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# Status of Nutrient in Acidic Soils of Manipur under Different Land use System

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***ABSTRACT:*** *A survey on the agroforestry systems in six districts Manipur revealed the problems of degradation of natural resource, mainly forest soil and water, Jhumming in the hills, population pressure, land use pattern, ignorance, lack of proper transport and communication facilities contributed towards the low agricultural production status. In the valley, only areas of religious importance and some pocket are conserved with forest trees. Certain need based systems are identified Multipurpose tree species viz. Parkia roxburghii (low to medium altitude), Alnus nepalensis, (medium to high altitude) in combination with various agricultural and horticultural crops an found promising in developing sustainable agro forestry system for this region. A Study was conducted in characterization of some physical & chemical properties of six different Districts of Manipur (Senapati, Churachandpur, Thoubal, Chandel, Bishnupur, Imphal East) under some blocks/Sub-divisions. As a part of the study in Senapati district of Kangpokpi Block under different land use system-Agro forestry a model on Agri-horti base farming system for partially reclaimed acid soils. The Study aim is to identified the fertility nutrient status jhum and terrace cultivation, the Soil pH ranges 4.5-5.4 Organic Carbon 1.1-1.6, available N (kgha-1) 263-301, available P2O5 (kgha-1) 10.8-21.6 and available potash P2O5 75 – 175 (kg ha-1) K2O in jhum cultivated area of Senapati District main Agri-horti crops (Banana, pineapple, maize, beans paddy) compare to jhum cultivated area the terrace land of this District in the same village has got Soil pH 4.7-5.9, available Organic Carbon ranges 1.5-1.6 per cent and available N, P, K, are 319-432, 21-25, 112-300 kg ha-1 were recorded.*

***Key words:*** *Agro-forestry, jhum, terrace, Agri-horti.*

## INTRODUCTION

In North east about 2.7 million hectare are used for shifting cultivation. The number of years before a community returns to the same land depend on its availability to the community and the population, currently the cycle has strunk to 5-7 years as compared to earlier decades. The average size of plot cultivated by a family of 2 adults and 3 to 4 children is 1 to 2.5 ha. There are significant geographical areas. The seed mixture varies considerably from region to region as does the length of the cycle. Some 8-10 crops are grown in the same field: these include paddy, maize, beans, tapioca, parkia, sweet potato, ginger, turmeric, chillies, banana, leafy vegetables. The Study area of the village of Kangpokpi, Kangchup and Saparmeina usually adopted crops are mainly parkia, rice beans, maize, sweet potato, tapioca etc.

The State of Manipur is a vast complex of varied ecosystem. The mountainous chain rising from low lying plains to well over 2000 m has a complex physiography. The valley hills of Manipur lies between 23/68O N- 25.68ON latitude and 93.03OE to 94.78 E longitude. The valley is flate and elongated ranging from 700-800 m. above mean sea level. The climate is warm summers and cold winters. The mean annual air temperature varies from 19 to 27OC and the mean annual rainfall is 1467.5 mm. The total geographical area of the state is 22,327 km2, with a population of 23,99,000 (2001 census). Sixty seven per cent of the total geographical area is hills covered by different types of forest. Depending upon the altitude of hill ranges, the climatic condition of the state varies from tropical to sub-alpine. Generally, most of the hilly soils are found deficient of micronutrients like Zn, Fe and Mn. Manipur covers six different districts viz. Senapati, Churachandpur, Chandel, Bishnupur, Thoubal and Imphal East. The region has a large variation in topography, elevation and location resulting in great contrasting climates from region to district. The nature and type of vegetation occurring in a particular part depends upon the combination of prevailing climatic conditions, altitude, slope, edaphic and biotic factors and latitude. As a result, the entire state displays extreme variations in soil characteristics

