The Pharma Innovation Journal 2020; SP-9(4): 236-239

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.03
TPI 2020; SP-9(4): 236-239

www.thepharmajournal.com
Received: 19-02-2020
Accepted: 21-03-2020

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A review on zero budget natural farming: a path towards sustainable agriculture

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Abstract
Agriculture is an important sector in India. It is indispensible for the sustenance and growth of the Indian economy. Most of the farmers heavily depend on inorganic external chemical inputs such as fertilizers and pesticides that contaminate groundwater and other water-dependent ecosystems, reduce soil fertility over time. The continuous use of pesticides and chemicals is a serious problem for the health of farmers across India. Central government's promise to double farmer's income by 2022, with the same one aspect being considered is natural farming methods such as the Zero Budget Natural Farming (ZBNF) given by *Shri Subhash Palekar*, for which he was honoured with *Padma Shri*. Zero Budget' means without using any credit, and without spending any money on purchased inputs such as fertilizers and pesticides. Zero budget farming promises to drastically cut production costs. Zero budget farmers use mulching, soil protection techniques, natural pesticides and fertilizers. The principal methods of Zero budget natural farming has basically four pillars Jivamrita, Bijamrita, Acchadana (Mulching) and Whapasa. Palekar also gave formulae for Fungicides i.e. Sour buttermilk (Khatti Lassi), Sonthastra for pest management i.e. Agniastra, Brahmastra, Neemastra, Dashparni ark. Saptdhanyankur ark also been used for shining in fruits, vegetables and seeds. By using ZBNF farmer will be able to grow chemical free food.

Keywords: Four pillers of natural farming, ZBNF, pest management formulae, Saptdhanayankur ark

Introduction
Agriculture is an important sector in India. It is indispensible for the sustenance and growth of the Indian economy. On an average half the country's population today depends on agriculture and allied services for their livelihoods and it contributes around 17 per cent of the gross value added to the national economy (Anonymous, 2017) [2]. Today, India is a major supplier of several agricultural commodities like tea, coffee, rice, spices, oil meals, fresh fruits, and fresh vegetables. India is a large producer of several agricultural products. In terms of quantity of production, India is the top producer in the world in milk, and second largest in wheat and rice. Agriculture in its prevailing form/practices such as mono-cropping requires farmers to rely heavily on inorganic external chemical inputs such as fertilizers and pesticides. These contaminate groundwater and other water-dependent ecosystems, reduce soil fertility over time, and contribute to biodiversity loss in farmlands. A latest report from WHO reveals that >50% eatable items have chemicals that are carcinogenic in nature (Prasada, 2016) [11]. The use of external inputs by adoption of uniform, hybridized, and genetically modified crop varieties erodes genetic diversity of seeds, and reduces their capacity to adapt to changing climatic conditions. The continuous use of pesticides and chemicals is a serious problem for the health of farmers across India More than a quarter of a million farmers have committed suicide in India in the last two decades as well as Farmer find themselves in a vicious cycle of debt, because of the high cost of production, high interest rates for credit, the volatile market prices of crops, and private seeds. According to National Sample Survey Office (NSSO) data, almost 70% of agricultural households spend more than they earn and more than half of all farmers are in debt.

Central government's promise to double farmer's income by 2022, with the same one aspect being considered is natural farming methods such as the Zero Budget Natural Farming. The word 'budget' refers to credit and expenses, thus the phrase 'Zero Budget' means without using any credit, and without spending any money on purchased inputs. Zero budget farming promises to drastically cut production costs, ending the debt cycle for desperate farmers. Alternative low-input farming practices have emerged in pockets across the world promising reduced input costs and higher yields for farmers, chemical-free food for consumers and improved soil fertility. ZBNF is one such low-input, climate-resilient type of farming that

encourages farmers to use low-cost locally-sourced inputs, eliminating the use of artificial fertilizers, and industrial pesticides. It was originally promoted by Maharashtra agriculturist Shri *Subhash Palekar*, for which he was honored with *Padma Shri* in 2016 (Anon., 2016). He was born on 2nd February, 1949 in *Belora*, a small village in the district of *Amravati*, *Maharashtra*, India. He grabbed a B.Sc. in Agriculture from Nagpur. Being dedicated towards the betterment of his village farm, after graduation, he experimented and revealed that continuous use of chemicals made the farm field barren. So, he decided to find an optimal solution.

