AFPRO
Action For Food Production
57 years of Excellence

National Seminar
on
Regenerative Agriculture: Emerging Perspectives, Challenges, and the Way Forward

Seminar Report

Organized by
Action for Food Production (AFPRO)
in partnership with
Louis Dreyfus Company & Asian Development Bank

18 March 2025
India International Centre, New Delhi

The seminar brought together agricultural scientists, policy experts, field practitioners, and institutional stakeholders to deliberate on ecological and sustainable solutions for the growing challenges faced by Indian farmers. Sessions focused on holistic practices to improve soil health, reduce chemical dependence, enhance biodiversity, and build climate resilience. Case studies, scientific findings, and grassroots innovations were discussed to develop a shared understanding and collaborative direction for scaling regenerative practices in India.

Background

Solutions to current smallholder and marginal farmer stress can be addressed by uniting concerned stakeholders in the agricultural sector who can contribute their expertise and share insights to collaboratively develop scientifically sound, logically robust, cost-effective, integrated farm-based approaches, aligned with the prevailing agricultural challenges that endanger farm-based livelihoods.

Lighting the Lamp (*L to R*): Dr. Jacob John, Executive Director, AFPRO; Dr. N.J. Kurian, President, AFPRO; Mr. Sumeet Mittal, CEO, Louis Dreyfus Company; Padma Shri Mr. Subhash Palekar, Agriculture Scientist; Mr. S.G. Salunke, Director-Program, AFPRO; and Prof. Priti Malhotra, Professor, Delhi University

The smallholder and marginal farmer bears the brunt of the challenges that are threatening the farming ecosystem today. While all farmers are affected, those with adequate resources can adapt and overcome these challenges. Agricultural livelihoods contend with two primary pressures: diminishing factor productivity and climate change.

The most significant challenge to agricultural productivity is the persistent decline in factor productivity. Today, farm productivity is challenged by overuse and dependence on chemical inputs. Conventional, intensive farming, characterized by excessive tillage and the overuse of synthetic inputs, has demonstrably degraded soil health, contaminated water sources and diminished biodiversity. Increased soil health deterioration measured in terms of its physical, chemical and biological properties, reduction of soil organic matter, nutrients' deficiency, declining biodiversity, pests and diseases dynamics, surface run-off and erosion, secondary salinization and sodicity problems, pollution hazards and subsoil compaction intensify the problem Compounding these issues are water-resource challenges, including a declining water table and water scarcity. Additionally, rising temperatures also impact productivity in allied activities like animal husbandry and fisheries. Livestock, dairy and poultry face heat stress and frequent disease outbreaks, while fisheries abundance and spawning are affected.

Global warming and climate change have created unprecedented climate risk, and susceptibility to climatic variability has emerged as a major threat. Residue burning leads to the emission of Greenhouse Gases (GHGs) which are the primary cause global warming. Accompanying air pollution deteriorates quality of life for all living beings. Burning crop residues also destroys valuable nutrients, leading to soil fertility deterioration, and associated loss of biodiversity, soil flora and fauna.

Adaptation to and mitigation of climate change have become the new key strategies to be participated in globally and implemented locally. This requires embracing climate resilient agricultural practices and phasing out practices that contribute to GHG emissions, thereby mitigating global warming.

Looking ahead, Indian agriculture faces several challenges, which reflects inefficiencies in agricultural practices, productivity, and resource utilization. Hence we need to focus on the approaches and frameworks which are environmental friendly and also benefits smallholder farmers in different agro-climatic zones of our country. Regenerative Agriculture has been seen as a promising approach to work on this objective and therefore AFPRO organized this National Seminar to gather different stakeholders and design a future roadmap for building resilience among the smallholder farmers in India.

