Approaches Towards Natural Farming - A Viable Alternate to High Input Agriculture

Deep Jyoti Das

The ill effects of Green Revolution has led the scientists, policy makers and people to think about other alternative approaches. Such an alternate has to be essentially viable to meet the needs of present and future generations. Such one of the most promoted and fascinating approach of present concern is Natural farming, which speaks about growing crops in harmony with nature. This seminar discusses four approaches towards Natural farming, *viz*., Do Nothing Farming, given by Japanese philosopher Masanobu Fukuoka; Zero Budget Natural Farming (ZBNF) by Subash Palekar; Rishi-Krishi by Mohan Shankar Deshpande and Natueco culture by Sripad Dhablokar. While Do-nothing emphasizes on no tillage, no organic and inorganic fertilizers, no weeding and no dependency on chemicals; ZBNF focuses on natural farming through its so called four pillars, *viz*., Beejamrita, Jeevamrita, Acchadana and Waaphasa. Rishi Krishi tries to keep the soil alive through the incorporation of rhizospheric soil of Ficus bangalensis. A special cow-based preparation named Amrut Pani is used for various farming practices of Rishi Krishi. Natueco combines nature and ecology through critical scientific methods to gain the highest benefits from the available resources of a farm. It recommends soil rejuvenation through preparations like Amrut Mitti and Amrut Jal. The seminar also focuses on viability of these approaches setting the criteria of sustainability, holistic nature, benefits provided to different sectors of the system and possible food security along with some scope for implementation in North Eastern Region. Finally, it recommends sufficient research experiments, multinational yield trials, demonstrations, trainings, awareness programmes to confirm the viability of the approaches.

Keywords: *Do nothing farming, Masanobu fukuoka, ZBNF, Subash palekar, Rishi krishi, Amrut pani, Natueco, Sripad dhablokar, Amrut mitti, Amrut jal*

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Introduction

Agriculture has been the basic reason for human existence since ages. Even today, it provides livelihood to more than half of the world's population. Progress of any country directly depends on the progress of its farmers. This in turn depends upon the type of farming approach the farmers are going through. The world has witnessed the collapse of many civilizations only due to the adoptation of faulty agricultural practices. Selection and adoptation of a viable farming approach should be the prime criteria for a nation's prosperity. In the pre-British period, Indian agriculture was primarily subsistence based traditional farming approach. Farming was intimately closed to nature. It was characterized by small and marginal farmers producing food for the family and local village communities. Due to decentralisation of agriculture, all the farmers had the flexibility to choose the crop depending on the agroclimatic and soil conditions (Palaniappan & Annadurai, 2007). Soil health and pest control was achieved through shifting cultivation, legume introduction, green manuring, intercropping, mixed cropping, crop rotation, fallowing etc. Livestock played a central role in all aspects of cultivation- from tillage to fertilizing croplands, from irrigation water lifting to threshing. However, agriculture of that period was a gamble of monsoon. There had always been a risk and uncertainty about crops' success. Such approach could not be viable for the increasing population demands. During the British period, a conversion of subsistence agriculture to industrial based commercial agriculture occurred. The heavy tax imposed by Britisher saltered the farmers' relationship with his farming land. The forest policy of the British Government, which denied the farming community to use forests further broke the natural relation between forest and agriculture. Indian farmers were forced to cultivate new crops like cotton, jute, sugarcane, tea, and indigo, which were needed as raw material for various industries. This 'forced agriculture' affected the farming community adversely. After the independence, there was an urgent need to turn the "begging bowls'' to "food basket" in order to keep up the food demands over population growth in India. The failure of monsoon arrival over Asia in 1965 and 1966 added additional emphasis on the issue. To keep the nation's food security ahead, it was in evitable to change the methodologies and introduce a new farming approach in India. Thanks to the scientists and policy makers, who implemented the Green Revolution as a need of the time- which resulted in substantial and magnificent increase in food grain production through the use of improved crop varieties, high levels of inputs like chemical fertilizers pesticides and intensive irrigation practices. This newly introduced intensive agricultural follows a trend of an open system, which is, rather being cyclical, it supports a open flow of material. Instead of a complex and diverse system, it focuses more on one side or specialised activities like limited crop rotations and a small number of species and varieties (Sharma, 2008) This type of farming was also called High Input Agriculture due to higher level of input and output per unit agricultural land area. This type of farming approach was characterised by low fallow ratio, higher use of inputs, capitals, labours and higher crop yields per unit land area with an aim of maximizing yields in short time. However, it is now being realised that this immediate and isolated production-based farming approach costed us the soil health. 60% of our agricultural land is now being suffering from indiscriminate use of irrigation water and chemical fertilizers. The drastic increase in consumption of chemical fertilizers, specially nitrogenous fertilizers and their impact on soil, water and ecosystem (Móring et al., 2021, Kumar et al., 2012), increasing multinutrient deficiency in soil with each decade (Kumar, 2012), increasing use of chemical pesticides (Nayak & Solanki, 2021) and resulting heavy metal accumulation, decrease in natural biodiversity, pest resurgence and health hazards, food poisoning, genetic erosion of local land races, soil salinity and groundwater depletion due to faulty irrigation practices, appearance of difficult weeds, vicious circle of farmers' debt due to dependency on external inputs, high cost of production and lack of access to credit have compelled the people to question about the viability of high input agriculture. The ills of green revolution resulted in establishment of many eco-friendly farming system

