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Natural Farming: A Path to Sustainable, Eco-Friendly, and Zero-Cost Agriculture

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Current agricultural practices involve adopting hybrid seeds, high-yielding varieties, extensive tillage practices, and monocropping, as well as using broad-spectrum pesticides to control pests, weeds, and pathogens. This is followed by mechanization for intercultural operations and harvesting the crop yields. All these practices increase the cost of crop cultivation. In some instances, by adopting these practices, crop failures caused by natural calamities leave farmers with nothing except an increase in their debt. Additionally, modernization in agriculture increases the emission of greenhouse gases, leading to climate change. Hence, natural farming is proposed as an alternative to the chemical-intensive modern agriculture. In natural farming, all inputs, from seed sowing to harvesting, are prepared by farmers using locally available resources. Natural farming helps increase the quality of crop yields, makes farmers self-reliant, and reduces environmental pollution caused by current agricultural practices.

Keywords: Natural farming, pesticides, farmers.

Introduction

Modern agricultural practices involve the use of extensive tillage, monocropping, the adoption of high-yielding varieties, seed treatment with fungicides and insecticides, synthetic fertilizers and nutrient application, intensive irrigation, weeding with herbicides, pest and disease control with broad-spectrum pesticides, and more frequent and numerous applications, all followed by mechanized crop harvest. Although these practices yield higher results, they have both direct and indirect adverse effects on the environment, human health, and soil health. Due to the excessive use of chemical fertilizers, soil fertility has declined significantly. Extensive tillage and monocropping result in soil erosion, the buildup of pests, and the proliferation of pathogens. The adoption of mechanization results in soil compaction, a decrease in employment opportunities for daily labourers, an increase in the cost of cultivation due to fuel prices, and also results in the emission of greenhouse gases, which leads to climate change. Excessive irrigation and fertilizer application cause nitrates and phosphates to leach into the ground and cause water pollution. In some instances, fertilizers entering nearby water bodies cause eutrophication, which results in the excessive growth of algae that depletes the oxygen content.

Pesticides

Currently, most farmers use synthetic pesticides to control pests. These pesticides not only kill the pests but also have several adverse effects on soil health, human health, and the environment. During the time of pesticidal application in the field, either due to runoff from pesticide-treated fields or runoff through rainwater into nearby water bodies, pesticides mix into the water bodies, which leads to the death of organisms in the water or results in the accumulation of pesticides in their fat tissues, known as bioaccumulation, and the transfer of

these chemicals to higher organisms in the food chain, known as biomagnification, which ultimately leads to death or a decrease in the lifespan of organisms. Recently, there have been advancements in the equipment used for delivering pesticides onto crops. Most of the equipment, commonly known as sprayers, is equipped with nozzles that deliver the pesticides in very minute particles known as fog, mist, smoke, smog, aerosol, etc. Most of these particles are lighter than air and are easily blown by the wind, mixing with air particles and travelling long distances, causing air pollution. Many farmers, either during handling of pesticides, during application, exposure due to not using personal protective equipment kits (PPE kits), or from eating food materials containing pesticidal residues, develop severe health problems such as cancers, liver failure, and kidney failure. Many agricultural commodities produced in one country are exported to several other countries, but often these commodities are halted in international trade due to the presence of pesticide residues.

Generally, farmers apply pesticides to control pests that cause damage to agricultural commodities. However, these pesticides, mostly broad-spectrum, kill not only the targeted pests but also other non-target beneficial organisms. For instance, earthworms are known as friends of farmers. In the cotton ecosystem, spiders are considered predators of leafhoppers and aphids. In rice, spiders play an important role in the natural control of BPH, WBPH, leaf folder, and other lepidopteran caterpillars. Several wasps control pests by acting as parasites. All these beneficial organisms are also killed due to the application of pesticides, disturbing the ecosystem's food chains and food webs. Pesticides have been used in agriculture since the 1800s, but no pesticide has completely eradicated pests. This shows that pests have several mechanisms to develop resistance. Due to resistance, farmers need to use more powerful pesticides with higher doses and more frequent applications. This results in an increased cost of cultivation.

