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Enhancing the Nutritional Value of Food Through Process of Natural Farming in India

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Abstract
Natural farming also referred to as organic farming, vital for health since it produces pesticide-free goods. The amount of vital micronutrients in naturally cultivated food has been found to be higher. The Bharatiya Prakritik Krishi Paddhati Program, found effective in Andhra Pradesh, Karnataka, Himachal Pradesh, Gujarat, Uttar Pradesh, and Kerala is an initiative of the Paramparagat Krishi Vikas Yojana, supports natural farming in India. The purpose of this study is to identify the difficulties experienced by farmers as well as the requirements and limitations of natural farming in India. Natural farming depends on the potential of the soil under the present local climate conditions and employs the agro-eco system as a self-contained unit. Only 4.9, 2.0, and 1.6 percent of the net sown area in the top three states with the most organic farming, Madhya Pradesh, Rajasthan, and Maharashtra, are used for organic farming, respectively. In a few states such as; Meghalaya, Mizoram, Uttarakhand, Goa, and Sikkim, organic crops account for 10% or more of the net sown area. This study examines the health benefits of regularly ingesting foods that are naturally generated. Natural-grown plants are better for a therapeutic diet as well as contributing in economic development.

Keywords: Organic farming, Eco-system, Seed, Micronutrient, Climate, Agriculture

Introduction

Natural Farming also known as ‘the Fukuoka Method’ or ‘do nothing farming’ which is an ecological farming approach established by Masanobu Fukuoka (Fukuoka, 1978). In India Natural farming is a traditional chemical free practice based on diversified farming system which involves crops, trees and livestock with functional biodiversity (De, 2022). Bharatiya Prakritik Krishi Paddhati (BPKP) is a submission under Paramparagat Krishi Vikas Yojana (PKVY), which falls within the umbrella of National Mission on Sustainable Agriculture (NMSA) aims at promoting traditional indigenous practices, which give freedom to farmers from externally purchased input. It also promotes on recycling of on-form biomass mulching, use of cow dung-urine formulations and exclusion of all synthetic chemical inputs either directly or indirectly (NITI Aayog, 2021). Sustainable Development Goal number 2 (Zero Hunger) targeted to achieve food security for all and end hunger and malnutrition from all especially from infants, poor and vulnerable population of the country (Korav, 2020). This goal also highlighted that achievement of sustainable agriculture worldwide to obtain more nutritious, chemical free foods at low cost that can be availed by all. In this regard natural farming is the one of the best

alternatives to achieve the sustainable development goal by dealing with malnutrition in the developing country like India (NITI Aayog, 2021). Indian Government also suggests to cut the use of chemical fertilizers and pesticides as they can be damaging the health of the soil and thus are not ecologically balanced and thus results in imbalanced ecosystem (NITI Aayog, 2021).

There is another term used in natural farming that is Zero Budget Natural Farming (ZNBF) which is a sustainable method of farming practices which do not involve use of any artificial fertilizers and pesticides that ensures the healthy growth and improved soil fertility (Kumar Das, et. al. 2022) . There are several steps involved in natural farming from 1 to 3 years of agricultural land conversion period, farm designing, choice of varieties of crops, land management, nutrient management, weed management to soil and water conservation (De, 2022). From the Nutritional standpoint naturally grown products provides rich sources of micronutrients including sodium, potassium, zinc, manganese, calcium, Iron, vitamin A, Vitamin C, as well as phytonutrients such as phenolic compounds, terpenoids and hence can be used as therapeutic dietary formula (Acharya and Kendra, 2013). Lack of awareness among the farmers, high price and shortage of organic seed results into only small part of the net sown area under organic farming in the majority of the states, even the top three states with most of the organic farming, Namely Madhya Pradesh, Rajasthan, and Maharashtra only have 4.9, 2.0, and 1.6 percent of their net sown area dedicated to organic farming respectively. Only a few states including Meghalaya, Mizoram, Uttarakhand, Goa, Sikkim, have organic crops covering 10 percent of their net sown area (Annual Report 2019-20). To achieve sustainable development goals, food security, balanced ecosystem there is a constant need of natural farming over the conventional one which ultimately leads to a better living standard and irradiation of several nutritional and degenerative diseases (Palekar, 2005).

