NATURAL FARMING FOR SUSTAINABLE DEVELOPMENT AND EFFICIENT WATER USE

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ABSTRACT

The 'Green Revolution' due to conventional farming succeeded in increasing the food grain production. It was due to use of improved varieties of seeds, chemical fertilizers, pesticides and farm machineries. However, it gave rise to various problems like loss of fertility of soils, environmental problems and health hazards. The system required high input costs and is ecologically and economically un-sustainable. Thus, there is a need to have a sustainable farming system which is economically viable and environmentally acceptable. United Nations Conference on Environment and Development (UNCED Earth Summit) held in Rio de Janeiro in 1992 also adopted to have 'Sustainable' Agriculture and Rural Development. Natural farming system is one of such systems. It advocates reliance on the organic waste available in farm lands for meeting the nutritional requirements of plants. No chemical fertilizers or pesticides are used in this system. Just a catalytic culture called *jivamrita* derived from cow dung, cow urine, pulse flour etc is used in this system. This gives rise to earthworm population and growth of various micro-organisms which are helpful in improving the soil fertility and crop production. The yields from such system are more as compared to the conventional system. Also, the food and fruits derived from such system nutritious and have more shelf value. It is very easy to adopt and a large numbers of farmers in India are carrying on cultivations based on this method. It is also found to be effective in mitigation of problems of green-house gases and climate change.

About 80% of total water is utilized in agriculture. Hence, even a small improvement in irrigation efficiency would result in huge saving of water which could be utilised for other purposes. Further, this saving of water would negate the necessity of construction of water resources projects which involve huge costs and also have various other environmental and social concerns. Taking this into account, Govt. of India had initiated National Water Mission to improve irrigation efficiency atleast by 20%. Natural farming would be one of the steps in this direction.

(Key words: Sustainable, Natural Farming, Earthworm, *Jivamrita*, crop rotation, mulching)

1. INTRODUCTION:

The beginning of the conventional system of agriculture using high yielding varieties, chemical fertilizers and pesticides is attributed to Norman Borlaug, an American scientist. In the 1940s, he developed new disease resistance high-yield varieties of wheat in Mexico. Due to the success of his research there, the technologies spread worldwide in the 1950s and 1960s. Although, the production in agriculture sector due to this 'Green Revolution' increased initially, it showed its limitations and inadequacies on the long run. FAO (2008)

observed that the conventional agriculture results in progressive degradation of soil structure and fertility leading to increased production costs and reduced profitability of farming. This farming system has become unsustainable as evidenced by declining crop productivities, damage to environment and chemical contaminations (Narayanan, 2005). Harmful effects of this farming system on human population have also been observed. According to United Nation Environment Program (UNEP) and the World Health Organization (WHO), nearly 3 million people suffer from 'acute pesticide poisoning' and about 20,000 people die every year from it in the developing countries (UNEP, 1992).

It is observed that continuous and excessive use of chemical fertilizers and pesticides has led to loss of fertility of soil (Rodriguez, 2004). It impaired the power of 'biological resistance' in crops making them more susceptible to pests and diseases (Sinha and Herat, 2012). High input cost of seeds, chemical fertilizers and pesticides has made this kind of agriculture unsustainable and economically unfeasible (Singh et al., (2011). Pests became immune requiring stronger and more pesticides (Pandey & Singh, 2011). There was contamination of water sources and overall decrease in the agriculture production (Fernando, 2009). This system requires more water for irrigation. Farmers in India are committing suicides due to high input cost in such agricultural practices (IGIDR,2006**).**

Thus, there is a need for sustainable and eco-friendly agriculture system to feed the growing population of the world. Such system should have capacity to increase the organic matter for providing nutrients for plants, improve soil porosity as well as moisture holding capacity and to create favourable condition for biotic activity in soil (FAO,2008). Agenda 21 on sustainable agriculture adopted at the Earth Summit in Rio de Janeiro, Brazil in June 1992, makes it obligatory for international agencies and governments of all nations to give incentives to farmers to shift away from the environmentally destructive high-tech chemical agriculture to the environmentally friendly sustainable agriculture by improving upon the traditional technologies with modern scientific knowledge. The International Movement for Ecological Agriculture held in Malaysia in 1990 has also called for alternative technology in agriculture (Sinha et al., 2009).

