
REVIEW

Crop protection issues under Natural farming-a brief account

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Natural farming is an organic farming method that does not use chemicals. It has its roots in Indian tradition and is enhanced by contemporary ecological knowledge, resource recycling, and on-farm resource optimization. It is regarded as a diversified farming system based on agroecology that integrates livestock, crops, and trees with functional biodiversity. It is primarily focused on biomass mulching, using on-farm cow dung-urine formulations, preserving soil aeration, and excluding any synthetic chemical inputs. It is primarily based on on-farm biomass recycling. Natural farming provides a healthy ecosystem paired with robust crop development generating resistance build up against insect pest and disease attacks. Various approaches have been proposed for pest management in natural farming, taking into account the biology, physiology, and habits of the pest. Natural farming is thought to be a cost-effective farming method with potential to boost employment and rural development. It is anticipated to lessen reliance on purchased inputs.

Keywords: Agroecology, soil- health, climate-resilient farming system, organic farming

INTRODUCTION

Agriculture has been the mainstay of the Indian economy as over 70% of Indian population depends directly or indirectly on agriculture and allied services for their livelihoods. After independence, India had made considerable progress in agriculture and transitioned from subsistence to commercial agriculture leading towards self-sufficiency in several fields. Indian agriculture in its present form relies upon heavy use of inorganic chemical inputs such as fertilizers and pesticides and as a result, negative consequences and challenges are being faced by the stakeholders - from farmers to consumers; apart from its negative impact on natural ecosystems and biodiversity (Tripathi *et al.*, 2018).

Modern technology intensified conventional farming systems creating an environmental pressure and generating negative effect not only on human health and natural resources but also

on the sustainability of agriculture production system (Mylonas *et al.*, 2020). Agriculture in India has already witnessed adverse impacts in many aspects like soil degradation, biodiversity loss, rising cost of cultivation, etc. It is important to note that, though India has gained its outstanding position in food production, at the same time received poor ranking in the hunger index (Menon *et al.*, 2008). Negative health impacts such as disruption of the hormone, neurological and immune systems are being observed in the human body, which has become a hindrance in achieving sustainable development goals like elimination of poverty, hunger and malnutrition (Paroda, 2017). Furthermore, the possible health implications of pesticide residue(s) had also terrified in many cases in choosing pesticide-free items.

Thus, restoring soil health by reverting to non-chemical agriculture along with sustainable crop production system has gained major thrust in recent times and search for a better alternative with no/limited negative impact on natural agro-ecosystem has a credited as the most suitable alternative to chemical agriculture (Duddigan *et al.*, 2022, Mishra, 2018). Natural farming, popularly known as zero budget natural farming, is an

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innovative farming approach. It is low input based, climate resilient, and low cost farming system because all the inputs (insect repellents, fungicides, and pesticides) are made up of natural herbs and locally available inputs, thereby reducing the use of artificial fertilizers and industrial pesticides (Devarinti, 2016; Laishram *et al.*, 2022). Adoption of natural farming practices enriches the soils with organic carbon, increased microbial activity, increased activity of earthworms leading to restoration of natural nutrient cycles, improved water holding capacity and increased biological activity. The concept of chemical-free and climate-resilient farming system was put forwarded in India by Subhash Palekar in the year 2006 with an aim to reduce the cost of production and to pre-green revolution agriculture (Khadse *et al.*, 2019). Natural farming systems rely largely up on biomass recycling, biological rejuvenation of natural nutrient cycles and promote usage of on-farm plant and livestock-based inputs. There has been a worldwide move for organic agriculture and organic food accounts for 1%–2% of food sales worldwide (Mahanta *et al.*, 2021). They have also forecasted that in future, the growth is expected to range from 10% to 50% annually depending on the country. India has been exporting organic products worth \$ 515 million (2017-18) produced from 1.78 million hectares of organic cultivated area (Kumar *et al.*, 2020). India ranked 1st in terms of the number of organic farmers and 5th in terms of certified organic area in the world (Lakhani *et al.*, 2020). The major organic exports from India have been flax seeds, sesame, soybean, tea, medicinal plants, rice, and pulses. Northeast India has traditionally been organic and exports from Assam, Mizoram, Manipur and Nagaland to UK, USA, Eswatini and Italy have proved the potential by increasing volumes and expanding to new destinations.

