

## Prospects of Natural Farming in India

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The world needs to upsurge over all food production by 70 percent by 2050 in order to keep up with growing global population and the change in consumption driven by expanding middle class as per the recent reports of Food and agriculture organization (FAO). Our country, India is anticipated to be the most populated nation globally by 2030, with 1.51 billion people. Under such circumstances, confirming food security for the burg growing masses would be one of the concerns for the nation. For that reason, implementing any farming practices or production technologies at big scale which are not scientifically verified and/or might have deleterious consequences on crop yield, may pose serious concerns on the national goal of confirming food and nutritional security. ‘Green revolution’ technology which includes use of high yielding variety seeds, chemical fertilizer and irrigation adopted in mid-1960’s helped in overcoming the food scarcity in the country. Conversely, intensification of agriculture had led to substantial antagonistic environmental effects, soil degradation, greenhouse gas emissions, eutrophication of land and water bodies and loss of biodiversity. Contrastingly, Natural Farming is inimitable chemical free farming method that is deliberated to be agro ecology-based diversified farming systems, which incorporate crops, trees, livestock allowing functional biodiversity.

### **Origin and Importance of Natural Farming**

Natural farming is not a technique but a view of seeing ourselves as a part of nature, rather than separate from it. It is also known as “the Fukuoka Method”, “the natural way of farming” or “do-nothing farming”. Do nothing farming refers not to lack of efforts, but to the avoidance of manufactured inputs and equipments. In India, Natural Farming (NF) or Zero Budget Natural Farming (ZBNF) inmid-1990s was first time indorsed by an agriculturist ‘Sh. SubashPalekar’,who has been conferred with one of the utmost civilian award of the Country for endorsing this alternative farming system. This farming system is considered to significantly reduce production costs by substituting the chemical fertilizers and pesticides

with home grown products like Beejamritha, Jeevamritha, Neemastra etc. and adopting intercropping and mulching. According to him, natural farming system requires only one indigenous cow for 30 acres of land. It is also envisioned to improve soil health, increase soil organic carbon even without adding massive quantity of Farmyard manure as in case of organic farming and thus help in conquering sustainable agriculture with reduced carbon foot print.

### **Aims of Natural Farming**

The main aim of natural farming is to increase the yield of farmers by optimizing production potential and by avoiding the use of chemical (Fertilizers, herbicides and pesticides) to provide abundant high quality healthy food at the best price. *The golden rule of Natural Farming is to enrich the level of organic matter in to the soil, which supports microbial life, and therefore the soil fertility.* The important step in natural farming is conservation of crop diversity, no tillage , water shed management, crop diversification, integrated nutrient management, integrated weed management and integrated pest management.

### **Assents and criticisms of Natural Farming**

Out of the total 146.5 million farmers present in India, more than 85 percent of farmers are small holders and more than 100 million farmers (68.5 percent) are operating on an average 0.38 hectare of land restated that mainstream of the poor and hungry individuals in the world live on small farms and skirmish to survive on too little land with low input-low yield technologies. Under such situation, use of modern technology and innovation in Indian agriculture is considered the only way out. Further, a section of scientific community is pitted against natural farming system disapproving that is being not grounded on scientific evidences and promoting certain opinions, particularly indigenous cows, backward-looking and chauvinistic idiom. The National Academy of Agricultural Sciences (NAAS) in India conducted one-day brainstorming session at Delhi and reached to a consensus that the government should not invest capital and human resources towards promoting ZBNF. It has also criticised ZBNF calling it an “unproven” technology that will not bring tangible gain to either farmers or consumers. On the other hand, the Indian Council of Agricultural Research (ICAR) has appointed a committee under the Chairmanship of Prof. V. Praveen Rao, Vice Chancellor, PJTSAU, Hyderabad to examine the ZBNF’s viability. The committee is

conducting experiments at five different locations in India. After having exhaustive study of the movement, the prevalent ambivalence makes Natural Farming a valuable case for the political ecology of agriculture. Contrary to it, the protagonists of ZBNF believe that conventional agriculture or chemical farming contributes to land degradation by adding chemicals in soil and food systems, while agro-ecological system restores soil fertility. Nevertheless, the Finance Minister, Govt. of India has stressed upon the ZBNF practices and appealed the farmers to replicate this innovative model that can help in doubling farmers' income. Furthermore, addressing the 14<sup>th</sup> Conference of Parties (COP) to the UN Convention to Combat Desertification, the Prime Minister of India mentioned that ZBNF is the way for sustainable agriculture. There are several variants of Natural Farming, under which the farmers do local customization and adaptation according to their local conditions. But, the steppingstone for ZBNF or Natural Farming in India is the advocacy by its chief proponent Sh. Subhash Palekar, who in due course also raised several controversies. Initially, he named the practice as 'Zero Budget Natural Farming' (ZBNF), which has been later changed to 'Zero Budget Spiritual Farming' (ZBSF), and sometime, it has been renamed as 'Subhas Palekar Natural Farming (SPNF)'. He conducts training programmes for the farmers at different locations in different parts of the country and suggests following:

- ✓ Since, nothing to be purchased from the market under ZBNF practices, the production cost becomes zero. Therefore, it is named as 'Zero Budget'.
- ✓ All the needed nutrients are available in the soil, but in unavailable form. These can be converted into available form by the microorganisms, which are available in plenty in the indigenous cow dung and uncultivated soil.
- ✓ Green Revolution technologies like chemical fertilizers and pesticides have destroyed these micro-organisms in the soil system.
- ✓ One gram of cow dung contains about 300 to 500 crore beneficial microbes, thus Jeevamritha acts as culture.
- ✓ Only dung of local cow is effective. One can mix half cow dung and half the dung of bullock or buffalo, but not of Jersey or Holstein at any cost.
- ✓ For one-acre land, only 10 kg/month of cow dung is sufficient. Therefore, a farmer can cultivate 30 acres of land with only one indigenous cow.

- ✓ The micro-organisms available in cow dung decompose the dried biomass (mulch) on the soil and make the nutrients available to the plants. It also increases earthworm population in the field.
- ✓ Thus, Jeevamritha is perfect and complete solution for crop cultivation. There is no need to add FYM in bulk quantity.
- ✓ Organic farming is not suitable for poor Indian farmers, as it requires huge quantity of FYM, making their agriculture unremunerative. Besides, the worms *Eiseniafoetida* used in vermi-composting convert considerable amounts of heavy metals into bio-available form, and the roots absorb these poisonous heavy metals which ultimately enter into the human food chain.

Globally, soils contain more carbon than plants and the atmosphere combined. Losing carbon-rich organic matter from soils releases carbon dioxide, a greenhouse gas, which can accelerate climate warming. But by regenerating soils, we can sequester more carbon underground and slow climate warming. In addition to protecting soil, cover crops take carbon out of the atmosphere as they grow and funnel it into the soil. Unlike cash crops that are harvested and removed from the soil, cover crops are left to decompose and contribute to soil formation. While plants are the original source of carbon for soils, microbes control its fate by using it as food, thus ensuring that at least some of it will remain in the soil. Thus, it is believed that ZBNF or Natural Farming is based on the above hypothesis. With different interventions under it- adding microbes, adding cover crop, minimum tillage, multi-cropping, etc. it helps in soil regeneration and ultimately would lead to sustainable agricultural growth.

### SubhashPalekar's Approach of ZBNF

According to Sh. SubhashPalekar, the ZBNF/NF has following 4 essential components:



### 1. Jeevamritha:

It is a fermented microbial culture. It provides nutrients, but most importantly, acts as a catalytic agent that promotes the activity of microorganisms in the soil, and also increases population of native earthworms.

#### Preparation of Jeevamritha

Put 200 litres of water in a barrel

- ✓ Add 10 kg fresh local cow dung
- ✓ Add 5 to 10 liters aged cow urine
- ✓ Add 2 kg of Jaggery (a local type of brown sugar)
- ✓ Add 2 kg of pulses flour and
- ✓ Add a handful of soil from the bund of the farm.

Stir the solution well and let it ferment for 48 hours in the shade. Jeevamritha is ready for application. The 200 litres of Jeevamritha is sufficient for one acre of land. 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 and jaggery). A handful of undisturbed soil acts as inoculate of native species of microbes and organisms. Jeevamritha also helps to prevent fungal and bacterial plant diseases.

