NATURAL FARMING: STATUS, CHALLENGES AND PROSPECTS

Abstract

Indiscriminate use of modern agro-chemicals has led to deterioration of soil, food and water quality affecting the plant, animal, and human through the food chain. The need to explore sustainable alternative management strategies has led to reignition of the age old concept of 'Natural farming' (NF) in a more systematic way. The concept has been popularized by Padma Shri awardee Shri Subhas Palekar as a low cost farming technique especially for the benefits of small and marginal farmers. Currently, Government of India has initiated NF through implementation of Bhartiya Prakritik Krishi Padhati (BPKP) where a total of 4.09 lakh ha area has already been covered in 8 States. The idea of NF revolves around four principles such as use of low inputs, mulching, multicropping and use of natural inputs. The approach draws its strength based on 'four wheels' or four pillars which includes (1) Jivamrita: a microbial solution to increase soil microbial activity and mineralize soil nutrients (2) Bijamrita: a seed treatment solution to protect young seedlings from soil-borne diseases; (3) Achhadana: mulching of top soil in order to check evaporation, and (4) Whaphsa: Irrigating crops during the most crucial period of water need to synchronize plant demand. Farm level management of insect /pests is taken care of through preparation of natural insecticides namely, Bhamastras, Neemastras, etc. Adoption of NF has the potential to improve soil and food quality besides improving crop yields and socio economic condition of farmers. However, the fact that this approach lacks adequate scientific evidence limits its wide scale adoption. Realizing its potential as a sustainable crop and soil management practice, long-term trials should be carried out to validate the yield and growth benefits and aid in its popularization.

Keywords: Natural Farming, Natural Inputs, Jivamrita, Bijamrita, Achhadana, Whaphsa.

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I. INTRODUCTION

Agriculture forms the backbone of household income in 50% human population of India. With 28 states and 8 union territories (UTs), India is home to world's largest human population of more than 1.4 billion which is 18% of the world's human population. Additionally, it is a home to 15% of the world's livestock population. The huge population is supported by resources that comes from merely 2.4% of the world's geographical area. It is estimated that, India would require around 311 million tons of food grains (cereals and pulses) during 2030 to feed around 1.43 billion people, and the requirement would further increase to 350 million tons by 2050 when India's population would be around 1.8 billion (Kumar and Sharma, 2020). Due to its strong and robust national agricultural systems, independent India made significant developments in increasing its food productions through green revolution in mid-1960s. Due to introduction of high-yielding nutrient responsive varieties of rice and wheat along with the application of fertilizers, India witnessed a dramatic rise in food grain production. Around 50% increase in food grain production was due to fertilizer. The fertilizer consumption rose in 2019-20 to 28.97 million tonnes (Mt) against 2.26 Mt in 1970-71 (FAI, 2022) **(Fig. 1)** However much of our fertilizer consumption till date is skewed towards nitrogen (N). Despite a steady increase in nutrient consumption for nitrogen (N), phosphorous (p), and potassium (k) (Fig. 1), the nutrient balance has been severely harmed. As a result of which the partial factor productivity (kg food grain produced per unit of fertilizer nutrient used) exhibited a decline from 48 kg kg^{-1} in 1970-71 to 10 kg kg^{-1} in 2020-21 (FAI, 2022; Agricultural Statistics at a Glance, 2022) **(Fig. 1).**This injudicious use of fertilizers and other chemicals have led to various harmful impacts in our eco system including soil and water pollution, eutrophication, aquatic biodiversity disruption etc. Moreover, the lucrative intensive agriculture has lured the framers to take non-institutional loans but low productivity, market instability and erratic monsoon trapped them in an infinite loop of debts. According to the National Bank for Agriculture and Rural Development's (NABARD), 2018 financial inclusion survey, 52.5 percent of all agricultural households in India were in debt. Another area of concern is the burden of fertilizer subsidies given by the government for the benefit of farmers. As most of Indian farmers are small and marginal in nature, each year government spends a staggering amount on subsidies to reduce their financial burden. For example, during 2019-20, government spent an amount of 79,996 crores on fertilizer subsidies (FAI, 2022). The target of doubling farmer's income by 2022 has not been accelerated much. We are facing a number of roadblocks such as, small land holdings, lack of mechanization, low partial factor productivity, low nutrient use efficiency, high cost of chemicals, shift in cropping systems, depleting ground water level, lack of institutional farm credits, etc. Even with such challenges, India as a country has improved its status from a poverty stricken country to food bowl for the world where it supplies food grains to other countries. But, the aftermath of green revolution in form of disruption of natural resources such as, soil and water pollution, land degradation, damage to the native flora and fauna, greenhouse gas emissions, etc., can't be overlooked. It has forced the policy makers and scientists to think of alternate strategies to make farming more profitable keeping in mind that practices must be eco-friendly and sustainable for long term. With this background, the concept of natural farming has come into lime light recently and is being popularized as a low cost farming technique. This chapter provides a detail overview of this approach highlighting its prospects as well as challenges.

