

Perspectives of Zero Budget Farming on Sustainable Agriculture

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SUMMARY

With the burgeoning human population it is imperative to provide quality and adequate amount of food. Over the decades, farming is completely relied on chemical inputs in order to produce higher yield rather than quality of the produce. However, this approach put humans at risk during crop spraying, gradually deteriorates the soil fauna by losing its vigour and eventually becomes unproductive. Challenging the notion of farmers, that use of chemical inputs will give higher yields despite quality Subhash Palekar introduced a new alternative approach called “Zero Budget Natural Farming” a new component practiced in agriculture that will conserve the fertility of the soil and also ecologically safer. As the name Zero Budget specifies that without using any external credit and without spending any money on purchased products farming can be practiced which produce sustainable yields. Farmers are in debt due to agrarian crisis where they invested a huge amount of money to buy the inputs required for farming. To make farmers prosperous and increase the production of the commodity Zero Budget Farming will help the farmers to earn profitable yields and reduce the debt incurred in farming. The basic fundamental methods involved in Zero Budget Natural Farming include green manures, compost, crop rotation, mulching, biopesticides and mechanical cultivation. Although to accomplish a successful Zero Budget Natural Farming there are four key pillars involved in it which includes Jivamrita, Bijamrita, Acchadana and Whapasa. To conclude, Zero Budget Natural Farming is an effective and exclusive method used both in crop production and protection compare to chemical substances for sustainable agriculture.

INTRODUCTION

Agriculture has been the basic source of subsistence for human societies, over thousands of years and it provides a livelihood to half of the world’s population, even today (FAO, 2018). As climate is a dynamic factor, creating a resilient food systems has become a need of the hour. Across the world, agriculture is facing multiple setbacks, be it the form of extreme weather events like floods and droughts or factors such as soil degradation, soil salinity and water shortage. To feed the global population of 9.6 billion by 2050, as projected by (U.S. Census Bureau 2008) scaling up food production is paramount. But ensuring food security, producing more with less resources and building the resilience of smallholder farmers are also important in creating a food secure future. With the advent of Green revolution farmers are switched to chemical farming practices, leads to indiscriminate use of chemical fertilizers and synthetic pesticides that degrade the beneficial soil biota and makes soil infertile and unproductive and also contribute to the high cost of crop production (Kumar, 2017). On this pretext, there is a new approach of farming known as Zero Budget Natural Farming.

Zero Budget Natural Farming (ZBNF) specifies that a farming in “harmony with nature” where it completely eliminates the chemical fertilizers and pesticides usage in farming and makes farming as a chemical free zone, which inspires the farmer to make farming with lower inputs As the name “Zero Budget” literally means without credit and without any external inputs farming is practiced (Padmavathy and Poyyamoli, 2011). ZBNF strictly opposes the usage of chemical fertilizers and pesticides (Kumar *et. al.* 2019). At a time when chemical-intensive farming is resulting in soil and environmental degradation, water depletion and pushing up the cost of farm inputs, a zero-cost environmentally-friendly farming method is definitely a timely initiative. It is already being practised in Andhra Pradesh, Karnataka, Kerala, Himachal Pradesh, Uttarakhand and Chhattisgarh. The chief architect of Zero Budget Natural Farming is Padmashri Subhash Palekar popularly known as “Krishi ka Rishi”(the sage of agriculture”) suggested four key pillars are involved in ZBNF which includes Jeevamrutham, Beejamrutham, Acchadana and Whapasa plays an integral role in ZBNF (Mishra, 2018). The Economic Survey 2018-19 reports that about 1.6 lakh farmers follow ZBNF. While ZBNF seems to have hit the right chord when it comes to environmental sustainability, enough data needs to be generated to conclusively prove that ZBNF is a potential solution and is scalable.

