

Transition towards regenerative food systems in Punjab and Haryana

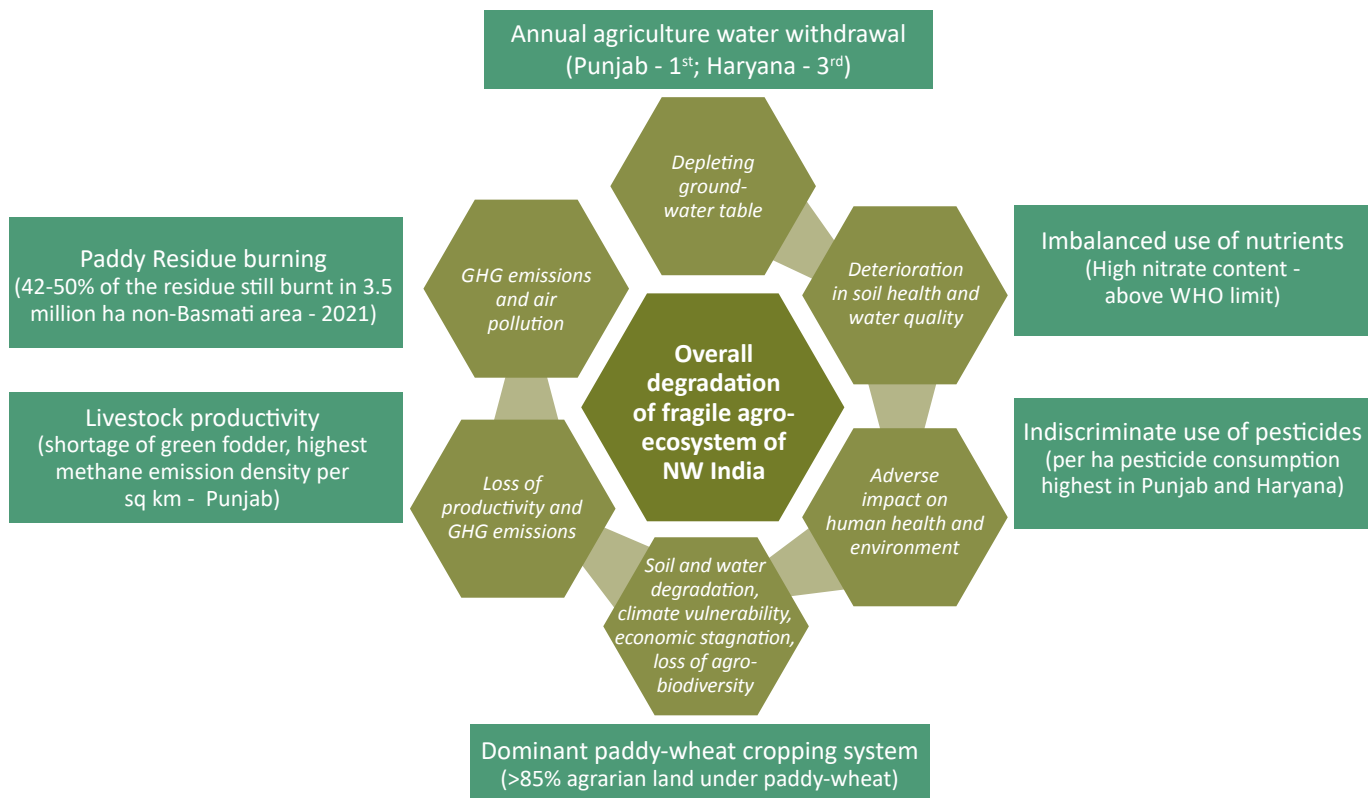
BACKGROUND

Northwest India (mainly Punjab and Haryana), which follows a predominantly rice-wheat cropping system is one of the most important regions for India's food security. Agricultural intensification in this region has led to the prevalence of rice-wheat cropping system, excessive use of agro-chemicals, over-exploitation of ground water, crop residue burning, etc. (see figure). The impact is aggravated by severe depletion of groundwater and contamination, soil erosion, stagnant productivity, and agro-biodiversity loss. One of the key challenges that has garnered policy level attention in Northwest India during the last few years is paddy stubble burning and its management. Due to the limited window of 2-3 weeks available between the harvesting of paddy crop (especially with long duration paddy varieties) and the sowing of the next wheat crop, farmers take recourse to paddy stubble

