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Spiritual Farming: A Tool for a Sustainable Agriculture Revolution: A Review

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ABSTRACT

Agriculture is extremely important in a developing country like India. Apart from fulfilling the food requirement of the growing Indian population, it also helps to improve the country's economy. By 2050, 60% of India's population would have severe food insecurity. Increased food production is critically needed, but high production costs and market price fluctuations are forcing farmers into debt. The usage of chemical fertilizers and pesticides has expanded in India since the green revolution. Excessive chemical use has a negative influence on the ecosystem, soil, human health and groundwater purity. Spiritual farming or Zero Budget Natural Farming (ZBNF) is the most effective way to lower farmers' input costs. Subhash Palekar practised and advocated Zero Budget Natural Farming (ZBNF) in India. Building elements of ZBNF are jeevamrith, bijamrith, mulching and soil aeration. These four approaches contribute to improved soil health, microbial population and crop output. Intercropping, contour bunds, crop rotation, green manures, compost, and biological pest management is some of the other fundamental elements. Spiritual farming as the potential to reduce pollution while also preserving productivity in our agroecosystem and has the ability to improve agricultural viability and food security.

Key words: Benefits, Impacts, Principles, Spiritual farming, Zero budget.

One of humanity's most fundamental concerns is feeding a projected population of 9 billion by the mid-century. Between 1980 and 2020, global agricultural output increased by more than thrice (Sreenivasa *et al*., 2010). Green Revolution technologies, which increased yields and revenues over old ways, helped to enable this at first. The intensive, high-input agriculture that resulted, reliant on chemical fertilisers, pesticides, and irrigation, has resulted in evidence of environmental deterioration and poor health effects linked to synthetic chemical exposure (Ajaykumar *et al*., 2022). As a result, methods like sustainable intensification and agroecology have emerged that are more environmentally focused.

Pesticides and chemical fertilisers, especially heavy metals such as Cd, Cu, Mn, and Zn, can pollute the soil profile and leak down into groundwater (Bharucha *et al*., 2020). Plants that absorb this heavy metal store it in sink portions for a longer period of time. Peoples who consume these plant products suffer serious health problems (Barabasz *et al*., 2002). Herbicides such as atrazine and metolachlor, which have been used for a long time, have reduced the microbial population in the soil. After witnessing the harmful effects of chemical farming, newly introduced agriculture technique among farmers is zero budget natural farming (ZBNF), also known as zero budget spiritual farming (ZBSF). It has attained wide success in southern India especially Karnataka where it was firstly evolved (Kumar, 2012). Now it is spreading all over India, so rapidly. The term 'budget' is used to describe credit and expenditures, and using no credit and without spending any money on purchased inputs is referred to as a "zero budget". 'Natural farming' refers to farming that is done in harmony with nature and without the use of chemicals (Smith *et al*., 2020).

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As an alternative to the Green Revolution, Mr. Subhash Palekar, a Padma Shri laureate, pioneered this zero-budget natural farming approach in India in the 1990s (Korav *et al*., 2020). ZBNF refers to a farming practise that requires no or very little external inputs. Farming on a shoestring budget is also known as low-budget farming. ZBNF is gaining traction in restoring soil quality for long-term crop production through diversification, microbial activity, nutrient recycling, and beneficial biological interaction (Devarinti, 2016). Overall, biofertilizers play a significant influence in plant development and output, making them a critical component of organic and sustainable agriculture (Upadhyay *et al*., 2020). Alternative low-input farming approaches have sprung up all over the world, offering producers fewer input

costs and higher yields, as well as chemical-free food for consumers and greater soil fertility. For long-term agroecosystem management, ZBNF is a low-input, climate-resilient farming option that allows farmers to employ low-cost, locally available inputs while avoiding the use of chemical fertilizers and pesticides.