Scientific research and morale aimed at addressing these challenges are of paramount importance, underscoring the urgent need to continuously reinvent and adapt farming practices. The Green Revolution, closely associated with Dr. M. S. Swaminathan, though subject to criticism for its environmental and social repercussions, was at the time of its implementation, a necessary and effective scientific intervention. It played a pivotal role in alleviating widespread food scarcity and ensuring food security in a nation grappling with immense developmental challenges. It succeeded in significantly increasing food production, thereby saving millions of lives from starvation and malnutrition. Societal needs have always played a crucial role in shaping agricultural practices and policymaking. Although such policy decisions remain open to debate, they were primarily driven by the pressing requirement to improve pest resistance and enhance crop yields for vulnerable communities.

However, the unintended adverse impacts of the Green Revolution on natural resources and the serious environmental consequences, such as the widespread contamination of soil and water resources due to the overuse of chemical fertilizers and pesticides, present a dilemma for policy planners, agricultural scientists, and researchers.

Technical Sessions

Subject matter experts, agricultural specialists and scientists brought forward their thoughts, experiences and learnings to the seminar. There were different schools of thought with diverse philosophies but converging around the shared concern of regenerating agriculture to sustainably enhance and fortify farm productivity in the face of climate change.

1. Regenagri Program Standards and Criteria

Field Implementation Efforts from AFPRO's Regenerative Agriculture Project supported by LDC

AFPRO is implementing a Regenerative Agriculture project in Aurangabad District, Maharashtra and financially supported by Louis Dreyfus Company, (LDC), Being implemented in 38 villages with a total area of 11500 Ha, the project has entered its third year of operations.

Dr. Jacob John delivering the Welcome Address

This project has been designed for promoting regenerative farming framework in order to achieve environmental impact goals in the backdrop of climate change and extreme weather events. The project will set a roadmap for the farmers as well as the development agencies for transitioning to holistic farming, increasing soil health, encouraging biodiversity, reducing greenhouse gas emissions and

Dr. N.J. Kurian delivering the Keynote Address

sequestering CO_2. The objective is to e eventual regeneration of our planet and to sustainably secure the future of agricultural products and their supply chains.

regenagri as a global certification standard has been evolving and there are certain standards and criteria for field assessment and regenagri certification. At the same time this approach offers newer opportunities to the farmers for accessing the carbon credit markets and environmental subsidies.

Among the regenagri standards, following practices have been set as of primary importance which relate to crop production, landscape management and environment impact, which form the main principles of regenagri farming approach.

- Conservation Tillage, Cover-cropping, Crop Rotation, Multi-cropping and Inter-cropping, Perennial Cropping, Irrigation efficiency measures
- Soil Analysis, Natural fertiliser and crop protection strategies, reduction of synthetic fertilizers and pesticides
- Promoting biodiversity, Buffers around watercourses, Hedgerows and Windbreaks, Conservation of natural habitat, Afforestation
- Rainwater harvesting, Water Quality and Pollution Prevention, Plastic Pollution Prevention, Renewable Energy, Reduction of Greenhouse gas emissions

Under this project a total of 6,573 farmers were registered for regenagri certification across all crops, including cotton and the audit was conducted by Control Union as the certification agency. All participating farmers have qualified and the project has received regenagri certificates.

2. Carbon Farming – Carbon Energy Restoration for Regenerating Agriculture and Combating Climate Change

Carbon Sequestration for Regenerating Natural Soil Processes

Carbon Farming is a holistic farm approach to optimizing carbon capture or sequestration on farm landscapes by implementing practices that are known to improve the rate at which CO_2 is removed from the atmosphere and stored in plant material and/or soil organic matter. Carbon farming explicitly acknowledges solar energy as the driving force behind farm ecosystem dynamics, with carbon acting as the energy carrier.

World's cultivated soils have lost between 25 to 75 percent of their original carbon stock, which has been released into the atmosphere in the form of CO_2, mainly due to unsustainable management practices. It is estimated that there is significant global technical potential of Soil Organic Carbon sequestration of about 10%-20% of total global emissions (UNEP 2018).

