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Organic Farming a Pathway to Achieve Sustainable Agriculture Development: A Comprehensive Review

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Review Article

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ABSTRACT

Sustainable agriculture development through organic farming not only provides food requirements for the current creation in an environmentally friendly way manner also however provides food for prospective generations and controls our surroundings. Mainly, quality food is provided by organic farming without negative effects on the condition and effectiveness of the soil side by side with the environment. Organic farming also helps to produce a larger quantity of food for a huge amount of the Indian population. In current agriculture huge number of pesticides, fertilizers and synthetic

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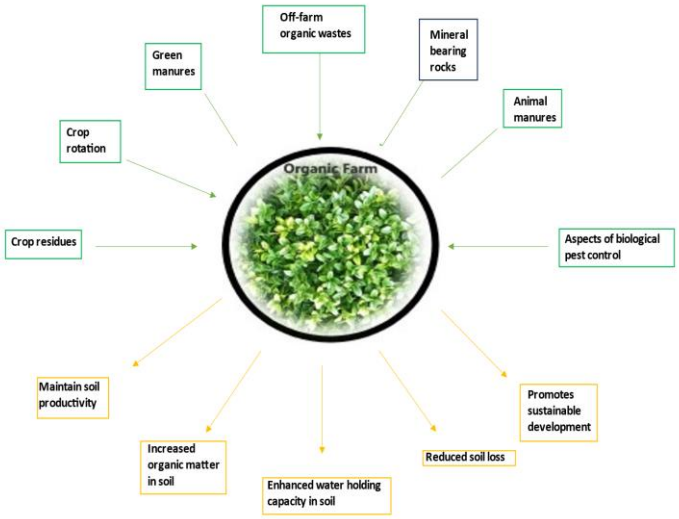
compounds are used, which causes adverse impacts on soil health, water hazards, toxic residues increasing in the animal feed industry and the food chain in this manner increasing healthcare issues. The objective of the review paper is to identify synthetic fertilizers and pesticides that can be replaced with natural alternatives as well as to examine how organic farming might promote sustainability in agriculture.

GRAPHICAL ABSTRACT



Keywords: Biofertilizers; bio-pesticides; manure; organic farming; sustainable agriculture.

1. INTRODUCTION

Approximately 187 countries are currently working on organic agriculture, with India occupying a similar position (Ravisankar et al 2021). Organic farming is rapidly gaining popularity in agriculture. India plays a crucial part in the manufacturing of organic food. In total organic production, 30% of producers present in India in the world manor 2.30 million hectares, 27,59,660 farmers, 1730 total producers and 745 total traders in India (FiBL survey 2021). Mainly, we can keep our nature clean, green, and rich by following organic farming. If we go to any organic farming area there, we see only the humming of birds, insects and animal movement. Researchers shows that almost above 30% of plants and wildlife present in the organic farming zone in comparison to conventional agricultural practices system due to decrease utilization of artificial fertilizres and pesticides. But in modern agriculture platforms, different synthetic chemicals i.e., agrochemicals compounds are extensively used for controlling diseases, pests and weeds. Contingent inside the structure of chemicals, agrochemicals are classified into synthetic pyrethroids, carbamates, organochlorines, chlorophenols and organophosphates (Hamza et al 2016). The World Health Organization (WHO) categorizes agrochemicals to be either incredibly dangerous, very hazardous, moderately hazardous, somewhat hazardous, or acutely harmful, according to the median lethal dose (Lethal Dose$_{50}$) for rats (WHO survey 2020). Crop productivity increases and more closely matches human demands in greater populations when agrochemicals are used during agricultural operations. Using agricultural chemicals consistently and without judgment harms the wellbeing of people, threatens biodiversity and harms the ecosystem (Elahi et al 2019). Our forefathers have been engaging in agriculture since the beginning of time, using farmland and natural resources as input (Nedumaran and Manida 2020). Due to the various negative effects that synthetic fertilizers and pesticides in the system of conventional farming cause, some consumers have received reimbursement (Kalyan 2005). As a result, they switched to organic farming which produces goods that are healthy and non-injurious to human health. Besides maintaining the soil fertility status, soil health, levels of the organic matter concentration, the biological function of fostering soil, self-sufficiency of nitrogen through the biological nitrogen fixation and use of legumes crop, use of weed, wastes of livestock and byproducts of

