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Natural Farming: Embracing Regenerative Agriculture for Sustainable Crop Production

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Natural farming, a regenerative agriculture is advocated and promoted worldwide to produce safe and quality produce and to live in harmony with nature. It is "Chemical free farming" or "do-nothing farming" is a sustainable farming approach that aims to work with nature instead of trying to change it. It focuses on improving soil biological fertility without relying on synthetic chemicals or external inputs. It lies in a simple principle of utilizing low-cost and local inputs with zero utilization of chemicals. Major strategy is continuous application of cow dung and cow urine-based concoctions beside following effective recycling of crop residues, leguminous intercrops as soil cover, pre-monsoon dry sowing, minimizing the irrigation and balancing the soil, air and moisture by irrigating at noon. The farmer is considered only to be a facilitator - the real work is done by Nature herself.

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No- tillage and farming without the application of herbicides, inorganic fertilizers and pesticides is practiced. Here, actual physical work and labor has been seen to reduce by up to 80% compared to other farming systems. The essence of natural farming is minimizing the external inputs to the farm land, which degenerate the soil nature and improving the crop yield. The Natural farming a cost-effective farming practices with scope for raising employment and rural development. Natural farming also offers a solution to various problems such as food insecurity, farmers distress, health problems arising due to pesticide, fungicide and fertilizers residue in food and water, climate change and natural calamities.

Keywords: Natural farming; ZBNF; chemical free; natural resources; sustainable agriculture.

1. INTRODUCTION

"Conventional agriculture, which gained momentum after the Green Revolution, has significantly increased crop yields to meet the demands of a growing population. However, the continuous use of chemicals in crop production has led to soil health deterioration and environmental hazards due to toxic residues. After 50 years of the Green Revolution, India faces second-generation challenges such as declining factor productivity growth, poor soil health, loss of soil organic carbon, pollution of ground and surface water, water-related stress, increased incidence of pests and diseases, rising input costs, reduced farm profits and the adverse impacts of climate change" [1]. "While chemical use is beneficial in the short term, it is detrimental to long-term sustainable agricultural production" [2]. "The harmful impacts of chemical fertilizers in intensive agriculture include the depletion of the carbon reserve pool and secondary and micronutrients, leading to soil productivity and fertility degradation" [3]. According to the National Sample Survey Office (NSSO), over 70% of agricultural households spend more than they earn and more than half of all farmers are in debt due to rising costs of inputs like fertilizers and chemical pesticides.

"To achieve the Central Government's goal of doubling farmers' incomes by 2022, it is crucial to reduce farming expenses and promote natural farming methods like Zero Budget Natural Farming (ZBNF). This approach minimizes farmers' reliance on costly external inputs like chemical fertilizers and pesticides, which are often unaffordable. The zero-budget farming model significantly reduces farm expenditure and dependence on farm loans. It also encourages the use of own seeds and locally available natural fertilizers, promoting farming in synchronization with nature" [4].

"In India natural farming is promoted as Bharatiya Prakritik Krishi Paddhati Program (BPKP) is a sub-mission under the Paramparagat Krishi Yojana (PKVY), which falls within the umbrella of the national Mission on Sustainable Agriculture (NMSA). BPKP aims at promoting traditional indigenous practices, which give freedom to farmers from externally purchased inputs. It focuses on on-farm biomass recycling with major stress on biomass mulching; use of cow dung–urine formulations and exclusion of all synthetic chemical inputs either directly or indirectly. The scheme has a total outlay of Rs 4645.69 crore for the period of six years (2019-20 to 2024-25). Under BPKP, financial assistance of Rs 12200/ha for 3 years is provided for cluster formation, capacity building and continuous handholding by trained personnel, certification and residue analysis with a vision of covering 12 lakh ha in 600 major blocks of 2000 hectare in different states" [5].

2. NATURAL FRAMING

"Natural farming, as the name suggests, involves farming with nature without using modern tools and technology like machinery, genetically modified seeds and soil testing. This method operates on the principle that soil contains all the essential nutrients for plant growth. Plants obtain 98-98.5% of their nutrition from air, water, and sunlight, with the remaining 1.5% from the soil. Thus, the system can sustain and flourish without nutrient supplementation, similar to a forest ecosystem" [6]. "Natural farming is a chemical-free, traditional farming method considered an agroecology-based diversified farming system integrating crops, trees, and livestock with functional biodiversity" [7]. "It emphasizes the synergistic effect of plant and animal products on crop establishment, soil fertility and microorganisms" [8].