#### Application of Jeevamritha:

It should be applied to the crops twice a month in the irrigation water or as a 10% foliar spray. The preparation is stored up to a maximum of 15 days and used in the field either through spray or mixing with irrigation water. For horticultural crops, Jeevamritha is applied

- ✓ Water vapour condensation through activating available earthworms
- ✓ Using polycropping and different mulches with trees, crop biomass to conserve soil moisture & adding organic carbon
- ✓ Seed treatment with cow dung, urine and lime based formulations
- ✓ Ensuring soil fertility through cow urine, cow dung, undisturbed soil, pulses flour & jaggery concoction

### 2. Beejamritha:

It is a treatment used for seeds, seedlings or any planting material. Beejamritha is effective in protecting young roots from fungus as well as from soilborne and seed-borne diseases that commonly affect plants after the monsoon period.

**Preparation of Beejamritha-** Mix local cow dung, considered to be natural fungicide, and cow urine (as anti-bacterial liquid), lime and soil. The dung is tied in a cloth and is kept in urine for about 12 hours. The dung is removed from cow urine, cow dung is squeezed and urine is added with about 50 grams of lime.

**Application as a seed treatment:** Add beejamritha 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.

**3. Acchadana - Mulching.** Three types of mulching have been suggested under ZBNF:

- ✓ **Soil Mulch:** This protects topsoil during cultivation and does not destroy it by tilling. It promotes aeration and water retention in the soil. Therefore, deep ploughing should be avoided.
- ✓ **Straw Mulch:** Straw material usually refers to the dried biomass waste of previous crops. Any type of dry organic material will decompose and form humus through the activity of the soil biota which is activated by microbial cultures.
- ✓ **Live Mulch:** It is essential to develop multiple cropping patterns of monocotyledons and dicotyledons grown in the same field, to supply all essential elements to the soil and crops. Dicot group such as pulses are nitrogen-fixing plants. Monocots such as rice and wheat supply other elements like potash, phosphate and sulphur.

**4. Whapasa moisture:**

The advocates of ZBNF counter the over-reliance on irrigation in green revolution farming. Whapasa is the condition where there are both air molecules and water molecules present in the soil. Thus, irrigating only at noon, in alternate furrows, may fulfil the moisture requirement of the crops, a significant decline in need for irrigation in ZBNF. However, rarely this practice is being followed by any farmer.

**Indian Soil and Natural Farming**

Soil is a fundamental and essential natural resource for existence of all living organisms. Soil health or quality is defined as the capacity of soil to function as a vital living ecosystem that sustains plants and animals. Intensive crop cultivation using broadly using

imbalanced fertilizer, high nutrient mining through monoculture, decline in organic matter status, deficiencies of secondary and micronutrients, etc. have deteriorated the soil health across the region in India resulting into declining crop productivity growth. There are 6 major soil types in India- Alluvial soil, Red soil, Black soil, Laterite soil, Arid soil and Forest & mountain soil Each soil type has its own characteristics in terms of physical and chemical properties, like Alluvial soil is highly fertile, with high phosphorus and potash content. Laterite soil is acidic in nature, while Black soil is rich in potash and magnesium, but poor in phosphorus. Red soil has high iron and potash content but lacks phosphate.

### **Nutrient deficiency in Indian soils**

Overall, about 59 and 36 per cent of Indian soils are low and medium in available N, respectively. Similarly, soils of about 49 and 45 percent area are low and medium in available P, respectively; while soils of around 9 and 39 per cent area are low and medium in available K, respectively. Among various soil characteristics that affect the availability and uptake of micronutrients, soil pH and organic carbon content are the two most important factors. Availability of most micronutrients is higher in acidic soils as compared to alkaline soils. Soil pH between 6 and 7 shows the highest availability of micronutrients. Since, 71 per cent of Indian soils are moderately alkaline, soil micronutrients tend to be deficient in them. Analysis of more than two lakhs soil samples during 2011-2017 revealed huge variation in different types of micronutrients deficiency in India soils. On an average, 36.5, 23.4, 12.8, 11.0, 7.1 and 4.2 per cent soils are deficient in zinc, boron, iron, molybdenum, manganese, and copper, respectively, across the country.

Our soils are very low in organic matter content and thus have poor soil fertility. Organic carbon is an index of good soil health and application of organic manures helps in maintaining high organic carbon content of the soil. Soil organic carbon (SOC) is the key constituent which dictates soil physical condition, chemical properties including nutrient status and biological health of a soil. Management practices that reduce organic matter in soils, or bypass biologically-mediated nutrient cycling also tend to reduce the size and complexity of soil communities. Soil organisms, both animals (fauna/micro-fauna) and plants (flora/micro-flora), are important for maintaining the overall soil quality, fertility and stability of soil. Soil organic matter helps soils hold onto water and nutrients and supports soil microbes that recycle nutrients. They are intimately associated with biological and

biochemical transformations occurring in soil (NAAS, 2018). The SOC stock of Indian soils is 10 to 12 percent of the tropical regions and about 3 percent of the total carbon mass of the world.

