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Review on the Importance of Organic Farming for Vegetable Production

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Abstract: Organic agriculture seeks to augment ecological processes that foster plant nutrition while conserving soil and water resources. Organic systems eliminate agrichemicals and reduce other external inputs to improve the environment and farm economics. The National Organic Standards Program prohibits using synthetic chemicals, genetically modified organisms, and sewage sludge in organically certified production. Ethiopia possesses significant potential for producing sustainable organically grown crops that meet high-quality standards for local and regional retail marketsOrganic farming is a method of agricultural control that aims to maintain soil productivity and control pests on a farm. It strictly prohibits the use of manufactured fertilisers, pesticides (including herbicides, insecticides, and fungicides), plant growth regulators such as hormones, livestock antibiotics, food additives, and genetically modified organisms. . The main components of organic farming worldwide include green manure, animal manure, optimum tillage and cultivation, mulching, and compost. Organic production reduces the risk of yield failure, stabilizes returns, and enhances food security for small farmers' families.

Keywords: organic farming, production, vegetables.

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1. INTRODUCTION

The global production of organic vegetables is steadily increasing, leading to a dramatic shift in people's dependence on them in developed nations. BasedAccording to a UN survey, at least 130 countries commercially produce organic food; the global area under organic production now stands at 31 million hectares (ha), and the market for organic food has surged to an estimated US$27.8 billion annually. Rapidly expanding market seems to be prompting farmers to shift to organic farming practices (Cornish and Stewart 2002).

Different research revealed that Ethiopia has a large potential for sustainable production of organically grown crops that can be produced to high-quality standards for the local and regional retail markets (importance only to cereals and protein crops) (Willer and Yussefi 2007). We can develop certified organic production for the European, American, Middle Eastern, Japanese, and other export markets.

Various authors have provided varying definitions of organic farming, but it is crucial to convey the meaning in a context-appropriate manner. According to Dabney et al. [2004], organic farming is a comprehensive management system that enhances the health of the agro-ecosystem by promoting biodiversity, nutrient cycling, soil microbial activity, and biochemical processes. Organic farming emphasizes management practices involving the substantial use of organic manures, green manures, organic pest management practices, and so on; it has also come to mean that it is a system of farming that prohibits the use of artificial fertilizers and synthetic pesticides (George and Gegner, 2004). Organic farming, also known as a form of agriculture control, aims to

maintain soil productivity and control pests on a farm. It strictly prohibits the use of manufactured fertilisers, pesticides (including herbicides, insecticides, and fungicides), plant growth regulators such as hormones, livestock antibiotics, food additives, and genetically modified organisms. It relies on ecological processes, biodiversity, and cycles adapted to local conditions rather than the use of inputs with adverse effects.

Today, there is a global push to promote organic farming due to various reasons. These include the loss of trust in non-organic food products following a series of food scares, the desire to avoid pesticide residues in food, the desire to consume food produced without the use of genetically modified organisms (GMOs), the demand for the highest standards of animal welfare, the need for environmental protection and enhancement, the desire to protect the environment from GMO contamination, and the health and safety of farm and food workers worldwide (USDA, 2002).

Activities and systems of organic farming that ensure profitability, sustainability, health safety, environmentally friendly soil fertility, management of disease and pests, and control of soil erosion include the use of cover crops, green manures, animal manures, and crop rotations to fertilize the soil. Biological control, crop rotations, and various other techniques are employed to control weeds, insects, and diseases. We employ rotation grazing and mixed forage pastures to manage livestock and provide alternative health care for the welfare of animals. Reducing external and off-farm inputs and eliminating artificial pesticide fertilisers and other materials, such as hormones and antibiotics, can significantly reduce environmental pollution. Willer, H.; Lernoud, J., 2017 emphasizes the importance of renewable resources, the preservation of soil and water, and the implementation of management strategies that aim to reestablish, sustain, and improve ecological equilibrium.

Despite the benefits of organic farming, it comes with certain disadvantages. One criticism of organic agriculture is the lack of naturally available nitrogen, leading to the need for chemical fertilisers to sustain current yields (Codex Alimentarius, 2007; Willer, H.; Lernoud, J., 2017). The aforementioned observation highlights that organic farmers experience a significantly greater reliance on labor compared to their conventional counterparts. Organic growers, due to their non-use of synthetic chemicals, are unable to implement many of the cost-saving and yield-enhancing chemical treatments commonly used by conventional growers. Some scholars claim that organic farming produces yields too low to feed a growing world population. So most of the farmers use chemical fertilizers. These fertilisers pose risks to human health and are harmful to plants, which is why this review aims to educate farmers about the benefits of organic farming for long-term soil fertility management and production.

