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Sustainable Agriculture: Cultivating the Future through Organic and Natural Farming

Swapnashree Sahoo and Jainendra Kumar Singh

Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi-221005, Uttar Pradesh, India

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Introduction

Modern farming methods necessitate extensive use of chemical fertilizers to increase crop production. However, these methods are costly and create health and environmental issues. There are concerns about the residual effects of chemicals on the edible portions that are consumed daily. The use of chemicals in agriculture, including fertilizers and pesticides, can harm soil health by reducing microbial diversity, acidifying the soil, depleting minerals, and ultimately causing soil and water pollution. In recent times, a global resurgence of interest has been observed in environmentally conscious and sustainable farming techniques that promote improved crop quality and soil health. "Organic or Natural Farming" has become a generic term for a concept of chemical-free, diverse agriculture-based farming practices with an emphasis on inexpensive natural resources and management techniques. The demand for organically grown produce is on the rise due to its health and nutritional benefits. According to the definition by the United States Department of Agriculture (USDA), the term organic farming refers to "a system which avoids and largely excludes the use of artificial inputs" (e.g., fertilizers, pesticides, hormones, feed additives, etc.). Organic farming relies on crop rotation, crop residues, animal manures, off-farm organic waste, mineral-grade rock additives, and biological systems of nutrient mobilization, to ensure optimal plant protection while sustaining the health of soils, ecosystems, and people (Ram and Pathak, 2018). This farming technique employs ecological processes, biodiversity, and local cycles instead of utilizing inputs that have detrimental effects. Organic agriculture fuses age-old practices, cutting-edge innovation, and scientific principles to foster a shared environment and cultivate equitable relationships while ensuring a high quality of life for everyone. Whereas, natural farming focuses on using native resources using agro-ecological principles, minimizing the need of externally purchased inputs, encouraging people participation, and managing native resources primarily for the benefit of farmers and community. Organic nutrient management strategies, including organic farming and nature-based farming systems like Permaculture, Natueco farming,

Panchagavya, Biodynamic farming, and *Rishi krishi*, as well as zero budget natural farming, are being considered as potential alternatives to chemical fertilizers and pesticides.

Permaculture

Permaculture is a system of agriculture which directly utilizes the patterns and features observed in natural ecosystems. The word Permaculture originally referred to "permanent agriculture" but was expanded to stand also for "permanent culture".

The three fundamental principles of Permaculture are:

- Maintaining a healthy earth that supports and fosters all life systems, leading to their multiplication.
    - Ensuring that natural resources are accessible to all individuals.
    - Recycling of agricultural waste.

There are 5 zones:

Zone 0 is the area that represents the house. Zone 1 includes frequently visited areas like the kitchen garden and microclimate. Zone 2 consists of semi-intensive cultivated areas like food production, market crops, and greenhouses. Zone 3 comprises occasionally visited areas with large fruit and nut trees. Zone 4 covers minimal care areas, such as wild food gathering, wood cutting for fruit and timber. Lastly, Zone 5 represents the unmanaged zone, which includes the wilderness zone, foraging, inspiration, and meditation.

Permaculture draws it basis from several organic farming systems including agro forestry, integrated farming, sustainable development and applied ecology. It has been most frequently applied to designing homes, landscaping, and incorporating techniques like agroforestry, natural construction, and rainwater harvesting.

Natueco farming

Natural farming practices emphasize the importance of working in harmony with nature, minimizing reliance on external inputs, and employing scientific techniques that utilize available resources in the surrounding environment. This approach aims to reduce harm to the ecology while achieving significant benefits. Key components of natural farming include the use of amrutmitti and amrutjal. Amrutjal, also known as nectary water, is made by combining 10 liters of water, 1 liter of cow urine, 1 kg of fresh cow dung, and 50 g of jaggery. This mixture is allowed to ferment for 3 days and is stirred well twice or thrice each day. On the 4th day, a concentrated suspension is prepared. One part of this suspension is diluted to 10 parts with water. Amrut Mitti, made from green and dry plant biomass, is prepared by drying and crushing the biomass well. The dried biomass is then immersed in the Amrutjal in a container and left to sit for 24 hours.