approaches. Perhaps the most widely recognized alternative to high input agriculture of present concern is organic farming. The principles and practices of organic farming are attractive. However, there are still questions left with the viability of organic farming, especially in Indian situation, where small and marginal farmers form the core of the Indian rural economy constituting 85% of the total farming community but possessing only 44% of the total operational land. The average size of land holdings has reduced by half from 2.28 ha in 1970 to 1.16 ha in 2010.In this situation a major debate arises for the efficacy and implementation of organic farming all over the country, as sources of crop residues to meet the nutrient demands, plant protection, certification process, quality and marketing still remains unanswerable. In many situations, the cost of cultivation of organic farming exceeds the conventional farming (Kumar et al., 2017). The cattle population of India just increased marginally from nearly 150 million in 1950s to hardly reaching 200 million in 2020. This questions the availability of FYM, which is the major source of nutrient in organic farming- where it is recommended to apply upto 10 t FYM per hectares. Indian Farmers are still not yet recovered from debt. According to a data of National Sample Survey Office (NSSO), more than 50% of farmers are in debt due to increased cost of farm inputs. This has led the scientists, policy makers and people to think about some more alternatives of high input agriculture. The aim is to realise the objective of doubling farmers' income- for that the farm expenditure must be brought down considerably. This can be only achieved when we go back to the basics and take out the best out from it.one such alternative is Natural farming approach.
According to the NITI Ayog, Natural Farming is a chemical-free alias traditional farming method. It is considered as agroecology based diversified farming system which integrates crops, trees and livestock with functional biodiversity.

Different approaches towards natural farming

Natural farming promotes cultivation in harmony with nature. There are no strict bound principles and practices adhered to Natural farming, as opposed to organic farming. This has resulted different approaches towards natural farming based on suitability in a specific location. Some of the such approaches towards Natural farming of considerations are -Do nothing farming, promoted by Japanese philosopher Masanobu Fukuoka; Zero Budget Natural Farming (ZBNF) by Mr. Subash Palekar; *Rishi-Krishi* by Mohan Shankar Deshpande & Natueco culture by Sripad Dhablokar.

Do nothing farming

It is perhaps the most basic form of natural farming. It is also referred as "the Fukuoka Method", "the natural way of farming". The practice was established by Japanese philosopher and farmer Masanobu Fukuoka, in his book "The One-Straw Revolution" in 1975.The concept of Do nothing is philosophical based approach which believes that nature don't need any intervention for its productivity. Human should act just as a facilitator only in crop production-rest all the activities are handled by the mother nature. The entire practice of Do nothing is based on four principles, *viz*., no cultivation: It says that human cultivation of soil, plowing or tilling are unnecessary, no fertilizer: use of chemical fertilizers, prepared compost are unnecessary. By using straw, green manure and a little poultry manure, one can get high yields; no weeding by tillage or herbicides: it promotes to control the weeds rather than eliminating. By practicing straw mulch, ground cover and temporary flooding, one can attain effective weed control and non dependency on chemical pesticides and fertilizers (Nene, 2017) Though Fakuoka was able to show consistent and comparable yields to that of the most technologically advanced farms in Japan after 25 years of his approach, the possibility of success are very less now a days. Rather being a scientific approach, it is basically an esthetic or spiritually driven approach to life. Practice of Do nothing is same with going back to that primitive stage, where humans didn't

have the knowledge how to till a land and grow crops. This raises the question of acceptability of the approach in a mass platform, specially in a situation where food security is a major concern for the nation.

