

## **Sustainable Agriculture and Land Management**

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### **Abstract**

The research paper discusses the potential for sustainable agriculture to contribute towards sustainable development with a particular focus on land management. Sustainability of agricultural food production systems is important to our everyday life and will become even more critical to the future of our world. As population increases, more demands will be placed on our farmers to produce even more food.

Most of the developing countries including India face a dilemma problem of high population growth creating poverty, food crisis and land degradation at the same time the resources like land, water, nutrients and energy are limited in supply. India is primarily based upon agriculture and hence a sustainable long-term agricultural growth can only alleviate poverty. Most of the population is engaged in agriculture. Again land which is fixed in supply by nature is the primary input for agricultural production. The poor farmers need to maximize their income earned from this sector in the short-run.

The paper reflects on the many ways science has helped farmers deal with the demands for increased food production in an environmentally conscious world. It also enlightens on the production practices called "best management practices" used by farmers to practice their trade profitably while protecting the environment from nutrient pollution.

Land degradation is a global issue of the 21st century and by the year 2050 it may create a serious threat to food production, adverse impact on agronomic productivity, the environmental pollution, food security and quality of life. Hence a proper planning and management of the available land resource is necessary to ensure maintenance of their production potential, quality and diversity. Hence the limited scarce land resource must be used in a socially acceptable eco-friendly manner.

**Keywords:** Population growth, Soil Management, Sustainability, Agricultural Practices

## **1. Introduction**

Sustainable agriculture has emerged as an alternative agricultural system that addresses many of the constraints faced by resource-poor farmers and at the same time ensures environmental sustainability.

It refers to the capacity of agriculture over time to contribute to overall welfare by providing sufficient food and other goods and services in ways that are economically efficient and profitable, socially responsible, and environmentally sound. The world population is predicted to increase to 9 billion. There are also estimates that agriculture will have to increase food production to meet the demand by this increase in population, by as much as 70%.

Agriculture has advanced tremendously over the last 100 years. In fact it's been keeping up with food production at a very high rate. During the ancient civilizations, farmers learned how to get water out of a river and raise it up and put it in a canal to help irrigate their crops in between flood seasons. Now we can pump large amounts of water from the aquifer, over from surface water to irrigate crops very efficiently, in very large areas with center pivots, and we've taken it a step further, particularly with our intensive fruits and vegetable crops by using drip irrigation. And also fertilizers, pest management, new varieties of crop plants have all played an important role. They all lead to an increase in crop productivity, which is very important. It helps farmers produce more on the same land by more intensifying, the production practices. But again, some argue that some of these technological advances have also, led to more risk for environmental problems.

Some other issues that I agriculture will be facing as we try to increase food production are availability of good land for agriculture. Due to the lack of availability of land for agricultural use, we have to have increase the productivity on the land that we have and use it more wisely and, and more sustainably.

Sustainability is related to the quality of life in a community whether or not the economic, the social, and the environmental systems that make up that community are providing a healthy, productive and meaningful life for all of the community members, present and future.

## **2. Principles of Sustainable Agriculture**

### **2.1 Economic sustainability**

In order to be truly sustainable, a farm must be economically profitable. Sustainable agriculture can improve the economic viability of a farm in a number of ways. In the short term, improving soil management and crop rotation can increase yields while, in both the medium and long term, improved soil quality and water availability, as well as other environmental benefits from sustainable practices, may raise the value of the farm and provide for payments for environmental services. Economic viability can also be achieved through, for example, reducing machinery, chemical fertilizer and pesticide costs (for farmers who can afford these inputs), depending on the specific characteristics of the production system.

## **2.2. Environmental sustainability**

Sustainable agriculture is frequently described as ecologically sound practices that have little to zero adverse effect on natural ecosystems, or even enhance environmental quality and the natural resource base upon which the agricultural economy depends. Typically this is achieved through protecting, recycling, replacing and/or maintaining the natural resource base such as land (soil), water, biodiversity and wildlife that contribute towards conservation of natural capital. Synthetic fertilizers can be used to supplement natural inputs, as needed. Under sustainable agriculture, synthetic chemicals known to harm soil organisms, soil structure and biodiversity are avoided or reduced to minimum use.

## **2.3. Social sustainability**

Social sustainability relates to the quality of life of those who work and live on the farm, as well as those in the surrounding communities. It includes ensuring equitable revenue or returns to different stakeholders of the agricultural production chain. In the context of high unemployment, sustainable agriculture can promote sharing of agricultural value added by more members of the community through more extensive use of available labor, at least for some techniques, thus contributing to social justice and cohesion. Fair treatment of workers and choosing to purchase supplies locally rather than from more distant markets are also elements of social sustainability.

