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Natural Farming: Eco-Friendly and Sustainable?

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Abstract

Healthy soil is the foundation upon which sustainable agriculture is built. Farming practices differ mainly based on soil inputs and crop protection measures. In conventional chemical farming practice, indiscriminate use of chemical fertilizers and pesticides destroy the beneficial soil micro flora change the soil nature and also contribute to the high crop production cost. Heavy metals from the polluted soil may enter the food chain in significant amounts and show adverse health effects. The essence of natural farming is to minimize the external inputs to the farm land, and nurture the soil fertility. It was shown that enrichment of soil occurs through propagation of beneficial soil microbes. It encourages the natural symbiosis of soil micro flora and crop plants. Mulching can maximizes the moisture content in the soil, forms the cover for the earthworms and minimizes the weed propagation. This paper reviews the concepts of natural farming in the context of its eco-friendly nature and sustainability.

Keywords: Natural farming; Chemical farming; Beejamruth; Soil micro flora; Mulching; Jeevamruth

Introduction

Conventional Chemical farming is facing either reduced production or increased costs, or both [1-4]. Farming monocultures, such as Rice, wheat and Cotton etc., repeated on the same land results in the depletion of topsoil, soil vitality, groundwater purity and beneficial microbes. It is finally making the crop plants vulnerable to parasites and pathogens. Environmental pollution by chemical fertilizers and pesticides is posing a serious threat worldwide. Their continuous usage may destroy the beneficial soil micro flora [5-7]. Nitrosamines the transformed products of nitrogen fertilizers are dangerous ecological poisons. Nitrosamines isolated from the soil exerted phytotoxic, mutagenic and carcinogenic effects on plants, animals and humans [8,9]. Intensive use of inorganic chemical fertilizers and pesticides resulted in the contamination of soil, surface and ground water with harmful chemicals and accumulation of heavy metals [10,11]. Uptake of heavy metals like Cd, Cu, Mn and Zn by plants is proportionate to the increasing level of soil contamination [12]. People who consume these plant products are at risk of adverse health effects. Cadmium and lead are the elements of major concern due to their accumulation potential and toxic effects in the plants and animals [13]. Crops such as spinach, lettuce, carrot, radish, and zucchini can accumulate heavy metals in their tissues [14-19]. The rhizosphere contains diverse microbes with beneficial effects on crop productivity. The plant growth promoting rhizobacteria (PGPR), mycorhyza and cyanobacteria promote plant growth and also protect them against pathogens [20]. It was shown by Ayansina and Oso6) [1] who commonly used herbicides atrazine and metolachlor decreased the microbial counts of the soil. Increased cost of production of crop lead to the suicides of the farmers in India. Monoculture of rice crop, commercial crops like cotton and capsicum posed a threat to biodiversity and increased the scope for invading pathogens [Figures 1–3].

Natural Farming

Philosophy

Natural farming philosophy is working with nature to produce healthy food, to keep ourselves healthy, and to keep the land healthy. Everything in Nature is useful and serves a purpose in the web of life. Also termed 'Do Nothing Farming', because the farmer is considered only to be a facilitator - the real work is done by Nature herself. No-tillage and farming without the application of herbicides, inorganic fertilizers and pesticides is practiced. Here, actual physical work and labor has been seen to reduce by up to 80% compared to other farming systems. Natural farming differs from Organic farming by not using any organic manure like FYM and vermi-compost. In Japan, Fukuoka started Natural farming by experimenting with the Nature and following the natural ways of crop propagation. He achieved yields similar to those of chemical farming but without soil erosion [21-23]. The essence of natural farming is minimizing the external inputs to the farm land, which degenerate the soil nature. At first, because there was no habitat for many of the insects, he had to make natural insecticide like pyrethrum which comes from chrysanthemum roots, and he had to spray that on his vegetables in order to keep pests like cabbage worm and cabbage moths away. When we follow nature without destruction,

Figure 1: Indigenous Cow.

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Figure 2: Straw mulching.

