

Zero budget-zero wastage natural farming: possible prototype to evergreen revolution in Agriculture

Bhavana Halanaik*

College of Agriculture, Central Agricultural University (Imphal), Kyrdemkulai, Meghalaya 793 105

Food security refers to a country's ability to obtain or produce sufficient amount of food for its current and future population. Zero Budget-Zero Wastage (ZB-ZW) natural farming systems aid in bringing about the evergreen revolution. Prime Minister Narendra Modi emphasized Zero Budget Natural Farming (ZBF) at the United Nations Conference on Desertification (COP-14), noting that India is working on this strategy. Zero Budget Natural Farming is a chemical-free farming method in which the overall cost of growing and harvesting plants is zero (taking into consideration that the costs incurred by the farmers are recovered through intercropping). Zero Waste agriculture is a one of a kind farming practice which entails increasing the use of natural resources by cultivating crops and raising animals. Algae, bacteria, plants and other microorganisms are examples of these resources, which can be used to produce a variety of foods. The concept is gaining traction across the world. Hence, it is worthwhile to devote attention to these Zero Budget-Zero Waste Natural Farming methods for successfully bringing evergreen revolution to the country.

Keywords: Agave, Evergreen revolution, Zero Budget, Zero Waste

GIVEN the agricultural limitations of India with 53.5% marginal and small holders (Agri. Census 2015–16), there is a need for revolution in agriculture. There are two possible prototypes to achieve it, viz. Zero Budget Natural Farming (ZBF) and Zero Wastage Natural Farming (ZWF). Introduction of Zero Budget-Zero Wastage (ZB-ZW) natural farming systems could be one of the trails to regard agriculture as an adaptable valued and self-sustainable enterprise. ZB-ZW system is a pliable system that aids to construct resilience to external shocks and broaden the agricultural sector's threshold to multidimensional catastrophes. Tailoring the ZB-ZW farming system policies in accordance to local conditions creates high value and high utility of the produce.

Zero budget farming promises to end a reliance on loans and drastically cut production costs. Natural farming means farming with nature and is devoid of chemicals.

Zero Wastage means incorporating the concept of minimizing risk and maximizing the resource utilization and their by-products. The ability of agricultural systems with respect to sustaining the system, generate a community of common interests and welfare measures and, utilization of culturable waste and fallow land for ZB-ZW farming has been demonstrated.

Zero Budget Natural Farming (ZBF)

The neo-liberalization of the Indian economy led to a deep agrarian crisis that is making small scale farming an unviable vocation. Privatized agricultural inputs sector, and market forces are affecting the economies of farming negatively, because of economic unreachability. Indian farmers increasingly find themselves in a vicious cycle of debt, uncertainty and privation. Ever rising production costs, high interest rates for credit, the volatile market, and the rising costs of fossil fuel-based inputs are certain hindering

factors. Under inaccessible formal sources of credit, private credit sources lend credits with high interest rates. Debt/liability is a problem for farmers of all sizes in India. Inability of the farmers to earn profits, despite obliqueness to reach break-even in farming forces farmers to borrow more and loose the draft power. The vicious circle of borrowing irrationally does not break, unless there are structural interventions.

Under such conditions, Zero Budget farming (ZBF) promises to end a reliance on advances and drastically cut production costs, ending the debt cycle of farmers. In ZBF, the production cost will be zero, inputs need not be purchased from outside, because all things required for the growth of the plants are available *in situ*. Tribal communities relentlessly have established this organic relationship with nature owing to their true understanding of numerous phenomena in nature. Many have learnt this organic

relationship from tribal people and applied the same in their farming practices, known as zero budget natural farming.

Zero Wastage Natural Farming (ZWF)

ZWF is a whole-farm business (an all-inclusive farm industry) approach that delivers more sustainable farming. ZWF uses the best of modern technology, science, and traditional methods to deliver prosperous farming that not only enriches the environment but engages local communities as well. ZWF incorporates the concept of minimizing risk, increasing production and profits, whilst improving the utilization of organic wastes of from livestock enterprises and crop residues. ZWF introduces a change in the farming techniques for maximum production with optimum resources utilization. In ZWF, there is no waste and waste is seen only as a misplaced resource which can become a valuable material for another product. It is a comprehensive system which integrates crops with livestock and there are synergies and complementarity between enterprises that comprise the crop and animal components that form(s) the basis of ZWF. In ZWF, integration usually occurs when outputs (usually by-products) of one enterprise are used as inputs by another within the farming system.

Zero wastage farming system is the science of optimizing the use of resources in the farms. It is making and implementing decisions for organizing and operating a farm for maximum production and profit, with the least cost combination. It draws on multi-disciplinary principles and folk agronomy articulating the farming community's outlook/approach towards innovation. Despite enormous benefits in (of) ZWF, there is a dearth of awareness and poor management of different enterprises and their information.

Positioning ZWF and ZBF

The food production has increased from 51 MT in 1951 to 275 MT in 2020–21. Despite plenteous

production, the number of farmer suicides is ever greater than before, and it is in an ascending order. Debt is a problem for farmers. In India, farmers end their lives, mainly because of the increased scale of intensive farming, wherein input purchase and its application is two-fold expensive. Privatized input markets make Indian farmers entrapped in a vicious cycle of intensive farming driven debt. High production costs, high interest rates for credit from informal sources, the volatile market prices of crops create income deficit. Gross costs greater than gross returns would lead to economic losses, despite marginal addition of capital and labour. Thus, to violate the principle of Law of diminishing marginal returns (LDMR) in agriculture, the only alternate is Zero budget and Zero wastage natural farming.