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and in soil organic matter. By and large, the soils under forests are richer in organic matter status than those of aerable lands. Soils at higher elevations reveal a build up of organic matter due to accumulation of grass roots and prevailing lower temperature of the region. Agro forestry has become popular in Asia over the past decade as a means for agricultural and rural development. Shifting cultivation is practiced extensively in the hill regions of Assam, Meghalaya, Manipur, Nagaland, Tripura, Arunachanal Pradesh and Mizoram and to some extent in other parts of the country. About 2.7 million hectare is used for shifting cultivation in the North East hill region. Research achievements made in N.E. Region to over come shifting cultivation. Terracing on sloppy lands has been suggested as a alternative to shifting cultivation. But due to three main reasons viz. expensiveness, high input requirement and wood problems, this has not become popular in the recent past. ICAR Research Complex, Barapani has suggested on integrated farming system as an alternative to shifting cultivation. In which upper 1/3rd portion is put under forest and pasture species for rearing of animals, middle 1/3 portion is put under forest and pasture species for crops (trees and shrub) and lowest 1/3 portion for agricultural crops (Cereals, pulses, oil seed, cash crops etc). This is viable and sustainable system for this region. Which planning and developing a particular agro-forestry system in a particular area some factors say Agroclimatic condition, Soil type and depth, fertility status of soil, slope and side of the hill water shed area purpose of land use, size of the holding, existing land use pattern and native crops or vegetation. A survey on the agroforestry systems in five hill districts and four valley districts of Manipur revealed the problems of degradation of natural resource, mainly forest, soil and water, Jhumming in the hills, population pressure, land use pattern, ignorance, lack of proper transport and communication facilities contributed towards the low agricultural production status. In the valley, only areas of religious importance and some pocket are conserved with forest trees. Certain need based systems are identified multipurpose tree species viz. *Parkia roxburghii* (low to medium altitude), *Alnus nepalensis*, (medium to high altitude) in combination with various agricultural and horticultural crops are found promising in developing sustainable agro forestry system for this region. Uncertainties in agriculture are quite common: The main reasons for this are uncertain rains and infertile soils leading to high risk of crop failure. Soil erosion due to high intensity of rainfall and uncovered soils were also observed. Clayey soils which have low in filtration rate, shorter period of workability, poor soil aeration, fragile economy of farmers and chronic fodder shortage are causing lack of draft power at critical times. Agro forestry is a collective word for all land use systems and practices in which woody perennials are deliberately grown on the same land management unit as crops and / or animals. This can be either in same form of spatial arrangement or in sequence. The soils of hills are characterized by acidity leading to nutrient imbalance. The crop productivity in the hills is low because of low fertilizer consumption, socio economic conditions of farmers and remoteness of holdings. The need for applications of NPK is felt on almost all soils but the application of lime and Mg been felt on highly acidic soils. Application of FYM along with NPK was found useful in boosting the crop productivity in rice, wheat, maize and potato etc. Organic matter also acts as mulch especially under rainfed conditions of hills. OM could economic on NPK by 50 per cent depending on its rate of application. The integrated plant nutrient supply and management system aims at sustainable productivity with minimum deleterious effect on soil health and environment. Integrated management is more important especially in the hills where the fertilizer consumption is much less than in the plains of India. Most of the acid soils occur in hilly area of NEH region. Manipur soils are acidic with pH ranging between 4.5 and 6.8, rich in organic carbon, total N and alkaline $KMnO_4$, oxidizable N, low to medium in available P and medium to high in available in the soils of some hill districts (Chandel, Senapati, Ukhrul and Tamenglong). And texture of the soils varies from sandy loam to clayey, which is taxonomically classified as ultisol, alfisol, inceptisol and antisol. Organic carbon ranges from 1.44 to 4.09 percent and available P and N ranges from 2.97 to 26.72 and 210-616 mg kg-1 (M Ray ICAR 2000). (M. Raychaudhuri *et al* 2000). Acid soils in India cover nearly 30 per cent of the total area of the country. Latarites and various lato solic soils are the large groups among acid soils. The other groups are podzolic soils, brown forest soils, peat soils, etc. Generally lighter in lexture, the acid soils are low in Cao and Mgo, high in free iron oxides and mostly kaolinite in mineralogy. Similarly the acid soils are generally low in P content. The amount of micro nutrients, viz. B, Cu, Mn, Zn and Mo in acid soils are variable depending upon the place and the soil group. The acid soils are characterized by low bacterial and high fungal population. In India, the

acidic red and laterite soils are of quail significant in Assam and other North Eastern states. Time has been applied to various crops in different acid soils of India with the primary objectives of increasing crop production. Rice is the major crop in the latarite and various acidic red soils. Since this crop has a greater degree of tolerance for acidity, within the range pH 5 to 6, attempts to get higher production of rice in acid soils have generally culminated in failure. The crops that have responded well to lime application are mostly legumes followed by crop cotton maize.

