

Review Article

Principles and Practices of Zero budget Natural Farming

Abstract

Zero Budget Natural Farming (ZBNF) is a way of farming, which is based on minimum use of external inputs, no use of chemicals, minimum disturbance to soil, use of local bio-resources for production various commodities in the farm, etc. ZBNF is based on four major pillars: Jeevarutha; Bijamruita; Acchadana (mulching) and Whapasa (moisture management). Advantages of ZBNF are improvement of yield, ensurance of better health, environment conservation, increased farmers' income, employment generation, reduced water consumption, minimized cost of production, elimination of application of synthetic chemical inputs, rejuvenation of soil health, etc. ZBNF has been getting popularity in different states like Andhra Pradesh, Karnataka, Himachal Pradesh, and Rajasthan. Government support is needed for extending the same to other states. In this chapter, effort has been made to compile the information available in different sources.

Keywords: cost-effective farming, organic farming, resource conservation, soil health

Introduction

Pest management in zero budget natural farming

Diseases and pests harm crops, weeds account for the bulk of agricultural losses following pests and diseases. In organic agriculture, managing this loss is yet another difficult task. Crop pests are killed or repelled by a chemical made from plant extracts. A blend of pepper powder, neem seeds, buttermilk, cow's milk, and green chilies is used to make some plant protection products. The following is an explanation of a few studies that have discovered chemical-free naturally extracted chemicals.

Preventive measures

- Seed treatment with beejamrut.

The primary application of the Beejamrutha is seed treatment. Due to the high risk of disease attack during germination, seed treatment is crucial for successful seed germination. Seed germination is increased because diseases that affects the seeds is controlled by the beejamrutha-soaked seeds.

Ingredients required for Beejamrutha

To prepare beejamrutha for 100 kg seed, 20litres of water, cow urine 250 ml perlitre of water, cow dung 250 grams per litre of water, Lime 2.5 g per litre of waterand soil-like dikes or clay bundles without any stone is required.

Preparation method Beejamrutha

1. Mix all the components in a plastic or cement tank. Additionally, confirm that there are no lumps in the cow dung. And blend the materials with a wooden stick. Turning the mixture in a clockwise direction is necessary. so that the combination begins to disperse good energy.
2. A poly net or jute bag is used to cover the mixed tank. Additionally, the tank has to be stored in a shaded area and kept out of direct sunshine and precipitation.
3. The Beejamrutha is ready to be utilized for treating seeds after a single day.

•Spraying of panchgavya as growth promoter and insect and pest repellent

A denser canopy and larger leaves are always developed by plants treated with panchagavya. In order to maximize metabolite and photosynthate production, the photosynthetic system is engaged for improved biological efficiency [9,10]. It protects the plant from fungus and other insects and serves as a biofertilizer as well. With 16 various types of nutrients, it is an efficient growth booster that speeds up decomposition, reduces insect infestation and ailments, and strengthens plant resilience to disease.

• Push pull strategy by crop diversity

Utilizing a mix of behaviour-modifying cues, the "push-pull" technique is a revolutionary tool for integrated pest control programs that modifies the number and distribution of insect pests and natural foes [11,12]. This technique uses stimuli that disguise host apparency or repellent or deterrent to repress or dissuade pests from the main crop (push). Using highly visible and alluring stimuli, the pests are concurrently drawn (pulled) to other locations, such traps or trap crops, where they are concentrated, making control easier.

•Border crops

It is customary to seed border crops such as sorghum, red gram, and maize one month prior to sowing or planting the main crop. The border will reach a particular height at this time, acting as a barrier wall to prevent vectors from entering the main crop.

•Trap crops

Marigold planting. Marigold has a long history of successful usage as a trap crop. It can be used as an intercrop, crop residue supplement, or as cover crop in rotation to combat plant parasitic nematodes.

•Sticky traps

Aphids, whiteflies, and adult leaf miners are among the several pests that can be observed using yellow sticky traps. Significant numbers of whiteflies can be captured in seedling production zones by using yellow sticky traps at a rate of 1-2 traps/50-100 m².

•Light traps

Specific phototrophic macro-lepidopteran insect pests such as hairy caterpillars, bollworms, pod borer, semilooper, tobacco caterpillars, and macro coleopterans like white grubs may be mass-trapped with a light trap. All of these significant pests, which are found in practically all agro-ecological zones of the nation, may be captured using enhanced light traps on the majority of crops, including commercial and field crops, pulses, oilseeds, cereals, and vegetable crops.

•Pheromone traps

Pheromone are the chemical signals sent by insects in order to find food, communicate, attract mates, or alert others to potential predators. Traps can be used to monitor target pests in residential or agricultural regions by using certain pheromones. It might be able to identify an infestation early on by keeping an eye out for insects. Using pheromone traps to detect pest insects early on can help reduce harm to other plants and crops.