ORGANIC AND NATURAL FARMING SYSTEMS

The primary difference between natural farming and organic farming lies in their approach to external inputs. Natural farming completely eschews synthetic and external inputs, while organic farming incorporates approved organic inputs as part of its practices ([https://times of agriculture.in/natural-farming-vs-organic-farming](https://timesofagriculture.in/natural-farming-vs-organic-farming)).

Organic agriculture is a production system that sustains the health of soils and ecosystems through use of ecological processes, biodiversity and cycles adapted to local conditions. The benefits of organic farming are production of better taste and more nutritious food, reduces pesticide and chemical residue in soil, promotes biodiversity, consumes less energy and long-term sustainability. Some of the challenges of organic farming include shortage of organic biomass, disparity of supply and demand, time of crop management, high input costs, lack of special infrastructure including transportation and lack of assured marketing facility organic produce.

Some of the Principles of organic farming are- no tillage, no fertilizer, no pesticides or herbicides, no weeding, no pruning, it believes that respecting the nature of the life is the best way to achieve top quality and yield. In this method the disease is prevented rather than curing with medicines

The differences between organic and natural farming may be outlined as follows:

NATURAL FARMING

Organic Farming	Natural farming
<p>Organic fertilizers and manures like compost, vermin-compost and cow dung manure are used and added to farmlands from external sources.</p> <p>It utilizes basic agro practices like ploughing, tilling, mixing of manures, weeding, etc.</p> <p>Organic farming is still expensive due to the requirement of bulk manures, and it has an ecological impact</p> <p>Organic farming has a slight adverse effect on the surrounding environment as it involves intervening with the natural processes.</p>	<p>Neither chemical nor organic fertilizers are added to the soil from external sources</p> <p>It is done without ploughing, and cultivation are carried out the way it would be in natural ecosystems.</p> <p>It is an extremely low-cost farming method, completely moulding with local on biodiversity surrounding environments.</p> <p>Natural farming practice does not have any effect on the surrounding environment, and it confirms with local processes of biodiversity.</p>

Natural Farming is a chemical-free alias traditional farming method. Popularly known as “do nothing” farming, natural farming is an environmentally sustainable way of growing food. It is considered as agroecology based diversified farming system with integration of crops, trees and livestock with functional biodiversity. Natural farming, if done effectively enhances farmers’ income along with restoration of soil fertility and environmental health and mitigating and/or reducing greenhouse gas emissions. The most critical aspect of the natural farming is to let nature play a dominant role to the maximum extent possible. Natural farming (*shizennôhō*), also referred to as “the Fukuoka Method”, “the natural way of farming” or “do-nothing farming”, is an ecological farming approach proven by Masanobu Fukuoka (1913–2008). Natural Farming follows the scientific approach of correctly using the right material at the right amount and at the right stage so that the crops or livestock can reach their optimum growth. Natural farming relies on nutritive cycle theory, which states that plants and livestock need different nutrients during different stages of growth. In India, natural farming of Masanobu Fukuoka was called “Rishi Kheti” with the use of cow products like buttermilk, milk, curd, and its waste urine for preparing growth promoters. The Rishi Kheti is considered to be non-violent farming. Natural farming opposes human exploitation on life.

ANCIENT INDIAN ROOT OF NATURAL FARMING

India has been the ancient wisdom of farming since beginning of human civilization. In our epic historical books, it was written that the enlightened *Rishis* live in forests to understand the rhythms of nature. One of these great rishis was *Parashara Maharishi* who taught the art and science of cultivation as per Vedic science. There is brief mention of several organic inputs in our ancient literatures like Rigveda, Ramayana, Mahabharata, Kautilya Arthashastra etc. Natural and organic agriculture has its roots in traditional agricultural practices that evolved over the millennium. Methodical Indian agriculture began by 9000 BC as a result of early cultivation of plants and domestication of animals. Wheat, barley, and jujube were found domesticated in Indian

subcontinent by 9000 BC. The farmers of Indus valley civilization were reported to cultivate pea, sesame and dates. Wild rice was found domesticated in Southeast Asia as early as 5440 BC. The prosperity of agriculture started growing because of innovation.

