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A Survey on Challenges in Organic Agricultural Practices for Sustainable Crop Production

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ABSRTACT

Organic agriculture is the production system to enhance the biodiversity and health of the soil by avoiding the usage of chemical. Organic agriculture has proposed as an alternative and holistic production system that prohibit the use of synthetic pesticides, fertilizer, growth hormones and feeding livestock. It combines tradition, science and innovation to encourage health of soil, and support to achieve global food and security to ecosystem. This paper introduce organic agriculture system by highlighting major principles, sustainability to enhance the productivity of crops and major challenges in organic agriculture food production system. Organic agriculture has grown nearly 20% annually to make healthier food and take more concern on the effect of environment and attempts to improve the produce sustainable environment for future generation.

Keywords: Organic agriculture, fertilizer, pesticides, ecosystem, sustainability, challenges

1. INTRODUCTION

After Green Revolution, crops are grown without caring for restocking which leads to exhaustion and depletion of soil and result in low production of crops. The introduction of chemical fertilizer for managing the seed and modern approaches for farming took shape for Green Revolution(Willer and Lernoud 2019a). The use of chemicals, pesticides and fertilizer boost up the crop production and started to pollute the total chain in agriculture. Heavy usage of chemical pesticides and fertilizer make the soil in a stage where no longer crops are produced. So the farmers started to produce food in organic manner that required for supporting the demand of human. The crop production in organic agriculture has many challenges(Reganold and Wachter 2016).

Organic agriculture means cultivating the crops without using chemical fertilizers, pesticides etc. and depends on the organic source for crop production, soil health, reduce insects that affects the crops, weeds, pest etc. and provide nutrients to the crops. The organic agriculture is contrast to the agriculture which has simple non-chemicalization(Barik 2017). It is a comprehensive methods for the improvement of the crop production without affecting the health of soil and crop and leads to the improvement of ecology in surroundings and it is the requirements of sustainable crop production.

'Organic agriculture is the production method which withstands the soil nutrients, ecosystem and health of people' according to International Federation of Agriculture Movement (IFOMA).(Aher, Bhaveshananda, and Sengupta 2012)It suggest that organic agriculture solve all the issues based on the ensuring the health of

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soil by presenting best option for crop production and achieve many importance in the present day agriculture.

Organic agriculture is also called as ecological agriculture or biological agriculture which takes the advantage of traditional conventional agriculture approach and uses the modern agriculture technologies. Modern equipment are used in organic farming to enhance varieties of crop, policies in conservation of water and soil for crop production(Bedoussac et al. 2015).

The main goal of organic agriculture is sustainable development of organic farming to improve the harmony of agriculture with nature and enhance the crop production which enrich the biodiversity of the environment both economically and ecologically. Organic agriculture play an important role in protecting the biodiversity, enhancing the health of soil and comprehensively maintain the farming community for the crop protection.

The key for Organic agriculture ischoosing suitable crop for farming based on the soil and climate condition in that area. The crop produced using this approach are healthy and productive. The organic agriculture approach rely on animal manure, green manure, organic wastes, crop rotation and using biological pest control methods to maintain nutrient, productivity and control pest and weeds.(Palaniappan and Annadurai 2018)The organic agriculture includes treating nutrient content in soil and environment as a source for future generation.The crop is planted to provide a balanced supply of food by feeding the soil with manures, organic material and compost. The organic agriculture provided based on the renewable resources which reduce the pollution in environment by recycling the household waste relatively than dumping and burning the organic waste.Organic crop can be sustainably grown using the manure from farm-yard,earthworm, compost, and crop waste(Yadav et al. 2013). The components necessary for the crop production such as sulphur, magnesium, nitrogen, calcium etc., are available in the organic manure. In organic agriculture, earthworm play an important role in drying, soil throughput and microflora needed for the growth in plant.