According to the Food and Agriculture Organization sustainable agricultural development is "the management and conservation of the natural resource base, and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations. Such development, conserves land, water, plant and animal genetic resources and is environmentally non-degrading, technically appropriate, economically viable and socially acceptable" FAO (1995). Improvement in agricultural sustainability requires the optimal use and management of soil fertility and soil physical properties. Both rely on soil biodiversity and soil biological processes. This calls for widespread adoption of management practices that enhance soil biological activities and thereby build up long-term soil productivity. The natural farming is one of such easy and cost effective methods. It is suitable for the small and marginal farmers in developing countries. Also, it has potential to reduce the problem of water logging and soil salinity by way of improving drainage conditions. Further, the net benefits through such methods are also higher than the convention method (Singh et al., 2011).Natural farming is also found to be effective in reducing the green-house gases and combat climatic change (Sinha and Herat, 2012).

Realizing the side effects of conventional agricultural practices, Govt. of India initiated National Programme for Organic Production (NPOP). Farmers in India are gradually shifting

back to sustainable farming. According to the International Fund for Agriculture and Development (IFAD), there are over 44,926 certified organic farms in India, making it one of the most important exporters of organic food to the developed nations (Pandey and Singh, 2011). The National Mission (of India) for 'Sustainable Agriculture' also advocates for adopting efficient, safe and environmentally sound methods of agriculture practices (Ministry of Agriculture, 2010). Further, National Water Mission aims to reduce the wastage of water by improving water use efficiencies at least by 20%. (MoWR, 2009). This could be achieved by switching over to the natural farming as the water requirement for this farming technique is much less as compared to conventional farming (Susan, 2011).

2. PRINCIPLES OF NATURAL FARMING?

Natural farming is based on the insight of Masanobu Fukuoka, the pioneer of Natural farming in Japan. He stated that 'nature is intrinsically in harmony with itself as long as there is no interference of human beings' (Fukuoka, 2009). This kind of farming was practiced in India in various forms and was referred as *Rishi Kheti* meaning agriculture adopted by the sages (Parisara, 2010). The concept aims at reproducing natural conditions that improve soil productivity and growth of plants. It is surprisingly simple to adopt. It does not entail any new or innovative methods of growing.

In nature there are various living beings. The animals, insects, birds can move from place to place, but trees cannot. However, the nature has made arrangements for the trees to prepare food by themselves. One can find a lot of grass, wild plants and trees in full blossom in forests. They grow of their own in nature without any external input by human beings. On the same analogy, natural farming principle states that the crops too could be grown without the external fertilizers and pesticides. In natural farming, the inputs available in nature in their original form are used as fertilizers and pesticides. It is suggested to use the local varieties of seeds as they are more conducive to local conditions and are resistant to pests. In natural farming, various organism and insects are allowed to grow. They decompose and convert the complex organic matter to provide food for plants. The growth of insects, spider, ants, birds etc. is allowed to have healthy eco-system leading to natural pest control (Sharma, 2009a). For this to happen, a 'microbial culture' called *Jivamrita* (Nectar for life) derived from cow dung and cow urine is applied to soil. This creates conditions very conducive for the growth of earthworms, micro-organisms and various living being which are helpful for improving the soil fertility (Palekar, 2009).

In Natural Farming, weeds are also allowed to grow, which are used for mulching. The weed prevents soil erosion, holds moisture, propagates microorganisms, produces organic fertilizer, improves soil ventilation and suppresses pests. Natural farming recognizes that indigenous microorganisms and fungi are an integral part of the ecosystem. They have an important role to play and hence, instead of eliminating them, they are respected and protected.

In natural farming, the nutrients, soil improvers, growth enhancers, pest controllers etc are all made by the farmers using natural materials generally available at the farm land. Nothing needs to be bought. The requirement of nutrients and elements like nitrogen, phosphorous, potassium, calcium etc are derived from decomposition of organic waste. Earthworm and other microorganisms play very important role in this process.

There is a slight difference between organic farming and natural farming. In organic farming, various 'organic' manures, composts, pesticides are applied to farms; while in natural farming, it is left to be in harmony with nature. Only a catalytic culture derived from cow

dung and cow urine is used. It does not require any external input in monetary terms. Hence, it is also called 'zero budget farming' in India.