Plants and Soil Microbiome – Key interplay in the carbon agroecosystem

Plants provide carbon rich sugar sap to soil microbes. Decaying plant matter turned into the soil provides nutrients and carbon. Soil microbes (primarily bacteria and fungi) use these carbon sources (sugars and plant matter) and turn them into various organic molecules like proteins, lipids and complex sugars, providing nutrients, minerals and trace elements as feedback to the plants and soil. It is these that make up the soil organic matter (SOM) or soil humus and glomalin, which play a crucial role in carbon sequestration and soil aggregation.

Plants also form a barrier between air and soil to reduce carbon emissions by soil microbes. Tillage results in plant residue removal and exposes soil carbon to air oxidation, ddestroys soil aggregates, pore spaces, glomalins and fungal hyphae. Pesticides kill soil organisms including microbes. Fertilizers can reduce soil organic carbon. Nitrogen application on soil surface decreases root size and depth, reduce root dependence on microbes for nitrogen, and reduces root exudation of carbon sap to the soil for microbes.

Carbon Farming to Regenerate Agriculture

Carbon Farming emphasises increasing farm system energy or Carbon. Practices of minimum tillage, residue retention, cover cropping, integrated nutrient management, agroforestry and integrating animal husbandry result in soil and water conservation, increase in soil organic carbon and improved soil aggregation. This further improves soil biodiversity, earthworm activity and microbial biomass carbon, leading to sstrengthening of rhizospheric processes and elemental nutrient cycling and water cycling. The overall result is growth in net productivity, with increase in use efficiency of inputs and ecosystem services. Serving the goals of climate change adaptation and mitigation, carbon farming yields farm ecosystem stability and resilience attained through restoration of soil and environmental quality.

Biochar – An Organic Soil Enhancer for Carbon Sequestration

Biochar is charcoal made from biological material and used to improve soil health. The identification of biochar in the highly fertile dark soils of the Amazon basin in the 19^{th} century sparked an interest in this source of organic carbon. Soil organic carbon, formed out of decaying organic residue (from local biodiversity), improves soil structure, increases water retention and provides much needed nutrients to the soil.

Technical Session (*L to R*): Dr. M.V. Venugopalan, Principal Scientist & Head of PME Cell Agronomy, ICAR; Dr. T.K. Das, Principal Scientist & IARI; Mr. Rajveer Singh, Managing Director, Apex Cluster Pvt. Ltd; Mr. Rajeev Baruah, Expert Regenagri and Mr. S.G. Salunke

Biochar can be produced locally from farming leftovers such as stalks remaining after harvest. It promotes soil microbes which live off the organic carbon in biochar and enhance soil fertility. On the other hand, burning leftover stalks releases CO_2 and contributes to air pollution, while stacking them separately for decomposition can spread insects and pathogens.

When biomass either burns or decomposes its biogenic carbon carbon re-enters the atmosphere as carbon dioxide and methane. Producing biochar stores carbon in a durable solid form persistently removing it from the atmosphere to reduce the effects of climate change. Turning organic waste into biochar intercepts carbon emissions before they enter the atmosphere.

The Intergovernmental Panel on Climate Change estimates that Biochar has the potential to remove 2.6 billion tons CO_2/year or the equivalent of 803 coal -fired power plants in 1 year, with co-benefits like increased yields and enhanced food production. In terms of total GHGs, a research places conservative estimates that at least 6% of annual global carbon emissions can be removed by the use of Biochar.

3. Regenerative Agriculture – Principles and Practices

Findings from a Scientific Study by ICAR-Central Institute of Cotton Research, Nagpur Heightened Interest over the Last Decade

There has appeared an increasing and urgent scientific and popular interest in Regenerative Agriculture. This has increased greatly in the past 8-10 years in terms of number of news items published and internet visits to online publications and citations.

The key drivers of this interest in Regenerative Agriculture are the search for farming practices which would insulate against increasing climate vulnerability, reduce Greenhouse Gas (GHG) emissions, remediate soil health deterioration, while being scientifically evidenced and provide market opportunities.