Objectives

This theoretical study aims

1. To study the current scenario of natural farming in India
2. To assess the challenges faced by the farmers for shifting to natural farming from conventional one
3. To find out the role of natural farming on environment and enhanced nutritional quality of foods.

Methodology

To conduct this theoretical study several research and review articles, reports were searched using Research Gate, Google Scholar and relevant secondary sources. All the reference articles used were not more than ten years old. After reviewing all those sources, the following sub heads are made.

Principles of Natural Farming

In Natural Farming there is no weeding, no tillage, no pesticides and herbicides, no fertilizers and no pruning is carried out just as it would in ecosystems found in nature (Kaur, 2020).

Among the four, the first is ***No Tillage***, that is no plowing or turning of the soil. For centuries, farmers have assumed that the plow is essential for growing crops. However, non-tillage is fundamental to natural farming. The earth cultivates itself naturally by means of the penetration of plant roots and the activity of microorganisms, small animals, and earthworms. The second one is called **Chemical-Free Fertilizer**. Their sloppy agricultural methods deplete the soil of vital nutrients, which causes annual land depletion. If the soil is left alone, it will naturally maintain its fertility in accordance with the regular cycle of plant and animal life. The third Principle is **No Weeding or use of Herbicides**. The biotic

community is balanced by weeds, which also contribute to soil fertility building. Weeds need to be kept under control not eradicated. The fourth Principle is **No Dependence on Chemicals**. Disease and pest imbalance started to be a major issue in agriculture when weak plants appeared as a result of such artificial techniques as fertilization and plowing. Although harmful insects and plant diseases are constantly there. They do not occur frequently enough in nature to warrant the use of toxic chemicals. Growing robust crops in a healthy environment is the reasonable solution to disease and insect management. These four natural farming principles follow the natural order and promote the replenishing of nature's riches (Fukuoka, 2010). To eradicate pests and diseases, farms utilise natural insecticides like Dashparni ark and Neem Astra (dacnet.nic.in).

Constraints and Challenges faced by farmers in Natural Farming

The market of organic (one of the natural farming methods) food is rapidly expanding although its usage is limited in affluent homes and extremely health-conscious consumers. There are plenty of backlash due to lack of knowledge and understanding of the benefits of natural farming, there has been a major barrier to consumer adoption and unsteady support from legislator, academics and contributors (Palekar 2005). Besides this there are lack of good marketing policies, Inadequate farming infrastructure, high input cost of farming and lack in Governmental policies to promote natural farming are the challenges faced by implementing organic or natural farming in our country (Khurana, 2020).

1. **Convincing the Farmer:** Organic farming is expensive since it requires on-going expenses. The majority of farmers still use chemical fertilisers because they cannot afford the higher cost of organic farming. Organic seeds are more expensive, require more time to grow, and must be kept in low temperatures for extended periods of time (cnisbss.org 2022).
2. **The Disparity between Supply and Demand:** The region where the demand is coming from must have willing producers, aggregators, and farmers. However, in general, metropolitan areas without sufficient farmland for organic produce production are the source of demand. In order to close this gap, smart transportation and appropriate supply channels are required (Azam, 2019).
3. **Shortage of Organic Seeds:** Farmers are forced to use conventional seeds only because there are not any seeds that are certified organic; otherwise, the seeds might have undergone chemical treatment (cnisbss.org 2022).
4. **Confused Certification Framework:** Agriculture in India is not being industrialised under a system of laws or norms. As a result, anyone could sell anything under the description organic which diminished trust. (cnisbss.org 2022).
5. **High Input Costs:** An appropriate regulatory framework, adherence to the regulations, and disclosure of that information are necessary conditions for building confidence with customers (cnisbss.org 2022).
6. **The High Price of Organic Produce:** The prerequisites for fostering customer confidence are a proper regulatory structure, adherence to the regulations, and communication of that information. Require a simplified focused, ambitious, and well-funded national programme that unifies several ministries and programmes and establishes the relationship between the Center and the State in order to promote organic and natural farming on a national scale (funding, accountability, coordination) creating powerful forces that aid farmers and removing obstacles (Narayanan, 2005).
7. **Climate and weather:** Since natural farming practices do not depend on synthetic inputs to accelerate crop development, they may be more susceptible to fluctuations in climate and weather. In

India, where the climate can be unpredictable, this can be difficult for farmers (Palekar, 2005).

