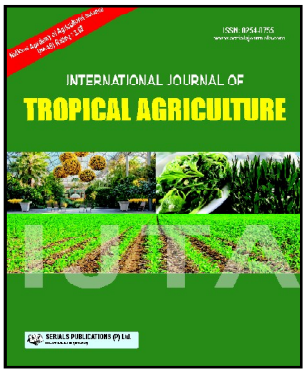

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Sustainable Hill Agricultural Diversity of Nagaland

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Abstract: Nagaland lies in one of the 10th distinct bio-geographic zone under one of the identified 18 Mega hot spot in the world with reference to threats to biodiversity. It has the finest tropical and subtropical evergreen forests along with unique broad leaved Moist Temperate forests. The floral vegetation and fauna elements represent the transition zone between Indian, Indo Malayan and Indo Chinese bio-geographic region. Patkai range of Nagaland acts as a bio-geographic gateway and many ancient angiosperms and primitive flowering plants present in this mountain range. Nagaland is as part of Eastern Himalayas, as one of the centre of origin of rice and secondary origin of citrus, chilly and maize. These unique and rich terrestrial flora and fauna diversity support a sustainable rich agro biodiversity with different types of traditional farming practices of rice based agriculture, which elements had evolved, over to a millen-nia, in intricate association with the communities distributed along the mountain and hill slopes. Natural topography coupled with age-old system the people have developed a skill farming practices culturally and ecologically suited to the cultivation systems which has conserved many indigenous lesser known, semi-wild germplasm of various crops through various farming systems of Jhuming, Zabu, Alder based Shifting Cultivation, Upland Wet Terrace farming, Kitchen gardens, Agroforestry system. The most remarkable feature of Jhum cultivation is that more than 50 various crops of cereals, vegetables and fruits can be grown in one Jhum fallow field following the mixed and sequential cropping system. Mixed cropping and multi-layer structure are basic traditional features of shifting cultivation making it a 'biodiversity hot spots' in the village landscape. A total of 110 crops and 867 rice genotype are listed from the rice based farming system alone, and more than 40 lesser known fruits and vegetables are also recorded from the fallow land.

Key words: Sustainable, hill agro-diversity of Nagaland.

INTRODUCTION

Nagaland is one of the frontier-state of Indian union. It is flanked by Myanmar in the East, Assam state in the West and North, and Manipur state in the South. It lies between 25°6′ and 27°4′ North latitudes and 93°2′-97°15′ East longitudes. It has a total area of 16,580 sq. km., with a total population of 1.99 million (2001 census). The Nagas are the indigenous inhabitants of the state constituting about 84% of the total population being influenced by Christianity. Naga languages have been included under the Tibeto-Burman family of language by the Survey of India.

Nagaland prevails one of the richest biodiversity in the country as well as in the world as per given unit area (Changkija 2014). It lies in one of the 10th distinct bio-geographic zone under one of the identified 18 Mega hot spot in the world with reference to threats to biodiversity (Meyers, 1988). It has the finest tropical and subtropical evergreen forests along with unique broad leaved Moist Temperate forests. The floral vegetation and fauna elements represent the transition zone between Indian, Indo Malayan and Indo Chinese bio-geographic region and Patkai range of Nagaland acts as a bio-geographic gateway and also due to many ancient angiosperms and primitive flowering plants present in this area is considered as a cradle of flowering plants (Takthajan 1996). Nagaland as part of Eastern Himalaya is considered as one of the centre of origin of rice and secondary origin of citrus, chilly and maize. Nagaland is featured with young mountainous hilly, sharp crest, ridges, deep gorges with narrow valleys, and the whole state enjoys the popular Monsoon climate with an annual average rainfall of 250 cm and 85% of relative humidity. The area is endowed with rich flora and fauna, exposed to monsoon current of heavy rainfall with high relative humidity and the rate of evaporation is low. The conditions are not so uniform all over the area, and differ from the foothills to the hills and to higher hills varying to different vegetation systems.

