

Zero Budget Natural Farming: A Sustainable Approach to Chemical-Free Agriculture

Paramita Samanta¹, Parijat Bhattacharya^{1*}

¹Department of Agriculture, Swami Vivekananda University,
Barrackpore 700121, Kolkata, West Bengal, India

*Corresponding author: parijatb@svu.ac.in

Abstract:

Zero Budget Natural Farming (ZBNF) is an innovative agricultural practice that emphasizes chemical-free farming with zero production costs. Developed by Subhash Palekar, ZBNF promotes the cultivation of crops without external inputs such as pesticides and fertilizers, advocating for a harmonious relationship with the environment. The term “Zero Budget” signifies that farmers can grow crops without incurring any expenses, thereby alleviating financial burdens and reducing reliance on loans. The principles of ZBNF include minimal soil disturbance, the use of bio-stimulants, native seeds for mixed cropping, and the incorporation of livestock to enhance soil health. This method not only conserves water—utilizing 50-60% less compared to conventional practices—but also significantly lowers methane emissions through improved aeration techniques. Additionally, ZBNF has been shown to enhance soil fertility and promote sustainable agricultural practices across diverse agro-climatic zones. Despite its benefits, concerns regarding ZBNF’s long-term viability and productivity persist. Some farmers have reported declining yields after initial successes, leading to a return to conventional methods. Therefore, scientific validation of ZBNF’s effectiveness is crucial before widespread adoption. This review aims to explore the principles, benefits, and challenges of Zero Budget Natural Farming, highlighting its potential as a resilient agricultural system that aligns with contemporary sustainability goals.

Keywords: Zero Budget Natural Farming, Sustainable Agriculture, Chemical-Free Farming, Soil Fertility, Agro-Ecological Practices.

Introduction:

Zero-Budget Natural Farming (ZBNF) is a sustainable agricultural practice that aims to minimize production costs and reliance on external inputs, particularly chemical fertilizers and pesticides. It is a method focused on reducing or eliminating the cost of external inputs like fertilizers and pesticides by utilizing locally available resources. The core idea is to leverage natural processes and locally available resources to cultivate crops, effectively eliminating the need for significant financial investment in farming. Continues use of chemical fertilizer, crop residue burning, and pesticide application can cause the environmental pollution worldwide. It emphasizes ecological balance, soil health, and water conservation while minimizing environmental impact and promoting farmer self-sufficiency. The ZBNF movement has achieved massive scale not only because of effective farming practices, but because of a social movement dynamic – motivating members through discourse, mobilizing resources from self-organized pedagogical activities, charismatic and local leadership, and generating a spirit of volunteerism among its members. There is a growing call to scale up agro-ecology from various sectors – intergovernmental bodies like the Food and Agriculture Organization of the United Nations (FAO), social movements like La Via Campesina (LVC), scientists and civil society organizations (Parmentier 2014; Rosset 2015; FAO 2015). Based on empirical and scientific evidence, the growing consensus is that agro-ecologically diverse farming not only is more productive, but also brings a host of ecological and social benefits ZBNF has now spread across the country and a series of significant policy initiatives are cropping up. Various studies point to indebtedness from increasing costs of green revolution inputs as well as low incomes due to declining market prices as some of the key drivers of the agrarian crisis and farmer suicides in India (Mohanty 2005; Vyas 2005; Misra 2008; Vakulabharam 2013). Like agro-ecology, which is a scientific discipline, set of

practices, and a social movement (Wezel et al. 2009), ZBNF too signifies both a set of practices and a social movement. We thus use the term ZBNF for both practices and movement.

Key aspects of Zero Budget Natural Farming:

Concept:

ZBNF is rooted in the idea of working with nature rather than against it, fostering a harmonious relationship between agriculture and the environment. The concept of ZBNF was developed by Subhash Palekar in the mid-1990s as an alternative to the Green Revolution's reliance on chemical inputs. ZBNF has two major axes, one agronomic and the other structural. On the one hand, it is about improving soil fertility through a number of agro-ecological principles, including diversification, nutrient recycling, increasing beneficial biological interactions, among others (Palekar 2006). ZBNF opposes use of external inputs or synthetic fertilizers. On the other hand, ZBNF is about de-linking farmers from external input and credit markets to create autonomy by not purchasing anything from external actors and especially from corporations (*sensu* Rosset and Martíneztorres. 2012).

