesser land leveller
  - (v) One rice trans-planter
  - (vi) One diesel pump (5 hp)
- Finger millet, Pearl millet and sorghum were grown under rainfed condition during Kharif 2022
- Seed of dhaincha crop was produced during Kharif 2022
- About 40 trees of date palm and Palas were pruned and shaped

Construction of one-acre pond

Cleaning of slops of Bhadur Dam

Formation of approach road in block D

Distinguished Visitors

- Visit of Chairman and members of Works Committee of ICAR-IARI, New Delhi to review the progress of different infrastructure development works at IARI-Jharkhand during 09th -11th Nov. 2022.

Chairman and members of Works Committee at ICAR-IARI, Jharkhand

- Visit of Site Selection Committee for KVK, Hazaribagh at ICAR-IARI-Jharkhand on 12th Dec. 2022.

Site Selection Committee meeting for KVK, Hazaribagh at ICAR-IARI-Jharkhand

- On occasion of ICAR Foundation Day, 120 probationers of Jharkhand Agriculture Services visited the institute and had interactions on Agriculture scenario and possibilities in the State on 16th July, 2022.

Probationers of JAS interacting with scientists of ICAR-IARI Jharkhand

- ICAR-IARI Jharkhand facilitated and coordinated the visit of newly elected village representatives like Mukhiya, Jila Parishad etc. to the institute for exposing to the different improved technologies of Agril & allied Sectors on 27th Aug, 2022.

Newly elected village representatives at ICAR-IARI Jharkhand

- ICAR-IARI Jharkhand facilitated the self-sponsored visit of Progressive farmers under the leadership of Shri Meenu Mahto, Badkagaon, Hazaribagh for exposing to the different improved technologies of Agril & allied Sectors on 20th Oct., 2022.

Visit of progressive farmers

- Deputy Commissioner Ms Nancy Sahay visited ICAR-IARI along with BAU and Department of Animal Husbandry. Her primary concern was to restrict illegal construction in the premises of ICAR-IARI Jharkhand. She ensures that strict action will be taken against illegal constructions.

Deputy Commissioner Ms Nancy Sahay at ICAR-IARI, Jharkhand

Miscellaneous Activities

- ICAR-IARI, Jharkhand organized live Telecast of the Hon'ble Prime Minister address on the Occasion of PM Kisan Samman Sammelan on 17th Oct. 2022.

Dr. P.K. Sinha participated in Hello Kisan Program of DoorDarshan (DD Kisan) as Resource Person on the theme of Natural Farming on 27th May, 2022 & 11th Oct. 2022.

Awards and Recognition

- Dr. P.K Sinha received Young Scientist Award in International Conference on "NATURAL SCIENCE AND GREEN TECHNOLOGIES FOR SUSTAINABLE DEVELOPMENT" (NTSD-2022) during 30th November to 2nd December, 2022 at Goa University, Taleigao Plateau, Goa.

Dr. P K Sinha, Receiving NESA

- ICAR -IARI Jharkhand Gauriakarma Hazaribagh has been awarded as best exhibit award for the exhibition stall put up by the institute during the conference organized by the Indian Association of Soil and Water Conservationists, Dehradun in collaboration with ICAR-Indian Institute of Soil and Water Conservation, Dehradun; Birsa Agricultural University, Ranchi; ICAR-Mahatma Gandhi Integrated Farming Research Institute; Motihari; Damodar Valley Corporation, Hazaribag; Directorate of Soil Conservation, Ranchi and Jharkhand State Watershed Mission, Ranchi.

- Dr. Dipak Gupta received NESA-Distinguished Scientist Award by National Environmental Science Academy, New Delhi during International Conference on Natural Science and Green Technologies For Sustainable Development (NTSD-2022) during 30th November to 2nd December, 2022 at Goa University, Taleigao Plateau, Goa.

Dr. Dipak Kumar Gupta, Receiving NESA

- On the occasion of Hindi Diwas on 14-09-2022 various competition was organised and the names of the winners of the competition are as follows-

Hindi Questionnaire Competition	
Participants	Position
Dr. Santosh Kumar (Scientist)	Ist
Dr. Pankaj Kumar Sinha(Scientist)	2nd
Dr. Krishna Prakash(Scientist)	3rd
Dr. Surjit Kumar(AAO)	3rd
General Hindi Vocabulary Competition	
Dr. Vishal Nath(OSD)	Ist
Dr. Krishna Prakash(Scientist)	2nd
Shri Ashok Kumar (Scientist)	3rd
Hindi Essay Competition	
Dr. Vishal Nath (OSD)	Ist
Dr. Himani Priya (Scientist)	2nd
Dr. Santosh Kumar(Scientist)	3rd
Ms N Bhavana (M.Sc)	Consolation Price

Success Story

Adoption of Techniques for Vermicomposting of Cow Dung Manure

After getting training on "Techniques of Vermicomposting of Cow Dung Manure" organised at IARIJ during 06-08 January, 2022, the Dairy Unit of Animal Department, Gauria karma is successfully converting about 25% of generated cow dung manure into the vermicompost under the guidance of IARIJ. They have produced about 25 quintals of vermicompost in last 6 months.