The vegetation types of Nagaland forest are classified as follows:

1. Tropical forests (Up to 1000 m.)
   - (a) Tropical Wet Evergreen Forest
   - (b) Tropical Semi-Evergreen Forest
   - (c) Tropical Moist Deciduous Forest
2. Subtropical forests (between 1000-1800 m.)
   - (d) Sub-tropical evergreen broad leaved forests.
   - (e) Sub-tropical mixed deciduous broad leaved forests
   - (f) Sub-tropical Pine forests.
3. Temperate forests (1800-3848m.)
   - (g) Montane Wet Temperate Forest
   - (h) Temperate Rhododendron forests
   - (i) Sub-Alpine Forest

AGRO-BIODIVERSITY

A unique and rich terrestrial flora and fauna diversity along the altitude gradient from flood plains to high mountain ranges support diversified agriculture systems evolving different farming practices resulting rich agro biodiversity within its micro climatic ecosystem conditions. These rich agro-diversity elements have evolved, over a millennium, in intricate association with the communities distributed along the mountain and hill slopes. The interactions between the tribal people and the natural system have helped in maintaining the richness of its genetic materials in both production systems and wild lands species communities of the mountain environment (Changkija 2000). Nagaland of Eastern Himalaya is considered as primary and secondary center of origin of rice, maize, millets, chilies (capsicum) and cucumbers representing a rich of germplasm diversity. That large number of quality rice of glutinous, aromatic and medicinal values are

produced under the influence of micro climatic conditions and their different ecosystems in the state (Changkija 2012). The varied climate and the altitude have also greatly influence the rich biodiversity along with agricultural diversity. The impact of the environment on a culture is often primarily perceived through an examination of the subsistence technology, which is universally of fundamental interest to all societies of man. This study has been carried out with the objective of making a detail survey on agro-diversity of traditional practices such as the Jhum system, Alder (*Alnus nepalensis*) based cultivation system, Zabu farming system, wet terrace system, Agro-forestry called "Soumni/Yokya" and the Kitchen gardens. This is viewed as the result of a long period of the people's interaction with their environment, in an area mostly located in the subtropical belt with hilly terrain consisting of gentle slopes. The people with their simple technology are seen to have developed a subsistence skill much suited to their natural habitat. Main source of livelihood of the people in Nagaland is agriculture as which about people engaged in agriculture as their main occupation. Among the farming systems majority of is under shifting/Jhum cultivation due to the nature of the topography of the land and its ecosystem and this practice of jhum is a way of life.

The Naga way of life revolves around two (2) types of cereal based farming system, *i.e.*

(1) Dry-land cereal based cultivation and

(2) Wet-land rice based cultivation which governs most of their life, culture and traditions.

Both dry and wet cultivation systems support rich agro-biodiversity resulting in perfect sustainable cropping pattern. Total number of 867 paddy land races (genotypes) has been recorded from Nagaland and more than 100 different mixed cropping crop species grown in the jhum system of cultivation in Nagaland (Appendix-2).

Dry-land Cereal Based Cultivation

Dry-land cereal based cultivation practices in Nagaland can be sub-classified into nine (9) categories based on two cropping system of Sequential cropping and Intercropping systems. Out of nine (9) categories, six (6) cultivation systems are the most prevailing system is the Jhum /shifting cultivation practices supporting a rich agro-biodiversity and are as follows:

Jhum/Shifting Cultivation

(i) One year cropping Jhum; practice by tribes of Ao, Lotha, Sangtam, Sumi, Phom, Lower Konyaks.

(ii) Two fallow years Jhum cropping; Practice by tribes of Ao, Lotha, Sangtam, Sumi, Chang, Phom, Lower konyaks, Yimchungru, Khiammungan.

(iii) Jhum practiced of Upper Konyaks tribe.

(iv) Jhum system of Eastern Nagaland: practiced by tribes of Yimchungru, Khiammungan, Chang.

(v) Jhum Cultivation System of Job's tears with paddy; practiced by tribes of Angami, Chakisang, Yimchungru, Khiammungan.

(vi) Jhum cultivation based on alder tree (*Alnus nepalensis*); practiced by tribes of Angami, Upper Konyak, Eastern Sumi, Chang, Khiamungan, and Yimchungru.

Note: Table on different types of Shifting cultivation based on cropping pattern as shown as Appendix-1

(b) Zabu system

(c) Kitchen garden

(d) Traditional Agro-forestry system

(a) Jhum/Shifting Cultivation

The Shifting cultivation commonly referred as Jhum cultivation called in Northeast India and it is also term as Swidden cultivation and is a form of low-input agriculture and fallow management is common in South East Asia particularly in paddy, taro, Jop's-tear, amaranth, maize, casava-based system etc. This is a social attired to culture and a sustainable and minimum tillage farming practice in sparsely populated areas keeping long duration of fallow.

In this system the jungle is slash and burned and then crops are planted using minimum tillage practices with the crops rotation and maintaining a four to five canopy system. These helps in weeds control in the first three months enabling crops to grow quickly, retain soil moisture and obtain maximum nutrients available in the soil by mix and canopy cropping. Soil traps and barriers are also laid in horizontal rows on the slope lands at regular intervals to trap and collect the soil. Another practice is growing cover crops and contour crops on the slope checked the soil erosion and conserve the soil and moisture. Therefore, the soil erosion from the Jhum field is low compared with the other developmental woks such as soil erosion by road constructions, logging, and other exogenous farming system in Nagaland. Jhum/shifting agriculture is a fine example of how a production system can be adopted to an ecological and social conditions and the cultural background of a community (Ramakhrisnan 1992). By this cultivation system tries to capture soil fertility nurtured by forest growth and it is released in one or two fallow flush through slash and burn.