agriculture are used in the recycling of organic matter and crop rotation due to the reduce of pests and diseases (Chhonkar 2002). Ignore usage of pesticides and instead practice organic farming to reduce environmental and human problems (Sharma and Singhvi 2017). The integration of opportunity of economics and protection of the environment direction to sustainable agriculture (Ferella et al 2019). Firstly, more farmers should practice organic farming, which will reduce the distribution of toxic materials and benefit human health (Yanakittkul and Aungvaravong 2017) and secondly, the recycling of organic wastes increases the amount of organic matter in the soil (Ulm et al 2019). Organic farming environs the various conveniences for the representation of society such as the performance of social, environmental and economic. Farmers who are involved in professional work and part time work are dangling to pause the organic farming (Heinze and Vogel 2017). Organic agriculture considers as a form of agriculture in which sustainable resources of natural components are used like the application of all bio-products and crop residues. In this way, natural residues and products are used by farmers of organic farming for improving their crop yield and soil health side by side with environmental safety and producing more milk and meat in animals (Epule et al 2015). Demonstrated micronutrients, the larger quantity of antioxidants, without injurious fertilizers, chemicals, pesticides, good in taste and more other things are contained in organically produced foods generally and it keeps the plant sustainable and controlling environmental balance (Deshkar et al 2024). Eventually, 3.1 million farmers started their cultivation process organically on the 72.3 million hectares of farmland in the world. Ten top countries are certified in area under organic (Fig. 1).

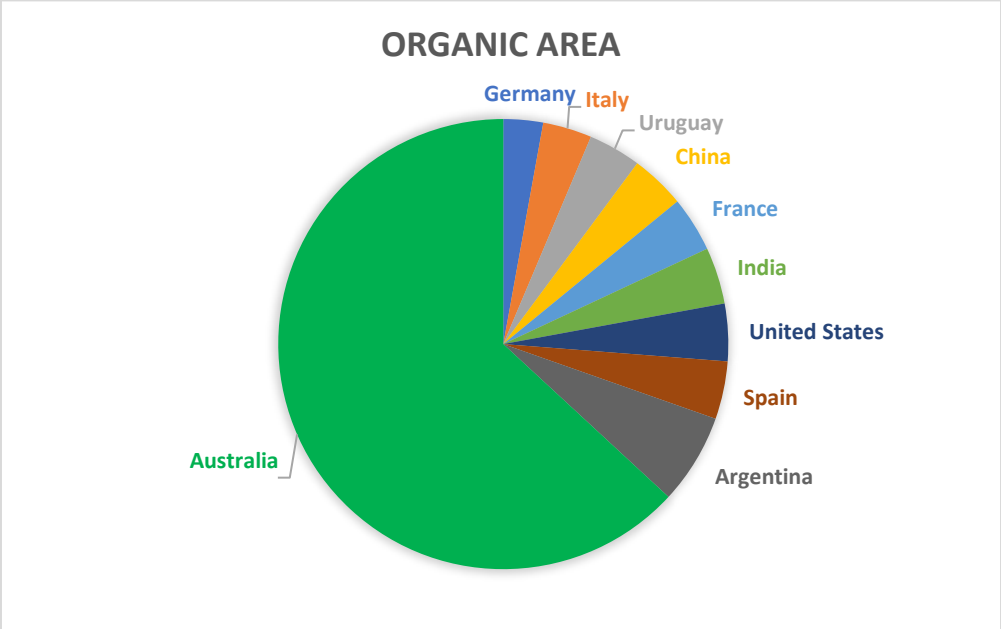


Fig. 1. FiBL & IFOAM - Organics International survey 2021

Table 1. Exportable organic crops from India

S.No	Commodity Type	Goods
1.	Fruits	Pineapple, orange, banana, passion fruits, cashew and mango
2.	Plantation	Cocoa, tea and coffee
3.	Vegetables	Onion, okra, potato, tomato and brinjal
4.	Pulses	Black gram and red gram
5.	Oil seeds	Sunflower, sesame and castor
6.	Spices	Ginger, nutmug, turmeric, cardamom, chilli, black paper, vanilla and clove
7.	Nut	Walnut
8.	Others	Herbal extracts and cotton

(Source: APEDA)

2. SUSTAINABLE AGRICULTURE

Incessantly, many resources and foods are supplied by agriculture considering the world's expanding population (Knapp et al 2018). It is crucial in a number of ways in any activities of human and human existence (Gondchawar and Kawitkar 2016). However, there are a variety of issues that hamper agriculture's ability for the purpose of people in the present as well as the future. These issues include land degradation, a rapid loss of biodiversity, climate change, pollution, the depletion of water resources, increasing expenses of production, and a decrease in farm numbers. (Peters 2010; Rivera-Ferre et al 2013; Thrupp 2000). Agriculture is not only imperative to deal with these worries, but it is also a major contributor to them given how it has been practiced over the past few decades (Koohafkan et al 2012; Goodland 1997). Sustainable agriculture is a production practice of animals and plants with the application of site-specificity, that will progress over time i.e., satisfy the need for human food and fibre, enhance the quality of the environment, sustain the farm operational economic viability and increase the way of life of farmers and the state of society (U.S. Farm Bill 1990).

