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Regenerative Agriculture: Footprints for Sustainability

Akshay Kumar Yogi[1*], Shila Neel[1], Narendra Kumar Bhinda[2] and Monu Choudhary[2]

[1]ICAR-IARI, New Delhi, Delhi (110 012), India
[2]MPUAT, Udaipur, Rajasthan (313 001), India

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Corresponding Author
Akshay Kumar Yogi
e-mail: akyogi37@gmail.com

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Abstract

Agriculture is in crisis. Soil health is collapsing. Biodiversity faces the sixth mass extinction. Crop yields are plateauing. The concept of a regenerative agriculture can be traced back to the cusp of the 1980's sustainability evolution. In response to the apparent dichotomy between sustaining our growing human population through agricultural production, regeneration of resources for sustainable quest in changing scenario of global warming issues related with conventional practices. Regenerative agriculture could be proved as guide ground concept for overall improvement of soil water and environment millennium.

Introduction

Agriculture has a significant environmental footprint. It is associated with approximately one third of global land use, and is a key driver of land use change globally including across the biodiverse tropics (Searchinger *et al.*, 2019). Food production is also associated with ~ 15% of global greenhouse gas emissions. At the same time, global food needs are anticipated to grow, as a consequence of increases both in population and in per capita demand. In response to these various pressures, many actors are seeking more sustainable ways of producing food. Regenerative Agriculture is a holistic land management practice that leverages the power of photosynthesis in plants to close the carbon cycle, and build soil health, crop resilience and nutrient density. Regenerative agriculture improves soil health, primarily through the practices that increase soil organic matter. Regenerative Agriculture reverses this paradigm to build for the future.

Regenerative Agriculture: Definition

"Regenerative Agriculture" describes farming and grazing practices that, among other benefits, reverse climate change by rebuilding soil organic matter and restoring degraded soil biodiversity - resulting in both carbon drawdown and improving the water cycle.

Regenerative agriculture has been proposed as an alternative means of producing food that may have lower - or even net positive - environmental and/or social impacts (Rhodes, 2017). Regenerative agriculture has at its core the intention to improve the health of soil or to restore highly degraded soil, which symbiotically enhances the quality of water, vegetation and land-productivity and part of a climate change mitigation strategy. This enhances and sustains the health of the soil by restoring its carbon content, which in turn improves productivity - just the opposite of conventional agriculture, and estimates that regenerative annual cropping could reduce or sequester 14.5-22 gigatons of CO_2 by 2050.

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E-mail: *bioticapublications@gmail.com*

At the same time, some commentators remain more cautious about the potential for regenerative agriculture to contribute to sustainability objectives (Ranganathan *et al.*, 2020).

Other Terms Used to Refer to Regenerative Agriculture

Some other terms were commonly used synonymously with, or adjacently to, the term "regenerative agriculture." These terms included "agroecological farming" "alternative agriculture," "biodynamic agriculture," "carbon farming," "nature inclusive farming," "conservation agriculture," "green agriculture," "organic regenerative agriculture," and "sustainable agriculture."

Regenerative Agriculture: Differences with Organic Farming and Permaculture

Regenerative Agriculture, permaculture, organic farming, conservation agriculture… all these are "analogues" of sustainable agriculture that share a large number of common practices, and regenerative agriculture is no exception. Regenerative agriculture is different from permaculture as it consists of a much more comprehensive process of integrating all human activities (including agriculture) into the environment; by doing so through sustainable development and alongside the rules of natural ecosystems. Concerning agro-ecology and more particularly organic farming, regenerative agriculture can be considered a sub-division. Unlike organic farming, regenerative agriculture does not necessarily prohibit the use of chemical pesticides.

Regenerative Agriculture Principles

- Minimize soil disturbance
- Keep the soil covered
- Integrated livestock
- Living roots year-round
- Maximize crop diversity

Nurture Relationships Within and Across Ecosystems

Regeneration of natural resources by linking the part of ecosystem as a single unit like relationships between land people and wildlife, waterbodies, conserve land sites biodiversity spots *etc*. laid the foundation of conservation, restoration and revival of degraded resources back to normal state with aim of following.

- Prioritize soil health.
- Reduce reliance on synthetic inputs.
- Reshaping of conventional agricultural policies and economies at farm level.

Why Regenerative Agriculture?

The creativity and wise resource management farmers get yield benefits and production. Growing of food, fiber, down the carbon, water conservation and reduce pollution, prolify soil biota and improving land use cycle over long-term sustainability goals make its vital to practice regenerative agriculture (Figure 1).

