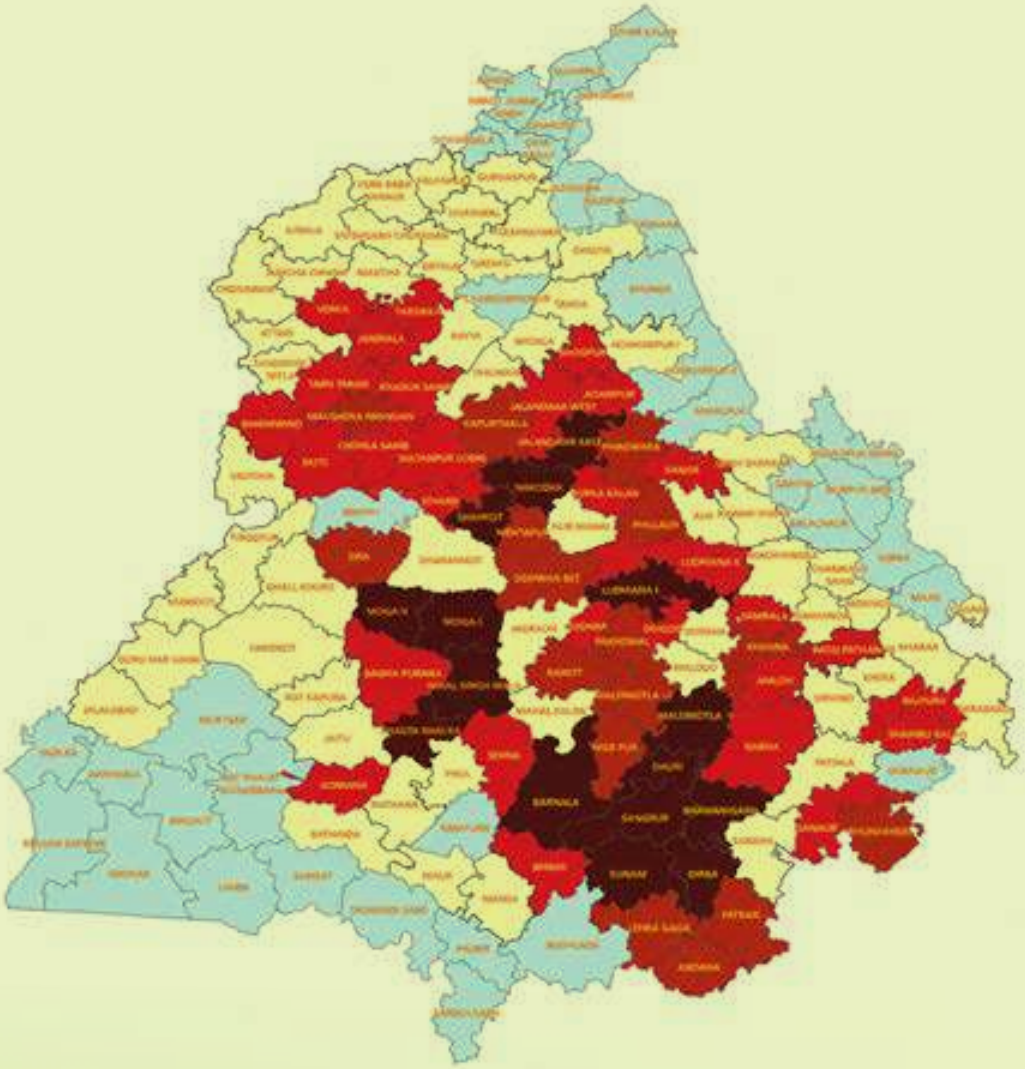
International Symposium
on
Advances in Ecologically Sustainable Rice Cultivation and National Food Security- Unlocking Potential of DSR in Punjab



PUNJAB STATE FARMERS' & FARM WORKERS' COMMISSION

GOVERNMENT OF PUNJAB

April, 2026

Hon'ble Sh. Kultar Singh Sandhwan, Speaker, Punjab Vidhan Sabha.

GROUP PHOTO

Step Towards Rangla Punjab.....

Punjab State Farmers' & Farm Workers' Commission

The State-of-Art Agri-Exclusive Data Centre

Knowledge Partners

IRRI International Rice Research Institute

irdf Integrated Research and Development Foundation

Food and Agriculture Organization of the United Nations

CONTENT

FOREWORD

Punjab has long been at the heart of India's food security, contributing far beyond its limited geographical area. However, this success is now facing serious challenges such as declining groundwater levels, rising input costs, environmental degradation, indebtness and climate stress. These concerns make it necessary for us to rethink and reorient our agricultural practices towards sustainability, without compromising productivity and quality.

The International Symposium on *"Advances in Ecologically Sustainable Rice Cultivation and National Food Security – Unlocking the Potential of DSR in Punjab,"* held on 16th April 2026 is a timely and commendable initiative in this direction. The Punjab State Farmers' and Farm Workers' Commission organised this symposium along with its knowledge partners such as IRRI, PAU, GADVASU, Geneshifter, IIT Ropar, FAO and IRDF. The symposium brought together scientists, policymakers, academicians and farmers on a common platform. Such collective deliberations are essential to address the complex challenges facing our agriculture sector and to identify practical and scalable solutions.

A key focus of the symposium was Direct Seeded Rice (DSR), which has emerged as a promising alternative to conventional transplanted paddy cultivation. The discussions clearly highlighted that DSR can help save water, reduce labour requirements, and minimise environmental impacts, while maintaining productivity while supported by appropriate technologies and practices. Although encouraging progress has been made in expanding the area under DSR, its adoption remains uneven even in the most suitable areas. This calls for stronger policy support, greater awareness among farmers, and large-scale demonstrations to build confidence at the grassroots level by providing solutions of their every problem being faced in DSR.

This is the first time, I have participated any programme to such long time and I am confident that the recommendations outlined in these proceedings will guide meaningful action in the times ahead. With coordinated efforts, strong institutional support, and active participation of farmers, we can work together to build a resilient, sustainable, and future-ready agricultural system for Punjab.

Kultar Singh Sandhwan
Speaker
Punjab Vidhan Sabha

FOREWORD

Punjab has earned a distinguished place in the agricultural development of the country through the hard work and commitment of its both farmers and farm workers. The state has consistently contributed towards strengthening national food security and supporting the rural economy. However, agriculture in Punjab is presently confronted with serious concerns including excessive dependence on groundwater, increasing cost of cultivation, and the growing impact of climate change. Addressing these challenges requires a balanced approach which will protect farmers' interests while promoting environmentally sustainable agricultural practices.

The International Symposium on "Advances in Ecologically Sustainable Rice Cultivation and National Food Security – Unlocking the Potential of DSR in Punjab," held on 16th April 2026 at Chandigarh, is an important initiative in this direction. The symposium created a constructive platform where scientists, agricultural experts, policymakers and progressive farmers came together to exchange experiences and deliberate upon practical solutions for the future of Punjab's agriculture.

I have been told that the discussions during the symposium particularly emphasised the importance of Direct Seeded Rice (DSR) as an emerging alternative within the rice cultivation system. The experiences shared by researchers and farmers indicated that DSR can contribute towards conserving groundwater, reducing labour requirements, lowering input costs, and improving resource-use efficiency. At the same time, it was also recognised that wider adoption of such technologies depends upon sustained extension efforts, scientific guidance, timely access to suitable inputs, and continuous institutional support at the field level.

I am pretty sure that the recommendations and insights presented in this volume will contribute meaningfully towards policy formulation and future agricultural planning in the state. It is intended that these proceedings will encourage wider dialogue and collective action for building a resilient and sustainable agricultural system in Punjab. We have fixed a target of 2.0 lakh ha bringing under DSR during 2026-2027, to that an allocation of Rs. 40.00 Crore has been made in the budget.

Gurmeet Singh Khudian
Minister of Agriculture and Farmers Welfare
Animal Husbandry Fisheries
Dairy Development and Food Processing
Government of Punjab

FOREWORD

Punjab's agriculture stands at a critical juncture. The wheat-paddy system has long ensured food security and farm income stability, but it has also contributed to growing ecological stress, particularly in the form of declining groundwater levels and increasing input dependence. Continuing on this path without putting in place the ecological and sustainable modification will further deepen these looming challenges.

The International Symposium held under the ages of Punjab State Farmer's and Farm Worker's Commission on 16 April 2026 at Chandigarh brought together Researchers, policymakers and farmers to engage with these issues in a practical and evidence-basedmanner. It also drew upon insights from both national and international researchers, enriching the discussions with wider evidence and comparative perspectives. There was a shared understanding that while transitions such as Direct Seeded Rice (DSR) and crop diversification are necessary, However, new challenges need to be meticulously addressed. Field experiences indicate that DSR holds potential for reducing water use and labour constraints, but its adoption depends on effective extension support, timely availability of inputs, and sustained institutional backing.

DSR has emerged as a promising alternative within the existing rice cultivation system, which is an extensively water consuming. Its potential to reduce water use, address labour shortages during peak transplanting periods, and maintain yields under suitable conditions makes it an important option for consideration. However, its successful adoption depends not merely on technological availability but on the broader ecosystem of support including demonstrations that build farmer confidence, extension systems that provide timely guidance, and reliable access to quality seeds, seed drills and inputs. Without these interventions, even well-intentioned interventions risk limited uptake.

On this occasion, the Commission also unveiled the State-of-the-art Agri Exclusive Data Centre and the Pocket book of Punjab Agriculture 2026, which aim to provide reliable, accessible, and policy-relevant information. These resources are intended to support researchers, policymakers, and farmers in making informed decisions.

This Document brings together the key insights from the symposium. I have a great hope that it will contribute to shaping appropriate policies that make sustainable agricultural practices both financially viable and attractive for Punjab's farmers. I would also like to place on record my sincere appreciation for the valuable contributions of Padma Shree and World Food Prize Laureate Dr. Gurdev Singh Khush, Dr. Kulwinder Gill, Dr. Sharon Elizabeth, Dr. Gurreetpal Singh Brar, Dr. Satbir Singh Gosal, Dr. Virender Kumar, Dr. Kuldeep Singh and all participants for their participation in the conference and for sharing their insightful perspectives.

14/05/2026

Sukhpal Singh
Chairman
Punjab State Farmers' and Farm Workers' Commission

FOREWORD

Punjab has played a vital role in strengthening India's food security, with its farmers consistently contributing to the nation's grain reserves and Punjab Mandi Board has also played a pivotal role therein. However, the challenges facing agriculture today require us to rethink not only production practices but also the broader systems of research, marketing, and policy support. Farmers often make cropping decisions based on expected returns, and over time, this has led to the dominance of certain crops eliminating other less remunerative cropping system. It is therefore important to create conditions where diversification becomes both viable and profitable, supported by scientific research and market assurance.

The International Symposium on "Advances in Ecologically Sustainable Rice Cultivation and National Food Security – Unlocking the Potential of DSR in Punjab," held on 16th April 2026 at Chandigarh, provided an important platform for discussing these issues. The deliberations highlighted that while innovations such as Direct Seeded Rice (DSR) offer promising solutions for reducing water use and improving sustainability, their success depends on strong institutional support, better access to technology, and effective extension systems that connect farmers with scientific advancements.

A key concern that emerged is the need to strengthen agricultural research and ensure adequate funding for universities and research institutions. Scientists are working on valuable innovations, including improved crop varieties and alternative uses of agricultural residues, but their efforts require greater financial and infrastructural support. Investment in both research and assistance very much essential to equip the farmers with practical solutions that can enhance productivity while addressing environmental challenges.

Water management and technological adoption must also remain central to Punjab's agricultural strategy. Efficient use of irrigation resources, expansion of canal systems, and integration of modern technologies can significantly improve resource use and productivity consequently bringing sustainability. Farmers must be supported in adopting new techniques, including emerging tools that enhance monitoring and decision-making at the field level.

This Documentary of proceedings reflects the key discussions, concerns, and recommendations that emerged during the symposium. It underlines the importance of coordinated efforts in strengthening research, strengthening market systems, ensuring policy support, and promoting sustainable practices. It is my considered opinion that these insights will contribute an up-to-date knowledge booster for policymakers and practical interventions that benefit farmers.

Harchand Singh Barsat
Chairman
Punjab Mandi Board

FOREWORD

Punjab's agricultural system is at a pivotal movement where sustaining productivity must go hand in hand with conserving natural resources. Over the years, conventional practices, particularly puddled-transplanted rice cultivation, have contributed significantly to food security but have also led to serious environmental concerns including groundwater depletion, reduced natural groundwater recharge, and soil degradation.

The International Symposium on "Advances in Ecologically Sustainable Rice Cultivation and National Food Security – Unlocking the Potential of DSR in Punjab," held on 16th April 2026 at Chandigarh, served as an important platform to deliberate on these issues. The discussions provided valuable insights into both the scale of the challenges and the pathways available for addressing them in a coordinated manner.

A major focus of the symposium was understanding the bottlenecks confronting its wider adoption and finding pathways for their redressal and promoting Direct Seeded Rice (DSR) as a sustainable alternative to conventional methods. The deliberations highlighted that DSR has a tremendous potential to significantly reduce water use, lower labour and input costs, and minimise environmental impacts, including greenhouse gas emissions. It also offers greater flexibility in cropping systems and can contribute to improving overall farm sustainability. However, the transition to such practices requires a clear roadmap, strong institutional support, and effective dissemination of knowledge so that farmers can adopt these methods with more confidence.

This volume of proceedings brings together the key insights, data, and recommendations emerging from the symposium. It aims to provide a practical direction for policymakers, researchers, and practitioners working towards sustainable agricultural development in Punjab. I am highly thankful to Prof Dr. Sukhpal Singh Chairman, Punjab State Farmer's and farm Worker's Commission to trusting and guiding our path at each and every step.

I would also like to acknowledge the dedicated efforts of our team of the Punjab State Farmers' and Farm Workers' Commission, including Manavpreet, Gagandeep, Shubham, Shavdeep, Jatinder, Hardeep, Bahal and Harman along with the support extended by Dr Sukhwinder Singh, Dr Vikash Kumar, Dr Gurinder Kaur, Dr Jatinder Singh, Dr Shaik Iftikhar Ahmed, Aishwarya and Parmeet from IRDF whose commitment and coordination made this symposium possible. Without their contribution holding International symposium in such a short span would not even thought of, all the members have exhibited an exemplary contribution which reflects a strong collective cooperation for addressing the pressing challenges of the agricultural sector. It is firmly considered that the outcomes of this symposium will guide meaningful action and contribute to building a more sustainable and resilient future for Punjab's agriculture.

Ranjodh Singh Bains
Administrative Officer-Cum- Secretary
Punjab State Farmers' and Farm Workers Commission

BACKGROUND

India is the largest producer and exporter of rice, with a 40% share (20 Million Tons) in global exports (2025) amounting to $12,5 billion (Rs 1.15 Lakh Crores). Measures and supportive policies like MSP, ensured procurement and subsidies have bolstered its production and in return this contributed to ensuring National Food Security and get established India as a leading exporter. However, the extensive and the vast expanse of paddy cultivation now faces many challenge such as groundwater depletion, residue burning and climate stress thus, threatening sustainability especially in the original green revolution states viz. Punjab, Haryana and Western Uttar Pradesh.

Punjab, with 1.5% geographical area of country, contributes more than 40% of rice in the central food reserves, even exploiting its natural resources. It is often being argued that the water use in Punjab for rice cultivation is higher than the recommended levels. Direct Seeded Rice (DSR) method offers a promising alternative to such challenges. With the right varieties, mechanization and management, DSR can match traditional yields and at the same time by saving 20-50% water, cutting 25-30% labour costs, lowering emissions (~50% methane reduction), easing residue issues, enhancing farm profitability.

The Punjab government has earmarked Rs 40 crore for 2026-27 to provide incentives for promoting DR and other water efficient crops. Morerover, in the state is also offering Rs 1500 per acre incentive to encourage farmers to adopt this technology, targeting an expansion of up to 5 lakh acres. In 2024 Kharif season, the area under DR saw a significant increase of up to 44% covering 2.4 lakh acres compared to 1.72 lakh acres in 2023. However, its adoption remains uneven, underscoring the need for supportive policies and institutional backing.

The Punjab State Farmers' and Farm Workers' Commission collaborating with knowledge partners viz. International Rice Research Institute, Punjab Agricultural University, Guru Angad Dev Veterinary and Animal Sciences University, GeneShifter, FAO and Integrated Research and Development Foundation, is organising a one-day International Symposium on "Advances in Ecological Sustainable Rice Cultivation and national Food Security - Unlocking Potential of DSR in Punjab*. The Symposium provided a platform to bring together all the stakeholders including scientists, policy makers, farmers, government officials, academicians and leading exporters, etc. from different sections to actively deliberate upon prospects and challenges in adoption of DSR and suggesting policy roadmap to promote it by addressing these challenges, thus further strengthening food and ecological systems of the country in general and Punjab in particular. The participation of the progressive farmers, DSR Warriors and cooperatives who have adopted DSR and have successfully contributed to bringing a meaningful change. Further, the Commission is also in the process to evolve low silica paddy cultivar, best suitable nutrient-rich fodder for the animals, for the State of Punjab with Punjab Diaspora GeneShifter Company. The Commission is also getting established as a Nodal agency for the State of Punjab catering benefits to the farmers of Carbon Credit from the International market especially in agriculture sector.

The Punjab State Farmers' and Farm Workers' Commission has taken the lead to organize International Symposium on " Advances in Ecologically Sustainable Rice Cultivation and National Food Security - Unlocking the Potential of DR in Punjab" on 16th April 2026 at Shivalik View, Chandigarh under the able guidance of Prof Dr Sukhpal Singh, Chairman, PSFC. The proceedings of this symposium and roadmap for strategic promotion of DSR in Punjab has also been chalked out keeping in view the suggestions of the learned delegates of this symposium.

The Commission would lead this project continuously for 5 years to increase underground water development in the over-exploited 15 blocks in collaboration with some funding agencies. In the First go, all villages of 15 dark blocks of seven districts, where extraction of sub-soil water is more than 300% would be covered for promoting DSR in each village to address this imminent threat looming of dwindling water resources in the State of Punjab. List of highly over-exploited blocks of Punjab are as below:

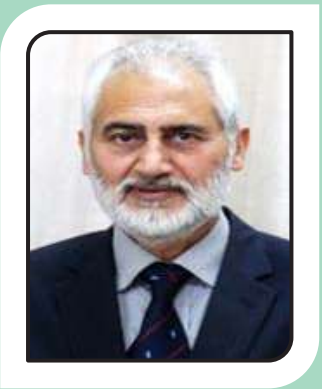
S. No.	District	Block	Total No. of Villages	Extraction (%)	Status
1	Barnala	Barnala	70	320	Over-exploited
2	Bathinda	Bhagta Bhai Ka	29	345	Over-exploited
3	Jalandhar	Jalandhar East	78	400	Over-exploited
		Nakodar	89	313	Over-exploited
		Shahkot	93	344	Over-exploited
4	Ludhiana	Ludhiana -1	110	353	Over-exploited
5	Malerkotla	Malerkotla -1	69	308	Over-exploited
6	Moga	Moga-1	50	333	Over-exploited
		Moga-2	43	344	Over-exploited
		Nihal Singh Wala	38	331	Over-exploited
7	Sangrur	Bhawanigarh	66	348	Over-exploited
		Dhuri	60	344	Over-exploited
		Dirba	47	342	Over-exploited
		Sangrur	71	310	Over-exploited
		Sunam	52	341	Over-exploited
Total			**965**		

DIGINATORIES

1. Hon'ble Sardar Kultar Singh Sandhwan, Speaker, Punjab Vidhan Sabha.

- Sh. Kultar Singh Sandhwan is the Hon'ble Speaker of the 16th Punjab Legislative Assembly (Punjab Vidhan Sabha), holding office since March 21, 2022.
- A prominent Aam Aadmi Party (AAP) leader, he represents the Kotkapura constituency as a two-time MLA

2. Prof Dr. Sukhpal Singh



- Dr. Sukhpal Singh, Chairman, Punjab State Farmer's and Farm Worker's Commission.
- He was the former Principal Economist and Head, Department of Economics and Sociology at Punjab Agricultural University.
- He holds a Ph.D. in Economics, with advanced research training from the International Centre for Development Oriented Research in Agriculture(ICRA) and participatory research experience at K.N. University of Science and Technology, Holland.
- His research spans critical issues in the rural economy, including agrarian distress, farm debt, rural suicides, depeasantisation, and rural marketing and policy reforms; he has authored 2 books and over 200 research and policy papers.
- Dr. Singh has received multiple national and international recognitions, including the German Fellowship Award (ICRA), State Award (Government of Punjab), and Best Book Award (PAU), and has presented his research widely across leading global academic platforms.
- He is a distinguished member of the High-Powered Committee constituted by the Hon'ble Supreme Court of India on agrarian reforms.