### **Role of soil micro-organisms**

For sustainable farming, healthy soil is the most important factor. Soil microbiologists believe that healthy soil means living soil, which involves trillions upon trillions of living microorganisms consuming first organic matter, then each other, and releasing nutrients in the process. They have also recognised some 150 species of arbuscular mycorrhizal fungi (MF) that colonize the root systems of plants. Plants offer photosynthetic sugars to MF, which in turn assist the plant by facilitating the uptake of mineral nutrients and water. In healthy soil, mycorrhizal fungi grow immensely which works like sponge. It helps in improving soil aggregate stability, build soil carbon, improve water use efficiency, increase the efficiency of nitrogen, phosphorus and sulphur.

To increase the mycorrhizal fungi, it needs to reduce/eliminate chemical use, reduce/eliminate tillage, reduce/eliminate synthetic fertilizers and living plant cover as long as possible. Cover crop also reduces soil temperature, which improves soil moisture condition and in turn helps in soil bacterial growth. Thus, it also helps in building a soil carbon sponge, which absorbs water and make available to the plants. 95 percent of the bio-fertility of soils is about these microbial processes, not the actual nutrient content in the soil or how much we put on as fertiliser. The application of chemical fertilizers, biocides, tilling of lands, etc. is detrimental to these soil micro-organisms, and consequently roots of the plants act simply as straw sucking mainly those nutrients, which has been supplied externally in the forms of chemical fertilizers. While through biological processes, all kinds of nutrients are made available to the plants through decomposition of root biomass of previous crops or mulches. The study has shown that crop residues are good sources of plant nutrients and can increase yield and water use efficiency, while decreasing weed pressure. Long-term studies of the residue recycling have indicated improvements in physical, chemical and biological health of soil. For example, about 40 percent of the N, 30-35 percent of the P, 80-85 percent of the K, and 40-50 percent of the S absorbed by rice remain in the vegetative parts at maturity, similarly about 25-30 percent of N and P, 35-40 percent of S, and 70-75 percent of K uptake are retained in wheat residue.



### Pest control solutions

According to ZBNF-adopter farmers, when chemical fertilizers are applied to the crops, the vegetative growth of the crop is very good and lush green. This attracts the insects/ pests to the crops. While in case of Jeevamritha, the leaves colour is not that much green and therefore, menace of pests is limited. However, when infestation occurs, the farmers prepare different types of formulations (Kashayam) made up of locally available plant materials to control the pests. Some of these are:

1. **Neemastra** is the most commonly used pest controlling solution which is prepared by the farmers. Cow dung, cow urine, neem leaves, and water are used for preparing the neemastra. The neem leaves are grinded into paste and added with water. The solution is directly applied to plants without any further dilution. For this, 5 kg of neem paste is added with around 2-3kg of dung, 10-20 litres of cow urine, handful of soil. The solution is fermented for about 48 hours. It was found that the farmers are making the solution ranging from 100-200 litres depending upon their usage and crops grown.
2. **Brahmastra** is prepared from five types of bitter leaves. Neem leaves are used along with the other bitter tasting leaves, like custard apple, chillies, etc. Around 20-30 litres of cow urine is used and is boiled for about 2-3 hours. The solution is cooled for about 12 hours and is filtered using fine cloths. The solution is further diluted with about 15 litres of water for every 1 litre of Brahmastra. The farmers are using 10-20 litres of cow urine and 5kg of neem leaves in preparing Brahmastra.
3. **Agniastra** is prepared by adding 5 kg of neem paste with around 1 kg of tobacco leaves, 0.5 kg of chillies and 0.5 kilo of garlic paste. These are added in about 2530 litres of cow urine and is cooled down for about 24 hours. The solution is then filtered and used. The solution is diluted before applying in the field for every half litre of Agniastra about 15 litres of water is added. Agniastra is considered to be effective against insects like like Leaf Roller, Stem Borer, Fruit borer, Pod borer.
4. **Tutikadarasam** is prepared from datura leaves and cow urine. The leaf are boiled in cow urine for 2-3 hours and is cooled then it is filtered using cloth.
5. **DashpariniKashyam**: It is prepared from ten types of plant leaves. The leaves of Neem, Agelemarmelos, Calotropis, *Sennaauriculata*, Papaya, Custard apple, Gauva, *Vitexnegundo*, castor, Pomegranate, Nerium, Ocimum, Aloe vera, Tobacco, Datura,



*Lantana camara* and *Pongamiapinnata* are used in preparing the solution. Green chilli and garlic are also crushed and added and mixed with 20 litres of cow urine. It is kept up to 45 days for fermentation. The solution is filtered and sprayed after dilution. In about 8-10 litres of solution 100 litres of water is added for dilution.

