

Sustainable Agriculture: A Path Towards Better Future

ARTICLE ID: 0053

Rakhi¹, Mohd Shah Alam², Jay Nath Patel³

Department of Agronomy, School of Agriculture, Abhilashi University Mandi – 175028 (Himanchal Pradesh)

Light of the shifting agricultural environment, production farming must give way to profit-driven sustainable farming. Through careful examination of input and output, the balance between financial gain and environmental concern can be accomplished in the context of research for sustainable agriculture. It is a significant problem, but research needs to concentrate on methods that can achieve balance in a more realistic manner. Here, we've compiled a list of many methods for enhancing the farming system's long-term production, profitability, and sustainability.

Introduction

'Sustainable' is a term that is frequently used in today's society to describe a variety of concepts. Sustainability in agriculture aids in finding the ideal balance between the requirement to produce food and the maintenance of environmental ecosystems. According to estimates, the expected 9.6 billion people on the planet will require almost 70% more food than is now produced by the year 2050 in order to consume the necessary

number of calories per day (FAO, 2017). Healthy food production is made possible by sustainable agriculture, which preserves future generations' ability to try to do the same. When it comes to resource consumption,



agricultural practices are frequently found to be somewhat inefficient, which is closely related to production costs.

The practice of farming according to ecological principles, which is the study of interactions between living things

and their surroundings, is known as sustainable agriculture. It has been described as an integrated system of practises for both plant and animal production that are site-specific and long-lasting.

Need for Sustainable Agriculture

- ❖ The world's population is expected to rise to 9.2 billion by 2050. Global food production will need to double by 2050.
- ❖ Food demand driven by population growth and land scarcity. Resources are limited.

- ❖ Up to 70% of the population in developing countries live in rural settings and rely on farming for their livelihoods.
- ❖ Challenges is to achieve global food security while having a positive impact on the environment and society.

Techniques for Adaptation of Sustainable Farming

Sustainability in agriculture is a broad concept with many facets, including social (having a fair deal with employees and a mutually beneficial relationship with the surrounding community), economic (should be a successful business contributing to a robust economy), and environmental (having potential to attenuate air, water, and climate pollution, build and maintain healthy soil, manage water wisely, and promote biodiversity). Working with nature rather than against it will be useful in order to meet these requirements.

The following considerations must be made in order to proceed in this direction: It is important to prevent irreversible changes to the land, such as erosion. It is important to make sure that natural resources (such as water, energy, soil, plants, animals, biodiversity, ecosystems, etc.) are used responsibly and sparingly. As long-term stability and productivity are necessary for sustainable agriculture, more renewable and diverse resources (such as wind energy, solar energy, etc.) should be utilised as opposed to total self-sufficiency. In the face of global farm consolidation and infrastructural development, sufficient revenue should be generated to remain on a farm. The "3 R concept" of reducing, reusing, and recycling should be given top priority. Due to this, farming will become both environmentally and financially viable.

Different Sustainable Farming Methods and Practices

1. Permaculture

David Holmgren and Bill Mollison are the authors of the term "permaculture," which originally meant "permanent agriculture" (Holmgren, D., 2002). It is a system that uses natural-world principles to guide the growth of human settlements, enabling people to coexist peacefully with the environment. The major goal of this system is to eliminate waste and boost system efficiency by "working smarter, not harder." In this case, emphasis is placed on the usage of perennial plants, such as fruit trees, nut trees, and bushes, which work together in a system that is supposed to imitate how plants in a natural ecosystem would work.

2. Biodynamic Farming

The farm is considered as a living system, and a lot of attention is placed on the overall development of the farm, according to this farming system concept. It is also taken into account how the soil, plants, animals, and microbes interact with one another on a farm. A biodynamic system combines "dynamic" practises with "biological" practises to develop the farm, its inhabitants, and its products with energy (Sharma, 2012). Dynamic practises involve the influence of cosmic forces to develop the farm, its inhabitants, and its products. Cow dung, silica, and extracts of various plant components, such as yarrow flowers, chamomile flowers, oak bark, stinging nettle shoots, etc., are the major ingredients in several biodynamic preparations, according to Reeve et al. (2011). These preparations can either be applied through field spraying.

3. Urban Agriculture

It includes a wide range of activities, including the raising of animals such as chickens and fish, growing different sorts of crops including grains, vegetables, mushrooms, and fruits, and cultivating non-food items like fragrant and therapeutic herbs or ornamental plants. It reveals an alternative way of thinking about how turning cities into agricultural producers rather than just consumers of food might help with sustainability, better health, and the eradication of poverty. It not only makes use of unused urban space for agricultural production but also contributes to the conversion of organic solid waste and wastewater into resources for farming (the former can be utilised as fertilizer and the latter as irrigation).

4. Hydroponics and Aqua- Ponics

With the help of specialised nutrients that are given to water, plants are grown using these cutting-edge agricultural methods without the use of soil. Crops are produced using a hydroponics system in which the roots are either directly exposed to a mineral solution or buried in an inert media, such as gravel or perlite. In this technique, it is typical to cultivate peppers, lettuce, tomatoes, and cucumbers. Aquaponics is the practise of raising aquatic animals (such as fish) with the cultivation of hydroponic plants using water that contains the waste products from the aquaculture fish. Both of these systems are widely accessible, ranging from modest home systems to large commercial systems.