3. ROLE OF EARTHWORMS IN NATURAL FARMING:

Earthworms are known as the best friends of farmers. Aristotle called them "the intestines of soil" probably because they are able to dig and move in the soil while digesting it. In Egypt, they were seen as an important element of soil fertility and Cleopatra made them sacred, prohibiting farmers from killing them (Minnich 1977; Kevan 1985). In his last book, in 1881, Charles Darwin wrote of earthworms, 'It may be doubted whether there are many other animals which have played so important a part in the history of the world as have these lowly organised creatures.' He recorded that they mix mineral and organic matter in the upper layer of soil, improving the fertility (Blanchart, et al, 2010). Earthworms have protected the 'earth' for over 600 million years as 'ecosystem engineers' and have fed people as 'farm managers' since mankind arrived on earth (Sinha and Herat, 2012).

The basic principle in Natural Farming is to facilitate the growth and multiplication of earthworms. They dig, plough and enrich the soil continuously during their life span.They till and aerate the soil. When the soil is very compact, they literally eat their way through! The burrows range from 3 to 12 mm in diameter. Through the simple act of eating, earthworms promote bacterial growth, enhance soil structure and hasten the decomposition of organic matter (Shivakumara, 2008). Most earthworms reduce plant pathogens and release enzymes and hormones in their excreta beneficial to plant growth (Gajlakshami and Abbasi, 2004). They act upto 5 M depth of soil. They give birth to about 6-7 earthworms at a time about one to six times a year. The earthworms work continuously without taking any rest and create casts of about their own weight per day. They pulverize all these materials in their intestines and a paste like cast is excreted on top of the soil. Thus the top soil becomes porous and full of enrichment and allows water to percolate in.

Earthworm casts consists of small granules of 1-2 mm diameter. It has about 5 times more Nitrogen, 7 times more Phosphate, 11 times more Potash, 2 times more Calcium and 4 times more Magnesium than the surrounding soil (Palekar, 2009). Earthworm casts contain microorganisms, inorganic minerals and organic matter in a form available to plants. Also it consists of a large number of decomposing and nitrogen fixing bacteria. It has also various microbes which kill the disease causing pathogens. The casts contain such enzymes which continue to disintegrate organic matter even after they have been excreted (Gajlakshami and Abbasi, 2004). Earthworms harbour millions of 'nitrogen-fixing' and 'decomposer microbes' in their gut. They have to necessarily feed upon microbes, particularly fungi, to meet their protein/nitrogen requirement essential for growth and reproduction. Earthworm's body contains 65% protein, 14%fats, 14% carbohydrates and 7% other matter (Visvanathan, 2005).

An hectare of living topsoil contains approximately 900 kg of earthworms, 2,400 kg of fungi, 1,500 kg of bacteria, 133 kg of protozoa, 890 kg of arthropods and algae, and even small mammals in some cases (Pimentel et al., 2005). About 10 earthworms do live and work in one sq. ft. of land (USDA, 2009). Thus in one hectare, there will be about 1 million earthworms. When these earthworms die, they release about 14% of Nitrogen of their dry weight. The biomass also contains rich potash and other minerals useful for plants.

4. PRACTICING NATURAL FARMING

In natural farming, the requisite inputs readily available on farm are used without purchasing it from market. It is encouraged to use the local seeds instead of hybrid seeds. The seed is treated with *'Bijamrita'* for better germination. There is no need of chemical or organic fertilizers. There is no need of pesticides also as the pests would generally not occur if natural farming is practiced. Even if it occurs, it would be controlled by the insects, birds, the friendly predators or pesticides derived from cow dung and cow urine. The need of all the nutrients would be fulfilled through the use of a microbial culture called '*Jivamrita* (Nectar for life)' derived from cow dung and cow urine. All that is required is Indian breed of cow, which in any case forms an integral part of farming families in rural area. Just one cow is sufficient for about 10 ha of land (Babu, 2008). It is better to use fresh cow dung and stale cow urine for preparation of such culture. Dung of Indian breed of cow is more effective as it has long intestine and the digestive process release less methane gas. (Palekar, 2011).