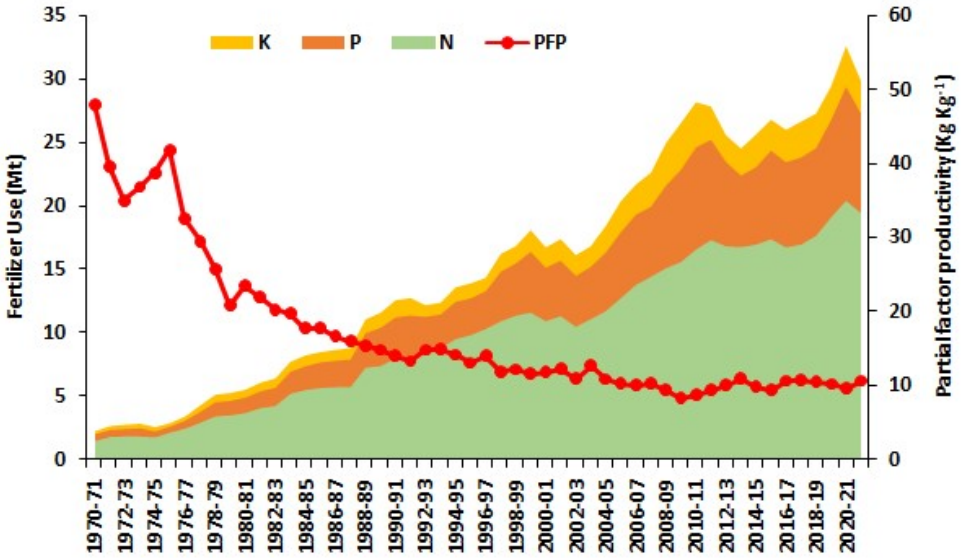

Figure 1: Year Wise Fertilizer Consumption (Million Tons) and Factor Productivity (Kg Kg^{-1}) After Green Revolution
(Source: FAI, 2022; Agricultural Statistics at A Glance, 2022)

II. WHAT IS NATURAL FARMING?

It has been well established that indiscriminate use of agro-chemicals has resulted in deterioration of soil health, biological diversity, quality of food, and water affecting the plant, animal, and human through the food chain (Dhaliwal et al. 2019; Jat et al. 2017; Das et al. 2014). Thus there is a need to explore alternative management strategies which shall enhance soil health and environmental quality in a more sustainable way. Organic farming (OF) certainly, provides that benefits in terms of maintaining soil quality and providing major eco-system services (Meena et al., 2020). But, recently, the term "Natural Farming" (NF) has come to lime light due to extensive popularization and push by Govt. of India (GOI). In the budget session of July, 2019, Hon'ble finance minister of India has recognized the increasing problem of farmer's distress and called for a 'back to basics' approach with an emphasis on NF . This is not a new thing. This is an age-old practice which has been followed for a long time in the rural pockets of India where farmers formulate some concussions to apply as fertilizer and plant protection chemicals by utilizing their on-farm resources. In view of increased pressure on farming and agrarian crisis, even the UN (United Nations) has recognized the role of small-scale family farmers to safeguard global food security and launched a global action plan to benefit family-run farms (FAO, IFAD, 2019). In its true sense, NF concept is originally formulated by a Japanese naturalist and philosopher named Masanobu Fukuoka (1913–2008). It minimizes human interaction and gives nature to adjust its own course, thus called "do nothing farming". But, in India this naturistic way of farming has been popularized by Padma Shri awardee Shri Subhas Palekar for the farming of small and marginal farmers. It has gained traction as a grassroots movement attempting to improve India's capacity to produce its own food by farming with nature and ending farmers' reliance on purchased inputs and credit due to its farmer-friendly and culturally Indic approach (Shyam et al., 2019). This whole idea of NF is centred on desi cow (*Bos indicus*) as the focal point for input. Inputs such as, cow urine, pulse flour, jaggery, butter milk, forest soil, garlic,

