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REVIVING AGRICULTURE: THE PROMISE OF ZERO BUDGET NATURAL FARMING IN INDIA

[1]Baddigam Kasi Reddy* and [2]Dumpapenchala Vijayreddy

Email

kasireddyhorti123@gmail.com

[1]Division of Vegetable Crops, Indian Agricultural Research Institute (New Delhi), Indian Institute of Horticultural Research, Hessaraghatta, Bengaluru, Karnataka- 560089, India

[2]Department of Plant Pathology, Division of Crop Protection, Indian Agricultural Research Institute (New Delhi), Indian Institute of Horticultural Research, Hessaraghatta, Bengaluru, Karnataka- 560089, India

The Green revolution increased agricultural output immensely in India, but it additionally led to environmental degradation and socioeconomic issues owing to high input reliance. To mitigate these consequences, Subhash Palekar's Zero Budget Natural agricultural (ZBNF) method, established in the 1990s, provides a sustainable, low-cost agricultural technique that makes use of local resources. ZBNF removes external inputs such as chemical fertilizers, hence improving soil fertility, water conservation and biodiversity. This approach is gaining popularity as a climate-resilient solution, particularly in India. Its guiding principles, which include Jeevamrutha, Bijamrita, mulching and Whapasa, encourage self-sustaining agriculture. Despite certain implementation issues, ZBNF provides a realistic approach for decreasing farmer debt, increasing yields and promoting environmental sustainability.

In India, the farming sector has been dominated for the past over 40 years by green revolution. The green revolution has influenced the economy by increasing agriculture production by productivity. A revolutionary impact of green revolution/modern agricultural techniques is that it has broken away from the old and outdated traditional practices. Conventional agricultural practices, heavily rely on high inputs such as seeds, irrigation water, machinery and fertilizers. These practices, while initially boosting productivity, lead to land and water degradation over time, ultimately reducing long-term productivity. To address these problems, many sustainable agricultural solutions have been developed, with a focus on reducing input dependency and promoting environmental and socio-economic sustainability.

The term Zero Budget Natural Farming (ZBNF) refers to a farming approach in which the expenses associated with cultivating and plants for crop harvesting are zero. The idea behind ZBNF, which was first presented by Padmashri Subhash Palekar, a Maharashtrian agriculturist, in the mid-1990s as a counter to the Green Revolution's practices of heavy irrigation, chemical fertilisers and pesticides, is currently gaining traction as part of a movement to return to more traditional farming practices. Zero Budget Natural Farming (ZBNF) is a low-input, climate-resilient farming approach that has gained popularity in India and other parts of the world. Its goal is to increase farmers yields using locally available resources and reduce input costs by doing away with chemical fertilizers and enhancing soil fertility (Bharucha *et al*., 2020). Palekar's research revealed that the primary reason of farmer suicides and debt across the globe was the expense of external inputs like fertilisers and insecticides. The high interest rates on credit and production costs might be greatly decreased by returning to the old farming practices. The Food and Agriculture Organisation of the United Nations states that zero budget natural farming is an alternate way to significantly reduce farming expenses, which could aid in ending the global farmer debt cycle (Singh *et al*., 2018). Overall, the growing interest in alternative agricultural systems like ZBNF reflects a movement towards more holistic and sustainable methods of producing food, which are critical to meeting the challenges of feeding an expanding world population while preserving the planet's resources for future generations.

Effect of Agrochemicals

While agricultural chemicals can effectively eradicate weeds, diseases and pests, this is not always the case, especially if the chemicals are not used incorrectly. In order for insects to survive condition toxic species, naturally initiate changes in their environment by mutating or migrating. This can ultimately lead to increased pest populations. Agricultural chemicals, on the other hand, can adversely affect the bacterial community once they leave plants and enter the soil. As a result, nitrogen and other nutrients in the soil can be retained, which will lead to plant growth. earthworms play an important role in maintaining the fertility and condition of the soil, as do bacteria. Organic waste is broken down and converted into natural fertilizer for plants. Worms also contribute significantly to soil structure by creating pathways for plants to irrigate crops, drainage and aeration. however, chemicals interfere with this natural process by reducing earth populations. This leads to further soil erosion and soil exhaustion, making it unsuitable for plant growth.