3. ORGANIC FARMING IN INDIA

In India organic agriculture was promoted by the declaration of Sevagram in 1994, organic farming has raised more laps and this system was strong with the bits of help of initiatives at the non-governmental and governmental levels (Fig. 2). The national standard was developed in India by the National Programme for Organic Production (NPOP) and all strategies and support for the encouragement of organic farming were done by the National Project on Organic farming (NPOF). India is just beginning to develop organic farming and 2.65 million hectares of farmlands are cultivated under organic farming conditions (Gopinath et al 2022). Rajasthan, Madhya Pradesh and Maharashtra – the half cultivated areas of these top three states come under organic cultivation. During the time of the green revolution in 1966, all scenarios in agriculture were changed by the promotion of high yielding varieties and usage of a huge number of fertilizers and pesticides for higher food production and security. Besides, decreasing health of the soil and increasing the toxicity of food through the application of a larger quantity of synthetic fertilizers and pesticides and making it harmful to consumers. The reasons for organic farming are; firstly, the food industries of organic farming are raising quickly and assuring more profitableness. Secondly, to maintain our environment's health and vitality, which is primarily feasible through organic farming on a social, environmental, and economic level. Thirdly, to stop using artificial fertilizers and pesticides that are harmful to human health and deteriorate soil health over time by being ingested through food. Fourthly, the walkout of the balance between the livelihood and environment turns out to be exceptionally monumental because of the harmful effects caused by the practices of conventional agriculture.

3.1 Organic Components for Plant Nutrients

By the application of a huge amount of synthetic fertilizers and pesticides increases the production of crops besides air, water and soil are also be polluted. Severally, this conventional farming system improved distrust in farmer's minds about a sufficient and quality food supply (Vassilev et al 2015). By include organic matter helps maintain soil health and fertility while simultaneously enhancing the soil's physical, chemical and biological properties in an organic agricultural system (Tejada et al 2016). Because of this, farmers started using organic materials, which are explained below.

3.1.1 Crop rotation

Crop rotation, or cycling the crops for two or more years on the same plot of land, is the most crucial practice in the organic farming system and this practice helps to reduce pests, diseases, weeds and weed seeds while also improving soil fertility. For instance, growing leguminous crops in rotation enhances the condition of soil fertility (Biernat et al 2020).

3.1.2 Crop residues

Crop residues are the residues of the crop left on arable land after harvesting the crop. They not only improved erosion control but also fixed the CO_2 in the soil, reduced the loss of evaporation, increased the concentration of organic matter, and sometimes also used it as biofuel (Laamrani et al 2017; Liang et al 2012). When crop residues act as green manure and supply nitrogen in the soil during the time when crops are grown, it reduces the usage of artificial fertilizers (Raheem et al 2019). Mainly, leguminous crops are used

as green manure crops, but they are not suitable for long-duration crops due to the quick decomposition of crop leftovers and the short supply of nitrogen (Rothe et al 2019). Decrease the usage of synthetic fertilizers for the use of crop residues as green manure through nitrogen fixation and the supply of nitrogen in the process of biological decomposition (Zhou et al 2020). In this process, the yield of the crop increases through the use of crop residues like green manure (Subaedah et al 2016). Crop residues are not only used as manure but also to control nematodes and weeds without reducing the yield of crops (Puig et al 2019).

3.1.3 Organic manure

Organic manure refers to Manure, which is the waste materials of animals and plants that are used in order to give plant nutrients (Chhonkar 2002). Utilizing organic Manure, organic farming makes a substantial contribution to the growth of agricultural sustainability. (Jiang et al 2022). Directly, organic manure serves to promote the growth of the crop due to the supply of things that are humic and increases the availability of microorganisms, improving soil productivity (Aisha et al 2014). Depending on the concentration of nutrients, organic manure has two groups, e.g., bulky organic Manure and concentrated organic Manure (Reddy & Reddy 2021).

3.1.4 Bulky organic manure

A lower percentage of nutrients are present in bulky organic Manures as comparison with concentrated organic Manure. The result is, a huge amount of bulky organic Manure is necessary for supplying the food substances in the plants (Sohail et al. 2019). Parts of bulky organic Manures are Farmyard Manure (FYM), Compost and Green Manure (Reddy & Reddy 2021).