### Policy Recommendations

Natural Farming (NF) practices or Zero Budget Natural Farming (ZBNF) practices encompass much larger perspective than the scopes visualized in common parlance. The discussion/ debate on 'Zero Budget' may not be tenable, as the terminology might be more appealing to communicate to the rural farmers, and secondly, actual practices definitely lead to significant reduction in market dependency for farm inputs. As Soil Microbiologists emphasize upon the important roles played by the invisible microorganisms in the healthy soil, the NF practice can be sustainable if it is adopted in true spirit. It is well documented that millions of fungi, bacteria, actinomycetes, etc. available in healthy soil make available all those nutrients which are needed for all types of plants through fixation, solubilization and mineralization, provided the soil is covered with organic matter (mulch), and proper moisture is maintained. However, application of chemical fertilizers and/or biocides has serious damaging effect on these microorganisms, and therefore, plants depend mainly on the external nutrients applied to the soil. Moreover, from operations point of view, like preparing Jeevamritha, Beejamritha, multi-cropping, different kasayams for pest management, etc. NF require not only regular monitoring and engagement, but also the conviction to continue these practices. Even though, the NF practices results into better farm profitability, it would be humungous task to implement these practices by relatively large farm land, as polycropping may not be compatible with farm mechanization, particularly sowing and harvesting. It may be quite feasible for the smallholders, which has adequate family labour to look after the field and use these inputs on regular interval. Having said that, following policy recommendations may be applicable for expansion and sustainability of Natural farming practices:

- 1. Systematic research should be conducted at ICAR institutes/SAUs:** There are several issues related to Natural Farming, which require further refinement as well as to create credibility for the practices. Such as
  - ✓ Effect of dung and urine from different species (buffaloes/ bullocks/ crossbred, or other ruminants, etc.) for preparation of Jeevamritha and Beejamritha,

- ✓ Quantity and frequency of jeevamritha application,
  - ✓ composition of jeevamritha,
  - ✓ Possibility of preparation of Jeevamritha concentrate for longer shelf-life and portability,
  - ✓ Effect of Natural farming on different crop combination and under different agro-climatic and irrigation conditions, etc.
- 2. Impact of Natural farming may be multi-faceted:** Comprehensive socio-economic study on impact of Natural Farming may be conducted to examine its implication on
- ✓ Carbon footprint due to saving of chemical fertilizers (manufacturing and distribution) and its effect on climate change;
  - ✓ Saving of fertilizer subsidy
  - ✓ Improvement in soil health
  - ✓ Increased crop diversity and food diversity at farmers' household level
  - ✓ improvement in farmers health- reduction in time and money spent for hospital visit
  - ✓ Improvement in farm income, etc.
- 3. Creating awareness through training and demonstration by KVKs:**
- Phase-wise rollout of capacity building of farmers and demonstration may be initiated by the selected KrishiVigyanKendras (KVKs) in each agro-climatic zones and for different crops. The KVKs may also experiment on the efficacy of the practices with improved varieties/ hybrids.
- 4. Certification of Natural Farming produce:**
- Since the natural farming produce is chemical-free, the consumers would be ready to pay premium price for the product. Therefore, proper mechanism may be developed for certification of these products under PGS, to create different segment in the market- between conventional products and organic products.
- 5. Encouraging Farmers Producers Organization (FPOs) based on Natural farming:**
- Special incentives may be given to the FPOs promoting exclusively the Natural Farming practices. Such FPOs may be given financial support for developing monitoring system as well as value addition and marketing of NF produce. Natural farming or ZBNF started as a grassroots movement, aiming to provide multiple



benefits, both to the environment and to farmers. Promoters of ZBNF claim that the soil already contains all the nutrients needed for plant growth and that the action of microbial cultures added to the soil releases these nutrients from the soil itself. However, agricultural scientists argued that the practice would result in a sharp decline in crop production and make soils less resilient to droughts.