Pesticides can release toxins into our air, which can affect plant, animal and human health. During the sowing process, strong winds blow agricultural chemicals around nearby fields. Plant species are slowly disappearing due to insufficient pollinator populations that can expose agricultural chemicals to pesticides through ingestion or inhalation while important pollinators such as bees, fruit flies and some mosquitoes roam plants, insects and water because of the proximity. Agricultural chemicals in the air can be inhaled by animals, birds and other animals; They can absorb water through the skin or eat the seeds of infected plants. Pesticides have also been linked to increased mortality rates in birds and other small mammals. Because they feed on insect populations and help maintain the ecosystem's balance, birds and other predators, such as vultures, are important to the ecosystem. Some species, such as hummingbirds, are also important pollinators. Thus, a decline in bird populations may lead to an increase in plant pests and/or insects as well as the extinction of some plant species.

Pesticide residues can be blown into water bodies as a result of wind drift, inadvertent dispersal, rainwater carried by contaminated soils, or flushing irrigation water after use it has been shown that it is the main additive to human and animal contact with contaminated water to the health of any animal Fish are important in the marine ecosystem because they provide food for birds and other mammals. Consequently, declining fish populations will severely affect many other species in food chains and food webs.

A farming method called natural farming needs no tillage, no fertilizers, no pesticides and no weeding. Masanobu Fukuoka, *father of modern – day natural farming*, worked on methods based on his own unique theories, insights and philosophy

Principles of Natural Farming

- Masanobu Fukuoka, in his book, one – straw revolution, indicates four basic principles of natural farming:

1. No ploughing
2. No chemical fertilizers
3. No weeding and
4. No plant protection

- It is an encompassing farming method that combats commercials, expenses and farmers reliance on input markets.

- In the zero Budget Natural Farming (ZBNF) nothing has to be purchased from the outside.
- All things required for the growth of the plant are available around the root zone of the plant.

Reasons to adopt ZBNF

- Reduces costs
- Increases yields, short run and the long run
- Reduces risks
- Reducing water requirement
- Enhancing soil fertility
- Promoting bio diversity
- Higher price realization

Four Pillars of Zero Budget Natural Farming

Palekar conducted extensive research over a period of six years and the following findings were made:

1) The only manure from nearby Indian cows effectively replenishes the depleted soil. It is less efficient to use dung from Jersey and Holstein cows. Bullocks' or buffaloes' excrement can also be used if there isn't enough manure from nearby cows.
2) The black Kapila cow's dung and urine are thought to have magical properties.
3) For optimal benefits from cow dung and pee, make sure the dung is as fresh and the urine as stale as feasible.
4) Ten kilogrammes of local cow manure are needed each month to maintain an acre of land. One cow's dung can help fertilise thirty acres of soil per month, as the average cow produces eleven kilogrammes of dung every day.
5) Additives include urine, jaggery and dicot flour.
6) A cow's manure helps revitalise the soil more when it produces less milk.

"*ZBNF is symbiotic and self-sustaining in nature*"- Subash Palekar (Palekar, 2014).

Below are showing the top 4 pillars which provide support to the zero-budget natural farming

1. Jeevamrutha

The first and most crucial pillar of zero budget farming is Jeevamrutha. It is a combine of soil, water, pulse flour, cow breed, aged cow urine and new cow dung from India's native jaggery plant. One kind of natural fertiliser that is put on farmland is this mixture. It is put to the crops directly OR with each irrigation cycle and is made up of 20 kilogramme of cow dung, 5–10 l of urine, 20 kg of jaggery and 2 kg of dicot flour. Not only does it supply nutrients, but it also serves as a catalyst, encouraging the activity of earthworms and other microbes in the soil. Jeevamrutha also aids in the defence against bacterial and fungal plant illnesses. For the first three years only, Jeevamrutha is required. after which the system becomes self-sustaining. (Khadse and Rosset, 2019).