3.1.5 Farmyard manure (FYM)

The nicely decomposed blend of cow dung, urine of the farm animals, litter of the farm and remnant materials of fodder or roughages of cattle are known as farmyard manure. Farmyard manure that has nicely decomposed comprises 0.5 % nitrogen, 0.2 % phosphorus and 0.5 % potassium (Tandon 1992). Different methods of preparation of FYM are the pit or trench method, box method and heap method.

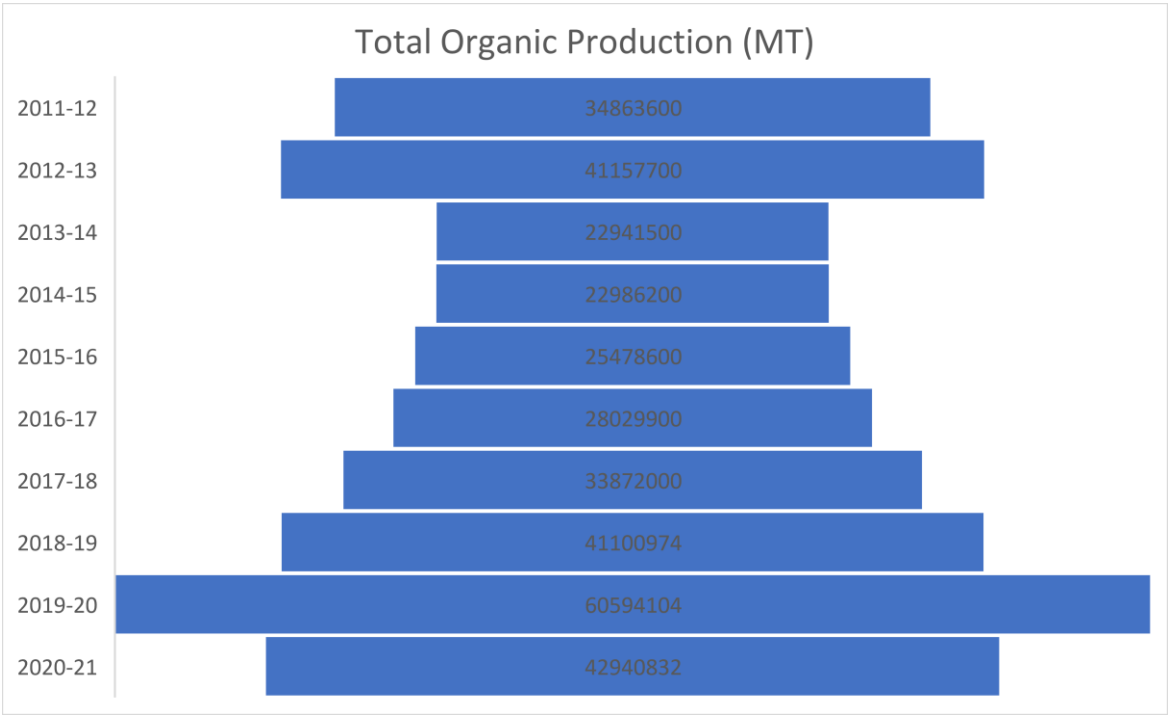


Fig. 2. Last 10 years total organic production statistics in India
(Source: FiBL survey 2021)

Table 2. Nutrient percentage of concentrated organic Manure based on Livestock

Organic manure	Nitrogen (%)	Phosphorus (%)	Potassium (%)
Sheep and goat manure	3	1	2
Poultry manure	3.03	2.63	1.4
Fish meal	4-10	3-9	0.3-1.5
Raw bone meal	3-4	20-25	-
Meat meal	10.5	2.5	0.5
Steamed bone meal	3-4	20-25	-
Blood meal	10-12	1-2	1.0
Horn and hoof meal	13	-	-

(Source: Reddy & Reddy 2016)

