

## Shifting Cultivation: An ‘Organic Like’ Farming in Nagaland

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### ABSTRACT

Nâga farmers adopt an age-old traditional cultivation system called shifting cultivation, where a land is selected for cultivation for one or two years and thereafter left it abandoned for several years. About 73% of the people in Nagaland are dependent on agriculture and most of them are involved in shifting cultivation, because of compulsion of its natural hilly topography and traditional way of cultivation. It is a known fact that shifting cultivation has negative impact on soil health and ecosystem. Adopting integrated farming system model may be the best for saving the environment. But, it won't be possible for someone whose occupation changes drastically overnight. Issuing certificate as ‘organic like’ agriculture to those who wish to practice improved shifting cultivation with minimum impact in the ecosystem may alter this environmentally harmful system into less harmful and the poor farmers can fetch a premium price over the conventional products.

**Keywords:** Shifting cultivation, integrated farming system, organic, environment.

### INTRODUCTION

Nagaland, a state in North Eastern India with geographical area of 16,579 km<sup>2</sup> (located in between 93°20' and 95°15'E longitude and 25°6' and 27°4'N latitude) receives an annual rainfall of 2,000-2,500 mm. It has a total population of about 20 lakhs with a population density of 120 persons/km<sup>2</sup>. The area under forest cover is about 8,62,532 ha which represents about 55.8% of total land mass and area under shifting cultivation is 123,909 ha (Table1). Due to wide variation in altitude (100–3,840 m asl), different agro-ecological patterns and farming systems including shifting cultivation are predominant in this state having a large number of ethnic groups and several sub-ethnic groups with intricate lifestyle. A total of 73% of the people in Nagaland are dependent on agriculture (Nakro 2009). The present agricultural practice of Nagaland is organic by default (Yadav et al. 2004), unlike the modern mechanized farming system in plain areas of the country. In comparison with all the states of India, Maharashtra alone has about 0.5 million ha

area which is under organic farming, out of this only 10,000 ha is the certified area (Bhattacharya and Chakraborty 2005), while in Nagaland, out of 7, 22,464 ha total cultivated area, only 3000 ha of land is under certified organic farming benefiting 3,575 farmers growing crops like maize, soybean, french bean, ginger, large cardamom, passion fruit and chilli (Anonymous 2013).

Traditionally, shifting cultivated fields are slashed, dried and burnt *in situ* which eradicate soil surface inhabiting micro-organisms including pathogens and other pests making the field suitable for cultivation of different crops, Zero tillage method, that includes stick dibbling method, which is normally primitive for growing of the crops. This practice enhances quick germination of seeds without getting infected by the soil borne pathogens. Upland paddy is often mixed with other crop primarily to create a physical barrier for the movement of insect pests- pathogens. Secondly, this practice provides food source to the farmers throughout the year. Sometimes creeping vegetables like pumpkin, cucumber, etc., are incorporated in

between plants primarily for checking the weed pests and secondly attracts the insect pest pathogen for feeding in preference over the paddy crop. It has also been observed that jobs tear (*Coilacryma jobi* L.) are sparsely cultivated in patches over the paddy field to avoid birds and rodents pest. These plants produce disturbing and loud sounds during the blow of winds which inturn drive out the entry of rodents and birds in the field. Pungent odour spices like ginger, garlic, onion chilli etc are usually grown in paddy field which directly or indirectly repel the pest pathogen from the paddy field. Apart from these, Farmers in hills make use of plants like *Clerodendron serratum* near the paddy field so as to avoid the incidence of insect pests over the paddy field. With the decomposition of the leaves of *C. Serratum*, *Artemisia vulgaris*, *Eupatorium odoratum*, *Meriandra bengalensis*, *Eucalyptus* spp. they slowly emit an unpleasant odour and inhibit that help in the occurrence of pests and pathogen over the field as reported by Bidyalakshmi (2010). Likewise, there are several ITK's practiced in shifting cultivation, which are similar to Organic farming. However, the farmers are not getting certificate for organic farming because of its harmful effect on environment. This article aims to review and reflect the situation/condition under which the shifting cultivation is practiced without any inorganic source of nutrition for plant growth and development.