DIGINATORIES

3. Sh. Harchand Singh Barsat

- Sh. Harchand Singh Barsat is the Chairman of the Punjab Mandi Board.
- He holds office of Chairman (COSAMB), National Council of State Agricultural Marketing Boards, India.
- He served PSEB for almost 30 years.
- He is a practitioner lawyer of the Hon'ble Punjab & Haryana High Court, Chandigarh.

4. Sh. Mohinder Singh Sidhu

- Sh. Mohinder Singh Sidhu Chairman, PUNSEED
- He is a Committee Member of the Punjab State Agricultural Policy
- Progressive Farmer and Member Kisan Club Sangrur
- He is the State President of AAP's Kisan Wing.

5. Sh. Gurmit Singh Sohi

- Sh. Gurmit Singh Sohi, PCS, presently serving as Deputy Principal Secretary to the Hon'ble Chief Minister of Punjab.
- He holds M.A. degrees in Economics and Political Science along with a B.Ed. and has six years of teaching experience.
- He is actively studying the socio-economic changes in Punjabi society and agriculture after the Green Revolution and the impact of freebies on the consumption of natural resources.

INTERNATIONAL DELEGATIONS

1. Padma Shree And World Food Prize Laureate Dr. Gurdev Singh Khush

- Dr. G.S Khush is a World Renowned Plant Geneticist and Breeder celebrated for his pivotal role in Green Revolution
- He Served as the Head of the Plant Breeding Department, IRRI, Phillipine (1972-2002)
- He is currently an adjunct Prof., US Davis and Chairman of the Gurdev Singh Khush Foundation
- His about 300 genotypes of paddy are being cultivated all over the world.
- Dr Khush hails from district Hoshiarpur

2. Dr. Kulvinder Singh Gill

- Dr Gill hails from district Hoshiarpur
- He earned his BSc in Agriculture (Honours) from Punjab Agricultural University in 1981, followed by an MSc in Plant Breeding in 1983. He then pursued a PhD in Genetics at Kansas State University (KSU), completing it in 1990.
- After his doctorate, he continued at KSU as a postdoctoral researcher. Later, as a Senior Scientist, He joined the University of Nebraska-Lincoln as an Assistant Professor and Cytogeneticist.
- In 2002, he moved to Washington State University as the inaugural Vogel Endowed Chair Professor in Wheat Breeding and Genetics.
- He currently serves as Professor and Director of the Climate Resilient Wheat Innovation Lab at WSU. Since 1996, he has taught advanced graduate-level courses in Cytogenetics, Epigenetics, Crop Breeding, and Molecular Crop Improvement.

3. Dr. Virender Kumar

- Dr. Virender Kumar, Research Director, International Rice Research Institute -South Asia Research Centre-Varanasi
- He is Principal Scientist - Weed Science and Systems Agronomy & Interim Research Director & Head of Sustainable Impact Department at International Rice Research Institute, Varanasi

INTERNATIONAL DELEGATIONS

4. Dr. Sharon E. Benes

- Dr. Sharon E. Benes, Ph.D, Professor - Soil Science and Crop Nutrition
- Research Focuses on salinity effects on crop production and the evaluation of salt tolerant
- forages and halophytes for saline drainage water reuse systems on the San Joaquin Valley Westside.
- Coordinator of graduate program and also J.G. Boswell Endowed Chair.
- Recipient of 2001 Outstanding Research and Scholarly Activity Award for the College of Agricultural Sciences and Technology.
- Recipient of 2019 Salgo Noren Teaching Excellence Award.

5. Dr. Gurreet Pal Singh Brar

- Dr Gurreet Pal Singh Brar, Scientist, California State University, Fresno, USA
- Dr. Brar has extensively worked on water conservation. He relentlessly worked on for generating awareness about sustainable use of water in Punjab.
- Dr. Brar also translated book "Jadon Dariya Sukde ne" book of water crisis all over the world

6. Dr. Vinay Singh

- Dr. Vinay Singh National Technical Coordinator- Food Systems and Nutrition at UN FAO
- He is persuasive social development and research professional, extending monitoring and evaluation, impact evaluation (RCT), policy formulation, strategic project planning, implementation and advocacy support to Government and multilateral organizations.

NATIONAL DELEGATIONS

1. Dr. T.N. Parkash Kammardi

- Dr. T.N. Prakash Kammardi is a distinguished agricultural economist and currently serves as Member of the Karnataka State Policy and Planning Commission, contributing to policy formulation in agriculture and allied sectors.
- He has held key academic and policy positions, including Professor and Head at University of Agricultural Sciences Bangalore and Chairman of the Karnataka Agricultural Prices Commission, with extensive experience in agricultural policy, pricing, and rural development.
- Dr. Kammardi has a strong academic background with advanced training from institutions such as University College London and the University of Bonn, and has contributed widely through research projects, publications, and policy studies.

2. Dr. A.K Singh

- Dr. A.K Singh, Leading Paddy Plant Breeder, IARI (PUSA), New Delhi.
- He is Former Director and Vice-Chancellor of the Indian Agricultural Research Institute, New Delhi, a deemed to be university.
- Dr Singh is an alumnus of Banaras Hindu University, Varanasi where he did his bachelor's degree and Master Program in agriculture with specialisation in plant genetics and breeding.
- Dr Singh is an instrumental bringing out herbicide tolerant paddy variety.

3. Dr. Kuldeep Singh

- Dr Kuldeep Singh, Former Director, NBPGR.
- He is the Head of GeneBank, ICRISAT, Hyderabad
- He is recently toured the Niamey regional genebank, a vital center for the conservation and distribution of millets and legumes. This genebank plays a crucial role in supporting agriculture in the most challenging dryland areas of West and Central Africa.

NATIONAL DELEGATIONS

4. Dr. Gopal Krishan

- Dr. Gopal Krishan is Scientist-E and Officer-in-Charge of the Nuclear Hydrology Laboratory at the National Institute of Hydrology, Roorkee.
- He has over 24 years of research experience in hydrological investigations, groundwater systems, isotope hydrology, and hydro-geochemistry.
- He has published more than 100 peer-reviewed international journal articles, along with book chapters and edited volumes, and has led several national and international research projects.
- His work includes collaborations with leading global institutions such as the British Geological Survey, IIRS-ISRO and other international research organisations.

5. Dr. Surinder Paul

- Dr. Surinder Paul is the Director and Scientist-G, Indian Meteorological Centre, Chandigarh, which operates under the Indian Meteorological Department (IMD). He is a prominent figure in regional meteorology, frequently providing weather forecasts, heavy rain alerts, and heatwave warnings for the states of Punjab and Haryana.
- Dr. Paul is a key person in the development of "The State-of-the-Art Agri-Exclusive Data Centre." At PSFC, SAS Nagar.

6. Dr Ajai Rana

- Dr Ajai Rana, Chairman, Federation of Seed Industry of India.
- Asia Pacific Business Head, RiceTec & CEO at Savannah Seeds Pvt Ltd Gurgaon, Haryana, India Asia Pacific Business Head, RiceTec & CEO at Savannah Seeds Pvt Ltd Gurgaon, Haryana, India.

STATE DELEGATIONS

1. Dr. Satbir Singh Gosal

- A renowned agricultural biotechnologist Dr Satbir Singh Gosal joined as Vice Chancellor of Punjab Agricultural University Ludhiana.
- Dr. Gosal holds a B.Sc from Punjab University and M.Sc & Ph.d in Plant Breeding from PAU, with postdoctoral research experience in the UK.
- He holds Director Research, PAU before his elevation as Vice Chancellor, PAU.

2. Dr. Jatinder Paul Singh Gill

- Dr. Jatinder Paul Singh Gill is the Vice-Chancellor of Guru Angad Dev Veterinary and Animal Sciences University (GADVASU) in Ludhiana, Punjab
- He is a distinguished academician with over 34 years of experience, specializing in veterinary public health, research administration, and zoonotic diseases
- Dr. Gill joint FAO/WHO expert meeting on Foodborne Antimicrobial Resistance.
- He holds Director Research, GADVASU before his elevation as Vice Chancellor, GADVASU.

3. Dr. Ajmer Singh Dhatt

- Dr. Ajmer Singh Dhatt, Director Research, PAU Ludhiana.
- He progressed to the position of Vegetable Breeder in 2001, Senior Vegetable Breeder in 2009, and later headed the Department of Vegetable Science in 2015. His leadership roles continued as Additional Director of Research (Horticulture and Food Science) in 2019 and Director of Research in 2023.
- Dr Dhatt was the PhD student of Dr Sajjan Singh Uppal, an eminent Tomato Breeder, PAU, Ludhiana.

STATE DELEGATIONS

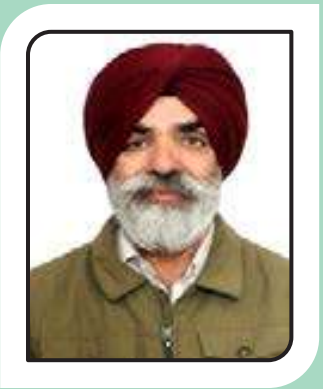
4. Dr. Pushpinderpal Singh

- Dr. Pushpinderpal Singh, Project Director, AWaDH, IIT , Ropar
- Techno-Optimist Experimental Physicist Project Director : ANNAM.AI, an AI - CoE of the Ministry of Education, Govt. of India, and DST iHub – AwaDH.
- Dr Singh is the Scientist bringing AI & IoT in agriculture of the country and has been financially supported (Rs 300 Cr) for it by the GOI.

5. Dr. Gurjit Singh Brar

- Entry Batch in Agriculture Department :2000
- He has completed BSc Agriculture from S.K.G.V. College, Sangaria, Rajasthan
- MSc (Vegetable Crops) from PAU, Ludhaina
- Dr. Gurjit Singh Brar, Director Agriculture & Farmers Welfare Punjab.

6. Dr. Amrik Singh



- Entry Batch in Agriculture Department :1990
- He earned his BSc in Agriculture from Punjab Agricultural University in 1990 and MSc from Tamilnadu Agricultural University, Coimbatore in 2012. He then pursued a PhD in Agronomy at LPU, Jalandhar in 2025.
- Dr. Amrik Singh is a highly experienced agricultural professional currently serving as the Cane Commissioner of Punjab. He has over 34 years of experience within the Punjab Agriculture Department and is widely recognized for his work in agricultural extension and sustainable farming.
- Dr Singh was also awarded as best extension specialist by PAU and many other institutions.

7. Dr. Makhan Singh Bhullar

- Dr. Makhan Singh Bhullar Principal Agronomist cum-DEE
- Assistant Professor, PAU Ludhiana (December 1992-March 2003), Associate Professor (March 2003- March 2009), Professor (March 2009- to date)
- Field of Specialization: Weed Science; Crop Production, DSR Expert Scientist.

8. Dr. Ranjit Singh

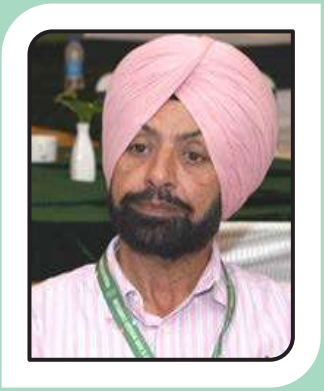
- Professor Ghuman is a distinguished economist renowned for his extensive research in rural development, public policy, and socio-economic issues in India.
- He currently holds the position of Professor of Eminence at the Punjab School of Economics, Guru Nanak Dev University (GNDU), Amritsar. He has held prominent academic positions, including Professor and Head of the Department of Economics at Punjabi University, Patiala.
- Dr Singh, Member, High Powered Committee on agrarian reforms constituted by the Hon'ble Supreme Court of India.

9. Sh. Davinder Sharma

- He is a prominent Indian food and trade policy analyst, agricultural scientist, and writer known for his advocacy on sustainable agriculture, food security, and farmers' rights. He is a member of the High-Powered Committee on Agrarian Reforms constituted by the Hon'ble Supreme Court of India.

STATE DELEGATIONS

10. Dr. Ranvir Singh Gill



- Dr. Ranvir Singh Gill is a prominent Plant Breeder and currently serves as the Section In-Charge of the Rice Improvement Program at the PAU. He is recognized for his work in developing both Basmati and non-Basmati rice
- He has contributed to the development and release of key rice varieties, including Basmati (Punjab Basmati 4, 5, and 7) and non-Basmati (PR 128, PR 129, PR 130, PR 131, and PR 132).

11. Dr. Darminder Bhatia

- Dr. Dharminder Bhatia joined Punjab Agricultural University (PAU) as a Quantitative Geneticist on August 6, 2014.
- For his doctoral research, he was awarded the prestigious Monsanto Beachell-Borlaug International Fellowship and spent a year as a visiting scholar at the Arizona Genomics Institute, University of Arizona, USA.
- Dr. Bhatia has twice attended the World Food Prize Ceremony at Iowa State University, USA. His expertise in working with wild rice led to the identification of two major bacterial blight resistance genes (Xa38 and xa45) and one brown planthopper resistance gene (BPH34).
- He played a pivotal role in developing Punjab Basmati 3, the first basmati rice cultivar bred using marker-assisted selection, and was instrumental in establishing a speed breeding facility at PAU. With over 70 research papers published in high-impact journals, he has made significant contributions to the field of rice genetics and breeding.

12. Dr. Jasvir Singh Gill, PAU, Ludhiana

- Dr. Jasvir Singh Gill is a Senior Agronomist (equivalent to Associate Professor) at Punjab Agricultural University (PAU), Ludhiana, specializing in weed management, crop residue management, and regenerative agriculture.
- He did wonderful research on "Tar-Wattar" DSR technique.
- Dr Gill is prominent Scientist promoting DSR.

13. Sh. Amarpal Singh Bhullar

- Sh. Bhullar holds a postgraduate degree in Political Science from Guru Nanak Dev University and a specialised Diploma in Cooperative Business Management (Marketing) from Vaikunth Mehta National Institute of Cooperative Management, Pune, Maharashtra.
- He has had an extensive professional career in the Punjab Cooperative Department since 1975, with significant experience in the management and functioning of Primary Agricultural Credit Societies (PACS) and district cooperative banking institutions.
- He has contributed to institutional capacity building as faculty at the Agriculture Cooperative Staff Training Institute, Chandigarh, and as visiting faculty at leading institutes of public administration and cooperative management.
- His work has focused on training design, human resource development, and strengthening cooperative leadership across different administrative levels.

14. Sh. Manmohan Singh

- Sh. Manmohan Singh is the founder of National Agro Industries, a pioneering firm in agricultural machinery since 1976, recognized for introducing South Asia's first Zero Till technology in 1993, notably acknowledged by Dr. E. Norman Borlaug- A Noble Laureate.
- Under his leadership, the company has developed a wide range of innovative farm equipment—including Happy Seeder, Smart Seeder, pneumatic planters, and urea briquetting machines—promoting precision agriculture and environmentally sustainable practices.
- With a global presence in over 80 countries and a strong domestic network, the organization collaborates with leading agricultural universities and research institutions, offering advanced, ISO-certified machinery tailored to diverse crops and farming systems.

15. Dr. Manohar Lal

- Dr. Manohar Lal is a Senior Official with the National Bank for Agriculture and Rural Development (NABARD) in Punjab, recently active as a General Manager (GM) in the Regional Office, Chandigarh, as of early 2026. He has been involved in high-level meetings regarding the Punjab State Traders' Commission and State Credit Planning.

16. Dr. Maninder Kaur

- Dr. Maninder Kaur is an Associate Professor at Dr. S.S. Bhatnagar University Institute of Chemical Engineering & Technology (UICET), Panjab University, Chandigarh.
- She is affiliated with the institute's faculty in chemical engineering, specializing in areas such as electrical engineering and power systems.
- Dr. Kaur works on sustainable management of Crop Residues of various field crops.

17. Dr. Sukhwinder Singh

- Dr. Sukhvinder Singh, Ph.D. (Economics), is a retired Associate Professor with over 32 years of experience in research, training, and development, specializing in participatory rural governance, decentralized planning, and agricultural and rural development.
- He has extensive expertise in Social Impact Assessments (SIA), along with the design and implementation of Social Management Plans (SMPs) and Resettlement Action Plans (RAPs), particularly in infrastructure and land acquisition projects.
- Dr. Singh has undertaken major research, consultancy, and evaluation assignments with national and international organizations including the World Bank, UNDP, FAO, UNICEF, European Union, and USAID, and has contributed significantly to capacity building of Panchayati Raj Institutions
- He has published several books and research papers.

18. Dr. Gurinder Kaur

- Dr. Gurinder Kaur is an Assistant Professor at the Centre for Research in Rural and Industrial Development, an ICSSR-supported research institute, with academic specialization in social anthropology.
- She holds a Ph.D. in Anthropology from Panjab University and has a strong research focus on medical anthropology, particularly critical medical anthropology.
- Her research examines themes such as medical pluralism, cultural interpretations of health and illness, drug addiction, and gendered dimensions of health, with emphasis on structural and institutional determinants.
- She has contributed to several research projects and publications, including a book on religion and health, and has worked on studies related to gender, farmer suicides, drug addiction, maternal health, and self-employment.

19. Dr. Vikash Kumar

- Dr. Vikash Kumar, PhD., is presently teaching at Centre for Research in Rural and Industrial Development (CRRID), Chandigarh. Simultaneously, he is also the consultant to the "High Powered Committee on Agrarian Reforms" constituted by the Hon'ble Supreme Court of India.
- His areas of academic interest are Sustainable Development, Rural and Agricultural Transformation, Human Rights and Migration Studies Regional Cooperation in South Asia.
- He has been the Project Director/Co-Director of more than a dozen of academic research projects funded by national and international organizations.
- Dr. Kumar was recently nominated for the 7th Common Review Mission under the aegis of Ministry of Rural Development, GOI, New Delhi.

20. Ms. Komal Jaiswal

- Ms. Komal Jaiswal is the Founder of GreenAffair and a passionate advocate for soil health, regenerative agriculture, and conscious living. For over two decades, she has worked at the intersection of ecology, food systems, and human wellbeing, helping farmers, communities, and urban growers reconnect with the soil and the natural cycles that sustain life.
- Through GreenAffair, Komal promotes regenerative farming practices, soil microbiology awareness, and toxin-free food systems. She also leads educational initiatives, farmer trainings, and community programs focused on restoring soil fertility and building resilient ecosystems.
- A strong believer that healthy soil leads to healthy food and healthy people, Komal continues to inspire individuals and farmers alike to adopt sustainable practices that nurture both the land and human health.

21. Dr. Harjeet Singh Bhandol

- He is a highly qualified and accomplished professional serving as Assistant Registrar, Cooperative Societies, Mansa. With a strong academic foundation and multidisciplinary expertise, he has made significant contributions to the cooperative sector, legal studies, and management.
- He holds a B.Sc., Higher Diploma in Cooperative Management (HDCM), MBA, LL.B., LL.M., and Ph.D, from Punjabi University, Patiala and has also qualified the UGC-NET, reflecting his academic excellence and commitment to higher education.
- Dr. Bhandol is also a recognized author and columnist, contributing regularly to both English and Punjabi newspapers, where he shares insights on cooperative development, legal awareness, and socio-economic issues.
- He is an accredited author with the National Council for Cooperative Training (NCCT), New Delhi.

22. Mr. Naveen Kumar

- Mr. Naveen Kumar, Lead Agronomist, GrowIndigo, Carbon Credit Expert, New Delhi. Grow Indigo is leading the transformative movement towards regenerative agriculture in India, seamlessly blending the expertise of Mahyco and Indigo Ag – His parent companies – in the pursuit of sustainable climate solutions. Our unwavering commitment lies in empowering smallholder farmers. They strive to maximize farmers profitability by introducing innovative and sustainable approaches and products that optimize yields, enhance income and reduce resource wastage.