(Dipak Kumar Gupta, Pankaj K Sinha, Krishna Prakash, Vishal Nath)

Adoption of Hybrid Pusa HQPM 1 Improved in Hazaribag district of Jharkhand

Maize is the second most important crop in Hazaribagh district of Jharkhand next to rice yet the productivity of maize in the area is very low in comparison to national productivity. A substantial amount of dietary requirement for energy in this area is being fulfilled by maize. Adoption of bio-fortified maize with increased lysine, tryptophan and provit. A would contribute in attaining nutritional security in a more holistic approach. The hybrid Pusa HQPM 1 Improved developed by ICAR-IARI, New Delhi have been demonstrated on farmers' field during kharif 2022 in Hazaribagh district of Jharkhand and the performance of hybrids were found to be excellent in every locations and average grain yield of 57.5 q/ha was recorded (As per crop cutting from the area of 2 mtr x 2 mtr in five replications). There is huge demand of green cob among the people in Jharkhand and the green cob weight of 234 q/ha was recorded in comparison to 188 q/ha of the other locally available varieties grown by the farmers. Owing to the cob size, yield potentiality and quality of kernels in respect of quality protein, the farmers are keen interested to adopt these hybrids for their maize cultivation. As a matter of fact, these hybrids have gained immense popularity among the cultivators that resulted in high demand of seed very rapidly. It is expected that other farmers will also go for the cultivation of this QPM hybrid in next season.

(Santosh Kumar, Preeti Singh, Vishal Nath)

Adoption of Hybrid DHM 121 in Hazaribag district of Jharkhand

Maize is a staple food crop in the countryside areas and is the major crop of uplands of Jharkhand during Kharif. However, the traditional varieties of maize grown in the area have low yield potential and are susceptible to diseases and pests. To address these issues, the ICAR-IARI, Jharkhand conducted the demonstrations of the Maize hybrid DHM 121 on the farmers' field, which has shown promising results in terms of grain yield as well as green cob yield. The maize hybrid DHM 121 was distributed among the tribal farmers under tribal sub plan project. Training was also imparted to them on the scientific package of practices of maize cultivation for higher productivity and profitability. The farmers were initially skeptical about the new hybrid variety, but with the help of ICAR-IARI, Jharkhand, they were able to understand the benefits of the new variety.

The following table summarizes the yield of traditional varieties and improved hybrid in terms of grain yield and green cob yield:

Type of Maize varieties/hybrid	Grain Yield (Kg/ha)	Green Cob Yield (Kg/ha)
Traditional	1,800-2,000	11,200-13,000
Hybrid available in local market	4,500-5200	22,500-23,500
DHM 121	6,200-6,800	26,300-27,600

As we can see from the table, the Maize hybrid DHM 121 has a much higher yield potential than the traditional varieties. The grain yield is almost double, while the green cob yield is more than double. This has led to an increase in income for the tribal farmers who have adopted the new variety. The improved yield of the new variety has also led to better food security in the region, as farmers are able to produce more maize for their families and sell the surplus in the market. In conclusion, the adoption of Maize hybrid DHM 121 by tribal farmers in Jharkhand has been a success story, leading to an increase in yield, income, and food security in the region. After conducting demonstration, farmers were convinced to adopt the DHM 121 hybrid maize variety due to its high yield potential, good resistance to pests and diseases, and suitability for local weather conditions. Overall, the success of the DHM 121 hybrid maize variety in tribal areas demonstrates the importance of introducing improved varieties that are suitable for local conditions, and the value of extension services to help farmers adopt new technologies and practices.

(Santosh Kumar, Preeti Singh, Vishal Nath)

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INTERNATIONAL YEAR OF MILLETS 2023

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Contact Details :

Prof (Dr.) Vishal Nath, Officer on Special Duty
E-mail : iarijharkhand@gmail.com

Editors :

Preeti Singh, Santosh Kumar, Krishna Prakash, Manoj Chaudhary, Himani Priya, Shilpi Kerketta, Asha Kumari, S.K Mahanta, Vishal Nath

ICAR-IARI-Jharkhand
Gauria Karma, Hazaribag-825405, Jharkhand