Pesticidal Poison

Pesticides indirectly affect human life. In India, several accidental pesticide poisonings have occurred. On April 29, 1958, in the Sasthamcotta region of Kerala, a total of 64 people were killed due to eating chapatis contaminated with Follidol pesticide. In 2008, at Sindhikela, Balangir region of Orissa, the mixing of organophosphate pesticides into drinking water led to 65 people suffering from poisoning and 2 deaths. On July 16, 2013, at Gandaman village of Bihar, 23 to 27 children died after eating a midday meal contaminated with monocrotophos pesticide. In 2017, in the Yavatmal district of Maharashtra, more than 800 farmers were exposed to pesticide poisoning due to inhalation of pesticides from cotton fields. In April 2021, at Ramachandrapuram village of Telangana, 1 person died and 2 were exposed to pesticide poisoning after drinking tea made with pesticide granules due to the mistake of using the granules as tea powder. Hence, we need to search for other options for managing pests at low cost and with greater safety to the environment.

Farmer Debts

Most Indian farmers are small farmers. They need to earn money for their livelihood from that small piece of land. From soil preparation to harvesting, various costs are involved, such as hiring a tractor for soil preparation and tillage, purchasing seeds from stores, fertilizers, weedicides, pesticides, hiring labour and machines for intercultural operations, and harvesting the produce. They need to spend their own money on the field. In some instances, in India, many farmers borrow money from fertilizer shops and other people. Natural calamities like droughts, heavy rains, etc., sometimes destroy the crops and prevent them from repaying the debts. This often results in farmers committing suicide.

Greenhouse Gas Emissions

Modern agriculture is one source of greenhouse gas emissions. It is estimated that approximately 30 to 35% of greenhouse gases come from the food sector, which includes both on-farm and off-farm practices. Various sources of greenhouse gases include enteric fermentation in livestock, improper manure management, paddy cultivation, fertilizer

production units, crop residue burning, and burning fossil fuels for power sources in tractors, machines, and other equipment. These greenhouse gases result in climate change. To overcome this, we need to search for another farming method that causes fewer environmental problems.

Natural Farming

Natural farming is a method of farming naturally without buying external inputs, and all the required inputs are prepared manually from available resources. Natural farming is not a new approach; this method was followed before the discovery of industrial farming (Kumar et al., 2023). In 1937, Sir Albert Howard, in India, put forward the idea of non-chemical farming. Later, from 1940 to 1970, a Japanese farmer and philosopher named Masanobu Fukuoka developed the concept of natural farming and popularized it through a book publication titled *The One-Straw Revolution* (1975). Following this, from 1990 to 2000, an Indian agriculturist from Maharashtra named Subhash Palekar created and promoted natural farming under the name Zero Budget Natural Farming (ZBNF), also known as Subhash Palekar Natural Farming (SPNF). For this contribution, he was awarded the Padma Shri in 2016. From seed sowing to harvesting, natural farming involves the following practices.

Cropping System

In natural farming, instead of following monocropping, several cropping systems like mixed cropping, intercropping, crop rotation, multi-tier cropping, agroforestry, and relay cropping etc. are followed. The main aim of adopting these practices is to save the farmers from total crop failures. In case of monocropping, various factors like a decrease in the market price of products result in an entire loss, but in the following cropping systems, if one crop fails, the other crop will compensate for the loss, and the farmer will benefit. Additionally, in the following cropping systems, apart from income, the subsidiary crop provides many benefits, like covering the soil helps in weed suppression, secreting pest repellent substances, etc.

Tillage

The main aim of natural farming is to give minimal disturbance to the soil. Many beneficial organisms, such as spiders, insect pest predators, and parasitoids, inhabit the soil. If we give minimal disturbance, their populations will increase and help check the population of pests. Additionally, avoiding mechanization for tillage will save the cost of hiring machines and labour, and also help decrease greenhouse gas emissions by reducing fuel burning. Practices like zero tillage and minimum tillage are undertaken in natural farming. Seeds are sown by dibbling or manual planting.