23. Sh. Naseeb Kairon

- Sh. Naseeb Kairon, Programme Coordinator, The Roots Foundation, Haryana. Roots Foundation emerged with an aim to create a lasting impact, one that stems from the roots and reaches the very heart of the issue at hand. The Roots Foundation acknowledges that the most effective solutions come from the very communities it serves, built on the belief that sustainable change begins by empowering those at the grassroots level

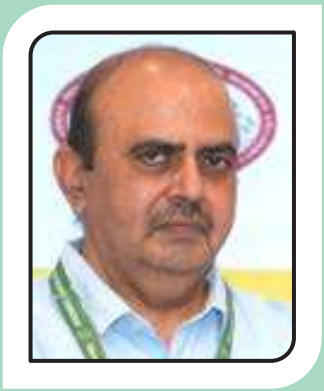
24. Sh. Jaswinder Singh Saini

- Sh. Jaswinder Singh Saini, CEO, Primary Agricultural Credit Society Lambra Kangri, Hoshiarpur. The journey of this extraordinary society began on 27th July 1920, when it was registered with just 11 members.
- The society has grown into a strong institution serving four villages—Lambra, Beron kangri, Dudiana Kalan & Baggewal with a total population of over 3700 people and nearly 1922 active members.

25. Dr. Jatinder Singh

- Dr. Jatinder Singh is an Assistant Professor at the Centre for Research in Rural and Industrial Development (CRRID), Chandigarh. He obtained his PhD from Jawaharlal Nehru University (JNU), New Delhi.
- His research areas include Rural Development, Foreign Direct Investment, Technology Development and Industrialisation in India.
- He has published 26 research papers in refereed National and International Journals and 2 books with Routledge, New York and India. His recent book, Dynamics of Drug Addiction and Abuse in India, was published by Routledge, New York in January 2023.
- He has presented numerous papers at various national and international conferences.

26. Dr. Anil Sood



- Dr. Anil Sood is a former Scientist SG and Head, Agro-ecosystem and Crop Modelling Division, Punjab Remote Sensing Centre (PRSC), Ludhiana with a vast academic and research experience in the field of applications of geospatial technologies in the field of agriculture.
- He holds a Doctorate degree in Soils from CSK HPKV, Palampur and Masters degree in the same subject from PAU, Ludhiana reflecting a strong academic foundation in agricultural sciences.
- During his tenure at PRSC, he holds various positions and contributed significantly in applications of geospatial technologies in the state of Punjab for spatial mapping of nutrients & water quality for irrigation, watershed management, crop monitoring and yield modelling, crop residue burning monitoring and mapping besides leading the team for developing web and mobile applications for custom hiring of farm machinery and reporting crop residue burning.
- He has published more than 50 peer reviewed research papers in the reputed journals and presented his work at various International/National conferences/ workshops.

27. Prof Rajvir Singh Sohi

- Prof Rajbir Singh Sohi is an accomplished academician and researcher presently serving as Assistant Professor in the Post Graduate Department of Botany, Khalsa College, Amritsar.
- He completed his B.Sc. from DAV College, Amritsar (2000), followed by M.Sc. and PhD from the Department of Botanical and Environmental Sciences, Guru Nanak Dev University. He further enhanced his international research experience as a Post-Doctoral Fellow at Georgetown University, Washington DC, USA (2011–2014).
- He is the Founder member of the "Young Innovative Farmer Group".
- He is a passionate farmer who has adopted DSR since its advent.

28. Dr. Gurkirpal Singh Bala

- Entry Batch in Agriculture Department : 2000
- Dr Gurkirpal Singh Bala is currently serving as a Soil Testing Officer, Hoshiarpur
- He has completed B.Sc. Agriculture (Hons.) in 1995, M.Sc. in Plant Pathology in 1997, and PhD in Plant Pathology in 2000, PAU.
- Dr Bala has also contributed to agricultural research through the publication of 3 research articles and completion of 2 research thesis in the field of Plant Pathology and agriculture.

29. Dr. Ranjodh Singh Bains

- Entry Batch in Agriculture Department : 2000
- Dr. Ranjodh Singh Bains is currently serving as Administrative Officer-Cum-Secretary of the Punjab State Farmer's and Farm Worker's Commission & Also Block Agriculture Officer, Ghanour, Patiala.
- He holds B.Sc. Agriculture (Hons.) (1994) and M.Sc. in Vegetable Breeding(1998) from Punjab Agricultural University Ludhiana.
- He has been the Nodal officer for RKVY, PMKISAN, Debt Waiver Scheme, etc.
- He has been conferred with Best Extension Worker by PAU in 2025-26.

INAUGURAL SESSIONS

The inaugural session of the International Symposium on Advances in Ecological Sustainable Rice Cultivation and National Food Security: Unlocking the Potential of Direct-Seeded Rice (DSR) in Punjab set the context for discussions on the sustainability challenges of rice cultivation in Punjab. It highlighted the region's critical role in ensuring National Food Security while drawing attention to pressing concerns such as groundwater depletion, high water-intensive practices, and environmental degradation. The session emphasized the need for a balanced approach that integrates water-saving technologies like DSR, development of short-duration varieties, supportive policy frameworks, and strengthened research and institutional mechanisms to ensure both ecological sustainability and farmer livelihoods.

Summary of Presentations and Discussions

1. Padma Shree World Food Prize Laureate Dr. Gurdev Singh Khush- Eminent Rice Breeder

- Rice production in Punjab and potential Central Government Policies to reduce it.
- High water use by rice cultivation in Punjab and possible impacts on National Rice output and local water resources is a major concern.
- Dr. Khush supports reducing rice area in Punjab (example target: from ~3 million ha to 1.5 million ha).
- He believes a reduction in Punjab's rice area would not greatly affect total Indian Rice output because rice is expanding in other states.
- Primary motivation is conserving Punjab's dwindling water resources.

- Direct planting (without puddling) can save water; puddling increases water use by about 30% more than that of Direct Seeding requires.
- Partial or alternate irrigation can reduce water but may lower yields.
- Shorter-duration varieties can reduce water needs by shortening the crop period.
- Punjab Agricultural University and other institutions are developing new varieties, including shorter-duration types.
- Breeding and biotechnology are ongoing and can contribute to varieties that need less water; progress has moved from 5–6 month varieties to ~3–4 month varieties.

Government should:

- Encourage adoption of water-saving technologies and varieties.
- Provide subsidies, especially initially, to offset risks for farmers adopting new methods.
- Support procurement of new machinery required for non-puddled/direct planting.
- PAU and other research institutions are actively promoting reduced rice area and new cultivation methods; some experiments and farmer adopters exist.

Adoption status and challenges

- Some experiments and early adopters of non-puddled rice have been tried; adopters report satisfactory yields.
- Wider adoption is needed; farmers may be hesitant without incentives, proper know how, appropriate machinery, and support.
- Trade-off exists between water savings and potential yield reductions under reduced irrigation.

Key takeaways

- Reducing rice area in Punjab is recommended to conserve water and likely will not severely affect national rice supply.
- Water-saving practices (direct planting, short-duration varieties) and supportive government measures (subsidies, machinery support) are essential for adoption.
- Ongoing breeding and biotechnology work aims to produce varieties that maintain yields with lower water use, but adoption and scalability remain challenges.

2. Prof Dr Sukhpal Singh Chairman, Punjab State Farmers' and Farm Workers' Commission, SAS Nagar

Key facts and context

- Punjab has ~4.2 million hectares cultivated, high land fertility and very high productivity; contributes ~6–6.6% of India's rice area but ~9% of national rice production due to higher yields (~4,428 kg/ha vs national ~2,800 kg/ha).
- Punjab is a major contributor to India's rice exports; India supplies ~40% of world traded rice and much of that export capacity depends on Punjab's production.

Production patterns and problems

- Dominant rice–wheat crop rotation established since the Green Revolution; about 40–45% of cropped area under paddy/wheat in kharif/rabi seasons.
- Rice gives assured production, MSP procurement, storage and market support — hence lower perceived risk and steady returns for farmers compared with many alternatives.
- Major problems associated with paddy:
- High water consumption and groundwater depletion.
- Large residues (stubble) leading to burning and environmental issues.
- Storage and procurement burdens (large buffer stocks).

Water resources and deficits

- Total annual water availability ~52 BCM (rainfall + groundwater + canal), agricultural demand ~62 BCM and total water demand is 66 BCM → deficit ~13 BCM.
- Many blocks are water-stressed; some high-rice blocks extract far more water than natural recharge happening.
- Estimates of water required per kg rice vary widely (2,000–5,000 liters), and a robust measurement system is needed to disaggregate rainfall vs canal vs groundwater use and to set realistic water budgets.

Alternatives, constraints and incentives

- Several alternative crops (maize, cotton, sugarcane, pulses like mung/urad, oilseeds, vegetables) discussed; they vary in profitability, water use, market risk and input needs.
- Some alternatives (cotton, certain oilseeds, vegetables) can give higher returns but involve higher market or production risk and/or require seed, processing and market linkages.
- Pulses give lower returns compared to paddy; to compete with paddy, need stronger support system (market, seed availability, procurement/subsidy).
- Structural supports favor paddy/wheat (MSP, assured procurement, power subsidies), making crop shift difficult without compensatory policies.

Policy, procurement and buffer-stock issues

- Current central buffer and procurement norms result in very large stocks (example cited: 600 lakh tonnes on hand vs a normed buffer of 200 lakh tonnes); raises questions whether this reflects overproduction, procurement policy, distribution inefficiency or access/coverage gaps under NFSA.
- Need to reassess buffer norms, procurement scale, and export policy to manage surpluses and storage burdens.
- Export markets are important for managing surplus but processing and product durability are constraints; policies could incentivize processing/ value addition.
- Establishment of center of Excellence for Pulses and Oilseed crops in the State.

Power, electricity subsidy and institutional questions:

- Free or subsidized electricity for tube wells likely contributed to groundwater over-extraction. Critical policy questions:

- Would metering/billing pumps reduce overuse, and what would be the cost impact on farmers?
- If bills are imposed, should compensation be provided via DBT or other mechanisms, and what administrative/measurement changes are needed?
- Institutional support required for technology adoption (e.g., direct-seeded rice (DSR), drip irrigation), seed systems, market linkages, and targeted subsidies.

Research, technology and monitoring needs

- Develop reliable water-use accounting per crop (disaggregate rainfall, canal, groundwater) and standardize water-use estimates.
- Evaluate adoption feasibility and location-specific suitability of DSR and other water-saving technologies; identify institutional/extension needs.
- Assess whether existing input/subsidy policies and fiscal signals encourage overuse of agrochemicals/fertilisers and whether those should be reformed.

Discussion points and follow-up questions proposed

- Profitability and risk comparison of paddy vs alternative crops in Punjab's agro-climatic zones.
- How to make non-MSP/non-procured crops competitive (market development, procurement expansion, export promotion).
- Infrastructure and technology needed to support crop diversification (processing, storage, seed supply).
- Rationalization of buffer stock norms, procurement policy and export policy to handle surpluses.
- The role of electricity pricing, pump metering, and targeted payments in reducing groundwater over-extraction.
- Environmental solutions for stubble burning and residue management.
- Institutional arrangements required for large-scale adoption of DSR and other conservation practices.

Key takeaway:

Punjab's high rice productivity and supportive policy framework have produced major national export and food-security benefits but created serious water, environmental and stock-management challenges. Addressing these requires coordinated policy shifts (procurement, pricing, subsidies), stronger market/infrastructure support for alternatives, improved water accounting and targeted institutional measures to enable diversification and water-saving technologies.

3. Dr. Kulvinder Singh Gill-Geneticist-cum-GeneShifter-Professor, Washington State University, USA

- Speaker addresses concerns about rice area reduction, groundwater decline, and related solutions.
- Emphasizes rice as a vital crop for India and the need for strategic, system-level actions.

Production and trade

- Annual rice consumption: about 14 crore tonnes (140 million tonnes).
- Production varies around 13–15 crore tonnes; basmati exports cited around 2–2.5 crore tonnes.
- Punjab: ~32 lakh hectares under rice, contributes ~9–10% of national production; Punjab yield ≈ 4.5 t/ha vs national average ≈ 2.9 t/ha.

Water-table and area-reduction debate

- Reducing rice area is often proposed to conserve groundwater, but speaker argues reductions should target low-yield, high-water-use regions, not high-yield areas like Punjab.
- Groundwater decline is regional and interconnected (e.g., UP has larger rice area and affects shared aquifers).
- Policy/solutions should be systematic at central/state levels, based on yield-water trade-offs across states.

Direct-seeded rice (DSR) and water savings

- DSR can reduce irrigation water; speaker cites observed water savings of roughly 10–20% (some claims range higher).
- Challenges with DSR: weed problems, herbicide tolerance issues, and residue effects on subsequent crops (follow-up crops can be affected).
- Need for targeted strategy and proper rollout of DSR technologies; breeding of DSR-specific varieties is required

Varietal breeding and physiological traits

- Current rice varieties have non-responsive stomata (open ~24x7), causing higher water loss. Breeding for stomatal regulation and other traits could maintain yields with less water.
- Proposal to use global germplasm with lower silica content and other favorable traits to develop high-yielding, water-efficient varieties.
- Work is non-GMO (natural breeding/germplasm use) and aims to incorporate desired traits into high-yield lines.

Rice straw problem and valorization

- India produces ~13 crore tonnes of rice straw annually; straw disposal and stubble burning are major problems.
- Straw has high silica and moisture issues, limiting its use as animal feed or other products.
- Project aim: reduce silica in straw (phase 1) and then improve nutritional content (iron, zinc, protein) in phase 2 so straw can be animal feed and prevent burning; this could convert straw into a valuable resource.

Ongoing project, partners, and approach

- Speaker's organization (GeneShifters) collects global germplasm and works on breeding without institutional approval constraints to retain flexibility.

- Collaborating with leading local institutions (PSFC, PAU, Guru Angad Dev Veterinary and Animal Sciences Unversity) to scale the project.
- Emphasis on research & development and strategic investments to solve the problems rather than ad-hoc fixes.

Key takeaways:

- Solutions must be evidence-based and region-specific; So need not to blame Punjab.
- Develop rice varieties and management systems that use less water and produce usable straw.
- Collaboration and support needed from stakeholders (researchers, institutions, policymakers, and farmers) to implement the proposed breeding and straw-utilization projects

4. Sh. Harchand Singh Barsat, Chairman, Punjab Mandi Board, SAS Nagar

- Farmers choose crops based on perceived profit; historically favored certain crops (e.g., jeera) for higher returns.
- New crop varieties and residues/research findings can support alternative uses (e.g., for fodder).

Agricultural research and funding:

- Scientists are working on useful innovations; need greater funding and special packages for research and agricultural universities.
- Universities and research centers reportedly lack sufficient funds and infrastructure (libraries, research support).

Market and policy gaps:

- India lacks a national-level marketing policy and comprehensive central statistics on crop production and regional demand.
- Price disparities across regions: examples of apples and kinnow sold at much higher prices in distant markets than local ones.
- Current system benefits large traders with little contribution to production or research.

Disaster relief and government response:

- Speaker criticizes central government for inadequate relief to Punjab farmers after floods, contrasting responses in other states.
- Concerns about crop damage from extreme weather (heat, lodging in wheat) and insufficient central assistance; perceived unequal treatment (e.g., 15% waiver given to Rajasthan and Haryana but not Punjab).
- Asked to release States RDF of about Rs 8000 Crores.

Water, Irrigation, and Technology

- Emphasis on efficient water use; Punjab supplies water to neighboring states and should practice good management strategies.

- Punjab has increased canal irrigation usage from ~20% (pre-2022) to ~80% and aims to exceed 90% coverage through irrigation systems.
- Claim that groundwater/glacial sources ensure long-term water availability if managed properly.

Technology adoption:

- Need to adopt new techniques and technologies (including AI-assisted monitoring) and connect farmers with scientific advances to improve yields and resource use.

Calls to Action and Closing Points

- A national marketing policy and reliable central statistics system should be put in place.
- Greater funding for research institutions and targeted support packages for scientists and universities.
- Fair central government relief and policies favoring Punjab farmers.
- Sharing ideas through discussion forums to benefit farmers and strengthen Punjab and India.

5. Dr. Satbir Singh Gosal, VC, Punjab Agricultural University, Ludhiana

Historical background and Green Revolution

- Post-1947 food insecurity motivated focus on increasing cereal production (wheat and paddy).
- Punjab's fertile land and proactive farmers helped lead adoption of new technologies and high-yielding varieties; collaboration with international research (Mexico for wheat, IRRI/Philippines for rice) accelerated yield increases.
- Industry, Universities and Agricultural Institutes supported variety development and extension.

Rice (paddy) expansion and consequences

- Paddy area expanded drastically alongside wheat; incentives (MSP, industry and good varieties) encouraged monoculture.
- Surplus production created storage/market pressures in mandis (markets); concerns about how to procure and store harvests.
- High rice area contributed to water depletion and soil/pollution issues.

Crop diversification challenges

- Diversification remains limited because of absence of whole Eco System required for it.
- Rice/wheat provide higher and more reliable incomes and established marketing systems.
- Alternative crops need comparable price and market infrastructure for farmers to switch.
- Suggestions: ensure market and price support for alternative crops to incentivize diversification.

Water and soil concerns

- Groundwater levels falling (~0.5 meter decline noted); traditional wells drying.
- Deep groundwater has high heavy-metal content and may be unsuitable for crops/consumption.
- Recommendation: mix canal (surface) water with groundwater where possible; avoid overuse of deep saline/heavy-metal-rich water.

Short-duration varieties and resource savings

- Development and adoption of short-duration rice varieties (examples: PR126, PR131, PR114, PR128, PR130, PR121, PR132, PR133) reduce crop duration by ~30–40 days compared to older varieties.
- Benefits: lower water use, reduced fertilizer and pesticide needs, lower disease/pest exposure, reduced environmental pollution, and better marketing windows.
- Emphasis on optimizing transplanting dates, irrigation scheduling and land leveling to maximize water savings.

Direct-seeded rice (DSR) and agronomic techniques

- Direct seeding of rice (including zero-tillage) is promoted; earlier challenges with herbicides and seed treatments have improved with better product availability.
- Technical conditions matter: seed treatments and herbicides work only if adequate soil moisture exists at sowing.
- Techniques recommended: alternate wetting and drying (AWD), ridge-bed planting, surface seeding, smaller bed/careful field layout, sensor-based irrigation scheduling.
- Digital agriculture: soil moisture sensors and automated irrigation can optimize water, but farmers' observational intelligence remains valuable.

Soil fertility management and conservation practices

- Promoting short-duration varieties plus optimized nutrient management can reduce need for nitrogen fertilizers; some approaches aim to eliminate additional N after establishment.
- Adoption of laser land leveling, smaller bed sizes, and irrigation schedule adjustments to save water.

Other concerns

- Heavy metals in groundwater pose long-term risks beyond pesticide use.
- Market/mandi infrastructure, storage capacity and procurement policies influence cropping choices.

Key takeaways

- Short-duration varieties and improved agronomic practices can reduce water, fertilizer and pesticide use.
- Market incentives and infrastructure are needed to enable crop diversification away from rice/wheat.

- Water quality and falling groundwater are critical constraints; mixed-source irrigation, AWD and digital sensing can help but require appropriate technical conditions and farmer adoption.

6. Dr. Virender Kumar, Research Director, International Rice Research Institute, South Asia Regional Centre, Varanasi

- Focus: how to use government subsidies to drive changes toward sustainable, profitable rice production in Punjab.
- Problems identified
- Severe groundwater over-extraction in Punjab: many blocks are over-exploited (examples: 70–80% and some up to 300% extraction rates), with water tables falling ~0.5–1+ meter/year in places.
- Current rice cultivation practices drive high water use, greenhouse gas (methane) emissions, rising energy and labor costs, and threaten long-term sustainability.
- Broader pressures: increasing water demand from non-agricultural sectors and potential fuel/energy price rises raising cultivation costs.
- Proposed solution: Direct-Seeded Rice (DSR) and related measures
- Promote Direct-Seeded Rice (DSR) combined with short-duration varieties and precise water management as an alternative to puddled transplanting.
- DSR can reduce irrigation, labor, and tillage costs and cut methane emissions significantly when managed properly.

Evidence and benefits

- Recorded average water savings ~20% with DSR; potential up to 50% with recommended management and short-duration varieties.
- Labor and cost savings: eliminates nursery raising, transplanting, and much puddling/pulling; reduces major cost components (35–40% tied to puddling/field prep)
- Emissions: properly managed dry DSR can reduce methane emissions by up to ~90% (dependent on water management).
- Punjab Agricultural University (PAU) has developed DSR agronomy packages and identified suitable varieties; two DSR-specific varieties are scheduled for release at Cuttack.

