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# The Strengths and Limitations of Organic Farming: A Path to Future Food Security

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### Abstract

Agriculture plays a crucial role in meeting the basic needs of food and shelter in India, with over 70% of the population relying on it. However, the shift towards high-yielding varieties and intensive use of chemical fertilizers and pesticides has resulted in deteriorating soil health and declining food grain quality. As India's population is expected to reach 1.35 billion by 2025, an additional 33 million tons of fertilizers will be needed to meet the demand for food grains. Despite this, the effectiveness of chemical fertilizers has been diminishing over time, and the land is becoming increasingly barren due to improper management. Factors such as excessive use of chemicals, unbalanced fertilizer application, and overuse of water have contributed to the depletion of soil fertility and the loss of beneficial microorganisms. To counter these challenges, organic farming practices, such as mixed cropping and the use of natural fertilizers, offer sustainable alternatives. Organic farming not only protects the environment but also improves soil fertility, reduces soil erosion, and produces high-quality crops. However, its limitations include lower productivity, insufficient supply of organic fertilizers, and delayed nutrient availability. Given the limitations of both organic and chemical farming, an integrated approach that combines chemical, organic, and biological fertilizers is necessary. This approach will help achieve sustainable food production without compromising soil health and meet future food grain requirements. Maintaining a balance between these farming techniques is key to ensuring the long-term productivity and sustainability of agriculture in India.

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### Introduction

Food and shelter are basic needs for humans, and farming is essential for meeting these needs. In India, over 70% of the population depends on agriculture. The use of high-yielding varieties and modern technology (chemical fertilizers, pesticides, herbicides, fungicides, etc.) has indeed made us self-sufficient in food grain production. In the past, the primary goal was to increase production. However, during this period, the health and sustainability of the soil were neglected. If the health of the land that yields crops deteriorates, production will eventually lose its value. Today, scientists face many issues, such as deteriorating soil health, stagnation in growth, declining quality of food grains, and environmental pollution. To address these, new research is needed.

By 2025, India will require an additional 33 million tons of nitrogen, phosphorus, and potassium-based fertilizers. This is because, by that time, the country's population (around 1.35 billion) will require about 301 million tons of food grains. Even with expensive fertilizers and chemicals, it is uncertain whether we will be able to produce enough high-quality food. This is because there is little possibility of expanding the area under cultivation, and due to improper management, fertile lands are gradually turning barren.

Despite the increasing use of chemical fertilizers and pesticides, the production capacity of food grains is declining. In 1970-71, 1 kilogram of nitrogen, phosphorus, and potassium fertilizers produced 17.1 kilograms of food grains. By 1988-89, this had reduced to 8.1 kilograms. Now, there are concerns that it could drop below 6.5 kilograms. Several factors could contribute to the declining effectiveness of

chemical fertilizers. According to a famous economic theory, as the use of a particular resource increases, its utility decreases. This principle also applies to chemical fertilizers. The main reasons for the decline in the effectiveness of chemical fertilizers are the lack of organic fertilizers and the unbalanced and excessive use of chemicals and water, which damages the physical, chemical, and biological properties of the soil. As a result, the organic matter in the soil is diminishing, and its productivity is declining. Additionally, the number of beneficial microorganisms in the soil is decreasing. In tropical and subtropical regions like India, these processes happen much faster. Soil fertility is a gift of nature, and it is our responsibility to preserve or improve the quality of the soil and maintain its productivity. Therefore, any actions or processes that harm the environment (such as overuse of chemicals, excessive water usage, or heavy machinery) should be avoided in agricultural management. For example, the use of chemicals (fertilizers, pesticides, herbicides, fungicides), excessive water usage in gardening, and the practice of monoculture should be avoided.

In organic farming, mixed cropping is primarily practiced. Additionally, natural organic fertilizers and organic materials are used to supply nutrients to the crops. Organic pest management techniques and plant-based insecticides are also employed, such as tobacco extracts, lemon extracts, or the use of parasitic insects.

#### • Principles of Organic Farming

1. Utilize waste products from farming as an energy source, ensuring no harm to the natural environment, maintaining harmony between farming and the environment.
2. Use and develop technology that relies on biological methods.
3. Preserve and improve natural resources, such as maintaining soil fertility for the future.
4. Use mixed cropping techniques rather than monoculture to increase overall farm income.
5. Reduce production costs.
6. Enhance the nutritional quality of food grains.
7. Ensure safe habitats for wildlife.

#### • Benefits of Organic Farming

1. No pollution of natural resources like soil, water, and air.
2. Improves soil fertility and productivity, and helps maintain it.
3. Reduces soil erosion.
4. Produces high-quality products.
5. Reduces the loss of useful nutrients in crops, thereby increasing nutrient efficiency.
6. Improves the physical, chemical, and biological properties of the soil.

While studying the principles and benefits of organic farming, it is also important to consider its limitations.

#### • Limitations of Organic Farming

1. **Low Productivity:** Fully adopting organic farming may not meet the required production levels. After improving the health of the soil, production may increase. However, at present, organic farming alone cannot meet the production demands.
2. **Insufficient Supply of Organic Matter and Fertilizers:** To obtain higher yields, it is necessary to provide the required nutrients to the crops. Organic fertilizers often lack essential nutrients in sufficient quantities. This requires the use of more organic

fertilizers. Certain nutrients, such as phosphorus, are very low in organic fertilizers. In such cases, the use of chemical fertilizers becomes necessary. Additionally, organic fertilizers may not meet all the nutrient needs of the crops, and chemical fertilizers may be required.

3. **Delay in Nutrient Availability from Organic Fertilizers:** Organic fertilizers take time to release the nutrients required by crops because they need to be broken down first. It takes around 1.5 to 2 months for nutrients from organic fertilizers to become available to plants. Food crops typically have a life cycle of 3 to 4 months. During the initial stages, crops need more nutrients for root and shoot development. Therefore, for food crops, using chemical fertilizers in the early stages may be necessary.

#### Conclusion

Considering the above points and the future food grain requirements, it will not be feasible to rely solely on organic or chemical farming methods. To meet future food grain targets, an integrated fertilizer management system and integrated pest management system must be adopted. By maintaining a balance between chemical, organic, and biological fertilizers, it is possible to increase productivity without depleting soil fertility, thus achieving the future goals of food grain production.

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