## MATERIALS AND METHODS

Soil samples were collected from different block level and sub-division under different land use systems to find out soil fertility constraints. Various physico-chemical parameters were studied in each land use system in six districts of Manipur where three stages of soil sampling were adopted covering blocks and sub-division in the first stage where two villages from each block were taken up in the second stage by random sampling without replacement. In the third stage, ten ultimate respondent farmers which is located in an area of 100 meter between the farmers were drawn, the samples were collected, stored in cloth bags and then process for analysis following standard methods (Jackson 1973). As a part of the study evaluation on some chemical properties of the jhum land and terrace of Senapati district intervention to Kangpokpi Block of Saparmeina, Kangchum and Kangpokpi village where the same method of sampling were followed as mention above.

## RESULTS AND DISCUSSION

### The Physico-chemical Properties of the Jhum and Terrace Field

The data indicate (Table 2) that the mean pH value (5.3) in soils of jhum fields was higher then in soils of terrace fileds (4.9). It varied from 4.7 to 5.9 and from 4.5 to 5.4, respectively. It seems that higher pH in soils of jhum fields may be due to flash burring in jhum field, which is allocating in nature. Such fending has been also recorded by Misra and Saithan tuaanga (2002). The organic carbon content was lower in jhum fields and it varied from 1.3% to 1.5% with an average of 1.40, while in the terraced fields it varied from 1.6-1.69% with an average of 1.63. Such diversion in organic carbon may be possibly due to burring of dry biomass and washing down of organic math from the jhum fields. This results an in conformity with the findings of Bandyopadhyay and Chatto padhyay (1997). The electrical conductivity of the soils ranged from 3.66-13.69 µm Sm-1. The lowest and highest values of electrical conductivity were recorded in the soils of Saparmeina. The available nitrogen contents of the *jhum* field varied from 263.4-301.0 N kg $ha^{-1}$ which is lower than terrace field (319-432 N kg$ha^{-1}$). These may be due to leaching and erosion of surface soil and the organic matter content is low in jhum field result are in conformity with the finding of Srinivas *et al.* (1998). The available phosphorus content in *jhum* field and terrace were low and less than 25 kg P2O5ha-1. The mean available phosphorus content of the jhum field was found to be 19.01 $P_2O_5$ kg $ha^{-1}$ whereas terrace field is 21.83 $P_2O_5$ kg $ha^{-1}$. Similar findings were also reported by Srinivas *et al* (1998). This may be due to the fixation of phosphorus by iron and alluminium in acid soils. The available potash contents were varied from low to medium. The lowest value was recorded from the *jhum* field of Saparmeina (75 kg ha-1) and the highest value was recorded from the terrace land of Saparmeina (300 kg ha-1) Mean available potash in jhum field (57.6 kg $ha^{-1}$) is lower compared to terrace field (220.6 kg $ha^{-1}$). Such finding has been also recorded by Prasad (1981).

### The Physical and Chemical Properties of the Six Different Districts

The soils are acidic in range and pH of the surface soil (0-15 cm) varies from (4.4-6.4) and organic carbon (0.56-2.38%). The macro and micro nutrient status of the five district soils are given in table (4) and (5). Available nitrogen is in medium range in Bishnupur village namely viz Chiru, laingam, Nambol (Koriphaba), Ishok, Waroiching, Khalaba. Four farmers were selected from each village by simple random sampling without replacement. Similar trend of medium range of available nitrogen follow in Churachandpur where Thoubal, Senapati, Chandel, Imphal East has got medium to high range of nitrogen. Soil phosphorus is very low in soils of Bishnupur sub-division, of Senapati and Kangpokpi villages of district, and maximum areas of Imphal East, Chandel, Thoubal, Churachandpur are medium to high in range. However available potash is relatively low in Bishnupur and Thoubal blocks soils compare to high content of potash in Umphal east and Thoubal district, this may be due to continuous cultivation of crops and sufficient use of fertilizer though there is low to very low available potash in Churandpur and Chandel district, this may due to intensive cultivation and fertilizer consumption is lower compare to other blocks/ district.