Building elements of zero budget natural farming

Jivamrita/jeevamrutha

Jeevamrutha is a fermented microbial culture. Microorganisms play an important role in the conversion of unavailable forms of nutrients to available form in the plant root zone. When jeevamrutha is injected into the soil, the bacteria in it assist the non-available form disintegrate (Duddigan *et al*., 2022). It provides nutrients, but most importantly, acts as a catalytic agent that promotes the activity of microorganisms in the soil, as well as increases earthworm activity; it requires 20 kg cow dung, 5-10 l urine, 2 kg dicot flour are well mixed and this add-in irrigation tank at regular intervals of 15 days until the soil is enriched or spray 200 l of jeevamruth twice in a month. During the 48 hour fermentation process, the aerobic and anaerobic bacteria present in the cow dung and urine multiply as they eat up organic ingredients (like pulse flour). A handful of undisturbed soil is also added to the preparation, as inoculate of native species of microbes and organisms. Jeevamrutha also helps to prevent fungal and bacterial plant diseases. According to Mr. Palekar, only one cow is needed for 30 acres of land that should be a local desi cow not imported Jersey or Holstein because of imported cow dung and urine contains more pathogens and desi cow dung contains 300 to 500 crores of effective beneficial microbes (Tripathi *et al*., 2018). Palekar suggests that Jeevamrutha is only needed for the first 3 years of the transition, after which the system becomes self-sustaining. Apply the jeevamrutha to the crops twice a month in the irrigation water or as a 10% foliar spray.

Beejamruth

This is the one of the traditional methods and also a totally scientific method to treat the seeds before sowing. Farmers have been treating their seeds with local cow urine, cow dung, and a small amount of soil from the farm's bund or land since time immemorial (as stated even in our textbooks and other ancient literature, such as the Vedas). For preparation of Beejamruth we need 20 l water, 5 kg desi cow dung, 5 l desi cow urine, 50 gm of lime and one handful of soil from bund (Palekar, 2016). As a result, in Natural Farming (ZBNF), seeds are prepared with a combination of cow manure, cow dung and other locally available products that are equally good at avoiding seed-borne diseases (Sreenivasa *et al*., 2010). Add Bijamrita to the seeds of any crop: coat them, mixing by hand; dry them well and use them for sowing. For leguminous seeds, just dip them quickly and let them dry.

Acchadana-Mulching

According to Palekar, there are three types of mulching.

a. Soil mulch

Soil mulch is a thin layer of loose soil surface that can be created by frequently stirring the soil with surface tillage implements like danthis, guntakas (blade harrows) etc., Soil mulch of surface 5-8 cm dry soil effectively reduces the evaporation losses by obstructing the raise of soil moisture through capillary action (Khadse *et al*., 2018). The soil mulch also prevents deep cracks in soils (especially black soils) by reducing the direct action of atmosphere and hence evaporation is also reduced. The repeated intercultivations done in rabi crops even in the absence of weeds help in reducing evaporation losses. Among the different mulches soil mulch is the cheapest.

b. Straw mulch

Straw and other crop residues like stubbles, groundnut shells, cotton stalks *etc*; can be used as mulches on soil surface for moisture conservation (Bhardwaj, 2013). Straw mulches reduce both the amount of energy absorbed by the soil and its movement above the soil and hence reduce evaporation However; the availability of adequate crop residues is a problem for use as mulches. Palekar's approach to soil fertility is very simple – provide dry organic material which will decompose and form humus through the activity of the soil biota which is activated by microbial cultures.

c. Live mulch

Is the term used to describe the covering of soil surface through the plant canopy in intercropping system (symbiotic intercrops and mixed crops) (Patil Shirish *et al*., 2013). According to Palekar, it is essential to develop multiple cropping patterns of monocotyledons (monocots; Monocotyledons seedlings have one seed leaf) and dicotyledons (dicots; Dicotyledons seedlings have two seed leaves) grown in the same field, to supply all essential elements to the soil and crops (Palekar, 2016). For instance, legumes are of the dicot group and are nitrogen-fixing plants. Monocots such as rice and wheat supply other elements like potash, phosphate and sulphur.

Whapasa-moisture and aeration

It means mixture of air and water in the soil particles. Whapasa is the soil microclimate in which soil organisms and roots can live safely due to the availability of adequate air and necessary moisture (Walker *et al*., 2021). 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 nutrients by older roots. In soil, out of soil mineral and organic matter, there is an equal proportion of water and air present. If a higher amount of water application leads to hold air space in the soil and plant suffers oxygen deficiency it may lead to

cause death of plants except water-loving plants like rice (Kumar, 2012). The soil aeration also an important parameter to plant growth so application interval should be longer.