### Concept and facets of organic farming

Sir Albert Howard, father of organic farming feels that a shift from natural methods of crop production to adoption of newer methods finally leads to the loss of soil fertility. Codex Alimentarius Commission defines "organic agriculture as holistic food production management system, which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles and soil biological activity. It emphasizes the use of management practices in preference to the use of off-farm inputs, taking into account that regional conditions require locally adapted systems. This is accomplished by using, wherever possible, agronomic, biological and mechanical methods, as opposed to using synthetic materials, to fulfil any specific function within the system" (FAO, 1999). Thus, organic agriculture avoids or largely excludes the use of synthetic chemical fertilizers, pesticides, growth regulators, livestock feed additives etc. and solely depends on the use of animal manures, crop

residues, off-farm organic wastes, green manures, crop rotation with legumes and biological pest control to maintain soil productivity (Palaniappan and Annadurai 1999). The idea nourish the soil rather than the crops to sustain soil health, and it is a means of giving back to the nature what has been taken from the soil (Funtilana 1990).

Organic farming is being treated as a measure to restore sustainability of agricultural production and maintaining environmental quality at the same time (Hazarika 2013). Improved soil biological activity, as influenced by organic farming, is also known to play a key role in suppressing weeds, pests and diseases (IFOAM, 1998). There is scientific evidence that organic agriculture can sequester more carbon than conventional agricultural practices. Studies showed that higher carbon accumulated in organic systems as compared to the conventional systems (Niggli et al. 2009). It was estimated that the global average sequestration potential of organic crop was 0.9-2.4 Gt CO<sub>2</sub> per annum, which was equivalent to an average sequestration potential of about 200 to 400 kg C/ha/yr for all croplands (Schjonning et al. 2002). In, nearly 40 years of cropping, organically managed soil had greater aggregate size, stability in water, and microbial biomass carbon than conventionally managed soil (Schjonning et al. 2002). It may sound realistic that fields not receiving fertilizers (urea, diammonium phosphate or DAP and single super phosphate or SSP) will have lower fertility than those receiving alternative inputs (FYM, biomass etc.), but that is not acceptable. In field where organic farming is being followed, its fertility is highly unlikely to be low due to the fact that it is a more close system as compared to the conventional agriculture, where most farmers remove all biomass from above the ground. Also, it may be noted that the use of most fertilizers adversely affects the functions of the agriculturally beneficial microorganisms (Streeter 1988). Thus, the use of fertilizers beyond a threshold level adversely impacts productivity and harms the microbial life of soil. A research finding showed that the field receiving organic inputs generally has healthy soils rich in microbial life (Parr et al. 1992). It has been estimated that accumulated P in soil is adequate to sustain the crop yields globally for about 100 years (Goldstein et al., 1993). Plants cannot use these elements as food unless converted to soluble form or 'available form'. In organic farming, plants have

to convert the unavailable bound forms to available form and that happens due to organic acids produced by beneficial microorganisms. These microorganisms are abundantly available on the surface of plant roots or in products such as in 'cow dung ferments', widely used in organic farming. Improved P-availability has been reported when some plants or crops secreting mineral solubilising factors from their roots e.g. 'psidic acid' from roots of pigeon pea as reported by (Ae et al. 1990). Bagged fertilizers used in conventional agriculture in soluble form, can be readily taken up by plants. But, it is NPK fertilizer that is widely available in market. Excessive or inappropriate use of NPK fertilizer can cause imbalance in availability of the different other elements needed for plant growth, besides potentially suppressing functions of beneficial microorganisms (Streeter 1988). Approximately 30 different elements found in plant tissues and therefore needed for their growth of the plants. Among these nutrients, four (nitrogen, carbon, hydrogen and oxygen) constitute about 90% of the body weight of a plant (Bourguignon 1998). It is worth noticing that all the four are gases. Non-believers or unaware persons may note that ash content is generally less than 10 % of crop biomass when burnt and it is suggestive of the fact that rest of the mass was due to gases or the elements that are volatiles. A plant can access the gases from air or soil (i.e. air in soil pores) and assimilate them in the presence of light through biochemical processes (eg. photosynthesis) going on in its body during the growth process. Only rest of lesser than 10 % of its body weight is accessed exclusively from soil. It is hypothesized that in organic farming plants can access much of their need of the four major elements (N, C, H, and O) from air (including the air in the soil pores) and water.

