Proceedings of

5th National Brassica Conference-2024 on

Oilseed Brassicas for Sustainability, Profitability and Nutritional Security

(Held on February 07-09, 2024)

Organized by

Society for Rapeseed-Mustard Research, Bharatpur

in collaboration with

ICAR-DRMR, Bharatpur

&

SKNAU, Jobner

at

RARI, Durgapura, Jaipur

5th National Brassica Conference-2024

"Oilseed Brassicas for Sustainability, Profitability and Nutritional Security"

February 07-09, 2024

PROCEEDINGS

INAUGURAL SESSION

Chief Guest	:	Dr. Kirodi lal Meena, Hon'ble Minister of Agriculture & Horticulture, Rural Development, Disaster Management, Relief & Civil Defence, Govt. of Rajasthan
Special Guest	:	Dr. T. Mohpatra, Ex-Secretary DARE, DG ICAR, New Delhi and Chairperson, Protection of Plant Varieties and Farmers' Rights Authority, New Delhi
President	:	Padma Shri, Dr. Arvind Kumar, Ex- DDG (Edu) , ICAR, New Delhi and Founder Vice- Chancellor, Rani Lakshmibai Central Agricultural University - Jhansi, Uttar Pradesh
Guest of honour	:	Dr. D. K. Yadava, Assistant Director General (Seeds), ICAR, New Delhi
Chairman	:	Dr. Balraj Singh, Vice-Chancellor, Sri Karan Narendra Agriculture University (SKNAU), Jobner
Rapporteurs	:	Dr. N. K. Gupta, Director Education, Sri Karan Narendra Agriculture University (SKNAU), Jobner
	:	Dr. R. K. Yogi, Sr. Scientist, ICAR-Directorate of Rapeseed-Mustard Research, Bharatpur

The inaugural session of the 5th National Brassica Conference on "Oilseed Brassicas for Sustainability, Profitability and Nutritional Security", organized by Society for Rapeseed-Mustard Research, Bharatpur in collaboration with ICAR-DRMR, Bharatpur and SKNAU, Jobner was held at RARI, Durgapura, Jaipur during February 07, 2024 at 9:30 AM with the participation of about 250 delegates across the country.

The session started with the welcome address by Dr. Balraj Singh, Vice-Chancellor, SKNAU, Jobner. He heartily welcomed the Chief Guest Dr. Kirodi lal Meena, Hon'ble Minister of Agriculture & Horticulture, Rural Development, Disaster Management, Relief & Civil

Defence, Govt of Rajasthan, Padam Shri Dr. Arvind Kumar, Ex- DDG (Education), ICAR, New Delhi & Ex-Vice Chancellor RLBCAU, Jhansi, Dr. T. Mohpatra, Ex-Secretary DARE, DG ICAR, New Delhi and Chairperson, PPV&FRA New Delhi, Dr. D. K. Yadava, Assistant Director General (Seeds), ICAR, New Delhi and other dignitaries present on this occasion. In his address Dr. Bal Raj Singh expressed his gratitude to Hon'ble Minister for accepting request for inauguration of 5th National Brassica Conference, Vice Chancellor said that sir your presence will inspire the researchers, policy planners, students and representatives of various agencies came from across the country to perform their duties sincerely towards the farmers comunity. He thanked to Society for Rapeseed-Mustard Research for choosing Rajasthan state specially RARI, Jaipur for hosting this key event. He stated that the organisation of 5th National Brassica on "Oilseed Brassicas for Sustainability, Profitability and Nutritional Security" in Rajasthan was important because Rajasthan state alone contributes more than 42% in area and 45% in production of Rapeseed-mustard in the Country and shall play an important role in achieving edible oil self-sufficiency in near future.

The three-day' conference was inaugurated by the Dr. Kirodi lal Meena, Cabinet Minister of Agriculture and Horticulture of Rajasthan State. Dr. T. Mohpatra was present as special guest of the conference. Chief Guest stated that Rajasthan is the one of the biggest rapeseed-mustard producing state in country. Inspite of being one of the largest producer of rapeseed-mustard, India imported more than 50% of its consumption, which is matter of concern. He urged the scientists to develop the technologies to cope up with the insect-pest, diseases and other environmental factors in order to further increase the production rapeseed-mustard. He particularly emphasized to address problem of aphid management in mustard to reduce losses. Transfer of the technology to the farmer's field efficiently was the other point raised by him. Special guest Dr. Trilochan Mohapatra emphasized the need for increasing the production of edible oil to meet the domestic requirement in the country. He said that government spent a big amount on the import of edible oil, which is a huge burden on the economy. He said, currently the country required around 25 million tonnes of edible oil, while the production was 10 million tonnes only. In this direction, the use of technology and hybrid seeds will play a significant role. He emphasized, the research work on genome editing, speed breeding and marker-associated breeding for yield enhancement and also manage the biotic and abiotic stresses. However, in mustard level of heterosis can be exploited but employ difficulty in seed

