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## A study on ITK's: Reservoir of traditional wisdom of farmers of Arunachal Pradesh

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### ABSTRACT

This study aims to document and validate the indigenous technical knowledge (ITK) used by tribal farmers in Arunachal Pradesh, specifically focusing on crop, animal, protection, and post-harvest management. The research was conducted across three agrarian societies—Apatani, Galo, and Minyong—within the Lower Subansiri, West Siang, and East Siang districts, utilizing purposive selection of 12 villages. The findings demonstrate that these low-cost, organic practices have evolved over generations and are highly sustainable, particularly in the management of upland rice pests and pathogens through the use of medicinal plants and biodiversity. The study concludes that such traditional wisdom serves as a vital reservoir of expertise that should be scientifically validated and integrated into agricultural development programs. It recommends establishing networks between research institutions and farming communities to document and channelize these eco-friendly technologies for sustainable agriculture.

**Keywords:** Indigenous Technical Knowledge, Arunachal Pradesh, Sustainable Farming, Tribal Wisdom, Organic Cultivation

### Introduction

India is one of the world's largest and oldest agricultural societies, one which has remained predominantly rural despite decades of modernization. People's technology is local wisdom that is unique to a given culture or society. It is the basis for local decision making in agriculture, animal health care management, natural management and host of other generation, in many societies by word of mouth. India has a rich tradition of oral knowledge that goes back to the *vedics* times. Much of that wisdom is being rediscovered by the modern world. This knowledge consists of many facts and helped them to evolve many practices which have been tested over long periods of time and proved beneficial. Appropriateness of these practices lies in efficient use of local resources. Nevertheless, a greater appreciation of indigenous knowledge is necessary to improve the ability of development agencies and extension services to provide relevant support for the sustainable development and management of natural resources. North eastern region is one of the most picturesque regions having variety of ethnic culture. It is also diverse in ecological habitats ranging from mountains to valley with rich diversity in plants and crops and ethnic diversity. Ethnic communities of the region practice their traditional cultivational practices of diverse crop suitable in different ecosystems solely on organic conditions without any external inputs to the system; and value the land and the environment for the sustainability of the system for future generations.

A rich heritage of accumulated indigenous agriculture knowledge is being practiced. But unfortunately the wisdom was passed on either by words of mouth or observation and rarely documented in written form. According to Jiggin (1989) [1], Slikkerveer (1989) [2] and Warren (1989) [3], indigenous knowledge system have been largely ignored in many developing countries. At the same time, Vanek (1989) [4], Hansen and Erbaugh (1987). As a result, the significance of many of the indigenous useful practices is either lost or at times, the practices itself has been distorted. Often, farmers know more than many qualified professionals about the local resources dynamic within their interdependent, complex and flexible systems. They should be properly understood and incorporated for the development of sustainable farming system and practices. People's knowledge suggests alternatives in such circumstances. People's knowledge used effectively by one society can be used to solve problem faced by other societies in similar agro-ecosystems. Indigenous/conventional knowledge is eco-friendly and sustainable as evidenced by many of these technologies surviving for many centuries. The present knowledge of agricultural scientist with little exposure to the indigenous practices or their underlying wisdom has failed to give due recognition to the strength of such indigenous technology and culture and emotional issues of such wisdom. Lack of adequate document is a serious constraint to scientific validation and commercialization of such knowledge. Documenting and incorporating the indigenous knowledge system (IKS) in agricultural education, research and extension pave the pragmatic approach towards a sustainable development. Rural communities have reservoir of expertise in management of agro ecologies and their associated agricultural livestock and aquatic systems (Prain 1994). Yet remarkable, this widely available knowledge resource is rarely tapped by resource starved national agri

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cultural research and development systems (Edison 2004). In the present technology generation system, there is often no role of farmer's except a nominal or contractual participation by way of conducting adaptive trials on their field (Mangala Rai 2005).