**Micronutrient (Zinc, Copper, Manganese)**

Most of the menieral soils consist of Zn in the range of 10 to 300 ppm. Zinc is fixed with clay crystals keeping in views of Zn deficiency in some districts of Bishnupur, Churachandpur, Senapati and Chandel. Villages of Sawombung, Kangpokpi, Bishnupur block and Churachandpur block are found highly deficient in Zinc this may be due to adsorbed or fixation of Zn2+ by clay minerals or may be due to Zinc form stable complexes with soil organic matter as the soils found to be high in organic matter content. Thus the action of organic matter on Zinc can be expected to be variable depending on the characteristics and amount of organic materials involved. When immobilization and complexation reactions of organic matter prevail availability of soil zinc will be adversely affected organic matter in soil may form organic complexes with Zn and thus may avoid its transformation to other forms. Deficiency of Zinc is observed in the hill soils where wide cultivation of maize is there almost all the soils of the five districts are mostly deficient in Copper. Soils of Bishnupur district which have organic carbon percent ranging from 0.67 ti 1.58 percent occur acute deficiency of copper (0.149-0.681 ppm) in table which has got soil pH of (4.9-6.2). Similar to Bishnupur district, Chandel and Senapati soils were found to deficiency in copper. Where as Thoubal, Churachandpur and Imphal East are above critical level of copper except in few villages.

**Manganese**

Manganese found sufficient in all the soils of five district soils with pH lower then 5.5 may content large amounts of them Mn in water soluble and exchangeable divalent form but with the rise of pH, amount of these forms decreases. The relationship between pH in all the districts range from 4.4 (Najum village of Chandel) to 6.4 of Tekcham leikai of Thoubal which have a co-relation of available Manganese ranging from 2.03 to 7.26 in all the five districts.

Deficiencies in zinc are more sufficient in hill soils where more cultivation of maize is practice in which zinc is highly sensitive to maize crop. Deficiencies in major and micro nutrients can be amended using organic source, biodiversity, change in physio graphy and correcting acid soil with liming as well as developing a farming system integrated with Agri and horti crops as most of the hills area are habited with both agri and horti crops which can be developed to a model of agroforestry.

## CONCLUSION

Agri-hosti model can be developed partly and partially in the hill slopes of >500 ft. and < 500 ft. Locality has a costume of jhum cultivation which can be modified to agroforestry by introducing new crops above the exiting crops likely parkia, banana tree, tapioca and beans along with agri crops of rice, maize etc. From the above finding, it can be concluded that

**Table 1**
**Different Land Use System in Jhum and Terrace Cultivated Area in Senapati District**

| *Sl. No.* | *District* | *Block* | *Village* | *Physiography* | *Crops cultivated* |
|---|---|---|---|---|---|
| 1. | Senapati | Kangpokpi | Kangpokpi | *Jhumland* | Parkia, Maize, Beans, Paddy |
| | | | Kangchup | *Jhumland* | Pineapple, Maize, Paddy |
| | | | Saparmeina | *Jhumland* | Maize, Paddy, Beans, Tapioca |
| 2. | Senapati | Kangpokpi | Kangpokpi | *Terrace* | Paddy, Maize |
| | | | Kangchup | *Terrace* | Paddy, Maize |
| | | | Saparmeina | *Terrace* | Paddy, Maize |