Scenario of Indian Agriculture during British colonial period:

The Indian economy in present times is growing at a steady pace which is better than the economic conditions of some of the other developing nations. The agricultural sector alone contributes about 15-18% of the gross domestic product of the country. But as we can all imagine, this was not the case back in the old days when the British ruled the country before we got our independence in 1947. The British East India Company had played a role of traders between the periods of 1600 AD to 1757 AD in India. But, company entered as a ruler from 1757 in Bengal state and till 1818 brought entire India under the rule of company. The series of famine occurred during last quarter of 19th century raised the need of looking towards illness of agriculture in India. An establishment of famine commission (1880, 1898 and 1902) and irrigation commission (1903) had impact of intense discontent of Indians. These commissions had made constructive suggestions for improvement of agriculture in India (Desai, 1968). Zamindari, Ryotwari and Mahalwari land tenure systems were existed in India. Major part of agriculture production was gone in the hands of zamindars and government in this land tenure system (Mamoria, 1973). The British government had established research institutes and Agriculture Colleges for imparting agriculture education and research in India. Indian Council of Agricultural Research in 1929, Indian Agricultural Research Institute, Delhi were established for promoting research on various crops during the British period. It means the base of agriculture research and education had formulated by British in India (Mamoria, 1973). In short, the extension of irrigation, banking sector and agricultural research was the major positive works to develop agriculture sector. However, British had played role of administrator and collection of revenue than welfare of India. Hence, there was no motivation to increase crop yield. Consequently, agriculture sector ruined through exploitation and insecure land ownership in India.

Scenario of Indian Agriculture Post British Colonial period:

India faced the spectre of poverty, inequality, low productivity and food crisis at the time of independence. Despite of the introduction of land reforms, green revolution and public investment in agriculture, economic reforms of 1990s, the situation could not be improved much. In nutshell, Indian agriculture became unremunerative and unviable for Indian farmers. The different problems of Indian agriculture such as, falling share in GDP, indebtedness, inequalities, declining production of food grains, poverty, decreasing share of public investment, falling share in exports etc. have manifested in an agrarian crisis (Chadha and Kaur, 2018).

Paradigm Shift in Green Revolution:

The green revolution has been the cornerstone of India's agricultural achievement, transforming the country from one of food deficiency to self-sufficiency through enhanced technology adoption, increased public and private investments and certain institutional innovations that have augmented production and productivity gains (Kumar, 2005). The Green Revolution in India was initiated in the 1960s by introducing high-yielding varieties of rice and wheat to increase food production in order to alleviate hunger and poverty. Post-Green Revolution, the production of wheat and rice doubled due to initiatives of the government, but the production of other food crops such as indigenous rice varieties and millets declined. This led to the loss of distinct indigenous crops from cultivation and also caused extinction (Nelson *et al.*, 2019).

Status of Genetically Modified Crops in India:

Global demand for food is increasing with the growing world population and decreasing arable land. So it is the need of the hour to produce adequate food to the emerging population. Genetically modified crops (GMCs, GM crops, or biotech crops) are plants used in agriculture, the DNA of which has been modified using genetic engineering techniques. Genetic engineering is the simple addition, deletion, or manipulation of a single trait in an organism to create a desired change (Shetty *et al.*, 2017).

Table: 1 Notable Achievements of GM crops

S. No	Crop	Year	Characteristic Gene
1.	Tobacco	1982	Antibiotic resistant
2.	Tobacco	1986	Herbicide resistance
3.	Tobacco	1987	Insecticidal proteins from <i>Bacillus thurengensis</i>

4	Tomato	1994	(Flavsavar) Increase the shelf life
5.	Golden rice	2000	Enriched vitamin A

Advantages of GM crops:

- Easing of world hunger
- Development of crops that can be grown in marginal soil.
- Reduced strain on non-renewable resources
- Development of drought resistant crops
- Development of salt-tolerant crops
- Development of crops that make more efficient use of nitrogen and other nutrients.
- Reduced use of pesticides and herbicides.
- Development of pest resistant crops.
- Reduced herbicide use is better for the environment and reduces costs for farmers.
- Improved crop quality.
- Development of frost resistant crops.
- Development of disease resistant crops.
- Development of flood resistant crops.
- Improved nutritional quality.
- Development of foods designed to meet specific nutritional goals.

Implications of GM crops: (Sparrow, 2010)

- Allergic reactions
- Not 100% Environmentally Friendly
- Lower Level of Biodiversity
- Decreased Antibiotic Efficacy
- Unusual Taste
- Not Totally Safe to Eat
- Cross-Pollination
- Gene Spilling
- Food Supply at Risk
- Economic Concerns

What is Zero Budget Natural Farming? IS Zero Budget Farming Literally means without money?