PHILOSOPHY OF NATURAL FARMING

The main philosophy of natural farming is to produce healthy food grown crop with nature, to keep ourselves as well soil healthy. Being a part of web of life, farmers are considered facilitator to support the equilibrium of nature. As mentioned, the main essence of natural farming is to minimize use of external inputs to farmland and limited to those which are degenerative in nature. In natural farming, soil is supplemented with natural microbial inoculums like Beejamruth and Jeevamruth to accelerate propagation of soil micro flora. Thus, natural farming suggests-

- ❖ No external inputs
- ❖ Local seeds (use of local varieties)
- ❖ Microbial seed treatment
- ❖ Microbial inoculants for soil health
- ❖ Cover crops for biomass mulching and biomass incorporation for maximum beneficial microbial activity
- ❖ Mixed cropping
- ❖ Integration of livestock, native breed for cow dung and cow urine as essential inputs for several practices
- ❖ Water and moisture conservation etc.

We can summarize some of the advantages of natural farming are as follows-

- ❖ Natural farming is eco-friendly and utilizes inputs that are made from natural and locally available materials
- ❖ Natural farming respects life as it respects the nature of life is the best way to realize bountiful harvests and better quality
- ❖ Natural farming provides high-quality produce better taste
- ❖ Natural farming products are having greater nutritional qualities without chemical residues
- ❖ Farmers prepare farm inputs and thereby reduces the initial cost of production
- ❖ It improves soil ecosystem and thereby productivity of the soil

- ❖ It neutralizes risk of biotic & abiotic stress
- ❖ Materials used are biodegradable and socially acceptable

However, looking at the cons of natural farming the challenges like high input costs and constant expenditure, disparity between demand and supply, shortage of quality planting materials, undefined certification framework, lower crop production faced by the farmer cannot be ignored. But if we see the present-day global agricultural scenario in the context of climate challenges the benefits of natural farming never be ruled out and needs further retrospections. The benefits of natural farming with respect to high nutritional contents (Protein, amino acid, crude fat, and other essential nutrient were about 300 per cent higher than ordinary products) leading to quality and good taste, almost undetectable level of chemical residue such as nitrate, strong resistance to climatic fluctuation are some of the key criteria for opting natural farming. Similarly under the system, healthy animals are reared rather than making animals healthy by feeding those hormones and antibiotics.

BASIC PILLARS OF NATURAL FARMING

Jivamrita

It provides nutrients and also acts a catalytic agent promoting activity of microorganisms in soil. It also increases earthworm activity. It prevents crop from fungal and bacterial diseases. For preparation of Jivamrita we need to take 200 litres of water in a barrel, 10 kg fresh local cow dung, 5 to 10 liters aged cow urine, 2 kg of Jaggery (a local type of brown sugar), 2 kg of pulses flour and a handful of soil from the bund of the farm.

The items have to be stirred well and allow to ferment for 48 h in the shade and Jeevamritha will be ready for application. The 200 litres of Jeevamritha is sufficient for one acre of land. During the 48 h fermentation process, the aerobic and anaerobic bacteria present in the cow dung and urine multiply as they eat up organic ingredients (like pulse flour and jaggery). A handful of undisturbed soil acts as inoculate of native species of microbes and organisms. Jeevamritha also helps to prevent fungal and bacterial plant

diseases. Jeevamritha should be applied to the crops twice a month in the irrigation water or as a 10% foliar spray. The preparation is stored up to a maximum of 15 days and used in the field either through spray or mixing with irrigation water.

Bijamrita

This is a seed treatment product, protecting young roots from fungus as well as from soil-borne and seed-borne diseases. It is basically made up of water (20 l), cow dung (5kg), urine (5 l), lime (50g) and a handful soil. Local cow dung, considered to be natural fungicide and cow urine (as anti-bacterial liquid), lime and soil have to be mixed properly. The dung is generally tied in a cloth and is kept in urine for about 12 h. Beejamritha has to be added to the seeds of any crop to coat them, mixing by hand, dry them well and use them for sowing. For leguminous seeds, the seeds to be just dipped quickly and to allow them to dry.