Zero Budget Natural Farming

Zero Budget Natural Farming (ZBNF) or Zero Budget Spiritual Farming or Subash Palekar Natural Farming (SPNF) is an agroecological farming approach that promotes growing crops in harmony with nature (Bishnoi & Bhati, 2017). The concept was promoted by agriculturist and extension worker Mr. Subhash Palekar, in the mid-1990s as an alternative to the Green Revolution's method. ZBNF has agronomic and structural aspects (Khadse & Rosset, 2019).Agronomic aspects focuses on improving soil fertility through a number of agroecological principles including diversification, nutrient recycling, increasing beneficial biological interactions; while structural aspects focuses on de-linking the farmers from external inputs and credit markets and thus creating autonomy by not purchasing anything from external actors and corporations. Literally 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. But the phrase "zero budget" does not mean that cost of cultivation is completely zero, rather it refers to the aim of achieving dramatic cuts in production costs by ending dependence on external synthetic inputs and agricultural credit. it is meant to signify that the need for external financing is zero, and that any costs incurred can be offset by a diversified source of income. The phrase 'Natural Farming' invokes the agroecological basis on which these cuts are to be achieved.The practice of ZBNF consists of four principles, referred as the four 'wheels'orfour 'Pillars' of ZBNF*viz.*, *Jeewamrita, Beejamrita, Acchadana* and *Waaphasa.*

***Jeewamrita* (soil inoculum)**

The word *Jeewamrita* means 'life tonic' (Khadse et.al, 2018). It is a homemade fermented microbial culture made of water, desi cow's dung and urine, jaggery, legume flour and a handful of soil as an inoculum of diverse, local microorganisms. It is claimed that application of *Jeewamrita* promotes soil microbial activity, increases earthworm activity and helps to prevent fungal and bacterial diseases. There are two types of *Jeevamrita* based on form *viz.*, the wet form applied a as a slurry, called the *Dhrava Jeewamrita* (*Dhrava*means Solution) and the dried form prepared for storage, called *Ghana jeewamrita (Ghana* means concentrated). Accounting all ingredients used to produce *Jeewamrita*, up to 8.3 (±0.4) kg N ha^{-1} $year^{-1}$ could be provided in *Dhrava jiwamrita*, and 3.3 (±0.2) kg N ha^{-1} $year^{-1}$ in *Ghana Jiwamrita* (Smith, 2020).But it is not applied as a nutrient source, but rather as a culture of soil microorganisms, which is believed to increase the available nutrients when applied to soil, which is already rich in nutrients. In other words, *Jeewamrita* just acts as a facilitator to convert non available form of soil nutrients to available form through microorganisms. The soil is considered as *Annapurna- a* complete storehouse of nutrients under ZBNF, and no source of nutrients-both in organic or inorganic form are recommended here. *Jeewamrita* is only needed for the first 3 years of the transition, after which the system becomes self-sustaining. To prepare *Jeewamrita* for 1 *bigha*, 2 kg *desi* cow's dung and 1 to 2 L urine is added to 40 L water followed by adding 200 g jaggery, 200 g pulse flour and a handful of soil from bund. The solution is stirred and fermented for 48 hr in shadow. It is applied at each irrigation cycle or directly to soil or crops. Ram et. al., (2018) reported bacterial population increases rapidly from the date of preparation of *Jeewamrita* upto 9^{th} day, after which the population decreases rapidly. Population of fungi increases gradually up to 14^{th} day. However, Azotobacter and *Azospirillum* population reduces with time in *Jeewamrita.*

Beejamrita

It meansseed tonic. Itis a homemade microbial seed treatmentwhich is claimed to protect seedlings from seed or soil borne diseases and young roots from fungus.It is made up of water (21 L), desi cow's dung (5 kg), urine (5L), lime (50 g) and a handful of soil from bunds.From an experiment of Vyankatrao, 2019 in Ratnagiri, Maharashtra, it is evident that *Beejamrita* performs better over mere cow dung, cow urine and control in Green gram seeds in terms of germination percentage, seedling length and seed vigour index. A concentration of 75% *Beejamrita* can be chosen for best economic results and performance.

