

RISKS AND OPPORTUNITIES OF INCREASING YIELDS IN ORGANIC FARMING: A REVIEW

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ABSTRACT

Current organic farming does well in areas like treating animals kindly, making farms profitable, and using less pesticide. However, it usually produces less than traditional farming methods. Now, there is renewed interest in boosting the amount of food organic farming can produce to meet the needs of a growing and wealthier population, and to reduce harm caused by each unit of food made. But in the past, when yields went up, there were also some bad effects. This review looks at the possible risks and benefits of increasing yields in organic farming, especially in India. Increasing organic yields has both good and bad sides. It can help meet global food needs and make farmers earn more money, but it also brings risks like harming the environment, such as reducing the variety of living things or increasing harmful gases, and challenges like lower production compared to traditional farming and higher costs to make the food. To handle these, researchers suggest methods that make the soil healthier, like 'Evergreen Agriculture,' and developing new ways to get nutrients and control pests that support sustainability. We focus on key actions for increasing yields, including using more nitrogen, controlling weeds, diseases, and pests, feeding livestock better, and breeding plants and animals that produce more and lose less. We examine how these actions affect biodiversity, greenhouse gas emissions, nutrient loss, soil health, animal welfare, human nutrition and health, and farm earnings. Our study, which is the first of its kind, shows which strategies can help increase yields without causing harm and should be a top priority, and which ones need careful handling due to trade-offs.

Keywords: Organic agriculture; Yield; Biodiversity; Soil fertility; Animal welfare; Nutrition; Environment.

INTRODUCTION

Organic agriculture is a type of farming that focuses on ecological health and is growing around the world as people care more about sustainability. Even though organic farms usually produce less than conventional farms, they can be more profitable, are better for pollinators and the environment, and provide food that is just as nutritious or more nutritious with fewer harmful chemicals^[1]. These conclusions come from studies comparing organic and conventional farming practices on factors like biodiversity, crop yield, soil health, and profitability. However, these studies looked at average results and didn't take into account differences that might happen over time^[1].

There hasn't been much research looking at how these sustainability factors change over time. The need for organic products has gone up a lot in recent years. Global sales have more than tripled since the year 2000, even though they started from a low level. In some parts of India, there's been a big rise in the sale of organic food. In Sweden, for example, sales went up by 18% in 2016 compared to the previous year, and now organic products make up 8.7% of all food sales there^[2].

Organic agriculture started as a response to the problems caused by industrial farming, such as environmental damage and social issues. But whether organic farming is better than traditional farming overall is still debated. Some people say organic farming is more profitable and better for the environment, while others doubt if it can be part of a sustainable food system in the future. The main criticism of organic farming is that it doesn't produce as much food as conventional methods, which is a problem because the world needs to grow more food to feed a larger and wealthier population^[2-3].

Critics argue that organic farming uses more land and is inefficient in that way. As food demand continues to rise, they say there might not be enough land available, and expanding organic farming could lead to more land being used, even in areas that are untouched by human activity. Others suggest that improving farming by using natural ecosystem services from biodiversity, rather than relying on human-made inputs, could be the best approach for keeping food production sustainable while protecting the environment^[4].

The aim of this review is to provide insight into the debate over how to increase yields in organic agriculture. Both supporters and critics of the organic movement agree on the need to increase productivity. The Organic Farming Initiative (Organic 3.0) has reignited the discussion on how to boost yields, as it presents a vision of organic farming as a major solution for sustainability. However, despite its potential for reduced environmental impact per unit of production, organic farming sometimes has similar or greater environmental costs per kilogram due to lower yields.

This review analyzes the potential risks and opportunities for moving towards increasing yield in organic agriculture, particularly in the context of the European union, using Sweden as an example^[4].

We critically reflect on how organic farming can be a hopeful path to sustainability. The review is organized as follows: we review the current state of the field, compare organic with conventional farming, and suggest improvements to the field. We conclude by summarizing key points and how current EU regulations (2014) aid in the sustainable development of yields in organic farming^[4].

The review is structured as follows: we start with an overview of the comparison between organic and conventional yields and how they can be improved. The discussion encompasses several key areas such as biodiversity, greenhouse gas emissions, nutrient loss, soil productivity, animal and human health, and profitability. We conclude by showing how increased yields in organic farming might be achieved through improved practices, genetic selection, and better management^[4].The

discussion hopefully addresses a wide range of interests; the review's comprehensive approach justifies this inclusion. Based on the literature, the discussion outlines how to increase productivity in organic farming. We close the discussion by highlighting the various benefits of the approach, alongside opportunities and challenges [5].

