



## Holistic Approaches for Sustainable Agriculture

**Dr Geetinder Gill**

*Assistant Professor, PG Department of Economics,  
Khalsa College, Amritsar*

### **Abstract**

*Rampant use of fertilizers and pesticides in agro ecosystems has resulted in buoyant crop yields but has adversely affected all the spheres of the environment. The short sighted and inefficient agro-management techniques adopted during the green revolution have deteriorated agricultural soils, depleted ground water, and poisoned the food that we eat today. This paper focuses on the urgency of thinking about 'Holistic Approaches' for the achievement of sustainable agriculture. The first approach relates to soil management to accomplish the goals of sustainable food production. The second approach is management of water in agricultural activities to prevent exhaustion of ground water, while the third approach relates to adoption of ecological agriculture to enhance the crop production without causing environmental pollution. Sustainable agriculture needs coordinated efforts of all the stakeholders involved in agricultural activities and can be accomplished through resource use efficiency, diversification of crops, use of agricultural residues, processing of food, minimizing grain rotting which occurs due to lack of warehouse facilities, reducing soil erosion, adopting new technologies, and incorporating improved varieties of crops. This would bring global agricultural sustainability with time in real sense.*

**Keywords:** *Soil erosion, Diversification of crops, Sustainable agriculture, Environmental pollution, Ground water depletion.*



## Introduction

The main purpose of sustainable agriculture is to fulfil increasing food needs for the present generation without compromising the requirements of future generations. The sustainable agriculture is directly dependent upon healthy environment, economic and social security. Every individual contributing towards the food production, whether he is a good grower, food processor, distributor, consumer, or agro waste manager can play an important role in ensuring a sustainable agriculture system. There are many agricultural practices that are commonly used by people working in sustainable agriculture. The growers may use the methods which promote the soil health, judicious use of water, fertilizers and pesticides which can reduce the environmental pollution. The consumers need to promote the value based foods that are grown in environmental friendly way. Sustainable agriculture can solve complex problems related to food production [1]. The use of fertilizers and pesticides have pros as well as cons. Both increase the crop yields but can cause water and soil pollution and enter into animal and human food chain and adversely affect their health. There are many pesticides which are linked to cancer which have entered the food chain as they are used in agriculture [2]. Diversification of crops is also the need of the hour to promote sustainable agriculture. Agriculture not only provides material to food industry but also provides raw material to other industries like textile and leather industry. The crop diversification requires suitable crop variety and suitable regional facilities which can help in getting good yield. New techniques of irrigation, use of bio fertilizers/pesticides and modern technology involved in harvesting of crops has greatly improved the socio-economic conditions of farmers.

## Approaches for Soil Management

The good quality of soil is very essential for agriculture as it provides all the essential mineral nutrients to plants. Management of soil is required to ensure the availability of mineral elements to plants. It is directly or indirectly related to crop productivity and human health. As the population is increasing day by day throughout the world, it becomes necessary to focus on soil management to achieve food security. But the soil management in a sustainable manner is a challenge which requires adequate nutrient management and appropriate soil conservation practices. Moreover, efforts are required to limit soil degradation via erosion or



contamination with toxic pollutants so that man can derive such food which is safe and nutritious. Deforestation and shifting cultivation has deteriorated the soil quality which has caused reduction in soil fertility that can prevent the sustainable agricultural production. However, adoption of appropriate agro forestry techniques not only reduce the soil losses but also increase the soil organic matter, improve its physical properties, and conserve the water resources. In addition to this, there are techniques like minimum tillage, mulch, and intercropping that can be used to elevate the soil organic matter for sustainable soil health. Thus, soil, water, and nutrient resources management not only improves the agricultural yield but also reduces adverse environmental impacts caused by land degradation, especially linked to the loss of topsoil which occurs through mineral imbalance or erosion which is directly linked to decrease in agricultural productivity [3].

#### **Approaches for Water Management**

Water, an essential resource for sustainable agriculture development is also the most fundamental constituent of environment. The quantitative and qualitative aspects of natural system are being significantly impacted by rapid population growth, extension of irrigation agriculture, industrial development and climate change. The sustainable use of irrigation water should be a priority for agriculture, especially in arid areas. Therefore, under water scarcity conditions as well as climate change it is essential to introduce water saving policies which can increase the water efficiency with less water use through better water management. Water management refers to improvement of water allocation for irrigation by selecting most appropriate irrigation technology keeping in mind the surrounding environmental conditions and right scheduling of water application to the fields. There are many agricultural practices, such as soil management, improvement in irrigation, bio fertilizer/pesticide application which are directly related to the sustainable water management in agriculture and other resources of the environment. The adoption of sustainable water management is not only linked to technological problems but also involves many other socio-economic factors.

Sustainable water management can be achieved by adequate use of water resources for irrigation, use of wastewater for irrigation as well as active participation of farmers in water management and sustainable agriculture. Efforts are required to find the most suitable economic crops that use



minimal water. The use of appropriate irrigation methods that minimize loss of water by evaporation from the soil are required. The farmers should also be encouraged to adopt advanced and less water demanding practices over traditional high-water demand cropping and irrigation practices [4]. In water management, attention should be given to irrigation scheduling which means when to irrigate and how much water to apply in a particular season. The irrigation frequency also depends on irrigation method. Therefore, both irrigation scheduling and the irrigation method are inter-related and inter-dependent.