Despite the excellent technological strides achieved during last two decades in the area of dairying, socio-economic and technological constraints in transfer of technology are causing impediments in the promotion and adoption of dairy production (Sah 1998). Farmers of Banka, take care of their milch animals with their local traditional knowledge system available in particular production environment and socio cultural conditions. This paper documents relevant of tribal wisdom of the farmers of Arunachal Pradesh, It describes indigenous practices, their potentialities and constraints that would further help strengthen the farmer's existing knowledge as well as useful for development base in their programs.

### Validation of people's technologies

The ICAR RC for NEH Region AP Centre, Basar has taken up the responsibilities to document and validate the traditional technologies. So that people will aware about them and give respect and to know

the worth of their traditional practices. Keeping this point in our mind, the present study was undertaken with the specific objective to find out the indigenous practices used by the tribal's in the area of Crop, Animal, Protections (Insect, pest and disease) and post harvest management.

**Methodology:** The study was undertaken in three agrarian developed societies of Arunachal Pradesh i.e. *Apatani*, *Galo's* and *Minyong* residing in the following districts viz. Lower Subansiri, West Siang and East Siang district of Arunachal Pradesh. From each district two blocks were selected purposively on the basis agrarian culture and their contribution in agricultural production. Thus in all the three districts 12 villages (three villages each form district) were selected purposively on the basis of agriculture oriented villages in lower Subansiri district viz, villages in West Siang District.

### Findings

Some of the ITK which is used generally in Arunachal Pradesh by the tribal peoples

| Description of ITK                                                                                                                                             |  | Probable scientific explanation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Remarks                                                                                                                        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| Agronomy practices                                                                                                                                             |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                |
| <i>In situ</i> burning of slashed debris in jhum field for managing microorganisms of soil surface.                                                            |  | Traditionally, jhum field sites are slashed, dried and burnt <i>in situ</i> which eradicate soil surface inhabiting micro-organisms including pathogens and other pests making the field suitable for cultivation of different crops.                                                                                                                                                                                                                                                                                                                                                                                            | This is a common traditional practice of almost all tribal communities residing in hills all over N.E.India.                   |
| 0-tillage method of seed sowing to avoid implements born contamination of seeds.                                                                               |  | Tribal farmers strictly follow 0- tillage method that includes stick dibbling method which not only avoid the seed contamination through modern implements but also renders least disturbance to the soil. This practice enhances quick germination of seeds without getting infected by the soil borne pathogens if any.                                                                                                                                                                                                                                                                                                        | 0-tillage is a common practice in traditional farming systems.                                                                 |
| Removal of weed pests from upland rice field at regular interval to avoid weed competition with rice and infection by other pests and pathogens.               |  | First weeding is done after a month of seed sowing and the weeded grasses were allowed to decomposed in the field between rice seedlings which get gradually decomposed in course of time that provide not only nutrients to the plants but also create unfavourable environment for the incidence of pests and pathogen of rice plants. Second weeding is done just at the tillering stage (a vulnerable stage for the attack by insect pest -pathogen) is done which play similar role as that of the first weeding. Third weeding is done just before the ripening stage of rice in order to avoid the sheltering of rodents. | Frequency of weeding depends on the density and composition of weeds in the field.                                             |
| Growing selected traditional varieties of rice for disease resistance and better adaptation in the selected jhum sites.                                        |  | Traditional farmers in the hills are particular in selecting the traditional land races rice varieties having better adaptive and insect pest pathogen resistance characters. Further, these varieties possess the attributes that smother the growth of weeds in the rice field. They preserve these qualities of rice since millennia of their experiences. Insect pests and disease resistant land races rice which are location specific in yield performance are harvested selectively from the better rice plants and store separately for the purpose of seeds for the next season at the time of Harvesting.             | This is a very good practice of the tribal farmers in the hills who have been practicing this tradition since time immemorial. |
| Cattle Disease                                                                                                                                                 |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                |
| <b>Lebak Kinam:</b> is gradual decomposition of the hoofs (Roy,1986) Flies and other insects aggravate the disease and the consequent severity of the disease. |  | The cattle suffering from this disease are kept with their hoofs submerged in water. This protects the sore from the bite of flies and insect and it's reported to affect a cure                                                                                                                                                                                                                                                                                                                                                                                                                                                 | -                                                                                                                              |
| <b>Napa bangnam kinam:</b> is a disease of mouth and tongue. The mouth gets sore all over inside and the animal, unable to eat dies of starvation              |  | To cure it, either ginger paste with salt is applied to be affected parts or food covered with <i>siye</i> leaves is put in the mouth of the animal                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | -                                                                                                                              |
| <b>Sagi kinam:</b> is a disease when an affected animal grow thin every day but does not show any other symptoms.                                              |  | A paste of ginger, <i>siye</i> leaf and salt is prepared and administrated along with the food. It is believed that ginger, wrapped in a <i>siye</i> leaf, hung from the neck is also an effective cure                                                                                                                                                                                                                                                                                                                                                                                                                          | -                                                                                                                              |
| Poultry Disease Management                                                                                                                                     |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                |
| <b>Tabum Kili</b> is sore of the eye                                                                                                                           |  | Birds attacked with this disease, cannot open their eye. A paste of ginger and chilli is prepared and applied to the eye and the bird is cure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | It seems to be a harsh treatment so the scientist can not recommend this practice                                              |
| Plant Protection Management                                                                                                                                    |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                |
| Cooked rice is spread in the plots                                                                                                                             |  | Boiled rice in the field attracts birds which incidentally predate on semi-opper as well                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Biological insect control by attracting birds                                                                                  |
| Soap water spraying to orange                                                                                                                                  |  | Cost effective control for sooty mould                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Physically removes the pathogen by washing off                                                                                 |
| Bunchy top disease in chilies                                                                                                                                  |  | Dusting of ash , use of Gugul ( <i>Commiphora wightii</i> ) smoke , spray of sour butter milk , spray of liquid waste of tanned leather was recorded in tribal areas                                                                                                                                                                                                                                                                                                                                                                                                                                                             | The mentioned treatment is effective to cure the bunchy top disease in chilly.                                                 |