**Table 2**
**Chemical Properties of Jhum and Terrace Cultivated Area in Senapati District**

| *Sl. No.* | *Locations Jhumfield* | *pH* | *EC($\mu Sm^{-1}$)* | *O.C.(%)* | *Available N (kg $ha^{-1}$)* | *Available $P_2O_5$ (kg $ha^{-1}$)* | *Available $K_2O$ (kg $ha^{-1}$)* |
|---|---|---|---|---|---|---|---|
| 1. | Kangpokpi | 5.3 | 6.88 | 1.4 | 301.0 | 21.6 | 175.0 |
| 2. | Kangchup | 4.7 | 6.21 | 1.5 | 282.2 | 18.0 | 87.5 |
| 3. | Saparmeina | 5.9 | 13.69 | 1.3 | 263.4 | 10.8 | 75.0 |
| | Mean | 5.3 | 8.9 | 1.4 | 282.2 | 16.6 | 57.6 |
| | **Terrace field** | | | | | | |
| 4. | Kangpokpi | 5.0 | 7.12 | 1.7 | 332.4 | 21.6 | 250.0 |
| 5. | Kangchup | 4.5 | 3.66 | 1.6 | 319.8 | 25.2 | 112.5 |
| 6. | Saparmeina | 5.4 | 8.26 | 1.6 | 432.77 | 22.5 | 300.0 |
| | Mean | 5.0 | 6.3 | 1.6 | 360.1 | 23.1 | 220.6 |

**Table 3**
**Physico-chemical Properties of Six Districts of Manipur**

| *District* | *Block/ Sub-division* | *Village Site of Collection* | *Crop History* | *Texture* | *Ph* | *Organic (%))* |
|---|---|---|---|---|---|---|
| Bishnupur | Bishnupur | Chiru | Paddy | SIC | 6.2 | 1.16 |
| | | Laingam | Paddy | | 5.2 | 1.29 |
| | | Ishok Chingphu | Pineapple | | 5.4 | 1.27 |
| | | Waroi Ching | Paddy | | 4.9 | 1.58 |
| | | Khalaba | Paddy | | 5.0 | 0.67 |
| | | Koriphaba Ching | Paddy | | 4.9 | 1.23 |
| | | Keinou Ching | Paddy | | 4.8 | 1.38 |
| | | Khuga Wangma | Paddy | | 5.1 | 1.20 |
| | | Lourok (Kumbi) | Paddy | | 5.4 | 1.35 |
| | | Mean 5.2 1.24 | | | | |
| Churachandpur | Churachandpur | Kawtlian | Paddy | SIC | 5.6 | 2.11 |
| | | Kwakta | Paddy | | 5.4 | 1.37 |
| | | Mean | | | 5.5 | 1.74 |
| Thoubal | Thoubal | Tekcham Leikai | Vegetable | SIC | 6.4 | 1.95 |
| | Wangjing | Haokha Mamang | Vegetable | | 5.5 | 1.53 |
| | | Sanneloakol | Paddy | | 5.8 | 1.85 |
| | | Wangjing (Red Soil) | Pineapple | | 4.6 | 0.68 |
| | | Mean | | | 5.6 | 1.50 |
| Senapati | Kangpokpi | Seloi (W/4) Upper Char Bazar | Vegitable | SIC | 5.2 | 0.95 |
| | | Mandir (Kangpokpi) | Maize | | 4.7 | 1.95 |
| | | Shantipur (Kangpokpi) | Maize | | 5.1 | 1.30 |
| | | Tnagual Modi Village | Vegetable | | 5.0 | 0.89 |
| | | Mean | | | 5.0 1.27 | |
| Chandel | Chandel | Kamenkhu | Paddy | SIC | 4.6 | 0.62 |
| | | Panchai Village | Paddy | | 5.1 | 1.27 |
| | | Arimlok | Paddy | | 4.8 | 0.87 |
| | | Najum Village | Paddy | | 4.4 | 0.56 |
| | | Mean | | | 4.7 0.83 | |
| Imphal East | Sawombung | Ka Bouk Haobi | Paddy | SIC | 5.8 | 1.39 |
| | | Sambei (Pangei) | Paddy | | 5.1 | 1.55 |
| | | Chingkhu (Pangei) | Paddy | | 5.4 | 1.37 |
| | | Haotan | Paddy | | 5.4 | 1.44 |
| | | Pourabi | Paddy | | 5.3 | 1.80 |
| | | Chingarel | Paddy | | 6.1 | 1.23 |
| | | Mean | | | 5.5 | 1.46 |