A large number of microorganisms are available in cow dung. These microorganism consists of Nitrogen fixing bacteria, phosphate solublizing bacteria, potash solublizing bacteria, Sulphur solublizing bacteria, Ferrous bacteria, digester bacteria and billions of other useful bacteria and fungus species. In one gram of cow dung, there are about 30-50 billions of beneficial bacteria. (Palekar,2009). When the cowdung is added for preparation of *Jivamrita,* these bacteria multiply at the speed of double in every 20 minutes. Thus, the quantity of bacteria increases manifold. Within 3 days, *Jivamrita* becomes full of microbial activities. When it is applied to soil, it attracts the earthworm population which produces very useful and fertile casts on soil surface (Raipure, 2009).

5. ROLE OF *BIJAMRITA:*

Cow dung as well as the cow urine are well known to Indians since ages for their germicidal and medicinal properties. There are mentions of use of cow dung and urine for sustainable agriculture as well as for disease prevention in ancient Indian treaties like Charaka Samhita, Sushrut, Vaghbhat and Nighantu, Ratnakar etc. (Subramaniam Swamy, 2009). In India, it was a tradition to treat the seeds with the solution of cow dung and cow urine before sowing. In natural farming, a culture called '*Bijamrita*' (Seed Nectar) derived from cow dung and cow urine is used to treat the seeds before sowing.

Bijamrita is a mixture of 20 litre water, 5 kg cow dung, 5 litre cow urine, a handful of soil and 50 gm lime. It is to be fermented for a night. The resultant solution is '*Bijamrita'*. This is sufficient for 1 quintal of seeds. Before sowing, the seeds should be put in brine solution. The seeds floating on surface are to be discarded. The rest of the seed be dried and '*Bijamrita*' applied gently. Seeds are to be dried before sowing.

Bijamrita protects the seeds from harmful fungus bacteria and pathogens and protects the crops from soil borne diseases. Further it enhances the germination and gives protection power to seedlings.

6. ROLE OF *JIVAMRITA:*

The practice of Natural farming revolves mainly around the use of Jivamrita (Nectar for life). Some people call it *Amritpani'*. *'Jivamrita*' is not a fertilizer, but a microbial culture. Soil has a lot of nutrients, but many of them are not in 'available form' to plants. Some micro-organisms, fungus and the earthworms convert these non-available forms of nutrients to available forms. Due to addition of *Jivamrita,* they become activated and supply nutrients to plants. The earthworm population increases due to application of *Jivamrita* (Rupela at el., 2006)

For preparation of '*Jivamrita*', about 200 litre of water is taken in a barrel. About 10 kg of cow dung is added to it. It is stirred well and then 2 kg of jaggery and 2 kg of flour of any pulses is added. It is again stirred well and 10 litre of cow urine and a handful of soil is added to it. The solution is kept in shade covered with porous gunny sack for 48 hours for fermentation. This is required to allow escaping of poisonous gases like CO_2, CH_4 and NH_3. After 48 hours ***Jivamrita*** is ready. This should be used within 7 days. After 7 days the nice smell turns to pungent but still you can pour it on empty lands. This *Jivamrita* is sufficient for one acre of land.

Jivamrita is to be either mixed in the water to be supplied to land or added directly to the soil. In ponded agriculture fields, it could be added at four corners and the middle of the field. *Jivamrita* is to be applied preferably once in 15 days. But when this is applied, soil should have moisture (Palekar, 2011). *Jivamrita* could be sprayed on crops or fruit trees also. For this, 5 litre *Jivamrita* is to be filtered through cloth and added in 100 litre of water. It acts as growth hormone, anti-fungal medicine, anti-harmful bacterial alkaloids useful for conversion of soil nutrients from non-available to available form.

When the *Jivamrita* enters the soil, miraculous action takes place. On the fourth day, numerous local earthworms would be visible in soil. They get attracted to the *Jivamrita* and come out from the depth of soil. After 7 days, there will be remarkable change in the colour of the leaves of the crops. They will become more greenish and healthy (Palekar, 2009).

7. PREPARATION OF NATURAL PESTICIDE

Cow urine and neem are important constituents in preparation of natural pesticides. Neem is very effective in management of approximately 200 insects, pests and nematodes. It is very effective against grosshoppers, leafhoppers, plant hoppers, aphids, moths, caterpillars, beetle etc. Cow urine is very effective in management of pathogens and insects and also acts as growth promoters for the crops (Yadav, 2010).