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## Management of *Gandhi* bag

Is one of the major insect pests of rice in West Siang District, Lower Subansiri, Upper Subansiri and Upper Siang districts. This pest usually emerges in the rice field at the time of Panicle emergence. As soon as the pest appears in the field during flowering, local farmers fix several short wooden/bamboo sticks randomly at certain interval in the rice field (both low level and upland condition). Then dead frog/crab/are placed on the top of each stick. Sometimes, tribal people are also seen to purchase dry salted fish (which emits some fishy odor), make them into small piece and tie them with each stick. As the dead frogs/crab/fishes rot and start to emit foul smell, adult *Gandhi* bugs are attracted by this foul smell and gather in mass on the rotten frogs/crabs/fishes.

The philosophy behind this local practice is that until unless emitting of this foul smell stops, adult *Gandhi* bugs remain busy in large number with these rotten frogs/crabs/fishes kept on sticks for at least 5-6 days. In the mean time, milk stage of rice florets turn into thick dough stage. Naturally *Gandhi* bugs ten do not prefer feed to rice florets and damage to rice grain is automatically reduced.

Control of rice diseases by placing some plants medicinal near of the field.

Farmers in hills make use of plants by placing leaves of *Clerodendron serratum* near the rice field so as to avoid the incidence of insect pests over the rice field. As the leaves of *C.serratum* get decomposed, it slowly emits an unpleasant odour that inhibits the occurrence of pests and pathogen over the field.

Use of certain plants of medicinal values for the control of pest pathogen in the upland rice jhum field.

Tribal farmers in the hills often make use of locally available plants of medicinal values such as *Artemisia vulgaris*, *Eupatorium odoratum*, *Meriandra bengalensis*, *Eucalyptus* spp. etc. They place the leaves & branches over the rice field which on decomposition not only provide nutrients to the plants but also emits unpleasant odour which directly or indirectly creates unfavourable environment for the occurrence of pest- pathogens over the rice field.