Barriers and challenges to adoption

- Adoption remains low despite incentives (e.g., Punjab ₹1,500/acre; Haryana up to ₹4,500/acre) due to:
- Knowledge-intensity of DSR and a "land-to-land" variability gap in implementation.
- Early failures (estimated 5–10%) usually due to improper package implementation, especially during first 20–30 days.
- Not all areas are suitable for DSR; need mapping of suitable zones.
- Many farmers cannot afford or access machines; service provision gaps exist.

Recommended actions

- Target promotion only in areas mapped as suitable by PAU.
- Implement intensive hand-holding and capacity building: train extension staff (KVKs, department personnel), machine operators, and service providers on full DSR agronomy (not just sowing).
- Develop and scale service-provider business models (with higher/subsidized support for providers who serve more farmers).
- Shift incentive design from area-based to outcome-based: monitor actual water savings and practices, verify outcomes, and provide top-up payments for verified conservation.
- Strengthen monitoring systems to measure impact rather than just area under DSR.

Key takeaway

- DSR, if implemented with the right varieties, agronomy, capacity building, service models, and outcome-based incentives, offers a viable pathway to sustain rice production while saving water, reducing emissions, and improving farmer incomes; Punjab can lead by example.

7. Dr. T. N. Prakash Kammardi, Former Chairman, Karnataka Agricultural Price Commission (KAPC), Bangaluru

- Rice and food security
- Rice is central to food security in Punjab, India, Asia, and many poorer regions; India supplies ~40% of world rice trade.
- Any changes to rice production have wide national and global implications.

Ecological and technical challenges

- Local ecological issues in Punjab: falling water table, salinity, puddling.
- Global ecological issue: methane emissions contributing to climate change.
- Balancing local and global dimensions of ecology and food security is a complex challenge.

External risks: war and trade dynamics

- International conflict and trade agreements increase vulnerability of India's rice sector.
- Fertilizer supplies are energy-dependent and largely imported (e.g., DAP nearly 100% import reliance); disruptions from war could sharply reduce fertilizer availability.
- A modest 10–15% fall in fertilizer supply could reduce rice output by an estimated ~20 million tonnes, threatening buffer stocks and food security.

Research, policy, and institutional recommendations

- Agricultural research should broaden focus from technical fixes to agrarian and farmer-centered approaches.
- Democratize agricultural R&D: actively involve farmers at all stages to build trust and ensure relevance.

- Public-sector institutions should lead research and extension; be cautious about agreements with multinational companies and ensure farmer interests are protected.
- Caution against reducing rice area or tinkering with rice production during critical times; policy changes should be carefully considered.

8. Dr. Vinay Singh, Representative, FAO of the United Nations

Context and purpose

- Speaker frames current moment as appropriate to shift from traditional to sustainable practices, focused on Direct Seeded Rice (DSR).
- The workshop is DSR-focused and aims to address scalability and sustainability of DSR in the region.

Current initiatives

- FAO is working on transforming wheat–rice systems in several states, including work in Sangrur and Patiala districts of Punjab.
- FAO plans to roll out and test a combined package of practices this season; if successful, it could be a "game changer" (scientific evidence exists but the combined package has not yet been tested at scale).

Main challenges identified

- Scalability: DSR adoption is low and not yet scalable across varied soils.
- Soil suitability: DSR has not proven suitable for all soil types.
- Weed control and herbicide dependence: DSR often requires pre- and post-emergent herbicides (raising pollution and sustainability concerns).
- Water use: Although AWD (alternate wetting and drying) can save water, water consumption remains an issue and farmer adoption is limited.
- Farmer concerns: Practical difficulties with weed management and other agronomic requirements reduce farmer acceptance.

Strategic concerns and needs

- Need to identify wheat alternatives or complementary strategies to improve system resilience.
- Urgent need to address groundwater depletion in Punjab/Haryana (~1.7 meters decline per year) to sustain the region's role in national food security.
- Testing and validating a combined package of interventions this season to evaluate scalability and impact.

Key takeaway:

- DSR and related water-saving technologies show promise, but technical, agronomic, and adoption barriers (soil suitability, weed/herbicide issues, water use, farmer constraints) must be resolved and a validated, scalable package tested to enable large-scale transition.

9. Dr. Pushpinderpal Singh, Project Director, AWaDH, IIT Ropar

- Discussion about water use, narratives, and technology-driven interventions in Indian agriculture, with a focus on rice cultivation (particularly in Punjab) and efforts to optimize irrigation and fertigation using AI.

Key points

- Prevailing narratives: Public perception that Punjab rice is poor quality, over-polluted, contains heavy metals, and uses excessive water; similar narratives exist for wheat.
- Traditional practices: Older farming norms favored continuously flooded crops (rice, betel, banana); universities and new varieties have promoted reduced-water alternatives

Water use statistics:

- Globally ~25% of freshwater goes to agriculture.
- In India ~75% of fresh water is used by agriculture; about 50% of that is for rice.
- Opportunity to save up to ~50% water in regions like Punjab through optimized practices.

Technology and AI initiatives:

- Team (from IIT Ropar) received a government project (~300 crore INR) to help farmers via AI, focusing on optimum irrigation and fertigation and an "optimum grain" component.
- AI models incorporate ~1.9 billion parameters and an aggregated knowledge base from agricultural universities (past 60–70 years of research).
- Mobile-capable AI can provide actionable guidance (e.g., how much water is sufficient, crop water deficiency, days to wait) using photos and local weather, with references to the original agricultural scientists.
- Recent AI advances enable on-device models that do not require large centralized systems.

Pilots and validation:

- Piloting in three regions: Haryana, Punjab, and Rajasthan.
- 8,000 farmers engaged for end-to-end experiments to build trust and demonstrate outcomes.
- Plan to roll out pan-India models in June–July, launching from Delhi, with an initial target to bring ~1.5 crore farmers onto the model for strong data and feedback.
- Crop scope: Models being developed for rice, cotton, wheat, sugarcane and ~250 crop Package of Practices (POPs) analyzed (~1,700 POPs referenced).

Farmer adoption considerations:

- Farmers need low-cost, fast, and economically beneficial solutions; even small cost savings encourage adoption.
- Trust concerns: farmers may blame tech if outcomes fail, so rigorous field validation and references are emphasized.
- Call for farmer/community participation in data collection to improve model quality.

Actions and requests

- Invitation for farmers, communities, and stakeholders to join data collection and pilot efforts.
- Offer to share contact details for collaboration; encourage connecting before national launch to contribute data and feedback.

Key takeaways

- Significant water savings in Indian agriculture (especially rice) are technically feasible through optimized irrigation/fertigation and newer crop varieties.
- AI-powered, mobile-first solutions informed by decades of agricultural research are being developed and piloted to provide farm-level, referenced guidance.
- Field validation, large-scale farmer participation, and demonstrable economic benefits are critical to build farmer trust and drive adoption.

10. Dr. A. K. Singh, Former Director, IARI, New Delhi

Problem

- Traditional transplanted rice consumes about 3,000 liters of water per kg of rice and is lowering groundwater levels in Punjab, Haryana and western Uttar Pradesh.
- Continued transplanting threatens long-term water and environmental sustainability.

Proposed solution: Direct-Seeded Rice (DSR)

- DSR can save about 30% water, eliminate transplanting labor cost (~₹5,000 per acre), and reduce greenhouse gas emissions by ~25–30%.
- Despite benefits, adoption is limited mainly due to higher weed pressure in DSR.

New seed varieties and availability

- Two herbicide-tolerant Basmati varieties developed by Pusa: Pusa Basmati 1979 (improvement of PB 1121) and Pusa Basmati 1985 (improvement of PB 1509).
- Varieties tolerate imazethapyr weedicide (market names include Pursuit), allowing effective post-emergence weed control without crop damage.
- Seed distribution: Pusa institute has supplied seed (~1,000 quintals) and licensed companies are offering seed; seed currently available from Pusa.

Recommended sowing windows and seed rate

- Optimal sowing: 25 May – 20 June (complete before monsoon onset).
- Pusa Basmati 1985: early June (1st–3rd week) — shorter-duration variety.
- Pusa Basmati 1979: late May to early June.
- Seed rate: ~6 kg per acre (treated seed recommended; treatment with Bavistin/Steward/Thiram-like fungicide for 24-hour effectiveness).

Agronomy and sowing methods

Two main methods:

- Uttar-battar (rice-on-top) method: after wheat harvest, plough, puddle/level with laser, wet field a few days before sowing, incorporate puddling after emergence, consolidate to retain moisture; fewer volunteers/weed mixes.
- Dry-field sowing with machine (BBC/seeders): prepare field (plough, level, laser), sow, then irrigate. Seeders drop multiple seeds per spot to ensure emergence even under crusted soil.
- Use DSR-specific seeders to maintain row spacing and plant population.

Weed and herbicide management

- For heavy grassy weed infestations: apply pendimethalin within ~48 hours after sowing as an initial control.
- At 15–20 days after sowing (after initial irrigation and when field is walkable), apply imazethapyr (e.g., Pursuit) at about 450 ml diluted into 200–250 liters of water per acre; this kills emerged weeds within a week without harming the tolerant varieties.

Incentives and policy request

- Haryana provides a ₹4,500 per acre subsidy for DSR (registration in May, verification by July, then payment).
- Speaker requests Punjab government to increase its support/subsidy level given the long-term water and environmental benefits.

Key takeaways

- DSR with herbicide-tolerant Pusa Basmati 1979 and 1985 offers substantial water, labor, cost, and GHG benefits if accompanied by proper sowing timing, seed treatment, mechanized sowing, and targeted herbicide use.

11. Dr. Amrik Singh, Cane Commissioner, Department of Agriculture & Farmers Welfare, Punjab

Issues with direct-seeded rice (DSR) and wild rice contamination

Main points

- The speaker reports recurrent, location-specific problems when using Direct-Seeded Rice (DSR).
- A principal issue is invasion/contamination by wild rice (referred to as "wild paddy", "chaara/choba"), which:
- Appears more frequently under direct seeding than transplanting.
- Matures earlier, shatters, and reduces crop quality and yield.
- Increases harvesting/workload and can negate yield benefits.

Causes

- Seed contamination and seed-source reliability (dealers/relatives) suspected in many cases.
- Environmental and soil factors are location-specific; some soils exacerbate the problem while others do not.

- Possible linkage between DSR practice and breakdown of dormancy patterns or ecological conditions that favor wild rice emergence — speaker requests targeted research on why wild rice appears more in direct seeding.

Requests / recommended actions

- Investigate the seed-source chain and ensure clean certified seed for DSR.
- Conduct research on:
- Why wild rice incidence is higher in direct seeding versus transplanting.
- Effect of environment/soil on dormancy and wild-rice seed behavior.
- Monitor and document DSR trials across locations to identify soil- or site-specific risk factors.

Key takeaway

- DSR can save labour but has recurring, location-specific problems—especially wild rice contamination and some disease outbreaks—likely linked to seed sources and local soil/environmental conditions; targeted investigation and seed-quality control are needed.

Vote of Thanks:

Dr. Ranjodh Singh Bains, Administrative Officer-Cum-Secretary, PSFC, SAS Nagar

Main problems identified

- Severe groundwater depletion in Punjab due to prolonged puddled-transplanted rice cultivation; natural aquifer recharge is declining.
- Formation of hardpan (compacted layer) from decades of puddling reduces soil infiltration and prevents recharge of rainwater.
- Rising input costs (fertilizers, seeds, labor) are reducing farmers' profitability and increasing distress.
- Increasing extraction depth is bringing up water containing heavy metals and possibly radioactive elements (e.g., uranium), posing long-term soil and health risks.
- Climate change is accelerating; speaker emphasized acknowledging and responding to shifting climate realities.Proposed solutions and benefits discussed
- Promotion of direct-seeded rice (DSR / direct-seeded wet systems) as an alternative to puddled transplanting:
- Potentially reduces methane emissions by ~35–50%.
- Reduces water use—large irrigation water savings claimed (speaker referenced 1,980 cubic meters per hectare irrigation use as a baseline).
- Lowers labour costs (claimed ~50% reduction) and input costs; improves cropping flexibility and potential for better crop rotations.
- Reduces global warming potential (~45% reduction cited for some greenhouse-gas measures).
- Need for a roadmap/platform to implement changes, share lessons and scale DSR and sustainable practices across Punjab.
- Data and scale references:

- Paddy cultivation area cited: ~4.1 million hectares total, with ~3.2 million hectares using transplanted rice this year.
- Speaker repeatedly asserted very high monetary value of irrigation water per acre.
- Water-use and emission reduction estimates used to justify transition to alternate systems.

- **Actions and next steps**
- Commitment from scientists and officials (including those at a concurrent rice conference) to support the symposium's roadmap and follow-up action plan.
- Emphasis on urgent measures to stop groundwater decline, minimize contamination risks, reduce emissions, and adopt sustainable cropping systems for future generations.

SESSION I

Title: **Understand Direct Seeded Rice (DSR)-Advancements in Breeding, Agronomics and Possibilities of reaping benefits of Carbon Credits in DSR**

Chair: **Dr. Satvir Singh Gosal, VC, PAU, Ludhiana**
Moderator: **Dr. Makhan Singh Bhullar, DEE, PAU, Ludhiana**

1. Dr. Ajmer Singh Dhatt, Director Research, PAU, Ludhiana

Context and overview

- Symposium organized to discuss ecological sustainability, food security, and the potential of direct-seeded rice (DSR).
- India produces over 200 million tonnes of rice; Punjab contributes a disproportionate share of production relative to area (high productivity).
- Productivity rose from ~15 q/ha in the 1960s to ~67 q/ha; area and production have also increased substantially.
- Policy and market incentives (PDS, procurement, exports) encouraged rice expansion beyond Punjab into other states.

Benefits and concerns of intensive rice cultivation

- Economic attractiveness, ease of cultivation, and monsoon suitability drove rice expansion.
- Negative impacts: groundwater depletion, reduced cropping diversification, and sustainability risks from very intensive cultivation.

DSR (Direct-Seeded Rice) vs transplanted rice

- DSR saw large adoption during COVID-19 due to labor shortages; about 0.5 million ha initially, then area fell as labor returned.
- DSR advantages: labor savings, potential for carbon credits, water saving (especially with AWD—alternate wetting and drying).

Challenges for DSR:

- Poor germination under hot, dry early-June conditions (temps 40–42°C day, 25–30°C night; RH 25–30% vs ideal 25–28°C and 60–70% RH).
- Weed management: limited effective herbicides initially
- Nutrient deficiencies and seedling issues; nematode problems on light soils.
- Dry-DSR specific issues: water management and seedbed control of moisture for uniform emergence.

Technical recommendations and research/actions

- Agronomic recommendations: delay first irrigation ~20–21 days in some approaches; sow when normal weather/better moisture conditions arrive.
- Treatments to improve germination and seedling vigor: potassium nitrate, nano-particle seed treatments, bacterial culture treatments.
- Weed management: integrated chemical options and resistant/tolerant varieties being identified.

Breeding and genetics:

- Development of deeper-rooting and longer mesocotyl (1–9 cm) lines for better DSR emergence.
- Selection for improved nutrient uptake, drought tolerance, herbicide tolerance (e.g., Miza-tolerant materials), submergence tolerance, and resistance to biotic stresses (BLB, brown spot, sheath blight, nematodes).
- Grain quality improvements (lower silica) and use of conventional + advanced molecular techniques; new materials expected in 1–2 years.
- Two early DSR-suited varieties (126 and 131) showing good suitability.
- Recommendation to combine DSR adoption with continued use/improvement of transplanted rice: short-duration varieties and late transplanting (after 25 June) can help retain benefits (yield, water savings).

Key takeaways

- DSR is a promising approach to address labor shortages and reduce carbon/water footprint but has agronomic, weed, pest, and germination challenges in Punjab-like conditions.
- Continued research (breeding, seed treatments, weed control, irrigation timing) and integrated strategies are needed; transplanted rice should not be abandoned—use complementary approaches where appropriate.
- Collective planning and action across stakeholders are required to scale sustainable rice systems.

2. Dr. Virender Kumar, Research Director, International Rice Research Institute, South Asia Regional Centre, Varanasi

Background / context

- DSR (direct seeded rice) is not new historically but current focus is on mechanized and precision DSR, which differs substantially from older methods.
- Globally ~30% of rice area is DSR; some countries (e.g., USA, Australia, parts of Latin America) are nearly 100% DSR, while many Asian countries are transitioning (examples: Cambodia ~99% DSR, Vietnam/Thailand ~65–70%, Philippines ~40% DSR).
- India is in a transition phase; Punjab has specific reasons to consider scaling DSR.

Key drivers for shifting to DSR in Punjab

- Labor shortages and rising labor costs: labor is less available and more expensive, thereby, increasing cultivation costs.
- Groundwater depletion: some Punjab areas extract >300% of recharge; water tables dropping (~1 m/year in areas), making current flooded rice practices unsustainable.
- Rising energy costs: higher costs for land preparation, puddling, and pumping increase total cultivation economics.
- Greenhouse gas emissions: traditional puddled rice emits significant GHGs; DSR can reduce these emissions.

Main challenges and limitations of DSR

- DSR is knowledge- and management-intensive, especially during the first 20–30 days; it is not a simple plug-and-play solution.
- Weed control (particularly weedy rice) is a major issue; a management package exists but requires capacity building from lab to land.
- Crop establishment can be affected by early rains; suitable DSR-fit varieties are emerging to address establishment issues.
- Implementation requires hand-holding, monitoring, and trained extension workers.

Recommended actions to scale DSR (operational)

- Target suitable areas rather than blanket promotion; adopt a slow, steady-and-scale approach with strong hand-holding until farmers achieve success.
- Build capacity: train department staff, KVKs, Universities, Extension Specialists, private sector, NGOs, and service providers in full agronomy (variety choice, weed control, sowing timing, irrigation, fertilizers) — not only seeding operations.
- Develop and certify service providers so they can deliver both seeding and integrated agronomic advice.
- Use available herbicide-tolerant varieties and improved DSR-fit varieties to improve weed control and establishment

Policy and incentives

- Current incentive examples: Haryana pays ₹4,500/acre; Punjab currently ₹1,500/acre.
- Recommendation: maintain the ₹1,500 baseline and add a top-up up to ₹4,500/acre contingent on verified outcomes (e.g., actual water savings, aerobic crop management, correct sowing window). Develop verification mechanisms more quick and accurate by involving technological advances.

Key takeaways

- DSR can address Punjab's water stress, labor scarcity, rising cultivation costs, and GHG emissions if implemented carefully.
- Success requires targeted scaling, intensive capacity building and hand-holding, trained service providers, appropriate varieties and weed-management packages, and outcome-based policy incentives.
- If successfully scaled in Punjab, DSR could serve as a model for other states.

3. Dr. Kuldeep Singh, Former Director, NBPGR Head, Gene Bank, ICRISAT, Hyderabad

Context and background

Speaker represented an institute working on 11 crops, including rice; involvement with DSR (direct-seeded rice) research began ~2007.

Work included screening large germplasm sets and wild relatives; trials and repeats were done at PAU (Ludhiana) and with international partners like IRRI.

Key findings and important traits for successful DSR

- Iron-induced chlorosis (iron deficiency chlorosis) is a critical, often irreversible trait in DSR; varieties must be tolerant.
- Crop duration: lines longer than ~110 days are unlikely to succeed under DSR.
- Seedling emergence/coleoptile length: need lines that emerge quickly (coleoptile ~10–12 cm) to cope with high surface temperatures and dry topsoil.
- Weed management is a major constraint for DSR; specific traits and protocols are required.
- Nematodes (e.g., Meloidogyne like issues) and brown spot are potential major problems; resistance sources were identified from germplasm (examples cited).
- Grain chalkiness and head rice recovery are important but data were limited; speaker noted PAU may have those data.
- Aerobic/anoxic germination (anaerobic germination tolerance) and early vigor were identified as necessary for pre-monsoon sowing and variable water conditions.

Experiments and resources

- Large-scale mutation/breeding work: mutation protocols standardized; ~900k M2 seeds were treated for glyphosate resistance screening; some natural mutants were also found and analyzed.

- Screening involved thousands of lines (mention of ~1,600–2,000 lines initially, larger networks later); many trait sources and genes have been identified and genotyped over the past 10–12 years.
- Despite progress, current varieties still show at least ~10% yield reduction under DSR relative to alternatives (based on available data).