Under Jhum cultivation several crops species with diverse growth habits, stratified rooting system and mineral nutrient requirements enables to utilize optimum available space and resource. In the system multi-storied canopy helps in many ways such are large leaf area index, protects the land from extensive soil erosion, leaching, multiple cropping provides an insurance to cultivation further the farmers manage to get all his diverse requirement such as cereal, vegetable, spices, tuber crops, fruits, medicines and flowers etc. from the same field

Cropping system is the kind and sequence of crops grown on a given area of soil over a period of time and such cropping system is multiple cropping under which is the dichotomous classification of sequential cropping and intercropping. In Nagaland traditionally tribal practice both systems with intricately associated indigenous traditional knowledge resulted to perfect sustainable cropping pattern. The distinguished Jhum/shifting cultivation system practices are as follows:

(i) *One year cropping Jhum; practice by tribes of Ao, Lotha, Sangtam, Sumi, Phom, Lower Konyaks:* In this shifting cultivation system the jungle is slashed/cut, dried and burned just before the rainy season. Much unburned materials remains is gathered and re-burned thoroughly and followed sequential cropping starting by dippling various seeds, broadcasting paddy and sowing tuberous croup using minimum tillage practices. In this system, by crop rotation helps in weed control in the first three months enabling crops to grow quickly, retain soil moisture and obtain maximum nutrients available in the soil by intercropping and sequential cropping practices. Cropping pattern is shown as per in Table 1.

During the dry season (Feb-April) an effective mechanism of watering system "Bamboo drip irrigation" practiced in jhumland by Ao community in Mokokchung district especially this technology is applied to a local variety called sweet cucumber to market during spring (Early summer) to fetch more income. In this a pin-hole is made in the bottom of one or two internodes bamboo cylindrical so that water drips slowly to the crop/plant. The bamboo cylinder is kept filled with water, bounded to a

wooden or bamboo post near to the crop plant. This mechanism is applied especially to cucurbits for supply soil moisture.

(ii) *Two fallow years Jhum cropping; Practice by tribes of Ao, Lotha, Sangtam, Sumi, Chang, Phom, Lower konyaks, Yimchungru, Khiammungan:* This is continuous two years cultivation practice system: the first year cropping is followed by the Second year cultivation in the same plot by changing the crop pattern. In this cultivation system the field is slashed/cut leaving, the perennial and sequential crops and burned carefully before the rainy season. In this second year different paddy variety (shorter duration with shorter height, smaller grain size "*manen tsuk"* a drought resistance variety) is sown along with different crops by minimum tillage practices as crop rotation system. Normally in the second year fallow more crop items including vegetables, condiment, medicinal and ornamental plants are incorporated as sequential crops.

(iii) *Jhum practiced of Upper Konyak tribe:* This is a typical shifting cultivation system practiced in the border of Myanmar by upper Konyak tribe in Nagaland. In this system, an innovative technology is applied to check the soil erosion by cultivating *Colocasea* (Taro) as secondary staple food by horizontal rows to rows as contour and is bunted by means of mulching the scrub weeds in the fields. Plantation of taro (*Colocasea*) is done horizontally across the slopping field with the help of hoes so to form contour lines and then paddy is broadcasted and followed by dibbling other seeds of various vegetables. Weeding is done after the rainy season starts and the scrape are mulch the taro in horizontal lines, latter which becomes a contour line to check the soil erosion and fertilize to taro. Normally Jobs tears is incorporated as main crop in higher altitude fields and other secondary crops includes finger millet, sorghum, maize, pulses, cucumbers, pumpkin, chilies etc. Traditionally millet, *Colocasea*, maize, Job's tears, Sorghums, *Dioscorea* (yam) are intercropping crops and cucurbits, pulses, ginger, and various vegetables are sown along with the paddy as sequential crop in their fields and thus by practices the soil fertility is managed by mulching the sequential left plant materials after harvest resulting to a perfect sustainable cropping pattern.