Zero Budget Natural Farming (ZBNF), also known as Zero Budget Spiritual Farming (ZBSF), was introduced by Shri Subhash Palekar, who was honored with the Padma Shri

in 2016. The term “Budget” refers to credit and expenses, so “Zero Budget” means farming without using credit, spending money on purchased inputs, or using chemicals” [9]. “ZBNF is a holistic agriculture practice that counters commercial expenditure and market dependency for inputs, with all necessary growth factors available around the plant's root zone” [10]. “The natural farming is resource-efficient, minimizing the use of financial and natural resources while increasing crop yield. By restoring soil and water-related ecosystems, it decouples agricultural productivity from ecosystem degradation and biodiversity loss” [11].

3. HISTORY OF NATURAL FRAMING

3.1 The Emergence of Natural Farming Globally

3.1.1 Masanobu Fukuoka

“Natural farming was established by Masanobu Fukuoka (1913–2008), a Japanese farmer and philosopher, and introduced in his 1975 book “The One-Straw Revolution.” Also known as the Fukuoka Method, The Natural Way of Farming, or Do Nothing Farming, this philosophy does not imply a lack of effort but rather the avoidance of manufactured inputs and equipment” [12]. “Fukuoka's philosophy focuses on working with nature to produce healthy food, maintaining the health of both people and the land, and is distinct from biodynamic agriculture. Fukuoka distilled the natural farming mindset into five principles: no tillage, no fertilizer, no pesticides or herbicides, no weeding, and no pruning” [7].

“Natural farming minimizes human labor and adopts nature’s methods for producing cereals, fruits, vegetables, and ornamentals in biodiverse agricultural ecosystems. Seeds germinate without plowing on the surface, depending on microclimate conditions. Fukuoka observed that the ground remains covered by weeds, legumes, grains, vegetable crops, and orchards. Chickens roam freely in orchards, while ducks and fish populate rice fields. Ground cover enhances nitrogen fixation, and straw from previous crops mulches the topsoil. Each grain crop is sown before the previous one is harvested by broadcasting the seed among the standing crop, resulting in a denser, smaller, but highly productive and stronger plant” [13].

3.1.2 Yoshikazu Kawaguchi’s natural farming

Kawaguchi's principles, based on the philosophy of “Final Straw: Food, Earth, and Happiness,” restate the core values of natural farming:

- ✓ Do not plow the field.
- ✓ Weeds and insects are not considered enemies.
- ✓ There is no need to add fertilizer.
- ✓ Growing food is adjusted based on local climate and conditions [14].

3.2 The Emergence of Natural Farming in India

3.2.1 Subhash Palekar

The concept of natural farming in India was advanced by Subhash Palekar, a native of Amravati, Maharashtra [15]. Palekar earned a B.Sc. in Agriculture from Nagpur and dedicated himself to improving his village farm. After discovering that continuous use of chemicals rendered his farm barren, he sought an optimal solution. From 1986-88, Palekar researched forest vegetation and found that natural systems in forests could develop and nurture healthy ecosystems [4].

Through six years of dedicated research, Palekar revealed:

1. Dung from local Indian cows is particularly effective for re-enriching barren soil, unlike dung from Jersey and Holstein cows. In the absence of local cow dung, bullock or buffalo dung can be used effectively.
2. Dung and urine from the black-colored Kapila cow are believed to be miraculous.
3. Fresh cow dung and stale cow urine are most effective [5].
4. Ten kilograms of dung per acre per month is sufficient. An average cow produces 11 kg of dung per day, allowing one cow to fertilize 30 acres per month [16].
5. Urine, jaggery, and dicot flour can be used as additives.
6. Cows with lower milk production yield more beneficial dung for soil regeneration

Subhash Palekar, known as “Krishi ka Rishi” and the “Father of Zero/Low Budget Natural Farming” (LBNF), addressed two major issues in Indian agriculture: enhancing soil fertility through agro-ecological principles and freeing farmers from the cycle of debt by eliminating the need for high-cost external inputs [17].