Growing spicy crops in rice field to repel insect pests pathogens.

Tribal farmers often grow spicy crops like ginger, onion, chillies, garlic, etc., in patches amidst rice field. This practice primarily meant for supplementing the vegetables need of the household and secondly these plants emit some kind of pungent odour which directly or indirectly repels the pest pathogen from the rice field.

Growing selected traditional varieties of rice for disease resistance and better adaptation in the selected jhum sites.

Use of such locally available plants in the jhum fallow paddy field often practiced by Kuki tribes in the hills of Manipur. (*Bidyalakshmi et al 2010*)

## Post Harvest Technologies

Neem leaves are put in pulse bags for storage

Control storage insect pest

*Neem* leaves affect hatching of storage pests eggs

Bamboo grain storage structure plastered with cow dung with a layer of paddy straw and a layer of dried leaves of lake at the bottom to store paddy  
Putting 10-15 red chillies in one quintal rice bag

Reduce storage insect pests of paddy and prolongs storage life

Storing paddy seeds in thick layer of paddy straw, tied together forming sacks kept on planks suspended in the kitchen  
Bunching local small onion and hanging to the roof

Prevent storage pests

Prevent loss of seed viability

Enhance shelf life

Pungent odour acts as repellent

Smoke with higher temperature prevent storage pests

Dipping pulse seeds in cattle urine and shade drying

Protect from insect pests incidence and enhances storage life

## Crop Production

Well decomposed pig manure is mixed with paddy seeds soaked overnight. The treated seeds are stored overnight in gunny bags.

Promote uniform germination

Manure has intimate the growth regulatory effect in the seeds

(continued on next page)

Growing garlic in nut grass (*Lierxia hexandra*) affected field once in thrice      Minimize nut grass incidence in rice field years

The cut ends of plant cutting are presented with cow dung ball      Better sprouting and rooting of the

Nailing sterile jack fruit and papaya tree      Induce flowering and fruiting

**Storage Management**

Root exudation acts as weedicide and it help

Reduce desiccation and growth promoter

Iron availability induce flowering

| Description of ITK          | Farmer's Logic                                                                                    | Probable scientific explanation                                                                                                                                                                                                                                                             | Remarks                                                                                                                                                                                  |
|-----------------------------|---------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Grain storage with wood ash | Farmers believe that the wood ash is effective in controlling pests in stored grains.             | The ash is mixed with grains based on the extent of infestation, quantity of grain a storage structures. The methods are very economic and made up of locally available materials. The seeds and grains do not get chemically contaminated and the ash can be easily separated from grains. | However, it is good for small capacity storage so that quantity of fuel wood required is not too large                                                                                   |
| Grain Storage near kitchen  | Cereals and other food grains are stored in place where the smoke of burning firewood penetrates. | This smoke produces carbon dioxide (CO <sub>2</sub> ) and carbon monoxide (CO) gases that suppress the infestation of insect/pest in the seeds.                                                                                                                                             | This practice is low-cost appropriate technology, good for seed storage and represents best use of kitchen smoke. However, the practices is not effective and possible for large storage |