In, 1986-88 *Palekar* researched on forest vegetation, and discovered that the natural system that work in forests have the potential to develop and nurture them, while maintaining many healthy ecosystems. And after a huge effort in the field work, he finally gave the formulae of ZBNF. He also wrote many books such as, The Philosophy of Spiritual Farming, Five Layer Palekar Models etc. After six years of dedicated research, Palekar revealed that the dung of local Indian cows is effective in re-enrichment of barren soil, Dung and urine of black coloured Kapila cow is believed to be phenomenal. To get most out of cow dung and urine, ensure that dung is as fresh as possible and that the urine is as stale as possible (Pawar *et al.*, 2013) [10]. Desi cow Urine & Dung, jaggery and dicot flour can be used as additives. The lesser milk the cow gives, the more beneficial its dung towards the reviving of soil (Babu, 2008) [4]. An acre of land requires 10 kg of cow dung. Since the average cow gives 11 kg of dung a day, dung from one cow can help fertilize 30 acres of land per month. "ZBNF is self-nourishing and symbiotic in nature" (Palekar, 2014) [8]. Khadse *et al.* (2017) survey 97 farmers who are practicing ZBNF and the reasons for adoption of ZBNF is family health (54%), environment reasons (42%), reduce of cost of production (38%) and many other reasons. The pest attack reduced up to 84%, production cost decreased up to 91% and need of credit decreased up to 93%.

Agriculture in Himachal Pradesh is a way of life for the agrarian population and nearly 70 per cent population is directly or indirectly dependent on this sector. With the time increase in the usage of fertilizers and chemicals government implemented ZBNF in Himachal Pradesh in 2018 with targets to convert the whole Himachal Pradesh to ZBNF by 2022. In 12 districts of the state, a target of 50,000 farmers has already set for the year 2019-20. State government had earmarked Rs 25 crore for propagation of natural farming for the year 2018-19 and has announced subsidy of 50 percent for purchasing of indigenous cow breed to promote natural farming. Himachal Government has launched Prakartik-Kheti-Khushal-Kisan scheme to promote Zero Budget Natural Farming in the State. Under this scheme, trainings and workshops are being organized to make farmers aware about natural farming. Also, farmers are being given 75 percent subsidy on drums to make the input for natural farming and assistance for cowshed lining up to Rs.8000 and a provision of assistance up to Rs.10,000 has been made for opening of Sansadhan Bhandarn in each village for the supply of inputs in natural farming (Anonymous, 2018) [3].

Methodology

Zero budget natural farming (ZBNF) has basically four pillars Jivamrita, Bijamrita, Acchadana-Mulching, Whapsa moisture (Palekar, 2014) which are mentioned in Table 1. Other important principles are intercropping, contour and bund system, local species of earthworm. Palekar also gave formulae for Fungicides i.e. Sour butter milk (Khatti Lassi), Sonthastra mentioned in Table 2. For pest management i.e. Agniastra, Brahmastra, Neemastra, Dashparni ark which is mentioned in Table 3. Panwar *et al.*, (2013) [10] Jungle ki kandi used as gibberellic acid while Saptdhanyankur ark used for shining in fruits, vegetables and seeds as mentioned in table 4.

Table 1: Basic Pillars of ZBNF

Sr. No.	Methods	Preparation	Benefits
1.	*Jivamrita*	For (1acre) It is made from cow-dung (10 kg), urine (5-10 litre), jaggery (1kg) and flour (1kg) and is applied to crops with each irrigation cycle.	It provides nutrients and promotes activity of microorganisms in soil, as well as increases earthworm activity. It also helps to prevent from fungal and bacterial diseases.
2.	*Bijamrita*	For (10Kg Seed) it is basically made up of water (2litre), cow dung (500gm), urine (500ml), lime (5gm) and a little quantity of soil.	It is used for seed treatment, protecting young roots from fungus as well as from soil and seed-borne diseases.
3.	*Acchadana-Mulching*	It can be done by soil mulch, straw mulch.	It conserves soil moisture, by reducing evaporation.
4.	*Whapasa moisture*	The irrigation should be reduced and irrigation should be practiced at noon in alternate furrows.	It is appropriate proportion of air and water molecules present in soil.

Mulching in ZBNF takes various forms. "Live mulching" is promoted with cover crops of a mix of monocotyledons (like millets) and leguminous dicotyledons (like beans). The monocots provide nutrients like potash or phosphate, while the dicots help in nitrogen-fixing (Palekar 2006) [7]. Straw mulching is also promoted, using dry crop residue.

Whapasa means water vapour. Palekar claims that roots absorb water vapour and not water. He promotes a microclimatic condition around the roots, where there is a mix of air and water molecules and rejects over-watering. He prescribes watering only when the sun is high at noon for optimum whapasa formation. Palekar claims that up to 90% of water use can be reduced through ZBNF practices making it ideal for rain-fed farming (Palekar 2006) [7].