Table 1. Difference of Conventional farming, Organic farming and Natural framing [10, 18]

Aspect	Conventional farming	Organic farming	Natural farming
Use of chemicals	Heavily relies on synthetic fertilizers and pesticides	Minimizes the use of synthetic chemicals, favoring natural alternatives	Prohibited the use of any chemical or organic fertilizers or pesticides.
Use of external resources	Depends on external sources for manures and fertilizers	Utilizes organic manures and fertilizer from external sources	Relies only on locally available and farm- based resources e.g., Beejamrita and Jeevamrutha
Soil preparation	Involves plowing, tilting and mixing of manures	Requires basic farming practices like plowing and tilting	Avoids plowing and tilting, instead supports the natural decomposition of organic matter on soil surface
Weed control	Uses chemical herbicide or mechanical weeding	Promotes natural weed control techniques like mulching	Considers weeds as essential, using them as living or dead mulch layer
Pest control	Relies on chemical pesticides	Uses natural pest control methods, including biological control and natural pesticides	Uses natural, farm made pesticides like Dashparni ark and Neem Astra
Cost	Can be expensive due to the cost of external inputs and machinery.	May be expensive due to the cost of organic inputs and labour.	Can be achieved with minimal budget, relying on locally available and farm-based resources.

4. FOUR PILLARS OF NATURAL FARMING

4.1 Beejamrutha

Beejamrutha is a traditional seed treatment technique from ancient Indian agriculture. It involves preparing a nutrient-rich mixture applied to seeds before sowing. The name “Beejamrutha” comes from the Sanskrit words “Bheej” (seed) and “Amrutha” (nectar), highlighting its ability to revitalize and nourish seeds [19]. The preparation involves using local cow dung (a natural fungicide) and cow urine (an antibacterial liquid), along with lime and soil. The dung is tied in a cloth and soaked in urine for about 12 hours. Afterward, the dung is squeezed out, and 50 grams of lime are added to the urine. The seeds are then coated with Beejamritha and dried thoroughly before sowing. Leguminous seeds can be quickly dipped and dried [20].

“Beejamrutha contains general microflora and beneficial biochemical groups such as free-living nitrogen fixers, phosphorus solubilizers, bacteria producing plant growth-promoting substances, and bacteria with biological deterrent activities. The presence of such beneficial microbial biomass and nutrient content results in improved seed germination, seedling length, and seed vigor. Beejamrutha protects seedlings from seed or soil-borne diseases and young roots from fungus. It has been found to generate auxins (IAA) and gibberellins (GA_3), which promote plant growth” [21].

“Numerous experiments have evaluated the effectiveness of Beejamrit and Jeevamrit across various agro-ecological regions in vegetable crops. The seed weight of chilli increased compared to control treatments when Beejamrit, Jeevamrit, and Panchagavya were applied” [22]. “The Beejamrit was the most effective seed treatment, resulting in 92 percent seed germination in pea seeds compared to 56 percent in the control group. Beejamrit also acts as a potent antibacterial and antifungal solution” [23]. “100% Beejamrita led to high germination, seedling development and seed vigor index in legume seeds [24]. Additionally, Beejamrita is known for root protection and strengthening during transplanting” [25]. “An increase in microbial population when seeds were treated with Panchagavya and Beejamrit” [26]. “The

seed treatment with bijamrita in cucurbits and legumes significantly improved seed germination and seedling growth, promoting eco-friendly agriculture" [27].

4.2 Jeevamrutha

Jeevamrutha is a fermented microbial culture, where "Jeeva" means a living organism and "Amrutham" signifies an elixir of life, indicating its ability to enhance the life of any living organism. Jeevamrutha is prepared by mixing 10 kg of local cow dung with 10 liters of cow urine, 2 kg of local jaggery, 2 kg of pulse flour, and a handful of garden soil. This mixture is then diluted to 200 liters with water. The mixture is kept in the shade, covered with a wet gunny bag, and stirred clockwise three times a day, allowing it to incubate [28].

The benefits of jeevamrutha come from its high microbial load and growth hormones, which enhance soil biomass and sustain the availability and uptake of nutrients, leading to better crop growth and yield [29,30,31]. For instance, Jeevamrutha application increased the yield of capsicum [32] and the lycopene content of tomato fruit when combined with Panchagavya [33]. Additionally, applying jeevamrutha at 2000 liters per hectare significantly increased the green pod yield of French beans, and the yield improved further when supplemented with 6% Panchagavya [34].