Recommendations

- Long-term committed funding and focused breeding:
- DSR cannot outcompete transplanted rice without sustained, substantial investment (recommended multi-year commitment — atleast for 10 years — for breeding high-yielding DSR varieties combining all required traits).
- Integrate DSR into cropping systems rather than deploying it alone:
- Use crop rotations that include spring groundnut (peanut) followed by DSR; groundnut fixes nitrogen, provides biomass for mulch, and can reduce multiple problems.
- Coordinate agronomists and machinery/harvest specialists to synchronize groundnut harvest and DSR sowing as a single event to address operational constraints.

Additional notes

- Large national germplasm projects (e.g., NBPGR landraces screening) provide useful pre-screened materials and genotyping support for breeders.
- Several trait sources and genes from different institutions have now been pooled, but breeding to combine them into competitive high-yielding varieties remains the priority.
- No substantive content omitted; speaker also referenced collaborators, workshops, and specific institutional roles.

4. Dr. Ashish, Scientist ICAR-ATARI, Ludhiana

Targeting and adoption strategy

Farmers who try and accept one resource-conserving technology (RCT) are more likely to adopt other RCTs (e.g., DSR and residue management).

Programs should prioritize targeting those early adopters who are ready to try new technologies.

Support for first-time adopters

- First-time adopters need careful support: capacity building, hand-holding, and slow, cautious scaling.
- If a first attempt fails, farmers may avoid the technology for many years; therefore initial trials must be well-supported to reduce risk.

Machinery and cost considerations

- New machines for practices like residue management and DSR can be capital-intensive; expecting farmers to buy new equipment is unrealistic.
- Emphasize modifying and better utilizing existing machinery (e.g., Happy Seeder, zero-till drills) to improve efficiency rather than promoting purchase of new machines.

Social dynamics and farmer incentives

- Understand local social dynamics; farmers choose technologies that offer high profit and income with minimal risk.
- Technologies that do not deliver those benefits are unlikely to be adopted.

Overall recommendation

- Target willing farmers, provide strong initial support, adapt existing equipment where possible, and ensure technologies meet farmers' profit and risk criteria.

5. Dr. Dharminder Bhatia, Quantitative Geneticist, Rice Section, PAU, Ludhiana

Main points

- Successful DSR varieties so far owe much to agronomy; breeders need to adapt breeding targets specifically for DSR conditions (wet-to-dry systems).
- Transitioning from wet DSR to dry DSR requires clarified breeding effort and priorities: identify which traits matter most and how many breeding cycles are needed.

Key traits highlighted

- Plant architecture: optimal shoot and tiller structure for DSR.
- Root system: critical but not yet well-defined — desirable features discussed include:
- Deep roots capable of extracting subsoil moisture
- Longer mesocotyl length for deep sowing germination
- More root hairs and effective secondary roots for nutrient uptake
- Early establishment traits important for short-term DSR goals:
- Anaerobic germination (for flooding/waterlogged conditions)
- Germination from deeper soil depths (e.g., 6–8 cm), compared with current varieties sown at 2–3 cm
- Nutrient uptake efficiency and iron-deficiency tolerance
- Uniform emergence
- Biotic stress resistances (nematode resistance, brown spot resistance)
- Weed-competitive ability

Breeding resources and strategy

- Donor parents with relevant traits have been identified as Dr. Kuldeep elaborated but donors often carry many other background factors.
- Need to combine target traits into an elite genetic background to produce DSR-suitable varieties.
- This requires dedicated breeding efforts, focused funding, and a sustained program to develop and validate successful DSR varieties and models.

Key Takeaway

- A coordinated, well-funded breeding program focused on specific DSR traits (root traits, anaerobic/deep germination, nutrient uptake, emergence uniformity, stress resistances, and weed competitiveness) is necessary to produce elite varieties adapted to wet-to-dry and dry DSR systems.

6. Dr. Gopal Krishan, Scientist E, National Institute of Hydrology, Roorkee

Speaker and context

- Speaker is from the National Institute of Hydrology (under the Ministry of Water Resources/ Jal Shakti), presenting work done with the Punjab State Farmer's and Farm Worker's Commission and related projects.
- Focus: assessment of groundwater quantity, sources, age, recharge processes and quality in Punjab using isotope hydrology and other methods.

Key findings — Quantity, age and historical changes

- Two types of water: visible surface water (rivers, floods) and invisible groundwater; groundwater is declining while surface water appears abundant.
- Paleo-channels formed by past tectonic changes (directional shifts of rivers like Sutlej) feed groundwater.
- Isotope (nuclear hydrology) techniques used to study groundwater and identify sources (glacial vs rainfall vs canal/river recharge).
- Groundwater ages vary widely: examples include groundwater ~150 years old in some areas; other areas show recent recharge.

Historical timeline:

- Pre-20th century lower levels; British-era canal development raised groundwater levels.
- After the Green Revolution and widespread tubewells, groundwater abstraction increased greatly and levels began declining.
- Quantified changes mentioned (examples): stored volume changes on the order of tens to hundreds of cubic kilometers and level declines reported in various estimates (decimeter-to-meter scale reported by different sources).

Recharge sources and processes

- Main recharge sources quantified: rainfall (monsoon months July–September), canals, rivers, and irrigation return flow (returning pumped groundwater).
- Monsoon rainfall has become more variable: fewer rainy days and more intense events, impacting recharge efficiency.
- Managed aquifer recharge and identification of active recharge areas (including canal recharge and paleo-channel zones) are part of ongoing work.
- Installation of piezometers to monitor river–canal–groundwater interactions is underway.

Water quality issues

- Spatial variation in contaminants across Punjab:
- Arsenic is more prevalent in the Majha region.
- Southwest/south Punjab shows higher heavy metals and radon-related signatures (linked to uranium/thorium decay series).
- Detection of anthropogenic contaminants: pharmaceuticals (e.g., carbamazepine and sedatives) found in the Sutlej River and subsequently in groundwater.
- Contamination tends to increase with faster, shallow recharge and with depth in some cases.

Actions, methods and ongoing work

- Use of isotope hydrology and tracer methods to:
- Date groundwater and identify recharge sources.
- Quantify recharge contributions from canals, rivers, rainfall and irrigation return.
- Mapping of zones (topographic divisions of Punjab) and identifying paleo-channel recharge areas.
- Ongoing sampling, monitoring (piezometers), and studies under PSFC and Ministry support to inform managed recharge and groundwater management strategies.

Key takeaways

- Groundwater in Punjab shows both old and recent components; depletion has progressed since the Green Revolution due to increased pumping.
- Accurate measurement (dating and source identification) is essential to manage and treat groundwater problems.
- Recharge is heterogeneous (rain, canals, rivers, irrigation return); changing rainfall patterns and contamination (natural and anthropogenic) complicate quality and sustainability.
- Targeted monitoring and managed aquifer recharge interventions are being developed based on isotope and field studies.

7. Dr. Sharon Elizabeth Benes, Soil and Crop Nutrition Scientist, California State University, Fresno, USA

Background

- Speaker: Dr. Sharon Benes, California State University.
- Visit to Punjab State Farmers' & Farm Workers' Commission and Punjab Agricultural University with Dr. Gurreetpal Singh Brar alongwith her Research Scholars.
- Purpose: Share observations and thoughts on shifting from puddled transplant rice to direct-seeded rice (DSR).

Main problem motivating change

- Severe groundwater depletion in Punjab (up to ~1.7 m/year decline) and similar issues in parts of California.

- Consequences: reduced canal capacity, increased pumping energy requirements, dry wells in rural communities, and water quality problems (notably nitrate).
- Policy context (California example): 2014 legislation requires groundwater basins to reach sustainability by 2040, emphasizing both recharge increase and demand reduction.

Benefits of DSR (compared to puddled transplanting)

- Water savings: potential reduction in water use by up to ~30%.
- Labor savings: eliminates nursery and transplant labor.
- Avoids creating a hardpan from puddling, reducing stress on rice and benefiting subsequent crops (e.g., wheat).
- Reduced fuel, horsepower use, and equipment wear from fewer wet-soil cultivation.
- Less soil disturbance can help maintain or increase soil organic matter, improving soil physical, chemical, and biological properties.
- Allows fields to dry earlier after harvest, enabling possible intercropping with short-season crops (e.g., mung bean).

Challenges and considerations

- Weed control: different weed dynamics—some weeds may be reduced, others may increase.
- Yield gap risk during transition: initial yield reductions possible; causes include suboptimal seeding rates, weed management, nutrient optimization, and equipment choices.
- Learning curve: agronomic, environmental, and economic performance typically improve over time with experience and optimization.

Comparisons and evidence

- Reference to a 2012 paper addressing the yield gap in DSR.
- Positive U.S. experience with direct-seeded wheat: reduced dust emissions and preservation/build-up of organic matter.

Key takeaway

- Given severe groundwater depletion and related impacts, switching to DSR in Punjab is a viable strategy to reduce water demand and labor, though it requires adaptation (weed management, equipment, agronomy) and may involve an initial adjustment period.

8. Dr. Gurreet Pal Singh Brar, Senior Pomologist, California State University, Fresno, USA

- Dr. Gurreet Pal Singh Brar has translated book of Mr Fred Pears "When the Rivers Run Dry" in Punjabi language tittled as "Jadon Dariya Sukde Ne".
- Speaker advocates for direct seeding (zero-till/direct sowing) of rice in Punjab as a transformative practice for agriculture. He appreciated the initiative taken by the Punjab State Farmers' & Farm Workers' Commission

Key benefits claimed

- Conserves groundwater and reduces pressure on Punjab's most valuable resource: water.
- Lowers production of greenhouse gases (methane and nitrous oxide).
- Saves diesel fuel and reduces labour requirements.
- Demonstrated environmental benefits elsewhere (speaker cites California experience with groundwater depletion and climate impacts).

Problems highlighted

- Punjab faces severe water stress and climate change threats that endanger regional civilization and agriculture.
- Comparable crises observed in California (falling groundwater levels, land subsidence, and climate impacts).

Actions and recommendations

- Expand adoption of direct seeding through extension, outreach, and diverse platforms so farmers can adopt the technique.
- Request that the Punjab government formally incorporate direct seeding into Punjab State Agricultural Policy.
- Endorses more conferences and research to promote these practices.
- Endorsed that the Govt of Punjab should implement " The Punjab State Agricultural Policy-2023" as the solutions proposed are research and evidence based.

9. Sh. Naveen Kumar, Lead Agronomist, Growindigo, Pvt Ltd.

Key points and actions

- DSR provides visible and non-visible benefits: water savings, soil improvement, and potential to increase system resilience and productivity.
- Switching to DSR and reducing fertilizer use can lower methane and other GHG emissions, helping mitigate climate change.
- Carbon credits: one metric ton of CO2-equivalent reduced or avoided can be certified as a carbon credit. These can be digitally measured and monetized. GrowIndigo issues direct benefits to farmers through carbon credit programs.

Implementation and scale

- Approximately 1 million acres across pan-India are enrolled with the program.
- In January, 2026 about 50,000+ credits were issued for smallholder farmers in Asia — noted as a global first for this type of issuance.
- Work on carbon credits has been ongoing since 2021 across Punjab, Haryana, and other states.

Partnerships and promotion

- GrowIndigo is collaborating with Punjab State Farmers' and Farm Workers' Commission, and has an MOU with Atari to expand farmer benefits.
- Success requires active promotion and consistent effort from all stakeholders; partial or lack participation will hinder outcomes.
- Speaker urges coordinated action to save the environment and ensure farmers receive benefits.

10. Dr. Jatinder Singh, Agri Economist, CRRID, Chandigarh

Main points

- Income can rise by increasing yield or reducing costs. With limited productivity gains possible without a technological breakthrough, cost reduction is critical.
- DSR (direct-seeded rice) is presented as a technology that can substantially lower production costs — cited claims up to ~50% cost reduction.
- Environmental benefits: DSR can reduce groundwater depletion and other sustainability-related costs that are not direct monetary costs but affect long-term survival of farming systems.
- Barriers to adoption
- Despite promotion over many years, many farmers have not adopted DSR.
- Financial incentives (examples: Haryana ~Rs.4500/acre, Punjab ~Rs.1500/acre) alone are insufficient; farmers focus on perceived risks and past high-visibility failures.
- Weak extension services and diminished role/support from academic institutions limit farmer training and follow-up.
- Lack of guaranteed, multi-year funding undermines long-term capacity-building and adoption efforts.

Preconditions and recommendations

- Successful scale-up requires technical training and regular extension services to build farmer capacity and confidence.
- Programs need assured multi-year funding (e.g., suggested five-year guarantees) to sustain extension and support.
- Change in farming methods is necessary to achieve improved results; simply repeating old practices will not deliver new outcomes.
- Protecting against highly visible single failures is important, as these discourage wider adoption; ongoing local support and service providers can mitigate risk.

Key takeaways

- DSR offers potential cost and sustainability benefits, but uptake is constrained by risk perception, inadequate extension, and short-term incentives.
- Priority actions: invest in capacity building, restore/strengthen extension and academic support, provide assured multi-year funding, and ensure hands-on technical support to farmers.

11. Dr. Satbir Singh Gosal, VC, Punjab Agriculture University, Ludhiana

Water-saving agronomic practices (farmer-level)

- Promote farmer-level measures to save water rather than reducing cultivated area.
- Use short-duration and medium-duration rice varieties (examples: PR 126, PR 131) that mature earlier and save irrigation water.
- Recommend Direct-Seeded Rice (DSR) and specific sowing/timing practices observed over two years:
- Sow like wheat, delay first irrigation ~21 days after sowing (even in hot early-June conditions) — plants survive, roots develop, and subsequent irrigation is effective.

- Use Alternate Wetting and Drying (AWD) — allow soil to dry a couple of days before next irrigation.
- Emphasis on on-farm adoption of these practices.

Varietal development and research needs

Breeding and developing varieties (wide species use, new varieties) is slow, taking many years (e.g., nine years for a wheat variety).

Continuous, long-term funding is required to sustain research and breeding programs.

Carbon, greenhouse gases, and monitoring

Work underway to measure carbon sequestration by crops, and emissions of methane and nitrous oxide across systems (standing rice vs dry DSR, etc.).

Interest in accessing carbon credits linked to practices that reduce atmospheric CO2.

Biochar and residue management technologies

- Biochar production from straw (parali) by pyrolysis and application to fields is being developed and compared to in-situ residue management.
- The team is evaluating costs and suitability of biochar versus other in-field residue strategies, aiming to provide affordable, farmer-suitable technologies.
- They position themselves as advocates/extension providers to deliver practical, low-cost technologies to farmers.

Key takeaways

- Prioritize farmer-level water-saving techniques (short-duration varieties, DSR, AWD).
- Research and breeding require sustained long-term funding.
- Monitor greenhouse gas fluxes to support carbon-credit opportunities.
- Promote and compare practical residue-management solutions (biochar vs in-situ) with farmer affordability in mind.

12. Dr. Makhan Singh Bhullar, DEE, PAU, Ludhiana

- Panel chaired by Dr. Satbir Singh Gosal (Vice Chancellor, Punjab Agricultural University) discussed DSR (dry direct-seeded rice) developments, comparing DSR with transplanted rice and highlighting advantages and challenges

Varieties and breeding advances

- Two promising varieties mentioned: PR126 and PR131; originally developed for transplanted rice but performing well in DSR.
- Work underway at PAU on herbicide-tolerant lines and varieties tolerant to anaerobic germination (to germinate after rains/waterlogging).
- Breeding efforts include improving biotic and abiotic stress tolerance (e.g., low-silica varieties under advanced development).
- Recommendations for varieties suited to DSR: traits for anaerobic germination and deeper sowing (2–2.5 inches) to improve establishment and moisture resilience; short-duration varieties identified as high-potential for DSR.

Technology, management, and unresolved issues

- University updated and revived DSR technologies in 2020 addressing prior problems such as iron deficiency and other field-specific issues.
- Dry DSR has faced establishment/moisture-related challenges; developments and farmer adoption were reported as improving and resolving many earlier issues.
- "Turbo" or improved DSR methods highlighted as having strong potential.

Economic and environmental opportunities

- DSR offers indirect benefits via potential carbon credits: environmental protection and carbon capture from DSR practices could generate additional income in foreign currency.
- Biochar and other unexplored carbon-credit-related practices mentioned as having significant potential.

Needs and recommendations

- Long-term funding and continued R&D are necessary to sustain DSR adoption and development.
- Further knowledge dissemination to farmers and stakeholders was requested to scale adoption.

Key takeaways:

- Promising varieties (PR126, PR131), trait focus on anaerobic germination and deeper sowing, advances at PAU and IRRI collaboration, environmental benefit potential (carbon Credits/biochar), and the need for sustained funding and outreach.

SESSION 2

Title: **Transforming Paddy Cultivation, Climate Change and Sustainable Paddy Residue Management**

Chair: **Dr. Virender Kumar, Research Director, IRRI, Varanasi**

Moderator: **Dr. Ranvir Singh Gill, Plant Breeder & Rice Section Incharge, PAU**

1. Dr. Jasvir Singh Gill, Senior Agronomist DSR, PAU, Ludhiana

Background

- Speakers discuss rice sowing methods in Punjab, referencing past university recommendations (2010) and a newer technique developed after five years of research and promoted during/after 2020 (COVID period).
- Concern with timing of transplanting and legal/administrative limits (reference to restrictions before June 10).

Problems with traditional dry sowing (and early transplanting)

- Dry sowing between 1–15 June led to multiple water losses: evaporation, deep percolation, and runoff.
- Dry fields encourage soil crusting; early irrigation then increases water use and inhibits roots from growing deep.
- Surface-applied herbicides (e.g., pendimethalin) form a surface layer; subsequent irrigation reduces their effectiveness and increases weed pressure, increasing spray frequency and costs.

Water-saving alternative and recommended practices

- Delay transplanting (late transplanting) to reduce evaporation-related losses; promote direct-sowing/alternative methods to conserve water.
- Seed priming/seed treatment: soak seeds in potassium nitrate solution (priming) even for dry-sown or treated seeds.
- After priming, avoid irrigation for 21 days to encourage deeper root growth—this is central to the promoted technique.
- Use of laser leveling where available; prepare fields as recommended (avoid wheel tracks and compaction).
- Demonstrations (e.g., pulling up roots at day 18–22) are used to convince farmers the method works.

Benefits observed

- Deeper rooting reduces dependence on surface water and evaporation losses.
- Reduced weed establishment at the soil surface when managed correctly.
- Farmers who adopted the technique have been positive; some skepticism remains that extension efforts aim to overcome.

Implementation, support, and challenges

- Need for farmer education and on-field demonstrations to convince skeptical farmers about 21-day no-irrigation practice.
- Operational challenges: timing of monsoon (peak evaporation around 15–20 June), some villages lack reliable electricity or earlier irrigation access.
- State support noted: better access to initial irrigation water, subsidies for drilling equipment (referred to as "lucky drill" subsidy).
- Remaining issues exist; speakers suggest further discussion and follow-up to resolve them.

Key takeaway:

- A research-backed shift from traditional dry sowing toward seed priming, delayed/transplanted or alternative direct-sowing practices—with a 21-day no-irrigation period to encourage deeper roots—can reduce water loss and improve management, but requires farmer convincing, careful timing with the monsoon, and continued institutional support.

2. Sh. Manmohan Singh, CEO, National Agro Industries, Ludhiana

Background

- Speaker introduces themselves from National Agro Industry, Ludhiana.
- Company is a third-generation family business, started around 1957, specializing in seeding machines.

Product evolution and innovations

- Early machines: equipment pulled by bulls; later development moved to zero-till seeders.

- Developed inclined-plate seed delivery system to prevent seed breakage and improve seed control; system can handle up to ~6 kg seed without damaging grains.
- Converted earlier machines with attachments to serve different crops; resulting product now a multi-crop seeder (excludes sugarcane and potato).

Specific machine types and features

- Step seeder: allows adjustable seed rates step-by-step; in demand for flexibility.
- Smart seeder: can sow in standing residue/stubble with shallow cultivation (2–3 inches).
- Other types mentioned: Lucky seeder and various cultivator-compatible options; company adapts designs based on demand.

Collaborations, trials, and reach

- Worked with agricultural institutions (PAU) and other partners; conducted direct paddy-sowing trials in UP around 2000.
- Company exports machines to roughly 80 countries.
- Working on innovative idea of Direct Seeder-cum-Row Mulcher in collaboration with PSFC

3. Dr. Surinder Paul, Director, Indian Meteorological Department, Chandigarh

Main points

- Speaker is from the meteorological department and supports moving flood/continuous irrigation systems toward weather-based irrigation.
- Recommended approach: integrate real-time rainfall monitoring with forecasting systems to inform irrigation decisions and avoid unnecessary watering.