For preparation of natural pesticide called *Neemastra*, 2 kg of cow dung is mixed in 200 litres of water and 10 litres of cow urine is added to it. The paste of 10 kg of *Neem* tree leaves is added to this mixture and stirred it vigorously with a stick. It is kept in a shade for 48 hours for fermentation, duly covered with gunny bag. It is again stirred well clockwise for 1 minute every morning and evening. The solution is filtered using a clean cloth and store it in a vessel. This is *Neemastra* (Palekar, 2011). It is good to keep this in earthen pots. This has to be sprayed directly on plants without dilution. Apart from Neem tree leaves, leaves of other trees which the cows does not eat can also be added to prepare natural pesticide. Such bio-pesticides are reported to be very effective in controlling pests as compared to the chemical farming (Ranga Rao, 2007).

8. EFFICIENT WATER USE THROUGH NATURAL FARMING

Natural farming is reported to be very effective in reducing the water requirements in agriculture. It promotes mycorrhizal association. Better absorption of water and nutrients take place in plants grown under natural farming due to symbiotic association between root and fungus. Susan (2011) reported that the water use in natural farming is reduced by 30%. Pretty et al. (2006) also reported higher water use efficiencies in such agriculture systems. The 21 year long study at Rodale institute FSI in Pennsylvania established that the water volume percolating through such agriculture practice was 20% more than the convention farming

system (Yadav, 2010). This indicated an increased ground water recharge and reduced run-off in natural farming system.

8.1 Earthworms: The earthworms dig burrows, leave casts and provide aeration in soil. Earthworms modify the physical structure of soils by producing new aggregates and pores, which improves soil aeration, infiltration and drainage. They improve soil porosity by burrowing and mixing soil (USDA, 2009). Singh et al. (2007) carried out various experiments in India and observed that there is improvement in infiltration rates due to earthworm activities. Hynes (1998) also reported that the additions of organic manures results in increased water holding capacity, porosity, infiltration capacity, hydraulic conductivity and water stable aggregation and decreased bulk density and surface crusting. The extensive channelling and burrowing by earthworms loosens and aerates the soil and improves soil drainage. Soils with earthworms drain up to 10 times faster than soils without earthworms. In zero-till soils, where worm populations are high, water infiltration can be up to 6 times greater than in cultivated soils. Thus, there is conservation of water due to reduced runoff and less evaporation from soil surface. Also, the earthworm casts have very high water holding capacity which ultimately reduces the water requirement for irrigation (Palekar, 2009).

8.2 Insects, ants, termites: In natural farming, the insects, ants and termites are allowed to grow. Their activities make soils porous reducing the surface runoff from the farm lands. The dead remains of insects and ants add to the organic matter in the soil improving its water holding capacity.

8.3. Trees: In natural farming, trees are encouraged to grow at the farm boundaries. They provide resting place for birds. Birds feed on about 50 enemy pests thus controlling their population (Sharma, 2009a). The presence of trees retards the wind speed thereby reducing the evaporation of water from soil surface. The presence of trees lowers the temperature which ultimately reduces loss of water from soil.

8.4 Crop rotation: The rotational cropping pattern helps in improving the soil biodiversity and nutrients content. Dick (1992) stated that crop rotation improves the soil microbial activities. Crop rotation help in improvement in crop yields by way of suppressing deleterious microorganisms that flourish under monoculture. Addition of organic matter increases soil biological activities due to availability of plant biomass. The rotation of crops with cultivation of legumes is helpful for nitrogen fixation. Dicots have the special property of fixing free atmospheric Nitrogen in the soil in symbiotic association with bacteria named Rhizobium present in their root nodules (Palekar, 2009). This gives rise to microbial activities altering the soil structure thereby and hence there is efficient use of water.

8.5 Role of Mulching in Natural Farming: Mulching is an essential part of natural farming. Mulching could be done by cultivation of appropriate intercrops between the rows of the main crop. Dry twigs and leaves can also be spread in between the crops as mulch. On application of *Jivamrita*, the leaves and twigs get decomposed adding fertility to the soil. With soil surface completely covered with intercrops and mulch, the sunlight is optimally absorbed by the canopy itself, and little or no sunlight falls on the soil directly. This helps to maintain a microclimate with high humidity and moisture is retained in the soil, which in turn reduces the external water requirement (Sathyanand,2010). Mulching also reduces weed growth. It improves soil structure and water infiltration, decreases water runoff, reduces soil surface temperature and hence reduces water evaporation. Mulching reduces tillage, promotes humus formation and enhances the water holding capacity of the soil. Adequate mulching

keeps the top and sub soil moist and also reduces water loss due to evaporation so that the crop will be better equipped to tide over drought conditions (Babu,2008).