2. MAJOR REVIEW

Components of organic farming and its benefits

Organic farming is an important aspect of knowledge that improves or maintains soil fertility, increases profitability, contributes to weed and pest management, maintains biodiversity and ecological stability, reduces carbon emissions, improves sustainability, avoids consumer fear, and maintains health risks. Green manure, animal manure, optimum tillage and cultivation, mulching, and compost are the main components of organic farming worldwide.

Animal manure

Livestock manure is the most traditional and widely recognized organic fertilizer. Under ideal circumstances, the whole farm operation integrates livestock enterprises, and the maturing process becomes part of a closed system of nutrient recycling (Cummins, 2000). It supplies nutrients and organic matter, stimulating the biological processes in the soil that help build fertility and reduce the application of external chemicals. Regarding the use of animal manure as a component of organic crop production, several cautions and restrictions are in order, based on concerns about produce quality, food contamination, soil fertility in balance, weed problems, and pollution hazards.

Compost

Bacteria and other organisms have decomposed organic matter (plant and animal residues) over time to create compost. You can make compost from materials like leaves, fruit skins, and animal manure. Compost, a cheap and easy-to-make material, enhances soil and vegetable quality by improving soil structure, allowing more air into the soil, improving drainage, and reducing erosion. It also enhances soil fertility by adding nutrients and facilitating plant uptake of existing nutrients. Additionally, compost enhances the soil's water retention capacity, prevents the soil from drying out during droughts, and reduces pests and diseases in the soil and on the vegetables, thereby boosting yields (Fred, 2000). While chemical fertilisers offer nutrients to plants, they don't enhance soil structure and typically boost yields only during the application season. In contrast, compost nurtures soil life, enhances soil structure, and yields long-lasting benefits.

Mulching

Mulching means covering the ground with a layer of looser material such as compost, manure straw, dry

grass, wood chips, leaves, or crop residues. Typically, we avoid using green vegetation due to its slow decomposition and potential attraction to pests and fungal diseases. Mulches have several beneficial effects on the soil that aid in enhancing plant growth. These effects include reducing water loss due to evaporation, reducing weed growth by reducing the amount of light reaching the soil, preventing soil erosion, increasing the number of microorganisms in the topsoil, adding nutrients to the soil, improving soil structure, and adding organic matter. Hazelip (2000) asserted that alternative mulching materials, such as black plastic sheeting or cardboard, regulate soil moisture and temperature, suppress weeds, add organic matter to the soil, and minimize the need for artificial inputs to maximize production. Applying mulch to warm, wet soil requires careful attention. Applying mulch to dry soil, on the other hand, will keep the soil dry. Be mindful of the thickness of the mulch to prevent airflow and encourage pests. Use a layer of less than 10 cm to allow the germination of planted seeds through the mulch, and use layers of 10 cm or more to rid an area of land of persistent weeds.

Green manures

Growers grow green manures, also known as cover crops, to enhance the soil's structure, organic matter content, and nutrient content. We usually dig green manures into the soil when the plants are still young, before they produce any vegetables, and often before they flower. Growers cultivate them for their high-nutrient leafy material, which also provides soil cover (Askegaard, M., 2006). Fageria NK (2007) highlighted the remarkable properties of green manure, which include boosting and recycling plant nutrients and organic matter, enhancing soil fertility, enhancing soil structure, enhancing the soil's water-holding capacity, managing soil erosion, preventing weed growth, and halting the loss of nutrients.

Tillage and cultivation

Tillage and cultivation are tools that can accomplish a variety of objectives in farming systems: weed control, crop residue management, soil aeration, conservation of manures and other fertilizers, hardpan reduction, sanitation to destroy pest and disease habitats, etc. (Charles Ikenna NWANKWO, 2017). Every tillage operation aerates the soil and speeds the decomposition of the organic fraction. Overdoing tillage can deplete the soil's humus reserves, even though it may boost the current vegetable crop. Excessive tillage can also be directly destructive to earthworms and their tunnelling, reducing benefits to the land. There is also the danger of compaction, even when field operations are well-timed (Van Capelle et al., 2012).

Organic Farming and Vegetable Pest Management

A vegetable protection strategy is normally a combination of direct or reactive and indirect or preventative approaches. This applies in both conventional and organic farming, but given that in organic farming there are relatively few safety nets in terms of pesticides, the organic farmer must put most emphasis on preventative approaches.