Nitrogen fertilizers and farm energy are main drivers of GHG emissions. Improving Nitrogen Use Efficiency (NUE) in Cotton production globally has the potential to reduce GHG emissions by 37%. The switch from fossil to renewable energy similarly potentially can reduce GHGs globally by 12%.

A section of audience

Broad Consensus on Acceptability of Regenerative Agricultural Approach

There is a broad consensus on Regenerative Agriculture across stakeholders as an acceptable set of practices which would locally enable farming communities' to potentially reverse the ecological degradation and its impact on agricultural productivity.

- Rejuvenate soil fertility and health to improve productivity and livelihoods,
- Increase water filtration, retention, percolation and prevent runoff
- Increase bio-diversity and ecosystem health and resilience
- Reduce carbon emissions and promote carbon storage

Regenerative Agriculture can be said to be sum of the impact of its practiced principles – minimizing soil disturbance, maximize soil cover, maximize plant and soil diversity, conserving water, and ensure living roots all year-round and rationalized use of agro-chemicals.

This sum of impact is seen as improvement in soil health, which diversifies in terms of benefits to agricultural economy and ecology. These benefits are reduced input costs and improved bio-diversity, imparting climate resilience and lower GHG emissions, overall resulting in increase in yield/margins along the value chain and higher consumer acceptance and satisfaction.

Targeting Soil Health Improvement

Targeted soil health improvement can be achieved in the physical, chemical, biological and ecological perspectives, leading to improved water-nutrient-mineral-soil cycles.

- Physical health is seen as soil structure improvement and can be achieved through mulching, cover crops, reduced tillage and integrated farming systems.
- Chemical health in terms of nutrient supply for high yield to be accomplished through balanced fertilizer utilization, integrated nutrient management, integrated water management and soil amendment achieved by organic or inorganic inputs.
- Biological soil health is equated with enhancing soil bio-diversity. This is goal is fulfilled through promoting microbial consortia, bio-rational pest control agents, biological nitrogen fixation through planting legumes as inter or cover crops or crop rotation, soil disease management, application of manures or compost or vermicompost.
- Ecological soil health is read as environmental issues surrounding soil. These are addressed by reducing emissions through minimizing tillage, working on carbon sequestration by organic matter addition, moderation of soil temperature by mulching, soil and water conservation and reduced pollution (no residue burning/renewable energy promotion).

Timeline for Reaping Benefits from in Regenerative Agriculture

The majority of benefits gained from adoption of *Regenerative Agriculture* practices are experienced in the medium term of 3-6 years and sustained thereafter. In the short term of 1-3 years, key benefits are the reduction in cost of cultivation in terms of labor, time, farm power and reduction in GHG emissions.

Medium Term (3-6 years)

- Enhanced farm productivity through improved cropping system and improved use efficiency of agricultural inputs
- Improved water productivity through decreased runoff and soil loss, increase filtration and soil moisture retention in the root zone
- Increase soil organic carbon in low Soil Organic Carbon (SOC) soils
- Better climate resilience
- Improved soil biological activity

Long Term (6 years onwards)

- Build-up of stable Soil organic matter (SOM) pools (low SOC soils give early benefits)
- Better soil structure and bulk density

4. Conservation Agriculture – A Scientific Study of its Benefits for Agricultural Productivity

Principles of Conservation Agriculture

Conservation Agriculture aims to promote resource saving methodology for crop production with goal of encouraging natural and biological processes to flourish both above and below the ground. Strategically a key concept being researched for achieving economically, ecologically and socially sustainable agricultural production, Conservation Agriculture is as an integrated approach in management of crop, soil, water, environment and other resources. The foundational principles of Conservation Agriculture are

- Minimum Soil Disturbance – no tillage or reduced tillage
- Permanent Soil Cover – retaining crop residue and cover crops for organic soil cover
- Crop Diversification – diversified crop rotation or inter-cropping

Visible Impacts of Conservation Principles

Conservation Agriculture results in higher soil quality and sustainable increase in agricultural productivity with acceptable margins. This is the observed result from field projects of ICAR-IARI scientists, where resource conservation approaches have enriched soil with organic matter and nutrients, while reduction of runoff prevent erosion and enhance water availability for crops. No tillage results in lowering of costs of labor and machinery and fossil fuel energy, and elimination of residue burning. The ecological restoration and intensification improves overall farm environment, helping adapt to future impacts and also mitigating climate change.