As the name signifies “Zero Budget” literally does not mean that farming is practiced without any money but rather it specifies that the need for external credit is zero. Although, if any cost are incurred it could be compensated by practicing diversification of crops rather than mono cropping (APZBNF, 2018). However, many critics opposed the Palekar term ‘zero budget,’ as many raised question that this is not precise word suggested despite, some costs are involved in it. Recently ZBNF name has been changed to Subhash Palekar Natural Farming (SPNF) where it creates a chaos in many practitioners and farmers. However, many, including the AP government, continue to use the term ZBNF Khadse and Rosset (2019).

Is ZBNF is “Organic or Traditional”?

ZBNF is not organic oriented agriculture. There are no external inputs such as bio-fertilizers, compost or vermicompost or exotic and expensive bio products *etc* which is used in organic farming. Organic input based agriculture is very expensive. Despite, the output of ZBNF meet the requirements of organic certification. ZBNF is not a traditional agriculture. Cow dung formulation in ZBNF is not a bio-fertilizer, it is an inoculum. (Kumar, 2019).

Why Zero Budget Natural Farming matters?

According to National sample survey office (NSSO) almost 70% of agricultural households spend more than they earn and more than half of them are almost in debt. In states such as Andhra Pradesh and Telangana, levels of indebtedness are around 90% where each house hold bears an average debt of Rs.1 lakh. In order to achieve the Indian central government’s promise to double farmers income by 2022, one aspect being considered is natural farming methods such as ZBNF which reduce farmers dependence on loans to purchase inputs they cannot afford (Jebaraj, 2019). Besides, ensuring food security, producing more with fewer inputs, curtailing climate change and

creating resilient food systems, to overcome the drought, to make barren or infertile lands to fertile lands, importance of chemical free food consumption makes the ZBNF as a holistic approach. (Insights IAS, 2019).

Principles in Zero Budget Natural Farming: (Anonymous, 2018)

Zero Budget Farming:

In ZBNF production cost of the farmer is zero as no external inputs needs to be purchased. Apparently, plant takes 1.5 to 2.0% of the nutrients from the soil by the plant for their growth and development (the rest is taken from the air, water and solar energy) with avoiding chemical fertilizers. All the nutrients required for the plant growth provided by nature itself (as in the forest) and totally free of cost. Citing the Zero Budget significance farmer can also produce their own seeds and protects the crop from pathogens with the help of naturally available products.

Natural Inputs:

Unlike conventional farming methods Natural farming completely relied on naturally available compounds avoiding chemical inputs or organic compost like vermiculture. It acts like a catalyst to enhance biological properties of the soil and makes the soil more productive besides protecting the crops from harmful microorganisms. All the required nutrients are already present in the soil but they are in unavailable form. To make these nutrients in to available form the activity of microorganisms should be increased which increases the soil properties by producing humus and decaying matter. But the indiscriminate use of chemicals has destroyed these beneficial micro-organisms. It is thus imperative to increase the beneficial soil micro flora through natural methods like application of native cow dung which, according to S. Palekar, it contains 3 to 5 million of such beneficial microbes. If farmers are not accessible to native cows (Indian breeds) they can also go for another approach like use of buffalo or even human urine (Palekar, 2018), but Palekar claims that indigenous cow breeds have the most and best microbes and are preferable. His researches show that local cow dung is the most efficient compare to foreign cows (Jersey, Holstein). Only one cow is needed to cultivate 30 acres of lands (most indian farmers own less than 1 acre) as one cow gives about 11 kg of dung per day and as only ten kg of local cow dung are required per month to cultivate one acre of land. Indigenous cows breeds are less input intensive and easy to afford by a small and marginalized farmer compared to hybrid cows. The same situation of lack of native cows had been observed both in Karnataka and Kerala (Münster, 2016). After observing all these activities S. Palekar thus developed a natural catalytic agent known as jeevamrit which is freely available in nature promotes the formation of humus in the soil by encouraging the multiplication of micro- organisms that decompose the dried biomass of the soil and make it available as nutrients for the plants. On the same line, he designed a seed treatment mechanism to protect them from various diseases and insect pests without using any use of pesticides *i.e.* beejamrita is a natural mixture of water, local cow dung, local cow urine, soil and lime. Other mixtures aimed at managing insects and pests (natural pesticides and fungicides) includes tobacco, green chilli, garlic, neem and various fruits such as custard apple, guava, papaya, while dhatura, pomegranate. Suprisingly, both the components *i.e.* jeevamrutha, beejamrutha possess the beneficial bacteria which promotes the plant growth along with defense mechanism against insect pests and pathogens (Sreenivasa, Naik, and Bhat 2009). By using these natural catalysts, protections and treatments ensure the quality of the soil, the underground water and the crops preventing any deterioration or pollution of the environment and maintaining the productivity at a very good level on the long term, natural farming can thus equated with sustainable agriculture.