Weed control

Organic weed control promotes weed suppression rather than weed elimination by enhancing crop completion and phototoxic effects on weeds. Organic growers integrate cultural, biological, mechanical, physical, and chemical tactics to manage weeds without synthetic herbicides.

Weeds are controlled on an organic farm in a number of ways, including hoeing, mulches (which cover the soil and stop weed seeds from germinating), hand-weeding or mechanical weeding to keep weeds from growing, green manures or cover crops to outcompete weeds, soil cultivation done regularly and at the right time, when the soil is moist, field and crop sanitation, vegetable completion (which includes factors like vegetable choice, seeding date, seeding rate, row spacing, seeding depth, and plant nutrition), biological controls, the right way to plant, and stale seedbeds (Brennan and Smith, 2005).

Disease and insect pests

Organic farming relies a great deal on populations of beneficial predators and parasites, pest disease agents, insect-eating birds and bats, and other creatures to help manage insect problems. These biological controls assist in maintaining pest populations at levels where additional cultural activities or standard pesticides are typically sufficient for vegetable production. Biological control can be so effective in certain cases that farmers never need to take additional action. For soil borne-disease control in organic systems, organic farmers use composts, long known as effective plant pathogen suppressants. Rotations are also important for decreasing pathogens, as most of them are plant-specific. The USDA indicated to a researcher that a four-year organic rotation had a lower incidence of corky root and red root rot on-farm tomato than a two-year conventional rotation (George and Gegner, 2004).

Rotation may also help in the control of several insect pests, such as the cabbage stem weevil (Ceutorhynchus quadriceps) and celery fly (Euleia heraclei), which have a limited host range and live in the soil for part of their life cycle. Highly mobile, often non-specific pests, such as aphids, are less affected or unaffected by rotation design. As with posts, the less mobile, soil-borne diseases such

as Rhizoctonia root rot and stem canker of potatoes (Rhizoctonia solani) and club root of brassicas (Pasmodipohora brassicas) can usually be adequately controlled through the use of balanced rotations, appropriate break crops and good soil husbandry (Gomiero T, et al- 2011).In addition to the previously mentioned cultural and biological methods used as preventive measures, the organic vegetable protection strategy should prioritize the selection of varieties that exhibit a high level of resistance to locally significant diseases and pests. This is particularly important for diseases such as late blight in potatoes (Phytophthora infesting), which can have devastating effects. (Hazzelip, Emila.C, 2000).

Table. 1: Organic Management and Control Options for Common Vegetable Insects and Mites

Pest	Management and Control Options
Aphids	Use reflective mulch. - Consider resistant varieties if available, or varieties resistant to important aphid vector viruses. - Use strong water spray to wash aphids from plants. - Use style oil, where appropriate, to help reduce virus transmission. - Destroy crop residue promptly after the final harvest. Especially helpful with root aphids. - Foliar Sprays: Azadirachtin, neem oil, oil sprays, insecticidal soaps
Thrips	Grow tomato varieties resistant to tomato spotted wilt virus. - Use reflective mulch. - Promptly remove tomato spotted wilt virus-infected plants. - Avoid mowing or tilling field borders and adjacent fallow fields after transplants are set. - Foliar Sprays: Spinosad, azadirachtin, neem oil, insecticidal soaps, pyrethrins
Sweet potato Weevil	Plant only certified weevil-free slips. - Do not transport sweet potatoes from weevil-infested areas to non-infested areas. - Destroy crop residue promptly after harvest.

Source: Blake Layton, Ph.D. Extension Entomology Specialist

Economic profitability of organic farming

The economics of organic farming, a subfield of agricultural economics, encompasses the entire process and effects of organic farming in terms of human society, including social costs, opportunity costs, unintended consequences, information asymmetries, and economies of scale. Although the scope of economics is broad, agricultural economics tends to focus on maximizing yields and efficiency at the farm level. Economics takes an anthropocentric approach to the value of the natural world: biodiversity, for example, is considered beneficial only to the extent that it is valued by people and increases profits. Some entities such as the European Union subsidize organic farming, in large part because these countries want to account for the externalities of reduced water use, reduced water contamination, reduced soil erosion, reduced carbon emissions, increased biodiversity, and assorted other benefits that result from organic farming (Beecher N. A et al, 2002)

Impact of organic farming on ecological sustainability

Conservation tillage was not and is not considered a traditional practice of organic farming, yet its ready adoption points to the dynamic nature of organic agriculture and offers clear evidence of the underlying philosophy of sustainability. The organic farming principle and practices for sustainability meanwhile. To improve the balance of the ecosystem by reducing external chemicals to cause water, air, and soil pollution (Funk C, Kennedy B. 2016).