Polices in India:

In the Indian context, implementation of the National Mission for Sustainable Agriculture (NMSA) signifies a policy reversal away from the '**biologicallycentred green revolution**'. In addition, various initiatives such as **ParamparagatKrishi Vikash Yojana** (PKVY), **Rashtriya Krishi Vikash Yojana** (RKVY), **MissionOrganic Value Chain Development for North Eastern Region** (MOVCDNER), **Participatory Guarantee System** (PGS), and **National Programme for Organic production**(NPOP), **Network Project on Organic Farming** (NPOF) have been undertaken by the government of India in order to promote Organic Farming. Interestingly, the **PKVY** schemes in its revised guidelines has also included various other organic farming models like Natural Farming, Vedic farming, Cow Farming, Home Farming and Zero Budget Natural Farming (GOI, 2019). Among these alternative organic models, ZBNF has recently come into the spotlight. There is a number of pest management measures such as

Neemastra, Agnistra and Brahmstra, which are homemade preparations used for insect and pest control (Palekar, 2005). The ZBNF program is being implemented through a cluster approach under the PKVY and RKVY Schemes. Among the Indian states, Andhra Pradesh, Himachal Pradesh, Karnataka are progressively practicing ZBNF (GOI, 2019).

Andhra Pradesh Initiative:

Andhra Pradesh has been at the forefront of promoting ZBNF, aiming to become the first state to adopt it as a comprehensive farming approach. Between 1999 and 2004, the Food and agriculture Organization (FAO) and the Government of India together led a program to promote **Integrated Pest Management** (IPM) among cotton cultivators through farmer field schools (Mancini et al. 2008). The role of farmer choice, autonomy, and farmer-driven innovation was another recurring theme in our interviews. While not mentioned in our stakeholder interviews, this theme hearkens back to the farmer field schools of the 1990s and early 2000s (Mancini et al. 2008).

ZBNF in Karnataka:

Karnataka is a south-western state in India with a population of 61,095,297.9 Nearly 56 percent of the workforce in Karnataka is engaged in agriculture and related activities (Das 2005). The main crops grown in the state are rice, millet, maize, pulses, oilseeds, cashews, coconut, arecanut, cardamom, chilies, cotton, sugarcane, tobacco, coffee and silk (Government of Karnataka 2006). ZBNF falls under a larger tradition of farming in India, called natural farming. There are teachers from other parts of India who promote similar principles but not at the same scale. 10 Most have some combination of Gandhian principles, the Japanese natural farmer Fukuoka's teachings of '**do-nothing**' farming, and **traditional farming** methods (Dabholkar 1998; Fukuoka 2001; Mansata 2015). It is in this context that many farmers of all classes have looked towards alternatives to end debt and improve incomes.

Factors useful to analyze:

Horizontal pedagogical processes:

The farmer-to-farmer methodology was a key strategy for peasant organizations in Latin America to take agro-ecology to scale (Holt-Giménez 2006).

Farming practices that work:

Agro-ecology cannot spread based solely on social processes. Any process must be based on agro-ecological farming practices and principles that provide farmers with good results – that are ‘solutions’ to problems or obstacles that farmers face (Machín Sosa et al. 2013; Rosset et al. 2011; Kolmans 2006).

Social organization–social movements:

Community organizations and rural social movements serve as the culture medium upon which agro-ecology can spread.

Principles of ZBNF:

ZBNF is based on what Palekar calls the four wheels of ZBNF. Bijamrita (a seed treatment) and Jivamrita (a soil inoculant) are microbial mixtures which are ready in under 48 h. For those who do not have access to water or labour, a dry version of Jivamrita called Ghanajivamrita is prescribed; this can be prepared once and stored for a year. Both are sources of beneficial bacteria which have plant protective qualities and stimulate plant growth (Sreenivasa, Naik, and Bhat 2009).

