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Natural Farming - a chemical free traditional approach for sustainable crop cultivation

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Introduction

The adoption of chemical-based green revolution practices played a key role in achieving global food security and peace. However, on the other hand, it imposed a threat to our nature as well as to our existencein different ways. Presently, global climate change is a result of chemical-based intensive agriculture, forcing us to bring a revolutionary and transformational change in the existing farming practices with the aim ofsustainable crop cultivation without harming nature. For this, natural farmingmust become part of conventional agriculture.Natural Farming is considered a form of regenerative agriculture having the potential to manage land practices and sequester carbon from the atmosphere in soils and plants, where it is actually useful to save the planet instead of being detrimental. In fact, Natural farming is an age-old sustainablefarming technique that integrates crops, trees and livestock, allowing the optimum use of functional biodiversity.Further, it holds the promise of doubling farmers' income by eliminating the usage of costly inputs viz., chemical fertilizers and pesticides while delivering many other benefits *viz.*, soil fertility restoration,improving environmental health by reducing the emission of greenhouse gases.Natural farming is built based on natural or agroecologicalprinciples that greatlyemphasize the use of bio-inputs prepared from the farm and local ecosystems rather than purchased from outside.In Natural Farming plant extracts, cow dung, urine, and the cultivation of repellent plants are used as bio-pesticides that also maintain soil fertility.

Philosophybehind Natural farming

Masanobu Fukuoka, the Japanese farmer, and philosopher, first popularized natural farming in his book The One-Straw Revolution. Fukuoka distilled the natural farming mindset into five principlesas discussed below

No tillage: It reflects that natural farming does not involve tilling of the land. Instead of using machines, macro and micro fauna of soil accomplish tillage operation.

No fertilizer: Nitrogen, phosphorous,

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potassium, calcium and all other elements that are normally given in the form of chemical fertilizers in conventional farming are substituted with Natural Farming inputs such asfish amino acid- N, egg shells supplies - Ca and animal bones - P. These Natural Farming inputs are not only cheap but also highly effective to conserve soil health and productivity on a sustainable basis.

No pesticides: The key principle of natural farming is to say *'No'* to pesticide usage. Instead of using toxic chemicals, we use poisonous plant decoctions or extractions to control pests without killing natural enemies like spiders, coccinellid beetle, mirid bugs, etc. Moreover, it helps to improve environmental and human health status.

No weeding: In natural farming, weeding can be done with remarkably little labour and mainly involves the inclusion of close-growing cover crops/legumes/ wild grasses (rye and clover) for mulching which checks weed growth and also improves rainwater infiltration (controls soil and water erosion), soil organic carbon content, soil microbial biodiversity and helps to achieve high-quality yields.

The strong belief is that all these can be accomplished by careful timing of seeding and careful combinations of plants (polyculture). In short, Fukuoka brought the art of working with nature to a high level of refinement.