Technical actions and recommendations

- Make existing rainfall monitoring real-time and integrate it with forecasting (preferably via APIs) into a common platform for replication and operational use.
- Use forecast information and recent rainfall/soil moisture data to estimate deficit or surplus by district and decide whether to irrigate.
- Expected water savings from implementing such measures: roughly 30–40% of irrigation water.

Observations about current and recent monsoon behavior

- Recent decades show monsoon withdrawal extending by about 8–10 days (longer duration).
- Overall rainfall in Punjab has decreased; current seasonal forecast indicates below-normal rainfall due to super EI Nino development.
- Forecasts will be updated periodically to refine decisions.

Support for DSR (direct-seeded rice) and research replication

- Positive feedback on a experiment with DSR; speaker favors replication and scaling.
- Suggests developing a crop calendar tied to IMD meteorological conditions to support DSR adoption.

Key takeaway:

- Integrate real-time rainfall monitoring, multi-scale forecasts, and crop phenology (via shared APIs/platform) to convert flood irrigation to weather-based irrigation, conserve water, and tailor irrigation timing—supported by current forecasts indicating below-normal monsoon rainfall.

4. Dr. Anil Sood, Scientist SG, (Retd) Punjab Remote Sensing Centre, Ludhiana

Context and main points

- Speaker discusses how existing remote sensing and related technologies can boost agricultural monitoring, referencing observations made during COVID-related labor shortages when technology use increased in some areas.
- Panelists noted the technology is not new but gained attention during crises (e.g., transplanting and labor shortages), revealing gaps and opportunities.

Benefits of remote sensing and multispectral data

- Continuous, synoptic (satellite) views enable monitoring large areas from single scenes.
- Multispectral imagery allows derivation of vegetation indices and detection of crop stress, pest/insect attacks, or nutrient/herbicide issues.
- Regular time-series data supports ongoing monitoring and trend analysis.
- Remote sensing is useful for validating and monitoring indirect effects relevant to carbon credits.

Observed limitations and gaps

- Technology was not adopted uniformly or at the intended level in some states/areas.
- Initial monitoring covered limited areas; later-stage crop issues (extent of infestation, pest attacks) were not fully monitored.
- Remote sensing alone is insufficient — it requires ground validation and field feedback.

Recommendations / required actions

- Implement monitoring across key crop stages (sowing to harvesting).
- Combine satellite data with ground truthing: farmer feedback and field observations to validate and correct remote measurements.
- Use an integrated approach to consolidate different data streams and activities in one framework for effective technology deployment.

Key takeaway:

Remote sensing and multispectral technologies offer valuable, continuous monitoring capabilities for agriculture and related carbon accounting, but must be scaled, validated with field data, and integrated with on-the-ground feedback to be fully effective.

5. Dr. Maninder Kaur, Panjab University, Chandigarh

Context and problem

- Pollution in Punjab is commonly attributed to crop-residue (parali) burning and to electricity generation from coal.
- The project focuses on using agricultural residues and other local resources to reduce pollution and produce electricity sustainably.

Research focus and methods

- Laboratory work aims to convert crop residues (lignocellulosic biomass) into useful products (primarily biogas) by reducing the recalcitrant ligno-cellulosic nature and adding treatments to enhance biodegradability and biogas yield.
- Work proceeds in stages: laboratory-scale development followed by field assessment and system design.

Field study

- A village-level assessment was conducted to:
- Estimate annual electricity demand for the village.
- Inventory local resources: solar potential, livestock waste/manure, crop residues, and other organic wastes.
- Based on resource and demand data, microgrid designs were developed.

Microgrid designs and findings

- Two microgrid configurations were designed:
- Grid-connected microgrid (hybrid with existing grid).
- Fully off-grid microgrid using 100% renewable resources.
- Analysis indicates both microgrid designs can meet the village's electricity requirements.
- The primary ongoing objective is to increase biogas production from residues so it can be used for electricity generation.

Key takeaway:

- Combining lab-scale biomass pretreatment to boost biogas yields with village-level resource assessment and microgrid design can enable local, renewable electricity production and reduce pollution from residue burning and fossil-fuel generation.

6. Dr. Ajai Rana, Chairman, Federation of Seed Industry of India, Hyderabad

Overview

- Speaker with ~34 years' experience in Punjab agriculture and chair of a seed-industry federation presents on direct-seeded rice (DSR), comparing it to transplanted rice and drawing on international experience.

Background & observations

- Historically Punjab had ~2.0–2.2 million hectares of transplanted rice; now ~3.2–3.3 million hectares.
- Area under Cotton has declined partly due to problems from pink stem borer and other pests.
- Speaker has worked in USA (Midwest, Louisiana, Arkansas, Texas) and Brazil where DSR predominates; these regions show large-scale DSR adoption (millions of acres).

Reasons to consider DSR in Punjab

- Labor scarcity and large farm sizes make transplanting less feasible.
- DSR can be a full-system solution if implemented correctly.
- Some private companies and breeders are working on herbicide-tolerant varieties and biocontrol solutions.

Challenges and risks identified

- Weed pressure and wild red rice are major problems in DSR.
- Herbicide-tolerant mutation-bred varieties can enable blanket herbicide use (e.g., imazethapyr) but may also create issues with wild rice control.
- Nematode problems in DSR need addressing.
- Successful DSR requires more than just seed variety — it needs integrated management and technology.

Proposed components for successful DSR adoption

- Develop suitable varieties: plant architecture (erect habit, flag leaf), root traits, and genetics tailored for DSR.
- Seed treatments: nematicides, micronutrients (including zinc) and other seed-coating inputs to improve establishment and nematode control.
- Integrated weed and pest management compatible with DSR systems.
- Public–private collaboration for research, seed availability and extension.

Current progress and call to action

- Private sector work ongoing for ~11–12 years; significant DSR area adoption reported in Madhya Pradesh and Chhattisgarh (~125k–150k acres last year).
- Speaker requests coordination between Punjab Agricultural University (PAU), private sector, and public institutions to drive DSR adoption in Punjab through joint efforts.

7. Prof Rajvir Singh Sohi, DSR Warrior District Amritsar

Problem: Groundwater depletion and unsustainable model

- Punjab moved from ~6.5k tubewells (1962–63) to ~4 million tube/pump systems over ~60 years, exhausting deep fossil aquifers.
- Reliance on pumps/motors created vulnerability: if pumps stop, there is no alternative technology to extract very deep water.

- The Green Revolution model (about 70 years old) has run its course; current cultivation and development demands have changed and stressed natural resources.
- Consequences: visible drying of water resources, environmental/health and socio-economic stresses on farmers and rural communities; younger generation avoiding farming.

Proposed shift and technology: Change mindset and practices; adopt DSR

- Advocate changing cultivation practices (move away from unsustainable patterns) and adopting Direct-Seeded Rice (DSR) and related techniques.
- DSR can reduce need for puddling, help avoid stubble burning, and fit into diversified/triple-crop vegetable systems (potato, pea, pumpkin, etc.).
- Farmers are effective practitioners ("farmers are scientists"); research results need wider circulation and on-ground adoption rather than just lab reports.

Trials, evidence, and recommendations

- Speaker has been working on DSR since ~2005 and promoting it since 2010; conducted multi-year field trials (three-year trial mentioned).
- Reported yield comparisons (examples across years and crops):
- For a pumpkin/related crop: conventional yields cited ~43.15 q/ha (2010), 56 q/ha (2021), 60 q/ha (2022).
- Same years with DSR: ~46 q/ha (from 43), 58 q/ha (from 56), 71 q/ha (from 60) — indicating increases in multiple cases.
- Claims biological activity and agronomic benefits observed across crops including potato, pea, pumpkin.
- Recommends scaling up DSR, circulating results widely, and educating farmers (not by lecturing but enabling adoption).

Social and institutional notes

- Punjab remains agriculturally rich and diverse, but institutional focus/requests have shifted toward health and satellite centers, indicating changing regional development priorities.
- Urgent need to address farmer stress, revive sustainable practices, and align research/institutions with current field-level demands.

Key takeaway:

- The current water- and input-intensive agricultural model in Punjab is unsustainable; sustained field trials show DSR and changed cultivation practices can improve yields and reduce negative practices (e.g., stubble burning). The speaker urges wider adoption, dissemination of results, and a mindset shift among stakeholders.

SESSION 3

Title: **Production, Procurement, Marketing & Export Potentials and Role of Cooperatives therein;**

Chair: **Hon'ble Sardar Kultar Singh Sandhwan, Speaker, Punjab Vidhan Sabha**

Moderator: **Sh. Amarpal Singh Bhullar, DR-CS (Retd), Government of Punjab**

1. Dr. Harjeet Singh Bhandol Assistant Registrar, Cooperative Societies, Mansa

Key benefits of DSR discussed

- Potential to increase crop production.
- Water savings compared to conventional practices.
- Reduction in greenhouse gas emissions.
- Helps manage residue (stubble) and reduce field burning when appropriate machinery is used.

Role of cooperatives and institutional mechanisms

- Cooperatives presented as an effective medium to address agricultural distress and to support farmer adoption of DSR.
- Punjab has about 3,500 primary agricultural societies (paxes); approx. 60% already hold agricultural implements.
- Custom hiring centres and cooperative-managed machinery enable access to expensive equipment for small and marginal farmers at low rental rates.
- Government subsidies and establishment of custom hiring centres at society level were recommended/encouraged.

Gaps and recommendations

- Identified institutional gap and lack of coordination between departments (Agriculture and Cooperative departments) reduces effective farmer hand-holding and adoption support.
- Suggested that:
- Government should plug the coordination gap and strengthen inter-departmental collaboration.
- Subsidy/disbursement mechanisms be routed via cooperatives to directly benefit societies and members, improving timely access to inputs and machinery.
- Strengthening cooperative capacity would increase adoption of DSR and deliver environmental and farmer welfare benefits.

Operational points and outcomes cited

- Cooperative-run custom hiring helped provide post-harvest machinery and contributed to reducing stubble-burning incidents.
- Timely availability of inputs (Seeds, fertilizers, Pesticides) through societies encourages farmers to adopt DSR.

Key takeaway:

- DSR offers agronomic and environmental benefits; scaling it effectively requires strengthened cooperative institutions, better inter-departmental coordination, and subsidy mechanisms that empower primary societies to provide machinery and hand-holding to farmers.

2. Sh. Kuldeep Kumar, Joint Registrar, RCS, Patiala Division

- Speaker praises the cooperative department and recalls the historic role of PACS (cooperatives) since 1904 in supporting agriculture—providing inputs (seed, fertilizer and pesticides) to farmers when markets and roads were lacking—and contributing to the Green Revolution.
- Notes that the PSFC Chairman has included a substantial chapter on cooperatives in the new Punjab State Agricultural Policy-2023, addressing cooperatives' relevance to changing contemporary needs.
- Requests attendees to read the chapter on cooperatives in this farmer policy document distributed in the meeting bags (authored/endorsed by Prof Sukhpal Singh, Chairman).
- Mentions presence of three JR representatives (Jalandhar, Firozpur, and Patiala) and offers cooperative assistance to any farmer who needs support.
- Concludes with a brief apology and closing religious salutation.

3. Sh. Raj Kiran Johri - DGM, NABARD, Chandigarh

- Speaker describes NABARD's role in supporting pilot agricultural projects, specifically work on DSR in collaboration with PAU.

Key actions and initiatives

- NABARD supported a PAU-led pilot covering about 800 acres across ~12 districts, started 2–3 years ago.
- NABARD's core functions include providing finance to banks, state governments, and state corporations, and supporting development projects (farm and non-farm) as pilots for new techniques and technologies.
- NABARD focuses pilot support where risk prevents farmers from adopting new methods on their own.

Technical focus areas

- Primary emphasis on soil and water conservation within farm-sector development.
- Promotion and piloting of technologies such as:
- DSR (direct-seeded rice)
- Alternate wetting and drying and other water-management techniques
- Sensor-based irrigation, using AI
- Micro-irrigation and pivot technology demonstrations at PAU

Partnerships and support mechanisms

- NABARD works with cooperatives, providing finance, technology support, monitoring, and supervision for project implementation.

Outcome

- Positive results from DSR pilots noted; successful pilot outcomes encourage farmer adoption.

4. Ms. Komal Jaiswal, Founder, GreenAffairs, i-RISE Technology Business Incubator at IISER, Chandigarh

- Speaker introduces herself (not a scientist or a farmer) and says she has worked with soil for 15 years.
- Main purpose: advocate for soil health, adoption of new agricultural technologies, and growing nutrient-rich, quality food.

Key points about soil and biology

- Emphasizes the importance of the soil microbiome and diverse organisms (bacteria, fungi, nematodes).
- Notes different nematode types (bacterial, fungal, and root-feeding) and that some nematodes are harmful while others can be beneficial.
- Mentions development of India's first mobile soil-testing van used to demonstrate soil observations to farmers.
- Farming practices and technologies
- Supports DSR that grows without puddling and other low-water crops.
- Urges adoption of new technologies and support systems discussed in panel sessions; change will be gradual and adopted by willing farmers.

Market and institutional support

- Encourages producing quality, nutrient-rich food to meet growing global demand.
- Cites available institutional resources (Punjab Agricultural University, scientists, departments, labs) to support this transition.
- Asserts markets can be created for higher-value crops; gives price-change examples to illustrate market dynamics (low-priced traditional millets vs. current higher prices for some grains).

Regional and social context

- Praises Punjab farmers and notes Punjab's historical role in India's food production (Green Revolution).
- Remarks on migration of crop production (e.g., mentions wheat grown in Madhya Pradesh but sown by Punjabi farmers).
- References public awareness of health problems.

Call to action

- Invites attendees to help grow quality food; assures that market development will be addressed and asks farmers not to worry about market creation.

Purpose and status

- A sequential, scientifically based package for sustainable Direct Seeded Rice (DSR) is being proposed and field-tested this season; results expected next season.
- Aim: minimize chemical use, save water, reduce methane emissions, lower labor intensity while maintaining comparable cultivation cost to conventional methods.

Key components (sequence of actions)

- Field selection: critical to choose fields with retained biomass/crop residue (no burning) and good moisture retention.
- Post-wheat preparation: lobbing/tillage to allow weed emergence; use the 40–55 day window between wheat harvest and DSR sowing.
- Green manuring: sow and incorporate cover crops (Sesbania or mung bean) ~30 days before DSR to add biomass.
- Seed treatment: biological seed treatments recommended (brewing-yeast cell-wall product under testing, mycorrhiza or other biologicals as alternatives). Claimed evidence: brewing-yeast treatment reportedly needs much less water (presenter cites a 200× reduction claim from prior tests).
- Sowing window: ~25 May to 15 June.
- Irrigation and weeding:
- First delayed irrigation 10–15 days after sowing.
- Weeding 5–7 days after the first irrigation (timing helps manual weeding).
- Use Alternate Wetting and Drying (AWD) to save irrigation water; avoid continuous flooding.
- Other practices: residue mulching (retention) and integrated pest management.

Evidence and expected outcomes

- Individual practices (e.g., residue mulching) shown to reduce weeds by ~20–30%; combining seven steps/technologies is claimed to achieve 90–99% weed control (presenter cites scientific proof for activities).
- Package expected to address water use and emission issues if validated in trials.
- Brewing-yeast based seed treatment is a novel item under testing; a short video demonstration was shown/planned to be circulated.

Next steps and actions

- Ongoing field trials this season; assessment and rollout contingent on trial results.
- If successful, package to be adopted to reduce water use, chemical dependency, and emissions in DSR systems.

5. Dr. Vinay Singh, Representative, FAO of the United Nations

Purpose and status

- A sequential, science-backed package is being proposed to support sustainable direct-seeded rice (DSR).
- The package is currently being prepared and will be tested this season; results are expected next season.
- Aim: minimize chemical use, save water, reduce methane emissions, and reduce labor intensity.

Key problems addressed

- Weed pressure in DSR (pre- and post-emergence herbicide dependence).
- Water loss and inefficient irrigation.
- Methane emissions from flooded rice.
- Labor shortages and high labor demand for weeding and management.

Core sequential interventions (high-level steps)

- Field selection: critical to choose fields with retained biomass/residues (no burning) and suitable soil moisture/biomass conditions.
- Post-wheat management: after wheat harvest, perform tillage/rotary to allow weed emergence; use the 40–55 day window before DSR to implement preparatory steps.
- Green manuring: grow and incorporate green manure (mung bean) in the Zaid period (2–3 weeks before DSR) to build biomass and soil moisture.
- Seed treatments: use biological seed treatments (examples: brewing yeast cell-wall based treatment, mycorrhizae, or other biologicals). The speaker cites tests (including ICAR) and a claim that brewing-yeast based treatment can reduce water requirement dramatically (speaker referenced "200 times less water" claim).
- Timing of sowing: suggested DSR sowing window ~25 May to 15 June.

- Delayed first irrigation: withhold first irrigation 10–15 days after sowing to encourage weed emergence and allow timely weeding.
- Early weeding: perform weeding about 5–7 days after the first delayed irrigation to remove emerged weeds.
- Irrigation strategy: apply alternate wetting and drying to save water and reduce emissions.
- Integrated pest management: included as a cross-cutting component of the package.
- Residue mulching and retention: retain residues and use residue mulching; stated to reduce weed incidence by ~20–30% (as per cited scientific evidence).

Expected outcomes, evidence, and economics

- When the sequential seven-step package is followed, combined weed control could reach very high levels (speaker cites 90–99% control based on scientific studies).
- Individual technologies have quantified contributions to weed control (percentages referenced).
- Cost of cultivation is reported to be comparable to conventional methods, while addressing water use and emission issues.
- The package components are claimed to be scientifically proven; field-level testing/pilot rollout is underway and formal results are pending.

6. Dr. Sukhwinder Singh, Executive Director, IRDF, Chandigarh

Main points

- DSR shows positive results: saves water and does not reduce yields.
- Current promotion efforts involve agencies but are not reaching last-mile farmers effectively.
- Past diversification efforts (since 1985) exist, but DSR needs to be pushed in a "mission mode" for wider adoption.
- Paddy cannot be abandoned; no better alternative found yet, so DSR is an important technique for water conservation.

Challenges identified

- Limited adoption: only a few farmers have adopted DSR so far; overall uptake is slow.
- Negative incidents (a single farm failure) can spread distrust across villages and hinder adoption.
- Awareness alone is insufficient; farmers must be convinced and reassured.

Recommended actions / Key takeaways

- Strengthen outreach to village-level/last-mile farmers through targeted, mission-mode campaigns.
- Engage PSFC to help bring small/last-mile farmers into programs.
- Use farmer-to-farmer visits and demonstrations to showcase successful cases and reduce perceived risk.
- Address and counteract negative perceptions proactively (sanitize misinformation and handle failures).

- Scale promotion collectively, as was done during the Green Revolution, by coordinating institutions and agencies.

7. Dr. Gurjit Singh Brar, Director Agriculture and Farmers Welfare, Punjab

Main points

- Speaker describes a direct-seeding technique (referred to as "sidhibajai") that originated from farmers, was gradually standardized, and later developed by Punjab Agricultural University.
- The technique is presented as a water-saving measure, reportedly reducing water use by 10–20% and able to increase crop yield if adopted scientifically.
- Researchers and farmers have shared experiences supporting the technique's benefits.

Government program and incentives

- Punjab government has been incentivizing adoption with Rs. 1,500 per unit (described as "per killa") for the past three years.
- When the scheme started in 2023–24, the covered area was 123,000 acres.
- This year the government aims to expand coverage to 500,000 acres and has allocated Rs. 40 crore for the program.
- Registration for the incentive will open on the agriculture department's "Agri Machinery" portal from 10 May.

Calls to action and support

- Farmers and university scientists are asked to promote the technique so more farmers can benefit.
- Farmers are urged to register starting 10 May; those facing difficulties or needing technical help should contact block or district agriculture department offices.

8. Sh. Gurbinder Singh Bajwa, Farmer, DSR Warrior Group, Gurdaspur

- He represents a farmer group formed in 2014 under Dr. Amrik Singh, called the “Jang Roto Farmer Group,” and a dedicated subgroup named “DSR Warriors” (Direct-Seeded Rice).
- The group collaborates with universities, agricultural department scientists, and several named individuals (Dr. A.K. Singh, Dr. Bhullar, Dr. Gill, Sardar Kartar Singh, etc.).
- Group mission and activities
- They have been working on DSR (direct-seeded rice) since mid-2000s (speaker cites activity since 2005 and involvement from 2009); formalized group from 2014.
- Early DSR work was done manually/with improvised methods before machines were available; goal included protecting basmati quality from foot rot and maintaining export quality.