According to Sh. Subhash Palekar, the ZBNF/NF has following 4 essential components

Jivamrit

Jeevamrit is used as a preventative treatment for bacterial and fungal illnesses. This has a one-year shelf life and can be kept and applied by foliar spray or irrigation water (Khadse and Rosset, 2019). It can be made in a 250-liter plastic container by adding 10 kilogramme of fresh cow dung, 10 litres of indigenous cow urine, 2 kg of Jaggary, 2 kg of pulse flour and 150 g of undisturbed soil from bunds or forests to 200 litres of water and properly mixing. A cotton sheet should be used to cover the container in the shade. Each day in the morning and evening stir the mixture for 5 to 10 minutes with a wooden stick. Jeevamrit is available for use nine days after preparation, and it can be used up to twelve days afterwards (Glick and Bashan, 1997).

Beejamrit

Plant roots can be effectively protected by beejamritha against fungus, soil-borne infections, and seed-borne ailments that typically strike plants following the monsoon season. Combine the soil, lime, and local cow dung a natural fungicide along with the cow urine (an antibacterial liquid). The feces are placed in urine for around 12 hours while being knotted in a cloth. Cow dung is squeezed out of cow pee, and then 50 grams of lime are added to the urine (Kumar et.al 2020).

Acchadana – Mulching

Mulching encourages humus production, controls weeds, and maintains the crops' need for water. A favourable specific environment is necessary for the appropriate development, proliferation, and activity of the beneficial microorganisms that are used in Jivamrita. Natural Farming has recommended three different kinds of mulching (Palekar, 2019).

a. Soil Mulch: This prevents tilling from destroying the topsoil during farming. It increases soil aeration and water absorption. Deep ploughing should be avoided due to this fact.

b. Straw Mulch: The dried biomass waste from earlier crops is typically referred to as straw material. Through the action of the soil biota, which is stimulated by microbial cultures, any kind of dry organic material will breakdown and produce humus.

c. Live Mulch: Monocotyledons and dicotyledons must be cultivated in a variety of cropping patterns in the same field in order to provide the land and crops with all the necessary nutrients. Pulses are members of the dicot plant family, which fixes nitrogen. Other elements like potash, phosphate, and sulphur are provided by monocots like wheat and rice (Kumar et. al 2020).

Whapasa- Moisture

According to Palekar, vapourized water is what roots require. Whapasa is that portion of the soil's microclimate where roots and soil organisms can thrive with access to sufficient air and moisture. In the spaces between two soil particles, there is a mixture of 50% air and 50% water vapours (Palekar, 2019). When both water and air molecules are present in the soil, the situation is referred to as whapasa. As a result, irrigation in ZBNF could be significantly reduced by merely watering crops in alternate furrows at noon to meet their moisture needs. But very few farmers actually adhere to this method (Kumar, et.al. 2020).

Fact Sheets:

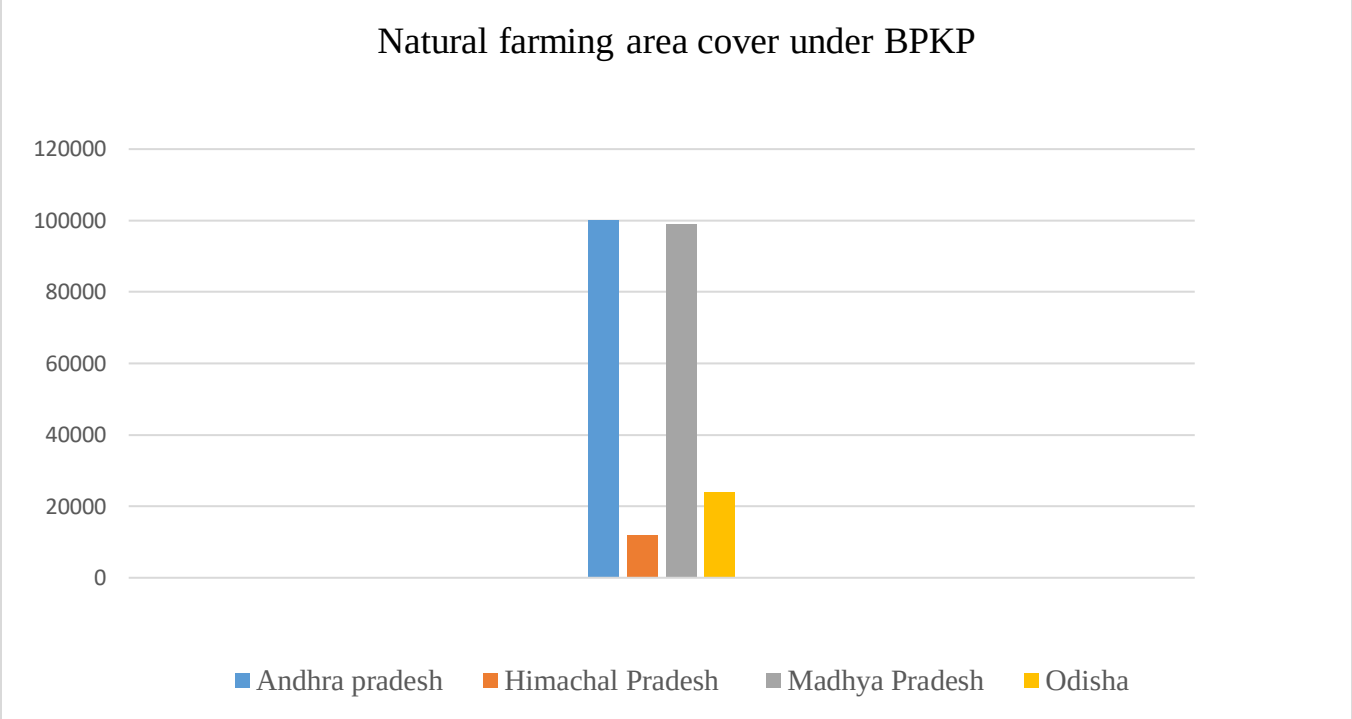


Fig 1: Shows the natural farming area covered in the four states under BPKP
(Source: Kumar.et.al. 2020)