2. PRINCIPLES OF ORGANIC AGRICULTURE

Organic agriculture is discussed as an ineffectual method for food production (Pickett and White 2013). The organic grown food is increased with the extent of organic farms, organically managed farmlands, market size for organic food production (Willer and Lernoud 2019b). Organic agriculture is a complete and unconventional agriculture method that utilize genetically modified organism (GMO)(Goh 2011).The health of ecosystem, soil and living organism can be developed by organic agriculture. It combines science, tradition and innovation together to provide the relationship between the environment and quality of life. The agronomical and mechanical approaches are used in the organic system relatively to the use of artificial resource for the crop production. The management practice in organic agriculture is based on the approval of maintenance, preservation, restoration and enhancement of ecological harmony which depends on the sustainability principle and support to achieve the goal of the economic, environmental and social maintenance(Miller 2010). The fertility of soil is protected in organic agriculture by maintaining the level of organic matter and making the organic waste as compost, greens and animals manure.

Organic agriculture avoids the use of fertilizer and artificial pesticides and depends on the biological pest control and rely on compost, organic manure, crop rotation and recycled waste to sustain the fertility of soil(Goh 2011).The population of human, animals, plants and soil is utilized for improving the health of the ecosystem which is the critical objective of the organic agriculture. Lynch in 2009 stated some principle based on the organic agriculture:

- Optimize biological activity, minimizing soil erosion and degradation, reduce pollution to protect the environment.
- Soil fertility is maintained by optimizing the biological activities within the soil

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- Biological diversity is maintained within the soil
- Material and resources are recycled to the greatest extent potential within the enterprise
- Organic food production system relies on renewable resources.

The organic agriculture may developed using some principles associated by IFOAM. The contribution of the organic agriculture express the potential to improve the vision of global agriculture. The program and standards improved to guide the position of the organic agriculture which is developed by IFOAM. The agriculture is the basic needs that are nourished daily in once life. The agriculture is embedded with the culture, history and community. The main concern of agriculture is to sense the activities which involved the way human interact with the soil, plants, animals etc., and predicting the process of food obtained, handling agriculture land, preparing and distributing the food produced by the organic agriculture and protecting the ecosystem for future generation. The four principle identified for organic agriculture by IFOAM are

- Ecological principle
- Principle of health
- Principle of fairness
- Principle of care

a. Ecological Principle

Organic agriculture is based on the ecological system which emulate and help them to sustain. The ecological principle experiences organic agriculture with ecological system. The production in organic farming is not exploitative and it should manage with cycles which is observed to be nature for the living system. The principle applied to organic agriculture in the stages such as manufacturing, processing, distribution, consumption and retailing the products. The input of resource is minimized by the concept of cycle and improve recycling and reuse of material. Organic agriculture should certify that it does not affect the living system like habitat, landscape, surface and ground water, and biodiversity which are outside the organic agriculture.

b. Principle of Health

Organic agriculture should maintain and improve the health of plant, soil, animal and human as indivisible. The principle of health is the foundation of organic agriculture which defined the health of living organism and are mutually dependent. The larger entities are formed by combing the separate entities together. Maintenance of mental, physical and social well-being is defined as health as the role of organic agriculture to maintain and improve the health process at all stages such as farming, processing, distribution and consumption.

c. Principle of fairness

The relationship should built by organic agriculture to ensure fairness with regard to the environment and opportunity of life. The social and ecological injustice is not perpetuate in the management of natural and environmental resource. Based on the resource in specific ecosystem and environment, organic agriculture should recognize the right sand ownership are provisional and ultimately held for the future generation.

d. Principle of Care

The approach of organic agriculture is stressed primarily by this principle and it govern development, management and choice of technology in organic agriculture. The organic agriculture is not static and survive for living and dynamic system. This

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principle depends on the involvement of all stakeholder and requires transparency and participation in organic agriculture

3. ORGANIC AGRICULTURE AND ENVIRONMENT

In twenty-first century the promising challenges are facing in which fulfill the society's rising food needs and in chorale diminishing agribusiness' environmental harm. It is basic to feature issues starting from the current agrarian framework. Changed agrochemicals being utilized in the agrarian exercises are antagonistically influencing soil, water, food, and barometrical climate as well. The utilization of substance based composts, pesticide, and insect poison have contributed in dirtying soil and water assets and exacerbated nitrate contamination; have prompted the amassing of a few weighty metals in soils and eutrophication of water; brought stratospheric changes; and furthermore have gravely affected rancher's wellbeing (Saffeullah et al. 2021).