onion, chili and other natural plant leaves serve as critical input. Apart from these inputs, NF combines agro-forestry, intercropping, and microbial inoculation to increase the activity of native soil micro-biota. As the inputs are homemade and require low cost, its gives farmers no financial burden and lacks any undesired ecological impact.

III. NATURAL FARMING CURRENT STATUS

The approach of NF emphasizes on the importance of holistic production of crops and animals so that synergistic effects of various parts of system can be harnessed. The ingredients used for this system rely on easily available on-farm produces, native soil microorganisms or mycorrhizae to enhance soil (Khadse and Rosset, 2019). The approach draws its strength based on 'four wheels' of NF: (1) Jivamrita a microbial solution to increase soil microbial activity which will ultimately mineralize soil nutrients and make it available to plants and protect against pathogens; (2) Beejamrita: a seed treatment solution to protect young seedlings from fungal and soil-borne diseases; (3) Acchadana: mulching of top soil in order to check evaporation and to add soil organic matter and (4) Whapahasa: for improving soil structure and aeration by applying irrigation at regular interval and alternate furrows synchronizing with plant demand. Even if NF started as a grassroots level revolution in parts of Karnataka and Andhra Pradesh, year by year more farmers and states are attracted towards it. Government of India has already initiated NF through implementation of Bhartiya Prakritik Krishi Padhati (BPKP-A sub scheme of Paramparagat Krishi Vikas Yojana)-since 2020-21 to promote traditional indigenous agro ecological farming which has gained huge importance across the country. A total of 4.09 lakh ha area has already been covered in 8 States under BPKP namely Andhra Pradesh, Chhattisgarh, Kerala, Himachal Pradesh, Jharkhand, Odisha, Madhya Pradesh and Tamil Nadu (**Table 1**).

Table 1: Status and Coverage of Natural Farming in India

Sl. No.	States	Area (Ha)	Crops under NF
1.	Andhra Pradesh	100000	Maize, Groundnut Cashew, Citrus, Palmoil, Tomato, Cotton, Paddy
2.	Chhattisgarh	85000	Rice, Wheat, Pulses
3.	Kerala	84000	Paddy, Banana, Leafy Vegetables, Cucurbits, Solanaceous varieties, Bhindi, Cool Season Vegetables, Spices and Condiments., Tubers, Coconut based inter crops garden like fruit plans, cocoa, nutmeg, coffee, Cashew, Pepper, Coconut, Arecanut
4.	Himachal Pradesh	12000	Wheat, Maize, Peas, Apple, Stone fruits, Pulses, paddy, coriander and other leafy vegetables
5.	Jharkhand	3400	Paddy, Wheat, vegetables , pulses, oilseeds
6.	Odisha	24000	Rice, Turmeric, Ginger and Pulses
7.	Madhya Pradesh	99000	Wheat, Rice, Pulses, Soybean
8.	Tamil Nadu	2000	Vegetable crops
	Total	**409400**	

(Source: https://pib.gov.in/PressReleasePage.aspx?PRID=1813682, Annual Report 2022-23)

The BPKP scheme is being up scaled in Mission Mode as a as separate scheme called National Mission on Natural Farming to cover 7.5 lakh ha area by developing 15000 clusters with a central budget outlay of Rs.1584 crore. There will be nation-wide outreach and training through central and state agencies. At least one model NF cluster will be developed in at least one Gram Panchayat in each block based on the learnings from a champion farmer (Each One Teach One) (Annual report, 2022-23). After its origin in Karnataka in 2002, data shows that around 100,000 farming households have already started following NF based farming methods (Khadse and Rosset, 2019). In the neighbouring state of Andhra Pradesh, farmers have shown more enthusiasm in adopting NF (now it is referred to as Andhra Pradesh Community-Managed Natural Farming, or APCNF). The state agriculture department is promoting the adoption of NF through the 'not for profit' organization Rythu Sadhikara Samstha (RySS). By 2020, around 580,000 farmers were engaged in NF (RySS 2020), and the local government plans to scale this up to 6 million farmers (Tripathi et al., 2018).