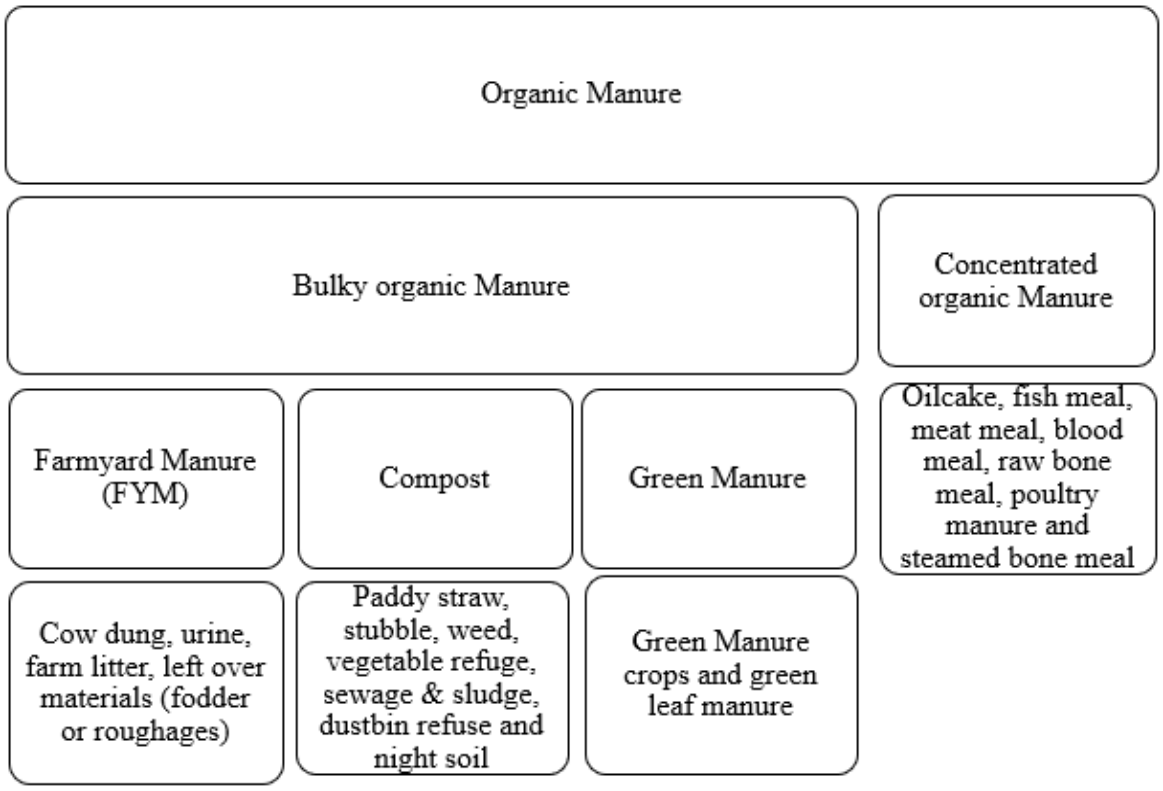


Fig. 3. Different kinds of organic Manures
(Source: Reddy and Reddy 2016)

Table 3. Non-symbiotic nitrogen fixing bacteria

S.No.	Kinds of Bacteria	Example
1.	Aerobic nitrogen-fixing bacteria	• Non-photosynthetic: *Azomonas, Azotobacter* • Photosynthetic: *Chromatium, Chlorobium*
2.	Anaerobic nitrogen-fixing bacteria	• Non-photosynthetic: *Clostridium* • Photosynthetic: *Rhodospirillum*
3.	Chemosynthetic bacteria	• Heterotrophic: *Desulfovibro*
4.	Cyanobacteria	• Heterocyst: *Anabaena, Calothrix, Nostoc* • Non-heterocyst: *Lyngbya, Oscillatoria*
5.	Free living Fungi	• Pullularia and Yeasts

(Source: Plant Physiology and Bio-chemistry by Dr. H.N. Srivastava, 2019)

3.1.6 Compost

The huge amount of waste materials like paddy straw, weeds, sugarcane trash and other waste is converted to compost manure through the decomposition of an anaerobic process. The nicely decomposed compost manure comprises 0.5% nitrogen, 0.15% phosphorus and 0.5% potassium. Several kinds of compost are present such as tow compost, sewage and sludge compost and vermicompost (Reddy & Reddy 2021).

3.1.7 Green manure

Green manure refers to the manure which is made by the decomposition of green plant materials. Green manure is made in two ways like green manure crops and green leaf manure. Some important crops for green manure are sunnhemp, dhaincha, sesbania and clusterbeans. Some weeds also plays a significant role as green manure crops like Parthenium (*Parthenium hystorophorus*), Water hyacinth (*Eichhornia crassipes*) and Cassia (*Cassia fistula*), etc. (Reddy & Reddy 2021)

3.1.8 Concentrated organic manure

A higher percentage of nutrients are present in concentrated organic manure in comparison to bulky organic manure. As a result, a lower amount of organic manure are required to supply plant nutrients. Some important concentrated organic manure is blood meal, oilcake, fish meal, meat meal, hoof and horn meal, steamed bone meal, raw bone meal, poultry manure and sheep and goat manure (Reddy & Reddy 2021).

3.2 Biofertilizers

Biofertilizers refer to biological substances which act as fertilizers and have the ability to enhance fertility of the soil by the fixation of nitrogen which is present in atmosphere through the activity of mycorrhizal fungi and bacteria. They not only fix the nitrogen but also increase the growth of the crop and produce biomass. Two types of biofertilizers are present in the soil e.g., Non-symbiotic nitrogen fixation Organisms freely present in the soil or stay out of the plant cell are known as non-symbiotic nitrogen (Reddy & Reddy 2021).