2. Bijamrita

For treating seed, seedlings and young planting material, use beejamrit. It is helpful in shielding nascent roots from fungal infections and illnesses spread by seeds and the soil. It can be prepared by hanging 5 kilogramme of fresh, locally produced cow dung in 20 litres of water for 12 hours after it has been wrapped in cloth and taped. Add 50 g of lime to one litre of water and let it sit overnight. To extract material, squeeze this bundle of cow dung three times in water. Stir thoroughly after adding the dirt from the forest or undisturbed bunds to the mixture. Stir thoroughly after adding five litres of native cow dung and lime water to the mixture. The seeds can now be treated by Bijamrit. Any crop's seeds are combined with bijamrit by hand, shade-dried and then sown. For leguminous crops, the seeds are simply dipped and rapidly dried. Similar to Jivamrita, Bijamrit has some advantageous bacteria that aid in both protecting plants and promoting their growth and development (Smith *et al.*, 2020).

3. Acchadana (Mulching)

The practice of covering the top soil with crop wastes, dried leaves, or cover crops is known as mulching. It keeps the top soil from eroding, enhances soil aeration, retains soil moisture, boosts the soil's ability to hold water, supports soil fauna, maintains soil nutrient levelsand inhibits the growth of weeds.

4. Whapasa

When water and air molecules are in the soil that state is called Whapasa. Proper soil aeration is essential for healthy plant growth and development. Increase soil fertility which increases the amount of humus, high water holding ability and the best soil structure for the growth of agricultural plants, especially during the dry season.

5. Ghanjeevamrit

NPK is fixed or mobilised by the beneficial microorganisms that Ghanjeevamrit nourishes the soil with. It is applied to improve the fertility of the soil. To make Ghanjeevamrit, combine 100 kg of native cow dung (which has been air dried for four to five days), 1 kg of pulse flour, 1 kg of jaggery, 3 litres of native cow urine and 250 g of soil from undisturbed bunds or forests. Once all the ingredients are combined, this can be baked and kept. Field use is possible after ten days of preparation. Apply Ghanjeevamrit at a rate of 250 kg ha^{-1} prior to seeding, following the indicated dosage. Best kept in a cool, dry place for up to six months.

Various Production Practices

1. **Crop rotation:** Crop rotation is a method of cropping, in which nutrients are depleted during the period of increase in soil fertility. In addition, the natural predators in the field benefit from the rotation.
2. **Crop residue management:** What remains after a crop is harvested is called crop residue. Farmers burn a lot of agricultural residues, especially in areas with high yield potential. Many farmers choose to burn agricultural residues left in the field, resulting in air pollution and nutrient waste, as the residues can interact with tillage and horticultural operations for the following crops
3. **Seed Quality:** In ZBNF, desi seeds are taken as input for next year's crop etc., to reduce the cost of seed imports.
4. **Soil quality Management**

   Soil fertility management: The natural ability of the soil to supply available nutrients in the right amounts and amounts for plant growth and development. Crop growth and yields are determined by soil nutrients. In ZBNF, the addition of living dead to the soil activates the beneficial microorganisms in the soil.

5. **Intercropping:** Intercropping gives additional yield/ unit area than sole coping. It provides shade and shelter for other crops. reducing soil runoff and preventing weeds. Intercropping systems use resources more efficiently and increase their productivity. Combining cash crops is very profitable
6. **Mixed cropping:** Intercropping improves soil fertility and increases crop yield as materials and wastes from one crop contribute to the growth of new crop plants and vice versa, while carefully selecting crops the two of them.
7. **Depth of planting:** Most crops are best planted when the soil is warm enough to germinate quickly. Insects such as wireworms often damage seeds that do not germinate in moist soil.
8. **Tillage:** When tillage is avoided, soil moisture rises, leading to a greater spread of ketachmas. Earthworms are known to fertilize soil by enriching their molds. The seeds are scattered and covered with straw before the previous crop is harvested. The seeds sprout when the next good season comes.
9. **Pest management:** loss of crops by weeds and subsequently by pests and diseases. Overcoming this loss is also a major challenge in organic farming. Plant materials are used to produce or control pests in crop fields. Neem seeds, green chillies, buttermilk, cow's milk and chili powder are some of the ingredients used in plant protection (Palekar, 2016).