Acchadana

Three types of *acchadana*or mulching are recommended in ZBNF, *viz.*, soil mulching (tillage with *desi* plough), mulching with dried biomass (straw, weeds) and live mulching(intercropping). Soil mulching involves tillage of the soil as normal, but to a reduced depth of only 10 – 15 cm. For mulching with dried biomass, one can take stubbles treated with *Jeewamrita* from the previous crop and incorporate weeds in the field. Mulching reduces evaporation, maintains soil temperature, absorbs atmospheric moisture, controls weed and helps to buildup organic carbon along with soil water conservation (Marwein et al., 2019)

Waaphasa

It is a microclimatic condition when both the air and water molecules are present in soil in equal proportion. ZBNF believes that roots need water in form of vapour. Irrigation is reduced and practiced only at noon. In alternate furrows, irrigation is applied, and in the unirrigated furrows, *Acchadana*is applied. It recommends to provide water outside the plant's canopy to maintain air balance and soil temperature. *Waaphasa* is expected to help in building up of soil humus and increase soil aeration. Other principles of ZBNF includes intercropping, use of local species of earthworm, pest management through special formulations namely, *Agniastra, Brahmastra and Neemastra*. *Agniastra* is composed of 10 litre local cow urine and 1 kg tobacco, 500 glocal garlic, 500g Green Chili,5 Kg Neem leaves pulp (crushed in cow urine). It is applied against pests like Leaf Roller, Stem Borer, Fruit borer, Pod borer etc. *Brahmastra* is prepared by leaves of neem, custard apple, *Lantana camara*, guava, pomegranate, papaya and white dhatura. They are taken together and crushed in mortar-pestle followed by boiling in cow urine. It is used to control all of the sucking pests, pod borer, fruit borer etc. *Neemastra'*s main component is neem. It is prepared with local cow's urine (5 L), cow dung (5kg), neem leaves and neem pulp (5kg) fermented for 24 hrs, used for sucking pests. Only *desi* cow's dung and urine is allowed in ZBNF. It believes dung from Jersey and Holstein cows is not effective. Generally microbial count is higher in *desi* cow's dung over Jersey's (Ali et.al., 2011) Fresh dung is preferred. The older the cow, better is the *Jeewamrita* and *Beejamrita* preparation. Non milking cow is preferred over milking cow. The Indian government has been promoting natural farming under the dedicated scheme of *Paramparagat Krishi Vikas Yojana*(*PKVY*).Indian Council of Agriculture Research through ICAR-Indian Institute of Farming Systems Research has initiated a study on evaluation of ZBNF practices in Basmati/ coarse rice-wheat system from Rabi Season 2017 at four locations namely Modipuram(UP), Pantnagar (Uttrakhand), Ludhiana (Punjub), Kurukshetra (Haryana).Other initiatives includes- brainstorming session on ZBNF by National Academy of Agricultural Sciences, pilot projects by Govt. of Karnataka, awareness programmes, trainings and workshops by Govt. of Kerala, '*Prakritik Kheti Khusha Kisanes'*scheme by govt. of Himachal Pradesh**.** Andhra Pradesh has launched ZBNF in September 2015 under *Rashtriya Krishi Vikas Yojana, Rythu Sadhikara Samstha (RySS).* Govt. of Andhra Pradesh is conducting experiments to generate the scientific evidence ZBNF in collaboration with University of Reading, UK; World Agro forestry Centre,

Nairobi, FAO and resource NGOs/Civil Society Organizations like Centre for Sustainable Agriculture, Hyderabad. The state has announced the intention to roll out ZBNF to all the state's 6 million farmers by 2024.Theresults from the state are encouraging (Bharucha et. al., 2020)