Altogether more than 30 different crops are sown in the field. In the early part second year taro, yam, ginger, hibiscus is harvested and the other various vegetable crops are sown along with paddy or jobs tears within the mulch across the contour lines. Latter traditionally cropping sequence ended and the field is abandoned to fallow leaving with some Agro forestry components such as palm tree (*Livestonia jenkinsiana, Caryota* sp), tea (*Camellia sinensis),* bamboos, cotton (*Hibiscus* sp.); fruit tree such as bananas, citrus, guava, pineapple, garcinia, myrica, etc., and wild relatives vegetable plant such as *Hibiscus suftarifa, Cleorodendrunm sp., Maranta arundinacea, Manihot esculanda, Pirrela frutescens* etc., are incorporated in the field.

(iv) *Jhum system of Eastern Nagaland; practiced by tribes of Yimchungru, Khiammungan, Chang:* This is also a typical shifting cultivation system practiced in the eastern part of Nagaland traditionally by three tribe; namely Chang, Khiammungan, and Yimchunger. This system of shifting cultivation is characterized by specific field crops and cropping pattern practices with about 20 different indigenous crops with neighboring tribes.

The cropping system maintains of a wide varietal genetical crops base and is adaptive since it reduces the threat of crop loss due to pests and pathogens. The main intercropping

crops cultivated are Jobs' tears, sorghum, Rhua (*Chenopodium sp).* and the sequential crops are millet, maize, taro, legumes in two seasons (*Clycine max*/soyabean, *Phaseolus vulgaris*/French bean and *Vigna umbelata*/rice bean and *Phaseolus sp*/ Cow-bean), various cucurbits, and different condiments etc. are cultivated.

(v) *Jhum Cultivation System of Job's tears with paddy; practiced by tribes of Angami, Chakisang, Yimchungru, Khiammungan):* This Jhum cultivation of Job's tears with paddy cultivation practiced by Angami, Chakisang, Yimchungru and Khiammungan is also zero tillage in which sowing is done by means of dibbling and the major intercropping crops are Maize, Colocasia, Allium sp Soybeans (having twice rotation sowing time), Ricebean, while the sequential secondary crops are different varieties Paddy, Job's tears, Surgham, Perilla Frutescence, cucurbits, ginger, chilies, various indigenous lesser known vegetables and condiments.

(vi) *Jhum cultivation System based on alder tree (Alnus nepalensis); practiced by tribes of Angami, Upper Konyak, Eastern Sumi, Chang, Khiamungan, and Yimchungru:* Alder based shifting cultivation farming system is another type of shifting cultivation farming system based on Alder tree and is popularly prevailing in Nagaland and particularly practiced by Angami, Konyak and Sumi, Chang, Khiamungan and yimchungru. The alder tree, *Alnus nepalensis* D.Don, a nitrogen fixing plant is an indigenous innovation towards sustenance and maintenance of the soil fertility (Changkija *et al* 1996). Since time immemorial the alder tree has served the Nagas in many ways by maintaining fallows in the shifting cultivation. The farmers are specialized and have perfected to an excellent cultivation system in which they incorporate the natural nitrogen fixing plant *Alnus nepalensis.* This is also a system which incorporates proper use of forestland maintaining natural trees in the jhum fields to manage the soil fertility. It has been found that the Alder based shifting cultivation system allows the soil to regenerate faster and the jhum cycle can be managed at a four years cycle with two years of cropping followed by two or more years fallow. It also greatly reduces the labour input in the clearing of fallows. This system is identified as one of the most promising bio-physically workable and socially acceptable indigenously innovated adoption towards fallow management (Changkija et al 1998). In this system, the naturally grown Alder trees are cut or pollarded at a height of about two meters from the ground to obtain a head of shoots, which are nurtured during the jhum period. New sapling is also planted and is left to mature during the fallow period to be pollarded at the next jhum cycle. The branches so cut are used or sold as fuel wood.

In this farming system of cultivation, most of the seeds of the intended crops are sown during the months of February to April and are harvested during the months of October to November and by this time the alder tree sprouts new coppices. In this system, mainly intercropping components are Paddy, Job's tears, maize and the sequential crops are *Perilla fruitescense*, colocasea, potato, soybeans, rice bean, cow bean, millet, maize, and various vegetables.

(b) Zabu Farming system

Zabu is an sustainable indigenous farming system practised by the Naga farmers mostly by the Chakesang tribe in Nagaland. This farming system has a combination of forest and agriculture incorporating the life-stocks and fishery, which is a well-founded soil and water conservation base.

In this Zabu system has forest land on the top of the hill, water harvesting tank cum fishery bellow the forest and livestock yard and paddy cum short duration fishery field at the foot hills. In some of

the case, when a proper source is not available for water storage, the run-off water from the upper catchments area is taken directly to the paddy fields. The water loss and percolation is controlled through puddling using various materials like straws of the paddy, stones, etc. This systems of farming is generally practised by growers having a minimum land area of 2.0 to 2.5 ha., in which the total available water can be utilised very efficiently and soil lose by erosion is reduced to minimum, often in the side a small vegetable garden also maintained and farmers do not use any artificial/chemical fertiliser. They manage the soil fertility indigenously which sustain their farming to centuries. This farming system is inherent agriculture and forestry land use in build with water harvesting, soil conservation and fertility management and which is also a resource management maintaining ecological balance.

