



POPULAR SCIENCE ARTICLE

From Soil to Sustainability: The Promise of Natural Farming

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Abstract

Natural Farming is emerging as an approach to sustainable agriculture that seeks to reduce dependence on externally purchased chemical fertilisers and pesticides while promoting efficient use of local farm resources and ecological processes. Excessive and imbalanced use of chemical inputs has raised concerns regarding soil health, nutrient losses, water pollution and environmental sustainability. Natural Farming addresses these concerns through practices such as *Bijamrita* for seed treatment, *Jivamrita* for enhancing soil biological activity, *Acchadana* (mulching) for moisture conservation, *Whapasa* for maintaining a balance of air and water in the soil, and ecological approaches to plant protection. In India, several states have promoted Natural Farming through farmer training, certification, assured markets and institutional support. The National Mission on Natural Farming, launched in 2024, further provides a national framework for expanding these practices. By integrating locally available resources, soil-health management, water conservation and biological pest management, Natural Farming has the potential to improve resource-use efficiency, reduce input dependence and contribute to environmentally sustainable and economically viable farming systems.

Keyword: Natural Farming; Sustainable Agriculture; Soil Health; Bio-inputs; Bijamrita; Jivamrita; Mulching; Whapasa

Introduction

Ensuring social equity and economic sustainability for farmers and others involved in agriculture and related enterprises is an important requirement for sustainable agriculture (Badiyal *et al.*, 2024). At the same time, growing concerns about environmental degradation and the long-term sustainability of agriculture over the past few decades have highlighted the need for farming practices that can produce food while conserving natural resources.

The increasing dependence on external agricultural inputs provides an important example of this challenge. In 1971–1972, India produced 105.2 million tonnes (Mt) of food grains. During the same period, fertiliser consumption was 1.80 Mt of nitrogen (N), 0.56 Mt of phosphorus (P₂O₅), and 0.30 Mt of potassium (K₂O). Fifty years later, in 2021–2022, food grain production had increased threefold. However, fertiliser consumption increased at a much faster rate, with nitrogen use increasing 11.3 times, phosphorus 14.2

times, and potassium 5.71 times (Fertiliser Association of India, 2023). This sharp increase in fertiliser use raises questions about the long-term sustainability of input-intensive agriculture.

The situation is particularly evident in regions where intensive cereal cultivation and low soil nitrogen availability have contributed to high nitrogen application. States such as Punjab, Haryana, Uttar Pradesh, Andhra Pradesh, Bihar and Tamil Nadu have consequently adopted high rates of nitrogen fertilisation (Bora, 2022). While the intensive and often imbalanced use of chemical fertilisers and other external inputs has contributed to higher agricultural production, their continued excessive use can have adverse effects on soil and environmental health.

Repeated application of chemical fertilisers can disturb soil nutrient balance, affect soil quality and alter the biological activity that is essential for maintaining healthy and fertile soils. Nutrient losses from agricultural fields can also enter nearby water bodies, contributing to

water pollution. In addition, excessive concentrations of reactive nitrogen can contribute to air pollution through the formation of nitrate particulate matter and can contaminate groundwater (Erisman et al., 2013). These environmental concerns, together with the need to reduce dependence on costly external inputs, have encouraged greater interest in farming approaches that work more closely with natural ecological processes.

One such approach is Natural Farming, which emphasises the use of locally available farm resources and natural biological processes to maintain soil fertility and support crop production (Nautiyal et al., 2024). It seeks to reduce dependence on purchased fertilisers and pesticides through practices such as the use of cow dung- and urine-based formulations, biomass recycling and minimal soil disturbance (Singha et al., 2026). By giving greater emphasis to soil health, resource conservation and efficient use of farm resources, Natural Farming has emerged as one of the approaches being explored for developing more sustainable and resilient agricultural systems.

Indian Scenario

Several Indian states, including Andhra Pradesh, Himachal Pradesh, Gujarat, Haryana, Karnataka and Kerala, have taken steps to promote Natural Farming. Among all the Indian states, Andhra Pradesh emerges to be the forerunner in implementing Natural Farming as a project on a large scale. Andhra Pradesh Community-led Natural Farming Initiative is a transformative women-led programme of the state government. Since its launch in 2015-16, the programme has expanded to 8,168 Gram panchayats, covering more than 1.77 million farmers and over 0.92 million hectares. Reported assessments indicate increases in farmer income ranging from 38% to 66%, water savings of up to 50%, and reductions in greenhouse gas (GHG) emissions of up to 46% per acre. Karnataka has also promoted Zero Budget Natural Farming (ZBNF), initially introducing it on a pilot basis across 2,000 hectares in each of the state's 10 agro-climatic zones. In Himachal Pradesh, the state government launched the Prakritik Kheti Khushal Kisan programme in 2018 to promote Natural Farming among farmers.