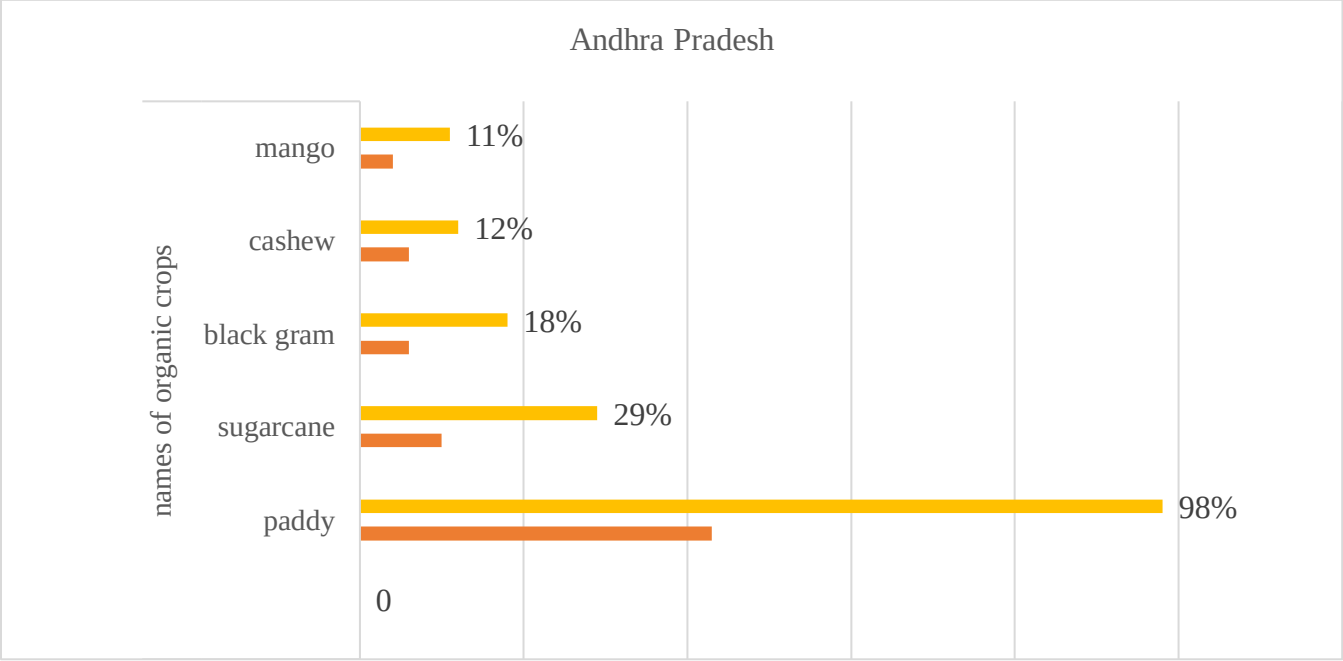


Fig 2: Shows the percentage distribution of different crops produced under natural farming and percentage of farmers working in the same (yellow bar shows the percentage of farmers) in the state of Andhra Pradesh which has the highest cover area for natural farming.
(Source: Kumar.et.al 2020)

Advantages of Natural Farming

Natural farming provides several benefits including environmental conservation such as improving the health of soil thus optimum use of water with much lower carbon and nitrogen foot prints, ensures better health as it does not includes use of any chemical fertilizers hence reduces health hazards and foods produced by natural farming are much dense in nutrition (Das, 2020) besides this minimized cost of production by encouraging farmers to prepare essential biological fertilizers using on-farm, natural and home-grown resources, increases livestock sustainability that is integration of livestock in the farming system plays an important role in Natural farming and helps in maintaining the ecosystem by using ecofriendly bio-inputs such as jeevamrit and Beejamrit are prepared from cow dung and urine and also generates employment by including more farmers in enterprises, value addition and marketing in local areas (agricoop.nic.in). Although this study focuses on the nutritional and health benefits of the crops produced by natural farming along with the insect, pest and disease management and environmental benefits.