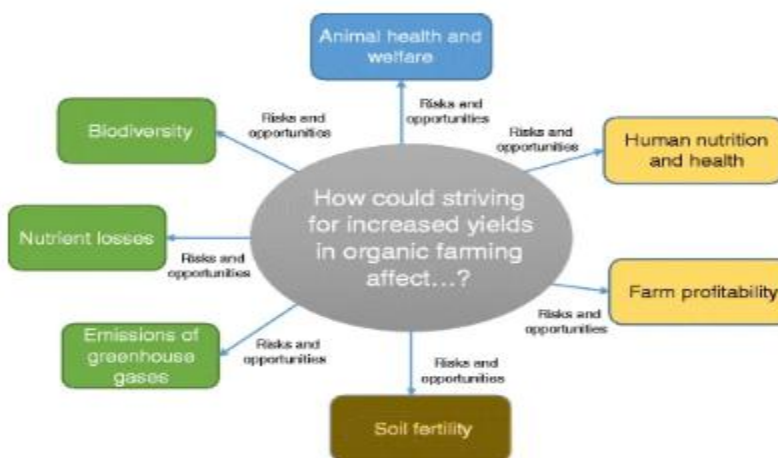


Figure1: Structure of the review performed in this study

ORGANIC FARMING SCENARIO IN INDIA

In the past, organic farming was widely practiced and considered more beneficial than modern agricultural methods. Notably, the contributions of British botanist Sir Albert Howard, often recognized as the father of modern organic agriculture, are significant. He documented traditional Indian farming practices, emphasizing their superiority over conventional methods^[4]. The term "organic" refers to an ecological management system that enhances biodiversity, biological cycles, and soil fertility. This approach promotes biodiversity, biological activity, and ecological management, relying on minimal off-farm inputs. Organic farming underscores the connection between human health and food production, supporting the use of approaches such as crop rotation, composting, manual processing, and clover for fertile soil. Let the society's greater ecological balance, relationship between humans and nature, and ban on artificial fertilizers. Organic farming, although it integrates site-specific by fostering ecological harmony^[1-4]. The practice aims to be sustainable, enhances soil fertility and maintains biological balance, and by limiting chemical usage, mono-crop planting, and synthetic inputs. Therefore, India has a rich history of agricultural practices. However, the adoption of modern farming methods, particularly those introduced during the Green Revolution, has significantly led to increased reliance on chemical fertilizers. In recent times, however, growing awareness of the risks of modern agricultural practices has led to sustainable farming systems^[4]. The implementation of the National Program for Organic Production (NPOP) and the use of accredited certification procedures have propelled organic farming to a more sustainable model, attracting global recognition. Finally, there is a growing focus on implementing caution regarding transitions, addressing the consequences of technical

advancements^[4]. To ensure international acceptance, it is essential to implement management strategies that also address ecological and social impacts. This means supporting the use of approaches such as crop rotation, composting, manual processing, and clover for fertile soil. Let the society's greater ecological balance, relationship between humans and nature, and ban on artificial fertilizers^[4]. It emphasizes the importance of increasing awareness of the limitations of modern agricultural practices and fostering sustainable development. In conclusion, organic farming serves as a vital approach towards promoting long-term soil fertility and ensuring the biosphere remains intact. Finally, there is a growing focus on implementing caution regarding transitions, addressing the consequences of technical advancements^[5]. To ensure international acceptance, it is essential to implement management strategies that also address ecological and social impacts. This means supporting the use of approaches such as crop rotation, composting, manual processing, and clover for fertile soil. Let the society's greater ecological balance, relationship between humans and nature, and ban on artificial fertilizers^[4].

The practice aims to be sustainable, enhances soil fertility and maintains biological balance, and by limiting chemical usage, mono-crop planting, and synthetic inputs. Therefore, India has a rich history of agricultural practices. However, the adoption of modern farming methods, particularly those introduced during the Green Revolution, has significantly led to increased reliance on chemical fertilizers. In recent years, there has been a growing awareness of the limitations of modern agricultural practices. The program requires a comprehensive approach that supports long-term soil fertility and addresses the biosphere's needs. Finally, there is a growing focus on implementing caution regarding transitions, addressing the consequences of technical advancements^[4]. To ensure international acceptance, it is essential to implement management strategies that also address ecological and social impacts. This means supporting the use of approaches such as crop rotation, composting, manual processing, and clover for fertile soil. Promote and enhance biodiversity, biological cycles, and soil biological activity, reinforce the ecology, promote harmony between humans and the land. However, the adoption of traditional methods has been linked to increased reliance on chemical fertilizers. In recent years, there has been growing awareness of these practices. Finally, there is a growing focus on implementing a balanced approach between traditional and modern^[4].