***Rishi-krishi* (*Rishi-Krishi* Deshpande agriculture technique)**

The concept of *Rishi-Krishi* has been drawn from *Vedas* and it is based on cosmic energy sources (Deshpande, no year). This method of Natural farming is currently being mastered by farmers of Maharashtra and Madhya Pradesh. Visionaried by *Aryakrishak* Mohan Shankar Deshpande, a Mathematics graduate, later turned botanist from Maharashtra. This approach aims at keeping the soil alive forever with the help of cosmic energy, which is considered as the only source of plant growth. To achieve the abovementioned aim, the technique believes that plants have their own language to communicate with the living organisms of the soil. Plants don't require any form of organic or inorganic fertilizer as food sources. The diet of each crop varies species to species and plant to plant. Cosmic energy is the only source of plant growth as per the concept. Hence nothing has to be purchased from the market- not even the earthworms, culture and casts also. The technique of *Rishi-Krishi* is established on four pillars *viz., Angara* (Holy Ash), *Amrut Pani* (Nectar water), *Beej Sanskar (*dressing of seeds for planting) and *Anchhadan* (Mulching). About 15 kg of soil from the base of a *banyan* tree (*Ficus bangalensis)* is incorporated over one *acre* of farmland. This soil contains millions of microbes, fallen leaves, bird faeces, metabolites which acts a culture for rapid growth and division of microorganisms in treated soils. Reported by Cheke et al., (2018), availability of nitrogen, phosphorus, potassium and sulphur is found maximum in soil treated with Umber (*Ficus racemose* L.) rhizospheric soil, followed by Banyan rhizosphere soil treated soil. Deshpande compares this soil with *Angara*-the holy ash from Indian temples. *Amrut pani* (*Amrut*-Sanskrit: *am ta*, means "immortality, *Pani* is water) is prepared by mixing 250 g of *ghee* into 10 kg of cow dung. Then 500 g honey is blended and 200 litres of water is added stirring all the time. It is used as seedling root dip treatment and soil drenching material for rainfed crops. 200 litres of *Amrutpani* are sufficient for one *acre* land. Sugarcane, turmeric, ginger, chili, tobacco, fruit trees perform well under *Amrut pani* as per the claim. Shekh et. al., (2018) from Junagadh, Gujarat reported a pod yield of 994 kg ha^{-1} and haulm yield of 2450 kg ha^{-1} in summer groundnut in *Amrit pani* treated plots. Pod yield from *Amrut pani* treated plots was significantly higher than that of control and *Beejamrita* treated plots. Ram & Garg (2020) reported 70% reduction of *Aspergillus fumigatus*, 100% reduction of *Colletotricum gloeosporioides* and *Fusarium solani* colony size in *Amrut pani* treatment over control. Seed dressing is emphasized over seed processing. Dressing of seeds *(Beej Sanskar)* having a hard coat like rice, wheat, corn, okra requires 1 kg *Angara* and sufficient *Amrutpani* to make a thick paste or muck. A small quantity of the paste is mixed with the seeds in a sifting pan followed by drying in shade. Crop biomass can be exploited best through mulching (*Anchhadan*). The advocators of this technique claim successful results in crops like sugarcane, soybean, okra, eggplants and sorghum.

Natueco farming / beyond organic farming

The word "Natueco" is consist of two words - "Natural" and "ecological". Natueco culture is a way of farming based on imitating nature through critical scientific methods to strengthen the ecology of a farm (Suchade, 2020). It is a holistic way to meet the farming and food requirements of today by addressing some serious issues like staying synergy with nature, reducing dependency on external inputs to a farm, working scientifically without harming the ecology and gaining the highest benefits from the available resources. The advocators differentiate Natueco from organic farming in the context that naueco is practiced through critical scientific inquiries and experiments resulting in an ever growing, novel and unique relationship between man

and nature, as against Organic farming which is based on trusting nature through empirical wisdom since ages. The technique of natueco is first visionaries by Sripad Dabholkar, a mathematician and horticulturist in his book – "Plenty for all". It believes in the philosophy of living and letting others to live, thus creating its objective of 5Ls- learning, living, livelihood, love and laughter. The objective is not only to produce an output, but also living in symbiotic relationship with the farm and its surrounding. Natueco focuses on four areas *viz.,* soil- soil with best primary productivity can be created by recycling biomass and establishing proper energy chain; roots- development and maintenance of root zones for efficient absorption of nutrients; canopy-harvesting maximum Sunlight available on earth through farming and external resources- minimizing the use of external resources to reduce dependency on secondary productivity of soil. To achieve these four areas, the principles of natueco is formulated as follows:

- Establishing canopy cover at the earliest for maximum harnessing of solar energy.
- Only matured leaves are capable of optimum harvesting of sunlight.
- There should be matching sink growth when optimum photosynthesis is taking place in the matured leaves.