Himachal Pradesh offers a notable example of how digital tools and assured markets are being combined to strengthen farmer participation in Natural Farming. Under its Prakritik Kheti Khushal Kisan Yojana, the state's Agricultural Technology Management Agency (ATMA) introduced the CETARA portal to formally register farmers practising natural farming,

enabling traceability and targeted procurement support. In Bilaspur district alone, 6,438 farmers adopted natural farming, of whom 5,505 were registered on the Sitara portal, with the state offering a support price of Rs 3,000 per quintal for maize grown through natural farming, procured exclusively from Sitara-registered farmers. This registration-linked assured-price model, complemented by the state's Himbhog and HIM-UNNATI branding and marketing initiatives, illustrates how Himachal Pradesh is working to make Natural Farming not just an ecologically sound practice but also an economically rewarding one, offering a replicable template for other hill states seeking to scale up adoption.

To make certification more accessible and farmer-friendly, Himachal Pradesh has introduced the Certified Evaluation Tool for Agriculture Resource Analysis-Natural Farming (CETARA-NF), a digital farmer self-assessed certification system operating under the state's Subhash Palekar Natural Farming (SPNF/PK3) programme. Unlike conventional third-party certification, CETARA-NF allows farmers practising natural farming to be identified in the market without requiring annual re-certification, and the system is offered free of cost while also meeting the standards established under the Participatory Guarantee System (PGS). Certification is further structured through the State Domestic Production Certification Protocol (SDPECP), which defines three progressive rating levels for farmers:

- Antral-PK3- an entry-level rating marking a farmer's initial conversion from chemical farming to natural farming.
- Sadharan-PK3 -awarded after one year under Antral-PK3 to farmers who continue natural farming practices while still using some external non-chemical inputs.
- Vishisht-PK3 -the highest rating, awarded after a further year under Sadharan-PK3 to farmers who practise natural farming strictly.

This tiered rating system allows both consumers and procurement agencies to distinguish farmers by their stage of transition, while encouraging continued adherence to natural farming principles over time.

Alongside certification, Himachal Pradesh has adopted several targeted strategies to strengthen the marketing of natural farming produce. Recognising that many natural farming farmers sell their produce independently, the state provides them with branded canopies for

smart marketing, giving both the farmer and the produce a distinct market identity. To ensure a steady, year-round supply of natural farming produce to urban consumers, a dedicated outlet has been piloted in Shimla, with plans to replicate the model across the state upon its success. The government is also promoting the formation of farmer-producer companies, through which farmers themselves determine the price of their produce, supported by technical, marketing, food-processing and input-related assistance; these companies are being brought under a state-level federation to strengthen collective bargaining and market linkages. As of the latest figures, natural farming has been adopted by 1.53 lakh farmers (about 16% of the state's farming households) across 3,563 Gram Panchayats (98.2% of the total), reflecting the combined effect of certification, assured pricing and structured marketing support in driving adoption across Himachal Pradesh.

Building on these state-level initiatives, the Government of India launched the National Mission on Natural Farming (NMNF) in November 2024 as a standalone Centrally Sponsored Scheme. The Mission aims to promote chemical-free, ecosystem-based natural farming practices rooted in traditional knowledge and local agricultural systems. It targets the adoption of natural farming across 7.5 lakh hectares through 15,000 clusters, with a total financial outlay of ₹2,481 crore, and aims to facilitate the participation of 1 crore farmers. To support implementation at the grassroots level, the Mission also envisages establishing 10,000 Bio-input Resource Centres and deploying trained Krishi Sakhis to facilitate last-mile delivery of bio-inputs and provide guidance to farmers. An incentive of ₹4,000 per acre per year for two years is being provided to encourage farmers to adopt natural farming practices. As of July 2025, more than 10 lakh farmers had been enrolled, alongside the development of 1,100 model farms and the engagement of 806 training institutes.