Collaboration and recognition

- The speaker emphasizes long-term cooperation with scientists, politicians, religious and social leaders in the DSR initiative.

- Praises a Punjabi translation of an agricultural policy document provided by Dr. Sukhpal Singh as a valuable gift for farmers and also requested Punjab Govt. to announce its implementation on priority.
- Stresses that successful implementation of the agricultural policy would secure Punjab's farming future.

Technical points and challenges

- DSR mechanization and scaling are underway; the technique requires specific practices (e.g., maintaining lines) and reduces certain labor tasks but has scope for expansion.
- Two main challenges identified:
- The first 20-day crucial period after sowing requires reliable canal water and electricity; 70% of DSR success depends on pre-sowing preparation.
- Issues related to anaerobic varieties and soil/current problems are being worked on by university researchers.

Closing/actions:

- Speaker calls for unity and energy among farmers, scientists, politicians, and community leaders to support Punjab agriculture and DSR adoption.
- He concludes with a rallying chant and indicates departure following the event.

9. Sh. Jaswinder Singh, CEO, The Lambra Kangri Multipurpose Cooperative Society, Hoshiarpur.

- He told that his third generation is in cooperative development movement in the state and never went for voted for president elections. The president is being elected unanimously by the members.
- Society is Own-Fund Society and demanded that, It should be equally treated with other societies where cooperative banks give them credit limits for extending benefits of Govt. schemes to the farmer member.
- Total Capital of the society is about Rs 36 crore.
- Extending about 14 services to its members.
- Well-equipped / app equipped CHCs with more than 100 farm implements, drones and petrol pump for its members.

10. Dr. Amarpal Singh Bhullar, DR-CS (Retd), Government of Punjab

Role of Cooperatives in Production, Procurement, and Marketing

Opening and context

- The role of cooperatives in production, procurement, and marketing, particularly to support rural India in distress.

Definition and strengths of cooperatives

- Cooperatives are autonomous associations of persons who voluntarily join to meet shared economic, social, and cultural needs.
- Members are both owners and users; governance is based on equality.
- Strength: member-ownership and use-oriented structure.

Key problems identified

- Lack of linkage between credit and marketing for farmers.
- Absence of outright purchase by societies of agricultural produce leads to exploitative market practices and losses for farmers.
- Many societies operate on a very small scale, limiting business viability and diversification.

Proposed solutions and examples

- Cooperatives must link credit with marketing and enable societies to purchase produce directly to protect farmers.
- Amalgamation/ consolidation of small societies to increase operational scale and business viability (example cited: Japan reduced ~2000 societies to ~550)
- Larger business volume would allow cooperatives to diversify activities and undertake more services for farmers.

Historical contributions of cooperatives

- Cooperatives played major roles in the Green Revolution (mechanization, input supply) and the White Revolution.
- Continued relevance requires adapting the pace and methods of action.

VALEDICTORY SESSION

Objectives of the Session

The main objective of the valedictory session was to discuss the need for strong and supportive policy initiatives that can promote sustainable rice cultivation in Punjab, especially through the adoption of Direct Seeding of Rice (DSR). The session aimed to highlight how policy support, institutional coordination, and practical interventions can help farmers shift towards water-saving technologies. It also focused on understanding the challenges faced by farmers in adopting new techniques and the need to create an enabling environment where farmers feel confident and supported in making this transition.

Another important objective of the session was to explore the futuristic roadmap for Punjab's agriculture in the context of declining water resources and the need for long-term sustainability. The discussion emphasized collaboration among government departments, research institutions, and farmers to ensure effective implementation of DSR and other innovative practices. The session also aimed to generate ideas for improving processing, marketing, and value addition of agricultural produce, so that farmers can get better income while conserving natural resources.

Valedictory Address

In the valedictory session, Hon'ble Sh. Kultar Singh Sandhwan, Speaker of Punjab Vidhan Sabha, delivered his address and shared his views in a very inspiring manner. He described the symposium as a very important and meaningful effort, not just a routine program. He said that such initiatives are necessary to write a new chapter in the progress of Punjab. According to him, this is not only about saving water but about saving the future of Punjab itself. He appreciated the

organizers for taking this important step at a time when the future of agriculture is facing serious challenges.

He strongly emphasized that Direct Seeding of Rice (DSR) is a practical and necessary solution for Punjab. He shared his experience from a village in Andhra Pradesh, where DSR has been successfully adopted and has shown excellent results. He said that similar success can be achieved in Punjab if all stakeholders work together. He also quoted the teachings of Shri Guru Nanak Dev Ji, reminding everyone about the importance of natural resources like air, water, and land. He stressed that if water had been respected and managed properly earlier, Punjab would not be facing such a serious crisis today.

He further said that Punjab has no option but to move away from water-intensive crops. He highlighted that the Government of Punjab is already taking steps by providing financial incentives of Rs. 1500 per acre to farmers adopting DSR. However, he stressed that the adoption needs to be expanded on a much larger scale. He explained that farmers usually adopt new technologies only after seeing successful results in nearby fields, so there is a need for large-scale demonstrations. He also praised Punjab farmers for being hardworking and open to adopting new technologies when properly guided.

Apart from DSR, he also pointed out the need to focus on processing, marketing, and branding of agricultural produce. He gave examples from other states where farmers have benefited from value addition and better market strategies. He stressed that Punjab also has great potential in this area and should move forward in this direction. He expressed confidence in institutions like Punjab Agricultural University to guide farmers and lead innovation in agriculture.

In his concluding remarks, he said that saving water and agriculture is not only the responsibility of the government but a collective responsibility of all Punjabis. He described it as a fight for survival and urged everyone to work together with commitment. He encouraged people to take a pledge to save every drop of water and to educate farmers properly about new technologies. He expressed hope that the outcomes of this symposium will prove to be a milestone for the future of Punjab agriculture.

Key Panelists

1. Prof Dr Sukhpal Singh, Chairman, Punjab State Farmers' and Farm Workers' Commission

- He appreciated all the speakers and participants for their valuable insights and contributions.
- He stated that the symposium has created a strong platform for future discussions and actions on water conservation.
- He emphasized that the key suggestions and observations made during the session should be taken forward seriously.

- He highlighted the need for collaboration among all stakeholders, including government, researchers, and farmers.
- He expressed commitment to continue organizing such programs to address important agricultural challenges.

2. Sh. Mohinder Singh Sidhu, Chairman, PUNSEED

- He emphasized that DSR is an emerging and promising technology for Punjab agriculture.
- He stated that its success depends on strong coordination between different government departments, research institutions, and policymakers.
- He highlighted that policy-level support is very important to scale up DSR adoption across the state.
- He pointed out that weed management is one of the biggest challenges in DSR cultivation.
- He stressed that continuous research and innovation are required to find effective and sustainable weed control solutions.
- He suggested that farmers need proper technical guidance and support to overcome these practical challenges.
- He congratulated Prof Dr Sukhpal Singh for successfully organising this International Symposium on DSR.

3. Sh. Davinder Sharma, Food and Policy Analyst and Member, High Powered Committee on Agrarian Reforms constituted by Hon'ble Supreme Court of India

- He highlighted that Punjab plays a very important role in ensuring food security for the entire country, and therefore its future is directly linked with the nation's future.
- He explained that earlier techniques like the System of Rice Intensification (SRI), developed in the 1980s, were very effective in saving water and improving productivity, but they were not widely promoted.
- He pointed out that lack of industrial and commercial interest was one of the reasons why such farmer-friendly techniques did not spread.
- He raised concerns about the increasing push of herbicide use in DSR technology, which may create long-term problems for soil health.
- He suggested that research institutions should focus on developing new paddy varieties suitable for DSR that require minimal or no herbicides.
- He stressed that sustainability should not be compromised while adopting new technologies, and environmental safety must remain a priority.

4. Dr. Ranjit Singh Ghuman, Professor of Eminence, GNDU and Member, High Powered Committee on Agrarian Reforms constituted by Hon'ble Supreme Court of India

- He clearly stated that saving water is not optional for Punjab; it is necessary for the survival of agriculture and the state.

- He raised an important concern that despite financial incentives and recommendations by institutions like PAU, farmers are still hesitant to adopt DSR.
- He emphasized the need to understand the real reasons behind this hesitation, such as risk, lack of awareness, or technical difficulties.
- He suggested that large-scale field demonstrations should be conducted so that farmers can see the benefits themselves.
- He stressed the importance of long-term studies to evaluate the performance and challenges of DSR under different conditions.
- He also highlighted that while increasing production, we must consider the economic, social, and environmental costs involved.
- He recommended adopting a holistic approach that balances productivity with sustainability.
- He further stressed the need for supportive policies at both state and central levels to create a favorable environment for DSR adoption.

5. Dr. Satbir Singh Gosal, VC, Punjab Agricultural University, Ludhiana

- He explained that paddy continues to dominate Punjab agriculture because of assured MSP and well-established procurement systems.
- He pointed out that diversification to other crops will only happen when those crops provide similar profitability and market security.
- He highlighted that PAU has already developed several technologies to save water in paddy cultivation.
- He mentioned options like short-duration crop varieties and delayed transplantation to reduce water use.
- He explained that DSR and dry DSR are effective technologies that can significantly reduce water consumption.
- He stressed that farmers should be given multiple options so they can choose what suits them best.
- He emphasized that the overall goal should be to save water while maintaining farmers' income.

6. Dr. T.N. Prakash kammardi, Former Chairman, Karnataka Agricultural Price Commission (KAPC), Bangaluru

- He emphasized that farmers are the backbone of the country's food system and deserve full support from policymakers and experts.
- He stated that it is the moral responsibility of society to guide and assist farmers in adopting better practices.
- He highlighted that DSR is beneficial not only for saving water but also for improving environmental sustainability.
- He stressed that such technologies should be promoted in a farmer-friendly manner.
- He suggested that policy frameworks should be designed to ensure that farmers get both economic and environmental benefits.

7. Dr. Virender Kumar, Research Director, International Rice Research Institute, South Asia Regional Centre, Varanasi

- He informed that a complete package of practices for DSR has already been developed by research institutions.
- He emphasized that the main challenge is to transfer this knowledge effectively from research labs to farmers' fields.
- He suggested strengthening the "lab-to-land" approach so that farmers can directly benefit from scientific advancements.
- He highlighted the need for capacity building and training of agricultural officers, extension workers, and farmers.
- He also mentioned that machine operators and those providing agricultural services should be properly trained.
- He stressed the importance of creating a full support system (ecosystem) to guide farmers at every step of DSR cultivation.
- He clarified that when the complete package is followed, there is no reduction in yield.
- He acknowledged that weed control remains a challenge but said that solutions are being developed.
- He advised that DSR adoption should be gradual but based on complete and correct knowledge.

8. Dr. Ranjodh Singh Bains, Administrative Officer-cum-Secretary, PSFC

- He shared that the Commission is working on innovative projects in collaboration with research institutions.
- He mentioned a project aimed at reducing silica content in paddy straw so that it can be used as animal feed, making it more environmentally sustainable in collaboration with GeneShifters.
- He informed about the establishment of a State-of-the-Art Agri-Exclusive Data Centre at PSFC equipped with weather data recording and other technologies.
- He highlighted that this data centre will support better research, planning, and policy decisions.
- He thanked all participants for their active involvement and meaningful discussions.
- He expressed hope for continued cooperation and collaboration in future initiatives.

Package of Practices for DSR - Punjab Agricultural University, Ludhiana

Unpuddled Direct Seeded Rice (DSR)

The declining water resources of the state demand the highest priority to development one such technology that has water saving potential. DSR provides several benefits such of water conservation technologies. Direct seeding of rice in unpuddled fields (DSR) is as 1) 10-20% saving in irrigation water, 2) 10-12% higher ground water recharge, 3) saves labour, 4) less prone to infestation of diseases (e.g. sheath blight, foot rot), 5) provides 100 kg/acre higher yield of succeeding wheat as compared to conventional practice of puddled transplanted rice.

DSR technology was recommended in 2010 in the state. The technology was further refined and in 2020, a novel DSR technique coined as 'tar-wattar DSR' was recommended. In tar-wattar DSR, a major departure from the earlier practice is delayed first irrigation which is applied at 21 days after sowing which has many added advantages like higher saving in irrigation water, better root development, lesser incidence of nutrient deficiency especially iron, lesser weeds and wider soil adaptability. Further, a new method of DSR 'Direct seeding on raised beds in tar-wattar fields', which offers higher saving in irrigation water as compared to earlier methods, has been recommended in 2022.

The success of DSR lies in the adoption of improved production practices which are discussed below:

- **Suitable soils:** Sow DSR only in medium to heavy textured soils. Its' cultivation is not successful in light textured soils due to severe iron deficiency and lower crop yields.
- **Laser levelling:** Laser levelling improves irrigation water use efficiency and ensures better germination. Plough the field with disc harrow followed by cultivation with cultivator and planking, then level the field with laser leveller.
- **Suitable varieties:** Short and medium duration varieties
- **Sowing time: 1-15 June**
- **Seed rate and seed treatment:** Use 8-10 kg seed per acre. Imbibe rice seed by dipping in 2% potassium nitrate solution (prepare solution by dissolving 200 g KNO3, in 10 litre water for 8 kg seed) for 12 hours. Dry the seed in shade and treat with 3 g Sprint 75 WS (mencozeb + carbendazim) per kg seed.

- **Direct seeding of rice should not be done on light textured sandy soils.**
- **Tar-wattar DSR technique is suitable for direct seeding in medium and heavy textured soils (including sandy loam, loam, silt loam and clay loam) which accounts for around 87% area of the state.**
- **Sowing should be done in the first fortnight of June.**
- **For effective weed control, spray 1.0 litre Stomp/Bunker 30 EC or 1.0 litre PEPE 25 SE per acre in moist soil immediately after sowing and thereafter use other herbicides as per recommendation.**

Method of sowing: Rice can be direct seeded by three methods:

1. Direct seeding in tar-wattar fields: Divide the field into kiyaras of desirable size after Laser Leveling and apply rauni irrigation. When the field comes to tar-wattar (sufficiently high but workable soil moisture) conditions, prepare field kiyara- wise with shallow cultivation followed by 2-3 plankings with load `of 3 sandbags on planker and sow immediately. Seed should be placed at 3-4 cm depth in 20 cm spaced rows. Avoid field preparation and sowing during noon hours for better results

Preferably, use Lucky Seed Drill (which sow rice and spray pre-emergence herbicide simultaneously) for direct seeding. Alternatively, use conventional rice drill having inclined plate metering system and spray herbicide immediately. Direct seeding with Lucky Seed Drill (fitted with press wheels) help in tackling the problem of krand formation (which occur if there is rainfall after sowing), conserves soil profile moisture and improves the efficacy of pre-emergence herbicide.

2. Direct seeding on raised beds in tar-wattar fields: This method saves higher irrigation water than other two methods.

Laser level the field and make 67.5 cm wide shallow beds (bed with 37.5 cm flat top with adjacent 30 cm furrow), preferably by using same bed planter that will be used for final sowing. Then apply rauni (pre-sowing irrigation) in furrows only.

When field come to tar-wattar conditions (within 2-3 days depending on soil type), use bed planter (fitted with bed compacter) for reshaping beds and simultaneous sowing (2 rows/bed) of treated seed, and apply pre-emergence herbicide immediately. Avoid sowing during noon hours for better results.

3. Direct seeding in dry fields: Treated seed should be placed 2-3 cm deep in rows spaced at 20 cm in a dry field and irrigation is applied immediately after sowing.

- **Weed Control**

Pre-emergence: Spray 1.0 litre per acre Stomp/Bunker 30 EC (pendimethalin) or PEPE 25 SE (penoxsulam 1% + pendimethalin 24%) in 200 litres of water for control of annual grass weeds and some broadleaf weeds. Prefer PEPE 25 SE for the control of complex weed sown using ising annual grasses, broadlead herbicide spray are done simultaneously and, if conventional rice drill is bed, then spray immediately after sowing. In case of sowing in dry fields, irrigation is applied immediately after sowing and herbicide is sprayed when the field comes to wattar condition which in general is within 1 to 2 days of sowing

Post-emergence: Depending on the weed flora present in the field, any of the herbicide listed in the table below may be applied at 15-25 days of sowing, by dissolving in 150 litres of water, when weed plants are at 1-4 leaf stage as given against each herbicide

Name of herbicide	Dose per acre	Target weed flora	Time of application (days after sowing)	Weed leaf stage at time of spray
Nominee Gold 10 SC (bispyribac sodium)	100mL	Swank, paddy mothas	15-25	2-4
Novlect 12 EC (florpyrauxifen-benzyl 2.13% + cyhalofop-butyl 10.64%)	500mL	Swank, chini, gha broadleaf weeds, paddy mothas, gandi wala motha	20-25	2-4
Ricestar 6.7 EC (fenoxaprop-p-ethyl)	400mL	Madhana, chini gha, chiri gha, takri gha	20-25	2-4
Almix 20 WP (chlorimuron ethyl 10% + metsulfuron methyl 10%)	8 g	Broadleaf weeds, paddy mothas, gandi wala motha	20-25	2-4
Eketsu 43 WG (bispyribac sodium 38 % + chlorimuron ethyl 2.5% + metsulfuron methyl 2.5%)	40 g	Swank, paddy mothas, gandi wala motha, broadleaf weeds	20-25	2-4
Vivaya 6 OD (penoxsulam 1.02% + cyhalofop-butyl 5.1%)	900mL	Swank, chini gha, broadleaf weeds, paddy mothas	15-25	1-2
Council Activ 30 WG (triafamone 20% + ethoxysulfuron 10%)	90 g	Swank, chini gha, broadleaf weeds, paddy mothas, gandi wala motha	15-25	1-2

- Always spray herbicide when weed plants are at the right leaf stage as mentioned against each herbicide.
- Always spray herbicide in moist field and maintain proper soil moisture (wattar) in the field for one week after spray.
- The leftover weeds may be uprooted before they produce seeds.

- **Fertilizers:** Apply 130 kg urea per acre in three equal splits at 4, 6 and 9 weeks of sowing. Reduce dose of urea to 90 kg per acre after green manuring with sunnhemp or FYM application @ 6 tonne per acre and 110 kg urea per acre if summer moong residue has been incorporated after picking pods. Apply phosphorus and potash on soil test basis, In case of zinc and iron deficiency, follow the recommendations as given under puddled transplanted rice.

PAU-Leaf Colour Chart (PAU-LCC) for need based Urea application

- No urea should be applied at the time of sowing.
- After four weeks of sowing, apply 25 kg urea per acre.
- After six weeks of sowing, start matching colour of the topmost fully exposed intact leaf of the randomly selected ten rice plants with PAU-LCC under shade of your body at 7 day interval.
- Whenever the greenness of 6 or more out of 10 leaves is lighter than the LCC shade 4, apply 30 kg urea per acre.
- No urea should be applied if colour of leaves is equal to or darker than the LCC shade 4.
- Use of LCC should be discontinued after initiation of flowering and no more urea should be applied.

Note: The leaves selected for measuring leaf greenness should be free from insect/disease incidence. There should not be water stress to the crop and nutrients other than nitrogen should be supplied as per recommendations. The PAU-LCC can be purchased from PAU Seed Shop at Gate No. 1, Krishi Vigyan Kendras and Farm Advisory Service Centres in different districts

Irrigation

1. **Direct seeding (flat/raised beds) in tar-wattar fields:** Apply first irrigation at around 21 days after sowing. After that, apply irrigations at 5-7 days interval depending on soil type.

2. **Direct seeding in dry fields:** Apply first irrigation immediately after sowing and second irrigation at 4-5 days after sowing. Subsequent irrigations should be applied at 5-7 days interval depending on soil type.
   The irrigation interval may be adjusted according to rainfall. Stop irrigation 10 days before harvesting. In this way, DSR saves around 10 to 20% irrigation water as compared to puddled transplanted rice.
   For sub-surface drip irrigation and fertigation in zero till DSR, see chapter on 'Multiple Cropping' under zero till direct seeded rice-wheat cropping system.

- **Rodent management:** Rodents cause damage to direct seeded rice crop at germination stage. Control weeds and rebuild bunds to destroy rat burrows and reduce their height and width. Do burrow baiting during lean period (May-June) as per the method given in chapter 14 "Management of Rodents and Birds".