(c) Home/Kitchen Garden

Home or Kitchen garden a sustainable as an indigenous fertility management small farm is being practiced by the farmers in the mountains. Farmers manage a simple and small farm in homestead's, where various vegetables, condiments, fruits, medicinal herbs, flower and fodder can be grown. Kitchen garden has become significant commercial enterprises for supplying high value goods to the market. Many opportunities are made available to greatly increase production, primarily because of the proximity of the kitchen garden to the homestead. Waste drainage water from the kitchen can be used to start seedling or irrigate annual crops. Ashes and sweeps from the households and domestic animals bedding are normally spread (as bio-fertilizer) in the garden and it does enrich the soil around the homestead. Given the above, it is not surprising that the kitchen garden, though small in total area, is an important part of the Germplasm conservation, overall production system and has successfully been used as an entry point into the enhanced productivity of the farming system.

(d) Traditional agroforestry (Soumni/Yokya)

Agroforestry is the deliberate growth and management of trees along with agricultural crops and or livestock. It is a system that is ecologically, socially and economically sustainable. Traditional Agroforestry in the tribal community has evolved over a century and is very diverse and complex. Today, as the condition changes, farmers continue to innovate, experiment and improve the systems. Farmers integrate agricultural crops, trees and livestock in these farming systems to meet their needs. This integration has resulted in a wide diversity of traditional agroforestry system and these systems are well suited to the local agro-ecological conditions, the specific subsistence and cash needs of farmers, their social and cultural context and the environmental conservation needs.

In the higher altitude or densely populated areas of Nagaland have developed practices to integrate their farming systems with adjoining forests to graze their mithuns, cattle in the fallow land and in the forests, or develop forests/gardens to meet their subsistence and cash needs. In the lower altitudes, in the foothills and areas adjoining the plains agroforestry of very specific trees that take long time to produce yield (*e.g.*, coconut, areca-nut, thatching-palm, mango, jack-fruit, litchi, petel-vine, black-pepper etc.), along with short term crop combinations are also developed. In the middle hills of the region, as most settlements with higher population being developed the agroforestry practices mostly emphases on growing local needs such as bamboo, constructional wood, fuel wood, thatching-palm, broomstick, fruit trees, along with the various crops for their sustenance. Agroforestry systems, particularly in high population and fuel-wood deficit areas, can serve buffer zones to mitigate the degradation of natural and plantation forests.

Wet-land Rice Based Cultivation

Irrigated bench terrace wet cultivation Practice

This type of cultivation system is practiced in the hill slopes wherever sufficient water is available. These are not rain-fed but irrigated using local skills. Terraces are cut into the slopes and flooded carefully using bamboo and local materials as water conduits. This system of irrigated terraced cultivation in the hills is practiced by the Angami, Zelianrong, Chakesang. In this cultivation system, suitable terraces are located and short terms fish and snail farming in combination with the paddy is also practiced during the monsoon.

Rain feed Valley wet cultivation practice

This type of cultivation system is practiced in the valley in plain land and in gentle slopes during monsoon season. These are purely rain-fed irrigated using local skills. Shallow rectangular ponds are flooded carefully and channel to compartments one another. This system of wet paddy cultivation in the valleys is practiced in the food hills in the state.

CONCLUSION

There are many excellent indigenous measures which technologies are scientifically appreciated being practiced by the Naga farmers such as Zabo farming system, Alder based shifting/Jhum farming system, contour banding shifting/Jhum farming system, Integrated agro-forestry system, Irrigated bench terrace farming system, home gardens farming system and etc. Technical improvements are still possible on many fronts of soil fertility management, integrated cropping amelioration, Fallow management and etc. In many instances indigenous knowledge of locally rooted can be a blended and exogenous knowledge should be crafted to suit local situations. It may be equal or even superior to the know-how introduced by outsiders. However these technical improvements, while only when farmers can lead increased productivity and profitability, will be accepted and will play a very important role in developing self-sufficiency and self-determination, strengthening the people participation and sustainability. The productivity system in context to Nagaland is closely linked with natural systems and to make mountain agricultural sustainable are to built-upon those perfected traditional farming technologies based on Agro-forestry component along with the plantation of selected plants (such as: *Alnus nepalensis, Albizia sp., Myrica esculanta, Sesbania sesban, Flemingia macrophyla, Tephrosia candida, Gajanus gajan, Crotalaria juncia* etc.) by which will fix Nitrogen into the soil and enrich the biomass to its fertility while conserving the soil.