Humid tropical conditions such as hot temperatures, high annual rainfall, and poor Soil properties require appropriate agricultural practices. The tropical rain forest as an original ecosystem with its closed nutrient cycles and biodiversity serves as an Ideal model concerning nutrient management and cropping patterns. The diversity of the production system is therefore of special

importance in the tropics: simplified. Systems and mono-cropping harm soil fertility and the ecological balance to a much greater extent than in temperate climates because soil oxidation and pest population dynamics run permanently and more rapidly in the tropics. Heavy rainfall and high temperatures accelerate the mineralization of the nutrients and retard the accumulation of soil organic matter. Tropical farming can only be sustainable if the primary rules of this natural system are respected. (Scialabba, 2002). Central to organic agriculture is the promotion of soil fertility, conservation of biodiversity (e.g. native flora and fauna), production methods that are adapted to the locality, and avoidance of chemical inputs. The use of such methods and the cultivation of a diverse range of crops stabilize the delicate ecosystems in the tropics and reduce drought sensitivity and pest infestations.

Organic production reduces the risk of yield failure, stabilizes returns, and therefore enhances food security for small farmers' families. Organic farmers do not fight against the natural dynamics; on the contrary, they use them to their advantage.

Biodiversity stability and organic farming

Organic farming mimics the biodiversity of nature through practices like intercropping, companion planting, establishment of benefits habitats, cover cropping, farming aping, and. The effort to increase biodiversity works hand-in-hand with enterprise diversity, which is often (but not necessarily) an objective on organic farms. A comprehensive study on humus contents in Bavarian fields concluded that local factors (soil texture, i.e. clay, silt, sand; precipitation) and the integration of livestock have a higher impact on soil organic matter than the farming system itself (organic, conventional) (Capriel, 2006).

As a general rule, diverse ecosystems in nature have a higher degree of stability than those with only a few species. The same is essentially true for agroecosystems. Farms with a diverse mix of crops have a better chance of supporting beneficial organisms that assist in pollination and pest management. Diversity above ground also suggests diversity in the soil, providing better nutrient cycling, disease suppression, and nitrogen fixation (Van Else, 2000).

Organic Farming Health Welfare

No evidence of a difference in the content of nutrients and other substances between organically and conventionally produced crops and livestock products was detected for the majority of nutrients assessed in organically and conventionally produced crops and livestock products. However, they also found that statistically significant differences between the composition of organic and conventional food were present for a few substances, organic products stand out as having higher levels of secondary plant compounds and vitamin C, whereas organic carbohydrates and minerals are not different from conventional products. Artificial pesticides can quickly find their way into food chains and water courses. This can create health hazards for humans. Human health can also be harmed by people eating foods (especially fruit and vegetables) that still contain residues of pesticides that were sprayed on the crop. There is also much concern for those people using chemical pesticides (Temme EHM. 2017.). De Jonge and Goewie (2000), described the vulnerability of chemicals on the environment as chemical pesticides can kill useful insects that eat pests, just one spray can upset the balance between pests and the useful predators that eat them. Artificial chemicals can stay in the environment and the bodies of animals causing problems for many years; insect pests can multiply very quickly, over a few breeding cycles, become resistant to artificial products and are no longer controlled. This means that increased amounts or stronger chemicals are then needed creating further economic, health, and environmental problems, due to the above overall short comes of synthetic chemicals should be deepened on organic farming is superior in terms of health safety and reducing environmental pollution (USDA, 2002).

Drawbacks of organic farming

Beginning as a small protest to the industrialization of agriculture in the 1920s, organic farming has become a significant force in agricultural policy, marketing, and research. (ed. Lockeretz, W.2007)Organic agricultural systems are friendlier to the environment and more sustainable than conventional farming systems. Organic vegetable production has some challenges such as; yield reduction occurring in the initial years of the transition from conventional to organic, apart from the reduced disease pressure resulting from the more diverse cropping system, organic crops have reduced N supply compared to conventional crops, and consequently a higher dry matter content and lower N content, which may make them less susceptible to airborne or foliar disease (S. Chandra and S. K. Chauhan[2004]). (Shalaby, T.A.plant 2022) concluded that practices such as tillage, cultivation, thermal weeding, polarization, and plastic mulching, such tools significantly reduce diversity in the field and tend to move the system in a less sustainable and with little biodiversity. As a unit of production where agronomic crops are concerned, most agricultural scientists believe that in the absence of chemical fertilizers, the large quantity of farm yard manure and other biomass that will be needed to compensate for the fertilizers is unavailable. Also, they believe that different crops cannot yield high without agrochemicals, fertilizers

in particular and therefore practicing organic farming means food insecurity for the country.