**Table 4**
**Major Nutrient Content in Six Districts of Manipur**

| *District* | *Block/ Sub-division* | *Village Site of Collection* | *Crop History* | *Texture* | *Available Kg/Ha* | *P2o5 Kg/Ha* | *K2o Kh/Ha* |
|---|---|---|---|---|---|---|---|
| Bishnupur | Bishnupur | Chiru | Paddy | SIC | 489.20 | 7.95 | 38.08 |
| | Nambol | Laingam | Paddy | | 464.10 | 4.25 | 253.10 |
| | | Nambol | Paddy | | 389.00 | 31.50 | 147.80 |
| | | Ishok Chingphu | Pineapple | | 413.90 | 7.28 | 197.10 |
| | | Waroi Ching | Paddy | | | | |
| | | Khalaba | Paddy | | | | |
| | | Koriphaba Ching | Paddy | | | | |
| | | Keinou Ching | Paddy | | | | |
| | | Khuga Wangma | Paddy | | | | |
| | | Lourok (Kumbi) | Paddy | | | | |
| | | Mean | | | 439.00 | 12.74 | 159.02 |
| Churachandpur | Churachandpur | Kawtlian | Paddy | SIC | 320.30 | 45.80 | 52.00 |
| | | Kwakta | Paddy | | 402.00 | 20.00 | 40.20 |
| | | Mean | | | 361.15 | 32.90 | 46.10 |
| Thoubal | Thoubal | Tekcham Leikai | Paddy | SIC | 464.10 | 30.80 | 141.00 |
| | Wangjing | Haokha Mamang | Paddy | | 260.00 | 20.00 | 343.60 |
| | | Sanneloakol | Paddy | | 560.00 | 39.00 | 479.20 |

*contd. table 4*

| *District* | *Block/ Sub-division* | *Village Site of Collection* | *Crop History* | *Texture* | *Available Kg/Ha* | *P2o5 Kg/Ha* | *K2o Kh/Ha* |
|---|---|---|---|---|---|---|---|
| | | Wangjing (Red Soil) | Paddy | | 326.00 | 21.00 | 174.72 |
| | | Mean | | | 402.52 | 27.7 | 284.63 |
| Senapati | Kangpokpi | Seloi (W/4) Upper | Paddy | SIC | 539.78 | 78.5 | 784.00 |
| | | Char Bazar | Paddy | | | | |
| | | Mandir (Kangpokpi) | Paddy | | 413.90 | 16.68 | 176.96 |
| | | Shantipur (Kangpokpi) | Paddy | | 489.20 | 11.53 | 490.52 |
| | | Tnagual Modi Village | Paddy | | 544.00 | 34.50 | 630.00 |
| | | Motbung | Paddy | | 539.3 | 17.25 | 40.32 |
| | | Mean | | | 505.24 | 31.69 | 424.36 |
| Chandel | Chandel | Kamenkhu | Spices (Ginger) | SIC | 439.00 | 21.17 | 22.40 |
| | | Panchai Village | Paddy/Maize | | 514.30 | 23.85 | 134.40 |
| | | Arimlok | Paddy/Maize | | 451.50 | 36.00 | 35.84 |
| | | Najum Village | Paddy | | 446.00 | 33.70 | 30.50 |
| | | Chingkhu | Paddy | | 514.3 | 25.76 | 204.00 |
| | | Mean | | | 473.02 | 28.10 | 85.43 |
| Imphal East | Sawombung | Ka Bouk Haobi | Paddy | SIC | 376.3 | 67.05 | 416.00 |
| | | Sambei (Pangei) | Paddy | | 439.00 | 19.71 | 194.88 |
| | | Haotan | Paddy | | 564.5 | 27.00 | 443.85 |
| | | Pourabi | Paddy/Vegetable | | 564.4 | 80.99 | 430.4 |
| | | Chingarel | Paddy | | 439.9 | 26.9 | 24.1 |
| | | Mean | | | 474.80 | 44.20 | 301.8 |