Advantages of Natural Farming

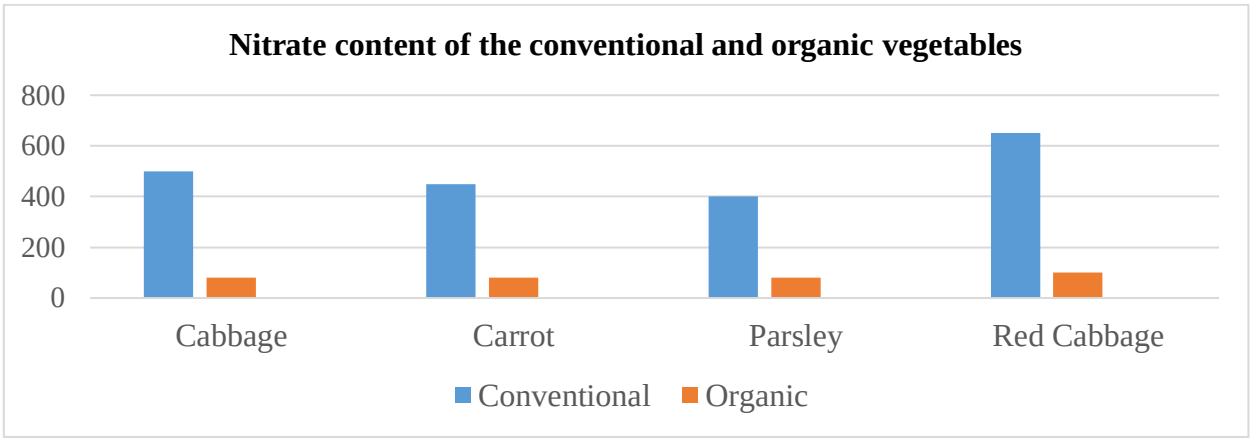
Environmental Benefits

Natural Farming provides with many environmental benefits from reducing exposure to harmful chemicals to combating the effects of global warming. In conventional agriculture the use of synthetic chemicals for crop rotation cause soil erosion and thus effect the environment in a negative way as natural farming refuse to use chemical fertilizers and in this way contributes to the preservation of natural environment. Several researches have shown that natural farming has eliminate about 500 million pounds of pesticides and chemicals from entering into the environment (Economic and Political Weekly, 2019). On an average, natural farming uses 30 to 50 per cent less energy than conventional farming. Natural farming does not involve use of synthetic nitrogen-based chemicals and thus reduces nitrogen run-off induced pollution (Government of India, 2001). This type of farming practices also facilitates the healthy soil formation due to its entire cultivation process and by balancing its carbon and nitrogen cycle. Another impact of natural farming combats the effect of global warming as it is a sustainable practice that potentially reduces the carbon di oxide production. By these ways the natural farming protects our environment and increases sustainability (Kumar et. al 2020). Natural farming can make farming profitable and aspirational by improving farmers' net incomes as a result of lower costs, lowered risks, comparable yields, and intercropping profits.

Health Benefits

Several researches suggested that foods grown by natural farming are more nutritious when compared to the foods obtained by conventional farming. Chemical fertilizers used in conventional methods makes the soil deficient in essential micronutrients such as zinc, iron, manganese (Agarwal and Gupta, 2020). In the natural farming small to moderate increase in antioxidants have been shown such as flavonoids, isoflavonols, anthocyanins, carotenopids, polyphenols, which help significantly in increasing immunity, eliminate free radicals from the body and also acts as an anticancer agent and an immunomodulator. They also provide skin protection, bright eyes, and prevent osteoporosis (Yu et.al 2018). These compounds also have been found to protect against chronic diseases including cardiovascular disease, prosate and neurodegenerative diseases (Baranski et al. 2014). The livestock or farm animal require more omega-3 fatty acids and includes feeding cattle grass and alfalfa. Omega-3 fatty acids are proved to be cardio friendly and found in organic meats, dairy and eggs (Ryan, 2004). Cadmium is a toxic

chemical naturally found in the soils and absorbed by plants; studies have shown that low cadmium level was found in foods that grown by natural farming due to ban on synthetic fertilizers. Meat produced by natural farming shown to contain low level of hazardous bacteria (Mayoclinic, 2021). Naturally grown foods are found to be higher in potassium, phosphorus, magnesium, iron and calcium when compared to conventional practices. Heavy metals used in chemical intensive farming can harm the nervous system, infertility and cancer. As for example potassium is used as chemical fertilizer which decreases the absorption of magnesium in plants (Yu et. al 2018).



(Source: Yu et al. 2018)

Chemical pesticides used during the harvest time when rich the plate of the human can cause carcinogenic, mutagenic harm in children, pregnant women, sick and diseased and older people. Cognitive ability is severely hampered, lowering of IQ and under development of brain, ADHD, and behavioral disorders among children. Prolonged exposure to these pesticides causes huge risk of abnormalities in brain growth and development, impaired sexual development among the unborn children of the pregnant mother. Using food products from chemical induced agriculture process promotes the risk of Parkinson's disease, Type 2 DM, Childhood Leukemia and reduced sperm count among population so, the study suggests to include organic or natural products in diet to lead a healthy life