production due to complex flower structure, presence of self-compatibility and thereby self-pollination in nature. Dr. Mohpatra, told that rapeseed-mustard has scope for horizontal and vertical expansion. Furthermore, there is a need to also increase the VRR for recently developed rapeseed-mustard varieties. Dr. Arvind Kumar, recalled that the government realized the importance of mustard crop among oilseed crops and established a separate institute for research in the year 1993 at Bharatpur. He appreciated the efforts made by the researchers and stated that, the tremendous progress has been made during last three decades in development of production and protection technologies. He stated that, the production has increased by almost three fold and productivity two fold, production from 4.5 million tonnes and productivity 778 kg/ha in 1993 to about 13 million tonnes and 1500 kg/ha in 2022-23, respectively. He remarked, it is imperative that we keep going and put more effort, because after making incredible progress, still country rely on huge quantity of import of edible oil to meet countries consumption requirement and rapeseed-mustard crop has the potential to bridge this gap of demand and supply. Keeping in view the impact of climate change, he suggested to develop heat, frost, drought, salinity, aphid and orobanche tolerant varieties of rapeseed-mustard for increasing production and reducing edible oil import burden. He emphasised there is need to work in mission mode for achieving self-sufficiency in oilseed production in future.

Guest of honour, Dr. D. K. Yadava, stated that, due to concentrated efforts the average national productivity of rapeseed-mustard has realised upto 1500 kg/ha, it became possible mainly due to development and deployment of high-yielding varieties/hybrids and crop management technologies. High genetic potential of the newly developed varieties/hybrids of the rapeseed-mustard can be exploited to further enhance the realized productivity at the farmers' fields. He urged to scientist for robust research programme for development of high yielding and improved quality varieties for specific traits such as Oil content and oil quality (low erucic acid and low glucosinolates, high oleic acid), Orobanche resistance, Sclerotinia resistance, and identifying potential male sterility systems for hybrids. Dr. Yadava also given the emphasis on popularization of newly released HYVs with climate resilience and improved quality traits are needed through large-scale demonstrations/cluster demonstrations/ minikits, by mapping the areas suitable for specific varieties. He also stated that Strengthening the current seed production and delivery system is needed to ensure sufficient quantity of quality seed of newly released and notified varieties. For this robust State Seed Rolling Plans are

required focussing on enhanced Seed and Varietal Replacement Rates and Phasing out the old and un-notified research varieties/ hybrids from the seed system.

Other dignitaries of the inaugural ceremony were Dr. D. M. Hegde, Ex- Director, Indian Institute of Oilseeds Research, Hyderabad, Dr. H. C. Sharma, Ex- Vice Chancellor, CSK Himachal Pradesh Agriculture University, Palampur, Dr. O .P. Sharma, Ex- Pr. Scientist, National Research Centre for Integrated Pest Management, Dr. J. S. Yadava, Ex-Project Coordinator, AICRP-RM, etc.....

Dignitaries on dais also released two publications viz Abstract book: 5th National Brassica on "Oilseed Brassicas for Sustainability, Profitability and Nutritional Security"published by Society for Rapeseed-mustard Research and another one Historical Research in Mustard and Taramira published by SKNAU, Jobner.

The Society for Rapeseed-Mustard Research, Bharatpur, recognised the lifetime achievement of rapeseed-mustard researchers in the country including Dr. T. Mohapatra, Dr. Dhiraj Singh, Dr. J. S. Yadava, Dr. Sanjay Jambhulkar, Dr. Abha Aghinotri, Dr. D. K. Yadava, Dr. P. C. sharma, Dr. Y. P. Singh, Dr. K. H. Singh, Dr. Mahak Singh, Dr. R. S. Mahala and Dr. P. D. Meena by conferring the Society's prestigious award "Life Time Achievement Award. President of Society Dr. Arvind Kumar and other dignitaries, presented citation and souvenir to the recipients and congratulated for their enomorous contribution in enhancing oilseed production in country.

At the outset Dr. P. D. Meena, Secretary SRMR presented the objectives and highlights of various achievements of society in short span of time. He stated that prior to this conference, society has organised four National Brassica Conferences with grand success and regularly publishing the Journal of Oilseed Brassica.

The session ended with vote of thanks presented by Dr. A. S. Baloda, Director, RARI, Durgapura, He extended gratitude to all contributors, including Chief Guest, organisers, sponsors, partners, speakers, participants, media persons as well as staff and students at RARI.

TECHNICAL SESSION- I: Genetic and Genomics Breeding

Chairman	:	Dr. D. K. Yadava, Assistant Director General (Seeds), Indian Council of Agricultural Research (ICAR), Krishi Bhavan , New Delhi
Co-Chairman	:	Dr. Sanjay J Jambhulkar, Ex- Scientist Nuclear Agriculture & Biotechnology Division, Bhabha Atomic Research Centre (BARC), Mumbai
Rapporteurs	:	Dr. Hari Singh Meena, Pr. Scientist, ICAR-Directorate of Rapeseed-Mustard Research, Bharatpur
	:	Dr. Shailesh Godika, University Head, Sri Karan Narendra Agriculture University (SKNAU), Jobner

On February 07, 2024, in the afternoon the technical session was organised in the main auditorium. The session was started with the introductory remarks given by the Chairman Dr. D. K. Yadava. He emphasized on improvement of rapeseed-mustard production and productivity in the country. He advocated to attend self-sufficiency in edible oil to reduce the huge import as India spending more than one lakh crores annually. He stressed on the vertical and horizontal expansion of rapeseed-mustard in non-traditional areas. He also expressed urgent need of quality seed production in sufficient quantity of the available high yielding varieties and development of short duration and disease-pest tolerent high yielding varieties for different conditions.