3.3 Nitrogen Fixation

These bacteria come into close proximity to the roots of grasses and cereals and fixing the nitrogen. This loose mutualism connection is known as associative nitrogen fixation. The associative bacteria in a root are *Beijerinckia*, *Azospirillum brasilense,* and *Azotobacter paspali*. whereas symbiotic nitrogen fixation refers to the fixation of nitrogen symbiotically and the building of a mutualistic relationship between plants and bacteria. This symbiotic nitrogen fixation occurs in three processes: nodule development as a means of nitrogen fixing in leguminous crops; nodule development as a means of nitrogen fixing in non-leguminous crops; and fixation of nitrogen through the non-nodulation process (Plant Physiology and Bio-chemistry by Dr. H.N. Srivastava, 2019**)**.

3.4 Bio-Pesticides

When pests are controlled and managed by the application of biological products and bio-organisms, those pesticides are known as bio-pesticides. Disturbances occur in ecology due to the bad effects on non-targeted insects through the regular application of synthetic pesticides. And developed resistance power in insects due to the continuous application of the same synthetic pesticides (Azeem et al 2019).

3.5 Pesticides from Plants are Phytochemically Diverse

Ahmad et al (2017) reported that secondary metabolites having antibacterial, antifungal, antioxidant or insecticidal properties, including alkaloids, terpenes, steroids, tannins, resins, phenols and flavonoids make up for the most part of the prevalent plant based insecticides contain bioactive substances. The growing demand for organic products of plant in the food, agriculture and medical fields have prompted research into chemical makeup of substances in many plant families (Jnaid et al 2016; Plata-Rueda et al 2017). For instance, *Jatropha carcus* seed kernels are rich in esters, flavonoids and phenolics (Oskoueian et al 2011) While tannins and flavonoids are the main bioactive compounds in the leaves of *Mentha piperita* (Pramila et al 2012). Given plant species are effective against a particular class of pests due to the particular chemicals that those species contain (Table 5).

3.6 Effect of Synthetic Fertilizers and Synthetic Chemicals on Plants and Soil

Contamination of surface bodies of water in conjunction with soil fertility and groundwater, reduces crop production and increases the

hazard of human inanition due to the use of higher amounts of nitrogen fertilizers (Narayan 2005). Excessive use of synthetic fertilizers that are not uptaken by the plant remains in the soil and may result in water pollution and be harmful to living beings (Rashmi et al 2020). Increases nitrification besides increased soil acidity. Excessive use of synthetic fertilizers causes the deficiency of micronutrients like zinc and manganese (Ojeniyi 1981). The increased decomposition rate of organic matter because synthetic fertilizers have been used as a result of huge amounts of nutrients lost by gas emission, leaching and fixation from soil (Alimi et al 2007). Use of excessive amounts of inorganic fertilizers results in shattering the soil organisms, decomposers and environment in the soil (Gruhn et al 2000). Nutrient imbalance occurs because of excess use of synthetic fertilizers resulting in less production of crops (Ojeniyi 2002). Soil health is disintegrated by the over cropping on a long-term basis and continuous application of synthetic fertilizers and synthetic chemicals without the input of organic matter and environmental pollution also occurs (Albiach et al 2000). Long-term application of chemical fertilizers can change the soil pH, increase acidification, causes pests and crusting problems in soil which are influenced by the low amount of organic substance and humus in soil, as a result of decrease the microbial activity and stunted growth of the plants (Pahalvi et al 2021).

Table 4. Different name of organic pesticides

Name of organic pesticides	WHO class	Plant genera	References
Eucalyptol (1,8- Cineole)	III	Blumea, Alpina, Eugenia, Piper, Zingiber, Salvia, Laurus	FAO: Rome, Italy, 1999
Allyl sulfide	III	Allium	Musk et al 1997
Citronella	U	Cymbopogon, Corymbia, Citrus,	Opdyke 1979
Citral (Geranial + Neral)	III	Thymus, Lippia, Piper, Eucalyptus, Zingiber	Isman 2006
Zingiberene	U	Zingiber	Koul 2016; Lis-Balchin 2006
Menthol	III	Thymus, Mentha	FAO: Rome, Italy, 1999
Thymol	II	Carum, Ocimum, Anabasis, Thymus	Isman 2006

Table 5. A few examples of plants with antibacterial properties, together with the target disease and their active components

