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Organic Farming: A Step towards Better Environment

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Abstract

Organic agriculture is a type of farming that avoids the use of synthetic pesticides and fertilizers in order to protect the health of the soil, environment, and people. Farming techniques should be changed to have a beneficial environmental impact. Due to the presence of more chemical residues in conventional agriculture, food has negative health impacts. Organic farming has grown in popularity as a result of food quality and safety concerns. Organic farming is environment friendly. It is beneficial to the soil's long-term fertility. Organic farming is the finest option for long-term farming since the yield does not diminish with time but rather grows. Integrated organic farming is a zero-waste method in which waste from one operation is used as a resource or nutrient in another. Farmers should consider organic farming as a viable strategy for combating climate change. India has emerged as one of the world's leading organic producers. India has created numerous organic brands of its own. People all across the world are becoming more aware of the dangers of pesticides and are asking for organic foods. Farmers are returning to organic farming owing to the rising threats that conventional agriculture poses to production, human health, and the environment. Organic farming should continue to expand. Organic agricultural techniques should continue to increase, which will help to reduce agriculture's negative environmental implications.

Keywords: Organic farming; Climate change; Biodiversity, Pesticide toxicity; Decomposition; Global warming

Introduction

"If we're looking to feed the world for the next 50 years, conventional can do it. But if we're looking at feeding the world for the next 1500 years, we must switch over to organic."

– Mark Smallwood

The International Federation of Organic Agriculture Movements (IFOAM) defines organic agriculture as a "production system that sustains the health of soils, ecosystems, and people". Agriculture contributes to climate change. Different agricultural practices have different impacts on the environment, and they vary widely based on the practices adopted along with the scale of activity. Modern farming techniques such as usage of pesticides, synthetic fertilizers, etc. to optimize crop production change the nitrogen balance of soil and soil fertility. Additionally, it penetrates groundwater through soil (Howard, 1943). Other than the target species, more than 98 percent of sprayed pesticides and 95 percent of sprayed herbicides are distributed across the entire agricultural field.

Pesticide toxicity is its capacity to cause injury or illness. Pesticides vary in the levels of toxicity that depend on their chemical and physical features. It also depends on the quality of being lethal to the ecosystem and its dose. Toxicity can be acute or persistent. Acute toxicity demonstrates immediate impacts of pesticides, i.e., a few hours or days, while chronic toxicity entails long exposure to the pesticides. Acute health effects include dizziness, nausea, rashes, stinging eyes, diarrhoea, skin damage, severe burns, and blindness. Such insecticides are harmful after a single big dose, with short-term exposure. Acute toxicity is measured by the values of LD₅₀ and LC₅₀. The LD₅₀ refers to the pesticide lethal dose that kills 50% of the animals tested. The treatments are dermal or oral. The smaller the LD₅₀, the more hazardous the pesticide is. The LD₅₀ value is given in mg/kg body weight. A pesticide with an LD₅₀ of 1 mg/kg is 100 times more dangerous than the LD₅₀ of 100 mg/kg. LC₅₀ is evaluated when the breathing air of the animal under examination is mixed with the pesticides in any form, such as sprays or dust. LC₅₀ is defined by the specific exposure time. The duration of exposure is essential as shorter periods demand higher pesticide concentrations.



Chronic effects may be undetected for weeks, months, or even years after exposure. Chronic health effects include cancers, damage to reproductive health (birth defects, sterility, damage to hormone-producing glands that can cause trouble with reproduction and childbirth), immunotoxicity, toxic hepatitis, and damage to the nervous system (anxiety, mood changes, loss of memory, trouble concentrating). Such pesticides are hazardous after repeated modest doses. Chronic exposure may include oral (through the mouth), dermal (through skin or eyes), inhalation poisoning (through lungs), or both lungs. Children are more vulnerable because they are still developing and any exposure during a specific early developmental stage can give them irreparable damage.

Table 1. WorkSafeBC defines these groups as shown in the following table.

Relative toxicity of pesticides to human based on acute oral and dermal LD ₅₀ 's		
Acute toxicity	Oral LD ₅₀	Dermal LD ₅₀
Very	Less than 500 mg/kg	Less than 500mg/kg
Moderate	500 to 1000 mg/kg	500 to 1000 mg/kg
Slightly	1000 to 2000 mg/kg	1000 to 2000 mg/kg

(Source: Hans and Rao, 2018)

Table 2. The Pest Management Regulatory Agency requires a symbol on the label that represents the relative toxicity of the product:

Labels and toxicity symbols				
Poison Hazard symbols				[No Symbol]
	Danger Poison	Warning Poison	Caution Poison	Very low toxicity
Acute oral LD ₅₀	Less than 500 mg/kg	500-1000 mg/kg	1000-2000 mg/kg	Greater than 2000 mg/kg
Acute dermal LD ₅₀	Less than 500 mg/kg	500-1000 mg/kg	1000-2000 mg/kg	Greater than 2000 mg/kg