Raw manure is an excellent resource for organic vegetable production; nevertheless, still, several cautions and restrictions are in order, based on concerns about produce quality, especially for those of raw crops i.e. vegetable and fruits, food combination, soil fertility imbalances, weed problems, and pollution hazards. Manures may contain such as residual hormones, antibiotics, pesticides, disease organisms, and other undesirable substances, may this substance to cause damage to desired organic crops. Manure is often rich in specific nutrients like phosphate or potash. While these nutrients are of great benefit to vegetables repeated applications of manure can result in their building to detrimental levels such as excessive phosphate in the soil and polluted surface waters, phosphate interferes with plant uptake of both copper and zinc; excessive potash can restrict boron, manganese, and even magnesium this problem leads to imbalance nutrient in the soil. Organic farming e.g. manure case pollution when leached into groundwater, nitrates from manure and fertilizers have been linked to several human health problems, flushed into surface waters, nutrients can cause eutrophication of ponds, lakes, and streams.

Organic versus inorganic farming in vegetable production

Vegetables can be produced by both organic and conventional methods. The general concept of organically grown produce refers to food that has not been treated with preservatives, hormones, or antibiotics and that has been grown without pesticides or artificial fertilizers in soil whose humus content is increased by the addition of organic matter and whose mineral content is increased by the application of natural mineral fertilizers. Data indicate that there were 40 acres of certified organic vegetable production in Oklahoma in 2001 (USDA, 2002).

Traditional organic farming is labor and knowledge-intensive whereas conventional farming is capital-intensive, requiring more energy and manufactured inputs. An organic production system is designed to a)enhance biological diversity within the whole system; b) increase soil biological activity; c) maintain long-term soil fertility; d) recycle wastes of plant and animal origin to return nutrients to the land, thus minimizing the use of nonrenewable resources; e) rely on renewable resources in locally organized agricultural systems; f) promote the healthy use of soil, water, and air, as well as minimize all forms of pollution thereto that may result from agricultural. Practices (Trewavas, A. 2004)

SUMMARY

Nowadays, organic vegetable production extends worldwide both in developed and underdeveloped nations, the main reasons of explanation of this system is more advantageous in terms of soil fertility improvement and maintenance, economical value, environmentally friendly, weed and pest management, increased biodiversity, ecological stability, reduced carbon emission, sustainability, avoid consumers fear and maintain health risks than conventional vegetable production that allows large application of external inputs such as fertilizer, herbicide, pesticide, and growth regulator hormones to enhance productivity. The major mechanisms used by the organic farming system to ensure more benefit than conventional systems are green manure, animal manure, optimum tillage, cultivation, mulching, and composting.

Despite, many benefits of organic farming over that of allowable high external or synthetic inputs, there are some disadvantages for instance, requires intensive labor, yield reduction in the initial period (3-5 years after transition from nonorganic to organic vegetable production), some mechanisms of organic agriculture e.g. tillage, cultivation and mulching to declined biodiversity, sometimes organic system does not completely liberate the amount of nitrogen require by the crop, causes of pollution in some extent due to contamination with the soil and water when used manure as organic component. However, the advantage of organic vegetable production over that of conventional one, this is lead to allow in the future vegetable production.

RECOMMENDATION

Organic farming is the most sustainable agricultural production which is ecologically friendly and maintains biodiversity. Therefore:-

- Awareness should be given to both small-scale and large-scale farmers that organic farming is cost-effective and has a positive effect on the environment.
- The government has provided support for the use of organic farming rather than using other farming systems which are dependent on using chemicals that endanger the biological balance between parasites and beneficial predators.
- The Organic farmers must put more importance on a protective approach.
- Other methods of organic farming should be done (improved) to eliminate weeds by dominating weeds and by releasing high levels of phototoxic effects rather than the crop.

- Organic farming alone should have the ability to eliminate challenges, rather than relating to other beneficiates.
- Awareness should be given towards using of compost both at small scale and commercial level

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