Figure 3: Covering crop.

nature takes care of us. Zero- Budget Natural Farming (ZBNF) is proposed by Subash Palekar, in India, with the same philosophy but with the indigenous supplements [24]. In ZBNF, soil is supplemented with the microbial inoculums like Beejamruth and Jeevamruth to accelerate the propagation of soil micro flora, beneficial to soil enrichment. Indigenous pesticide decoctions of leaves with cow urine Neemastram and Bramhastram etc., are introduced. The philosophy of the natural farming is to nurture the growth of these beneficial microorganisms without using external manure and chemical pesticides.

Practice

No-Tillage: Annual tillage chemical fertilization and pesticide use consistently affect populations of earthworms. When tillage is avoided, soil moisture content is increased, augment the propagation of earthworms. Earthworms are known to make the soil porous and enrich the soil with their castings. Seeds are scattered and covered by straw before harvesting the previous crop. Seeds are germinated by the arrival of next favorable season. In ZBNF, this practice is not given prominence.

Mulching: Grain crops, healthy orchard trees are grown with a ground cover of vegetables, weeds and white clover. Mulching with straw improves soil moisture content and conducive to the growth of microorganisms and earthworms [25]. It also improves seed germination without tillage. Growth of the covering plants like white clover holds back weeds effectively [21]. Growth of covering crops like legumes increases the nitrogen fixation in the soil Zaheer shah et al., Harvesting weed before flowering and covering the open land reduces the area for the crop weed and improves the organic matter content in the soil. With this practice usage of herbicides can be avoided.

Beejamruth: Application of Beejamruth is followed in ZBNF**.** It is a seed treatment mixture prepared from cow dung, cow urine, lime and a handful of soil [24]. Naturally occurring beneficial microorganisms are found in cow dung [26]. These microorganisms are cultured in the form of Beejamruth and applied to the seeds as inoculum. It is reported that seed treatment with beejamruth protects the crop from harmful soil-borne pathogens and also helpful in producing IAA and GA [3].

Jeevamruth: Soil microorganisms play an active role in soil fertility as they involve in the cycle of nutrients like carbon and nitrogen, which are required for plant growth [27]. They are responsible for the decomposition of the organic matter entering the soil and therefore in the recycling of nutrients in soil. PGPR, cyanobacteria and mycorrhiza constitute soil microorganisms [28,29]. They participate in decomposition, mineralization and nutrient supply to the plants. Phosphate Solubilizing Bacteria (PSB) and mycorrhizal fungi can also increase the availability of mineral nutrients (phosphorus) to plants [30-33]. Nitrogen-fixing bacteria can transform nitrogen in the atmosphere into soluble nitrogenous compounds useful for plant growth. These microorganisms, which improve the fertility status of the soil and contribute to plant growth. They may also show antagonism (biological control) to pathogens [34-36]. Soil is saturated with all the nutrients, but these are in the non-available form to the roots of the plants. Beneficial micro-organisms in Jeewamrith convert the nutrients in non-available form into dissolved form, when it is inoculated to the soil. Jeewamruth is either sprayed/sprinkled on the crop field or added to the irrigation tank in regular interval of 15 days until the soil is enriched.

Composition of jeevamruth

Water 200 litre, cow dung 10 kg., cow urine 5-10 liter, Jaggary 1-2 kg, flour of the pulses 1 kg, a handful of soil (Palekar. undated). This mixture is well stirred for few days and sprayed on crop for every fortnight. It is shown that this mixture facilitates the growth of beneficial microorganisms. Application of Jeevamruth facilitated the growth of beneficial soil microorganisms and improved crop yield [7,37,38].

Conclusion

Indiscriminate use of chemical fertilizers and pesticides posed a threat to the soil and environment. Many investigations have shown their adverse effects of change in soil nature, soil contamination, ground water pollution and decrease in soil micro flora etc. Studies have shown that natural farming, with the minimum external inputs and by application of supplements like Jeevamruth, improves the soil fertility by increasing the soil micro flora and available nutrients. This method encourages multi cropping and biodiversity of micro and macro flora. Labor and production costs are minimized. Hence it can be seen by many as eco-friendly and sustainable. But these studies are in preliminary stage, several investigations need to be conducted to validate the benefits in all crops, efficacy of indigenous pesticides like Neemastram, Brahmastram etc., and the time needed for the enrichment of the polluted soil [39-45].

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