The Important components of a Natueco farm are Natueco Soil, Knowledge base, Seed treatment, Bio-diversity, Live fencing and Data base.

Natueco soil

In Natueco, the nutrients are supplied through naturally available items around a farm, like tender leaves, mature green leaves, flowering stage plant's leaves, branches, stem, flower and roots, dried Leaves and decomposable parts of the plant, ash of the thick parts etc., It focuses on creating its own soil called Natueco soil, whose major components *are Amrut Jal* and *Amrut Mitti.* Amrut Jal is a solution of water, jaggery, cow dung and cow urine containing a very high number and diversity of micro-organisms. It is applied @ 1L/ft.^{2} which costs only 0.23-0.25 Rs/L. A fine paste of 1 kg cow dung with 1 L of cow urine is prepared followed by addition of 50 g jaggery and 10 L water. This solution is stirred thrice a day for 3 days. On fourth day, the solution is added to 100 L water. It can be applied at an interval of 15, 30, 90 and180 days after sowing. cow urine contains urea, mineral salts and acts as an insect repellent while cow dung acts a microbial culture. Jaggery is used as a food source for rapid microbial cell divisions. In case jaggery is not available, one can use 12 over ripe bananas or 6 guavas or 12 jackfruits or 500 ml of sugarcane juice or 12 cashew nuts fruits as an alternative of 50 g jaggery. It is believed that *Amrut Pani* helps in plant growth promoting activities, faster decomposition of biomass and can be used in seed treatment, feeder for roots growth and preparation of *Amrut mitti. Amrut mitti* is a special soil prepared by decomposition of biomass in soil and sand .it consists of 50% of biomass and 50% of activated mineral top soil (v/v). Its preparation can be divided into 3 stages, *viz,* heap making, seed sowing, pruning and heap turning.

Heap making: 100 kg dry biomass of C4 plants is chopped by 3-4 inch and soaked in *Amrut Jal* for 24 hours. This is spread in an area of 10 by 3 ft. followed by putting a thin layer of top soil in a ratio of 1/4th of biomass. This process is repeated upto 6th layer of both and then sand is added. The heap is then compressed by walking. These steps should be repeated till the height of heap reaches 1 ft and finally cover with mulching. The heap is turned once in every 7 days. After 30 days, the heap is covered with 2 Inches of soil.

Seed sowing (greening of the heap): In the heap, 6 different types of seeds with the 6 different tastes (six *rasas -shadras* according to Ayurveda) are sown after soaking the seeds in *Amrut Jal* for 4 hours. The 6 different type seeds according to taste are as follows - Sweet (Fennel seeds), Pungent (Chilies), Bitter (Fenugreek, Bitter gourd), Tangy (Ambadi, Tomatoes), Acerbic (Guarphali) and Salty (Spinach). It is

believed that the plants supply minerals in available form and provide different cultures through the roots.The seeds are spread @ 10 g./ ft^2 and soil is put above seeds about double the size of seed. *Amrut jal* is sprinkled over it and then covered with biomass. The surface is kept moist by sprinkling *Amrut Jal.*