**Other ITK's used by the farming community of West Siang:**

|                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <b>Tape</b> : The system is used for controlling the passage or crossing over of the fingerlings from one plot to another plot with the help of small bamboo sticks fixing vertically nearby the outlet of water in semi circular manner | The problem of fingerlings to cross over from one plot to another through over flow of water arises whereas by using <i>Tape</i> system it is totally controlled.                                                                                                                                          | The <i>Tape</i> is made with the net fixing as per the design upto the level of water in the field. The <i>Tape</i> is particularly used to control the crossing over of the fingerlings of middle finger or little finger size from one plot to another part so that the fish population can be maintained uniformly in the field. Further, to protect the fish from thieves or trespassers in the field a depressed area is also made in the centre of the plot for grouping together all the fishes in the field. It also makes easy for the farmer to harvest the fishes when mature. It's helps to protected from damages by wild animals |
| <i>Ricinus cummunis</i> Linn. Euphorbiaceae Castor Migyim iyoksu                                                                                                                                                                                                                                                             | Leaves used for curing joints fractures. Leaf is slightly heated tied with a thread on the fracture                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|  <b>Edir</b> : Eco-friendly way of fishing (Kanwat <i>et al.</i> 2008)                                                                                                                                                                  | <i>Edir</i> (well Designed basket with a valve) it's skillfully designed fishing trap in the form of conical in shape. Once entered the fish into the basket, it will not come out. This can be used after draining the river to catch running fish.                                                       | The <i>Edir</i> is kept downwards to catch the upward moving fish. If the mouth of the trap were fixed upward opposite the direction of current, it would be filling with debris, Sometimes <i>Edir</i> are damaged by others.                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Inner view Farmers Of <i>Edir</i> with <i>Edir</i>                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <i>Tuhum Kunam</i> : (Basketing by women) (Singh,K.A, &T.K.Bag,1994)                                                                                                                                                                                                                                                         | The main tool is <i>Raju</i> a conical basket made of cane. Actually <i>tuhum</i> means shrimps and <i>kunam</i> means collection. The basket is kept fastened in between two legs and the stones inside the water are moved towards the basket to scare the fish and then the basket is lifted hurriedly. | Disturb the water bodies and scared fishes try to hide in between the stone or move towards the river banks , then hunter will be lifted basket hurriedly which is already been put earlier.                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