Pest management in zero budget spiritual farming (ZBSF)

Agriastra

It is made up of 10 liters of local cow urine, 1 kilogram of tobacco, 500 grams of green chili, 500 grams of local garlic, and 5 kilograms of crushed neem leaves. 2 liters of Bramhastra are mixed with 100 liters of water for spraying. Agniastra is a very effective pesticide against leaf rollers, stem borers, fruit borers, and pod borers (Babu, 2008).

Bramhastra

Crush 3 kg of neem leaves, 2 kg of custard apple leaves, 2 kg of papaya leaves, 2 kg of pomegranate leaves, and 2 kg of guava leaves in 10 l of cow urine with some water. To spray one acre of soil, dilute 2-2.5 liters of this solution in 100 liters of water (Badwal *et al*., 2019). This approach is extremely effective against sucking rodents and pod/ fruit borers.

Neemastra

By using 5 l of local cow urine, 5 kg cow dung, 5 kg neem leaves 5 kg of neem pulp mixed well, and keep to airtight for 24 hours for fermentation. After the fermentation process is ready to use. Mainly controls sucking pests and mealy bug.

Other important principles of ZBNF and points to note

Intercropping

This is primarily how ZBNF gets its “Zero Budget” name. It doesn’t mean that the farmer is going to have no costs at all, but rather that any costs will be compensated for by income from intercrops, making farming a close to zero budget activity (Jannoura *et al.,* 2014). Growing two or more crops simultaneously on the same field; crop intensification is in both temporal and spatial dimensions; there is intercrop competition during all or part of crop growth. Intercropping systems tend to be low input, risk reducing under dry farming situations for crop diversification and fulfillment of subsistence objectives. At higher input levels it will be able to necessary to reevaluate and recombine various activities.

Mixed intercropping

Growing two or more crops simultaneously with no distinct row arrangement (Malézieux *et al.,* 2009). Also referred to as mixed cropping. The seeds of the crop varieties are mixed in desired proposition, sown and incorporated. e.g. Grass legume mixture; Mixing the seeds of sorghum and cowpea in 5:1 ratio and broad casted.

Row intercropping

Growing two or more crops simultaneously where one or more crops are planted in rows; often referred to as intercropping. e.g. Sorghum in paired rows intercropped with one row of cowpea.

Strip intercropping

Growing two or more crops simultaneously in different strips wide enough to permit independent cultivation but narrow enough for the crops to interact agronomically (Gallaher, 2009). Normally followed in sloppy lands and in soils prone for erosion. e.g. Wheat and Bengal gram in alternate strips of 5-10 m.

Contours and bunds

To preserve rain water, Palekar explains in detail how to make the contours and bunds, which promote maximum efficacy for different crops (Korav *et.al*, 2020). This practice consists in making a comparatively narrow-based embankment at intervals across the slope of the land on a level that is along the contour. It is an important measure that conserves soil and water in arid and semi-arid areas with high infiltration and permeability and is commonly adopted on agricultural land up to a slope of about 6%.

Local species of earthworms

Palekar opposes the use of vermicompost. He claims that the revival of local deep soil earthworms through increased organic matter is most recommended (Adhikary, 2012). Out of two thousand five hundred species of earthworms identified in the world, more than five hundred species of earthworms have been identified in India. Earthworm diversity varies with soils and choosing a native species for vermicomposting is necessary and there is no need to import them (Soni and sharma, 2016). Local species used in India are Perionyx excavatus and Lampito mauritii. These earthworms can be cultured or used in composting applying simple procedures either in pits, crates, tanks, concrete rings or any containers (Mupambwa and Mnkeni, 2018).

Cow dung

Accroding to Palekar, dung from the *Bos indicus* (humped cow) is most beneficial and has the highest concentrations of micro-organisms as compared to European cow breeds such as Holstein (Radha and Rao, 2014). The entire ZBNF method is centred on the Indian cow, which historically has been part of Indian rural life.

Benefits of zero budget spiritual farming

1. It maintains health of environment by reducing pollution and which helps in increasing agricultural production in a sustainable way. It helps in improving the soil health.
2. In one month, one cow may produce 10-12 kg of new dung, enough to cover 30 acres of land.
3. Under ZBSF, higher significant yields were discovered in a variety of cash and food crops. *E.g*. Cotton and gulli ragi yields were 11 percent and 40% higher in ZBSF plots than in non-ZBSF plots, respectively (Santhoshkumar *et al*., 2017).
4. Farm input costs are nearly zero or negligible as no fertilizers and pesticides are used. ZBSF farms have been able to survive drought and flooding for a long period.