Although the above mentioned elements are often discussed separately, they are not mutually exclusive: sustainable agriculture meets environmental, economic, and social objectives simultaneously. In many cases, sustainable agriculture practices are not new, but draw on traditional knowledge and practices, many of which have now been positively evaluated by scientific methods.

## **3. Sustainable Agricultural Practices**

There are many soil conservation best management practices that have been developed over the years. Methods for conserving are mostly directed at conserving the soil. Some of these fall under a general classification called conservation tillage. Strip-till, Ridge till, and No till are a few three of them that are discussed below.

- **Strip Tillage:** In this method we have specialized equipment that tills a small strip of the soil, not the whole breadth of the soil. The residue from the previous crop is kept on the surface of the soil. But in some situations, we need to till and loosen the soil to attain better seed soil contact for improved germination.
- **Ridge tillage:** It is a variation of strip tillage where we actually are building slight, small ridges or hills across the field that we are going to plant into. Again; this method relies on leaving the residue from the previous crop on the surface.
- **No-till:** As the word indicates we do not till the soil in preparation for planting. Here the crops are planted directly in the residue from the old crop. No-till takes special equipment rather heavy equipment to cut through the residue, particularly if it's something like corn. So, that you can cut through that residue and open up a seed furrow for the seeds to be deposited in.

This leaving the refuse on the, on the surface helps conserve moisture and prevents in many, many ways wind blowing of the sand and it adds organic matter to the soil. There are some other conservation best management practices that farmers use, such as:

- **Grassed waterway:** Here grasses are planted in a depression going across the field and in this depression is where the run off mostly is captured from this field. And if we plant grasses in this waterway then we can slow down the water for one thing and prevent or minimize erosion. As we slow down the water, we give it a chance to infiltrate it into the soil. And also, those plants if they're actively growing, they can take up nutrients that might be in that runoff. So grassed waterways is a very important way to conserve soil and many other things like nutrients and water.
- **Filter strip:** Filter strips are typically areas of plants, maybe grasses that are planted along the edge of a field between the fields that we're growing crops and say, a stream or a pond. And the idea is that, as runoff moves from the field towards the stream or water body, it passes through this filter strip and can be filtered. Sediment falls out and is collected in the filter strip, and the plants in the filter strip can take up nutrients and keep the sediment and nutrients from entering the water body.

Filter strips and grassed waterways have several advantages. They slow down the water flow, slow down the speed, and so, erosion is greatly reduced and that gives time for the water to infiltrate into the soil. The plants can hold the soil in place and those plants can take up nutrients.

#### **4. Achieving Sustainability**

The whole idea about sustainability is about understanding some of the basics of our biological world, and our physical world, and how things work together. For example, understanding the nutrient cycles, how things go between the physical and the chemical world to the biological world in our cropping systems. And then determining how to take advantage of the knowledge and the research so that we can better put together best management practices, and have tactics that farmers can adopt that will help them manage the nutrients and the water in their farming systems. Many farmers are already doing this some to a great degree, but there are also a lot of other farmers in this country and around the world who are still in need of assistance in understanding and adopting nutrient and water best management practices.

Technology has been important along the way. If you look back over agriculture development and our increases in our ability to produce food, technology has played a large role and will continue to play an important role. However, with increasing advancement in technology for producing more extensive farming methods, organic farming is overtaking these methods. While organic systems produce only 92% of the yield produced by conventional agriculture in developed countries, they produce 80% more than conventional farms in developing countries. Organic methods could produce enough food on a global per capita basis to sustain the current human population,

without putting more farmland into production. Leguminous cover crops could fix enough nitrogen to replace the amount of synthetic fertilizer currently in use.

These are some sustainable practices which have played substantial roles in yield increases:

- More efficient water use in both dry land and irrigated farming;
- Improvements in organic matter accumulation in soils and carbon sequestration; and
- Pest, weed, and disease control emphasizing on-farm biodiversity and reduced pesticides through integrated pest management or other techniques.

## **5. Conclusion**

Sustainable agriculture has emerged as an alternative agricultural system that addresses many of the constraints faced by resource-poor farmers and at the same time ensures environmental sustainability. It refers to the capacity of agriculture over time to contribute to overall welfare by providing sufficient food and other goods and services in ways that are economically efficient and profitable, socially responsible, and environmentally sound. This system involves a combination of inter-related soil, crop and livestock production practices in conjunction with the discontinuation or the reduced use of external inputs that are potentially harmful to the environment and/or the health of farmers and consumers. Instead, it emphasizes the use of techniques of food production that integrate and are adapted to local natural processes such as nutrient cycling, biological nitrogen fixing, soil regeneration and natural enemies of pests. Using local resources to make initial soil and land improvements can get farmers on a virtuous cycle where rising incomes relieve the constraints to adoption of more resource-intensive sustainable practices.

## **References**

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