The five lectures were delivered in the session which includes three lead and two invited presentations. The speakers were as under:

Lead presentations

- Dr. Sanjay J Jambhulkar, Ex-Scientist, BARC, presented a lead lecture entitled "Desirable plant type for enhancing harvest index in Indian mustard (Brassica juncea)"

  In his presentation Dr. Jambhulkar, stated that breaking the yield barriers for increasing production and productivity faces many challenges, and therefore, the development of desirable plant types remains the main concern in Indian mustard (*Brassica juncea*). The present harvest index is not appreciable. Tailoring desirable plant types by enhancing the harvest index could be the best option for increasing productivity and combating climate

change. Modified plant architecture by reducing vegetative components and enhancing seed yield components needs to be developed for an effective source-sink relationship. Reduction of plant height and duration by retaining the same amount of seed yield could easily be achieved through isolation of early and high-yielding mutations in all high-yielding varieties. Reduced plant height automatically decreases vegetative growth and helps to increase the harvest Index. Early maturity shall be useful in escaping high-temperature stress during sowing and maturity. Another approach to reduce the vegetative matter could be a reduction in leaf biomass. Converting dark green leaves into light green leaves shall help in reduced leaf biomass and efficient photosynthesis. The Harvest index could further be enhanced by adding yield components like increased pod density for more siliquae, long siliquae with more seed number and more seed weight up to the full plant capacity. Non-locular siliquae could accommodate more number of seeds with bold seed size. The yellow seed coat is an additional character to increase seed oil content and golden oil colour avoiding industrial processing.

The availability of desirable yield components is not much concern due to the vast Brassica genome plasticity. However, its utilization through interspecific hybridisation has been restricted due to large genome drags resulting in undesirable plant types. Therefore, such variability needs to be generated within the species for effective hybridization, isolation of desirable high-yielding recombinants and to tailor desirable plant types with high harvest index. Mutation breeding has been the best approach to overcome these barriers. A large spectrum of variability for these characters has been isolated in the Bhabha Atomic Research Centre through induced mutagenesis which has been effectively used in hybridization and developed the most desirable plant types with shorter duration. These genotypes are being evaluated in various parts of the country and found to be superior for seed yield indicating better plant type with higher harvest Index.

- Dr. K. H. Singh, Director, ICAR-Indian Institute of Soybean Research, Indore, presented a lead lecture entitled "Rapeseed-Mustard beyond northern India: strategies, research, policy innovations"

  Dr. Singh stated the region specific biotic and abiotic constraints for rapeseed-mustard crop and emphasized for breeding early maturing thermo-insensitive and disease-pest resistance varieties keeping consideration of consumer preference-quality parameters also and development of agronomic management for economic viable and

low cost of cultivation. Strategic intervention such as crop may be promoted in States of promise and State specific strategies keeping other competitive crops in consideration and Crop diversification can also be implemented. Upto 2.0 m ha additional area may be targeted in nontraditional area specifically northeastern India, which shall add about 2 mt to total production.

- Dr. Nanjundan J, Sr. Scientist, ICAR-Indian Agricultural Research Institute, Regional Station, Wellington, The Nilgiris, Tamil Nadu, presented a lead lecture entitled "Exploring the scope for Indian mustard cultivation in Karnataka: A multi-pronged approach"

  Dr. Nanjundan stated that, Indian mustard is the widely cultivated species. Though this species is having very limited area under cultivation in Karnataka, it has been realized off late that there is ample scope in it as this crop can be fitted well into different cropping systems of the state due to its wider adaptability. By bringing the mustard as an alternative crop at selected places in the state, we can mitigate the issues like monsoon failure, droughts, lower crop yields which are being encountered very frequently in recent years. With this view, the ICAR-IARI, New Delhi have come up with few Indian mustard varieties possessing specific traits like extra early maturity (Pusa mustard 25), novel quality oil having healthy fatty acid profile and no pungency (Pusa Mustard 30 and Pusa Mustard 31), widely adopted (Pusa mustard 28), climate resilient and high yielding. In the preliminary yield trials conducted at selected places in Karnataka, promising seed yield (upto 1.6 tonnes /ha) have been realised in these varieties and these results have proved that there is ample scope to bring more area under mustard cultivation in Karnataka, Further, the observations from these trials have also highlighted that the biotic stresses like white rust, powdery mildew and aphid infestation are the major limiting factors, among several others, affecting the mustard productivity in Karnataka and hence, developing varieties with multiple disease resistance has become a major breeding objective at IARI, RS, Wellington.

Invited presentations

- Dr. Mahesh Rao, Sr. Scientist, ICAR-National Institute for Plant Biotechnology, New Delhi, presented an invited lecture entitled "Pre-breeding approaches for the diversification of traits in rapeseed-mustard: Genetic stock development and its characterization"

The speaker highlighted that, due to less diversity, there is genetic sealing for the improvement of the *B. juncea* cultivars. So, there is urgent need to generate a number of well characterized diverse genetic stocks and the pre-breeding programs combined with traditional and molecular breeding approaches will be more efficient and speedy way to extend the genetic base. Genetic stock development entails identifying and utilizing wild relatives, landraces, and exotic germplasm to introduce novel alleles for desired traits in the cultivated species. He emphasizes on pre-breeding in rapeseed mustard as a critical step toward sustainable oilseed production and fulfil the domestic demands.