1. **Principles of Natural Farming:** Natural farming aims to cultivate plants that increase farmers' self-sufficiency while promoting animal, human, and plant harmony and environmental protection. The main premise underlying NF is to guide farmers towards chemical-free sustainable farming that improves soil fertility and ensures low production costs. The basic principle of NF is as follows **(Fig 2).**

Figure 2: Principles of Natural Farming (Palekar, 2014)

- **Low Inputs:** NF minimizes production costs for farmers as most inputs are readily available in their fields and some are affordable in the market. Fertilizer needs are reduced since plants utilize only a small percentage (1.5 to 2.0 percent (%)) of soil nutrients, with the rest obtained from air, water, and solar radiation. In natural environments like forests, these nutrients are freely provided by nature. Plant-based solutions are used to protect crops from pests and diseases, reducing the need for chemical purchases. NF lowers the cost of cultivation, reducing farmers' reliance on debt.

- **Mulching:** Mulching is crucial in NF, creating an optimal microclimate (25-32 °C temperature, 65-72% soil moisture) for microorganism development. It sustains these favourable conditions, reducing irrigation requirements.

- **Multi-Cropping:** In contrast to conventional farming's monocropping, NF embraces intercropping, multi-cropping, or mixed cropping, recognizing the harmonious interaction among plants. Natural farming optimizes soil utilization and nutrient cycling, taking advantage of crop interdependence. By combining long-lived species like chikoo, coconut, and mango with ephemeral species such as vegetables, legumes, medicinal, and fruit-bearing plants (e.g., banana, papaya, custard apple), crop diversification is promoted based on local and regional agro-climatic conditions. Multicropping serves as a reliable risk management strategy, offering alternative returns in case of crop failure.

- **Natural Inputs:** Natural farming prohibits the use of chemicals or organic compost, but it does promote soil biological activity as well as improves plant's defence against disease and pest attack. Even if soil is a reservoir of all essential plant nutrients, they are not in accessible forms to be utilized by plants. Bacteria, fungus and earthworm population help in transforming these nutrients into useful forms. Chemicals, on the other hand, hampers activity of these organisms. According to S. Palekar, indigenous cow dung contains 3 to 5 million beneficial bacteria and must be reintroduced into soil. Tobacco, green chilli, garlic, leaves of neem, custard apple, guava, as well as papaya and white dhatoora contain some natural insecticidal properties to control insects and pests. All of these natural inputs help to have a good crop establishment in harmony with nature.

2. **Components of Natural Farming:** There are mainly four pillars of NF as suggested by Padmashri Subhash Palekar **(Fig.3)** These can be referred to as four wheel approach. Under NF, he proposed a four-wheel approach for providing use.