Conservation Agriculture has spread from less than 1.0 Mha in 8 countries in 1970 to 205.4 Mha in 102 countries in 2019, about 14.7% of the world's cropland area. It is adopted in more than 50% of the cropped area in Argentina, Brazil, Canada, USA, Paraguay, South Africa and Uruguay, and is the dominant cropping system in Australia. In India Conservation Agriculture is adopted in 3.5 Mha.

5. Role of Nanomaterials in Regenerative Agriculture – Nano alternatives for optimal targeted synthetic agricultural inputs

Nanotechnology has transformative potential in revolutionizing agricultural practices, emphasizing its capacity to enhance productivity, sustainability, and crop resilience. Advancements in nanotechnology offer to leverage the unique properties of nanoparticles at the atomic scale to improve efficiency and precision. Nanotechnology based tools and techniques provide better alternatives as compared to conventional methods.

Key applications of nanomaterials span the entire agricultural value chain, from seed germination and crop growth to harvest, storage, transport and food processing. Notably, nanotechnology facilitates the effective transfer of genetic material, contributing to crop improvement and the development of climate-resilient varieties.

Nanotechnology-driven solutions for agro-health, including nano-fertilizers, nano-herbicides, and nano-fungicides, optimize and targeted nutrient delivery and reduce environmental contamination. Additionally, nano-biosensors enable real-time monitoring of soil health and crop conditions, while nano-bioremediation agents aid in detoxifying polluted agricultural ecosystems. Nano-composites improve the shelf life and safety of agricultural products during storage and transport.

By integrating nanotechnology into regenerative agricultural systems, stakeholders can achieve higher yields, reduced chemical dependency, and enhanced ecological resilience. However, there is need for continued research, responsible innovation, and scalable adoption of nanotechnology to address global food security challenges while aligning with sustainability goals.

Technical Session (*L to R*): Prof. Priti Malhotra; Mr. Ruchir K Pareek, Program Manager, IDH; Mr. Rajveer Singh and Padma Shri Mr. Subhash Palekar

6. Zero Budget Natural Farming – Pro-poor Natural Regenerative Agriculture

Zero Budget Natural Farming is a farming concept pioneered by Padma Shri Sh. Subhash Palekar, drawing on India's traditional farming systems and the logic on natural ecosystems. The term "Zero Budget" refers that farming can be done without any external chemical inputs or loans — hence the term "zero budget." He developed this approach witnessing the long-term harm conventional methods using fertilizers and pesticides inflicted on soil health, crop resilience, and farmer incomes.

Dr. Palekar describes Zero Budget Natural Farming (ZBNF) as a form of spiritual farming that embraces all aspects of the environment and ecology. While in earlier times, farmers did not rely on artificial inputs, yet the land remained fertile and rich in micronutrients essential for plant growth. ZBNF is not just a technique; it's a holistic farming philosophy with four pillars —

- **Jeevamrut (liquid organic manure) -** A fermented microbial culture made from cow dung, urine, jaggery, and other natural ingredients. This stimulates microbial activity in the soil, leading to enhancement of nutrient availability for plants creating conditions for restoring natural immunity to the soil.

- **Beejamrut -** Seed treatment with cow dung and cow urine from native cow species to ensure protection from diseases and healthy germination
- **Acchadana/Mulching** – Covering the top soil with organic/crop wastes, which then decompose into humus. This leads to conservation of top soil, water retention capacity of soil increases, evaporation losses decrease, thus creating conditions for soil fauna and soil biodiversity to flourish and release nutrients into the soil.
- **Waaphasa/Moisture/Soil Aeration -** Maintaining the right balance of air and moisture in the soil. This is a natural outcome of applying jeevamrut and acchadana, wherein aeration of the soil increase improving the water and nutrient fluxes, overall soil structure and composition, water retention capacity and availability.