According to the experience of farmers, change is an inherent feature of climate. However, change in a relatively permanent scale and state is an aspect of worry, since extreme weather events show recurring characteristic in every 3–5 years in India, where it used to be isolated and rare otherwise. To induce more flexibility in farming, drought resistant and highly adaptable crop to changing climate can be introduced. The induction of Agave (*Agave americana*) in the estimated culturable waste, fallow and current fallow land introduces accommodative and structural changes in farming. It is a high value, high utility and climate resilient crop which will overcome the myopia of time and space, if implemented efficiently.

High value, high function and resilient farming through Agave

Agave americana is a plant belonging to Asparagaceae family. Blue Weber or Blue Agave is widely used to extract nectar and prepare a beverage called Tequila from pina (the base of Agave plant) and its spiky leaves are great source of fiber. Agave provides hyper-dimensional uses for man. To reach peak maturity Agave requires 6 years, and around 6th year the Pina can be harvested.

Agave, however, can grow on hot dry land with a high-yield and low environmental impact. Agave can be widely grown in culturable waste and fallow land in India. Agave largely restores the moisture, regulates temperature, humidity and combat global climate change challenges. Agave is a food plant for Southwestern Americans; it is used as lubricant, also as a prebiotic dietary fiber, used in high quality disinfectants in Australia etc. Agave popularly distilled to make agave spirit (an alcoholic beverage) is being explored as an ethanol biofuel crop that will not compete with food. Agave has a huge advantage, as it can grow in marginal or desert land and therefore would not displace land allocated for producing staple/food crops (principal crops). The juice obtained by processing Agave could be fermented into a beer-like drink. The juice or syrup is also used medicinally. The stalks can be used for a variety of building purposes and they make good, light, strong walking sticks. Fiber is extracted from the spiked leaves and the cleaned fibers are used to make clothing, rope, baskets and brushes (Table 1). Information on the potential co-products from producing biofuels using Agave, including electricity from the bagasse, and on the energy intensity and the greenhouse gas emissions intensity of the biofuel production process would allow assessment of the environmental sustainability of these biofuels.

After every 4th year of planting, second sowing can be done with the suckers attached to the mother plant. Around 6 tonnes of fibre can be extracted from the rosettes of Agave plant/acre. After the extraction of fibre, the left-out material is called bagasse which could be the base compost material for Agave plantation. The heart/Pina of the plant at the 6th/7th year will yield high quality ethanol (C₂H₅OH), around 3000–5000 litres of ethanol could be produced from 1000 plants from an acre of plantation. The conversion ratio of sugar to ethanol is very high in Agave, compared to that of other biofuel crops like Maize



Blue Agave plants grown widely in wastelands



Agave Heart/Pina from which spirit can be extracted

and Sugarcane.

Producing only Agave spirit will lead to wastage of Agave fibers,

whereas agave biofuel production alone would exceed the costs of production and distillation for both

producers and distillers. However, if biofuel production is a by-product of Agave, the costs of production and distillation would be much lower than the estimated costs (Table 2).

Table 1. Extraction of fiber from Spiked Leaves/Rosettes of Agave and spirit form Pina

<i>Agave sisalana, Agave Americana</i>	
Life Cycle of the Agave plant	8–13 years approximately
Maturity of the Agave Plant	4–5th year onwards
Propagation	Suckers (Nursery Beds), Bulbils (Nursery Beds), Seeds
Planting	1000 plants/acre (Double Row Method), 650 plants/acre (Single Row Method)
Rosette yield	40–50 Rosette /plant and 260 tonnes of Rosette/Acre
Rosette Fiber yield	750 kg of Fiber/1000 male plants/acre and 500 kg of Fiber/1000 female plants/acre 6 tonnes of Fiber/acre
One labour/day can cut	2000–2,500 Rosette
One mature Agave plant can make	3–5 litres of Agave spirit
Agave spirit from 1000 Agave plants	3,000–5,000 litres of Agave spirit
Biofuel from 1000 Agave plants/acre	300–1100 litres of Biofuel from 1000 Agave spirit extracted pina

Table 2. Cost of production and revenue of Agave in 2019

Stage	Timespan	Expenses incurred (₹)	Revenue (₹)
Maturity of Agave Heart/Pina	6 th year onwards	95,000 ₹/acre of Agave production in the initial year	6,000–7,500 ₹/tonnes of Pina
One mature Agave Heart/Pina weight	25–50 kg (40–50% Alcohol)		
Young Plants/Shoots	12–30 shoots/parent plant	Harvesting and Transportation to factories and craft distilleries	6,000–10,000 ₹/acre
One litre of Agave spirit requires	5–8 kg of Pina		1,65,000–2,00,000 ₹/acre

SUMMARY

Zero Budget Farming can be achieved with the induction of Agave in the culturable waste, fallow and current fallow land which introduces accommodative and structural changes in farming. The potential to expand production on vacant but suitable land with minimal inputs creates feasible economic systems, since cultivable land potential is shrinking in the country due to prolonged dry spells. Agave can be grown on large-scale for production of biofuels and is likely to increase demand for labour and generate farm-based employment. It has the potential to drive the marginal and small farmers out of the vicious cycle of debt and suicide. It will generate regional employment, create common interest and social capital at every level, hence would play a great role in bringing evergreen revolution.

*Corresponding author's e-mail: bhavana.halanaik@gmail.com