burning to clear their fields. Stubble burning, however, leads to release of pollutants, especially particulate matter, in the form of smog in northern India mainly during the months of October to December. The resultant impact on human health is serious, besides deteriorating soil health and affecting the region's long-term agricultural productivity. To address this issue, the government and other stakeholders have promoted various initiatives in the last several years to end paddy stubble burning. The urgency is two-fold: to manage the paddy stubble effectively, and to diversify the region's predominant rice-wheat cropping system.

Since 2018, The Nature Conservancy (TNC) and partners¹ – with the support of state government departments, Krishi Vigyan Kendras (Farm Science Centres), and agriculture universities – have been working with farmers in Punjab and Haryana to

¹ Tata Trusts, Borlaug Institute for South Asia (BISA), International Maize and Wheat Improvement Center (CIMMYT), Precision Development, Syngenta Foundation of India, IPS Foundation, and CSR partners such as K K Birla Memorial Society, IBM, Diageo India, etc.



Move towards regenerative food systems in Punjab and Haryana – problems and challenges.

promote adoption of no-burn agriculture and regenerative agricultural practices, such as:

1. **Harnessing the power of Agricultural Residues through Innovative Technologies or HARIT project (2018-2022).** This project encouraged adoption of Happy Seeder (a technology for conservation agriculture), supported 40,000 farmers and crop residue management (CRM) machine service providers in 105 selected villages (through demonstrations, trainings, and peer-to-peer learnings), and reached out to 700 additional villages across seven districts in both

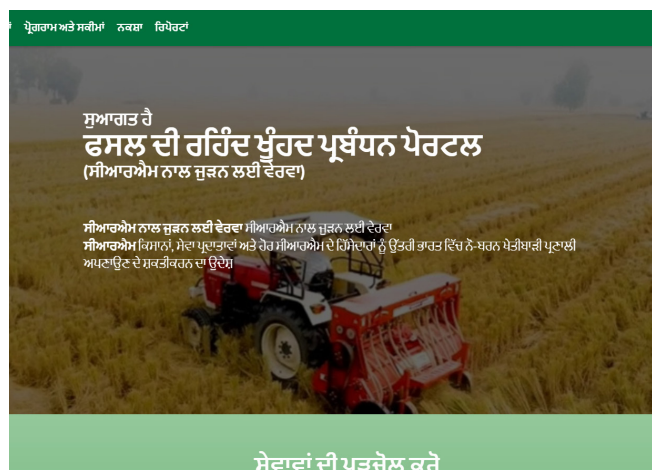
states with behaviour change communication (through advisories).

2. **Using technology to end crop residue burning (2021-2024).** TNC partnered with IBM to develop a web-based interactive hub that would support key decision makers and farmers in making informed choices on residue management and thus eliminate crop residue burning in North India.



BISA (HARIT project partner)

Training of farmers on CRM machinery during the HARIT project.



CRM Connect initiative of TNC.

3. **Other Corporate Social Responsibility (CSR) initiatives.** Through different CSR projects and various initiatives such as training, outreach, and

promoting CRM machine rental models through agri-entrepreneurs, TNC is supporting farmers in both states to develop a regenerative agriculture model and adopt no-burn practices.



Moong (lenti/pulse) demonstration in Ludhiana district, Punjab under the Regenerative Agriculture Model project of TNC.