Unpuddled Direct Seeded Basmati Rice (DSBR)

Suitable soils and agronomic practices like laser levelling, field preparation, seed rate, method of sowing, weed control, irrigation for DSBR are similar to that of direct seeded rice. However, varieties, sowing time and fertilizers for DSBR are as under:

Suitable varieties: Punjab Basmati 7, Pusa Basmati 1718, Pusa Basmati 1121 and Pusa Basmati 1509 are suitable for DSBR.

Sowing time: Optimum sowing time is 15-30 June

Fertilisers: Apply 54 kg urea per acre in three equal splits at 3.6 and 9 weeks after sowing. Reduce dose of urea to 18 kg per acre after green manuring with sunnhemp and 3 after picking pods. Apply phosphorus and potash on soil test basis. In case of zinc and iron deficiency, follow the recommendations as given under puddled transplanted rice .

ROADMAP & WAY FORWARD

Strategic Roadmap for Ecologically Sustainable Rice Cultivation Technology-DSR in Punjab

Central Role of Rice and the Need for Income-Linked Transition

Rice continues to remain central to Punjab's agrarian economy, underpinning both farm incomes and national food security. A large proportion of the state's produce is procured at Minimum Support Price (MSP), providing farmers with assured and timely returns, an advantage that most alternative crops currently lack. Over decades, a robust ecosystem of procurement infrastructure, input supply chains, irrigation systems, and mechanisation has developed around the rice–wheat cycle, creating strong structural support on paddy cultivation. At the same time, existing policy support, particularly in the form of subsidised electricity, fertilisers, and irrigation, further reinforces its relative profitability. In contrast, alternative crops often face higher production and market risks, including price volatility, weak procurement mechanisms, and inadequate post-harvest infrastructure. Under these conditions, a rapid or unplanned shift away from rice may expose farmers to income instability rather than improvement. Therefore, any transition strategy must be gradual and anchored in income assurance, with credible mechanisms such as effective procurement, price support, and risk mitigation for alternative crops. Until such conditions are firmly established, rice will continue to remain a rational and economically secure choice for farmers in Punjab.

Importance of Rice Cultivation for National Food Security in a Volatile Global Context

Rice cultivation in Punjab holds critical importance for India's food security, particularly in the context of increasing global instability, geopolitical tensions, and disruptions in international trade. In times of conflict or supply chain shocks, dependence on global food markets can expose countries to price volatility and shortages. India's strong domestic procurement system, supported significantly by Punjab's rice production, ensures adequate buffer stocks for the Public Distribution System (PDS) and welfare schemes. This strategic capacity has enabled the country to maintain food availability even during global crises. Given these realities, a sharp reduction in rice cultivation without viable and secure alternatives could weaken national food security resilience. Therefore, while promoting sustainable practices such as DSR and diversification, it is essential to maintain a stable and sufficient level of rice production to safeguard against external uncertainties and ensure uninterrupted food supply for the population.

ROADMAP

Best Sowing time for;
DSR: 1st-15th June
DSBR: 15th-30th June

1.0 Strengthening Incentive Support for DSR Adoption

Financial incentives play a critical role in motivating farmers to transition from long-established practices to adopt new approaches. The Government of Punjab presently offers an incentive of ₹1,500 per acre to promote agricultural practices among farmers. This initiative demonstrates a positive approach to supporting the agricultural sector. Additionally, there is a strong case for enhanced financial backing through a shared responsibility framework, wherein the Government of India should also provide an additional ₹1,500 per acre. While it is true that incentives alone are insufficient, they remain a critical entry point for behavioural change. Incentives for DSR should therefore be seen as part of a broader package including extension support, mechanisation, and input availability. Financial support reduces the initial risk, enabling farmers to experiment with DSR and gradually adopt it at scale. A combined incentive structure would not only improve farmer confidence but also accelerate adoption at scale, ensuring that sustainability goals related to water conservation and cost reduction are effectively achieved. The Punjab State Farmer's and Farm Worker's Commission has been writing to Government of India for additional assistance of Rs1500 acre along with it also submitted proposal for obtaining additional assistance to the farmers opting DSR in 15 over-exploited blocks.

2.0 Strengthening Farmer Awareness and Technical Capacity

A major constraint in the adoption of Direct Seeded Rice (DSR) is the lack of awareness and technical knowledge among farmers. Evidence shows that a significant proportion of farmers are either lack complete information or rely on traditional methods, leading to suboptimal outcomes. Capacity-building initiatives must be intensified through village-level demonstrations, farmer field schools, and pre-season training programmes through Krishi Vigyan Kendras (KVKs). Extension services should focus on practical aspects such as seed treatment, irrigation scheduling, and weed control to build farmer confidence and reduce initial failures.

3.0 Addressing Weed Management as a Critical Bottleneck

Weed infestation remains the most significant agronomic challenge in DSR, particularly during early crop stages. Inadequate weed control often results in yield losses, discouraging farmers from continuing with the practice. It is believed the success of DSR is highly contingent on effective weed management protocols. Therefore, there is a need to promote integrated weed management strategies, ensure timely availability of appropriate herbicides, and invest in research for region-specific

solutions. Strengthening extension systems for weed control can significantly improve adoption rates.

4.0 Leveraging Carbon Credits

The promotion of Direct Seeded Rice (DSR) presents an opportunity to align agricultural practices with emerging carbon markets by incentivising farmers for reducing greenhouse gas emissions and conserving water. Given that conventional paddy cultivation is associated with 50% methane emissions and energy-intensive groundwater extraction, a shift towards DSR can generate measurable carbon benefits. To effectively harness this potential, there is a need to institutionalise a carbon credit framework tailored to Punjab's agricultural context. The Punjab State Farmers' & Farm Workers' Commission (PSFC) should be designated as the nodal agency to coordinate this effort, given its policy mandate and interface with multiple stakeholders. PSFC can play a central role in developing standardised methodologies, facilitating aggregation of farmers, ensuring monitoring and verification, and linking farmers to carbon markets by international market monitoring. By acting as a credible intermediary, the Commission can help translate environmental gains into direct financial incentives for farmers, thereby strengthening the economic case for adopting sustainable practices such as DSR.

5.0 Promoting Location-Specific Adoption Based on Soil Suitability

The performance of DSR varies significantly depending on soil type and agro-climatic conditions. Studies highlight that DSR is more suitable for medium to heavy-textured soils, while its performance in light soils can lead to negate water-saving benefits. Policy interventions should therefore prioritise region-specific targeting, discouraging indiscriminate adoption. Mapping suitable zones and issuing district-level advisories can help ensure that DSR is implemented where it is most effective. PSFC has developed in house facilities to get this analysis report at its own, so PSFC will provide a detailed suitability report as soon as possible.

6.0 Strengthening Mechanisation and Custom Hiring Ecosystems through Cooperatives

The adoption of DSR is closely linked to access to appropriate and timely machinery such as seed drills and laser levellers. Limited availability and high upfront costs act as barriers, particularly for small and medium farmers. Promoting custom hiring centres through cooperatives and strengthening machinery access at the village level can address this gap. Improved mechanisation not only enhances efficiency but also ensures proper crop establishment, which is critical for DSR success..

7.0 Development of DSR-Specific Varieties by PAU

The success of Direct Seeded Rice (DSR) is closely linked to the availability of crop varieties that are specifically suited to its agronomic conditions. Currently, many farmers use varieties developed for transplanted rice, which may not perform optimally under direct seeding, particularly in terms of proper germination, there by good crop stand, weed competitiveness, early vigour, and tolerance to

moisture stress. In this context, Punjab Agricultural University (PAU) should prioritise the development of DSR-specific rice varieties that are tailored to Punjab's agro-climatic conditions especially which germinates evenin aerobic conditions. These varieties should focus on traits such as rapid germination, uniform crop stand, resistance to pests, and stable yields under varying moisture regimes. Strengthening research and breeding efforts in this direction will not only improve the reliability and performance of DSR but also enhance farmer confidence, thereby supporting its wider adoption across the state. Seed priming and virus detection/tolerance protocol against SRB-SDV also need to be strengthened.

8.0 Role of Market and Value Chain Institutions

Beyond production, the success of DSR also depends on efficient market linkages. Strengthening value chains, including procurement, storage, processing, and marketing, is essential to ensure that farmers realise adequate returns. Institutions such as Agricultural Marketing Research and Intelligence Institute (AMRII) and Innovative Agricultural Marketing Society (IAMS), as envisioned in the Punjab State Agricultural Policy, 2023 should be integrated into the DSR ecosystem to support long-term sustainability.

9.0 Development of Seed Drill-cum-Mulcher under PSFC Initiative

The development and promotion of a Seed Drill-cum-Mulcher under the leadership of the Punjab State Farmers' and Farm Workers' Commission can play a crucial role in strengthening the mechanisation ecosystem for Direct Seeded Rice (DSR). Such equipment can enable precise seed placement while simultaneously managing crop residues, thereby reducing the need for residue burning and improving soil health. Additionally, the retention of crop residue as mulch helps reduce soil moisture loss by limiting evaporation, thereby enhancing water-use efficiency. Given the challenges of timely sowing, labour shortages, and residue management in Punjab, an integrated machine of this nature can enhance operational efficiency and reduce input costs for farmers. PSFC has taken the lead in coordinating design, field testing, and large-scale deployment in collaboration with research institutions and manufacturers. Additionally, promoting this equipment through cooperatives and custom hiring centres will ensure accessibility for small and medium farmers, thereby supporting wider adoption of DSR and sustainable farming practices.

10.0 Establishment of Centre of Excellence (CoE) and Seed Hub for DSR

The establishment of a dedicated Centre of Excellence (CoE) integrated with a Seed Hub for Direct Seeded Rice (DSR) can serve as a comprehensive institutional mechanism to support its large-scale adoption in Punjab. The CoE should function as a central platform for research, innovation, and field validation, focusing on the development of region-specific agronomic practices, DSR-suitable varieties, and standardised protocols for weed and water management. Simultaneously, the Seed Hub component should ensure the timely production and distribution of high-quality, certified seeds tailored for DSR conditions. This integrated approach will bridge the

gap between research and field implementation by combining knowledge generation with input availability. In addition, the CoE can act as a training and capacity-building centre for extension workers and farmers, while also facilitating demonstrations and pilot projects. By linking innovation, seed systems, and field-level dissemination under one institutional framework, this initiative can significantly improve the reliability, scalability, and adoption of DSR across the state.

11.0 Strengthening Price Stabilization, Storage, and Input Support through Markfed

The role of Markfed can be expanded to provide comprehensive market and infrastructure support for farmers adopting Direct Seeded Rice (DSR) and alternative crops. Establishing a dedicated Price Stabilisation Fund will help protect farmers from market fluctuations and distress sales, particularly in crops where procurement mechanisms are weak. In addition, strengthening storage infrastructure through modern silos and godowns will reduce post-harvest losses and enable farmers to hold produce for better price realisation. Markfed can also facilitate the provision of machinery and critical inputs, such as crop chemicals including fertilizers and quality seeds, through cooperative networks and custom hiring centres. This integrated approach will not only reduce market risk but also improve access to essential resources, thereby creating a more supportive ecosystem for sustainable agricultural practices in Punjab. Further, farmers opting DSR should be encouraged to have an additional crop of moong beans before its sowing and procurement would be done Markfed.

12.0 Strengthening Mass Awareness through Daily Media Campaigns

The large-scale adoption of Direct Seeded Rice (DSR) is constrained not only by technical challenges but also by limited awareness and understanding among farmers. To address this gap, the Agriculture Department should undertake sustained, daily outreach through popular media channels, including newspapers, television, radio, and digital platforms. Regular dissemination of simple, practice-oriented messages, covering sowing methods, weed management, irrigation scheduling, and success stories, can help demystify DSR and build farmer confidence. Such campaigns should be timed strategically before and during the sowing season to maximise impact and should use local languages and relatable examples. A continuous and visible media presence will ensure that DSR remains part of public discourse, enabling wider outreach beyond formal extension systems and accelerating its adoption at scale.

13.0 Institutional Coordination and Governance Framework

Effective implementation of DSR requires coordinated action among multiple institutions, including research bodies, extension agencies, and government departments. Clearly defined roles, such as research by agricultural universities, implementation by state departments, and monitoring by nodal agencies, are essential. Strengthening institutional coordination will ensure efficient delivery of support services, timely interventions, and better accountability in achieving DSR targets.

14.0 Strengthening Role of Digital and Data Systems

A robust digital backbone is essential for effective implementation, monitoring, and scaling of DSR. There is a need to develop a state-level digital platform to track area under DSR, input usage, water savings, and farmer adoption in real time. Such a system can support targeted interventions, enable evidence-based policymaking, and facilitate integration with carbon credit mechanisms. It can also provide farmers with timely advisories through mobile-based platforms, improving decision-making at the field level. PSFC has also started to establish "The-State-of-the-Art Agri Exclusive " Data centre in commission to cater all data related needs of all stakeholders.

15.0 Strengthening Financial Institutions and Credit Access

Access to timely and affordable credit remains critical for farmers transitioning to DSR. Financial institutions, including commercial banks and cooperative banks, should design targeted credit products for DSR adoption, including support for machinery, inputs, and working capital. Linking DSR with priority sector lending and interest subvention schemes can further ease the financial burden on farmers. Accordingly, Scale of finance should also be announced separately for farmers opting DSR and other innovative ventures.

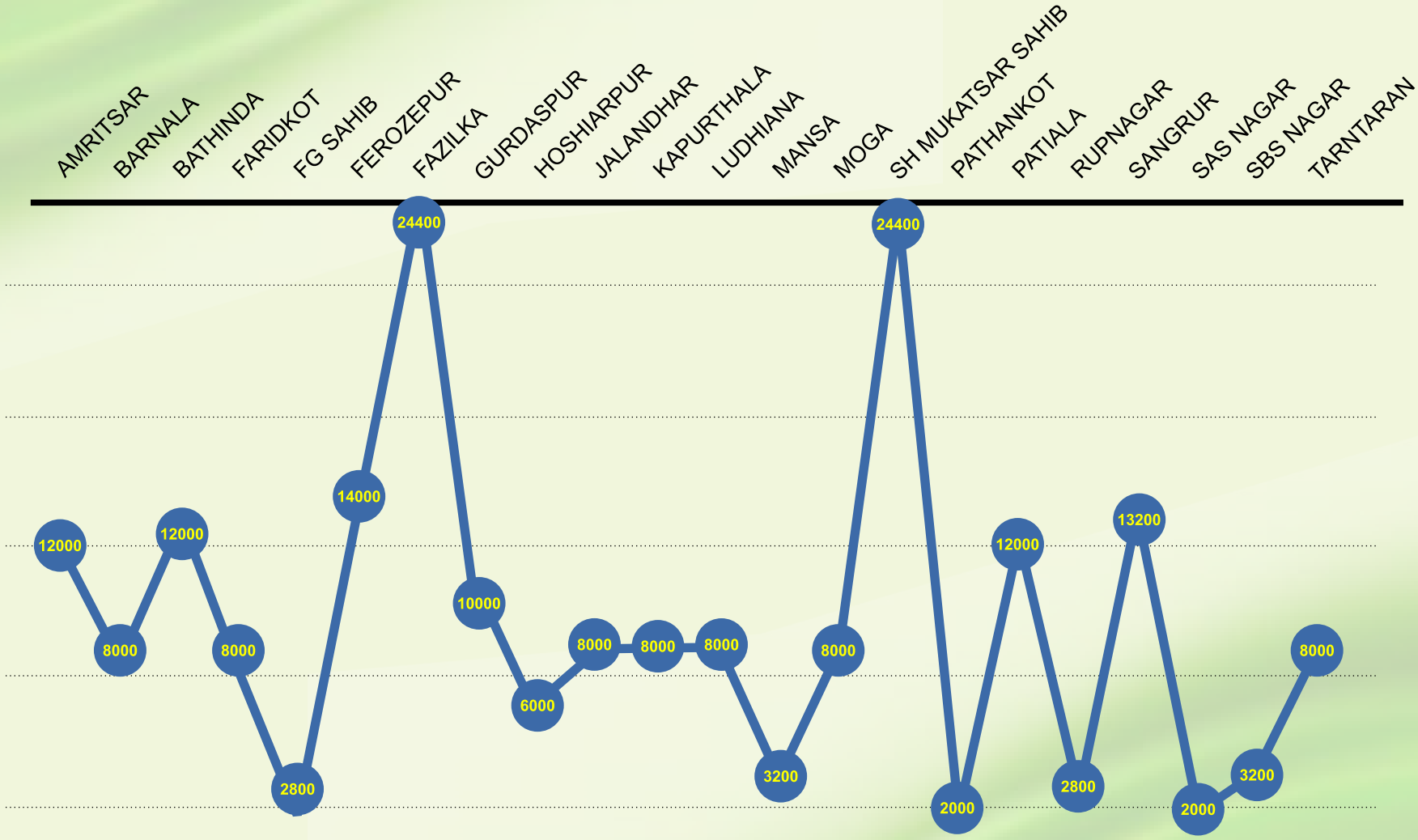
16.0 Aligning Water Conservation Policies with DSR Promotion

Punjab's agriculture faces a severe groundwater deficit, driven largely by water-intensive paddy cultivation. DSR offers a viable pathway to reduce water use, with studies indicating significant water savings and improved water-use efficiency. However, its promotion must be integrated with broader water governance measures, including incentives for water-saving practices. These farmer should also brought under the ambit of "Paani Bachao, Paisa Kamao" Scheme.

Direct Seeded Rice Adoption Trends and Flow of Funds

	2022-23	2023-24	2024-25	2025-26
Adoption (ha)	67306.6	51311.6	80666.6	94879.4
DBT(Lakh₹)	2524.0	1924.2	3025.0	3558.0

District-wise DSR Targets for 2026-2027 (ha)



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Dhandi Khurd, Fazilka
9988643542

Gurvikramjit Singh
Burj Nathu
94637 26656

DSR WARRIORS OF PUNJAB

Manjit Singh Dhillon
Sirye Wala, Bathinda

Tajinder Singh Bajwa
Panjgrai, Batala
9356065025

Chanan Singh Sran
Patti, Sri Tarn Taran Sahib
9988960665

Sukhwinder Singh
8360764070

Narinder Singh
Dayalgarh, Sangrur
9465090700

Daljinder Singh Bhullar
Jeond, Bathinda

Darshan Singh
Baurhai Kalan, Malerkotla
9855964628

Gurbax Singh Gill
Tarpai, Amritsar
9872429458

Dr. Rajbir Singh Sohi
Dashmesh Nagar, Amritsar
99158-65738

Amandeep Singh
Kothe, Sri Muktsar Sahib
9814180905

Jaskaran Singh Johal
Salempur Masandan, Jalandhar
9872777797

Surjit Singh
Burj Nathu
9779848001

For More Information of DSR Warriors

https://www.facebook.com/share/v/1C8LxEZdHb/

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3	Dr Harpritpal Kaur	Bathinda	98964-01313
4	Dr Kulwant Singh	Faridkot	81462-00703
5	Dr Jagdev Singh	F. Sahib	94173-55358
6	Dr Harbans Singh Sidhu	Fazilka	95929-52929
7	Dr Balwinder Singh	Ferozepur	99142-64249
8	Dr Randhir Singh	Gurdaspur	98149-43333
9	Dr Dipinder Singh	Hoshiarpur	88720-26514
10	Dr Jaswinder Sigh	Jalandhar	98140-16068
11	Dr Balkar Singh	Kapurthala	97814-11660
12	Dr Gurdeep Singh	Ludhiana	98728-00575
13	Dr Harwinder Singh	Mansa	98720-33997
14	Dr Jagseer Singh	Mukatsar	98157-25699
15	Dr Amritpal Singh	Moga	94171-71582
16	Dr Lekh Raj	S.B.S. Nagar	95309-33973
17	Dr Dara Singh	Patiala	88724-11099
18	Dr Jagir Singh	Pathankot	98552-26781
19	Dr Vinay Kunar	Ropar	94171-82016
20	Dr Dharminderjit Singh	Sangrur	88720-10028
21	Dr Sukhjinder S. Bajwa	S.A.S.Nagar	98142-74553
22	Dr Tejbir Singh Bhangu	Tarn Taran	95010-24748


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2026
When The Rivers Run Dry
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ਵਣਜ ਪਾਮਦਸ

Uniform Seed Placement and Crop Stand in DSR Field

Punjab State Farmers' & Farm Workers' Commission

Kalkat Bhawan, Ground Floor, Aerocity Block-C, SAS Nagar, Punjab

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