- Dr. Jogendra Singh, Sr. Scientist, ICAR-Central Soil Salinity Research Institute, Karnal presented an invited lecture entitled "Breeding salt tolerant Mustard (Brassica juncea): status and prospects"

  Speaker stated that, the traditional methods of crop improvement may have reached their maximum potential. Therefore, it is crucial to enhance the productivity of less productive lands, including salt-affected areas, in addition to increasing crop yields. In India salt-affected land is estimated 6.73 million ha. Despite the importance of salinity on the crop production worldwide, and the abundance of knowledge gathered on genes/mechanisms involved in salinity tolerance, there has been surprisingly little effort to breed for improved salinity tolerance. Developing salt tolerant crop varieties is critical because the increased water scarcity will demand for alternate sources like those having salinity and residual alkalinity. Indian mustard (*Brassica juncea*) is a major oilseed crop in these areas. Salt tolerance is a very complex factor controlled by a number of independent and/or interdependent mechanisms and genetic modification that lead to many changes in physiology and biochemistry at the cellular level. Genome editing, along with classical breeding systems, further aid to develop salt-tolerant mustard varieties in a short period. The Marker Assisted Selection (MAS) and backcrossing (MABC) have facilitated the use of simple sequence repeats (SSR) and single nucleotide polymorphisms (SNP) markers to identify quantitative trait loci (QTLs) and candidate genes that control polygenic traits like salt tolerance and seed yield. Thus, salt-tolerant mustard cultivars, along with consumer acceptance and good oil quality, are necessary to obtain optimal yield and expand cultivated areas on stress-prone land.

These lectures on various aspects of rapeseed-mustard covered all major thrust areas and fruitful discussions were made in the house. The lead lectures followed by the oral presentations (*Annexure-I*) by different participants on genetic and genomics breeding aspects. The chairman and all the subject experts made critical observations and give their valuable inputs and appreciated all the presenters. The session was concluded with the closing remarks by chairman and co-chairman.

The key points emerged are:

- Need for mission mode approach to bring Self-sufficiency in edible oil and reduce huge import in India
- Development of desirable plant types by enhancing the harvest index could be the best option for increasing productivity and combating climate change.
- Pre-breeding programs combined with traditional and molecular breeding approaches will be more efficient and speedy way to extend the genetic base.
- In India salt-affected land is estimated 6.73 million ha, therefore, it is crucial to enhance the productivity of less productive lands, including salt-affected areas, in addition to increasing crop yields
- Quality seed production in sufficient quantity of high yielding varieties recommended for different agro-ecological systems.
- Breeding early maturing thermo-insensitive and disease-pest resistance varieties
- More area may be added from nontraditional area specifically north eastern states

TECHNICAL SESSIONS-II: Resource use-efficient production technologies

Chairman	:	Dr. D. M. Hegde, Ex-Director, ICAR-Indian Institute of Oilseeds Research, Rajendra Nagar, Hyderabad
Co-Chairman	:	Dr. Sanjay Singh Rathore, Head, Division. of Agronomy, ICAR-Indian Agricultural Research Institute (IARI), New Delhi
	:	Dr. Ram Swaroop Meena, Assistant Professor, Institute of Agricultural Sciences, BHU, Varanasi
Rapporteurs	:	Dr. M.D. Meena, Sr. Scientist, ICAR-Directorate of Rapeseed-Mustard Research, Bharatpur
	:	Dr. R.L. Choudhary, Sr. Scientist, ICAR-Directorate of Rapeseed-Mustard Research, Bharatpur

On February 07, 2024, afternoon session took place in the Conference Hall of Agronomy Davison of RARI. The session was started with the introductory remarks given by the Chairman, Dr. D. M. Hegde. He emphasized the need to enhance the use efficiency of nutrients and water and stressed the need for efficient natural resource management and improvement in soil health for sustainability.

The following four lead lectures were delivered in the session, and the speakers were as under:

- Dr. Sanjay Singh Rathore Head, Division of Agronomy, ICAR-IARI, New Delhi, presented a lead lecture entitled "Sustainable crop intensification with mustard-based system for carbon, energy and economically efficient production system for achieving the green economy in agriculture"

  The speaker stated that, the agricultural sector has a huge environmental footprint but it can also be an engine for the creation of green jobs, livelihood, and mitigating climate change. Environmentally clean agricultural practices like organic, conservation, integrated and diversified mustard-based systems have the potential to create more livelihood opportunities without compromising the farm productivity and environmental quality. Integrative approaches including diversified systems could address the twin challenges of food security and climate change. Therefore, a study was conducted to assess the C footprint, energy dynamics, and financial outcome

concerning the environmental distractions. The system mustard equivalent yield (MEY) was significantly influenced by production systems as well as by diversified cropping systems. Among the production system, over the year's least productivity was recorded in integrated organic management, however maximum system productivity was achieved in integrated crop management. Among the cropping systems Maize+cowpea-mustard and pegionpea-wheat with ICM and IOM systems is the carbon neutral-energy efficient and economically viable production system and could be strongly recommended for achieving a green economy in the agricultural production sector.