IPS Foundation (Regenerative Agriculture project partner)

(i) Harnessing the economic and environmental potential of agriculture residue, and (ii) Incentivising and promoting crop diversification. The relevant policies of mainly paddy-growing states such as Assam, West Bengal, Bihar, Uttar Pradesh, Madhya Pradesh, Odisha, Andhra Pradesh, Telangana, Karnataka, Tamil Nadu, and Kerala as well as national-level policies and schemes were reviewed. The best practices and innovations from these policies were identified and their applicability to the context of rice-wheat cropping systems in Punjab and Haryana was analysed and discussed among the working group members and with other relevant stakeholders through online consultations. Based on the policy review and discussions, recommendations were framed that were suited to the policy and practice context of these two states.

KEY LEARNINGS AND RELEVANCE TO PUNJAB AND HARYANA

1. Crop diversification

The experience of other states' policies and programmes on crop diversification were classified into four broad categories of policy environment, price incentive mechanisms, value chain interventions and market reforms, and partnerships and institutional coordination. The key learnings and opportunities with relevance to Punjab and/or Haryana are summarised in Table 1.

Table 1: Policy best practices from other states and opportunities for Punjab and Haryana

SN	Best practice	Important state policies/schemes	Opportunities for Punjab and Haryana
1	Policy environment		
1.1	Developing policy on regenerative food systems	<ul style="list-style-type: none"> State Policy on Organic Farming in Madhya Pradesh (MP), 2010 Karnataka Organic Farming Policy, 2017 Rajasthan Organic Farming Policy, 2017 Odisha Organic Farming Policy, 2018 	Integration of regenerative agriculture practices and ecosystem-based approaches in the existing policies to protect climate, water, and provide ecosystem benefits to improve farmers' livelihoods and build their adaptive capacity to respond to climate change.
1.2	Promoting alternative crops for diversification	<ul style="list-style-type: none"> Odisha Millet Mission, 2017 (millets, pulses, and oilseeds) Vegetable and Fruit Promotion Council Keralam (VFPC) 2001 (fruits and vegetables) Karnataka Organic Farming Policy, 2017 (millets) MP's Crop Diversification Scheme, 2022 Rajasthan's Agriculture Policy, 2013 (spices and guar) 	Existing capacity building initiatives may be strengthened by adopting best practices such as end-to-end value chain interventions (e.g., Odisha Millet Mission), empowering farmers through partnership (e.g., VFPC model in Kerala where SHGs, Government of Kerala and other related institutions hold shares).

² <https://www.nature.org/en-us/what-we-do/our-insights/perspectives/foodscapes-regenerative-food-systems-nature-people/>

³ Comprised of Ms Neelkamal Darbari, IAS (retd.), Dr Sudhir Batish, Lt Col Monish Ahuja (Retd.), Dr Sheetal Sharma, Mr Akhilesh Yadav, and Dr Ravi Gopal Singh; with contributions from Mr Manoj Singh, Mr Devanshu Chakravarti, Mr Karthikeyan Nagarajan, and Ms Bharati Joshi.