Scientific effort needs to make explore areas of both traditional and modern scientific knowledge for soil improvement, crop intensification and stabilisation of the farming system without disrupting their culture and traditions especially in the mountain areas utilising appropriate low cost technology which can be adopted easily by poor farmers with little or no financial resources and which can be readily applied in the prevailing local conditions. What is therefore; required is the innovation of a low cost technology which can be adopted easily by poor farmers, innovation that promote local resource management attracts more attention and for the better management of natural resources. Thus any alternative strategy will have to be build-upon the traditional system and while dealing with traditional societies, research should be done on a participatory basis.

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APPENDIX -1

Table 1

Clasification of Shifting Cultivation of Nagaland (Shifting Cultivation Practices Based on its Crooping Pattern)

	Cropping categories	*Intercropping Practice*	*Sequential Cropping Practice*
(I)	*One Year Cropping (practice by Ao, Lotha, Sangtam, Sumi, Phom, Lower konyaks).*		
	Main	Paddy, Maize	Colocasia, Maize, Paddy,
	Secondary	Colocasia, Various dioscoria, Various cucurbits, Various legumes.	Various cucurbits, Various legumes, Chillies, Spices, Perilla frutesence,Tapioca, etc.
	Tertiary	Tapioca, Chilies Perilla Spices, frutesence, Medicinal plants, etc.	
	Other	Hibiscus, Allium sp, Ginger, Various solanum sp, Arrowroot.	
(II)	*Two Years Cropping System (Practice by Ao, Lotha, Sangtam, Sumi, Chang, Phom, Lower konyaks, Yimchungru, Khiammungan).*		
	Main	Paddy, Maize, Colocasia. Sorghum.	Maize, Cucurbits, Colocasia, Paddy.
	Secondary	Cucurbits, Yam, Various legumes, Ginger, Arrowroot Tapioca, Glycine max	Ginger, Sorghum, Various legumes, Dioscoria, Tapioca, Sugarcane, Banana, Perilla frutesence etc.
	Tertiary	Sugarcane, Sorghum, Perilla frutesen,Sesamum indicum, Spices, Banana, Zanthoxyllum sp,	
	Other	Medicinal plants, spices and condiments and ornamental sp.	
(III)	*Upper Konyaks Cropping System (practiced by Upper Konyaks.)*		
	Main	Millet, Paddy, Maize, Job's tears, Colocasia, Sorghum	Millet, Colocasia, Maize, Paddy, Job's tears,
	Secondary	Chenopod Amaranth, Glycine max. Sorghum, Dioscoria	Sorghum, Ginger, Chilies, Glysin max. Tapioca etc.
	Tertiary	Cucurbits, Various legumes, Chilies Ginger, Tapioca, Potato, Allium etc.	
	Other	Medicinal Plants, Condiments, Ornamental flowers, etc.	

Contd. Table 1

	Cropping categories	*Intercropping Practice*	*Sequential Cropping Practice*
(IV)	*Cropping System In Eastern Nagaland (practiced by Yimchungru, Chang Khiammungan.)*		
	Main	Millet, Paddy, Maize, French beans, Colocasia, Chenopod, Amaranth.	Millet, Maize, Colocasia, French beans, Paddy,
	Secondary	Job's tears, Sorghum, Chinopodium, Amaranthus, Glycine max. Dioscoria,	Ginger, Sorghum, Chinopodium, Amaranthus, Glysin max, Tapioca Job's tears, Chilies etc.
	Tertiary	Cucurbits, Chilies, Ginger, Tapioca, Potato, Allium sp. Perilla frutesen etc.	
	Other	Medicinal Plants, Condiments, Ornamental flowers, etc.	
(V)	*Cultivation System of Job's Tears with Paddy (practiced by Angami, Yimchungru, Khiammungan).*		
	Main	Millet, Paddy, Job's tears, Sorghum.	Paddy, Maize, Job's tears.
	Secondary	Maize, Colocasia, Perilla frutesen, Ricebean.	Colocasia, Perilla frutesen, Chilies, Allium sp, Ricebean etc.
	Tertiary	Allium sp, Chilies, Ginger, Solanum, Various legumes, Cucurbits.	
	Other	Medicinal plants, Condiments, Ornamental flowers, etc.	
(VI)	*Alder Tree Based Cropping System (Alnus nepalensis) (practiced by Khiamungan, Upper Konyak, Angami, Eastern Sumi, Chang, and Yimchungru).*		
	Main	Paddy, Maize, Job's tears,	Paddy, Maize, Job's tears,
	Secondary	Colocasia, Alocaceae, Potato, Glycine max., Rice bean and vegetables,	Colocasia, Alocaceae, Ginger, Rice bean, Chilies, Potato, Glysin max, Cabage and other vegetables.
	Tertiary	Cucurbits, Chilies Ginger, Tapi-oca, Alliums, Perilla frutesen, etc.	
	Other	Medicinal Plants, Condiments, Ornamental flowers, etc.	