### **Scenario of shifting cultivation vis-a-vis organic farming in Nagaland**

Nagaland possessed the second highest acreage under shifting cultivation next to Manipur. Land use pattern of Nagaland revealed that almost 16% of the total geographical area is under net sown area. About 1, 23,909 ha area is under shifting cultivation, which accounts for almost 7.5% of total area, 42% of total cropped area and 47.5% of net sown area. *Naga* farmers practise organic farming like system over generations mostly on hill slopes through a primitive land use system, i.e. shifting

cultivation. In another recent estimate, it is reported that land under shifting cultivation is covering an area of 7,000 sq km out of the total state geographical area of 16,579 sq km (Rathore et al. 2010). It is an extensive method of agriculture in which farmers rotate land rather than crops to sustain livelihoods. In this practice, at first a forest area is chosen, mostly at the top of the hills and the big trees, other vegetations are cut down and taken away for wood and fuel purpose. Thereafter, the leftover dried twigs of the plants are burned in-situ (Chatterjee 2012). Then, the seeds are sown with the first flash of pre-monsoon rain received during March-April, followed by harvest. The same piece of land is utilized for cultivation for a maximum of two years or seasons. The land is then left for growing of forest and the same site is again chosen for cultivation after 5 years. Thus, the practice of shifting cultivation results into destruction of natural vegetation, biodiversity, soil erosion, nutrient loss, and production of green house gases during burning. Due to these destructive effects on environment, getting certificate for organic agriculture is difficult in shifting cultivation, though the farmers are growing the crops organically. The nutrient requirements of crops are fulfilled mainly by natural resources from the dung of cow, mithun, pig and other animals. Even in many villages, farmers are instructed by the elders not to apply any chemical fertilizers as they believe that, these will degrade soil fertility in the long run. This attitude creates negative impact on fertilizer use and perhaps because of this the state is one of the lowest consumers of chemical fertilizers per hectare ( $1.5 \text{ kg ha}^{-1}$ ) in the country (FAI 2004).

### **Indigenous crop, soil and pest management in shifting cultivation**

The Nāga farmers harvest the crops by cutting or picking the economically important part, for instance paddy panicle, maize cob etc. leaving behind the residues in the high slope of the hills which protects the soil from erosion as well as enhance fertility after the decomposition of crop residues. Mixed cropping is preferred in shifting cultivation (Ramakrishnan 1992) to suit local conditions and to balance the nitrogen demand of the crops sufficiently. Nearly about 10-20 or more crops are grown on the same plot as intercrop with paddy as the main crop (Das et al. 2002). Requirements for other nutrients like P, S and

micronutrients are met with local and preferably renewable resources. Likewise, Alder (*Alnus nepalensis*), a non-leguminous tree which fixes 150 kg atmospheric N ha<sup>-1</sup> (Sharma et al. 2002), is also grown in many fields under shifting cultivation of Nagaland, Sikkim and other North Eastern states for enhancing the soil productivity for growing various crops. Apart from nutrient management, several organic management practices are followed to control insects, diseases and weeds like application of common salt to control broad leaf weed (Tabin and Singh 2008), use of dhatura (*Datura stramonium*) stems and leaves to control stem borer infestation in paddy (Das et al. 2002), use of dead frog or crab to control bug in paddy (Das et al. 2002), use of ash in terraced fields to prevent paddy from dying of unknown etiology after transplanting (Das et al. 2002), etc. In shifting cultivation no draft animals or heavy machineries (tractor, power tiller etc.) are used except the human labour. Sowing is done by the minimum tillage operations through dibbling or broadcasting and after harvesting the crop residues are left in their field. These two processes resemble shifting cultivation with the conservation agriculture.

### **Role of government and certification agencies in the state**

With the increasing demand for organic commodities, the Department of Agriculture, Government of Nagaland has initiated several programmes to strengthen the organic farming system in Nagaland. Schemes on promotion of organic Nagaland has being taken up under National Project on Organic Farming (NPOF) sponsored by the Ministry of Agriculture, Government of India. The Ministry of Commerce has also launched National Organic Programme in April 2000. Apart from this, Agricultural and Processed Food Products Export Development Authority (APEDA) is implementing National Programme for Organic Production (NPOP) in Nagaland (Gouri, 2004). Under the NPOP, documents like National Standards, accreditation criteria for accrediting inspection and certification agencies, are prepared and approved by the National Steering Committee.

Certification of organic farms is required to satisfy consumers that the produce is totally organic. In India, APEDA, an apex organization under Ministry of Commerce, has formulated a National Programme for Organic Production (2001) and also

developed a logo, 'India Organic'. APEDA has also accredited a number of organizations for certifying organic farms. In recent years, a number of national certifiers are also engaged in certification activity in Nagaland.