SN	Best practice	Important state policies/schemes	Opportunities for Punjab and Haryana
1.3	Crop-specific policies to promote a particular crop	<ul style="list-style-type: none"> ♦ Himachal Pradesh's (HP) Mukhya Mantri Khumb Vikas Yojana (MMKVY), 2020 (mushroom) ♦ Tripura Agarwood Policy, 2021 (agar) ♦ Nagaland State Bamboo Policy, 2004 (bamboo) ♦ Maharashtra's Integrated and Sustainable Textile Policy (ISTP), 2023-28 (cotton and sericulture) ♦ Telangana State Oil Palm Mission, 2022 (oil palm) ♦ HP Forestry Sector Medicinal Plants Policy, 2006 (medicinal plants) ♦ Meghalaya's Jackfruit Mission, 2018 (jackfruit) 	Need to develop crop-specific policies for basmati rice, pulses (moong), oilseeds (sunflower, mustard), potato, cotton, horticultural crops (kinnow, guava, etc.), herbs, and medicinal plants. Improvement in production and processing (e.g., MMKVY for khumb), providing incentives and improving processing (e.g., ISTP for incentives to sericulture farmers), and strengthening the marketing system (e.g., price monitoring cell of HP to monitor daily prices of pulses and vegetables).
1.4	Technological innovations in the agricultural sector	<ul style="list-style-type: none"> ♦ The E-Sahamathi platform and Farmer Registration and Unified Beneficiary Information System (FRUITS), Karnataka, with a digital database encompassing 50 lakh (5 million) farmers. ♦ Telangana's agri-hub sandbox offers technical support to agritech entrepreneurs. 	The agritech sandbox approach will support farmers' access to government schemes through one e-platform, enabling agricultural value chain transformation through digital means (e.g., Telangana agritech sandbox project's pilot phase's outreach to more than 7,000 chilli farmers to access AI-based advisories, soil testing, produce quality testing, and e-commerce services) and linking farmers to various key value chain actors through their consent (e.g., E-Sahamathi app enables retail firms' connect with consenting farmers and negotiation of deals).
2	Pricing mechanisms		
2.1	Incentives for crop diversification	<ul style="list-style-type: none"> ♦ Incentive Scheme for MP Crop Diversification, 2022 ♦ <i>Mera Pani Meri Virasat</i> Scheme, Haryana, 2020 ♦ Other states – Kerala, Karnataka, Odisha 	<ul style="list-style-type: none"> ♦ Adoption of learnings from an incentive scheme for uptake of an integrated farming system model in MP. ♦ Establishment of platforms at the state and district levels like SLBC (State-level Bankers Committee) and DLCC (District-level Credit Committee) along with NABARD (National Bank for Agriculture and Rural Development), to facilitate credit for crop diversification.
3	Value chain interventions and market reforms		
3.1	Promotion of farmers' markets	♦ Rythu Bazar (Market), Andhra Pradesh	Models like Rythu Bazar in Andhra Pradesh have encouraged farmers to diversify and grow their fruits and vegetables. Developing commodity-specific market infrastructure such as collection centres, storage facilities and processing units, etc. can be considered.
3.2	Promotion of Centres of Excellence (CoEs)	<ul style="list-style-type: none"> ♦ Odisha's CoE for millet crops. ♦ Rajasthan's Agri Marketing Intelligence and Business Centre. 	<ul style="list-style-type: none"> ♦ Establishment of dedicated missions or sub-missions. ♦ Establishment of research and development centres on regenerative agriculture equipped with testing laboratories.
3.3	Processing industries for alternative crops	♦ Rajasthan's Agro-processing, Agri-business, & Agri-export Promotion Policy, 2019, promotes a cluster-based approach in production, processing, and backward-forward linkages.	♦ Promotion of cluster-based processing industries for maize, soyabean, and mustard by FPOs, micro and small enterprises, etc.
3.4	Branding	<ul style="list-style-type: none"> ♦ <i>Siridhanya</i> brand for millets, Karnataka. ♦ <i>Mahagrapes</i> for grapes, Maharashtra. 	Commodity-specific brands could be promoted.
4	Partnerships and institutional coordination		
4.1	Procurement through NAFED	National Agricultural Cooperative Marketing Federation of India Limited (NAFED), under the Price Support Scheme, has procured 12.62 lakh Metric Tonnes of pulses and oilseeds valued at INR 7,072.21 crore (approx. 700 million) in the year 2021-22.	Effective coordination between state-level agencies and NAFED may help the purchase of pulses under normal market circumstances.