APPENDIX-2

Table 2
Cultivated crops of cereal based Jhum farming

Sl. No.	*Botanical name*	*Family*	*Local name*
1.	*Abelmoschus esculantus*	Malvaceae	Bendi
2.	*Allium ampeloprasum*	Lileaceae	Sangtamlasung
3.	*Allium fistulosum*	Lileaceae	Alulasung
4.	*Allium porrum*	Lileaceae	Repcha
5.	*Allium schoenoprasum*	Lileaceae	Alulasung
6.	*Alocasia Indica*	Araceae	Nokari-ami
7.	*Alocasia macrorrhiza*	Araceae	Nokari-ammi
8.	*Amaranthus caudata*	Amaranthaceaee	Ruua

Contd. Table 2

Sl. No.	*Botanical name*	*Family*	*Local name*
9.	*Amaranthus gangiticus*	Amaranthaceaee	Nokari Ruua
10.	*Amaranthus tricolor*	Amaranthaceaee	Alu-naro
11.	*Amomum subulatum*	Zingeberaceae	Milangosu
12.	*Andropogon sorghum*	Poaceae	Ajang (greate millet)
13.	*Andropogon vulgare*	Poaceae	Ajang-tenak (greate millet)
14.	*Arachishypoachea*	Papilionaceae	Patamjang (Peanut)
15.	*Binincasa hispida*	Cucurbitaceae	Maosu
16.	*Brassica arvensis*	Crusiferae	Ingnak
17.	*Brassica chinensis*	Crusiferae	Ingnak tamakla
18.	*Brassica juncea*	Crusiferae	Aori ingnak
19.	*Cajanus cajan*	Fabaceae	Mahajang
20.	*Canavalia gladiate*	Papilionaceae	Azung-matsuklashi (Sword bean)
21.	*Capsicum annum*	Solanaceae	Meritsu-talu
22.	*Capsicum baccatum*	Solanaceae	Lopu meritsu.
23.	*Capsicum chinensis*	Solanaceae	Lopu meritsu–tashila (King hilli)
24.	*Capsicum frutescens*	Solanaceae	Sangpang-meritsu
25.	*Carica papaya*	Caricaceae	Mamali
26.	*Chenopodium morale*	Chenopodeaceae	Rhuwa
27.	*Chenopodium pallidicaule*	Chenopodeaceae	Rhuwa
28.	*Citrullus vulgris*	Cucubitaceae	Tsupak matzu
29.	*Coix achrymal jobi*	Poaceae	Menjang
30.	*Colocacea esculenta*	Araceae	Moyariammi
31.	*Colocasia antiguorum*	Araceae	Ammi
32.	*Corchorus capsularis*	Tiliaceae	Postalisutong, Patt, (Jute)
33.	*Cucumis melo*	Cucurbitaceae	Apangmatsu
34.	*Cucumis maxima*	Cucurbitaceae	Mapu/Moyamatsu
35.	*Cucumis sativa*	Cucurbitaceae	Matsusu
36.	*Cucurbita moschata*	Cucurbitaceae	Mapu (Pumpkin)
37.	*Crotalaria tetragonata*	Papilionaceae	Yangli-ben
38.	*Cyphomandra patacea*	Solanaceae	Entzupenkena (Tree tomato)
39.	*Dioscorea bulbifera*	Dioscoriaceae	Atsung
40.	*Dioscorea deldoitae*	Dioscoriaceae	Asungcha
41.	*Dioscorea esculenta*	Dioscoriaceae	Nokaricha
42.	*Dioscorea opposite*	Dioscoriaceae	Acha
43.	*Dioscorea rotundata*	Dioscoriaceae	Moulocha
44.	*Dioscorea villosa*	Dioscoriaceae	Acha-tenenla
45.	*Dolichos lablab*	Papilionaceae	Matsuklashi (Hyacinth bean)