Plant name	Target pathogen	principal active chemical component	References
Allium cepa	*Escherichia coli*	2,2-diphenyl-1-picrylhydrazyl	Abdel-Salam et al 2014
Mentha piperita	*Staphylococcus aureus, Enterococcus faecium, Bacillus subtilis*	neomenthol, menthone, menthol, methyl acetate, acetylmenthol	Sokovic et al 2010; Pramila et al 2012; Kokina et al 2018
Origanum spp.	*Micrococcus luteus, Basillus spp, Serratia marcescens, Saprophyticus*	Terpinen, alpha-Terpinen,o-Cymene, alpha-Terpieol, Thymol, p-Cymene	Sharoba et al 2015; Plant and Stephens, 2015; Saaed and Tariq, 2009
Lantana camara	*Escherichia coli Klebsiella pneumoniae*	9,12,15-octadecatrienoic acid, caryophyllene oxide, Hexadecanoic acid, Phytol	Pawar et al 2013; Swamy et al 2015
Citrus spp.	*Staphylococcus aureus, Salmonella enterica, Escherichia coli, Pseudomonas putida*	*Neoeriocitrin, Neohesperidin, Eriodictyol, Hesperetin, Naringin, Limonene, Naringenin, Tetrazin, Coumarin*	Dhanavade et al 2011; Mandalari et al 2007

Table 6. Effect of organic materials on productivity of crop

Crop	Nutrients	Reaction	References
Cowpea (*Vigna unguiculata*)	N, K, P, Ca^{2+}, Mg^{2+}, Fe, Zn and Cu	Enhanced the available form of P, K, Fe and decreased total nitrogen in the system of organic systems over the mainstream farming systems.	Suja et al. *(*2017)
Rice (*Oryza sativa*)	N, K, P and micronutrients	The higher straw yield was obtained by the applying of organic substances as comparison with applying of only chemical fertilizers.	Khursheed et al. (2013)
Wheat (*Triticum aestivum)*, Potato (*Solanum tuberosum*) and Clover (*Trifolium sp*.)	P, K, Mg^{2+} and Ca^{2+}	The larger Mg^{2+} and Ca^{2+} availability in the farming systems of organic as comparison with mainstream farming.	Mader et al. (2002)
Cashew (*Anacardium occidentale*)	Nitrogen	Availability of nitrogen was high (435 kg ha^{-1}) in case of organic farming over conventional farming (402 kg ha^{-1}).	Mangalassery et al. (2019)
Citrus (citrus x sinensis)	Nitrogen	2 ton ha-1 more nitrogen present and 0-100 cm stocked in organic farming system than in the system of conventional farming.	Escanhoela et al. (2019)

3.7 Benefits of Organic Farming

Increasing the health of the soil because of the applying of organic substances (Mensik et al 2018). Reducing environmental pollution and maintaining environmental health through the applying of organic manures and followed through organic farming (Panhwar et al. 2019). Increasing the production of products of agriculture with organic farming in a sustainable way (Timsina 2018). Enhancing soil fertility and productivity by maintaining ratio of C:N of the soil due to the application of organic materials (Yu et al 2020). Organically produced products generated attention in both consumer's and producer's minds due to their nutritional quality (Magnusson et al 2003). The larger dry matter contained in the organically produced tuber and leafy vegetables as compared to a product of conventionally produced (Bourn and Prescott 2002). Lesser protein is contained in the organically produced cereals but lysine contained in wheat is higher over the conventionally produced cereals and wheat (Brandt et al 2001). Organically produced products includes more dry matter, antioxidants and minerals but no presence of residue parts of pesticides as compared to conventionally produced products (Lairon 2010). Organically produced tomatoes contain high amount of salicylic acid as compared to conventionally produced tomatoes (Rossi et al 2008). Organically produced products are produced without the use of pesticides so, no pesticide residue is present in these products (Lung et al 2001). In addition to not having any negative effects on environmental contamination, organic agricultural systems have a protective aspect for the preservation of the environment (Oquist et al 2007). Higher water holding capacity and good soil health and produced higher yield due to the following of organic farming system (Pimentel et al 2005). Much labour is required for the cultivation of organic farming and the job of income generating create in farms (Halberg 2008). Costs of organic products are 10-40% extra as compared to conventional products (Winter and Devis 2006). 30 % more jobs are generated in organic farming systems in rural areas and gain higher output (Pandey and Singh 2012). The balance and interdependence of plants, nutrients, soil microbes, the environment, and humans are the primary goals of the organic farming system (Berova et al 2010).