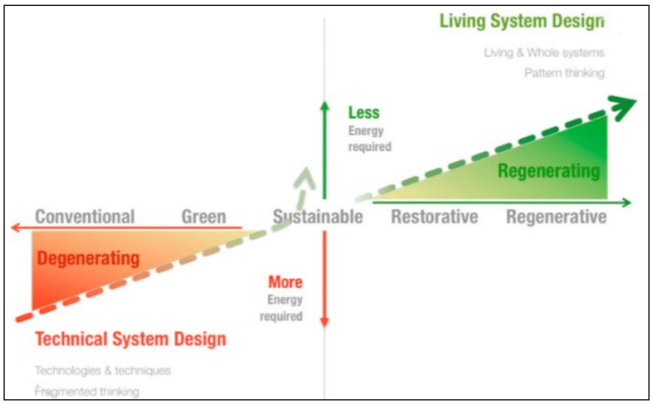

Figure 1: Regenerative Agriculture and agriculture sustainability

Environmental Benefits

- Improvements in soil productivity and fertility - the foundation of healthy water, nutrients, and carbon cycling - as evidenced by healthier crops, increased yields, improved soil test results, and vibrant microbial communities.
- Sphere the biodiversity on land, in the air, and in the water (following improved biodiversity in the soil), including richer plant, bird, and insect populations.
- Reduced soil erosion.
- Reductions in water pollution due to fewer chemical inputs.
- Improvements to water-holding capacity in the soil.

Economic and Community Benefits

- Diversified food chain and supply.
- Costs saving and healthy economies at farm level.
- Diversified revenue and financial inclusion.

Regenerative Agricultural Practices

Practices that, (i) contribute to generating/ building soils and soil fertility and health; (ii) increase water percolation, water retention, and clean and safe water runoff; (iii) increase biodiversity and ecosystem health and resiliency; and (iv) invert the carbon emissions of our current agriculture to one of remarkably significant carbon sequestration thereby cleansing the atmosphere of legacy levels of CO_2.

- Cover cropping.

• Holistically managed grazing, also known as intensive rotational grazing.

• Composting.

• Reduced or no fossil fuel-based inputs, including chemicals.

• Alternate land use system and agroforestry.

• Conservation buffers like hedgerows and riparian buffers.

• Animal or livestock integration.

• Manage grazes and wastelands.

• No-till/ minimum tillage.

• Soil restoration and fertility.

• Building biological ecosystem diversity begins with inoculation of soils with composts or compost extracts to restore soil microbial community population, structure and functionality restoring soil system energy (compounds as exudates) through full-time planting of multiple crop intercrop plantings, multispecies cover crops, and borders planted for bee habitat and other beneficial insects. This can include the highly successful push-pull systems. It is critical to change synthetic nutrient dependent monocultures, low-biodiversity and soil degrading practices.

• Well-managed grazing practices stimulate improved plant growth, increased soil carbon deposits, and overall pasture and grazing land productivity while greatly increasing soil fertility, insect and plant biodiversity, and soil carbon sequestration. Feed lots and confined animal feeding systems contribute dramatically to (i) unhealthy monoculture production systems, (ii) low nutrient density forage (iii) increased water pollution, (iv) antibiotic usage and resistance, and (v) CO_2 and methane emissions, all of which together yield broken and ecosystem-degrading food-production systems.

Climate Change and Regenerative Agriculture

• The potential of practices like carbon sequestration, diversified system and a healthy ecosystem are approach to reduce climate change and its consequences through resilient system and proper adoption strategy to it. Soil is one of the earth's greatest carbon sinks. It reduces the greenhouse gases emissions hence contribute in building green economy. Agriculture plays a significant role in contributing to climate change. Our food systems are also suffering enormous consequences from rising temperatures and increases in extreme weather events like droughts and floods.

• Resilience to climate extremities and insecurities.

• Reduce greenhouse gas emissions in agriculture.

• Increase food production and preserve agricultural land.

• Protect and restore natural ecosystems.

Hence inclusion of healthier practices at farm and conservation and restoration of carbon, water saving, reduce GHGs emissions make farmers as well ecosystem more resilient to climate change.

Regenerative Agriculture and India

NITI Aayog along with Ministry of Agriculture & Farmers welfare had convened several high level discussions with global experts on Natural farming practices. It is roughly estimated that around 2.5 million farmers in India are already practicing regenerative agriculture. In the next 5 years, it is expected to reach 20 lakh hectares - in any form of organic farming, including natural farming, of which 12 lakh hectares are under Bharatiya Prakritik Krishi Paddhati Programme (BPKP).

Conclusion

Transitioning to more sustainable forms of agriculture remain critical, as many current agriculture practices have serious consequences including deforestation and soil degradation. But despite agriculture's enormous potential to hurt the environment, it also has enormous potential to heal it. Drawing from decades of research, regenerative agriculture uses farming principles designed to mimic nature. To build healthy soils and fertile, thriving agro-ecosystems, this approach incorporates a range of practices like agroforestry and well-managed grazing. Benefits of these practices include richer soil, healthier water systems, increased biodiversity, climate change resilience, and stronger farming communities.

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