Acchadana

Acchadana conserves soil moisture, by reducing evaporation through use of soil mulch, straw mulch, etc. Live Mulch is essential to develop multiple cropping patterns in the same field to supply all essential elements to the soil and crops.

Whapasa moisture

Whapasa means the mixture of 50% air and 50% water vapour in the cavity between two soil particles. It is the soil's microclimate on which soil organisms and roots depend for most of their moisture and some of their nutrients. The frequency of irrigation should be reduced and should be practiced at noon in alternate furrows to fulfill the moisture requirement of the crops, thereby a significant decline in need for irrigation under natural farming.

The other general practices adopted in natural farming are zero cultivation and fallowing (allowing soil to rest and rejuvenate), use of biological/natural pest control practices, use of organic compost and bio-inoculants, use of indigenous resistant plant varieties, crop rotation and intercropping and fallowing (resting the soil).

ECOLOGICAL ENGINEERING IN NATURAL FARMING OF PEST AND DISEASE MANAGEMENT

Natural farming maintains a healthy ecosystem coupled with robust crop growth inducing resistance build up against insect pest and disease attacks (Lakhani *et al.*, 2020). Some of the specific ecologically curative approaches employed in natural farming include-

❖ **Intercropping:** It is based on the principle of agroecosystem diversity for pest and disease management, wherein two or more crops are raised simultaneously with the concept of "Resource Concentration". In different types of intercropping, strip cropping, two or more crops are grown in alternating strips, is a quite popular intercropping system of pest control.

❖ **Mixed cropping (*Push-Pull System*):** In the push-pull intercropping systems, specifically acts as the 'push' component to repels the insects (using semiochemicals), whereas the 'pull' component such as the trap-crop, attracts the pest species away from the main crop.

❖ **Trap crops:** Trap crops are plants those are more attractive to the insect pests than the main crop.

❖ **Cover crops:** The crops with quick growing habits, including green manure crops, living mulches, and catch crops, cover a significant ground proportion in a concise time span.

❖ **Flower strips:** Planting a flower strip of annual flowering plants provides an incessant and good magnitude of floral and extra-floral nutrients, which are accessible to vital natural enemies.

❖ **Plant corridors:** Corridors are utilized to conserve and maintain biodiversity and also to conserve natural enemies.

Pest management practices in natural farming

Pest management practices in natural farming have been considered as a major challenge considering different habitat, biology and

physiology of the pest. Different strategies have been advocated (Lakhani *et al.*, 2020) to meet the challenge and some of the strategies are-

Agniastra

It is effective against the pests like leaf roller, stem borer, fruit borer, pod borer. It is composed of 10 l local cow urine, 1 kg tobacco, 500 g of green chilli, 500 g of local garlic, 5 kg neem leaves pulp (crushed in urine) and then to be allowed to ferment before use.

Brahmastra

It is used to control all of sucking pests, fruit borer, pod borer. It is prepared by adding 100 g neem leaves, 100 g custard apple leaves, guava leaves, lantern camellia leaves, pomegranate leaves, papaya leaves and white dhatura leaves crushed and boiled in cow urine.

Neemastra

It is used for sucking pests and mealy bug. It is made up of local cow urine (5 l), cow dung (5 kg) and neem leaves and neem pulp (5 kg) and fermented for 24 hrs.

Dashparni Ark

It is prepared by adding Neem leaves-5 kg, *Vitex negundo* leaves-2 kg, *Aristolochia* leaves - 2 kg, Papaya (*Carica papaya*)- 2 kg, *Tinospora cordifolia* leaves- 2kg, *Annona squamosal* (Custard apple) leaves- 2 kg, *Pongamia pinnata* (Karanja) leaves- 2 kg, *Ricinus communis* (Castor) leaves- 2 kg, *Nerium indicum*- 2 kg, *Calotropis proceraleaves*-2 kg, Green chili paste- 2 kg, Garlic paste-250 g, Cow dung-3 kg, Cow urine-5 lit and Water-200 lit. It can be applied as a foliar spray to control insect pest