History

- 1930 – Mokichi Okada: Japanese philosopher and spiritual leader Mokichi Okada developed a farming approach that avoided the use of chemical fertilisers, laying an early foundation for what later became known as nature farming.
- 1951 – Newman Turner: British farmer and author Newman Turner advocated a system of “fertility farming” based on practices such as cover crops, minimum or no tillage, reduced weeding, and avoidance of synthetic fertilisers and pesticides.
- 1970s–1980s – Masanobu Fukuoka: Japanese farmer and philosopher Masanobu Fukuoka developed and popularised his philosophy of natural farming, emphasising minimal soil disturbance, reduced external inputs and working with natural ecological processes. His ideas gained international attention through his writings, particularly *The One-Straw Revolution*.
- India – Rishi Kheti: Fukuoka’s ideas were introduced and adapted in India, where the approach came to be referred to as Rishi Kheti by practitioners such as Partap Aggarwal.
- 1990s – Subhash Palekar and ZBNF: Subhash Palekar developed and popularised Zero Budget Natural Farming (ZBNF) in India. The approach emphasised on-farm biological inputs, soil fertility, livestock integration and reduced dependence on externally purchased and synthetic agricultural inputs.
- 2018 – Himachal Pradesh: Himachal Pradesh launched the Prakritik Kheti Khushhal Kisan (PK3) initiative to promote natural farming among farmers in the state, marking an important state-level effort towards large-scale adoption.
- 2019–20 – BPKP under PKVY: The Government of India introduced Bharatiya Prakritik Krishi Paddhati (BPKP) as a component of the Paramparagat Krishi Vikas Yojana (PKVY) to promote natural farming. The programme was implemented from 2020–21 and subsequently expanded across several states.
- 2020–2023 – Expansion across states: Natural farming programmes expanded across several states, including Andhra Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh and others. Under BPKP, natural farming was supported through cluster-based implementation, training and farmer capacity building. By 2024, the area sanctioned under BPKP since 2020–21 covered about 14.99 lakh hectares, involving more than 25.3 lakh farmers across participating States and Union Territories.
- November 2024 – National Mission on Natural Farming: The Union Cabinet approved the National Mission on Natural Farming (NMNF) as a standalone Centrally Sponsored Scheme on 25 November 2024.

The Mission was designed as an expanded and restructured form of BPPK, with an overall outlay of ₹2,481 crore. It aims to promote natural farming across 7.5 lakh hectares through 15,000 clusters, create awareness among 1 crore farmers, and establish up to 10,000 Bio-input Resource Centres.

- 2025 onwards – National-scale implementation: The NMNF entered its implementation phase with farmer training, model demonstration farms, Bio-input Resource Centres and community-based extension mechanisms. The Mission also provides an incentive of ₹4,000 per acre per year for two years, subject to the scheme's provisions, to support farmers adopting natural farming practices.

Components of Natural Farming

1. *Bijamrita* (Seed Treatment)
2. *Jivamrita* (Soil Enrichment)
3. *Acchadana* (Mulching)
4. Whapasa
5. Plant protection

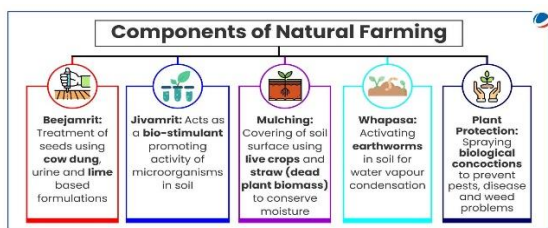


Fig. 1. Components of Natural Farming system

Bijamrita (Seed Treatment)

Bijamrita (also known as *Beejamrutha*) is a natural preparation used for seed treatment in Natural Farming. It is traditionally used to protect seeds from fungal and bacterial infections and to support seed germination and early root development.

Ingredients required for approximately 100 kg of seeds

- Water: 20 litres
- Fresh local cow dung: 5 kg, preferably from an indigenous (desi) cow
- Local cow urine: 5 litres
- Lime (calcium hydroxide): 50 g
- Farm soil: One handful, preferably collected from the farm bund or beneath a banyan tree

Preparation procedure

(Kumar *et al.*, 2020)

- Take 20 litres of water in a clean container.

- Place 5 kg of fresh cow dung in a clean cotton cloth, tie it securely and immerse it in the water for about 12 hours.
- Soak 50 g of lime separately in water for about 12 hours.
- After 12 hours, remove the cloth containing the cow dung and add the soaked lime solution to the container.
- Add one handful of farm soil, preferably collected from the farm bund or beneath a banyan tree.
- Add 5 litres of cow urine.
- Mix the preparation thoroughly. *Bijamrita* is then ready for use as a seed-treatment preparation.

Jivamrita (Soil Enrichment)

Jivamrita is a fermented preparation used in natural farming to enhance biological activity in the soil. It acts as a microbial stimulant and is intended to promote beneficial microbial activity, thereby supporting soil health. It is also reported to help suppress certain fungal and bacterial diseases in crops.