Seeds

In natural farming, desi/native seeds, open-pollinated varieties, heirloom seeds, and farmer-saved seeds are used. All these seeds are indigenous to particular places and are well adapted to those areas. The main reason for using these varieties is that, just as certain animals adapt and live well only in specific environmental conditions like deserts or very cold places, these seeds also perform well in their native environments. These seeds are resistant to the abiotic and biotic stresses of a particular locality. By adopting these seeds, the cost of purchasing seeds will be reduced, and farmers will become independent seed banks.

Irrigation

The main aim of natural farming is to reduce the wastage of water, conserve water, and use it efficiently. Water sources like rainwater harvesting structures can be used for water storage. Soil moisture is conserved by adopting mulching. Practices like providing irrigation only during the critical stages of the crop are known as critical irrigation. By doing so, the cost of cultivation can be reduced by decreasing the use of water pumps, power sources, and fuel costs, ultimately reducing the emission of greenhouse gases.

Weeding

Most people consider weeds to be harmful plants that should be removed from the field to get higher yields. However, this is not always the case. Weeds provide several benefits, such as fully covering the ground and preventing soil erosion from rain and wind. Some leguminous weeds help improve nitrogen content through nitrogen fixation. The penetration action of weed roots helps break up hard clods in the soil, improving soil structure and increasing the water-holding capacity of the soil. When weeds die, they act as soil nutrients, and weed flowers serve as nectar and pollen sources for many pollinators and beneficial biocontrol agents. Additionally, many weeds act as fodder for livestock.

However, weeds also compete with the main host plants for space, water, and nutrients, and many act as hosts for disease-causing pathogens and pests. Hence, weeds should be managed to get higher yields. In natural farming, the main aim is not the complete eradication of weeds but rather to prevent, suppress, and utilize them efficiently. According to Zero Budget Natural Farming (ZBNF) by Subhash Palekar, there are four core principles known as Jeevamrutha, Beejamrutha, Acchadana, and Whapasa. Among these, Acchadana deals with weed management. In the Sanskrit language, Acchadana means “covering” or “to cover,” which refers to mulching. Straw mulching with dry leaves, crop residues, straw, etc., and live mulches like growing leguminous crops or spreading crops such as cowpea and green gram are used. Additionally, cultural practices like adopting dense planting and multicropping systems are followed. All these practices cover the soil fully and prevent sunlight from reaching the ground, which helps in preventing the germination of weed seeds in the soil. Furthermore, mechanical practices like hand weeding with simple and low-cost tools such as sickles and khurpi are also followed.

Fertilizers and Pesticides

In natural farming, no fertilizers or pesticides are purchased from the stores; all are prepared manually using available resources and applied in the field. The basic requirement for the preparation of these concoctions is the cow. In ancient times, cows were treated as goddesses and were kept in every farmer's house, and their by-products, such as cow dung and cow urine, were used in the preparation of fertilizers and pesticides. The same method is followed in natural farming. Various preparations such as Jeevamrit, Beejamrit, Ghana Jeevamrit, Fermented Buttermilk, Rambaan, Sukhi Kandi, Tamar Lassi, Neemastra, Darekastra/Melia extract, Dashparni, Agneyastra, Brahmastra, Saunth Astra, Neem Seed Kernel Extract (NSKE), Lantana extract, Polygonum extract, Eupatorium extract, and Tobacco decoction are used as fertilizers and pesticides.

Conclusion

Natural farming is a sustainable, eco-friendly alternative to chemical-intensive modern agriculture, which depends entirely on inputs made manually by farmers from available resources. Natural farming offers immense benefits such as reducing the cost of cultivation, making farmers self-reliant and not dependent on credit sources for agriculture, conserving biodiversity by maintaining balance in ecosystem food chains, reducing environmental pollution by halting greenhouse gas emissions, and improving the health of farmers, soil, and consumers by providing pesticide residue-free food. Creating awareness among farmers through training programs and providing policies to support natural farming will help encourage its adoption by many farmers.

Reference

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