•Bird perches

Bird perches provide predatory birds with a place to rest as they search for food. These perches allow the predatory bird to rest and facilitate hunting grounds.

Curative measures

Agniastra: It is employed to manage caterpillars and any other sucking pests. Fill the container with 200 liters of cow urinate. Next, add 250 grams of garlic paste, 200 grams of turmeric powder, 500 grams of tobacco powder, 500 grams of green chili powder, and 2 kg of neem leaf paste. Once the mixture is well mixed, cover it and bring it to a boil until foaming occurs. After turning off the heat, take the container and place it in the shade, away from the sun, to cool for up to 48 hours. After 48 hours, stir the ingredients twice throughout the fermentation process, strain through a thin muslin cloth, and store. It has a 3-month shelf life. To prepare for spraying, use 6–8 liters of agniastra and dilute it with 200 liters of water. Depending on how severe the insect infestation is, the following ratios should be maintained. 100 litres of water+ 3 litres of agniastra.

Brahmastra: Brahmastra is a natural pesticide made from leaves that have certain alkaloids that keep pests away. It manages every type of sucking pest and covert caterpillar found in fruit pods.

Inputs needed: 20liters cow urine, 2 kg neem leaves, 2 kg karanj leaves, 2 kg custard apple leaves and 2 kg datura leaves. ()

Preparation of Brahmastra

Add 2 kilogram of fine neem leaves, 2 kg of karanja leaf paste, 2 kg of custard apple leaves, 2 kg of castor, and 2 kg of ?paste to a container filled with 20 liters of cow urine. Datura attacks the situation. Reduce the heat and boil until one or two bubbles form (overflow level). Cook while covering the pot and stirring in a circular motion. For the purpose of releasing the alkaloids in the leaves into the urine, cease boiling when the second froth appears and let it cool for 48 hours. The solution should be stored after being filtered with a muslin cloth after 48 hours. It is best to keep in plastic barrels or mold pots in the shade. The maximum duration of storage for the solution is six months.

Application of Brahmastra

6-8 liters of Brahmastra diluted in 200 litres of water are used as foliar spray for standing crops. The following ratio may be changed based on how severe the pest attack is:

100 liters of water +3 liters of Brahmastra, 15 liters of water +500 ml of Brahmastra, 10 liters of water+ 300 ml of Brahmastra. ()

Neemastra: In addition to killing insects or larvae that consume plant leaves and absorb sap, neemastra is used to prevent or treat diseases. Additionally, this aids in preventing the spread

of dangerous insects. Neemastra is a bio-insecticide and pest deterrent for natural farming that is incredibly simple to manufacture.

Inputs needed: 200 liters water, 2 kg cow dung, 10 liters cow urine, 10 kg fine paste of neem leaves. ()

Preparation of Neemastra

10 liters of cow urine should be added to 200 liters of water in a drum. Add 2 kg of local cow manure after that. Next, add 10 kg of neem seed pulp or 10 kg of finely ground neem leaf paste. Then, cover it with a gunny bag and stir it clockwise with a long stick. It should be kept in the shade. Every morning and evening, stir the mixture in a clockwise manner. You can use it after 48 hours. It can be kept for up to six months of storage. Water should not be used to dilute it. Apply foliar spray directly to the crop after filtering the prepared solution through a muslin cloth.

Controls: All the sucking pests, jassids, aphids, white fly and small caterpillars are controlled by Neemastra.

Dashaparni: Dashaparni serves as an alternative to Agniashtra, Brahmastra, and Neemastra. Depending on the extent of the infestation, it is used to control various kinds of pests.

Inputs needed: 200 liters water, 20 liters cow urine, 2 kg cow dung, 500 grams turmeric powder, 10 grams Asafoetida, 1 kg tobacco powder, 1 kg chilly pulp, 500 grams garlic paste, 200 grams of ginger paste, Any 10 leaves*. ()

Preparation of Dashaparni

Fill a barrel with 200 liters of water, then add 20 liters of cow dung and 2 kilograms of urine. Stir thoroughly, place a bag over it, and set it aside for two hours. To the mixture, add 200 grams of ginger paste, 500 grams of turmeric powder, and 10 grams of asafoetida. Give it a good shake in a clockwise direction, then cover with a bag and refrigerate for the night. Add 1 kg of tobacco powder, 2 kg of spicy green chilies, and 500 g of garlic paste the next morning. Thoroughly mix with a wooden stick in a clockwise direction. Place a sack over the mixture and let it rest in the shade for the whole day. Add any ten* different varieties of leaves (from the list below) to the mixture in the next morning. Mix thoroughly and place a bag over it. For the mixture's alkaloids to dissolve, fermentation should take 30 to 40 days. Stir twice daily. After 40 days, strain it through a muslin cloth and make use of it.