Ingredients required for 200 litres of *Jivamrita*

- Fresh cow dung: 10 kg
- Cow urine: 5–10 litres
- Jaggery: 2 kg
- Pulse flour (besan): 2 kg
- Fertile soil: one handful, collected from a field or bund
- Water: 200 litres

Preparation procedure

(Kumar *et al.*, 2020)

- Take 200 litres of water in a clean container.
- Add 10 kg of cow dung and mix thoroughly.
- Add 5–10 litres of cow urine and stir well.
- Add 2 kg of jaggery and 2 kg of pulse flour, and mix until the ingredients are well dispersed.
- Add one handful of fertile soil collected from a field or bund.
- Stir the mixture thoroughly in both clockwise and anticlockwise directions.
- Cover the container loosely with a cloth or lid to allow air circulation.

Keep the container in a shaded place and allow the mixture to ferment for about 48 hours. Stir it at least twice a day during the fermentation period.

During fermentation, microorganisms present in the cow dung, cow urine, and soil use the

organic materials such as jaggery and pulse flour as sources of nutrients. The addition of fertile soil also introduces native soil microorganisms into the preparation. Together, these processes contribute to the development of a microbially active preparation.

Application

Jivamrita can be applied to crops twice a month through irrigation water or as a 10% foliar spray. The prepared solution can be stored for up to 15 days and applied either directly as a spray or through irrigation water.



Fig. 2. Step-by-step procedure for the preparation of *Jivamrita*

Acchadana (Mulching)

Mulching is a practice in which we can cover the soil with natural and biodegradable materials to conserve soil moisture, suppress weeds, and increase soil life. Three types of mulching practices have been practised under Natural Farming (Choudhary *et al.*, 2024)

- Soil mulch
- Straw mulch
- Live mulch

Key benefits

- **Moisture conservation:** Mulching covers the soil surface and reduces direct exposure to sunlight and wind, thereby limiting evaporation and helping conserve soil moisture (El-Beltagi *et al.*, 2022)
- **Weed suppression:** The mulch layer reduces the amount of sunlight reaching the soil surface, which can inhibit the germination and growth of weed seeds and therefore reduces the competition for nutrient and water uptake for the crops (Duddigan *et al.*, 2023; Thankamani *et al.*, 2016)

- **Temperature regulation:** Mulching helps moderate soil temperature by keeping the soil cooler during hot periods and reducing heat loss during the night.
- **Enhanced microbial activity:** The mulch layer provides organic matter and creates favourable conditions for soil microorganisms, thereby supporting microbial activity and nutrient cycling.

Whaphasa (Balance of Air and Water)

Whaphasa refers to maintaining a balance between air and water in the soil around plant roots. It describes a soil condition in which adequate moisture and air are available within the soil pores, creating a favourable environment for root growth and soil biological activity. Maintaining this balance helps ensure proper soil aeration and supports root respiration while preventing excessive water saturation that can restrict the availability of oxygen to roots. *Whaphasa* is therefore considered an important principle of Natural Farming, with an emphasis on efficient water use and maintaining favourable conditions for plant growth and beneficial soil organisms such as earthworms.

Plant Protection

Plant protection in Natural Farming focuses on managing insect pests and diseases through ecological and preventive approaches, with minimal reliance on synthetic chemical pesticides. Instead of depending on a single method, Natural Farming adopts a holistic approach that combines cultural, biological, botanical and mechanical practices to maintain



crop health and regulate pest populations.

- **Cultural practices:** Practices such as crop diversification, intercropping and trap cropping can create a more diverse farm environment and help reduce pest pressure. They can also provide suitable habitats for

beneficial insects that naturally regulate pest populations (Pretty *et al.*, 2018).

- **Botanical preparations:** Natural Farming uses plant-based preparations such as **Neemastra, Neem leaf extract, Agniastra and Brahmastra** for managing insect pests. These preparations are traditionally used as alternatives to synthetic pesticides while aiming to maintain ecological balance (Gogoi *et al.*, 2026)
- **Biological control:** Beneficial insects, predators and other natural enemies can help regulate populations of harmful insect pests. Maintaining a diverse farm habitat can support these organisms and strengthen natural pest-control processes.
- **Mechanical practices:** Physical removal of pests, infected plant parts and weeds, along with other mechanical methods, can help prevent the spread and build-up of pests and diseases.
- **Seed treatment:** Preparations such as **Bijamrita** are traditionally used for seed treatment and are intended to protect seeds from certain seed-borne infections and support healthy germination.

Conclusion

Natural Farming offers an approach to sustainable agriculture by reducing dependence on externally purchased chemical fertilisers and pesticides, thereby potentially lowering production costs. Practices such as mulching and efficient water management can help conserve soil moisture, while reduced chemical inputs may minimise the risk of soil and water pollution. By integrating locally available resources with ecological farming practices, Natural Farming can contribute to improved resource-use efficiency, environmental sustainability and potentially better farm livelihoods.

Conflict of Interest: The authors declare that they have no competing interests or conflicts of interest.

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