The root hairs are present just below the end of tree canopy. So it is not necessary to give water to root of plant directly. Supplying water at the edges of the tree canopy is more appropriate. The roots will reach towards this source of water which is rather slightly away. This way, the length of root will increase and hence the height of plant and the yield will improve. If this method of irrigation is practiced, there will be huge saving of water as compared to normal irrigation system (Sathyanand 2010).

9. YIELDS AND QUALITY OF PRODUCE:

In naturally managed farms, the qualities of plant and animal products are much better in terms of nutrition, taste and shelf life (Sundaravadivel et al, 2011). Aher et al., (2012) compared the studies carried out by various scientists and found that the yields from such farming are more than the conventional farming. Susan (2011) reported that the yield from natural farming is double as compared to the conventional farming. Sharma (2009) reported higher yields from his farm as compared to the conventional farming. Vijayakumari (2012) conducted studies in Tamilnadu (India) using various methods of farming and found that natural farming gave more yields. Mohan (2008) carried out extensive studies on yield of vegetable crops using natural farming and reported that this method of farming give more yield than convention farming. Pretty (2006) also reported that the yields from such farming are 79% more than the conventional farming. Hindu (2009) reported a case of farmer in Karnataka who got the yield of 3 tonnes of paddy in an acre of land as compared to 1.18 tonnes by his neighbouring farmers who used conventional farming.

It is also observed that the quality of crop from natural farming is much better than the conventional farming. It is reported that such grown fruits and vegetables have been found to be highly nutritious, rich in 'antioxidants' than their chemically grown counterparts and can be highly beneficial for human health (Sinha et al, 2012). Cho (2012) observed that the natural farming produce has much higher nutritional contents. Proteins, amino-acids, crude fats and other essential nutrients in natural farming are identified to be as much as 300% higher than in conventional farming.

10. MITIGATION OF EFFECTS OF CLIMATE CHANGE:

Agricultural activities also are responsible for emissions of about 30% of greenhouse gases (ICID, 2012). Chemical agriculture has further augmented greenhouse gas emissions. From production in factories to their transport and use in farms, agrochemicals generate huge toxic wastes and pollution and greenhouse gases. Much of the world's carbon is held in the soils as 'soil organic carbon' (SOC). The conversion of SOC as CO_2 in the wake of modern mechanized chemical farming practices has augmented the atmospheric carbon pool as greenhouse gas, inducing the global warming and climate change (Sinha et al, 2012). Of the increase of atmospheric carbon over the last 150 years, about a third (33.3 %) is thought to have come from agriculture (Robbins, 2004). Thus, the problem of climate change can be mitigated by way of putting carbon back into the soil. This process is called 'carbon sequestration'. It can be done through sustainable agricultural practices like natural farming (Pandey and Singh,2011).

The Intergovernmental Panel on Climate Change (2000) recognised carbon sequestration in soils as one of the possible measures through which the greenhouse gas (GHG) emissions and global warming can be mitigated. A recent study conducted in Punjab (India) indicated that organic amendment can significantly reduce methane emission from rice field (Khosa et al., 2010). Use of crop residues and manure enhances soil organic matter content and earthworm activity to increase soil quality and C sequestration (Lal, 2004).

Earthworms feed on the 'fragile carbons' which is liable to be oxidised as CO_2 and secrete more 'stable carbons' to be retained in soil (Sinha et al., 2012). Thus, Natural farming has vast potential of C sequestration and GHG emission mitigation. It will provide a cost-effective opportunity to climate change mitigation and also help sustain food security in the world.