Nutritional advantages and health benefits

Organic fruits have a higher total sugar content, which gives them a better taste. Bread prepared from organically cultivated grain has a greater flavour and crumb elasticity. Organically grown fruits and vegetables have been proved to taste better and smell good (Rembialkowska, 2007). Rossi *et al.* (2008) stated that salicylic acid is higher in organically grown tomatoes than in conventionally grown tomatoes. Salicylic acid is a phytochemical found in nature that has anti-inflammatory and anti-stress properties, as well as the ability to prevent artery hardening and bowel cancer (Butler *et al*., 2008). Organic vegetables normally have far less nitrate content than conventional vegetables. Nitrates are used in farming as soil fertilizer but they can be easily transformed into nitrites, a matter of public health concern. Nitrites are extremely reactive nitrogen species that compete with oxygen in the blood for haemoglobin binding, resulting in methemoglobinemia. It also forms nitrosamine when it attaches to the secondary amine (Lairon, 2010).

Environmental impact

Spiritual farming has a protective role in environmental conservation. Spiritual farming is thought to be less hazardous to the environment since it does not allow the use of synthetic pesticides, the majority of which can affect water, soil and local terrestrial and aquatic fauna. (Oquist *et al*., 2007). In addition, organic farms are better than conventional farms at sustaining biodiversity, due to practices of crop rotation. Which improves physico-biological properties of soil consisting of more organic matter, biomass, higher enzyme, better soil stability enhanced water percolation, holding capacities, lesser water, and wind erosion compared to conventionally farming soil (Edwards, 2007). Organic farming or Natural farming uses lesser energy and produces less waste per unit area or per unit yield (Hansen *et al*., 2001). In addition, organically managed soils are of greater quality and water retention capacity, resulting in higher yield in organic farms even during the drought years (Pimentel *et al*., 2005).

Socioeconomic impact

Organic farming necessitates a higher level of labour, resulting in more income-generating employment per farm (Halberg, 2008). According to Winter and Davis (2006), Organic products typically cost 10%-40% more than conventionally grown crops, depending on a variety of factors in both the input and output arms. The high cost of acquiring organic certification, the high cost of labour in the field, and the lack of subsidies on organics in India, unlike chemical inputs, are all factors that increase the price of organic goods. However, because of increased health awareness, consumers are willing to pay a high price. Some organic products also have short supply against high demand with a resultant increase in cost (Mukherjee *et al*., 2018). Biofertilizers and pesticides can be produced locally, so yearly inputs invested by the farmers are also low (Lobley *et al*., 2005). As the labours working in organic farms are less likely to be exposed to agricultural chemicals, their occupational health is improved. Because organic foods have less nitrates and more antioxidants, they have a longer shelf life than conventional foods. Food deterioration is accelerated by nitrates, but antioxidants aid to extend the shelf life of foods (Shreck *et al*., 2006). Spiritual farming is currently a developing economic sector as a result of the profit generated by organic produce, leading to an increasing farmer preference for sustainable agriculture.

CONCLUSION

This system relies on traditional knowledge which is deeply rooted and entwined with the land, its bio resources (especially seeds), and climatic conditions; and it is reflective of socio-cultural needs. It is this highly evolved agro ecological system of farming. In zero budget spiritual farming, the external production cost is zero or extremely cheap. This is environmentally friendly. Seeds, fertilizers, and plant protection chemicals have all become significantly less expensive. It helps to preserve soil health since crop leftovers are continuously retained, replenishing soil fertility. Natural Farming products are of high quality, have a pleasant flavor, and produce a higher yield. When monitoring pests in ZBNF, it's critical to understand the interactions between various components in the environment. This agricultural practice would be beneficial to all of our environment's natural resources, soil, and human health, as well as the purity of groundwater. It is high time agro ecological practices that are farmer-centric and inclusive, whilst also building food security, are embraced. It is time to allow farmers to make the choice of what to cultivate and how, a choice that has been denied to them for decades. The new system of farming has free debt trap of farmers and it has instilled in them a renewed sense of confidence to make farming an economically viable venture.

Conflict of interest: None.

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