Jeevamrutha can also be applied in solid form, known as "Ghanjeevamrutha". It is prepared using 100 kg of air-dried cow dung, 1 kg of jaggery, 1 kg of pulse flour, 3 liters of cow urine and/or 2 liters of Jeevamrutha, and 250 grams of soil from undisturbed bunds or forests. These ingredients are mixed well and kept in the shade for 48 hours, turned 3-4 times a day. After 10 days, Ghanjeevamrutha can be used in fields at a recommended dose of 250 kg per hectare and is effective for up to 6 months when stored in a cool, dry place [35]. The combination of FYM (Farmyard Manure) 10t per hectare and Ghanjeevamrutha at 250 kg per hectare increases the yield, nutrient content, available nutrients, nutrient uptake and nodulation [36].

4.3 Acchadana / Mulching

Mulching effectively changes the growing environment of crops by capturing and utilizing rainfall, reducing the risk of crop failure, increasing soil organic matter content, reducing soil moisture evaporation, and improving soil temperature. Three types of mulching are suggested under ZBNF:

- ✓ **Soil Mulch**: Protects topsoil during cultivation without tilling, promoting aeration and water retention. Deep plowing should be avoided.
- ✓ **Straw Mulch**: Uses dried biomass waste from previous crops. Any type of dry organic material will decompose and form humus through microbial activity. Straw mulching creates a physical barrier between the soil surface and the atmosphere, significantly reducing soil moisture evaporation and soil erosion, regulating soil temperature, and promoting plant growth. It directly affects the soil microenvironment, enhancing sustainability [37].
- ✓ **Live Mulch**: Involves multiple cropping patterns of monocotyledons and dicotyledons grown together to supply essential elements to the soil and crops. Dicot plants, like pulses, fix nitrogen, while monocots, such as rice and wheat, supply elements like potash, phosphate and sulfur [38].

Table 2. Season wise crop combination under natural farming [39]

Particulars	Kharif	Rabi
Vegetable	Tomato + Beans + Cucumber	Cauliflower + Pea + Radish
	Tomato + Beans	Cauliflower + Pea + Fenugreek
	Tomato + Beans + Capsicum	Cauliflower + Pea + Coriander
	Tomato + Beans + Chilli	Cauliflower + Pea + Spinach
	Tomato + Beans + Bottle Gourd	Cauliflower + Pea + Potato
	Tomato + Bean + Okra	Cauliflower + Pea + Onion
	Tomato + Beans + Brinjal	Onion + Pea + Fenugreek
	Capsicum + Beans	Cauliflower + Pea
Vegetables-Pulses	Tomato + Maize + Beans	Potato + Wheat + Pea
	Capsicum + Maize + Beans	Cauliflower + Wheat + Pea

Particulars	Kharif	Rabi
	Bottle Gourd + Maize + Beans	Colocasia + Wheat + Pea
	Tomato +Maize + Beans	-
Vegetables-Pulses	Tomato + Soyabean	Cauliflower + Chickpea
	Tomato + Soyabean + Cucumber	Cauliflower + Kidney Beans + Potato
	Tomato + Soyabean + Chilli	Cauliflower + Chickpea + Coriander
	Okra + Beans	Cauliflower + Chickpea + Fenugreek
Vegetables-Oil seeds	-	Cauliflower + Mustard + Fenugreek
	-	Cauliflower + Mustard + Cabbage
	-	Cauliflower + Mustard + Coriander
	-	Cauliflower + Mustard + Radish
	-	Cauliflower + Mustard

4.4 Whapasa / Aeration

Whapasa refers to the presence of a mixture of 50% air and 50% water vapor in the spaces between soil particles. According to Palekar, plant roots need water in the form of vapors rather than liquid. Whapasa creates a microclimate in the soil, allowing soil organisms and roots to thrive with sufficient air and essential moisture. This microclimate increases water availability, enhances water-use efficiency, and builds resilience against drought. Most soil microorganisms and root hairs, which absorb water and nutrients, are active in the top 10-15 cm of the soil layer. Maintaining Whapasa in this soil zone is crucial [40].