CONCLUSION

Mapping the crop areas with all modern tools, IoT etc. to demark from the organic with zero or no fertilizer and chemical in future will help converting to natural farming. Moreover, policy and advisory support to the farmers on natural farming along with characterization inputs for natural farming

will certainly help in promotion of natural farming in India. There is a humble task to perform to facilitate certification for organic as well as natural farming from the government and other concerned agencies/organizations to ease the process certification and also to create a distinguished platform for marketing of products from natural as well as organic farming. Moreover, generation of scientific evidences of different agro-climatic regions with different crop combinations will be helpful for long-term sustainability of natural farming and to achieve food security in the country.

DECLARATIONS

Conflict of interest: Author declares no conflict of interest.

REFERENCES

- Devarinti, S.R. 2016. Natural Farming: Eco-Friendly and Sustainable. *Agrotechnology* 5: 147. doi: 10.4172/2168-9881.1000147
- Duddigan, S., Collins, C.D., Hussain, Z., Osbahr, H., Shaw, L.J., Sinclair, F., Sizmur, T., Thallam, V., AnnWinowiecki, L. 2022. Impact of Zero Budget Natural Farming on Crop Yields in Andhra Pradesh, SE India. *Sustainability* 14: 1689 (<https://doi.org/10.3390/su14031689>).
- Khadse, A., Rosset, P.M. 2019. Zero Budget Natural Farming in India – from inception to institutionalization. *Agroecol Sustainable Food Syst.* 43: 848-871.
- Kumar, R., Kumar, S., Yashavanth, B.S., Meena, P.C. Indoria, A.K., Kundu, S., Manjunath, M. 2020. *Adoption of Natural Farming and its Effect on Crop Yield and Farmers' Livelihood in India*. ICAR-National Academy of Agricultural Research Management, Hyderabad, India.
- Laishram, C., Vashishat, R.K., Sharma, S., Rajkumari, B., Mishra, N., Barwal, P., Vaidya, M.K., Sharma, R., Chandel, R.S., Chandel, A., Gupta, R.K., Sharma, N. 2022. Impact of Natural Farming Cropping System on Rural Households—Evidence From Solan District of Himachal Pradesh, India. *Front. Sustain. Food Syst.* 6:878015. doi: 10.3389/fsufs.2022.878015
- Lakhani, H.N., Jalu, R.K., Parmar, K.J, Patoliya, J.U., Kasondra, M.M. 2020. Natural Farming: New Horizon of the Agricultural Sector. *Int. J. Curr. Microbiol. App. Sci* 9: 774-780 (<https://doi.org/10.20546/ijcmas.2020.906.099>)
- Mahanta, D. , Bisht, J.K., Lakshmi Kant 2021. Concept and global scenario of organic farming. In:Advances in Organic Farming Agronomic Soil Management Practices p.1-16 (<https://doi.org/10.1016/B978-0-12-822358-1.00007-9>),Woodhead Publishing
- Menon, P., Deolalikar, A.,Bhaskar, A. 2008. Comparisons of Hunger across States: India State Hunger Index. International Food Policy Research Institute.
- Mishra, S. 2018. Zero Budget Natural Farming: Are this and Similar Practices the Answers?, Working Paper No. 70, Nabakrushna Choudhury Centre for Development Studies, Bhubaneswar.
- Mylonas, I., Stavrakoudis, D., Katsantonis, D., Korpetsis, E. 2020. Better farming practices to combat climate change. In: Climate change and food security with emphasis on wheat. Academic Press, pp. 1-29.
- Paroda, R.S. 2017. Strategy paper on Indian Agriculture for Achieving Sustainable Development Goals. Trust for Advancement of Agricultural Sciences, New Delhi, pp. 28.
- Tripathi, S., Shahidi, T., Nagbhushan, S., Gupta, N. 2018. Zero Budget Natural Farming for the Sustainable Development Goals –Andhra Pradesh, India. *Issue Brief* 2: 1-10 (retrieved on [www. ceew.in](http://www.ceew.in))