Some research papers found some naturally extracted chemical-free compounds are explained below. They are,

1. Agniastra: An herbal remedy called Agniashtra is made using cow urine, garlic, chilli fruits and neem leaves. It is employed to control fruit borers, stem borers and other varieties of crop caterpillars. Take 5 kg of fresh neem leaves and half a kg of each green chilli and garlic. To create a fine paste, crush all three of the ingredients. Mix well after adding crushed items to 20 litres of native cow urine. Boil the mixture for approximately 20 minutes, stirring occasionally with a wooden stick. Give the content a 48-hour cooling period. Use a fine cotton cloth to filter the contents. One hectare of crop requires the application of 5–6 litres of Agniashtra, diluted in 250 litres of water.

2. Brahmastra: Its formulation is based on botanicals and cow urine. It works as a natural insecticide against sucking pests including thrips, aphids and jassids as well as large and small insects like fruit borer and pod borer. Take 2 kilogramme of karanj (*Pongamia pinnata*)

leaves and 3 kg of fresh neem leaves. In the event that karanj leaves are unavailable, crush 5 kg of neem leaves into little pieces. Grind 2 kg of Datura leaves and 2 kg of custard apple leaves into fine particles. Combine all of the crushed leaves mentioned above with ten gallons of local cow dung. The mixture should boil for 20 to 25 minutes. Allow mixture to cool for 48 hours. Use a fine cotton cloth to filter the contents. To spray on a hectare, use five to six litres of filtrate and dilute it with 250 litres of water. Use 4% foliar spray if the infection rate is high. Organic insecticides. Brahmashtra has a six-month shelf life.

3. Neemastra: 5 L of local cow urine, 5 kg of cow dung, 5 kilogramme of neem leaves and 5 kg of neem pulp were combined, closed and allowed to ferment for a whole day. when the product of fermentation is prepared for usage. mostly manages Mealy bugs and sucking pests.

4. Dashparni extract: The extract from dashparni helps control several insect pests in orchards and crops. It is made by combining 2 kilogrammes of leaves from each of the 10 plant species listed in the above table with 5 kg of neem leaves. 10 litres of natural cow urine, 10 kg of natural cow dung, 500 grammes each of turmeric powder, garlic paste and ginger paste, 1 kilogramme of tobacco leaf powder and 1 kilogramme of hot chilli paste should be used. crushed the foliage into tiny fragments. Combine all the components above in a 200-liter shaded water drum. Using a wooden rod, shake the mixture three times a day and leave it to ferment for thirty to forty days. Use a fine cotton cloth to filter the contents. The filter can be used for up to six months if kept in containers. Shasta extract should be diluted with 250 litres of water (5–6 litres) before being sprayed on a hectare of crops.

5. Mixed leaf extract (decoction): It's also a botanical formulation made with cow urine that's prepared with the leaves of five distinct tree species that are commonly found on farms: custard apple, papaya, pomegranate and guava. Fruit/pod borer species and sucking pests can both be controlled with mixed leaf extract. 3 kg of neem leaves and 2 kg of custard apple, pomegranate, papaya and guava leaves should be taken. Grind the leaves into small fragments. Combine the pulverised leaves mentioned above with ten litres of native cow. The mixture was cooked with urine until half of its volume remained. Give the mixes a full day to cool. Use a fine cotton cloth to filter the contents. Stuff bottles with the filtrate. It takes 5 to 6 litres of extract for spraying in one hectare of crop after dilution in 250 litres of water.

6. Garlic and chilli extract: As the name suggests, it is a concoction primarily of garlic and chillies, along with neem, cow urine and basharam (*Ipomea carnea*) leaves. Various types of caterpillars, including as leaf rollers, stem, fruit and pod borers, can be effectively managed.

Make paste out of 500 g of each hot chilli and garlic bulb. Grind 1 kilogramme of besharam leaves and 5 kg of neem leaves into fine powder. Combine the aforementioned crushed leaves with ten litres of natural cow urine. After reducing the mixture's volume by half by boiling, let it cool for a full day. Use a fine cotton cloth to filter the contents. Stuff bottles with the filtrate. To saturate an acre, take five to six litres of filtrate and dilute it with 250 litres of water.

Government schemes and plans for ZBNF

India's Legislature is advancing natural farming in the nation from 2015- 16 through the traditional agricultural development plan's committed schemes and the National Agricultural Development Plan. In 2018andhra Pradesh started a plan to become the first state in India to practice 100% natural farming by 2024. It aims to carry out chemical farming on 80 lakh hectares of land by converting 60 lakh farmers of the state into ZBNF methods.