SN	Best practice	Important state policies/schemes	Opportunities for Punjab and Haryana
4.2	Engaging farmer producer organisations (FPOs) and SHGs for crop diversification	<ul style="list-style-type: none"> ♦ Vegetable diversification programme in Kerala engaged women SHGs as a platform for training and marketing. ♦ Odisha and MP governments involved FPOs in marketing of alternative crops. 	The state government can engage rural agricultural cooperative societies, FPOs, SHGs, and non-government organisations (NGOs) to promote crop diversification.
4.3	Institutional arrangement for effective farmer outreach	<ul style="list-style-type: none"> ♦ Rythu Bhrosa Kendralu, established at the village level in Andhra Pradesh as a 'one-stop shop' for farmers providing awareness generation, crop advisories, inputs, and facilitating procurement. ♦ FRUITS database is being used in Karnataka to facilitate faster and targeted delivery of agriculture and livestock-related advisory services to farmers. 	Existing institutions such as the Primary Agricultural Cooperative Societies (PACS) could be strengthened further for effective farmers' outreach, promoting PACS as multi-service centres (like in Gujarat), and establishing linkages between farmer producer companies (FPCs), FPOs and PACS.

2. Crop residue management

The experience of other states' policies and programmes on crop residue management were classified into five broad categories: (i) incentives, (ii) use as fodder/cattle feed, (iii) enforcement,

(iv) innovations in state-specific schemes in farm mechanisation, and (v) innovation in biomass-based policies and projects. The key learnings and opportunities with relevance to Punjab and/or Haryana are summarised in Table 2.

Table 2: Innovation in crop residue-based policies and projects, and opportunities for Punjab and/or Haryana

SN	Best practice	Important state policies/schemes	Opportunities for Punjab and/or Haryana
1	Incentives for Crop Residue Management	<ul style="list-style-type: none"> ♦ Haryana State Plan Scheme for Management of Crop Residue (not burning paddy stubble and baling it) for farmers. ♦ Incentives for <i>Gram Panchayats</i> to not undertake stubble burning. 	♦ Incentives for in-situ management of crop residue to improve the soil organic carbon.
2	Use of paddy straw as fodder/cattle feed	<ul style="list-style-type: none"> ♦ <i>Paira Daan Maha Abhiyaan</i> (campaign for donating paddy stubble as fodder) to Chhattisgarh's <i>Gauthan Yojana</i> (cow shelters). ♦ Bihar's Rohtas Model of Stubble Management for baling paddy straw and selling the bundles to dairy units for fodder. 	♦ Exploring the possibilities of selling paddy straw to HP, Rajasthan, or other fodder deficit states.
3	Enforcement (punitive action) against farmers (fines/blacklisting of farmers denying them access to government schemes) through state directive/ district-level orders	<ul style="list-style-type: none"> ♦ In Bihar, farmers were blacklisted, denying them access to government schemes for three years (2021). ♦ In Uttar Pradesh, farmers engaging in stubble burning were stripped off the benefits under <i>PM Kisan Samman Nidhi</i> in Deoria district (2022). 	Punjab and Haryana can enforce punitive actions based on the experience and learnings from other states.
4	Innovations in state-specific schemes on farm mechanisation		
4.1	Coordination with State Rural Livelihood Missions to promote women-managed custom hiring centres (CHCs) at the cluster level	♦ Bihar's <i>Mukhyamantri Harit Krishi Sanyantra Yojana</i> , 2018	♦ Small and marginal farmers and women SHGs can be engaged in the running of CHCs.