The utilization of manufactured outer information sources like composts and pesticides during green unrest has presumably achieved tremendous expansions in profitability however therefore prompts monstrous natural pressing factors. Natural agribusiness endeavors to handle this issue by limiting the manufactured synthetics and incorporating a few ecologically feasible practices. The natural framework attempts at a miniscule obstruction of the common harmony. It additionally makes progress toward giving unrivaled food by denying synthetic compounds hazardous for people.

The substantial interest are found in organic agriculture production system in the current situation to provide benefits for environment. It is considered as a foundational way to deal with agronomic creation that is making progress toward a comprehensive ecological manageability including social what's more, monetary viewpoints. An essential guideline in natural farming is to lessen ecological effects while keeping a monetarily attainable degree of creation. However, an unpredictable connection exists between the climate and the horticultural framework. Natural creation framework has been proposed as a potential method to decrease farming's ecological compels (Ponisio et al. 2015). It is regularly embraced for having lesser natural effects when contrasted with high-input ordinary ranches since it substitutes engineered agrochemicals with regular information sources like fertilizer or through environment administrations such as controlling pest (Azadi et al. 2011)

i. Organic Nutrition and Soil Fertility

The organic agriculture has the ultimate goal of preserving fertility in soil. The capability of soil in yielding more crops with the utilization of least resource like fertilizer describes the fertility of soil. The potential of the soil in limited ecosystem defines the soil quality by providing biological activity and preserving the environment of human, plants and animals. Nutrient sufficient for the growth of crop is provided by the fertile soil and maintain biotic groups and indicates the characteristic structure of soil.

The stock of organic matter in the soil is the backbone for maintaining fertility in soil. Maintaining one agriculture method for long time makes the soil equilibrium among the decomposition and accumulation of organic matter in soil. The organic agriculture maintain the organic matter in soil compared to the conventional agriculture (Bai et al. 2018).

ii. Organic Fertilizer and Soil Biological Properties

The intensity of biological activities in the soil can be maintained by the organic system to improve the quality of soil and create metabolic interaction among the plant and rhizosphere (Stolze and Lampkin 2009). The bacteria and fungi are large diversity in soil fertility and numerous organism are required for maintaining the biome in soil. In order to depict the soil health the key organism such as bacteria and fungi are selected as the indicator of environment.

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In organic field role of microbes is important in preserving soil and decay of organic matter is led by the microbial activity. Earthworms are considered as the friend for farmers and the fertility of soil is boosted. The factor such as soil, fertilizer and agronomic condition are influenced for organic agriculture than the conventional system

iii. Organic Agriculture and Global Warming and Climate Change

Organic agriculture isobserved as an appropriate agricultural method for realizing the purpose of change in climate(Scialabba and Müller-Lindenlauf 2010). The climate change can be adapt by the ecosystem with the support of organic agriculture and produce less emission of green-house gases form agriculture. Green-house gas emission can be reduced by tackle climate change with the help of fertilizer and nitrous oxide emission has the direct correlation while applied in the agriculture land(Müller and Davis 2009).

Organic agriculture focus on nutrient cycle, reducing loss through volatilization, emission, run-off and maintain nitrogen level instead of using synthetic nitrogen fertilizer on agriculture land which contribute to maintain climate friendly organic food production system. Because of high content of organic matter and protection layer in soil supports to prevent water loss and nutrient from the soil and helps to adapt the climate change in organic agriculture.

iv. Organic Agriculture and Carbon Sequestration and Nitrate Leaching

Organic agriculture increase the carbon sequestration and decrease the nitrateleaching which is achieved by practices like less input of nutrients, prohibiting synthetic fertilizer and chemical and crop rotation(Hansen et al. 2015). The natural resources like surface and ground water can be protected from the harmful chemical by prohibiting the pesticides in organic agriculture.