ZNBF cropping model is based on growing short-duration and long-duration crops (main crop) together. This creates a cost-recovery or additional income-generating option where the expenses of raising main crops gets recovered from short-duration crops resulting in "zero" expenditure for the main crop, resulting in the term "Zero Budget Natural Farming".

Transitioning from chemical-intensive agriculture to natural farming can initially result in lower yields as the soil rebuilds itself. The approach also demands a deep understanding of natural processes and a shift in mindset, which requires dedicated training and community support.

7. Regenerative Agriculture – An Approach for Driving Sustainability in Global Value Chains

IDH Project Experiences in Implementing Regenerative Agriculture

IDH - the Sustainable Trade Initiative, an institution funded by the Dutch and Swiss governments, as part of its efforts at driving sustainability in production value chains, has chosen to promote Regenerative Agriculture as a vehicle for sustainability in smallholder farm production and livelihoods ecosystems. With an aim for a proof of concept, and a business case for scalability, IDH is implementing regenerative agricultural practices in Madhya Pradesh with a strong emphasis on contextual analysis of local ecosystems, soil and water regimes, and demographic insights. A collaborative approach based on a partner coalition design is being adopted for implementation, involving local partners, local stakeholders, and subject matter experts, and other potential partnerships.

Regenerative Agriculture is seen by IDH as set of practices which arrest the degradation of farm ecosystem and builds the capacity to improve soil, water and biodiversity regimes without the aid of chemical inputs. This simple philosophy yields a resilient production system with improved long term productivity through improved soil structure, increased soil organic carbon

(SOC), enhanced microbial activity, efficient nutrient cycling, improved biodiversity and natural habitats, carbon sequestration and reduced greenhouse gas (GHG) emissions.

IDH attempted practical interventions at both farm and landscape levels, such as the substitution of inorganic nitrogenous fertilizers with bio-inputs, mulching, intercropping, and alternate pest management techniques. These practices have demonstrated significant reductions in GHG emissions and improved crop yields. Beyond the farm, interventions included ecological planning at the village level, establishment of women-led bio-input resource centres, and watershed treatments through convergence with government schemes like MGNREGS.

Policy and Recommendations on Regenerative Agriculture

Policy and Research

- **Soil Health Regeneration and Climate Resilience in Agriculture -** Regenerative agriculture is a call for a shift towards a more integrated and comprehensive perspective in agricultural policy and practice, one that acknowledges and addresses the interconnectedness of various challenges and opportunities. This increasingly prominent concept of Regenerative Agriculture, is yet lacking of a universally accepted definition, and as yet subject to diverse interpretations and carrying different meanings for different individuals and stakeholders. This is an opportunity for a reimagining, optimizing and integrating agricultural practices which engender soil health regeneration and climate resilience in the agricultural sector.
- **Agricultural Risk Assessment -** It is absolutely essential to adopt a holistic and comprehensive risk assessment. This assessment must extend beyond the immediate on-farm risks associated with production, such as climate variability, pest infestations, and disease outbreaks. It must also encompass the broader spectrum of market-related risks, including price volatility, access to markets, and fluctuations in demand.
- **Farmer Insurance and Other Support Schemes -** In the context of farmer distress, it is important to assess the effectiveness of existing support mechanisms, especially crop insurance schemes to provide adequate protection and relief to vulnerable farmers.
- **Limited Scientific Evidence from India -**There is limited scientific evidence from India of the benefits of regenerative agriculture and time frame for securing them under diverse landscapes and crops. Regenerative agriculture needs to be adopted as a progressive scientific research theme to examine and integrate the mix of solutions in terms of traditional and modern wisdom recommended for climate-resilience and soil health regeneration in agriculture.