Application: For spraying, dilute the 6–8 liters of prepared kashayam with 200 liters of water.

*Leaves of (Neem) - 3 kg, *Pongamia pinnata*(Karanja) - 2 kg, *Annona squamosa* (Custard apple)- 2 kg,(Castor) - 2 kg, (Datura) - 2 kg, *Calotropis procera*(Rubber bush) - 2 kg, *Vitex negundo*(Chinese chaste tree) - 2 kg, *Datura stramonium* (jimsonweed) - 2 kg,*Nerium indica*(neem) - 2 kg, *Hibiscus rosa*(Chinese hibiscus) - 2 kg, *Mangifera indica*(Mango) - 2 kg, *Lantana camara*(Lantana) - 2 kg, *Casia tora*(Senna tora) - 2 kg, *Psidium guajava* (Guava) - 2 kg, *Punica granatum*(Pomegranate) - 2 kg,*Moringa oleifera* (Drumstick) - 2 kg, *Coffea arabica*(Coffee) - 2 kg, *Maduca indica*(Mahua) - 2 kg,*Theobroma cacao*(Cocoa) - 2 kg, *Acacia nilotica*(Babul) - 2 kg, *Psoralea corylifolia*(Babchi) - 2 kg, (Bitter Gourd) - 2 kg.

Disease management of zero budget natural farming

Preventive Approaches

- Selection of healthy seed.
- Selected of disease resistant varieties.
- Seed treatment with beejamrut.
- Adjust sowing time.
- Crop diversity with border crops and intercrops.
- Mulching.
- Frequent spraying of liquid jeevamrut on mulch material as to increase diversity and increase bacteria in the soil (useful bacteria prevent spread of disease and induce immunity in plants).

Curative approaches

- Spraying of sour butter milk + Dry ginger + Milk solution.

Sour butter milk Ingredients

- Fermented sour butter milk-06 L.
- Water-200 L.

Preparation method: Take 6 litters of milk and make curd of it. Remove the creamy layer on it. Let it remain for 3-5 days so there will be a grey layer. Churn it, mix it with water, filter it, and spray it on infected plants.

- Shelf life: 3 days.
- Application: All disease.

Advantage of zero budget natural farming

Several studies have reported the effectiveness of natural farming in terms of increased production, sustainability, water conservation, soil health and crop ecosystem improvement. It is considered a cost-effective agricultural practice that can increase employment and rural development.

Natural farming offers solutions to various problems such as food security, farmers' problems and health problems caused by pesticides and fertilizers in food and water, global warming, climate change and natural disasters. It also has the potential to create jobs, which prevents the migration of rural youth. Natural farming, as the name suggests, is the art, practice and increasingly science of working with nature to achieve much more with less.

Improved Yield: Natural farmers reported yields similar to those of conventional farming. Higher yields per harvest have also been reported in several cases. Guarantees better health: As Natural Farming does not use synthetic chemicals, health risks and hazards are eliminated. Food has a higher nutrient density and is therefore more beneficial for health.

Environmental Protection: Natural farming provides better soil biology, better agricultural biodiversity and more rational water use with a much smaller carbon and nitrogen footprint.

Increasing farmers' incomes: Natural farming aims to make farming viable and purposeful by increasing farmers' net incomes through cost reduction, risk reduction, similar yield and intercropping yield.

Job creation: Natural farming creates jobs through organic farming input businesses, value addition, local marketing etc. The surplus of natural agriculture is invested in the town itself.

Less water use: By working with different plants that help each other and cover the soil to prevent unnecessary water loss from evaporation, Natural Agriculture optimizes "yield per drop".

Minimal production costs: Natural farming aims to drastically cut production costs by encouraging farmers to produce essential biological inputs using farm, natural and household resources.

Eliminate use of synthetic chemicals: Excessive use of synthetic fertilizers, especially urea, pesticides, herbicides, herbicides, etc., changes soil biology and structure, leading to loss of soil organic carbon and reduced fertility.

Rejuvenates soil health: The most immediate effect of Natural farming on soil biology is on microbes and other living organisms such as earthworms. The health of the soil depends entirely on the living organisms in it.

Livestock sustainability: Integrating livestock into the agricultural system plays an important role in natural farming and helps restore the ecosystem. Eco-friendly bio-inputs like Jeevamri and Beejamri are made from cow dung and urine and other natural products.