5. PEST MANAGEMENT IN NATURAL FARMING USING ASTRAS

Table 3. Role of astras in pest management

Sl. No.	Astras	Preparation	Control	Reference
1	Neemastra	The mixture is prepared by crushing 5 kg of neem leaves in water, then adding 5 liters of cow urine and 2 kg of cow dung. This mixture is fermented for 24 hours, with occasional stirring. After fermentation, the extract is filtered and diluted to 100 liters and can be applied as a foliar spray over an acre	Mealy bugs and sucking pests	[41]
2	Brahmastra	The formulation includes 10 liters of cow urine, along with 3 kg of neem leaves, 2 kg each of custard apple, papaya, pomegranate, and guava leaves. These ingredients are mixed together and boiled five times at intervals, allowing the contents to cool after each boiling session. After a resting period of 48 hours, the extract is filtered. Dilute 2 litres of extract in 100 litres of water for one acre.	It is effective against sucking pests and pod/fruit borers.	[42]
3	Agniastra	Mix 10 liters of local cow urine with crushed tobacco leaves, green chili, and garlic in an earthen pot. Add 5 kilograms of neem leaves pulp and boil the mixture thoroughly five times. Allow the solution to ferment for about 24 hours before straining it.	Aphids, sucking pests, stem borer, fruit borer and insects.	[43]
4	Dashparni	Neem leaves, Jatropa leaves, Heart-leaved moonseed leaves, Custard apple leaves, Karanja leaves, Castor leaves, Nerium leaves, oak leaves, green chilli, Garlic, Cow dung, Cow urine are the ingredients.	Controlling a wide range of insect pests and diseases.	[41]

6. OTHER LIQUID FORMULATION TO IMPROVE THE SOIL FERTILITY

6.1 Panchagavya

Panchagavya, a fermented organic product known for its ability to enhance plant growth and immunity, was introduced and popularized in Tamil Nadu by Natarajan. Derived from cattle waste and by-products, Panchagavya improves soil fertility by increasing organic matter, macro and micronutrient levels, and nutrient uptake in plants. It also promotes the growth and reproduction of microorganisms, thereby maintaining soil health [44].

To prepare Panchagavya, specific cow by-products are used: 7 kg of cow dung, 10 liters of cow urine, 3 liters of cow milk, 1 kg of cow ghee, and 2 liters of cow curd. Additional ingredients include 3 liters of tender coconut water, 3 kg of jaggery, 12 well-ripened poovan bananas, and 10 liters of water. These materials are mixed in proper proportions in an earthen pot, placed in a shady area, and covered. The mixture is stirred twice daily in both directions. After 30 days, the solution is filtered and collected for use [45].

An increase in growth and yield parameters at low concentrations of Panchagavya [46]. Similarly, An increase in the microbial population in post-harvest soils of cauliflower crops, with higher populations of bacteria, fungi, and actinomycetes (64.2×10^6, 26.8×10^4, and 34.9×10^4 cfu/g, respectively) observed with a 3% panchagavya spray [47]. Additionally, the application of panchagavya as a seed treatment led to a notable reduction in Phytophthora blight and anthracnose in capsicum and early blight in tomato [48,49].

6.2 Dasagavya

Dasagavya is prepared using the healthy leaves of various plant species, including *A. indica* (Kohomba), *C. gigantia* (wara), *V. negundo* (nika), *T. purpurea* (pila), *J. curcas* (edaru), *D. metel* (aththana), *P. pinnata* (magul karada) and *A. vasica* (adathoda). The collected leaves are thoroughly cleaned before extracting their essence. For each species, 1 kg of mature leaves is soaked in 1 L of cow urine for ten days. After soaking, the extracts are filtered, and 1 L of each extract is added to 5 L of the Panchagavya preparation. This mixture is then fermented for another 25 days, during which it is stirred regularly to ensure proper mixing of the Panchagavya and the eight plant extracts" [50]. Before applying Dasagavya to plants, it should be thoroughly filtered. A 3% concentration is recommended for use as a foliar spray and for seed treatments. Seeds should be soaked in Dasagavya for 20 minutes before sowing.

"Dasagavya is a growth promoter while it has the potential in boosting immunity against pests and diseases in plants" [51]. "Dasagavya is enriched with fermentative bacteria, including Lactobacillus, and produces various beneficial metabolites such as organic acids, hydrogen peroxide, and antibiotics that effectively combat pathogenic organisms. Dasagavya has the potential to enhance the shelf life, quality, quantity and taste of numerous fruit and vegetable varieties, demonstrating high biological efficiency in crops" [52].