SN	Best practice	Important state policies/schemes	Opportunities for Punjab and/or Haryana
4.2	Service centres for agricultural machinery	♦ Establishment of service centres for agricultural machinery and solar pumpsets, Tamil Nadu.	♦ Skill Development of youth in maintenance of CRM machineries (e.g., MP's programme for skill development of rural youth in farm mechanisation).
4.3	Different agricultural mechanisation schemes for different sets of farmers	♦ Different farm mechanisation schemes in Gujarat for farmers: AGR 2 for other than from SC/ST category, AGR-3 for ST category, AGR 4 for SC category.	Paddy-based schemes for targeting FPOs of small and marginal farmers in crop-burning hotspot districts.
5	Innovations in biomass based policies/projects		
5.1	Engagement of FPOs in biomass collection and storage and development of waste value chain for supplying stubble to biomass-based plants	♦ Uttar Pradesh Bio-energy Policy, 2022	Formulate a separate Biomass/Bio-energy policy focusing on developing waste supply chains from paddy straw to biomass-based plants by involving FPOs/SHGs as aggregators of paddy straw.
5.2	Villages run solely on renewable energy	♦ Madhya Pradesh Renewable Energy Policy, 2022	Villages can receive electricity from renewable sources including solar and crop residue-based biomass energy.
5.3	CoE for renewable energy	♦ Madhya Pradesh Renewable Energy Policy, 2022	Promotion of CoE on crop residue management for creating a repository of projects and best practices.
5.4	District-level volunteers for spreading awareness on renewable energy	♦ Madhya Pradesh Renewable Energy Policy, 2022	Involve students, NGOs, and other volunteers at the district level for spreading awareness (e.g., <i>Harit Mitras</i> in MP).
5.5	Multistakeholder collaboration for waste-to-worth projects for developing products from and markets for paddy straw	♦ Waste-to-Worth project, Andhra Pradesh: Collaboration between the Government of Andhra Pradesh, NGOs, and the private sector.	Develop multi-stakeholder partnerships to develop paddy straw-based marketable products.
5.6	Entrepreneurship in biomass-based products	♦ Maharashtra Energy Development Authority incentive scheme to promote biomass-based briquette entrepreneurs.	Manufacturing and promoting biomass briquettes through entrepreneurs.

POLICY RECOMMENDATIONS FOR REGENERATIVE FOOD SYSTEMS IN PUNJAB AND HARYANA

1. Short-term initiatives (0-2 years)

These recommendations target the operational challenges related to crop diversification and crop residue management, and are intended to be implemented within two years or less.

(i) Crop diversification

- ♦ **Price support and incentives:** To encourage farmers to shift to alternative cropping systems, the two state governments should consider offering an attractive minimum selling price for alternative crops, including a price-deficit payment system.

- ♦ **Public procurement infrastructure:** The two state governments should allocate adequate funds to establish dedicated procurement centres, well-equipped storage facilities, and a reliable transportation network for alternate crops.
- ♦ **Cluster approach:** Cluster-based crop planning, aligning inputs, technologies, infrastructure, personnel, markets, and buyers may be followed. Specific districts can be targeted for intensive crop-based diversification, considering factors such as soil type, groundwater depletion, and processing plant availability.
- ♦ **Production support system:** Farmers should be encouraged to cultivate food crops such as oilseeds, pulses, cotton, maize, and horticulture crops by establishing adequate production support systems (ensuring sufficient input supply,

creating seed banks or seed hubs and providing crop-specific machinery at subsidised rates).

- ◆ **Engage FPOs, FPCs, and NGOs:** Engage FPOs, FPCs, and NGOs: The governments may collaborate with FPOs, FPCs, and NGOs to implement capacity building programmes, conducting awareness campaigns, and seeking their inputs in monitoring and evaluation for promoting crop diversification.
- ◆ **Investing in information and communication technology platforms:** The two state governments may consider investing in information, education and communication infrastructure for sharing information and knowledge on regenerative food systems.
- ◆ **Leveraging digital technology using the sandboxing approach:** The Governments of Punjab and Haryana may consider adopting the agritech sandbox approach⁴, which can safeguard farmers against risks to farming while encouraging innovations.

(ii) Crop residue management

- ◆ **Service centres for agricultural machinery:** To improve efficiency and utilisation of existing CRM machineries, the rural youth may be trained to establish service centres for agricultural machinery.

2. Medium-term initiatives (2-5 years)

The medium-term initiatives prioritise development of policies and systems for crop diversification and crop residue management, and are proposed for implementation over a period of up to five years.