Limitation of zero budget natural farming

- This method of cultivation is used in some parts of India.
- The type of agriculture is debated and there is not much scientific research to evaluate.
- It is a very economical cultivation.
- This farming technique is used in small areas.

Opportunities and threats of zero budget natural farming

- In addition, it provides an opportunity to revive the traditional agricultural production system and traditional plant varieties/cattle. It is the "way to basics" for a sustainable and healthy future with nature.
- The main factor behind the low profitability of agriculture is the increase in agricultural costs. ZBNF offers an opportunity to reduce investments in fertilizer subsidies and agrochemicals and thus reduce agricultural costs.
- Another important project opportunity is research on the basis and mechanism of ZBNF, resulting in authentic and valid findings and reports that can be used by government, policy makers and researchers to address the challenge of "ZBNF: Reality or just". a myth'.
- Besides opportunities, the ZBNF project also has threats. Low initial yield loss (shown by several organic production trials), which may affect its popularity. However, this reduction is expected to be temporary and may take long-term implementation of ZBNF.
- Availability of good quality seeds for traditional durumwheat and BN hybrids is one that the promoters have explored local markets and traditional farmer groups and ensured seed availability.
- Another threat is availability of crop residues for mulching (Aachhadana) as groundnut and wheat residues are meant for animal feed. As a solution to avoid this

problem, plant residues are planned to be exported ex situ if they come from a farm of which ZBNF is a part.

- A fixed three-year project time is also considered less sufficient, since organic agriculture-type activities are long-term and require several years to see visible effects in terms of farm functionality, optimal soil health and carbon footprint.

To overcome this limitation, the study should be limited to a relatively shorter period cropping system, so the hybrid BN groundnut-wheat system, which can be easily studied in one period, was chosen. However, in assessing the quality of the long-term effects of ZBNF, a more sustainable project would have been more opportunistic and fruitful.

CONCLUSION

Zero Budget Natural Farming (ZBNF) is a way of farming, which is based on minimum use of external inputs, no use of chemicals, minimum disturbance to soil, use of local bio-resources for production various commodities in the farm etc. ZBNF is based on four major pillars, Jeevarutha, Bijamruita, Acchadana (mulching) and Whapasa (moisture management). There need to extend the horizon of ZBNF by integrating with more components of farming by linking livestock with crop. For bringing large scale application of ZBNF in farmers field, there is need that its practices need to be more perfected based on research and scientific studies. ZBNF is a positive effort in the direction of ecological farming in the benefit of mankind.

Reference

1. Bharucha Z.P, *et al* (2020), Towards redesign at scale through zero budget natural farming in Andhra Pradesh, India, International Journal of Agricultural Sustainability, 18:1, 1-20, DOI: 10.1080/14735903.2019.1694465
2. Bishnoi and Bhati, (2017), An Overview: Zero Budget Natural Farming, Trends in Biosciences 10(46), ISSN 0974-8431, 9314-9316, 2017
3. <https://naturalfarming.niti.gov.in/components/#:~:text=Fungicide%20prepared%20with,crops%20after%20filtering.>
4. Koravet *al.* (2020), Review- Zero Budget Natural Farming a Key to Sustainable Agriculture:
5. Challenges, Opportunities and Policy Intervention, *Ind. J. Pure App. Biosci.* (2020) 8(3), 285-295
6. Naik.A and B.A.K (2021) Status of zero budget natural farming: An overview, *The Pharma Innovation Journal* 2021; SP-10(7): 343-347

7. Naresh R.K, *et al* (2018) Zero budget natural farming viable for small farmers to empower food and nutritional security and improve soil health: A review, *Journal of Pharmacognosy and Phytochemistry* 2018; 7(2): 1104-1118
8. Patel V.K, Singh V.K and Kumar R., Basic Principle and Practices of Zero Budget Natural Farming, Morden concept of agriculture science, ISBN: 978-93-5834-019-8
9. Choudhary SK, Kumar R, Kumar A. General overview of zero budget natural farming (ZBNF). *Agricultural Reviews*. 2023;44(3):328-35.
10. Saharan BS, Tyagi S, Kumar R, Vijay, Om H, Mandal BS, Duhan JS. Application of Jeevamrit improves soil properties in zero budget natural farming fields. *Agriculture*. 2023 Jan 12;13(1):196.
11. Singh S, Singh V, Singh A, Singh O. Zero-Budget Natural Farming: Way to Sustainable Future. In *Encyclopedia of Green Materials* 2023 Mar 17 (pp. 1-9). Singapore: Springer Nature Singapore.
12. Bharucha ZP, Mitjans SB, Pretty J. Towards redesign at scale through zero budget natural farming in Andhra Pradesh, India. *International Journal of Agricultural Sustainability*. 2020 Jan 2;18(1):1-20.