Bijamrita/Beejamrutha:

Seed treatment using water (20l), cow dung (5kg), urine (5l), lime (50gm) and just a handful of soil. Bijamrita is a seed treatment, equipped in. This is a concoction prepared from locally available natural resources for the purpose of treatment for seeds, seedlings or any planting material. It reduces the possibility of seed infestation by pests and protects young roots from fungus, soil-borne diseases, and seed-borne diseases that generally affect the plants after monsoon. In the ingredients, the dung and urine from the indigenous breed cow act as a powerful fungicide, and anti-bacterial agent.

Research studies showed that inoculating with *bijamrita* to protect the crop from harmful soil-borne pathogens and young seedlings roots from fungus and soil-borne and seed-borne diseases also help to produce IAA and GA3 (Sreenivasa et al., 2010).

Jeevamrita/Jivamrita:

It is composed of the cow-dung (20 kg), Urine (5-10 l), jaggery (20 kg) and dicot flour (2 kg) and is applied to the crops with each Irrigation cycle OR directly to the crops. This is a fermented microbial culture prepared from locally available natural resources for the purpose of being applied to the soils/plants at different stages of their growth. It is a form of bio-fertilizer, a catalytic agent, promoting microorganism and earthworm activity in the soil. The 48 hour fermentation process multiplies aerobic and anaerobic bacteria present in the cow dung and urine, as they eat up organic ingredients, and a handful of undisturbed soil acts as inoculate of native species of microbes and organisms. The microbes present in *jeevamrutha* helps non-available form to dissolved form when it inoculated into the soil. It also helps as antagonism to (biological control) pathogens (Glick & Bashan, 1997). PGPR, cyanobacteria, and Solubilizing Bacteria (PSB), mycorrhizal fungi, Nitrogen-fixing bacteria are some important microbes present in the product (Chen et al.,1995). A fermented microbial culture made from cow dung, cow urine, jaggery, and pulse flour to enrich the soil. While transiting from conventional input-intensive agriculture, the application of *Jeevamrutha* to the soils and plants is required only for the first three years because after that the system becomes self-sustaining.

Achadana/Mulching:

Using organic matter like dried leaves and crop residues to cover the soil, conserve moisture, and suppress weeds.

There are three types of mulching.

- Soil mulching: It protects topsoil by avoiding tilling. It facilitates aeration, and promotes water retention. If not zero tillage, avoid deep ploughing.

- **Straw/Biomass mulching:** Application of dry organic matter (dead material of any living being) along with Jeevamrutha will lead to decomposition and humus formation that will improve soil fertility.

- **Live mulching:** This suggests inter-cropping or mixed-cropping by combining monocots (those seedlings with one seed leaf like rice and wheat) with dicots (those seedlings with two seed leaves like legumes) in the same plot of land. This will create a symbiotic relationship because monocots will supply elements like potash, phosphate, and sulphur, while dicots will work towards nitrogen-fixation.

It also supplies organic matter to the soil which contains many micro and macronutrients. Improves seed germination without soil plowing, reduce soil temperature in extreme condition, and increase soil temperature during winter. It conserves soil moisture by reducing evaporation loss of water from the soil layer and retains water for a longer time.

Waaphasa (Vaphasa):

Maintaining soil aeration and moisture for healthy microbial activity. This calls for an appropriate mix of water and air in the soil or the relevance of soil moisture. The irrigation should be reduced and irrigation should be practiced only at noon, in alternate furrow. It questions the thinking that plants need more water and irrigation is the way out. Rather, it calls for a reduction in water usage and resonates with the saying “**more cropper drop**”. Application of water in alternative furrows because of all roots of plants not absorb efficiently, younger horizontal and vertical roots absorb more amount of water than older one and nutrient solder roots. In soil, out of soil mineral and organic matter, there is an equal proportion of water and air present.