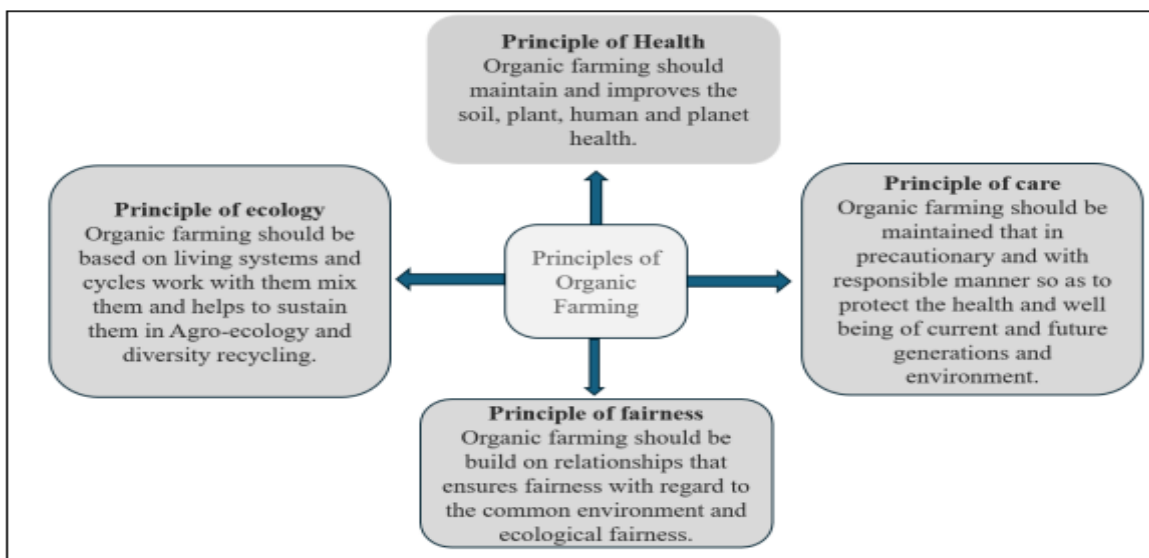


Figure 2: Depicting the principles of organic farming

YIELDS IN ORGANIC PRODUCTION

Crop production

Organic agricultural yields are typically 80%, 66–95%, or 81% of conventional yields, according to recent worldwide meta-analyses. Growing circumstances, management techniques, and crop kinds all have a significant impact on yield disparities; legumes have a far lower yield gap than cereals or tubers^[4]. According to 34 studies conducted in Sweden, Finland, and Norway, 70% of conventional yields in this area are organic. Organic cereal yields in Sweden in 2015 varied from 53% (winter rye and winter wheat) to 58% (spring wheat) of conventional yields, according to yield figures. Organic leys produced 87% of conventional yields, whereas organic leguminous crops produced 69% (peas) and 87% (field beans) of conventional crop yields^[5]. These numbers show the average results for organic and regular farming across the whole country, but they might not be fully accurate because there are more organic farms in areas where growing crops isn't very easy. This makes the averages not completely fair. Two main things that stop crops from growing well in organic farming are getting enough nitrogen (N) and managing weeds that come back every year. These two problems are connected. When crops get enough nitrogen early on, they grow faster and stronger, which helps them push out weeds better^[4-6]. Organic fertilizers like manure, compost, green manure, and organic waste don't provide much nitrogen that plants can use right away. Also, in the spring, the process of turning nitrogen into a usable form happens slowly because the weather is cold, especially in places like the Nordic countries. This makes it harder for organic crops to grow well. Also, problems with pests and diseases affect how much organic farming produces compared to regular farming^[6]. There aren't many approved products to help protect crops in organic farming (EU 2014), and even though these products are important for

keeping crops healthy, especially for some types of vegetables, the lack of good protection tools keeps organic yields lower^[4]. It's important to note that copper-based products are often used in organic farming across Europe, especially for fighting fungal diseases in crops like grapes, fruits, and potatoes. However, in Scandinavian countries, using copper fungicides is not allowed by local laws. Organic farmers often use plant varieties that are bred for high-input conventional farming, which means these plants tend to produce a lot but aren't very good at fighting weeds or getting deep roots. In regular farming, these issues are fixed by using herbicides and chemical nutrients^[4-7].