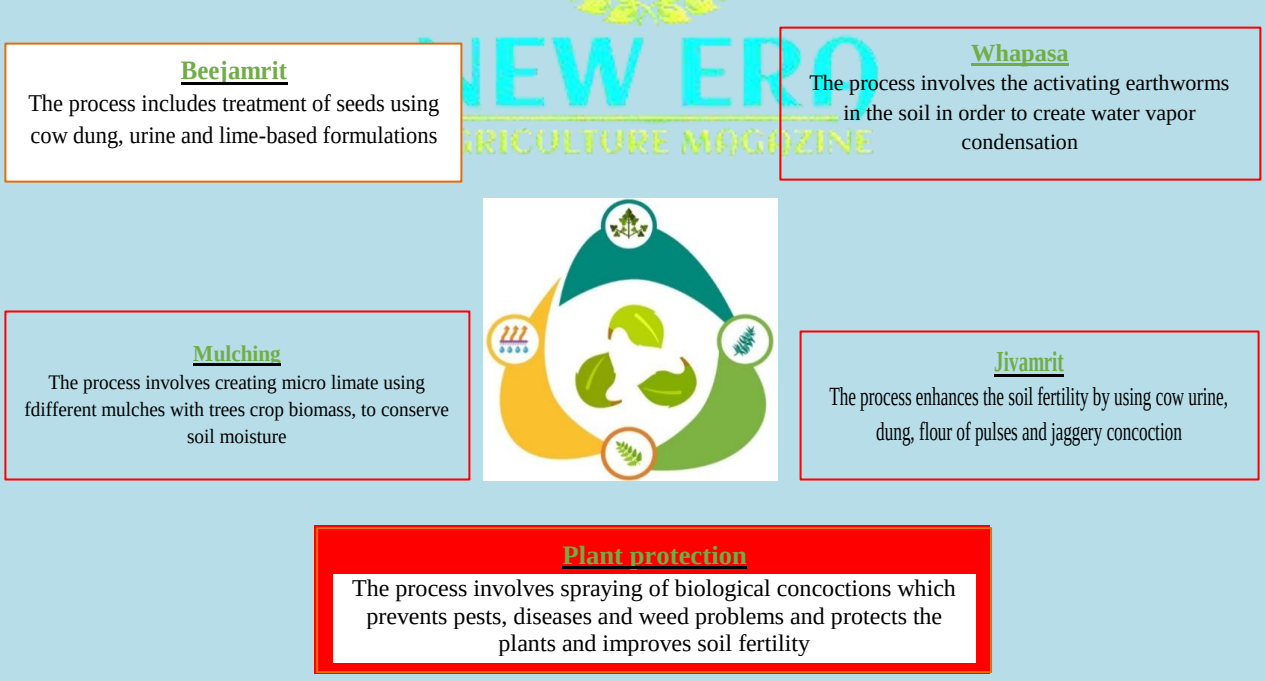

Fig 1: Key components of Natural Farming

The next question that arises here is how to fulfill various needs of crop production (high crop nutritional demand and protection), especially in highly populated countries like India. Keeping these major challenges in view India postulated four major aspects (Fig 1) for encouraging natural farming.

Beejamrutham/Bijamrith: Microbial coating of seeds using cow dung and urine-based formulations. It is used for seed and planting-material treatment and foliar spray as well. Highly useful to protect seed and seedlings especially during the early growth stages from soil borne pathogens and insects. Moreover, it act as a nourishment to the young growing seedlings and attracts soil microbiomes thatenhance the availability of N, C, H, P and S to plants.

Fig 2: Beejamrith

Preparation

Take 5kg Cow dung + 5 liters cow urine and mix with 20 liters of water then allowit to soak for 12 hrs.Then it is squeezed in water tub by using a cotton cloth. Then add 50ml lime water & cow urine and stir it well. Later ready to be added to the seeds followed by shade drying and sowing.

Jeevamrutham/Jiwamrita: Jeevamrit / Jeevamrutha is a microbial culture prepared by using on-farm inputs like cow dung, urine, jiggery and pulse flour used as a microbial enhancer. It has been found a suitable formulation in natural farming to meet the nutritional demands of the crops.

Fig 3: Jeevamrith

Preparation

Take 200-liter water in barrel and add 10 kg Cow dung + 10L Cow urine. Mix 2 kg Jaggery + 2 kg Pulse flour + 30 gm farm soil in a heap. Allow it to ferment for 5-6 days. Finally, apply along with irrigation water or through spraying.

Mulching(Acchadana): Mulching with organic residues or live mulching reduces tillage and consequently labour requirements, suppresses weeds, promotes humus formation and enhances the water holding capacity of the soil. It enhances biological activity and replenishes the nutrient base of the soil. It also enhances rainwater infiltration and checks soil and water erosion. Based on economics and

feasibility a farmer can adopt dust mulch/straw mulch/live mulch.

Fig 4: Acchadana

Whapasa: It aims to build soil humus with enhanced soil porosity and soil aeration through a favourable microclimate in the soil. Which mainly addresses the problem of increasing water demand as irrigation under water-scarce conditions. Palekar challenges the idea that plant roots need a lot of water, thus countering the over-reliance on irrigation in green revolution farming. According to him, plant roots need a water vapor. Waaphasa is the state of soil where both capillary and noncapillary pores equally share 50% of air molecules and 50% of water molecules in the form of water vapouroverall effective root zone depth of the plant is at field capacity. As per the reports of NITI ayog on ZBNF revealed that the adoption of natural farming significantlyreduces the dependence on the artificial application of water. Waaphasa - focuses on improving water use efficiency by reducing the quantity and frequency of irrigation water applied as only a limited amount of water is needed (in form of vapour) for crop growth.

Plant protection measures

Natural farming encourages the use of various kashayams (decoctions) made up of cow dung, cow urine, lilac, and green chilies for safeguarding the crop lants against various pests and diseases.

Fig 5: key components of plant protection

1. Agniastra

Preparation:

Take 20 lit cow urine+ 2 kg neem leaf chutney+ 0.5 kg tobacco powder+ 0.5 kg hot green chilli chutney+0.25 kg any local garlic chutney. Stir the contents with wooden stick, cover it with lid and boil it for a foam. Cool it for 48 hrs where all alkaloids will dissolve in it. Stir it for morning and evening hours for 1 minute and filter the contents.Take 200 lit of water add 6-8 lit of agniastra mixed and sprayed. The content can be used for 3 months

which controls pod borers, fruit bores, sucking pests and leaf eating caterpillars.