Intercropping and Crop Rotation:

Growing multiple crops together and rotating them to improve soil fertility and manage pests naturally. ZBNF heavily relies on the dung and urine of local Indian cows for preparing various bio-inputs.

Benefits of ZBNF:

La Via Campesina is of the view that “ZBNF exemplifies agro-ecological principles” where the emphasis is on “enhanced biomass recycling; strengthened ‘immune system’ of systems through enhanced functional biodiversity; enhanced soil conditions by managing organic matter and soil biological activity; minimized loss of energy, water, and nutrients; diversification of genetic resources; and enhanced beneficial biological interactions” (Khadse et al, 2017).

Reduced Production Costs:

Eliminating the need to purchase expensive inputs leads to significant cost savings for farmers. The cost of production in ZBNF is zero as farmers don't require buying any inputs. It consumes only 10 percent of the water that crops consume in conventional methods. Farm input costs are nearly zero or negligible as no fertilizers and pesticides are used. ZBNF promotes biodiversity, enhances soil health, and conserves water resources, contributing to a more sustainable and resilient farming ecosystem. ZBNF eliminates the need to purchase expensive inputs like chemical fertilizers and pesticides, significantly reducing production costs and potentially increasing farmer's income, especially for small and marginal farmers. ZBNF promotes biodiversity, enhances soil health, and conserves water resources, contributing to a more sustainable and resilient farming ecosystem.

Natural Inputs:

ZBNF utilizes natural substances like cow dung, cow urine, jaggery, and plant-based extracts to nourish the soil and manage pests. It emphasizes the use of locally available seeds and resources, reducing dependence on external sources and promoting self-reliance. Natural farming is eco-friendly sustainable to the environment maintains good health of soil, plant as well as human beings by increasing beneficial microbial population, chemical-free nutrients supply to plants and toxic-free food supplies to consumers (man and animals).

Improve crop health:

Both farmers and extension workers report better plant

health and vigour in ZBNF fields in a range of horticultural and arable crops, including after flooding and dry spells. The deeper and larger root systems and more robust plant structures in plants raised under ZBNF conditions. The ZBNF farmers in the districts of Ananthapur, Kurnool and Vishakapatnam, for example, reported greater resilience to cyclone damage as well as dry spells (with yields maintained under ZBNF conditions during the 2016 drought as well as dry-spells in 2017).

Improved Soil Health:

Natural inputs and minimal disturbance help restore soil fertility and biodiversity. ZBNF encourages practices like intercropping, mulching, and minimal soil disturbance, all contributing to long-term soil fertility and ecological health. Earthworm decomposes the plants and animals, which enriches the soil with humus. It also improves the Soil aeration and water holding capacity by making micro and macro pores in the soil. Pest management method used in this, not only helps to get rid from pest damage but also, protect us from the hilarious side effects of chemical methods , such as magnification, pollution, food poisoning ect.

Environmental Sustainability:

ZBNF minimizes the use of harmful chemicals, reducing pollution and promoting a healthier environment. It promotes biodiversity, enhances soil health, and conserves water resources, contributing to a more sustainable and resilient farming ecosystem. Crop rotation and intercropping protect the soil from exhaustion of moisture and nutrients. While, mulching slow down the evaporation and maintains adequate moisture in the soil. It provide favourable environment to the micro organism present in the soil.

Increased Resilience:

By promoting diverse and resilient farming systems, ZBNF can help farmers adapt to changing climates and weather patterns. Some of plant protections are made by using a mixture of butter milk, cow milk, pepper powder, neem seed and green chilli (Palekar, 2016). The two consecutive droughts,

the widening gaps between agricultural and non-agricultural sectors, as also untimely, inadequate and non-serviceable are not the only reasons to explain the increasing vulnerability of the agricultural sector. The multitude of technological and financial interventions envisioned to reduce risk can actually end up increasing it. This design flaw can be explained by borrowing a stylized representation through a fictitious example taken verbatim from Mishra (2015)

Enhanced Food Security:

ZBNF can contribute to food security by promoting sustainable and diversified food production. One cow can produce 10-12 kg fresh dung and it is sufficient to 30 acres of land in one month. Higher significant yield found under ZBNF in different cash as well as food crops E.g. 11 % and 40 % high yields of cotton and gulli ragi in ZBNF plots than in non-ZBNF plots. The National Family Health Survey 2015-16 (NFHS-4) indicates that from among under five children, 38 per cent are stunted, 21 per cent are wasted, and 36 per cent are underweight; from adults, 23 per cent males and 20 per cent females had Body Mass Index (BMI) that was below normal, and 21 per cent males and 19 per cent females had BMI that made them overweight or obese (International Institute for Population Science, IIPS, 2016).

Pest management:

Name of pest Management formulae : Agriastra

Composition: It is composed of 10 litre Local Cow Urine and 1 Kg Tobacco, 500gm of Green Chili, 500 gram Local Garlic, 5 Kg Neem leaves pulp (crushed in urine) for spraying, 2l Brahmastra is taken in 100 l water.

Control: It is effective against the pests like LeafRoller, Stem Borer, Fruit borer, Pod Borer.

Name of pest Management formulae : Brahmastra

Composition: It is prepared by neem leaves, custard apple Leaves, lantern camellialeaves, guava leaves, Pomegranate leaves, papaya leaves and white Dhatura leaves crushed and boiled in urine.

Control: It is used to control all of the sucking Pests, pod borer, fruit borer etc.

Name of pest Management formulae :Neemastra

Composition: It is made up of local cow urine (5l), cow dung (5kg) and neem leaves and neem pulp (5kg) Fermented for 24 hrs.

Control: It is used for sucking pests & Mealy Bug.

Challenges to adopt ZBNF:

There continues usage, decreased the soil micro and macrofauna which may directly effect on C-N ratio and nitrification activity (Jenkinson, 1982; Doran et al. 1996; Shaikh & Gachande, 2015). ZBNF is positioned by its advocates as a solution to the agrarian crisis and rising trend of farmer suicides in India (Palekar 2005, 2006,). While ZBNF is promoted as a counter-hegemonic movement challenging dominant ideas of economic globalization, as ZBNF becomes institutionalized in significant state-led policies it may now be at risk of becoming entangled with the very hegemonic institutions its leader has opposed.

Yield Uncertainty and Lower Initial Yields:

ZBNF systems often experience lower yields during the initial transition period compared to conventional farming, especially in regions heavily reliant on chemical inputs. This can be a deterrent for farmers who need to meet immediate food and income needs. Some studies suggest potential yield declines, with one study highlighting a 59% decline in wheat yields and a 32% decline in basmati rice yields.

Input Availability and Cost:

While ZBNF aims for zero input costs, the availability of inputs like cow dung and urine, particularly from indigenous breeds, can be a challenge. Even though ZBNF promotes “zero cost” input, there are implicit costs associated with family labour and the opportunity cost of using resources. The lack of scientific validation for claims of higher yields in ZBNF plots compared.

Labour Intensity and Knowledge Gap:

ZBNF practices like composting, pest control, and weed management can be labour intensive, requiring significant time and effort from farmers. Successfully transitioning to ZBNF requires a strong understanding of natural processes, ecosystem management, and specific ZBNF techniques, which many farmers lack.

Market and Policy Support:

ZBNF products often lack proper market linkages and certification, making it difficult for farmers to access premium prices for their produce. Limited government subsidies and policy support for natural farming compared to conventional practices can also hinder widespread adoption.

Sustainability Concerns:

Some experts question ZBNF's ability to meet the food security needs of a large population like India's, especially if implemented on a large scale. Concerns exist about the long-term impact on soil fertility and productivity, as well as the potential for yield stagnation or decline after a few years. Lessons from Sri Lanka, which experienced food security issues after a complete shift to organic farming, highlight the potential risks of rapid and large-scale transitions.