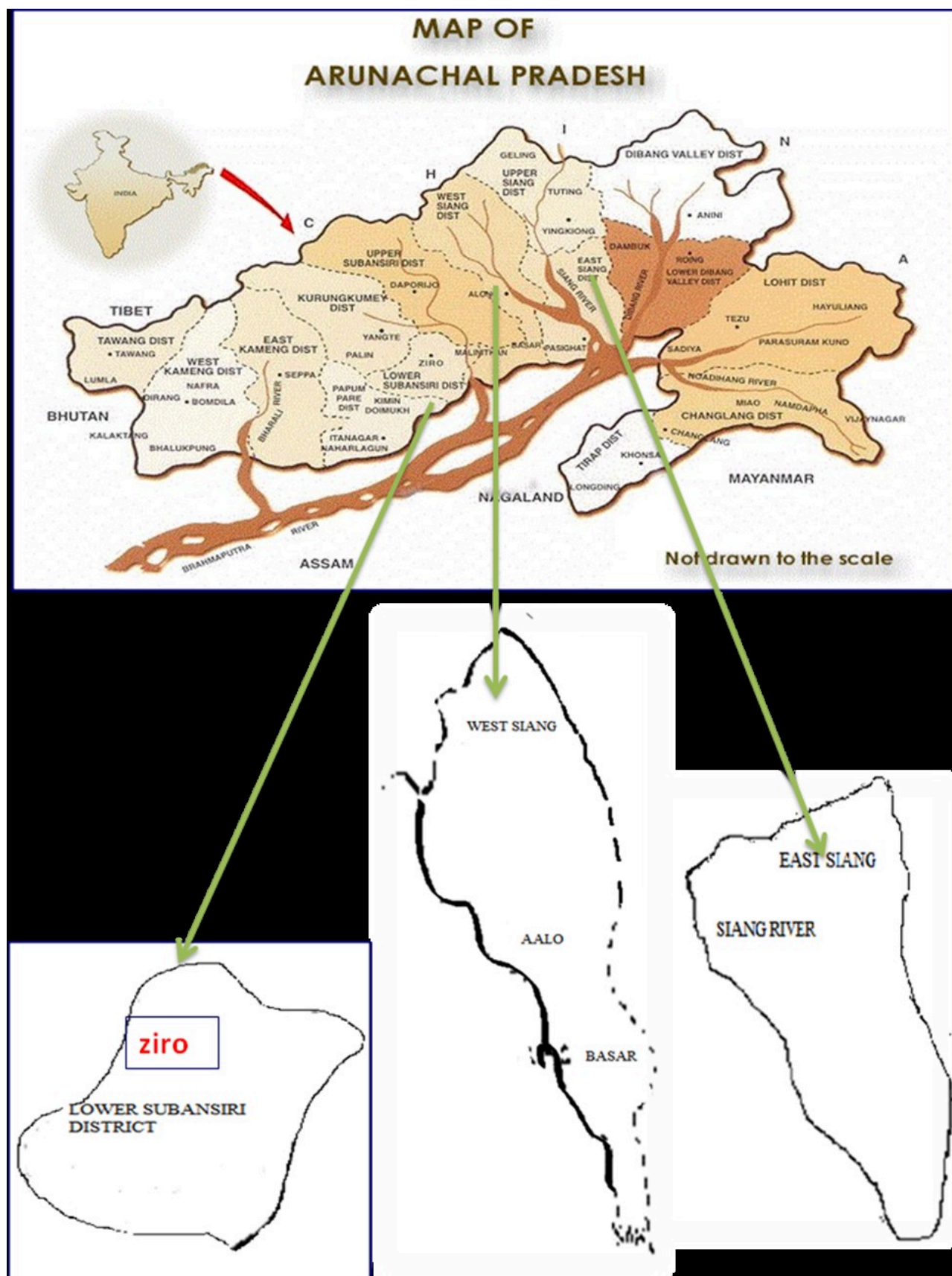


**Figure 1.** Map of selected districts for the study

Read-through of the above listed technologies clearly demonstrated that, they have not been developed overnight, rather have evolved over generations. These are only some of the practices observed in the study area. There are may be many more location specific practices not known to us. This study also revealed the source and the mode of diffusion of this knowledge and its relevance for frontier research and sustainability of the farming systems. Beside, all these technologies

are no cost or low cost methods, which could be easily understood, analyzed and applied in problem solving situations even illiterate and resource poor farmers.

Every social system has rich Store house knowledge is built from and it's is based on thousands of years of experiences. The indigenous knowledge has recently been recognized as an important source of innovations, which is considered potential substitute or complement to

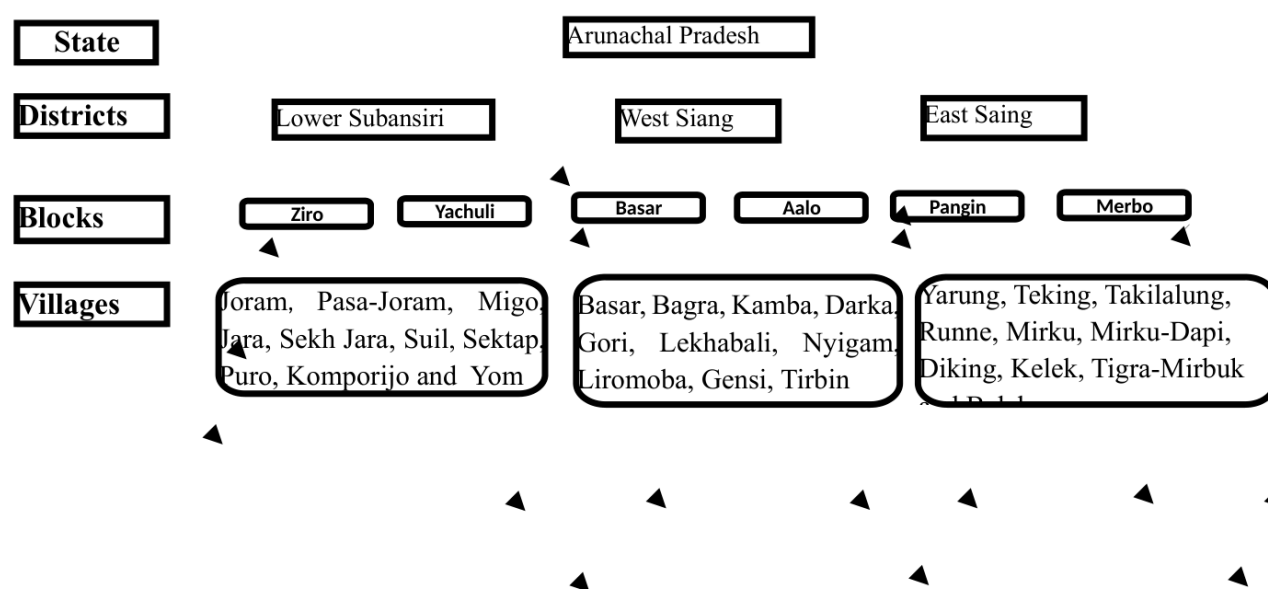
formal scientific knowledge and technologies (Thurston, 1992) [5]. The researcher should not treat these practices as outdated and unscientifically just because the resource poor farmers are practicing these. But the fact that people's technologies have withstood the test of time and are surviving over the years is an ample evidence for their sustainability. Our effort should be focused towards the scientifically validate these practices for wider use among the farming community.