- Dr. Ram Swaroop Meena, Associate Professor, Institute of Agricultural Sciences, BHU, Varanasi, presented a lead lecture entitled "Rice-based cropping system diversification by the Indian mustard and soil carbon management plans for long-term inability"

  The speaker said that, the rice-wheat cropping system (RWCS) makes major agricultural contributions to greenhouse gas (GHG) emissions. Advanced cropping techniques reduce GHG emissions, improve crop yield, restore damaged soils, and lessen pollution by lowering erosion and fertiliser runoff, cleaning surface and groundwater, and boosting microbial activity and soil biodiversity. A analysis of the carbon footprint (CF) of the different agricultural production processes is required to develop targeted mitigation and adaptation solutions. The C-intensive oilseed crops and the cultivation methods used to grow them, so that these methods may be appropriately modified to maintain food supply in the face of changing climate conditions. Indian mustard may be useful for system diversification in preserving soil health, raising crop and soil production, increasing resource use efficiency, and increasing farmers' income by lowering cultivation costs compared to the rice-wheat cropping system (RWCS). The Indian mustard crop responds very well to inputs under various climatic circumstances. Indian mustard presents an innovative way to diversify the RWCS. It will assist in managing the deteriorated soil, enhance input use efficiency, and improve the green credit system.

- Dr. M L Dotaniya, Sr. Scientist, ICAR-Directorate of Rapeseed-Mustard Research, Bharatpur presented a lead lecture entitled "Phytoremediation potential of mustard crop for improving soil health"

Speaker stated that, Numerous hazardous metals are used in industry, such as lead (Pb), cadmium (Cd), chromium (Cr), mercury (Hg) etc. Increasing concentration of metals in the natural ecosystem adversely mediated the ecosystem services due to unscientific disposal of waste. It also adversely affects the soil organic matter mineralization kinetics and plant nutrient dynamics in soil-plant continuum. Different metal contamination indices and strategies are working to reduce the contamination level at source point and at field level. Among the metal remediation methods, phytoremediation is a sustainable and environmentally friendly approach to mitigate soil contamination by using plants to remove, degrade, or immobilize pollutants. Indian mustard plants are known for their phytoremediation potential, especially in improving soil health by addressing various soil contaminants. Mustard plants have a remarkable ability to accumulate heavy metals such as Cr, Cd, Pb, Zn, Ni in their tissues. They take up these metals from the soil and store them in their roots, stems, and leaves. Addition of different types of organic and inorganic substances for enhancing the biosorption capacity for higher amounts of metal removal/immobilization by mustard. These strategies help in the remediation of soils contaminated with heavy metals, preventing their further migration into the food chain.

- Dr. Pushp Sharma, Principal Physiologist (Oilseeds) cum Head, Department of, Botany, PAU, Ludhiana presented a lead lecture entitled "Climate change and abiotic stresses in Brassicas: PGR, morphophysiological and biochemical insights"

  Dr. Sharma stated that, crop growth, productivity and genome stability are greatly affected by the environmental condition. Adverse environmental factors are threat for plants that prevents realization of full genetic potential and limits the crop productivity worldwide. One of the major reasons in decline of mustard productivity is the abiotic stresses. Different stresses during the critical growth stage and their duration determines the yield losses. Shading reduced sink strength by suppressing flowering, whereas profuse flowering continued under full sunlight. Specific leaf weight (SLW) and leaf water retention (LWR) were highly related to shade. Low light reduced photosynthesis and development of phloem and xylem tissues. Indian mustard faces high temperature at seedling and terminal stage due to late sowing. Lesser mortality and higher dry matter accumulation categorizes elite genotypes under controlled laboratory conditions and in the early sown mustard along with thermo tolerance indices. Promising genotypes were able to maintain lower temperature due to

transpiration cooling under terminal heat stress. Germination percentage, dry matter accumulation and vigour indices are important traits to monitor salinity tolerance in mustard seedlings. Plant growth regulators/substances can alter source sink relationship by enhancing mobilization of photosynthates and help in flower retention/sink under varied climatic conditions. Use of microbes in non-leguminous rapeseed mustard proved to be beneficial in mitigating drought and heat stress.

The four lead lectures as mentioned above covering various aspects of soil and crop production technologies for enhancing rapeseed-mustard production and resource use efficiency. The lead lectures addressed major thrust areas and fruitful discussions were made in the house. The lead lectures followed by the oral presentations (*Annexure-II*) by different participants on natural resource management for sustaining soil health and crop production.

The chairman and all the subject experts made critical observations and give their valuable inputs and appreciated all the presenters. The session was concluded with the closing remarks by chairman and co-chairman.

The key points are:

- Long- term study on carbon stabilization and carbon sequestration under different soil types is required
- Diversify the cropping system to generate carbon credits, carbon-footprint, and carbon budgeting and energy in popular crops.
- Divert the part of fertilizer subsidy towards budget for carbon sequestration.
- Strengthen the phytoremediation studies with respect to mustard varietal potential and soil properties.
- Quantify the potential of organic and inorganic soil amendments for improving rapeseed-mustard yield, oil content and promote the green economy.
- Need to develop genotypes tolerant to high temperature at seedling and terminal stages.
- More focused attention on climatic parameters in mustard based cropping systems.