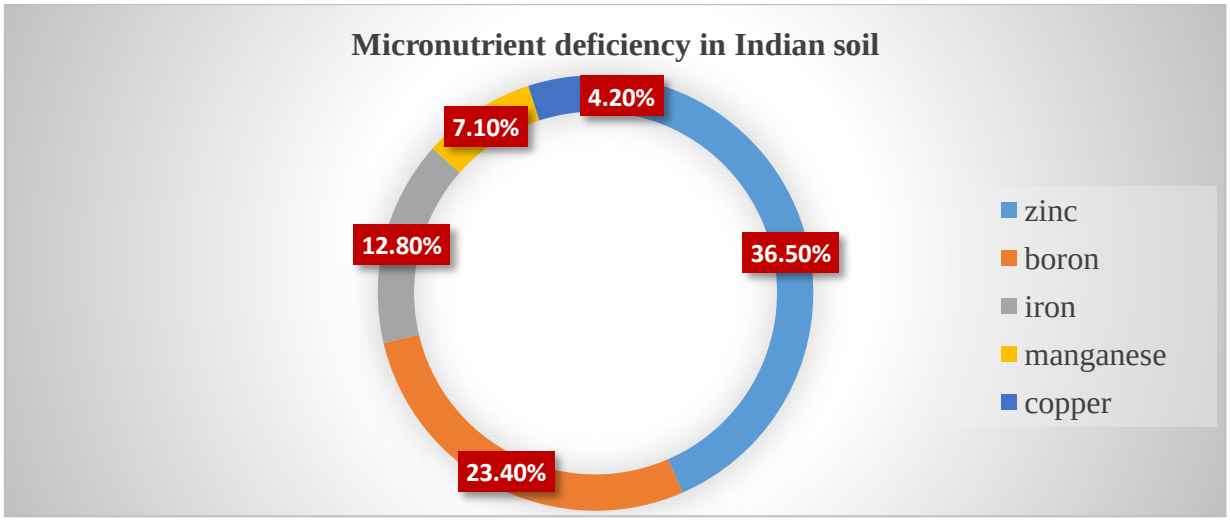


Fig 3: Shows the micronutrient deficiency in Indian soil

(Source: Shukla.et.al.2018)

Insect and Pest Management

Insect and pest management under natural farming are quite different from the conventional one. In conventional farming practices which is associated with use of injudicious use of chemical pesticides to kill or destroy the pests and insects and which in turn leads to killing of various beneficial lives including fishes, birds, wildlife, pollinators and microbes. To overcome the hazardous effects of chemical based conventional farming, Palekar suggested to use some natural products for insect- pest control as sprays under natural farming such as Darekastra or Paudhastra which is a solution used to control sucking insect-pests and young caterpillars attacking fruits and vegetables. This solution is made by mixing leaves of darek tree with water, cow urine and cow dung in proper ration and spraying 40 litres in 1 bigha area has proven to be enough to kill the insects. Another one named as Brahmastra which is made by mixing crushed and ground leaves of each of darek, papaya, guava, mango and duranta and mixed with cow urine which usually destroy the older larvae of infesting crops. Agneyastra is another solution used against pests like fruit borers, root borers and leaf borers and neem paste, Neemastra, dashparni are also available to control insects and pests in agricultural land without hampering the ecosystem under natural farming (Badiyala and Sharma, 2021).

Conclusion

The present study deals with the condition of natural farming in India. Natural farming is a chemical free agricultural practice which provides numerous benefits including ecology and health. Andhra Pradesh, Himachal Pradesh, Madhya Pradesh and Odisha shown to have highest Net sown for natural farming among all other states. The Palekar's Model of Zero Budget Natural Farming is considered to be a alternative solution of green revolution drive. Environmental benefits of Natural farming deals with reducing use of harmful chemicals to combating global warming. It also protects the health of human being by providing antioxidants, micronutrient and prevents the occurrence of chronic diseases such as Cardiovascular disease, Diabetes and types of neurodegenerative diseases. Insect and Pest management in natural farming also protects the lives of other beneficial animals. although there are a plenty of challenges in implementing Natural Farming in India due to lack of knowledge and poor infrastructure and unwavering support for legislators, academicians and contributors. The present study suggests that rapid research and continuous support from Government will promote the natural farming and thus help in achieving sustainable development goal by 2030 in India.

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