2. Brahmastra

Preparation:

Take 20 lit of cow dung urine+2 kg neem leaf chutney+2 kg *Pongamia pinnate* leaf chutney/*Lantana camera*+ 2 kg datura leaf chutney/2 kg custard apple chutney+ 2 kg castor leaf chutney/2 kg belpatra chutney. Stir it properly, while boiling the contents under low flame for 1 hour and cover with lid. Allow it cool for 48 hrs where all alkaloids will dissolve in it. Stir it for morning and evening hours for 1 minute and filter the contents. Take 200 lit of water add 6-8 lit of brahmastra mixed and sprayed. The content can be used up to 6 months. It controls sucking pests and leaf-eating caterpillars.

3.Neemastra

Preparation:

Take 200 lit water+10 lit cow urine+2 kg cow dung +10 kg neem leaves (small chaffed leaves). Stir the contents clock wisely with wooden stick and cover it with gunny bag and place it under shadow for 48 hrs (note: sunlight, rainfall should avoid completely). Stir it for morning and evening hours for 1 minute. After 48 hrsnimbin, homicide alkaloids dissolve in water. Filtrate the solution and go for spraying. It can utilize up to 6 months. It controls all types of sucking pests (Aphids, jassids, whitefly).

Disease Management

How to Control Pathogens/Fungus/Bacterial Diseases?

1. Take 200 lit water +10-20 lit jivamrita mixture.
2. Take 200 lit of water + 10-20 lit of buttermilk (sour) mixture.
3. Take 2 lit of water; add 200 g dried ginger powder/200 g of asafoetida (hing) powder, and stir it thoroughly to dissolve well. Boil the contents by covering the lid up to half concentrate. Keep it aside for cool. Take another vessel and take 2 lit of cow milk boil it by covering the lid until foam appears. Keep it aside for cooling and remove the cream. Take 200 lit of water, add cream less cow milk; add ginger/hing concentrate. Stir the contents with a wooden stick slowly and keep it aside for 2 hrs. Filter it with muslin cloth and sprayed it under 24 hrs.

For all types of Diseases: Take 200 lit water; add 15 lit Jiwamrita; add 5 lit buttermilk (sour). Stir the contents and filter them with a muslin cloth. Spray the mixture immediately to control any type of bacterial/fungal diseases.

Trap crops

It is acost-effective and ecofriendly way to control various polyphagous pests attracted by a specific group of plants known as trap crops. Sowing of these crop plants in

between main crops significantly reduces the insect load on the main crop.

Table 1: Trap crops with their respective insects

S.No.	Main crop	Trap crop	Insect pests controlled
1	Tobacco	Castor	Spodopteralitura
2	Chilli, Tomato	Marigold	Helicovera and Nematodes
3	Cotton	Alfalfa	Lygus bug
4	Maize	Beans and other legumes	Leafhopper, leaf beetles, stalk borer and fall armyworm
5	Cabbage	Radish	Root maggots and flea beetle
		Tomato	Diamondback moth
		Nasturium	Aphids, flea beetle and squash vine borer
6	Soybean	Sickle pod	Green stink bug and velvet bean caterpillar

(source: agropidia.iitk.ac.in)

Barriers to the adoption of natural farming

- Prevailing mindset for chemical farming
- Lack of knowledge of natural/agroecological techniques and fear of low yields
- Lack of risk-taking capacity to bear yield losses
- Absence of handholding support and risk coverage during the transition to natural farming
- Lack of assured market offering remunerative prices
- Low fertile soils, and a higher incidence of pests and diseases

Conclusion and future perspectives

Today, natural farming methods are developed as a response to the environmental harm caused by chemical-based intensive agricultural practices. In fact, it has the full potential to double farmers' income by eliminating the usage of costly inputs like chemical fertilizers and pesticides while delivering many other benefits including soil fertility restoration, and improving environmental health by reducing the emission of greenhouse gases. Apart from these, it provides healthy and chemical-free food to humans. However, the major issues that deny its adoption arelower crop yields during initial years, heavy weed infestation and limited availability of livestock as itdemands much organic manure. One of the major concerns aboutopting for natural farming is price instability. So, the government should take necessary actions like the provision of incentives and Minimum Support Prices (MSP) for the crops produced by natural farming in order toinspire farmers to cultivate crops in an environmentally sustainable way.Moreover, the regulatory bodies should put natural farming in a broader economic context by making people aware of the long-term hazards of chemical agriculture. ICAR

system should need to find out new approaches for effective control of weeds and insect pests (biological control measures). By this, the majority of the marginal and small farmers are urged to implement NF to reduce synthetic input usageand their debt burden for them. Such initiatives may encourage the chemical farming farmers to switch to chemical-free natural farming.

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