***Panchagavya* based farming system**

The preparation of *Panchagavya* primarily consists of five components derived mainly from cow sources. Specifically, the three direct components include cow dung, urine, and milk, while the two derived products are curd and ghee. For preparing *Panchagavya*, a wide-mouthed mud container, plastic container or concrete tank can be used, but metal container should be avoided. First, the cow dung and cow ghee are mixed in the container. The mixture is stirred thoroughly in clockwise and

anticlockwise directions, twice daily, for three days. On the fourth day, rest of the ingredients are added, and the mixture is stirred thoroughly in clockwise and anticlockwise directions, twice daily, for 15 days. The *Panchagavya* stock solution will be ready by the 18th day. The container should be kept in the shade with its mouth covered with a wire mesh or plastic mosquito net to prevent houseflies from laying eggs. If jaggery is not available, then 3 L of sugarcane juice can be added.

Application procedure: Generally, *Panchagavya* is recommended for all the crops, as foliar spray at 3% level (3 litres *Panchagavya* in 100 litres of water), in irrigation water (50 litres for one ha), as dipping seed and planting materials, or before seed storage.

Biodynamic farming

Biodynamic farming was spawned by late anthroposophist Rudolf Steiner. This method of farming is based on the Greek words "bios" (life) and "dynamic" (energy), and it is centered on working with these energies to foster growth in plants. Biodynamic farming also focuses on maintaining sustainable soil fertility and aligning plant growth with cosmic rhythms. Basically there are two types of biodynamic preparations

1. Biodynamic field spray (BD 500 – BD 501)
2. Biodynamic compost preparations (BD 502–BD 507)

General protocol followed for making of BD preparations

BD 500: It is prepared from fresh cow dung dually incubated in cow horn. The preparation method of BD 500, cow horn is filled with cow dung in the month of October /November and placed in a pit, 1 inch apart with base downwards, surrounded with 50% compost and soil. Pit is covered with moist soil and left it for 4 to 6 months. After 4 months if the cow dung has turned into dark smooth earthy smelling humus (BD 500), it is considered as ready to use, otherwise it is incubated further.

BD 501: Its preparation procedure involves cow horn filled with silica paste and buried during the summer time from April/May to September in soil pit, 1 inch apart with base downwards surrounded with 50% compost and soil.

BD 502: It is prepared from yarrow (*Achillea millifolium*) flowers. In its preparation protocol, bladder is moistened and flowers are filled up to top with the help of small cut and after filling cut sealed with cotton thread and buried it from September to March in a mud pot with earth inside.

BD 503: It is prepared from the flowers of the chamomile (*Matricuria chamomilla*) plant. In its preparation protocol, unwashed intestine of cow or bull is cut into 15 cm bits and one end of bit is closed with a cotton string and another end is used to fill dry flowers in it with the help of funnel. Bundle of filled sausages are placed in mud pot surrounded with fertile soil. Bundles were buried in soil in the month of October and let remained till February/ March.

BD 504: It is prepared from Himalayan stinging nettle (*Urtica parviflora*). In its preparation procedure terracotta pipes or mud pots are filled with dried leaves of stinging nettle and lid is kept open and the preparation is lifted in September after a year. It stimulates soil health, by providing

plants with the individual nutrition components.

BD 505: It is prepared by filling the brain cavity of skull of any domestic animal with crushed bark of the oak tree (*Quercus glauca*). The opening is closed with a well shaped bone piece. It should be placed in a location where there is exchange of water such as rain drain/swamp. It should be noted that a foul smell is emitted on lifting the preparation and removing it from the skull. This gradually reduces with drying after removal in a dark dry place. The preparation is buried in September and lifted in March.

BD 506: In its preparation the dandelion (*Taraxicum officinalis*) flowers are used. The unwashed mesentery of cow is filled with dried flowers of dandelion and wrapped into a parcel and tied with a jute thread. The parcel is placed in a good mixture of soil and compost into a pot in the month of September while lift in March.

BD 507: The juice of valerian flowers (*Valeriana officinalis*) is used for this preparation. A paste is prepared after grinding of flowers into a mortar and pestle. The paste is added to water in ratio of 1:4 in a bottle and kept it in cool place.

Rishi Krishi:

It is a method of natural farming developed by farmers of Maharashtra and Madhya Pradesh. In this technique, there are four component practices.