Contd. Table 2

Sl. No.	Botanical name	Family	Local name
46.	*Eleusine coracana*	Poaceae	Jenjang (Finger/Ragi millet)
47.	*Elscholtzia cummunis*	Lamiaceae	Napa
48.	*Fagopyrum esculanta*	Polygonaceae	Aokcha-wa, (Buckwheat)
49.	*Gajanus gajan*	Papilionaceae	Mahajang (Arhar dal)
50.	*Glycine max*	Fabaceae	Alichami
51.	*Gossypium hebacium*	Malvaceae	Methi (Cotton)
52.	*Hibiscus sabdariffa*	Malvaceae	Sentsurep
53.	*Helianthus annus*	Compositae	Anunaro (Sunflower)
54.	*Hibiscus sauratense*	Malvaceae	Sentsurep
55.	*Hydychium sp*	Zingeberaceae	Langpamoalajang
56.	*Hydychium sp*	Zingeberaceae	Lisujang
57.	*Hydychium sp*	Zingeberaceae	Mecheplasu
58.	*Ipomoea batatas*	Convulvulaceae	Chamiang
59.	*Lablab niger*	Fabaceae	Napakosu
60.	*Lablab prureta*	Fabaceae	Napakosu tenenba
61.	*Lagenerea siceraria*	Cucurbitaceae	Aku
62.	*Luffa cylindrical*	Cucurbitaceae	Poaksu
63.	*Lycopercicon lycopercicum*	Solanaceae	Penkena (tomato)
64.	*Lycopercicon prempinifolium*	Solanaceae	Wazapenkena (Cherry tomato)
65.	*Manihot esculanta*	Euphorbiaceae	Alicha
66.	*Maranta arundinaceae*	Maranthaceae	Nokorimi
67.	*Mentha arvensis*	Lamiaceae	Putina
68.	*Momordica charantia*	Cucurbitaceae	Koktsulikhajang
69.	*Mucuna bracteata*	Fabaceae	Kokoksu
70.	*Mucuna Prureta*	Fabaceae	Meri-kokosu
71.	*Ocimum bassilicum*	Lamiaceae	Nangpera
72.	*Ocimum carrum*	Lamiaceae	Nangpera
73.	*Ocimum gratissimum*	Lamiaceae	Meri-nangpera
74.	*Oriya sativa*	Poaceae	Ajak, Tsuk, (paddy)
75.	*Parkia ruxburghii*	Mimosaceae	Kiza-chami/yongjak
76.	*Pennisetum thyphoides*	Poaceae	Jenjang (pearl millet)
77.	*Perilla frutesen*	Lamiaceae	Pinglong
78.	*Perilla ocimoides*	Lamiaceae	Pingnak
79.	*Peskinensis junceae*	Crusiferae	Ingnak taluba
80.	*Phaseolus aurens*	Fabaceae	Chami
81.	*Phaseolus calcaratus*	Fabaceae	Lolee-chami
82.	*Phaseolus coccineus*	Fabaceae	Chamitenakla

Contd. Table 2

Sl. No.	*Botanical name*	*Family*	*Local name*
83.	*Phaseolus vulgaris*	Fabaceae	Kolaru
84.	*Phyllanthus acidus*	Euphorbiaceae	Nokari-lolosu
85.	*Phyllanthus glaucus*	Euphorbiaceae	Amiyang
86.	*Psophocarpus tetragonolobus*	Fabaceae	Thakra
87.	*Qoix lagryma jobi*	Poaceae	Menjang (Job's tears)
88.	*Ricinus cummunis*	Eurphobiaceae	Phakowa, (Castor)
89.	*Saccharium officinarium*	Poaceae	Motsu
90.	*Sechium eddule*	Cucurbitaceae	Peschu-jang (Squash/Chayote)
91.	*Sesamum orentalis*	Pedaliaceae	Pingnak
92.	*Setaria italica*	Poaceae	Chenjang (Foxtail/Italian millet)
93.	*Solanum bakeri*	Solanaceae	Meri-anlongkok
94.	*Solanum gello*	Solanaceae	Longkoksu
95.	*Solanum indica*	Solanaceae	Anlongkok
96.	*Solanum melongena*	Solanaceae	Pendosu
97.	*Solanum tuberosum*	Solanaceae	Allo (Potato)
98.	*Triticum aestivum*	Poaceae	(Wheat)
99.	*Vigna senensis*	Fabaceae	Anakchami (Cowpea)
100.	*Vigna umbellata*	Fabaceae	Malangchami
101.	*Xanthosoma atroverens*	Araceae	Meri-ami
102.	*Zanthoxyllum oxyphyllum*	Rutaceae	Mongmong/Monga
103.	*Zea mayze*	Poaceae	Ajangtangba
104.	*Zingeber erubescens*	Zingeberaceae	Sungsung
105.	*Zingeber officinaless*	Zingeberaceae	Assung/sungpak