The agriculture system is maintained using the valuable resources like fertilizer and to minimize the losses in hydrosphere and atmospheres is the foremost objective of the organic agriculture system. Leaching create more difficulties when posed with nitrate because of discharging some chemical form the lithosphere to atmosphere while the movement of nitrate in hydrosphere.(Lynch 2009)The surface and ground water may get polluted because of inadequatemanagement of the organic agriculture system.

The effective strategy of improving carbon sequestration is the main application of the organic agriculture. The carbon sequestration is improved by organic fertilizer by increasing organic matter of soil, crop growth is induced for root exudate input and improving the physical condition of the soil to increase the root growth.

4. SUSTAINABILITY OF ORGANIC AGRICULTURE

Earth cover almost 38% of land for agriculture (Owolabi, Ashaolu, and Twumasi-Ankrah 2016). The major contributor of the green-house gas is agriculture and provide food and other products. It also contribute for the agro chemical pollution, bio-diversity and soil degradation. The arable land is responsible for theenvironment consequence and it cover about 12% of land surface. Since the population in earth is growing and by 2050it can reach more than 10 billion people, so a sustainable agriculture system is needed to improve the food system and maintain the security of the ecosystem. The unsustainability of conventional agriculture leads to the organic agriculture to enhance the food production system.

The adequate amount of food with high quality is produced with enhance the environment based on natural resources. The main sustainability area in organic agriculture are production, environment, economy and well-being.

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i. Production

The production include the yield of crop in organic agriculture and the quality of the crop. Organic agriculture yield lea amount of organic food which is significantly less to have synthetic fertilizer and pesticides when compared to the conventional system. The production of the food system in organic agriculture in agro-ecological condition and sudden climate change where expected to enhance the yield in organic agriculture.

ii. Environment

Organic agriculture is friendly to the environment compared to the conventional agriculture system. The organic agriculture system have consistently better soil quality, greater carbon level in soil and decrease soil erosion. The organic agriculture provide greater faunal diversity, plant diversity, landscape and habitat diversity. The synthetic pesticides are not used in the organic agriculture and has little or no pesticides pollute the surface and ground water. The green-house emission with respect to the phosphorous and nitrate leaching is occur in the production area of organic agriculture. The excess use of phosphorous and nitrate fertilizer leads to eutrophication of freshwater and cause severe degradation of fresh water around the world. The usage of higher organic matter and low energy are the enhancement method to limit the emission of fossil fuel and increase the carbon content in the soil to address the change in climate.

iii. Economy

The financial performance of the organic agriculture is expanded globally. The economy of the organic agriculture is determined profitability using the main factor such as cost of labour, crop yield, premium price of the organic product, during organic transition period has the potential to reduce the income, and reliance on non-renewable resource is reduced for cost saving potentially.

The environmental cost and eco-system cost are associated with the monetary values in organic agricultural system. The environment cost created by the soil erosion, nitrate and phosphorous leaching of ground and surface water caused in the organic agriculture. The ability to decrease the conventional agriculture system provide the significant ecosystem in the organic agriculture.

iv. Well-being

The social well-being goals are adopted for organic agriculture to support the workers with fair income and maintain safe and imposing working condition to the workers in the organic agriculture. The food security can be improved in organic agriculture which enhance the necessity of the diverse crop.

5. CHALLENGES IN ORGANIC AGRICULTURE

The most important challenges in organic agriculture is inability of policy making level to take firm decision to promote agriculture and maintain sustainable agriculture. The major challenge in organic agriculture for sustainable crop production are as follows