6.3 Aattottam

To create an effective plant growth promoter, start by soaking goat dung in water overnight. The next day, add goat urine to the mixture and blend well. Incorporate all the remaining ingredients green gram, curd made from goat milk, banana, coconut water, and sugarcane juice. Let this mixture sit for 24 hours in a shaded area. When the mixture is ready, use a 2% solution during the branching stage, before the flowering period, and before the fruit starts to set. This natural formula enriches the soil with essential nutrients, boosts chlorophyll production, enhances branching, leafing, flowering & fruiting and serves as an excellent promoter of overall plant growth [53].

6.4 Farmers Effective Microorganism's

To prepare Farmer's Effective Microorganism (FEM), the required ingredients are 3 kg of pumpkin, 1 kg of banana, 3 kg of papaya, 3 kg of jaggery, and 5 eggs. Begin by chopping the fruits and vegetables into small pieces and placing them in a plastic container. Dissolve the jaggery in 10 liters of water, then add the eggs and mix all the ingredients thoroughly. Seal the container with an airtight lid and leave it for 10 days, releasing the air after this period. Mix the contents well and allow the mixture to incubate for an additional 45 days.

After 45 days, the container will have three distinct layers. The top layer will be a thin, white

layer indicating successful fermentation. The middle layer will consist of a pure brown liquid, while the bottom layer will be a semi-solid mass formed from the dissolved vegetables. To collect the semi-solid portion, open the tap at the bottom of the container and transfer it to one container. The top and middle layers should be collected in a separate container. Once ready, the FEM can be used as a foliar spray in a 2-5% concentration, serving effectively as both a herbicide and pesticide [53].

7. POLICY IMPLICATIONS UNDER NATURAL FARMING

7.1 Gujarat Model and Scheme for Promoting Natural Farming

In the Budget 2020-21, the Gujarat government introduced special financial assistance to promote natural farming practices under the Gujarat Atma Nirbhar package. Further two schemes were launched on 17 September 2020**.**

Sat Pagla Khedut Kalyanna: Rs. 900 monthly subsidy for the maintenance cost of one cow to a farming family practicing Natural farming.

Pagala for Natural Farming: Provision of Rs.1248 subsidy to farmers for purchase of a natural farming kit to prepare Jevamrita [54].

7.2 Prakritik Kheti Khushhal Kisan Yojana

Government of Himachal Pradesh launched a new scheme **"**Prakritik Kheti Khushhal Kisan Yojana**"** for sustainable agriculture through non-chemical, low cost, climate resilient and environment friendly natural farming in the year 2018-2019. Under the scheme financial assistance maximum upto Rs. 8000 is being provided for lining of cattle sheds which would facilitate collection of cow urine, Rs. 750/ drum and three drums per natural farming maximum up to Rs. 2250 for purchase of drum for input storage. A subsidy of 50% is being provided for the purchase of Desi cow limited to Rs. 25,500 and additional Rs. 5000 for the transportation purpose. One time assistance of Rs. 10000 per farmer family for preparation and sale of various natural farming formulations [55].

7.3 Pilot Project by Government of Rajasthan for Promoting Natural Farming

"As per the budget speech of the Honorable Chief Minister of Rajasthan, Rs 6,000 Lakhs will be spent to benefit 36,000 farmers in 15 districts during FY 2021-22. 750 Village Panchayats have been selected in 15 districts for implementing the scheme during FY2021-22 and a provision of expenditure of Rs 200 Lakhs has been made. The department of finance has allowed using Rs 500 Lakhs from State head and Rs 1,500 Lakhs from the Farmers Welfare Fund" [56].

7.4 Natural Mission on Natural Farming

"This mission was launched by the government of India to motivate farmers to adopt chemical free farming and enhance the reach of natural farming as a separate and independent scheme by up scaling the Bhartiya Prakritik Krishi Paddati schemes" [57,58].

8. CONCLUSION

Natural farming is a system where the laws of nature are applied to agricultural practices. ZBNF has been emerged as a farming model for small and marginal farmers to overcome the farming distress and sustaining the livelihood. It reduces farmer's costs through eliminating external inputs and utilising in-situ resources to rejuvenate the soil, simultaneously increasing incomes, restoring ecosystem/soil health and climate resilience through diverse multi-layered cropping systems and ensuring food security through a symbiotic partnership with nature. Therefore, it is concluded that nature farming has a good future although there are many problems yet to be overcome by practitioners and by adopting integrated farming every individual of the country will be able to get chemical free food with improved nutritional security.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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