### **Marketing of organic products**

Organic vegetables fetch a premium price of approximately 10- 50 % higher over conventional products. Market of organic products is growing at faster rate as compared to conventional ones. Export preference of organic vegetables offers a great scope to a state like Nagaland, which has inculcated the skill of growing crops organically since time immemorial. But in Nagaland even today organic products are sold in market as per the rate of non-organic produce and thus, fetches low income and productivity. Seufert et al. (2012) showed that organic yield was typically lower than the conventional yield. Moreover, high cost of certification had always been a matter of concern for small and marginal farmers. This problem continues because of unawareness among the poor farmers, inaccessibility of the extension personnel to the farthest corner of this mountainous state, lack of social media in local languages, lack of large scale production, poor transportability, lack of entrepreneurship, etc. However, recently some of the organic products in Nagaland like King chilli (raja mircha), squash, passion fruit etc are been sold in neighbouring states and even in international market.

Creation of awareness and dissemination of knowledge on Organic Farming through field demonstrations, social media, programmes etc. are the peak requirement of time. However, process of certification needs to be improved. The Government of Nagaland has affirmed its intension to work for total organic and defined organic pathway and policies. Under the service provider scheme of NPOF, more than 300 farmer groups have been developed throughout the country to spread organic farming. Various other schemes of NPOF being operated through the state Governments and many non-government agencies (NGO's) have also contributed extensively to the growth of organic agriculture.

### **How shifting cultivation differ from Non Pesticidal Managed (NPM) certificate?**

In many cases, the policy makers and scientists advocate to provide at least Non Pesticide

Management (NPM) certificate, as this scheme is in place in Southern India. NPM describes various pest-control techniques which do not rely on pesticides (Ramanjaneyulu et al. 2004). It may be defined as an 'ecological approach to pest management using knowledge and skill based practices to prevent insects from reaching damaging stages and damaging proportions by making best use of local resources, natural processes and community action' (Ramanjaneyulu et al. 2008). Some examples of Non-Pesticidal Management techniques include: Introduction of natural predators, Use of naturally occurring insecticides, such as Neem tree products etc. Non Pesticidal Management is mainly based on (Ramanjaneyulu et al. 2008): (i) Understanding insect biology and behaviour and managing them before they reach damaging stage and proportions. These preventive measures will reduce the pest numbers, (ii) Understanding crop ecosystem and suitably modifying by adopting suitable cropping systems and crop production practices, (iii) Building Farmers knowledge and skills in making best use of local resources and natural processes, and (iv) Natural ecological balance which ensures that pests do not reach a critical number in the field that endangers the yield. Ramanjaneyulu (2009) reported that the costs of cultivations could be brought down significantly without reduction in yield in such system. However, in shifting cultivation there is a possibility that they may get certificate for land as – "Non Pesticide Managed" (NPM), but this only deals with pests not with several issues as shifting cultivation does. The shifting cultivation essentially includes (i) Non application of chemical fertilizers and fulfilment of fertility requirement from traditional sources, and (ii) No tillage operations and residues are left in the field. Thus, shifting cultivation deserves a certificate, which is better than NPM. Since, farmers involved in this practice are not able to get a certificate for Organic Agriculture, therefore, a separate certificate "Organic Like" may be provided for the benefits of these farmers.

## CONCLUSION

For making shifting cultivation more acceptable, scientific systems of organic cultivation should be taught; special incentives and crop insurance may

be provided; and higher income should be guaranteed for the improved products of shifting cultivation on contrary to the non-organic products coming from the neighbouring states. Although, farmers in this region were adopting this age-old traditional shifting cultivation, because of compulsion of the natural hilly topography of the state. The practice of shifting cultivation eradicated and replaced with integrated farming system model may be the best for saving the environment, but not for someone whose occupation changes overnight radically. For this reason, scientific systems of organic cultivation should be taught since this gives a better option to generate income in a land where fertilizers has never been used before; special incentives and crop insurance may be provided. Even today traditional organic products are sold in market as per the rate of non-organic products and thus faces low income and productivity to the farmers. Issuing certificate as 'organic like' agriculture to those who adopt improved shifting cultivation may alter this environmentally harmful system to less harmful so that the farmers can fetch a premium price over the conventional products.

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