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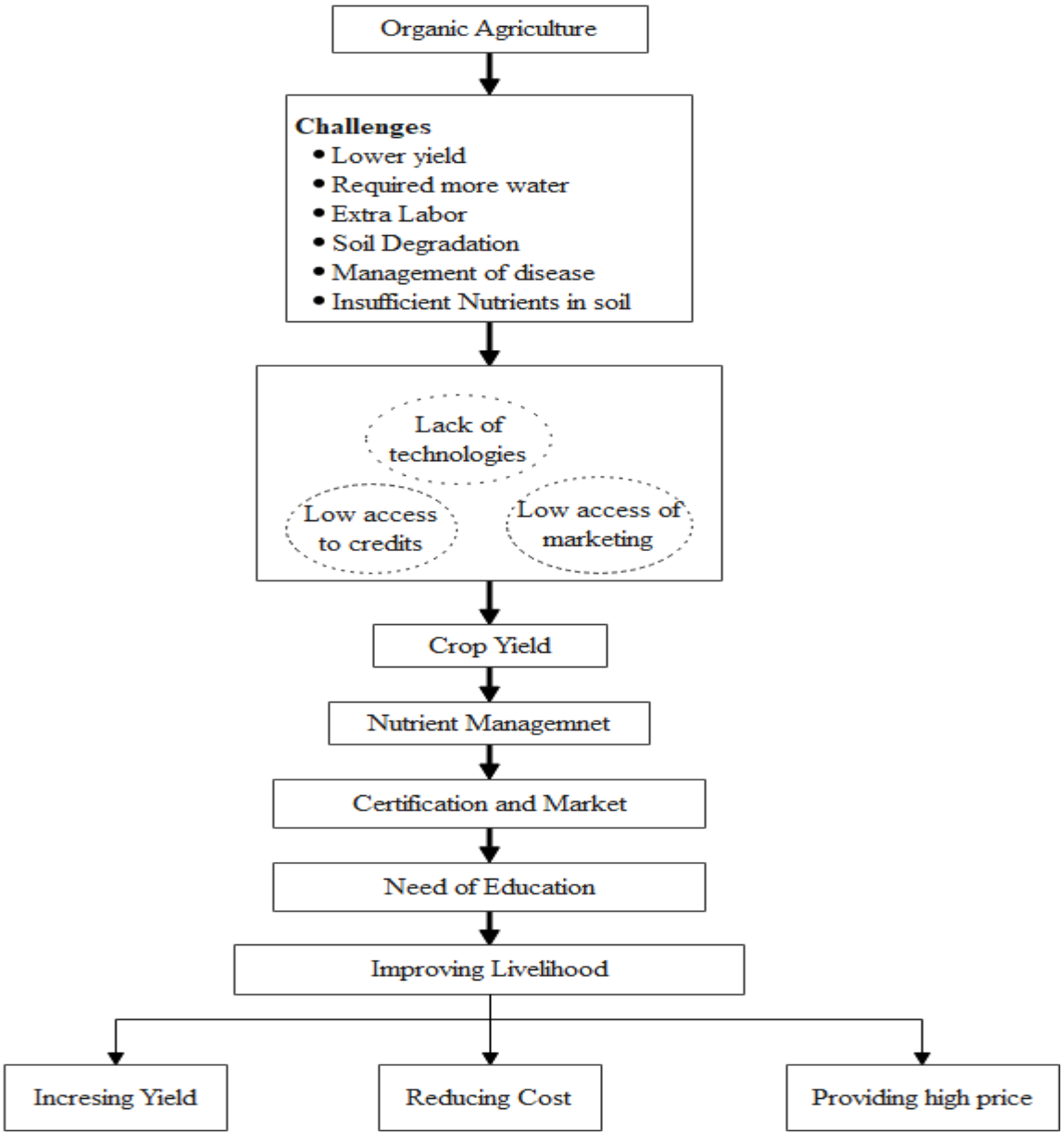

Figure: A framework to analyze the challenges of organic agriculture

5.1 Crop yield

The primary challenges in organic agriculture which consistently outperforming the production system compared to the conventional agriculture system. The crop production in organic system is lower in yield compared to other agriculture because of insufficient soil nutrients and limited methods to enrich the soil fertility, less management of pest, crop disease etc. The lack of access to adequate chemical fertilizer and insufficient protection methods to protect the crop and water in organic agriculture in developing countries is one of the reason for low yield of crops which is argued by some researchers (Kirchmann and Bergström 2008).