**Table 5**
**Micro Nutrient Ontents of Six Districts of Manipur**

| *District* | *Block/ Sub-division Collection* | *Village Site of* | *Crop History* | *Texture* | *Zn pmm* | *Cu pmm* | *Mn ppm* |
|---|---|---|---|---|---|---|---|
| Bishnupur | Bishnupur | Chiru | Paddy | SIC | 1.458 | 0.433 | 6.558 |
| | Nambol | Laingam | Paddy | | 1.204 | 0.458 | 7.258 |
| | | Nambol | Paddy | | 1.534 | 0.594 | 5.982 |
| | | Ishok Chingphu | Pineapple | | 1.629 | 0.149 | 6.498 |
| | | Waroi Ching | Paddy | | 1.22 | 0.588 | 5.44 |
| | | Khalaba | Paddy | | 0.99 | 0.601 | 5.82 |
| | | Koriphaba Ching | Paddy | | 1.03 | 0.681 | 6.01 |
| | | Keinou Ching | Paddy | | 1.33 | 0.998 | 5.99 |
| | | Khuga Wangma | Paddy | | 1.22 | 0.998 | 5.99 |
| | | Lourok (Kumbi) | Paddy | | 0.589 | 6.90 | 5.74 |
| | | Mean | | | 1.250 | 1.31 | 6.16 |
| Churachandpur | Churachandpur | Kawtlian | Paddy | SIC | 0.483 | 1.568 | 6.563 |
| | | Kwakta | Paddy | | 0.562 | 1.428 | 5.980 |
| | | Mean | | | 0.52 | 1.50 | 6.270 |
| Thoubal | Thoubal | Tekcham Leikai | Paddy | SIC | 1.038 | 2.107 | 6.021 |
| | Wangjing | Haokha Mamang | Paddy | | 1.530 | 2.023 | 5.562 |
| | | Sanneloakol | Paddy | | 1.235 | 1.962 | 4.950 |
| | | Wangjing (Red Soil) | Paddy | | 1.038 | 0.988 | 6.013 |
| | | Mean | | | 1.21 | 1.77 | 5.64 |
| Senapati | Kangpokpi | Seloi (W/4) Upper | Paddy | SIC | 0.584 | 0.579 | 2.845 |
| | | Char Bazar | Paddy | | | | |
| | | Mandir (Kangpokpi) | Paddy | | 0.652 | 0.599 | 2.752 |
| | | Shantipur (Kangpokpi) | Paddy | | 0.766 | 0.625 | 2.995 |
| | | Tnagual Modi Village | Paddy | | 1.202 | 1.232 | 3.00 |
| | | Mean | | | 0.80 | 0.76 | 2.90 |
| Chandel | Chandel | Kamenkhu | Paddy | SIC | 1.65 | 0.688 | 2.03 |
| | | Panchai Village | Paddy | | 2.03 | 0.925 | 2.52 |
| | | Arimlok | Paddy | | 1.95 | 0.586 | 2.48 |
| | | Najum Village | Paddy | | 1.58 | 1.102 | 2.63 |
| | | Mean | | | 1.80 | 0.83 | 2.42 |
| Imphal East | Sawombung | Ka Bouk Haobi | Paddy | SIC | 0.397 | 0.756 | 2.88 |
| | | Sambei (Pangei) | Paddy | | 2.049 | 2.173 | 6.206 |
| | | Haotan | Paddy | | 2.12 | 0.952 | 3.55 |
| | | Pourabi | Paddy | | 1.56 | 1.023 | 2.10 |
| | | Chingarel | Paddy | | 2.17 | 0.806 | 5.13 |
| | | Mean | | | 1.85 | 1.01 | 4.45 |

the various operations in shifting cultivation bring the more depletion of soil nutrients than that of the terrace cultivation. Therefore, terrace cultivation may be adopted to conserve the major plant nutrients to sustain the soil fertility and crop productivity. Shifting cultivation, not only depletes the major plant nutrients but also disturbs the ecological balance resulting in depletion in precipitation, disturbs the top soils leading to tremendous surface erosion in light textured soils, decrease water holding capacity and produces water repellent layers leading to increase surface runoff and landslide which causes tremendous loss of the soil resources.

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