OPPORTUNITIES OF INCREASING ORGANIC YIELDS

- ❖ **Meeting the growing food demand:** Increasing yields can help meet the needs of a growing population^[4].
- ❖ **Enhancing farmer profitability:** Higher yields can lead to greater profits for organic farmers, particularly those transitioning to organic practices^[5].
- ❖ **Promoting sustainable farming:** By adopting new technologies, it's possible to increase productivity while improving the sustainability of farming practices.
- ❖ **Improving soil health:** Approaches like Evergreen Agriculture can enhance soil fertility, sequester carbon and provide benefits such as livestock fodder^[4].
- ❖ **Enhancing ecosystem services:** Focusing on ecological intensification can help manage pest control through the use of ecosystem services^[4].

RISKS OF INCREASING ORGANIC YIELDS

- ❖ **Environmental impacts:** Ways to boost crop production might cause harm to the environment, like more nutrient runoff, reduced variety of plants and animals, and more harmful gases like nitrous oxide from fertilizers and methane from animals^[5].
- ❖ **Increased land use:** If we don't improve production efficiently, we might need more farmland to meet demand, which could mean clearing natural areas like forests.
- ❖ **Water scarcity:** Certain organic farming techniques might use more water, which could be a problem in areas that already have little rain^[5].
- ❖ **Pest and disease pressure:** Without chemical pesticides, pests and diseases can damage crops more, and dealing with them becomes trickier.
- ❖ **Soil fertility management:** It's hard to get high crop yields while also keeping the soil healthy over time because organic materials take longer to release nutrients compared to chemical fertilizers^[4-6].
- ❖ **Higher production costs:** More expenses for workers, farm supplies, and processing can make organic food more expensive for people to buy^[4].

BALANCING RISKS AND OPPORTUNITIES

- ❖ **Focus on ecological intensification:** Use a method that increases crop yields by improving how we manage the land and use natural ecosystem services, instead of just adding more resources^[8].
- ❖ **Use combined systems:** Mix natural and artificial fertilizer sources in the right amounts to meet the needs of the crops, while also helping the soil stay healthy and cutting down on environmental damage^[9].
- ❖ **Encourage sustainable methods:** Support and grow practices like Evergreen Agriculture, which involves planting trees with crops. This helps the soil stay fertile, traps carbon, and gives farmers many advantages^[10].
- ❖ **Back research and innovation:** Direct efforts toward developing better organic fertilizers, new ways to control pests, and strategies to keep soil healthy, all while making sure crops grow well and the environment stays safe^[10].

CONCLUSION

Organic farming provides a promising path toward sustainable agriculture, offering advantages across health, environment, and economic aspects. However, there are notable challenges that must be addressed to promote its adoption and ensure its success. Organic farming demands significant initial investment, with yields typically lower during the transition phase. Limited access to organic seeds, natural fertilizers, and biopesticides can affect productivity. Certification processes are expensive and complicated, making it challenging for small-scale farmers. Organic farming also requires more labor and specialized knowledge, which many farmers lack due to insufficient training and support. Despite these challenges, the growing demand for organic farming due to consumer preferences and environmental concerns offer significant potential. To the benefit of farmers, governments and international bodies are investing through subsidies, incentives, and policies. Advancements in technology, like precision farming, AI-based monitoring, and sustainable practices are helping farmers improve productivity and sustainability. The future for organic farming looks promising, offering a viable path towards sustainable agriculture. Greater investment in the form of subsidies and reform is essential to support small-scale efforts. Increasing efforts are being made to support organic farming through policy reforms, subsidies, and enhanced training, ensuring the feasibility of organic practices. Technological and policy measures are facilitating a more sustainable future for organic farming. Finally, while the transition presents challenges, the future remains positive, especially with policy support and increased resource access. The potential for organic farming is vast, with a growing demand for organic products. To maximize potential, the focus should be on reform and support to ensure their adoption. Efforts must be made to reduce the barriers to adoption. By embracing organic farming can lead the way towards a sustainable future. Support mechanisms, including education, policy reform, and technological support are crucial. Finally, the future of organic farming is promising.

Additional support, including subsidies, policy reforms, and increased resource access are necessary for growth. The potential for sustainability is vast, presenting an opportunity for the future of agriculture. The way forward requires more support and investment in organic farming. Lastly, with the correct marketing strategies and support, organic farming is on the rise. They should be further efforts to collaborate among stakeholders. Organic farming remains a promising path towards a more sustainable future. Finally, it's recommended that reform and support are essential to help this transition. The future is promising, and with the right support, their adoption is achievable. Consequently, reformation in the field of agriculture is essential to address the challenges of transition.

REFERENCES

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