5. Agroforestry and Food Forests

Agro-forestry is an integrated strategy that makes use of the beneficial interactions that result from integrating crops with trees and shrubs. In order to

develop more diverse, productive, profitable, healthy, and sustainable land-use systems, it blends forestry and agricultural technologies. In addition to providing farmers with an additional source of income, trees improve soil structure, stabilise soils, reduce nutrient runoff, and provide a favourable microclimate that protects crops from wind and heavy rain while maintaining a favourable temperature and soil humidity. Permaculture systems called "food forests" are constructed of a multilayered edible "forest." Such a "forest" is almost entirely made up of perennial food plants, including climbing plants, a canopy of tall and dwarf fruit and nut trees, a layer of fruit shrubs, layers of perennial herbs, and vegetables and mushrooms at ground level.

6. Poly Culture and Crop Rotation

Polyculture and crop rotation over monoculture is a very scientific and innovative approach to tackling pest and weed problems (as some pests prefer specific host), maintaining and enhancing the soil quality, coping with weather fluctuations, ensuring additional income for the farmers, and a healthy diet for the community. Here, emphasis is placed on the idea that crops grown in close proximity should complement one another.

7. Growing Heirlooms and Older Varieties

Only a few kinds are grown commercially to satisfy market demand for food that can be transported over great distances and kept for extended periods of time. Because of this decreased genetic diversity, food crops are less able to adjust to alterations in the prevalence of disease, pests, and climate. Growing heirloom and older kinds and preserving their seeds is crucial for preserving the gene pool of indigenous varieties,

preserving the richness of seeds, and creating future climate-resistant types.

8. Natural Animal Raising

Industrial agriculture keeps cattle off the land so that they can graze, protecting the crop from animal eating and keeping crops away from manure. However, there is a positive association between grazing animals and grassland. In addition to providing a wide range of nutrients to the animals through regulated grazing, heavy foot traffic prevents soil erosion by compacting the soil, and the manure that is left behind enriches the soil.

9. Mulching, Groundcovers and Manual Weed Control

Mulching and groundcovers are both effective ways to give the soil a layer of protection, control the growth of weeds, retain soil moisture, enhance soil health and fertility, and shield the soil from direct sunshine. Both organic and inorganic materials can be used as mulch; the former includes items like straws, husks, sawdust, grasses and cover crops, manures, composts, etc.; the latter mostly refers to polyethylene mulch, of which black plastic mulch is the most well-known.

10. Natural Pest Management

Instead, then utilizing pesticides, this approach of controlling pest insects uses birds, animals, plants, and mechanical methods. It is possible to manage the farm so that it supports agricultural pests' natural predators. It is possible to control the proliferation of dangerous pests by using the prey-predator interaction.

Advantages of Sustainable Agriculture

Sustainability in agriculture is the way to ensure and maintain agriculture productivity without the depletion

of natural resources. It is economically, ecologically and socially adaptable and has many fold advantages in human life. Some of its advantages can be summarised as:

1. Biodiversity Conservation

Healthy soil is one of the prerequisites for agricultural productivity and sustained biodiversity. However, due to the use of excess chemical fertilizers and pesticides soil health is degraded reducing its productivity. We know that soil is the foundation for production as without it we are unable to produce. There are many ways to improve soil health to sustain biodiversity. Feeding soil with animal manure, green manure, crop residue etc may improve soil health and maintain biodiversity. Sustainable agriculture mainly focuses on the use of such types of matter and the reduction of the use of chemicals.

2. Environmental Benefits

Sustainable agriculture encompasses the use of renewable energy resources thus reducing environmental hazards. Sustainable agriculture also focuses on crop rotation, thus mitigating the problem of pest outbreaks and hence fewer pesticides are used. In this way, it helps in pollution control. It also focuses on the less waste of food for sustainability. Thus provide a basis for food supplements for an increased population.

3. Reduction in Cost of Production

Sustainable agriculture reduces production costs in several ways. Sustainable agriculture focuses on minimum tillage or zero tillage by which the cost is reduced. Besides the less use of chemicals and incorporation of green manure, crop residue and organic substances improve the soil health. This

reduces the infestation of pests and hence farmers do not have to spend on pesticides.

4. More Production

Crop production is improved if one follows the measures of sustainable agriculture. Better soil -health due to the use of green manure, crop residue and less use of chemicals improves the production.

5. Better for Health

Sustainable agriculture focuses on the use of fewer chemicals like pesticides, fertilizers and more to organic farming. So, people may consume fresh products that are good for their health.

References

1. FAO, (2017). The future of food and agriculture—Trends and challenges. Annual Report.
2. Holmgren, D. (2002). Principles & pathways beyond sustainability. Holmgren Design Services, Hepburn.
3. Reeve, J. R., Carpenter-Boggs, L., & Sehmsdorf, H. (2011). Sustainable agriculture: A case study of a small Lopez Island farm. *Agricultural Systems*, 104(7), 572-579.
4. Sharma, S. K., Laddha, K. C., Sharma, R. K., Gupta, P. K., Chatt, L. K., & Pareek, P. (2012). Application of biodynamic preparations and organic manures for organic production of cumin (*Cuminumcyminum* L.). *International Journal of Seed Spices*, 2(01), 7-11.

Conclusion

In conclusion, sustainable agricultural systems use cutting-edge, scientifically based techniques to increase productivity while minimizing environmental damage. More creative business strategies can be used to profit from the techniques being used to promote agricultural sustainability. All farms can benefit from the many sustainable farming techniques outlined above, which yield a variety of fuels, foods, and fibres. These techniques can guarantee productivity, profitability, and long-term sustainability of the farming system with scientific application and good management.