Pruning and heap turning: On21st day after germination of seeds, the plants grown on the heap are pruned by 25% without damaging the stem. The residue is left on the heap. This allows elements found in the soft leaves such as Zn, P_2O_5, Mo to mix in the heap. Again, after 42^{th}day after germination, 2^{nd} pruning by 25% is done and residue is left on the heap. This enriches the heap with the elements found in mature leaves such as N, K, Mg. Finally, after 63 days after germination, plants are pruned completely leaving 0.5-1 inch above ground. At this time, flowering occurs in some plants, which make available elements such as Ca, Fe, Mn, SiO_2.When the biomass on heap turns yellow, it is soaked in *amrut jal* for 4 hours and spread on heap. Turning is done once in a week for 1month.Thus *amrut mitti* gets ready in 110-150 days. *Amrut Mitti* is light, soft, granular and black, smelling similar soil after first rain. 400 g *Amrut Mitti* is equivalent to 1 L and applied @ 4L/ $ft.^2$ of canopy. One heap of 30 $ft.^3$ gives 20 $ft.^3$*Amrut Mitti* – equivalent to 540 L. This 20 ft^3*Amrut Mitti* can be used for 135 $ft.^2$ area. *Amrut Mitti* costs around Rs. 3.15/kg. Suchde & Krushi, 2013 reported from the soil samples of Dewas, Madhya Pradesh that though there were insignificant changes in total phosphorus, a highly significant (($p<0.001$) increase in available phosphorus and soil organic carbon as compared to original soil was recorded from *Amrut mitti*. Organic Nitrogen and available potassium increased significantly at($p<0.01$) and ($p<0.05$) level, pH of *Amrut mitti* was higher (7.89) as compared to other samples.

Knowledge base

Natueco believes in natural intelligence or evolutionary intelligence of all lives to harness, nourish and manifest to its potential. It believes in knowledge by practice, education by experiment and learning with natural instincts. Natueco Science is generated by individual experiences of a farmer. And such individual knowledge is then shared across the Natueco farmers groups, called as "*Prayog Parivaar".* The knowledge base depends on developing a thorough understanding of plant physiology, plant geometry, plant chemistry, plant physics, fertility and biochemistry. This can be simply achieved through demystification of science. For sustainable resource management, a proper synthesis of scientific and indigenous knowledge is essential.

Seed treatment

4 different types of dicot seeds having less canopy and height then main seed are mixed with 2 part of fresh cow dung, 2 part of ash and 2 part of termite soil (or clay soil) with the help of cow urine. Balls of 1 cm diameter are prepared from this paste and main seed is inserted to it after drying. These balls are directly sown or preserved to use within 3 years it is believed that mixing dicot seeds like sesame, coriander, fenugreek, chickpea, onion tomato provide vital energy, disease and insect resistance capacity, nutrients to main plants. Termite soil or clay soil acts as binding agent. Cow urine helps in plant growth promotion and cow dung acts as a microbial culture for rapid mineralization and nutrient cycling.

Biodiversity: Bio-diversity is achieved in a Natueco farm through multi-layer crop cultivation. Two effective models of such integrated plantation have been created with a biodiversity on a limited area to benefit small farmers/ house gardens to produce the daily food requirement of a family in an effective way namely

a) Ganga Ma Mandal model
b) Ten Guntha model.

2.4.5 Live fencing: It acts as a wind breaker, protects farm from animals, gives income for daily requirements. supplies biomass for mulching, creates micro-climate and beautifies the landscape. Some important crops for live fencing are- Drumstick, Glyricidia, Jatropha, Bamboo, Vetiver Grass, Castor, Marigold, Rose, Arhar, Aleo vera etc.

2.4.6 Database: Natueco emphasizes on documentation of farm input and outputs for successful farm operation, self-education and transfer of knowledge base. Natueco culture tries to fasten the processes of an forest ecosystem like development of forest like soil through *Amrut Mitti*. The practices are attractive, however scientific evidences are very less.

Discussion

Viability criteria

A viable system is any system organised in such a way as to meet the demands of survival in the changing environment. One of the prime features of viable system is that they are adaptable. Ever since man started their life as a settled society by cultivating soil, agricultural practices have continuously been evolved to address the changing needs of human behaviour. The ever-growing demand for better productivity is generated not only due to growing population, but also due to an increasing percentage of the population taking up non-agricultural occupations. Changing eating habits of people added further demands for better productivity. The situation got aggravated when agricultural production started fulfilling other human needs like fuel, cloths, industries etc. The present goal ahead for Indian agriculture is to double the farmers income for prosperity, cope-up the climatic change and global warming, meeting the food demands for present and upcoming population. To meet these goals, there must be a viable farming approach as alternate to current high input agriculture. Natural farming can be one of such approach. To meet the changing human needs of present concern, an agricultural approach has to fulfil some criteria, so that it meets the requirements of viability. First, any viable system must be sustainable to meet out the changing human needs of current generation without hampering the ecology of tomorrow. It should emphasise that tomorrow's ecology is more important than today's economy the first rule of sustainability is to align with natural forces or at least not try to defy them. A sustainable approach mimics as closely as possible the complexity of healthy and natural ecosystem. It integrates three main goals-environmental health, economic efficiency and socio-economic equity. Environmental sustainability is associated with genetic resource base and bio diversity. In terms of economic efficiency, a farming approach must generate revenue both in terms of cash and kind. In the context of social acceptance, it must meet the nutritional and livelihood security of the farmers and reduce the market dependency. Besides sustainability, a farming approach essentially should be holistic. A holistic system is such that it considers the entire systems, rather than segmentation of its components. It says that in a farm, all the physical, chemical, biological, social economical aspects should be viewed as a whole, not merely a collection of parts. Along with these two, a viable approach should offer the highest benefits to all the stakeholders of the system. Again, meeting the criteria of food security is the prime concern for viability of a farming approach.