Scaling up of ZBNF among farmers:

Social organization:

Karnataka became the crucible where the experiment of ZBNF first succeeded in reaching a wide number of farmers, turning into a popular movement (Khadse et al. 2017). A decisive factor behind the scaling up of ZBNF in Karnataka was the coming together in 2002 of the guru of ZBNF, Subhash Palekar, with the social organization of Karnataka Rajya Raita Sangha (KRRS)- the largest farmers movement of the state. Mier Y Terán et al. highlight the importance of social organization and crises to the scaling up of agroecology, and in the case of ZBNF too, these were factors for its initial growth.

Local champions:

When Palekar was first invited to Karnataka, he received a mixed response. At one workshop in 2002 in Hubli Karnataka, notes a KRRS leader, the majority of farmers abandoned a five-day ZBNF workshop, leaving only a handful of remaining participants. Yet one of the participants, Krishnappa, a heavily indebted farmer at the time, was so convinced by Palekar's discourse that he abandoned chemicals and started practicing ZBNF. Krishnappa's 2-ha farm became one of the most successful model farms in ZBNF. Krishnappa's success convinced others to pay attention to ZBNF. He became a local trainer and advisor for other farmers. Over the years, hundreds of such local champions, many of whom we have interviewed and met, have developed across the state of Karnataka. Mier Y Terán et al. (2018) indirectly identify local champions and leadership as a factor in achieving scale, while Nicholls and Altieri (2018) refer to the importance of 'lighthouses', which are demonstration and training farms led by NGOs or farmers themselves as effective mechanisms for scaling up agroecology.

Self-organized pedagogical activities:

According to our interviews with ZBNF leaders, by 2006 the movement had gathered many new allies, and volunteers, beyond the farmers' movement. They were collectively organizing massive training workshops-with the participation thousands of farmers over five to seven days. This model of self-organized training workshops became the cornerstone of the ZBNF movement. The movement operated without a central organization or a bank account (Khadse et al. 2017). Mier Y Terán et al. (2018) highlight the importance of allies in agroecology movements.

Simple farming practices:

With regard to the links between agroecological practices and the scaling up process, Rosset and Martínez-Torres. (2012) discussed the importance of farming practices that actually solve problems that farmers face to taking agroecology to scale. Mier Y Terán et al. (2018) pointed out that simple practices may be important for early adoption. The experience of ZBNF

also highlights that adoption improves if initial practices are simple and require less effort or resources to implement.

Conclusion:

ZBNF is attaining wide scale in India among more and more farm family essentially as a farmer-led social movement, and more recently with the adoption of a significant public policy in the state of Andhra Pradesh. Other state Governments like Himachal Pradesh and Kerala are also initiating pilot programs in line with Andhra's experience. In both cases, its wide reach has been triggered by a number of factors identified by Mier Y Terán et al. (2018) as important for the scaling up of any agro-ecology process. Policy support is a welcome move and Important in order to move from 'islands of success' to massive adoption (Gregory, Plahe, and Cockfield 2017). It remains to be seen how these upcoming state interventions will unfold over time and a more detailed investigation is needed about their results and implementation. With this in mind, the Government of India is trying to promote organic farming by introducing several schemes. Various Organic models like Natural Farming, Vedic Farming, Cow Farming, Home Farming and Zero Budget Natural Farming is being practiced across India. In this backdrop, the study has selected one cluster formed under the PKVY scheme from rural West Bengal based on the ZBNF model. A survey carried out by LVC (La Via Campesina) suggests that ZBNF works not just in agronomic terms, but also brings about a variety of social and economic benefits. A majority of respondents reported that by adopting ZBNF, over time they saw improvements in yield, soil conservation, seed diversity, and quality of produce, household food autonomy, income, and health. Palekar's Zero Budget Natural Farming has undoubtedly made an indelible mark on farming in India. More than 40 lakh farmers across the country have benefitted greatly from this technique and surely this number will increase tremendously in coming years. In Conclusion, Savings on the cost of seeds, fertilizers and plants protection chemicals has been substantial. The new system has freed the farmers from the debt trap and has instilled in them a renewed sense of confidence to make farming an economically viable venture.

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