(Source: Hans and Rao, 2018)

Organic farming became popular after the rising knowledge about the detrimental impacts of modern industrial agriculture among people. To lessen the environmental implications several farming community practice organic farming. Organic farming is an environment friendly technique. It is an effective and promising agricultural technique for environmental sustainability as it promotes soil health; gives yield stability, minimal environmental damage, organic food and no use of artificial fertilizers. Under National programme for organic production (as on March 2021), total area registered under organic certification procedure is 4339184.93ha (2020-21). Among all the states, Madhya Pradesh has covered the most area under organic certification which is followed by Rajasthan. In 2016, Sikkim made an exceptional feat of converting its full cultivable land (more than 75000ha) under organic certification. Indian state Sikkim is currently world's first state that is 100 percent organic. The state has earned the prestigious Future Policy Gold Award from the UN Food and Agriculture (FAO), after beating around 51 nominees from around the world. Sikkim is a pride of the nation. India ranks 16th position in terms of total land area under Organic Agriculture (Willer and Julia, 2014).

Currently, around 12 states—Sikkim, Telangana, Madhya Pradesh, Bihar, Uttar Pradesh, Tamil Nadu, Chhatisgarh, Rajasthan, Gujarat, Uttarakhand, Odisha, and Karnataka—have state organic certification agencies that are accredited by APEDA (Agricultural and Processed Food Products Export Development Authority). Some states have produced organic brands like Bastar Naturals, Kerala Naturals, Organic Manipal, Tripura Organic, Naga Organic, Nasik Organic, Organic Rajasthan, etc. Organic farming does not use the hazardous practices of conventional agriculture. In essence, organic farming protects and promotes the quality of the environment; hence it is intimately tied to sustainable development. They also cultivate drought-resistant crops that grow well even with low water availability. Another example is from Tamil Nadu, India, where traditional organic farming gives the only glimmer of hope. Farmers in Tamil Nadu escaped the terrible drought by adopting traditional organic agricultural practices.

Decomposition of organic matter

Decomposition is a generic word used to describe the interconnected processes by which organic matter is broken down into CO₂ and humus with a continual release of nutrients. Along with the microbes, the soil fauna is also responsible for the decomposition of organic matter in agricultural fields. Certain agricultural approaches used in organic agriculture provide litter decomposition services, which increase the amount of nutrients available to plants. It's also crucial for plant growth because it helps to keep the soil structure and quality stable. When compared to other agricultural farming practices, empirical research reveals that organic farming has both higher and lower litter decomposition rates.

The increased rates of decomposition are explained by soil fauna with larger populations (Tuck et al. 2014). The pace of decomposition is determined by the litter quality and the surrounding environment. The C:N ratio is one of the major litter quality variables for decomposition. The carbon-to-nitrogen ratio (C/N ratio or C:N ratio) is the weight of carbon in organic remains divided by the weight of nitrogen. The C:N ratio is significant since it has a direct impact on residue decomposition as well as nitrogen cycling in our soils. The ideal C:N ratio for agricultural waste breakdown is 24:1. It can be used to examine sediments and soil, as well as soil organic materials and additions like compost. A nitrogen shortage (immobilization) will occur if the C:N ratio is greater than 24:1, while a nitrogen surplus will occur if the C:N ratio is less than 24:1. (Mineralization). Pesticides have an impact on the quality and structure of the soil. Pesticide retention in the soil is influenced by pesticide qualities such as water solubility and polarity, as well as soil quality factors such as organic matter, pH, permeability, and clay concentration.

Soil

All around the world, conventional agriculture poses a serious threat to soil deterioration. The increasing intensification of agriculture has an impact on soil physical features, soil fertility, microbial populations, soil nutrients, and soil enzymes. Organic fertilizers such as manure, dung slurry, and vermicompost are used to manage soil organic matter, while synthetic fertilizers are used in intensive agriculture. In the last 40 years, as the population has grown, pesticide use has expanded to meet the rising demand for yield. Pesticides have an effect on the activity of soil enzymes, which are necessary catalysts for preserving soil quality. Soil enzyme activity regulates nutrient cycles and, as a result, soil fertilization. Even if organic fields do not receive manure or both organic and inorganic fields receive manure for long periods of time, organically maintained soils have higher carbon content.

There was a 4-6% higher yield in case of organic farms when comparison between 60 organic and 60 conventional farms of cotton in Central India was done. Farmers realized they need less irrigation rounds and organically produced cotton sustains longer periods of droughts (Eyhorn et al., 2009).