The researchers make food policy and believe that the food production in organic agriculture is enough to feed for population globally, and important issues in regarding to low yield in organic agriculture is to improve the ability of food security. Higher yield of food production is not a solution for the insecurity problem in food and this regard to the multiple social and economic influence factor. When compared to conventional agriculture, the organic agriculture is 25-50% less in crop production (Seufert 2012). Organic agriculture is not preciseand biased toward the higher yield because the variety of crop species are adapted from the conventional

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method. The sufficient access of organic manure provide an opportunity in production of higher yield in organic agriculture,

5.2 Pest Management

Sustainable Agriculture practice is promoted in large scale by Integrated Pest Management (IPM). The available pest control technique and appropriate measure for the subsequent integration is the consideration measure that discourage the enhancement of population of pest and possess pesticides and other interpolation to justify economically and lower the risk to health of the human and environment(Baker, Green, and Loker 2020).Instead of using chemical pesticides, IPM prefer the use of physical, mechanical and biological control methods to prevent pest. Many developing countries are adapting this technique due to the growth of organic agriculture not only for economic advantage but also for the sustainable crop production. The appropriate cropping technique, natural pesticides and biological control are used to achieve pest management in organic agriculture. The main problem in weed control which is achieved by culture practices such as flaming, mulching and mechanical cultivation. The characterization of organic agriculture is managed by higher diversity of arthropod fauna and conservation of natural enemies compared to the conventional agriculture.

5.3 Disease Management

The essential component in organic agriculture is disease management. The potential of crop production level is reduced by disease in the crops based on the intensity and time. The different stage are involved in the intervention of disease management. The disease management may varies with type of pathogen, crop, season of cultivation, affected part and many other factors(De and De 2019). The option and recommendation in managing the disease may vary and development of chemical based pesticide and fungicides are used to manage the pathogens in the crop. Most management practice are aim to prevent the occurance of disease, enhancing the health of soil and maintenance of biological diversity. The organic agriculture aim to manage the disease under many strategies and prohibit to cause disease. Suitable climate condition such as temperature, humidity, moisture etc. are needed for pathogen to survive and infect the crop. Organic agriculture allows few natural complexes for management of disease in the crop production.

5.4 Nutrient Management

The management of nutrient is a formidable challenge in organic agriculture system that use organic fertilizer and the use of inorganic fertilizer is prohibited. The nutrient content of soil is ensured by optimizing the range of soil, manure management which guarantee optimum crop yield and reduce losses to the environment(Kopke et al. 2015). The nutrient management on the organic agriculture meet the requirement of crop nutrient and prohibit the depletion of soil nutrient and improve the productivity of soil without losses in excessive nutrient. The most important technique to maintain the nutrient of the soil is crop rotation since this method has the limitation as the nitrogen fertilizer cannot used as a substitute for the crop.

5.5 Certification and Marketing

The organic agriculture is mainly based on the certification of the crop production with premium priced for organic market in developed countries and non-certified production crop for local market in developing countries(Willer and Lernoud 2019b). The infrastructure of the organic agriculture is needed for the documentation procedure to certification since it is costly. The certification in organic agriculture has no advantage. The certification of organic agriculture is based on some standards. This includes the submission of organic agriculture plan and inspection in processing facilities. The organic product with certification is less profitable compared to the non-certified product.

6. CONCLUSION

Organic agriculture has the ability not only to produce the food product but also maintain biodiversity in environment. By the fact of human intervention, organic agriculture provides the disturbance to the natural habitats. This study provide that organic agriculture have wide range of service to environment. The organic content in soil manage the fertility of the soil and decrease the risk of soil erosion. The prohibition of synthetic fertilizer and pesticides poses no risk to the surface and ground water pollution and nitrate and phosphorous leaching are reduced in organic agriculture. The organic agriculture system have positive effect on diversity of ecosystem and contribute in the development of landscape. It enables the ecosystem to maintain the impact of change in climate and potential to decrease the green-house gas emission. It comprise recycling of organic matter and tightening internal nutrient cycle and contribute to carbon sequestration. Organic agriculture stabilizes resource depletion and positively contribute to the problem associate with the change in climate and helps to support and improve the biodiversity of environment globally.

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