11. SUSTAINABILITY OF NATURAL FARMING:

Natural farming utilizes only the naturally available resources for agriculture. It uses minimal external inputs. The input cost in such farming is very low while the yields are higher than the conventional farming (Dutta, 2007). There is improvement in the health and fertility of soil due to natural farming (Aggarwal, 2007). The scientific appraisal of 'Natural Farming' was carried out by Babu (2008). It was observed that it is eminently suited to the farmers, especially the small and marginal farmers because of its simplicity, adoptability and low cost of cultivation. Treatment with *Bijamrita* and *Jivamrita* has given extremely encouraging results for successful cultivation of crops. All the farmers selected for the study had expressed satisfaction about this method of farming and stated that the method had paid them good dividends. Lim (2011) carried out extensive review of such farming techniques and found that these farming techniques are most effective and environmentally, socially and economically sustainable. It allows farmers to improve local food production with low-cost, readily available technologies and inputs without causing environmental damages. Tamilnadu Agriculture University, Coimbatore, India has carried out studies on this system of farming and reported that the input requirement for this farming is just about 20% of the conventional system. Further, the shelf life of the produce is more and the sturdiness of the crop to drought condition is also reported to be improved (Selvaraj, 2007). Ramesh et al (2010) found that the net profit from such farming is 22% higher in such farming that compared to conventional farming. Vikas Sahyog Pratishthan (2010) has done extensive works at various villages in Maharashtra and demonstrated that even by cultivating on 12 gunthas (0.25 acre) of land, a farming family can have sustainability by adopting the natural farming technique. The 7 year long –term field trial at ICRISAT (AP, India) indicates that the net returns from such farming system is more as compared to the conventional farming syatem (Yadav, 2010).

Many of the developing countries do not have sufficient irrigation facilities. Natural farming play very important role under such conditions as it requires very small quantity of water as compared to conventional farming (Palekar, 2011). Plants grown under natural conditions consume less water (Parisar, 2010). Further, the crops grown have higher sustenance in even low rainfall conditions. Just one cow will be sufficient to provide dung and urine to cultivate 30 acres of land. As the expenditure required for natural farming is relatively less, a large number of farmers in India have switched over to the natural farming and they are reaping more benefits.

The area under natural farming is steadily increasing in India. It is widely adopted in Maharashtra, Karnataka, Andhra Pradesh, Kerala, Tamilnadu, Madhya Pradesh and Punjab.

The area under organic farming is also increasing. Area under organic farming was 4.4 Mha in 2011 (Hindu, 2011). This increased to 5.56 Mha during the year 2012 (Sakal, 2013). A provision of Rs. 351 cr has been kept in the Indian budget of year 2011-12 for promoting such kind of farming. During 2008-09, India produced about 1.878 Million tonnes of certified organic products. In an endeavour to promote such farming, Govt. of India has started a mission for 'Sustainable Farming' in the country (Ministry of Agri., 2010). The natural farming too has a great potential for adoption as it is economically and environmentally more sustainable and easy to adopt. There are numerous success stories of farmers who have switched over to this method of farming and have gained economically. Thus, the farming technique has a bright future in India. It can be emulated in other countries also.

However, more efforts are required to propagate the farming system among farmers. Various trainings need to be organized to educate farmers about the same. A few people like Subhash Palekar of Amravati, Subhash Sharma of Yeotmal, Bhaskar Save of Gujrat and Partap Aggarwal of Madhya Pradesh are devoted for spreading this farming in the country. Various agriculture departments and universities are also propagating this techniques (TN Agriculture University, Coimbatore). The aroma, beauty and the sight of healthy plants on the natural farms give a sense of serenity and fulfilment to the visitors to such farms.

12. CONCLUSION:

In natural farms, the inputs available with the farmers are used. It is very easy to adopt. It does not involve much input. There is no need to buy costly seed, chemical fertilizers and pesticides. A catalytic agent *Jivamrita* derived from cow dung and cow urine is used in this kind of farming. It increases the microbiological activities in soil. The population of earthworms increase and natural aeration and tilling take place. The highly fertile earthworm casts, biomass of microorganism and the decomposed organic matter provide required nutrients to plants. The soil becomes more fertile. This also improves soil porosity, water holding capacity and the rate of infiltration. There is less evaporation from soil surface. All these lead to less requirement of water for farming.

The method also aids in mitigation of problems of waterlogging and salinity. It also reduces green house gas emissions and acts as a mitigation measure for global warming. The yields from natural farming are higher and also have high nutritional value. It is very cost effective and ecologically sustainable. A large number of farmers in India have adopted this system of farming and are happy due to higher agriculture production. The method could be spread in other countries also for clean, healthy, poisonless and nutritional food. As Fukuoka said, the ultimate goal of natural farming is not the growing of crops, but the cultivation and perfection of human beings.

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