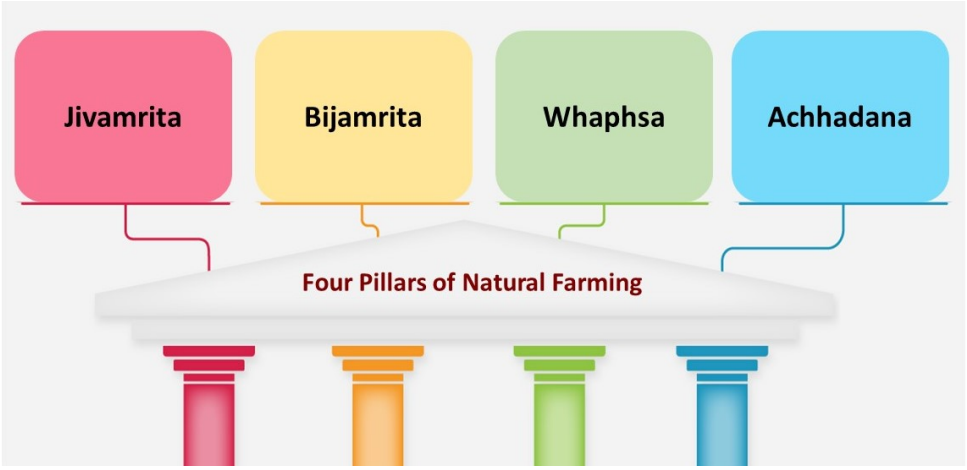

Figure 3: Four Essential Pillars of Natural Farming

Pillars of Natural Farming

- **Jivamrita:** As the name suggests Jivamrita, which means soil inoculants, and refers to a concoction made up of cow dung, urine, jaggery, pulse flour, water, and soil to multiply soil microorganisms. It is a microbial combinations that can be used within 48 hours after being prepared. It is basically a bio-fertilizer that delivers nutrients to

the plant roots via nutrient mineralization. Furthermore, when applied to the soil, it helps in increasing soil microbial and earth worm activity. Farmers who do not have access to water can make Ghanajivamrita, a dry alternative of Jivamrita that can be prepared once and kept for a year (Khadse and Rosset, 2019).

- **Bijamrita:** It is the liquid microbial solution based on cow dung and urine which aids in seed treatment. It prevents young plants from fungal, seed, and soil-borne diseases. It is believed to contain beneficial microbes that have plant-protective properties and boost plant growth (Sreenivasa, Naik, and Bhat, 2009).

- **Whaphsa:** Whaphsa, in NF, refers to maintaining an ideal microclimate around the roots. The principle is based on roots absorbing water vapour rather than liquid water, emphasizing watering during crucial moments. By creating a microclimate with a balance of air and water molecules, overwatering is prevented. This approach enhances water use efficiency by reducing the quantity and frequency of irrigation, leading to improved drought resistance. Palekar suggests watering plants only when the sun is high at noon for optimal whaphsa results. NF methods have been found to reduce water usage by up to 90%, making them suitable for rainfed farming and water-scarce regions.

- **Achhadana/Mulching:** Mulching in NF involves covering the topsoil with cover crops, crop residue, or organic material to reduce water evaporation and enhance soil humus production. Various mulching forms are employed. "Live mulching" suggests using a mix of mono-cotyledonous crops (like millets) and leguminous di-cotyledonous crops (like beans) to provide nutrients and fix nitrogen. "Straw mulching" involves applying dry crop residue, while "soil mulch" reduces tillage of the topsoil, improving aeration and water retention (Khadse and Rosset, 2019). Reduction in tillage improves aeration and water retention.

Local components are crucial in NF, particularly indigenous cows, cow dung, and urine, which greatly influence NF inputs. In the absence of indigenous cows, alternatives like buffalos or human urine can be utilized. However, the most favourable results are obtained with indigenous cow breeds possessing beneficial bacteria. Bacterial inoculums in cow dung and native soil multiply and derive nutrients from organic sources during fermentation. Additionally, the fermented culture attracts and enhances the activity of other beneficial microorganisms already present in the soil. The procedures to prepare these components are as follows **(Table 2).**

Table 2: Methods of Preparation of NF Components (Adapted From Via Campesina, 2016)

Name	Preparation	Application
Jivamrita	A container is filled with 200 litres of water, 10 kg of fresh cow dung (local Indian breed) and 5-10 litres of cow urine are added. Then, 2 kg of jaggery (brown sugar), 2 kg of pulse flour, and a palm full of undisturbed chemical-free soil	Apply 200 litres of Jivamrita in irrigation water to 1 acre of land twice a month, or apply a 10% solution

	(forest soil) are added and thoroughly mixed. The mixture is kept in shade for approximately 48 hours for fermentation.	on the leaves.
Bijamrita	It is made in the same way as Jivamrita. 5 litres of urine and 5 kg of dung from a local Indian-breed cow are added in a container having 20 litres of water. The mixture is then thoroughly mixed with 50 g of lime and a handful of local soil.	Coating and mixing the seeds by hand, or dipping seedlings in Bijamrita solution, drying in the shade, and sowing.
Acchadana/ mulching	Mulching is done in three ways: soil mulch (friable dirt/dust coverage on top soil), straw mulch (dried remains of previous harvests, dead materials of plants and/or animals), and living mulch (symbiotic mixed or intercrops preferably with monocot and dicot such as cereal-legume cropping).	Before sowing seeds or cultivating crops, use soil or straw mulch to cover land surfaces (living mulch).
Whaphsa	It allows soil to supply water vapour to plant roots by reducing irrigation quantity and frequency.	Irrigation in alternate furrows at noon to keep air and water molecules within the soil.