TECHNICAL SESSION III: Strategies for Disease / Pest Management

Chairman	:	Dr. H. C. Sharma, Ex-VC, Dr. Y.S. Parmar Univ of Hort & Forestry, Solan & Chairman, RAC, ICAR-DRMR, Bharatpur
Co-Chairman	:	Dr. P. K. Rai, Director, ICAR-Directorate of Rapeseed-Mustard Research, Bharatpur
	:	Dr. O .P. Sharma, Ex- Pr. Scientist, National Research Centre for Integrated Pest Management & Member, RAC, ICAR-DRMR, Bharatpur
Rapporteurs	:	Dr. Ashish Kumar Gupta, Pr. Scientist, ICAR-National Institute for Plant Biotechnology, New Delhi
	:	Dr. Jitendra Kumar Nathawat, Sri Karan Narendra Agriculture University (SKNAU), Jobner

On February 08, 2024, forenoon session took place in the main auditorium; the session was started with the introductory remarks given by the Chairman Dr. H.C. Sharma. He emphasized on better pricing/ MSP of mustard crop to enhance the area, production, productivity of *Brassica* crop in India.

The following two lead lectures were delivered in the session, the speakers were as under:

- Dr. Pankaj Sharma, Joint Director (School of Crop Health Biology Research), ICAR-National Institute of Biotic Stress Management, Raipur, presented a lead lecture entitled "Technological advancement in Sclerotinia rot management in oilseed Brassica"

  Dr. Sharma stated that, sclerotinia disease of rapeseed-mustard, caused by fungal pathogen Sclerotinia sclerotiorum, is the most destructive disease worldwide. Sclerotinia rot is also a serious threat to oilseed rape production with substantial yield losses. This disease gained importance particularly in areas where farmers practiced mono-cropping of Indian mustard, which led to complete crop failure. It is capable of infecting >500 plant species among 75 families. In India, it has become a serious problem in some parts of the country like Punjab, Himachal Pradesh, Haryana, Rajasthan and Bihar. Soil moisture along with RH and bright sunshine hour were most significant variable responsible for disease development in crop.

He discussed epidemiological studies provide the growers with information that SR can be effectively and economically managed by foliar application of fungicides viz., carbendazim/propiconazole or bio-agenst T. harzianum. Cultural practices, wider row spacing (45 cm) and no irrigation during 25 December to 15 January, also reduce the microclimate favourable for disease development.

- Dr. Ashish Kumar Gupta, Pr. Scientist, ICAR-National Institute for Plant Biotechnology, New Delhi, presented a lead lecture entitled "Potential strategies for the management of white rust disease (Albugo candida) in rapeseed-mustard"

  Dr Gupta emphasized that among all the biotic stresses, white rust disease caused by the biotrophic oomycete *Albugo candida* is reported to cause significant loss upto 20-60% in *Brassica* crops. To overcome this problem, several disease management strategies like crop rotation, chemical control using fungicide and development of disease-resistant varieties using conventional and molecular breeding are being used. However, the conventional approaches are not efficient against the white rust disease and consistent use of harmful chemical fungicides leads to environmental pollution. Furthermore, due to high variability among *A. candida* populations, the resistant barrier of genetically-similar *Brassica* varieties is broken-down easily. In such case identifying and exploiting the resistance associated genes against white rust disease offers the most durable and sustainable solution to effectively manage this disease. He discussed the identified loci and candidate genes will serve as valuable assets for genetically enhancing *B. juncea* resistance to white rust disease, contributing towards sustainable agriculture.

  The two lead lectures as mentioned above covering on management strategies of major diseases sclerotinia and white rust of rapeseed-mustard presented and addressed all major thrust areas. The lead presentation followed by Oral Presentations (*Annexure-III*) and a fruitful discussion were made in the house.

Dr. H.C. Sharma also advocated the use of technologies the genome editing as like in cotton to increase the yield of mustard. For disease and pest management he suggested extensive screening under uniform disease pressure to select potent source of host resistance.

Dr O.P. Sharma clarified that the role of oosopre for seed and load of oospore on seed for seed testing agencies need to be define. Dr. P.K. Rai gave over all scenarios of mustard area production & productivity in India. He also recommended horizontal extension of mustard area in NEH region and identified 7 districts in Jharkhand for mustard dissemination & extension programmes. Dr Rai suggested demonstration and establishment of mini expeller for oil in rural & distant areas of country. He told that mustard is the only crop that can made India self-sufficient in oil.

The key points emerged are:

- For disease and pest management there is need of extensive screening under uniform disease pressure to select potent source of host resistance
- *Orobanche* is emerges as big problem in specific areas and therefore, problem may be addressed introducing bio technological interventions
- Research emphasis should also be given on powdery mildew and sclerotinia rot disease.
- To maintain the diversity for tolerance against *Orobanche*
- Refinement of the IPM module and include bio formulation for environmental sustainability
- Common screening area need to be developed for different kind stresses in the country.