Paramparagat Krishi Vikas Yojna

Objective-Through the use of affordable, environmentally friendly technologies, the goal is to create agricultural goods free of residues from chemicals and pesticides.

The following are some of PKVY's main focus areas for encouraging organic farming:

1. Encourage kids in rural areas to farm organically and to become consumers, tradersand farmers. Share the newest innovations in organic farming technology.
2. Make use of the expertise of professionals from India's public agricultural research system
3. Set up one or more cluster demonstrations in a village.

The Andhra Pradesh Community-Managed Natural Farming (APCNF) (Formerly known as APZBNF)

The Department of Agriculture, Government of Andhra Pradesh, founded Rythu Sadhikara Samstha (RySS), a non-profit organisation, is in charge of carrying out this plan. The mission of RySS is to develop and carry out projects for farmers' overall welfare and empowerment.

Regenerative agriculture, or APCNF, is redefining Andhra Pradesh's food and agriculture systems and tackling the root causes of farmers' distress, which include soil

degradation, biodiversity loss, water scarcityand expensive chemical farming that has left farmers with large losses and debts. The most difficult task is getting APCNF to farmers and making sure they adopt it, even though it is an amazing technology with the ability to alleviate farmer pain.

Kancharana Ramarao, executive director of the Corporation, recommended financial assistance of Rs. 10,000 to each farmer as part of encouraging ZBNF in the district. Around 1,300 farmers are selected for financial assistance from the Corporation could get training from Agriculture and Horticulture Departments to adopt ZBNF method which would rejuvenate the soil contaminated with continuous usage of fertilizers and pesticides. “Around 5,000 acres of land will get back its fertility with healthy agriculture activity,” the officials said.

The researchers conducted controlled field studies in 28 farms from June 2019 to 2020, comparing ZBNF to conventional and organic treatments. Soil pH, moisture content, yield, nutrient content, temperature and earthworm abundance were all compared. The farms were dispersed over six districts in Andhra Pradesh (Kadapa, Anantapur, Krishna, Prakasam, Nelloreand Vishakhapatnam), spanning more than 800 miles and representing various agro-climatic zones. Research showed that compared to conventional and organic treatments, ZBNF production was much higher in Nellore, Prakasamand Kadapa. ZBNF was much greater in Anantapur than it was in the organic treatment aloneand it was significantly higher in Krishna than it was in the conventional treatment alone.

Challenges

- A small-scale study conducted in Andhra Pradesh in 2017 reported a significant drop in input costs and an improvement in yields; however, reports also indicate that many farmers, including those from Maharashtra, the home state of Mr. Palekar, have returned to conventional farming after witnessing a decline in their ZBNF returns after a few years, casting doubt on the method's ability to raise farmers' incomes.
- To achieve food security and self-sufficiency, India required the Green Revolution.
- In 2019, the National Academy of Agricultural Sciences wrote to Prime Minister Modi cautioning against promoting ZBNF without enough research to determine its long-term impact, shortly after the Prime Minister had commended the technique during a speech at a United Nations conference on desertification.

- Agricultural scientists believe that farming should shift away from solely relying on chemicals, but solid scientific proof is a prerequisite.
- Increasing needs and a larger population lead to higher agricultural productivity.
- A suitable policy framework that has not yet been established by the government
- Setting specified standards for organic product quality at country level to wardoff problematic insect species at national or worldwide level.
- Creation of a set of best practices for all crops.

Conclusion

There are various benefits to returning to a "back to the basics" approach in modern agriculture by implementing zero budget natural farming. ZBNF has developed with an extremely optimistic outlook for the good of the farming community. Because ZBNF cuts farm expenses to a minimum and makes farmers self-sufficient, it has boosted agricultural productivity as well as the socioeconomic standing of adopters (Das and Avasthe, 2020). Since it solely depends on internal resources, it has reduced the requirement for financing for farming operations. As a result, it reduces suicide and debt among the small and marginal farming communities. The Union Budget 2022–2023 calls for the expansion of chemical-free natural farming across the nation, starting with land corridors along the Ganga that are 5 km wide. Additionally, the Budget suggested updating curricula in agricultural universities to include courses on ZBNF.

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