3. **Insect-Pest Management under Natural Farming:** Farmers manage plant pests with natural products made basically from local resources at very insignificant or very low cost. The production and application of these natural insecticides help to protect the crop against insect-pests and diseases while preventing the negative impacts of pesticides **(Table 3).** Natural insecticides may be effective in controlling pests that cannot be controlled with chemicals.

Table 3: Details of Various Natural Insecticides/Pesticides Utilized Natural Farming (Palekar, 2014)

Name	Preparation	Benefits
Brahmastra	It is prepared by crushing and boiling neem leaves, custard apple leaves, guava leaves, lantern camellia leaves, pomegranate leaves, papaya leaves, and white dhatura leaves in urine	It is used to control all sucking pests, including fruit borer and pod borer
Agniastra	It is made up of 10 L of local cow urine, 1 kg of tobacco, 500 gm of green chilli, 500gm of local garlic, and 5kg of crushed neem leaves. 2 L Brahmastra is mixed with 100 L water for spraying	It is efficient against pests such as leaf rollers, stem borers, fruit borers, and pod borers
Neemastra	It can be made from fermented local cow urine (5 L), cow manure (5 kg), and neem leaves and pulp (5 kg)	It is used for sucking pests and mealy bugs
Dashparni Ark	5 kg neem leaves, 2 kg *Vitex negundo* leaves, 2 kg *Aristolochia* leaves, 2 kg papaya (*Carica*	It can be used to manage insect pests

	papaya), 2 kg *Tinospora cordifoli*a leaves 2 kg *Annona squamosa* (Custard apple) leaves, 2 kg *Pongamia pinnata* (Karanja) leaves, 2 kg *Ricinus communis* (Castor) leaves, 2 kg *Nerium indicum* leaves, 2 kg *Calotropis procera* leaves, 2 kg green chilli paste 250 g garlic paste, cow manure (3 kg), cow urine (5 L), and water (200 L)	as a foliar spray

IV. BENEFITS OF NATURAL FARMING WITH RESPECT TO SOIL ECOSYSTEM

There are many advantages of switching modern agricultural practises to a 'back to basics' approach through NF.

1. **Soil Fertility or Health Related Improvement:** 'Natural farming' involves farming in harmony with nature, abstaining from chemical use, to maintain biodiversity and a healthy equilibrium. It mitigates soil erosion, restores soil vitality, and enriches it with nutrients. Earthworms contribute to humus formation by decomposing plants and animals. This farming method promotes soil aeration and water retention through the creation of micro and macro pores. Unlike chemical fertilizers, it avoids soil and water pollution and prevents erosion. Crop rotation and intercropping protect against nutrient and moisture depletion. Mulching reduces evaporation, preserving soil moisture, and foster a favourable environment for soil microorganisms.

2. **Crop Yield Related Benefits:** While Jivamrita alone is insufficient to address the nutrient deficiencies in Indian soil, there are studies highlighting the potential of NF on crop yield. In an experiment in Himachal Pradesh, ghanjivamrit + jivamrit + mulching significantly increased wheat yield (1767.3 kg ha^{-1}) and gram yield (734.1 kg ha^{-1}) compared to the control. This treatment also exhibited the highest nitrogen availability (275 kg ha^{-1}), NPK uptake, viable microbial count, and dehydrogenase activity (Choudhary et al., 2022). Another study demonstrated improved onion growth and yield with bijamrita seed treatment and foliar spray of jivamrita (Prakash et al., 2022). Likewise, in elephant foot yam, corm treatment with bijamrita and soil application of jivamrita resulted in enhanced growth attributes and yield (Biswas et al., 2023). Additionally, vermicompost application combined with jivamrita at regular intervals led to higher French bean yield, improved soil health, and economic output (Sharma and Tahkur, 2022).