1. Angara (rhizospheric soil of banyan tree):

Fifteen kg of soil from the rhizosphere of banyan tree is applied per acre of farmland.

2. Amritpani:

The recipe of preparation of Amritpani includes 250 g of ghee from indigenous breed cow, half kg of honey and 10 kg of fresh cow dung from desi cow mixed with 200 l of water. The promoter of this agrisystem recommended dipping of sugarcane, turmeric, ginger into Amritpani before planting and in case of crops which seedlings are transplanted, dip the roots in Amritpani before planting.

3. Beej sanskar (Dressing of seeds):

One kg of banyan tree (Angara) mixed with sufficient amount of amritpani to make a thick paste. Apply the paste over the seeds having hard coat, dry it in shade and store and use according to need, while those seeds which have thin coat such as hemp, cereals, moong, groundnut paste is sprinkled over the seeds and use the seeds immediately.

4. Acchadana (Mulching):

There are four types of mulching:

(i) Soil mulch: This protects top soil during tillage. It promotes aeration and water retention in the soil.

(ii) Straw mulch: Straw material usually refers to the dried biomass waste of previous crops.

(iii) Live mulch: It refers to symbiotic intercrops and mixed crops. It is recommended that multiple cropping patterns of monocots and dicots should be adopted grown in the same field to supply all essential nutritive elements to the soil and crops.

Zero budget natural farming

Zero budget natural farming is a practice that emphasizes the growth of crops without the use of fertilizers, pesticides, or any other external inputs. This method focuses on allowing crops to grow

naturally, and the term "zero budget" refers to the zero net cost of production for all crops, including intercrops, border crops, and multi-crops. Zero Budget Natural Farming (ZBNF) has 4 key elements, viz. Bijamrit (seed treatment), Jiwamrit (microbial culture), Achhadana (mulching), Whapasa (soil aeration).

Bijamrit: It is used for seed dressing or root-dipping. It is prepared as per following protocol: Cow dung (50 g), cow urine (50 ml), fresh cow milk (50 ml), lime stone (2 g) and water (1 liter). All the ingredients are mixed thoroughly in a plastic jar and left for fermentation overnight.

Application: It is applied to the seeds of any crop. Seeds are coated with bijamrit by thoroughly mixing by hand and left it for drying. Dried seeds were used for sowing. It helps in protecting young roots from fungus as well as from soil borne and seed borne disease.

Jeevamrit: Jeevamrit is a fermented microbial culture. It is prepared by mixing cow dung (5 kg), cow urine (5 litre), pulse flour (1 kg), fertile soil (1/2 kg) and water (50 litre) in a plastic drum and left it for 5 to 7 days fermentation with regular stirring 2 – 3 times per day with help of a wooden stick. During the 48-hour fermentation process, the aerobic and anaerobic bacteria present in the cow dung and urine multiply as they decompose the organic ingredients (like pulse flour). A handful of virgin soil is also added as native microflora. Jeevamrit also helps in preventing fungal and bacterial plant diseases.

Application procedure: It is applied to the crops twice a month in irrigation water or as a 10% foliar spray. It helps to prevent fungal and bacterial plant disease. Two hundred litre of jeevamrit is sufficient for one acre of land.

Acchadana: (Sanskrit- acchadana means ("to cover") means Mulching. The details have been described in earlier section of *Rishi Krishi*.

Whapasa: Moisture enhancement to roots through water vapour. Whapasa is the condition where there are both air molecules and water molecules present in the soil.

Conclusion

Chemical free farming methods like natural and organic farming attempt to minimize or eliminate external agricultural inputs, especially synthetic ones and rely on ecosystem management. The intensive uses of inorganic fertilizers, pesticides and other inputs for maximizing agri-production were found essential to meet the food requirement of growing population. However, indiscriminate use of chemical inputs has caused serious hazard to human life. Conservation agriculture, carbon positive farming, organic farming, natural farming and regenerative agriculture have been recognised as such alternative agriculture practices to conventional farming to produce quality food without negative effects on the environment and manage biodiversity, increase populations of natural enemies, improve natural resources such as soil, water, air, and wildlife, and support pollinators, which are essential for maintaining a healthy environment and producing nutritious food.

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