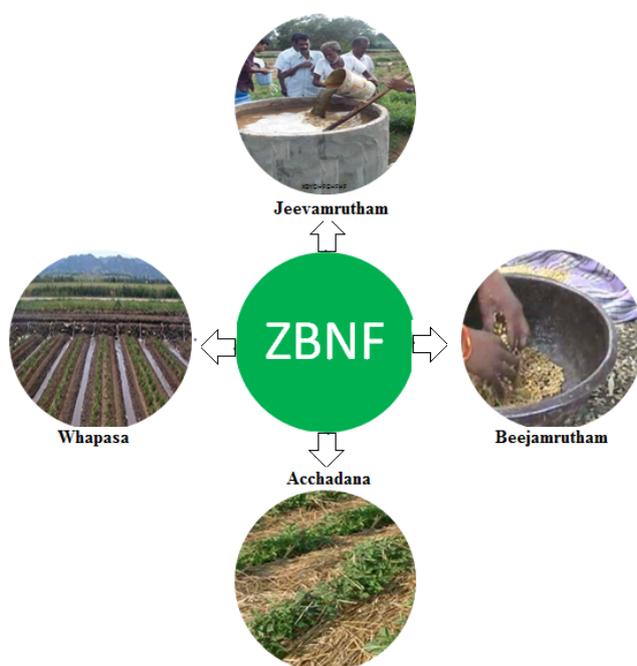
Mulching:

Mulching plays a prominent role in Zero Budget Natural Farming. In this approach a desirable micro-climate *i.e.* 25 to 32⁰C temperature, 65 to 72 % moisture and darkness and warmth in the soil is created to the soil where it conserves moisture and increases water holding capacity of the soil. Mulching indeed conserves humidity of the soil (therefore diminishing the need for irrigation), cools it and protects the micro-organisms.

Multi Cropping:

Intercropping, multiple cropping or mixed cropping, promotes the diversification of the crops and generates more income unlike in monoculture farming. Multiple cropping is the cultivation of two or more crops in the same area, during a growing season, to promote interaction between them. It is based on the assertion that there is a complementarity between plants. Natural farming enhances the use of the soil and its nutrients through this complementarity between the crops.

For example, one could cultivate the long duration crops (like chikoo, coconut, and mango) with short duration crops like various vegetables, leguminous, medicinal and aromatic plants and medium duration crops like banana, papaya and custard apple. The diversification of crops will be based on the area and prevailing agro-climatic conditions. In Multi cropping losses can be minimized and profits can be maximized by getting yield throughout the year where this is contrary in sole cropping system. Multiple cropping also leverages the limitation of outbreaks of invasive crop pests (some plants act as natural pesticides against other crops pests) while crop rotation protects the crops from endemic pests, maintains biodiversity, a better and richer nutrition.



Four catalysts used in Zero Budget natural farming Includes (Babu, 2008)

Jeevamrutha/Jivamrita: This is a naturally available compound from a desi cow contains a numerous microbes that enhances the fertility of the soil. The key ingredients used in the preparation of jeevamrutha includes cow dung, cow urine, flour, jaggery and a handful of forest soil which will be fermented for 48 hours and used with 200 litres of water efficient for one acre of land. This fermented bio fertilizer applied to soil/plants at different stages of their growth which increases the earthworm activity and carbon sequestration and make the soil temperature congenial for growth of microorganisms. It can be applied through irrigation water or through foliar spray. Unlike conventional agriculture, application of *jeevamrutha* to the soil is required only first three years after that it becomes self-sustaining.