3. **Benefits Related to Farmers Socio-Economic Conditions:** Natural farming not only improves soil fertility and productivity but also provides profitable returns to farmers. For instance, combining vermicompost and jivamrita resulted in a net return of INR 1,47,530 ha^{-1} and a B:C ratio of 2.56 in one study (Sharma and Tahkur, 2022). Another study showed that treating elephant foot yam with bijamrita and jivamrita achieved a net return of INR 1,69,189 ha^{-1} and a B:C ratio of 2.82 (Biswas et al., 2023). Since NF has minimal input costs, it allows farmers to attain higher profits and alleviates the burden of debt which in turn helps in reducing mental stress among farmers (Murall, 2016).

4. **Human Health and Food Quality Related Benefits:** Natural farming has the potential to safeguard against the harmful effects of chemicals found in fertilizers and pesticides, which are linked to diseases like cancer and diabetes. Products obtained from the Natural farming system is free from harmful chemicals and nutritionally superior, socially more acceptable and can fetch good economic value. (Tripathi et al., 2018). It improves climatic resilience, strengthens soil and crops, and helps to address the labour crisis by reducing the demand for different cross-cultural activities and hired personnel. By reducing external inputs, promoting waste recycling, and minimizing material footprint, NF helps to create sustainable agriculture.

V. CHALLENGES TO ADOPT NATURAL FARMING

Natural farming promotes environmental friendliness and ecological sustainability by nurturing soil, plant, and human health through enhanced beneficial microbial populations, chemical-free nutrient delivery to plants, and toxic-free food for consumers. Despite its potential, farmers may hesitate to adopt this approach due to various drawbacks. Several underlying challenges must be addressed to fully realize its goal of supporting farmers and increasing output. Some of the constraints in adoption of NF are as follows:

1. **Yield Loss and Other Environmental Benefits Compared to Other Farming Methods:** Natural farming is a new management practices and initially the soil systems takes time to adjust to it, resulting in lower crop yields initially due to the soil's familiarity with chemical inputs. The depletion of organic carbon and limitations on improved cultivars and GMOs may discourage farmers from adopting NF if production plateaus occur. To increase yields, NF practices should be evaluated across different cultivars. Some studies suggest that NF may not consistently outperform organic farming in terms of yield (Korat and Mathukia, 2022). To validate the yield and growth benefits of NF on a larger scale, long-term trials are necessary throughout the country, rather than being limited to enthusiastic farmers.

2. **Incidence of Disease and Pest:** Due to the absence of chemicals and pesticides in NF, the effectiveness of natural insecticides in combating pests is uncertain, leading to potential crop losses over time. Farmers need quick remedies to minimize losses and ensure crop production. Naturally occurring substances like insecticides and weedicides are insufficient to control crop-specific weeds, diseases, and pests, which can have devastating consequences. While some research reports suggest the use of natural products for pest and disease management, field trials are needed to validate these findings.

3. **Lack of Long-Term Data:** Without scientific data and evidence from research institutes, it will be challenging for the scientific community to establish credibility of any new techniques/practice. This lack of evidence may lead to skepticism among stakeholders and farmers regarding the effectiveness of the program. Farmers would be confused if there are conflicting views from a network of agricultural institutions. The microbial composition, efficiency, and impact of bijamrita, and bramhastra have not been scientifically evaluated. Due to the weakened agricultural market infrastructure, natural products have limited value in large-scale areas, even if their prices are competitive with chemically produced products.

VI. CONCLUSIONS

The concept of Natural Farming (NF) aims to boost farmers' confidence by promoting environment friendly farming methods. This approach offers both yield-based profits and environmental protection. With lower farming costs, any produce obtained contributes to overall profitability. The Indian government is keen on this win-win strategy and is formulating supportive policies. However, providing institutional credit and agricultural knowledge to small and marginal farmers in India is challenging. The substantial annual fertilizer subsidy further exacerbates fiscal issues. Thus, if farmers can obtain profit without heavy reliance on credits or burdensome loans, while raising awareness about soil and environmental conservation, it benefits the nation. However, caution is needed when popularizing NF, ensuring its viability alongside intensive agriculture. The lack of experimental evidence undermines its credibility, as the scientific community remains skeptical, particularly regarding growing of major food crops like rice, wheat, and maize through NF methods. While this alternative farming method has the potential to benefit millions of farmers, robust scientific evidence is crucial for its support.

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