Palekar also prescribes a number of natural fungicides and pesticides made from locally sourced ingredients like neem leaves, chilies, garlic, tobacco, sour buttermilk, etc. Increasing functional diversity is a critical principle of ZBNF; a number of crop combinations, with a view of increasing functional bio-diversity are proposed by Palekar. He rejects any external additions, including vermicompost made by exotic worm species and instead supports the growth of local earthworms *in situ.*

Table 2: Fungicides in ZBNF

Sr. No.	Name of fungicide	Composition	Benefits
1.	*Sour Butter Milk (Khatti Lassi)*	For (1acre) It is made from *Sour Butter Milk (Khatti Lassi)* (5 litres), Water (200 litres) then mixed and applied to crops by irrigation.	It acts as a fungicide.
2.	*Sonthastar*	Dry Sonth 200 gram, Desi cow milk (5 litre), Water (200 litre)	It acts as a fungicide.

Table 3: Pest Management in ZBNF

Sr. No.	Name of Pest Management Formulae	Composition	Benefits
1.	Agniastra	It composed of 20 litres Local cow urine, 500 gm Tobacco, 500 gm of Green Chilli, 500gm of Local Garlic, 5kg Neem leaves pulp (crushed in urine). For 1acre spraying, 6-8 litres Agniastra left after boiling is taken in 200 litres water.	It is effective against the pests like leaf roller, stem borer, fruit borer, and pod borer.
2.	Brahmastra	It composed of 10 lit local cow urine, 5 kg Neem leaves, Guava, Mango, Neem and Castor (Eranda) leaves pulp crushed (2-2 kg each). It is prepared by crushed and boiled in desi cow urine. For 1acre 2.5-3 litres solution mix in 200 lit water and used as spray.	It is used to control all of sucking pests, fruit borer, and pod borer.
3.	Neemastra	It is made up of local cow urine (5 litres), cow dung (5 kg) and neem leaves (5 kg) water (100 litres). It is prepared by mixing all materials and use after 48-72 hours for 1acre.	It is used for sucking pests and mealy bug.
4.	Dashparni ark	It composed of 200 litres Water, 20 litres local cow urine, 2 kg Cow Dung, 500 gm Turmeric powder, 500gm ginger paste, 200 gm Asafoetida (Heeng) Powder, 1kg Tobacco powder, 1 kg of Green Chilli paste, 1 kg Garlic paste, 2-2 kg Leaves of 10 plants Castor (Eranda), Neem karang, Custard apple, Bael, aak, datura, mango, guava, marigold, turmeric. Then mix all material then use this solution for 1acre after 28 days.	It is used to control all of sucking pests and borers.

Table 4: Other formulations in ZBNF

Sr. No.	Name of Formulae	Composition	Benefits
1.	Jungle ki Kandi	One year old cow dung cake 15 kg and 50 litres of water. Mix well in drum and place in shade for 4 days and spray the solution for 1 acre after four days in 200 litres of water.	It acts as growth promoter (gibberellic acid).
2.	Saptdhanyankur ark	100 gm of each sesame, green gram, black gram, lobia, coffee, mash, wheat seeds. Soaked and sprouted seeds of these are crushed in 200 litres of water & place it for 2 hrs. After 2 days drain out solution out of it and spray within 48 hrs in 1 acre area in 200 litres of water.	It develops shining in fruits, vegetables and seed crops.

Conclusion

The twin dimensions of the crisis - agrarian (declining share of pie to the farmer, poor returns to the farmer, and food and nutritional insecurity of the farmer among others), and agricultural (poor agricultural production, widening gap between agricultural and non- agricultural sector, agricultural debt being non-serviceable as also being inadequate and untimely, increasing risk and vulnerability) is real. According to the present situation the only solution is Zero Based Natural Farming has undoubtedly made an indelible mark on farming in India that resonates with principles of agro ecology and addresses the concerns of the twin-dimensions of the risk. Zero Budget Farming is also a valuable contribution to theoretical and practical problems regarding food and agriculture in the contemporary world. *Subhash Palekar* Natural Farming can be done without any cost. Farmer has to take care of soil by mulching, Jivamrit application and proper aeration. Soil is Annapurna (rich in nutrients) and it doesn't require anything from outside. So by adopting this farming every individual of the country will be able to get chemical free food and save the people from many diseases.

Acknowledgement

We are deeply grateful to the members of Zero Budget Natural Farming movement, several activities of India's sustainable agriculture movement, and staff and farmers connected to Himachal Pradesh Prakritik-Kheti-Khushhal-Kisan scheme. We are also thankful to 'The Pharma Innovation' journal for publishing our some of unpublish section draft of paper, as well as reviewers for their valuable comments.

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