Kenya was hit by a severe drought, which resulted in the loss of field crops. Kenya's food production has been hampered by a lack of precipitation, particularly brief showers. According to organic farmers in Kenya, they have been impacted to some level but still have some produce

to offer due to good soil that was only feasible through organic farming. When they moved to organic farming, their soil type changed, allowing them to retain more water than non-organic farmers. They have more seasons, or rather a longer season, since the land holds more water.

Some farmers in the major coastal agricultural region of Vedaranyam, in Nagapattinam district, overlooking the Bay of Bengal Sea, have withstood the drought by returning to traditional farming methods with basic yet inventive tactics. This aids them in combating soil salinity, which has increased as a result of seawater intrusion and a lack of irrigation water. The Centre for Indian Knowledge Systems, a district-based NGO, has been offering technical assistance to farmers for more than two decades, as well as assisting them in making the transition from chemical to organic farming. It has provided drought-resistant, traditional crops that use less water, prompting farmers to construct rainwater storage ponds. The increased N content and microbial activity show that organic farming has a positive impact. Organic farming enhances soil physical qualities, including water holding capacity, bulk density, and aggregate, for example, by increasing earthworm activity, which avoids soil erosion and makes the soil more fertile.

Pesticides contribute to global warming

According to research by an intergovernmental group on climate change, agricultural activities, including pesticide usage, account for around 30% of global emissions that cause climate change. The main cause of global warming is the release of greenhouse gases. Pesticides contribute to global warming throughout their life cycle, from production to application. When pesticides are manufactured, three major greenhouse gases are released: CO₂, CH₄, and N₂O. Every year, more than 200 million pounds of agricultural pesticide active ingredients are applied in California, with more than 40 million pounds of fumigants, which are among the most dangerous and largest contributors of greenhouse gases. The use of fumigants has been demonstrated to lead to the formation of N₂O, a 300-fold more powerful gas than CO₂. Over a 100-year time scale, the atmosphere warmed by one pound of N₂O is nearly 300 times warmer than the atmosphere warmed by one pound of CO₂. N₂O is a harmful greenhouse gas that contributes to climate change. Nitrous oxide depletes the ozone layer as well. Before being removed by a sink or destroyed by chemical reactions, nitrogen oxide molecules spend an average of 114 years in the atmosphere. The process of removing N₂O from the atmosphere depletes ozone levels. Climate change, according to scientists, will increase the chance of pests spreading throughout the ecosystem. Pests such as the Fall armyworm and Tephritid fruit flies have already established themselves in warmer climates. Other pests, such as the world's most devastating migratory pest, the Desert locust, are projected to shift their migratory patterns and geographical distribution as a result of climate change. Invasive pests are also a major contributor to biodiversity loss.

According to John Bohr, Chairman of the University of Notre Dame's Department of Biological Sciences, an increase in insect populations can lead to an increase in crop illnesses, which could lead to more chemical applications. Many infectious plant diseases are spreading when insect populations increase as a result of climate change. Plant pests including weeds, animals (mainly invertebrates), pathogens like bacteria, viruses, fungi are causing losses around 40% to major crops worldwide (Oerke, 2006). As a result, pesticide use promotes climate change, which leads to an increase in the pest population, which leads to more pesticide use to eliminate the pests. Organic farming has no negative impact on the environment, and the waste generated by organic farming is used as a resource. Therefore, there is no risk of climate change as a result of organic farming. Organic farming is assisting farmers all around the world in their efforts to combat climate change.

Pesticides have a negative impact on biodiversity

Pesticides have a negative impact on biodiversity. They might be toxic in the short term as well as the long term. Rachel Carson's environmental science book "Silent Spring," published on September 27, 1962, showed the negative effects of pesticide use on the ecosystem, which is

still relevant today. Pesticides assist farmers in growing food, but they also cause the extinction of many wildlife species. Pesticides, such as DDT and Dieldrin, are among the most harmful and persistent pollutants. After a decade of use, pesticides have been found to be harming our natural resources and biodiversity. Pesticides have the potential to stay in the environment, posing a serious hazard to the ecosystem (Pingali, 1999). According to a UN report by the Special Rapporteur on the right to food, excessive use and misuse of pesticides results in contamination of surrounding soil and water sources, causing loss of biodiversity, destroying beneficial insect populations that act as natural enemies of pests, and reducing the nutritional value of food. Pesticides have played a key role in environmental degradation, according to the European Union's Pesticide Regulation (PPR) (EC) No. 1107/2009. "The goal of this regulation is to ensure a high degree of protection for human and animal health as well as the environment, while also maintaining the competitiveness of community agriculture. The protection of vulnerable groups of the population, such as pregnant women, babies, and children, should be a priority. The precautionary principle should be followed, and this regulation on the market has no adverse effects on human or animal health, nor does it have any unacceptable environmental effects" (in accordance with the European Parliament and Council Regulation (EC) No. 1107/2009).