Panel Discussion (*L to R*): Mr. Raghavendra P Singh, Director of Operations, Aga Khan Foundation; Mr. Murli Dhar, Director, Sustainable Agriculture, World Wide Fund for Nature-India; Mr. Gangadhara Sriramappa, Louis Dreyfus Company and Mr. Rajeev Baruah

- **Study and Research for Local/Contextual Variations -** Regenerative Agriculture practices are local/contextual dependent and need modifications before adoption. Resources (finance, land, and skilled staff) are inadequate for micro level validation and refinement.

- **Standardization of Metrics -** There are no uniform set of standards to measure, compare and quantify the benefits of Regenerative Agriculture. This is needed for gaining consumer trust and sensitize the partners along the value chain.

- **Parallel Translation of Research into Climate Change Terminology -** Research results need to be translated into climate change mitigation terminology - carbon capture/ storage and GHG emissions reduction.

- **Financial Incentivization -** Outputs of Regenerative Agriculture are visible only in long run. Impact on improvement of soil health, biodiversity become visible only in long run. There is a difficulty in keeping all the stakeholders motivated during transition, and financial incentives could be one of the options to achieve this.

- **Streamlining procedure to gain Carbon credits –** This is an important farmer incentive to promote adoption of Regenerative Agriculture. Techniques that are credible, accurate, affordable and reproducible for measurement, reporting, and verification (MRV) of Carbon sequestration are needed.

- **Certifications and Premiums –** There are different certification schemes, each with its own set of standards and objectives play an important role in agricultural dynamics. While these certifications aim to promote sustainable and responsible agricultural practices, their effectiveness and market value can vary significantly. Some certifications have recently underperformed in delivering tangible benefits to farmers or gaining widespread market recognition. At the same time there have been cases of significant inconsistencies in price premiums for certifications deemed essentially the same. Hence the necessity of policy interventions to introduce a degree of regulation and control within these certification systems, with the aim of mitigating potential harm or exploitation.
- **Partnership between Producers and Brands -** Some companies are expressing a willingness to pay a premium for agricultural products that meet specific certification standards, reflecting their commitment to sustainability and ethical sourcing. There is need of forging stronger collaborations involving farmers and such brands. However, a significant challenge is that the quality and consistency of agricultural products should meet the rigorous standards and expectations set by these major brands.
- **"Lab to Land" Gap -** Agricultural research whether carried out by scientific institutions or by field programs implemented by various organizations, should eventually spread out to the intended key stakeholder – the smallholder, otherwise the disconnect between agricultural research and on-ground farming practices, commonly referred to as "Lab to Land" will persist. Farmers need to be guided on the necessity of change as a pro-active counter-measure to the potential risks that may accrue from climate variability.

Challenges: Farmers Perspective

- **Weeds –** With the adoption of minimum/zero tillage the prevalence of weeds increases, competing for resources and impacting yields. To combat this, cover cropping and intercropping or High Density Planting System are to be adopted. Herbicides would also be needed based on weed population – but in context of Cotton, Herbicide tolerant cotton in not available.
- **Water –** Sustainable access and availability of water resources would be required for planting cover crops and maintaining living roots year-round.
- **Farm Machinery –** Required for planting, land shaping, shredding cotton stalks are either not available or not affordable

- **Labour Intensive –** Availability of labour, high labour wages, and working conditions (drudgery), especially for small farmers
- **Knowledge Intensive -** Needs to be supported with appropriate training for knowledge building taking time to realize the benefits
- **Certification and Book-keeping –** Diverse certification standards for regenerative agriculture and laborious book-keeping, make the process of certifications and reaping its rewards quite cumbersome for the farming communities.
- **Mass Trapping/Mating Disruption –** These eco-friendly pest control methods need to be supported at community level over a large contiguous area, and are not for individual small farmers.