Table 2: Preparation of Jeevamrutha and Beejamrutha recipe:

S.No	Required Ingredients	Jeevamrutha (Quantity)	Beejamrutha (Quantity)
1.	Desi cow dung	10 kg	5 kg
2.	Desi cow urine	5 to 10 litres	5 litres
3.	Lime	-	50 grams

4.	Pulse flour (any)	2 kg	-
5.	Jaggery	2 kg	-
6.	Forest soil	Handful	Handful
7.	Water	200 litres	20 litres

Flow chart of Preparation of Jeevamrutha (Bishnoi and Bhati, 2017)

Take 200litre water in barrel



Take 10 kg Local cow dung



Take 5 to 10 litres of cow urine



Mix cow dung and cow urine and add 20 litres of water



Take 2 kg of Pulse flour



Add the flour to 2 kg jaggery



Add handful of soil to the above mixture

Beejamrutha/Bijamrita: (Seed inoculant)

This is also a naturally available resource from indigenous cow constitutes a mixture of cow dung, cow urine and lime mainly used for seed treatment against insect pests and soil borne pathogens which plays a vital role in yield reduction. It is applied to seeds, seedlings or other planting material as seed treatment, despite beejamrutha acts as powerful fungicide and anti-bacterial agent, respectively.

Flow chart of *Beejamrutha/Bejamrith* preparation (Bishnoi and Bhati, 2017)

Take 200 litre + 5 kg cow dung + 5 lit cow urine and handful of soil



Take 5 kg local cow dung in a cloth and bound it by a tape. Hang this in 20lit water for 12hrs



Take one lit of water and add 500 gm lime in it and leave for overnight



Next day morning squeeze this bundle of the cow dung thrice continuously, so that all the essence in the dung accumulate in the water



Add handful of soil to this solution and stir it well





Add cow urine to that solution along with lime water and stir it well



Beejamrutha is ready for seed treatment

Acchadana/ Mulching: The word mulch has been properly derived from the German word “*molsh*” means soft to decay, which apparently referred to the use of straw and leaves by gardeners as a spread over the ground as mulch (Jacks *et al.*, 1955) There are 3 types of mulching suggested by S. Palekar which includes: a) Soil mulching b) Straw mulching or Biomass mulching c) Live mulching. Mulching with straw improves soil moisture content and conducive to the growth of microorganisms and earthworms (Paoletti, 1999). The primary objective of it produces humus, conserves topsoil, increase water retention capacity, enhances soil micro flora and reduces the weeds. Mulching enhances the biological activity and replenishes the nutrient base of the soil. Adequate mulching keeps the top and sub soil moist and enhances the water holding capacity of the soil and also reduces water loss due to evaporation so that the crop will be better equipped to tide over drought conditions.(Babu,2008).



Mulching with paddy straw

Whapasa/Moisture:

This approach restore the water and air molecules present around the root zone of soil and holds the soil moisture consistently over a long period of time. Rather, it calls for a reduction in water usage and resonates with the saying "more crop per drop (Mishra, 2018) .



Moisture Conservation

Impact of Zero Budget Natural Farming over conventional farming: (ICCOA, 2018)

A survey carried out by LVC (La Via Campesina) suggests that ZBNF brings about a variety of social and economic benefits. A majority of respondents saw improvements in yield, soil conservation, seed diversity, quality of produce, household food autonomy, income, and health. There was reduced farm expenses and need for credit, one of the major problems plaguing Indian farmers. Further, it also ends poverty, end hunger promote food security for sustainable agriculture, Ensures healthy lives, Achieve gender equality and empower girls and women, Promote sustainable economic growth and decent employment for all, Combat climate change and halt the biodiversity loss.

ZBNF is a feasible approach for sustainable higher productivity: Success stories of Andhra Pradesh farmers

Mr. Giddaiya, a local farmer of Andhra Pradesh, has been practising Zero Budget Natural Farming in various crops like tomatoes, red gram and pearl millet in 2.02343 hectares (ha) after rigorous government training. He observed the reduction in cost of cultivation of Rs 10000 per ha. Marappa Naidu a resident of Andhra Pradesh followed ZBNF approach in his five acres of land where he followed *navdhanya* concept in which nine different types of crops are grown to increase the productivity. Similarly, In Anantapuram district, farmers are relied on ZBNF concept in which they cultivated groundnut with 136 percent there is a exponential yield under ZBNF. Naidu observed higher yield with five quintals of red gram under ZBNF compared to three quintals under conventional farming. In Gosanipalli village, around 150 farmers are approaching the ZBNF concept. Similarly, Ramajaneyulu, in his 0.81ha of land produced nine quintals of groundnut under ZBNF as compared to six or seven under non-ZBNF. Besides groundnuts, he also grows onions, tomatoes, carrot and red gram (Deepanwita and Niyogi, 2018). Several other such success stories are also reported from different states like Karnataka, Maharashtra and Himachal Pradesh.