PAN Europe aims to safeguard pollinators, which are vital to life, and to obtain a neonicotinoid ban. According to them, the EU's Common Agricultural Policy (CAP), which has spent 60 years subsidizing the pesticide business with taxpayers' money, has resulted in biodiversity loss, water pollution, soil fertility deterioration, and harm to people's health. Pesticide-free farming is encouraged by PAN Europe in order to protect biodiversity. They've also launched a new campaign called "Ban #Toxic12." Most of the most harmful pesticides identified on fruits and vegetables are sold in Europe, according to them, and these compounds should have been outlawed long ago. According to research, Brazil is the primary destination for more than half of the EU's pesticide export records linked to the death of bees. They are pesticides with three neonicotinoids: thiamethoxam, imidacloprid, and clothianidin as active. According to studies, there are multiple pesticides detected in bees (Botías et al. 2015, 2016, 2017). Brazil receives 58 percent of the EU's banned neonicotinoid insecticides, produced by Bayer and Syngenta. Bees are dying as a result of this in Brazil, which has more than 300 kinds of native bees. Insect decline has a variety of factors, with intensive agriculture and pesticide use being two of the most common. Insect population decline is mostly caused by the use of chemical insecticides against both target and non-target organisms.

Pesticides sprayed into native forest regions by planes to manage agricultural pests are causing trees to defoliate. Within a few months, these trees become feeble or die. Pesticides are being sprayed into the Brazilian Amazon by planes and helicopters, encouraging deforestation. Glyphosate, carbosulfan, and 2,4-D were among the pesticides discovered by the Brazilian Environmental Agency, IBAMA (Brazilian Institute of Environment and Renewable Natural Resources). Although the pesticide is approved for application by agricultural aircraft, it is illegal in native forests, according to one of the IBAMA agents. This method has been in use since 2018, and it takes longer than clear-cut deforestation. Some of the pesticides sprayed are defoliants, according to IBAMA. This causes leaves to fall or drop prematurely. Chemicals like this are employed in warfare to destroy the enemy's food supply. Furthermore, real-time satellite imaging is unable to detect pesticide applications. This is the method of deforestation that is used in a roundabout fashion. Tropical forests have the most living biomass, resulting in higher biodiversity rates. In tropical rainforests, the required variables such as sunlight, steady water, and dense plant concentration are found, resulting in a massive rise in both GPP and NPP. As a result, greater productivity raises biomass. Tropical environments have the maximum species diversity and are one of the most biologically diverse ecosystems on the planet. The highest mean net primary output of any terrestrial ecosystem is found in tropical rainforests, which means that an acre of rainforest stores more carbon than an acre of any other species of vegetation. Tropical rainforests have the most living biomass on the most fragile soils. Increased deforestation may cause the soil to lose its fertility totally, posing a threat to the environment.

Beneficial predators, pollinators, birds, and aquatic life are all lost as a result of pesticide use. According to studies, the cost of biodiversity loss might be more than \$1.1 billion each year. Supporting organic farming rather than conventional agriculture, which relies on pesticides, is one strategy to mitigate the negative effects of pesticides on wildlife. The positive "feed-the-soil" strategy can aid in the restoration of soil fertility and quality. This benefits the soil's health. This method focuses on improving soil health by removing all substances that degrade soil health, such as chemical fertilizers, and instead focuses on creating a soil food web and nurturing soil microorganisms.

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) regulate pesticides to protect humans and the environment, including wildlife, from "unreasonable adverse effects." The Endangered Species Act (ESA) is one of the most important laws for wildlife protection, while the Clean Water Act (CWA) and the National Environmental Policy Act (NEPA) are also important laws.

Conclusion

Organic farming is environmentally friendly. Improved crop rotations varied cropping methods, decreased tillage, and opportunities to promote the delivery of ecosystem services from both agricultural and semi-natural lands are among the most potential advantages of organic agriculture in enhancing yields. Organic farming techniques must be enhanced and integrated management systems will play a vital role in future agriculture to meet the global demand for food, fibre and fuel. Fruits marketed in many countries have been found to contain pesticide residues at higher concentrations, which are linked to human health issues. Various NGOs and individuals from various parts of the world promote organic farming and provide guidance to farmers all over the world in order to improve the environment. The demand for organic food has increased because of better nutrient availability like minerals, vitamin content and safety issues with the food produced by conventional agriculture. Organic farming has improved the quality of the environment with increased good soils, pest control and plant nutrient management with no loss of biodiversity, good health for people, providing organic food rich in nutrients, a good climate and cleaner air.

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