Challenges: Extension Official's Perspective

- **Existing Mind set -** Convincing farmers and changing their mind set and bringing about attitudinal change for adoption of change in practices.
- **Knowledge and Skills gaps –** Building up the knowledge and skills of farmers needs long term investment and commitment.
- **Reluctance to change due to existing limitations -** An existing production system, inadequate resources (finance, farm power/machinery, labour, farm fence) and limited market access (to inputs and diversified farm produce) are other reasons for non/partial adoption.
- **Generic recommendations to be refined -** Some regenerative agriculture recommendations are too generic and have to be refined and dovetailed to fit into the local production system. (e.g. choice of border/inter/trap crop, most compatible variety of the inter/rotation/trap/border crop for intercropping, planting pattern where the farmers can use their existing the farm equipment) This needs continuous engagement with the farmers.

Learnings from Field Implementation Experiences

- **Knowledge and Skill Gap -** Many farmers are unfamiliar with regenerative practices and have limited access to demonstration models and success stories from progressive farmers. Traditional mind-sets and reluctance to shift from conventional chemical-based farming are other limiting factors.
- **Short-Term Economic Pressure -** Farmers prioritize short-term yields and immediate returns/profit, whereas Regenerative Agriculture benefits takes time (soil regeneration, biodiversity improvement).

Valedictory Session (*L to R*): Mr. S.G. Salunke; Dr. George John, Former VC, Agriculture University, Ranchi and CEO, Deepalaya; and Dr. K.P. Sunny, Former Deputy Director General, National Productivity Council

- **Limited Access to good quality bio-inputs**
- **Natural Resources Constraints-** In rain fed areas, limited water availability makes cover cropping and biomass generation challenging. Small and fragmented land holdings make crop rotation, agroforestry and maintaining buffer on water courses are harder to implement
- **Livestock Integration -** Mechanization and increased cost of livestock has made it unfeasible to rear livestock for marginal farmers, thereby creating shortage of Farm Yard Manure (FYM) on field which is the most important aspect for soil health improvement in Regenerative Agriculture.
- **Lack of Policy and Financial Support/Incentives -** Government subsidies still favour chemical-based inputs such as fertilizers, pesticides over biological alternatives. There are no structured incentives for carbon farming, soil regeneration, or ecosystem restoration.
- **Climate Variability and External Risks** - Unpredictable weather patterns such as droughts, unseasonal rains affect regenerative agriculture implementation in terms of

severe pests and disease outbreaks which needs immediate control, and organic alternatives are not always accessible. Also, majority of registered pesticides used for pest control in India fall under category of Highly Hazardous Pesticides (HHP) according to regenagri principles, making it challenging.

- **Transition Challenges -** Fear of yield reduction during transition and social pressure from neighbouring farmers who continue using conventional practices. Initial transition costs (cover crops, composting, organic inputs) without immediate financial returns
- **Limited Research and Data -** Despite increasing interest in regenerative agriculture, there is still a need for more research and long-term data to fully understand its benefits, limitations, and scalability in the Indian context.
- **Local Context is key -** Thorough understanding of local conditions and community is required.
- **Entrepreneurial Opportunities for Input Delivery -** All inputs for regenerative agriculture may not be available in geography of programs. There are entrepreneurial opportunities for creating local supply chains of inputs to be inclusive of local communities.

The seminar articulated a compelling vision for Regenerative Agriculture as a scientifically grounded and socially inclusive pathway to revitalize Indian farming systems. By integrating soil restoration, biodiversity, reduced chemical dependence, and climate mitigation, regenerative practices can enhance productivity, resilience, and livelihoods—particularly for resource-limited smallholder farmers.

To unlock this potential, an ecosystem approach involving farmers, researchers, governments, and value chain actors is essential. The seminar served as a pivotal step towards the vision of aligning science, practice, and policy for a regenerative future.

♦ ♦ ♦

AFPRO

Action For Food Production

57 years of Excellence

Action For Food Production
25/1-A, Institutional Area, Pankha Road,
D-Block, Janakpuri, New Delhi - 110058
Telephone: +91-11-28525412, 28525452, 41062850
Email: ed@afpro.org
Website: www.afpro.org