TECHNICAL SESSIONS IV: "Trading policies and innovative approaches for technology dissemination"

Chairman	:	Dr. J. P.S. Dabbas, Head, Division of Extension, ICAR-Indian Agricultural Research Institute (IARI), New Delhi
Co-Chairman	:	Dr. Sudhesh Kumar Sharma, Director Extension, Sri Karan Narendra Agriculture University (SKNAU), Jobner
Rapporteurs	:	Dr. Harvir Singh, ICAR-Directorate of Rapeseed-Mustard Research, Bharatpur
	:	Dr. Hemraj Gurjar, Rajasthan Agricultural Research Institute (RARI), Durgapura, Jaipur

On February 08, 2024, afternoon session took place in the main auditorium. The session was started with the introductory remarks given by the Chairman Dr. J. P.S. Dabbas, He emphasized that Technology gap is a major problem in increasing production in the mustard growing region of the country. With the available improved latest technologies, it is possible to bridge the yield gap and increase the existing production level up to certain extent.

The following two lead lectures were delivered in the session, the speakers were as under:

- Dr. A.K. Sharma, Pr. Scientist (Agricultural Extension), ICAR-Directorate of Rapeseed-Mustard Research, Bharatpur presented a lead lecture entitled "Transfer of Agriculture Technology in India: Retrospect and Prospects"

  Dr. Sharma stressed in his talk that, there is greater chance now for extension to bridge the gap between technical know-how and farmers do-how. Establishing incentives and awards for extension service providers who follow the route of sustainable agriculture production and those who reach the unreached is also necessary. Strengthening agricultural extension covering the ailed sectors can play a vital role in ushering ever green revolution and improving the livelihoods. Extension programs can also be very helpful in managing knowledge and raising public understanding of issues like conservation agriculture, biotechnology, and climate change
- Dr. RK Yogi, Sr. Scientist (Agricultural Economics), ICAR-Directorate of Rapeseed-Mustard Research, Bharatpur presented a lead lecture entitled "Demand-supply dynamics of the oilseed sector: An Indian perspective"

  In his talk, Dr. Yogi, stated that, the need for vegetable oils and fats in the country has been growing quickly, but domestic production has not kept up with the demand. Per capita availability of edible oil consumption touched the peak levels to about 21.5 kg/annum, which created the demand-supply gaps significantly forcing towards the edible oil import dependency of the nation. The domestic edible oil production is about 11.65 against the demand 25.84 million tons In order to reach oilseed self-sufficiency, genetic advancement, along with the best packages and practices and their wider acceptance by farmers, will surely be a step ahead.

  The lead presentation followed by Oral Presentations (*Annexure-IV*) and a fruitful discussion were made in the house.

The key points emerged are:

- There was huge yield gap in improved production technology and farmers practices which need to be narrowed down through innovative approach in the era of digitalization
- Need to ensure the availability of quality seed of recently released varieties in different region on time to the farmers.
- Building trust in farmers about the new technology and varieties
- Strengthening agricultural extension to helpful in managing knowledge and raising public understanding of issues like conservation agriculture, biotechnology, and climate change.
- Procurement of rapeseed-mustard on MSP in mustard producing states

TECHNICAL SESSION-V: Brain Storming and Panel Discussion on Oilseed Brassicas for Sustainability, Profitability and Nutritional Security

Chairman	:	Dr. K. H. Singh, Director, ICAR-Indian Institute of Soybean Research, Indore
Co-Chairman	:	Dr. Neeraj Kumar Awasthi, Director, Anglo American Crop Nutrients (India) Pvt Ltd
	:	Dr. B.L. Kakralia, Director HRD, Sri Karan Narendra Agriculture University (SKNAU), Jobner
Moderator	:	Dr. Vinod Kumar, Pr. Scientist, ICAR-Directorate of Rapeseed-Mustard Research, Bharatpur
	:	Dr. S. K. Sharma, KVK (, ICAR-Directorate of Rapeseed-Mustard Research), Bansur
Panellists	:	Dr. P. K. Rai, Director, ICAR-DRMR, Bharatpur
		Dr. K.H. Singh, Director, ICAR-IISR, Indore
		Dr. Sudhir Maan, State Marketing Manager, IFFCO, Jaipur Rajasthan
		Dr. Ashok Kumar Sharma, Pr. Scientist, ICAR-DRMR, Bharatpur
		Dr. A. P. Singh, Senior Manager (AS), IFFCO, Jaipur, Rajasthan
		Dr. Shailesh Godika, Head, Dept. of Plant Pathology, SKNAU, Jobner
		Dr. Neeraj Kumar Awasthi, Director, Anglo American Crop Nutrients (India) Pvt Ltd
		Dr. R.S. Mahala, Director, SeedWorks, Hyderabad
		Dr. Mruthyanjaya, Hitech Pvt. Ltd.

The last technical session was held on "Brain Storming and Panel Discussion on Oilseed Brassicas for Sustainability, Profitability and Nutritional Security" on February 09, 2024.

The Brain Storming and Panel Discussion was one of the special and important sessions of the conference for meaningful discussions and experience sharing of stakeholders. Eminent speakers from diversified areas were invited as panelists.