Benefits and Welfare of Zero Budget Natural Farming: (Drishti, 2019)

- Increasing the cost of external inputs like chemical fertilizers and pesticides, throws the farmers in to indebtedness which leads to commit the suicide plaguing the farmers. Since in ZBNF there is no need to spend money or take loans for external inputs, the cost of production could be reduced and farming made into a “zero Budget” exercise. This would break the debt cycle for many small farmers and help to envisage the doubling of farmer's income by 2022.
- At a time when chemical-intensive farming is resulting in soil and environmental degradation, a zero-cost environmentally-friendly farming method is definitely a timely initiative.
- Besides, ZBNF promotes the usage of cow based formulations, mulching, crop rotation, scaling biodiversity, improving physical properties of the soil *etc* shows that holistic results could be obtained from ZBNF (Altieri, 2018 and Asha, 2015)
- It suits all crops in all agro-climatic zones.
- Quoting the benefits of ZBNF, in June 2018, Andhra Pradesh rolled out an ambitious plan to become India's first State to practise 100% natural farming by 2024.
- ZBNF produces higher yield with less input.
- ZBNF approach promotes the good agronomic practices and thus eliminates the applications of chemical derived compounds.
- Increase fertility of the soil, improves biodiversity and higher productivity.
- Provides lucrative livelihoods to small and marginalized farmers.
- Generates the higher income through diversification of cropping systems
- 2000 sq.m area is efficient to start ZBNF.
- By following ZBNF approach one can maintain sustainable agriculture.
- It promotes women empowerment and adequate nutrition.

Constraints in Zero Budget Natural Farming:

Apart from plethora of advantages in practicing ZBNF, on the flip side of this there are certain constraints involved. Though the name Zero Budget suggests no credit to be invested in ZBNF farming as the inputs are available in nature yet, farmers have to incur the cost of labour for field work and cattle rearing, cleaning the cattle shed and collection of dung and urine, and in the preparation of *jeevamrutha*, *neemastra* and *bramhastra*. Besides the cost of cattle feed is also quite high. Because of reduced grazing lands and depleting small water bodies, fodder price in recent years has scaled making it as costly as milk. Between 2012 (April) and 2018 (November), the wholesale price index (WPI) of cattle feed has increased from 106.7 to 159.3, a rise of about 50 per cent. Above all, ZBNF advocates the need of an Indian breed cow, whose numbers are declining at a fast pace. (Narayanamoorthy and Alli, 2019)

CONCLUSION

ZBNF is therefore a holistic farming approach where it moves on a primary objective reducing the cost incurred in farming and makes farmers life prosperous with sustainable yields. However it is a paramount to analyse ZBNF on scientific basis which will inspire many farmers, Agricultural universities and other organizations to practice Zero Budget Natural Farming. Besides, low cost input approach one has to maintain soil fertility for sustainable agriculture. Soil health card is a step in right direction in this regard. As farmers are over relied on chemical farming approaches day to day potential of the soil is deteriorating rapidly. So, it is imperative to improve the fertility of saline, acidic, alkaline and toxic soils by reclaiming them. There is requirement of innovative technologies to deal with wind and water erosion of soils and at the same time checking water logging, flooding and crusting. There is a need of location specific interventions towards balanced fertilization and integrated pest and nutrient management.

Future prospects on ZBNF:

- Scientific approach is needed.
- Field trails on horticultural crops should be done.
- Transparent policies should be regulated by the government to assist small and marginal farmers.
- Allocating a certain amount of Countries budget on ZBNF.
- Conducting a number of workshops on ZBNF in rural areas will empower the farmers.
- Projects should be given to all agricultural universities and KVK'S to evaluate the efficiency of ZBNF on various crops.

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