3.8 Effect of Organic Materials on Productivity of Crop

A recent meta-analysis in the coverage of global data displays that crop yield of organic farming is on the mean of 60-65% (Seufert et al 2012), 80% (De Ponti et al 2012) and 81% (Ponisio et al *2015)* yield of conventional. Biological materials in liquid form contain fewer growth stimulants and nutrients, which serve as a foundational element for reviving the growth cycle by reducing

chemical, physiological, and physical imbalances (Natarajan 2002). The grain output of rice and chickpea significantly increased by the application of Dhaincha (*Sesbania aculeata* L.) in organic farming (Singh et al 2001). As reported by a number of researchers, earthworm activity is higher in organically managed fields than it is in chemical agriculture (Edwards and Lofty 1974). Earthworms and microbes interact during the biodegradation process to produce vermicompost, which is worm faeces mixed with worm castings. Microelements including Fe, Mo, Zn, and Cu, along with macro elements like N, K, P, Ca and Mg were provided by vermicompost (Amir and Fouzia 2011). Nitrogen, phosphorus, and potassium, in that order, made up 0.74, 0.97, and 0.45 percent of the vermicompost (Kumar et al*.* 2021). In low-potential areas, compost and liquid manure are used during top dressing practices for growing maize performed much better than the practices used by conventional farmers today, which mix the used of manure and mineral fertilizers and the grain yield of maize were 11-17% greater than those produced using traditional methods (Onduru et al 2002). According to Tamaki et al (2002), continuous organic farming resulted in superior rice growth than conventional farming. Chan et al (2008) proposed that in three distinct places, the input for growing organic rice was 46,25 and 22% greater than for growing mainstream rice, yet the resulting yields were only 55, 94 and 82% of mainstream rice output respectively. Nevertheless, the higher premium prices of organically produced crops in the markets make up for the lower yield for greater input costs. With the usage of organic fertilizers throughout time, a steady rise in grain output was seen (Surekha 2007).

3.9 Impact of Organic Materials on Soil Fertility and Biological Properties

Organic carbon in soil, deposition of heavy metals, depletion of nutrients and soil compaction are affected by the pressures which is made by humans in agricultural soil (Smith et al 2016) Comparison organic farming systems to conventional farming systems, organic farming systems are more likely to have higher levels of organic carbon in the soil and side by side recycling of the organic matter and crop rotation with the leguminous forage crops in organic agriculture (Gattinger et al 2012). Research work was completed by Diacono and Montemurro (2010) and they reported that levels of organic carbon in the soil increased by enhancing yield which leading to an increase in crop residue and organic waste. Increasing the production and yield of crops by the applying of organic materials as fertilizers and these materials increased the organic matter in soil and long-term sustainability of nutrients in soils (Oelofse et al 2013). Rural and urban waste materials are used as compost making materials but waste materials in urban areas are toxic due to containing heavy metals which creates problems for living beings (Rupani et al. 2019). Ansari and Kumar (2010) reported that soil organic carbon increases with the applying of vermicompost and vermin-wash in soil. N, K, P, Mg, Cu, Ca, Fe and Zn nutrients are includes highly in use of chemical fertilizers treatments followed by vermicompost and vermin-wash treatments (Ramesh et al. 2010). According to Tharmaraj et al. (2011) proposed that enhanced the chemical properties (EC and PH), physical properties (moisture content, porosity and water holding capacity) and soil fertility (N, K, P, Mg and Ca) of soil by the applying of vermicompost along with spraying of vermiwash as comparison with the application of chemical fertilizers. An experiment was done by Dubey et al*.* (2014) and they reported that in case of 100 % organic farming system soil contains a good amount of nitrogen and organic carbon side by side controlling the content of potassium and phosphorus in soil in the initial stage. On but another hand, 100 % inorganic farming system soil contains enough amount of nitrogen and organic carbon besides less amount of potassium and phosphorus seen in the initial stage. A higher number of bacteria is present in the case of organic farming soil (Kumari et al. 2017). Trial work was carried out by Baishya et al. (2015) and they proposed that momentous enhancement in soil nitrogen, organic carbon, potassium and phosphorus after harvesting the crop due to the applying of 2.5 ton ha^{-1} poultry manure. The higher quantity of organic substances in the soil, the biomass of microbes and activity of enzymes on saline soil were increased by the applying of compost, prepared by municipal solid waste (MSW) and palm wastes but some activity was reduced in case of higher application of compost (150 ton ha^{-1}) (Ouni et al 2013).

4. CONCLUSION

The excessive use of synthetic or chemical fertilizers and pesticides in the traditional farming system is to blame for the environmental posture issue for supplying the food demanded by the present generation. Due to this reason, many

countries reduced their applying of synthetic fertilizers and started to practice organic farming. Organic farming requires more effort and time for adoption as compared to conventional farming. The soils chemical, physical and biological characteristics improved with the application of organic materials in the long term and farmer's income also increases. The most crucial element in creating sustainable agriculture is organic farming. I want everyone to practice organic farming.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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