### **Approaches for Crop Diversification**

There are many evidences that suggest that climate change is emerging as one of the major threats to agriculture which is significantly affected by the climate change and variability in seasons. Both increase the frequency of droughts especially in arid regions. The change in patterns of precipitation and its intensity, decline the crop yields and increase the agricultural risks, decrease the soil fertility and ultimately affect the income of farmers. For this emerging challenge, scientists need to focus on improving the productivity of crops by strengthening the advance farming systems. This will not only improve the livelihoods but will also reduce harm to the environment [5]. Therefore, there is an urgent need for the diversification of crops which is a well-known practice of growing more than one variety of crops belonging to the same or different species in a given area by rotating and/or inter cropping manner. Additionally, crop diversification is one of the most ecologically friendly method to reduce the uncertainties in agriculture, especially among smallholder farmers [6]. In a study, the effect of crop diversification was studied to envisage the effects on productivity, food security, nutrition, and income in Zimbabwe's smallholder farming community. In this study, a strong and positive correlation was observed between crop diversification and aforementioned indices [7].

### **Approaches for Management of Crop Residues**

In commercial farming, the focus of the farmers is generally on the immediate monetization of the crop yields. In their endeavour to produce two or three crops in a year, they fail to make use of the crop residue. Of the total mass produced, the monetized part is only a small proportion. The crop residue, which is actually the larger proportion, contains a large amount of assimilated



carbon and other nutrients such as potassium, phosphorous and nitrogen. These elements are plant nutrients and must be recycled for sustainable agriculture. Management of crop residues can decrease the global warming by increasing the carbon sequestration in agriculture as well as ensuring food security by increasing the grain yields. Crop residues can be used in a number of ways such as fuel in the form of methane gas or direct combustion, building materials, cardboard and paper manufacturing, animal feed, mushroom cultivation, animal feed and bedding for livestock etc [8].

### **Approaches for Ecological Agriculture**

Modern agriculture has great impact on environment. Therefore, efforts should be made for eco-friendly agriculture. Few decades back, in order to bring green revolution in India, soils were heavily loaded with fertilizers and pesticides to enhance the yield of food crops. Consequently, it polluted all the spheres of the environment. Ecological agriculture leads to minimal intrusion, fosters cumulation of soil organic matter, facilitates bio-diversity and enables utilization of better varieties. It improves the crop yields by building resilience of agro eco-systems with regards to environmental uncertainties, accumulation of soil organic matter and nutrients especially nitrogen and phosphorous, and diminishing pest issues. Therefore, agriculture should be done in such a way that it should not harm the environment.

### **Conclusion**

To achieve the objective of sustainable agriculture, a comprehensive strategy has to be adopted. It is only possible if all the stakeholders are involved in the process. The primary stakeholders are the farmers, especially the small and marginal farmers. At the outset, they have to be educated about the essentiality and benefits of adopting sustainable agricultural practices. Good results can be achieved only if they are willing partners. Agriculture is a source of livelihood for the farming community. Therefore, the techniques adopted have to be economically viable. If at all there is a financial outgo involved, it has to be compensated by the state or the community as the small and marginal farmers do not have the financial resilience for the same. The strategies adopted have to be socially acceptable and ethically justifiable. Moreover, their impact on the environment in terms of the short term results and the long term results have to be assessed. It



had to be ensured that the strategies do not boomerang in the long run. The systems should be robust so that they constantly improve and evolve as per the emerging requirements. It should be borne in mind that co-ordinated efforts of all stakeholders are required to achieve the desired results. Only this would bring global agricultural sustainability in the real sense.

### References

1. <https://asi.ucdavis.edu/programs/ucsarep/about/what-is-sustainable-agriculture>
2. <https://www.livestrong.com/article/139831-the-effects-fertilizers-pesticides>
3. White, P.J., Crawford, J.W., Alvarez, M.C.D., Moreno, R.G. (2012). Soil Management for Sustainable Agriculture. *Applied and Environmental Soil Science*, 2012:850739.
4. Chartzoulakisa, K., Bertaki, M. (2015). Sustainable water management in agriculture under climate change. *Agriculture and Agricultural Science Procedia*, 4: 88-98.
5. Nyasimi M, Amwata D, Hove L, Kinyangi J, Wamukoya G (2014) Evidence of impact: climate-smart agriculture in Africa. In: CCAFS working paper no. 86.
6. Joshi, P. K., Gulati, A., & Cummings, R. W. (Eds.). (2007). *Agricultural diversification and smallholders in South Asia*. Academic Foundation.
7. Makate, C., Wang, R., Makate, M., Mango, N. (2016). Crop diversification and livelihoods of smallholder farmers in Zimbabwe: adaptive management for environmental change. *SpringerPlus*, 5(1), 1135.
8. Zhang, Q., Yang, Z., Wu, W. (2008). Role of crop residue management in sustainable agricultural development in the North China Plain. *Journal of Sustainable Agriculture*, 32(1), 137-148.