Dr. Vinod Kumar, Pr. Scientist, ICAR-DRMR, Bharatpur moderated the session briefly introduced Dr. K. H. Singh, Director, ICAR-Indian Institute of Soybean Research, Indore, and requested to chair the session. Dr. Kumar welcomed all the panellists for kindly agreeing to participate in the panel discussions, and introduced the panelists.

In his introductory remarks, Dr. Singh, stated that the theme of the panel discussion is very much pertinent to the current perspective and scenario of the oilseeds in India.

He said that, the panel discussion will confine mainly on four points and he explained the as under

- Oilseeds including rapeseed-mustard are grown in energy starved conditions with low inputs and poor management practices due to which the total genetic potential of the crop remains unexploited
- In India, oilseed crops are typically grown in areas where fertility level is low, and small landholdings, which makes it challenging for the farmers to use modern farming equipment, technology, and practices
- In comparison to cereal crops, oilseed hybrids suffer from drought and do not show a significant increase in yield or oil content when compared to varieties. There is also scarcity of short, high yielding input responsive biotic and abiotic stress resistant varieties.
- Improper distribution or supply of quality seeds, timely availability and high price of other input like fertilizer, insecticides and pesticides
- Scope of horizontal expansion of crop

He then requested panel members to provide their views and then the panel was open to discussion. The panellists, experts from different disciplines put their vision on above topics and suggested as:

- Regardless of the increase in yield, the overall performance of the crop is still below its potential and there is a large yield gap. The main cause of this yield gap is the use of traditional crop management practices. Therefore, Technologies available with institutes to be aggressively taken to the fields.
- The nano urea is the alternate of Urea, It is easy on the pocket of farmers and will be effective in increasing farmers' income. It will also significantly bring down the cost of warehousing and transportation.
- In response of small holding panelists put their views, for the introduction of more subsidies and the promotion of alternative low-cost techniques of crop production.

- In this regard, experts also suggested to custom hire centres to be promoted to benefit reach of multiple farm machinery.
- Experts state that seed quality often directly correlates with a farmer's crop yield. Therefore, access of high-quality seeds to farmers must be assured, Increase the seed replacement ratio by encouraging seed production and here role of seed hubs, state farms and seed industry becomes very crucial.
- . Area expansion in non-traditional is to be specifically focussed.
- Increased MSP for oilseed crops is necessary, and procurement on MSP is essential for higher production.
- There is a need to campaign for suitable region specific intercropping for crop diversification

After a fruitful discussion among the panelists on different issues pertaining to rapeseed-mustard crop, the session was ended the vote of thank proposed by Dr. Vinod Kumar.

TECHNICAL SESSION-VI: VALEDICTORY FUNCTION

Chief Guest	:	Dr. Arvind Kumar, President, SRMR, Bharatpur
Chairman	:	Dr. P. K. Rai, Director, ICAR-DRMR, Bharatpur
Rapporteurs	:	Dr. Bhagirath Ram, ICAR-DRMR, Bharatpur
		Dr V.D. Meena, ICAR-DRMR, Bharatpur
Welcome Address &Presentation of Recommendations	:	Dr. M. L. Jakhar, Director, HRD, SKNAU, Jobner
Vote of Thanks	:	Dr. A.S. Baloda, Director, RARI, Durgapura
		Dr. P.D. Meena, ICAR-DRMR, Bharatpur

The valedictory session of three-day National Brassica Conference was held on 9th February 2024. The Chief Guest of the valedictory function was Padam Shri, Dr. Arvind Kumar, Former Vice-Chancellor, Rani Lakshmi Bai Central Agricultural University, Jhansi and Deputy Director General (Education), ICAR, New Delhi. During the welcome address of the function, Dr. M. L. Jakhar, Director, HRD, SKNAU, Jobner informed that, the conference featured four thematic areas covering Genetic and Genomics Breeding; Resource use-efficient production technologies; Strategies for Disease / Pest Management in rapeseed-mustard; Trading policies and innovative approaches for technology dissemination. Overall, there were ..keynote addresses, .. lead talks, .. oral presentations and .. poster presentations. The 5th National Brassica Conference was attended by about 250 participants from different institutions across the country.

In his Presidential address, chief guest Dr. Arvind Kumar congratulated rapeseed-mustard group for their contribution through developing production and protection technologies for enhancing rapeseed-mustard production in country. He stated that the rapeseed-mustard

technologies developed by the researchers at different universities/institutes are getting popularity at national level. He said that data shows there is about 32% yield gap in farmers practices and recommended packages. Therefore needs to fill this gap by promoting recent crop production and protection technologies. He remarked, after tremendous progress, still country rely on huge quantity of import of edible oil to meet countries consumption requirement and rapeseed-mustard crop has the potential to bridge this gap of demand and supply. He stated that, the development technologies specifically HYV/Hybrids can play the crucial role, since there is less limitation for wide hybridization in mustard, therefore, there is a need to broaden the genetic base by using pre-breeding approaches. He suggested for development of efficient resource use technologies and use of advanced technologies in the era of digitalization for irrigation, fertilizer and pesticide application.

In the concluding speech given by Dr. P. K. Rai, Director, ICAR-DRMR, Bharatpur surmises the research activities and achievements made by the researchers.

Valedictory function ended with the distribution of prestigious awards of the society and the prizes to the winners of poster and paper presentations (*Annexure-V*).