## Recommendation and conclusion

The community of researcher may remark that these traditional methods have not been evolved through scientifically experimentation but one would agree that art of cultivation has descended from one generation to the other and thus this traditional wisdom has been sustained through experience over a number of generations. They have developed local resources based crops production, post harvest technologies, livestock management skills and plant protection management technologies. Considering the benefits of people's technologies,

KVK, West Siang, ICAR AP Centre, Basar, Arunachal Pradesh has paved towards the ITK's practices and explained some practices scientifically and trying to validate these practices also, others need future study in a collaborative and interactive way with the farming communities. Potentials of these indigenous technologies for integration into the agricultural developmental programmes of Arunachal Pradesh. But, the need of hour is to initiate the networking among the ICAR, SAU's, KVK's, State Agricultural Departments, NGO's and other agrarian societies to locate the people's technologies. Document, validate and channelize such technologies and farmers experience and their application in solving the recurring problems relates to agriculture. We have explored as many as 12 ITKs based management practices for the control of pest pathogens of upland rice in our preliminary investigation in different north eastern region, different agro-climatic conditions. The insect pests found dominantly in upland rice were leaf folder, gundhi bugs and grasshopper and that of the diseases were blast (*Pyricularia oryzae*) and brown leaf spot (*Helminthosporium oryzae*).

**Fig.2. Flow diagramme of selected villages of Lower Subansiri, West Siang and East Siang of Arunachal Pradesh**



Commonly grown weeds were *Eichinochloa glabrescens* and *Cyperus iria*. Tribal ethnic groups namely Nagas, Chin-Kuki-Mizo were found to practice upland rice cultivation in Manipur hill slopes. Cultivation of upland rice in hills are more or less similar with all these ethnic communities. However, slight differences in their indigenous based knowledge system observed among Kuki and Nagas tribes. These differences were partly culture based tradition and partly based on locally available resources, topography, climatic conditions. Whatsoever be the case, all the tribal communities manage the crops exclusively under organic condition. They regard land as a means of their livelihood and maintain the soil fertility and productivity level at sustainable pace. Management of the land and crops against pests & pathogens using culture based ITKs deserves appreciation. Maximum utilization of the land by growing a number of crops in the same site which not only enhances the efficiency of the land system but also create physical barriers for the movement of the pests & pathogens in the field. Also growing number of leguminous plants in the field not only enriches the soil fertility but also provide shelter for many predators to prey the pests of paddy over the field. Further, use of locally available medicinal plants to some extent substitute the action of modern fungicides/ insecticides is a matter of appreciation. All these activities which are carried out in the open field laboratory by the ethnic groups showed that indigenous system of paddy cultivation has in-built mechanism for the control of pests & pathogens of rice in the field. This system is unique, organic by default and sustainable as

long as the population pressure on the land is maintained and hence management practices for upland rice followed by the tribal farmers are sustainable. Similar views have been expressed by different authors working in the areas of traditional knowledge for the sustainable management of crops in traditional farming systems.

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