Scope of natural farming in north eastern region

India is a rich country in terms of biodiversity and availability of natural resource base. The North East Region (NER) constitutes 8 states of the country- Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura. This region with 39 million population constitutes 3.8% of the country's population. Rural population is 327.71 lakh which constitutes 84.34% of its population as against

72.20% in India. (Singh, 2020). Agricultural land including fallow is 22.20% varying between 37.43% in Assam and 4.40% in Arunachal Pradesh. Cultivators (41.61%) and agricultural labourers (13.07%) constitutes the majority of workforces in North East India. Fortunately, the impact of Green Revolution in North East India is poor. NPK consumption/hain this region is low (Munda et. al., 2014) and soil is almost virgin. NPK consumption in kg/ha is 130.5 for Manipur, 46.6 for Assam, 29.4 for Tripura, 17.0 for Meghalaya and very less for other states of the region (Sharma, 2020). Irrigation covers only 11% of net sown area. Seeds of local land races dominates the region. For example, High Yielding Variety(HYV) paddy covers only 9.50 lakh hectares (35%) of area. Nearly five lakh families practice shifting cultivation covering about 2.2 million hectares. low input-low risk-low yield technology-based farming always prevails here. This trend implies the possible implementation of Natural Farming in the region. North Eastern Region (NER) is home to niche crops like Assam lemon, joha rice, medicinal rice, pineapple, passion fruits, large cardamom, oranges, ginger, Assam tea etc., the area has a significant bovine population (11.9 million, 4.27% share of national bovine population as per 2003 livestock census) too (Kumar et. al., 2007). If exploited properly, there is a huge scope for cow-based preparations in the area. The added advantage is the climate. North eastern states being the one of the mega biodiversity receiving very high rainfall leads to profuse production of biomass of weeds, shrubs and herbs, which can be exploited for mulching, feeding livestock, preparation of *Amrut Mitti* etc.

The India State of Forests Report (ISFR) 2021revealed that the north-eastern states have a total forest cover of 1,69,521 square km, out of their total geographical area of 2,62,179 sq km, which is 7.98 per cent of the country's geographical area. This accounts for 23.75% of the total forest cover of the country. These forest areas can be linked with natural farming with suitable agro-forestry and Natural farming principles. There is an ample scope to strengthen the agriculture sector of North East region through Natural Farming. To exploit the highest benefit from the natural farming, it is suggested that benchmark surveying of the potential areas for Natural farming, research, extension and human resource development, creating certification standards of various natural farming approaches with a proper combination can give the tremendous success for the growth and development of these states.

Conclusion

The review shows that do nothing farming is environmentally sound due to its chemical free nature, economically efficient due to restriction of external inputs, holistic as it intimately interconnects people with the nature and provides benefit to all the components of ecosystem. But it will not be socially acceptable, as practicing this will be like going back to the stage of hunter gatherers and food security is impossible Such a way. ZBNF is environmentally sound, economically efficient, holistic and provides benefit to all the components of ecosystem. It will be socially acceptable provided that food security of present and future generation is met thoroughly. The same explanation fits for Rishi Krishi and Natueco culture. But before implementation, there must have to be sufficient scientific evidences to support this approach. Therefore, a lot of research experiments, multinational yield trials, demonstrations, trainings, awareness programmes will be required, so that viability of these approaches can be proved scientifically.

Conflict of interest

The author declares that there is no conflict of interest in any form that could have influenced the research work reported in this paper.

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