(i) Crop diversification

- ◆ **Mission mode operations:** Both governments can establish dedicated missions or sub-missions along with CoEs for specific crops or products.
- ◆ **Support for the processing industry:** To motivate farmers, developing value chains and markets for farm produce is vital. The two governments may consider supporting promotion of processing industries around alternative crops such as maize, soyabean, and mustard. FPOs, FPCs, and

SHGs can be incentivised to establish processing plants, while loans under Skill India and MUDRA can aid in value chain development.

- ◆ **Crop-specific policies:** For crops such as mushroom, basmati rice, moong, oil seeds, and cotton, specific policies can be developed for focused attention and scaling up areas under cultivation, promoting ecosystem to develop value chains, and for better integration of the product with markets.

(ii) Crop residue management

- ◆ **Modifying policies on farm mechanisation:** The states may consider improving their policies on farm mechanisation by formulating dedicated schemes for FPOs of small and marginal farmers, etc.



Farmers' participation during a field day; HARIT project.

- ◆ **Framing a state policy on biomass-based energy:** A separate policy on biomass-based energy/bioenergy to enable development of a waste value chain from crop residues in each crop residue-burning hotspot district. FPOs and SHGs will be key stakeholders in the waste value chain, providing tangible income to the farmers through the sale of processed/aggregated stubble. The policy may set targets for co-powering villages through electricity from solar and crop residues.
- ◆ **Setting up a CoE on crop residue management:** Given the level of research and development currently being undertaken in Punjab on crop

⁴ The agritech sandbox is a controlled environment provided to innovative technology-led entities for limited-scale testing and certification of a new product or service from the perspective of conformance to norms and standards relating to the agriculture domain, technology and applicable regulations.

residue management, its government may consider setting up a CoE on crop residue management in an agriculture university in the state. The CoE can undertake action research in the crop-burning hotspot villages in collaboration with government entities, private agencies (foundations and CSR wings of private companies), and bilateral and multilateral agencies. The CoE will create a repository of past and ongoing research on crop residue management and will also hold periodic consultations on the subject by inviting experts. Most importantly, it will engage more proactively with the farming community.

3. Long-term Initiatives (> 5 years)

The long-term strategies focus on the promotion of regenerative food system policies. The focus will be on fostering regenerative practices that restore and enhance ecosystem health, improve soil fertility, and prioritise environmental stewardship for long-term agricultural sustainability. The governments must prioritise setting up infrastructure and support systems for farmers to adopt regenerative agricultural practices, adopt an ecosystem-based approach for improving farmers' overall livelihoods and building resilience towards climate change. They may establish research and development centres for regenerative agriculture equipped with soil testing labs. Demonstration farms and farmer training centres



Manoj Singh

Happy Seeder and combine with super straw management system in use at BISA farm, Ludhiana, Punjab.

CONCLUSIONS AND WAY FORWARD

Considering the vital role that farmers of Punjab and Haryana play in ensuring national food security, effective management of their expectations is critical. It is essential to provide farmers with the necessary knowledge, resources, and support, to transition to regenerative food systems. By empowering farmers through capacity building programmes and technical assistance, they can effectively adopt sustainable practices and contribute to the success of regenerative food systems.

Efficient resource management is another critical aspect to consider. Ensuring optimal utilisation of water, land, fertilizers, and other agricultural inputs will not only enhance productivity but also reduce adverse environmental impacts. Buffer management strategies should be implemented to safeguard against potential risks and disruptions in the agricultural system, such as price fluctuations, market dynamics, and climate-related events.

Punjab and Haryana can build a robust food system that not only addresses environmental challenges but also ensures a consistent supply of safe and nutritious food for the nation. The long-term success of implementing regenerative food systems in the region depends on continuous monitoring, evaluation, and adaptive management to align with the evolving needs and changing circumstances.

may also be established to showcase successful practices and provide technical support and training to farmers. Developing market infrastructure, such as collection centres, storage facilities, and processing units, will facilitate the marketing and sale of regenerative agricultural products. This will ensure fair market access and value addition for farmers practicing regenerative agriculture.