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**Mark Haominthang Lhungdim**
Department of Agricultural Extension, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal, India

**Adhikary Mayukh**
KVK, Sundargarh-1, Odisha University of Agriculture & Technology, Odisha, India

**Adhikary Manas Mohan**
Department of Agricultural Extension, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal, India

**Correspondence Author:**
**Mark Haominthang Lhungdim**
Department of Agricultural Extension, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal, India

# Tribal farmer's ethnopedological knowledge about decision support system in churachandpur district of Manipur State

**Mark Haominthang Lhungdim, Adhikary Mayukh and Adhikary Manas Mohan**

**Abstract**
The study is to describe the process of recording the local soil knowledge and validating the indigenous soil knowledge for the three tribal communities, Thadou-Kuki; e Hmar and Vaiphei in Manipur State. Transect walks and brainstorming's were used for the collection of information on the indigenous soil of the region. Results indicate that the farmers of this region use observable morphological characteristics, such as colour and texture and to a lesser extent, land use, as the major classification criteria. In the beginning, farmers distinguish 3 types colour – red, brown, and grey and they classify at least 6 types of soil found in the region. It was observed that the indigenous farmers were able to identify the various types of soil found on their land. Through participatory soil mapping exercises, an attempt was made to develop a single but comprehensive soil classification that reflects the major types of soil found in the region.

**Keywords:** Indigenous knowledge, ethnopedology, traditional soil classification, decision support system, soil mapping

## 1. Introduction
Indigenous knowledge refers to an institutionalized local knowledge that has been built upon and passed on from one generation to another. Folk taxonomies have always been with the farming communities since ancient times. Farmers have been classifying soils based on the suitability of the soils to the crops or based on the land management found suitable in that area. Farming communities have been continuously transforming this taxonomic knowledge into farming strategies and practices which they can use for their development. Local farmers have a profound knowledge of their soils (Kundiri *et al.*, 1997) [11]. They form the basis for many management practices, such as the fine attunement of cropping systems to the agricultural capabilities of the site, and adjusting soil conservation practices (Weinstock 1984, Marten & Vityakon 1986 and Pawluk *et al.* 1992) [19, 12, 14]. They have developed local taxonomic systems of soil classification that are usually use-oriented (Habarurema and Steiner, 1997; Sandor and Furbee, 1996; and Corbeels *et al.*, 2000) [4, 15, 2]. They commonly adopt parameters such as colour, texture, dept, changes in soil behaviour under different conditions, drainage, and parent materials/geomorphic features in classifying the soils for their own need (Hecht, 1990; Warren, 1992; and Ishida, 1998) [5, 18, 8]. Indigenous Soil Classification which is synonymous with Ethnopedology, is the study of local or indigenous knowledge of soil and land management in an ecological perspective. It is an emerging hybrid discipline that is a component of ethnoecology and stands to offer much for land-based studies. The concept of ethnopedology has been defined in several different ways and various approaches to ethnopedological studies have been suggested (Ettema, 1994; Ishida *et al.*, 1997; Barrera-Bassols & Zinck, 2003; Krasilnikov & Tabor, 2003) [3, 7, 1, 10]. Ethnopedology is perceived as the study of indigenous soil knowledge, soil evaluation and soil classification in accordance with the definitions used by, among others (Krasilnikov and Tabor, 2003) [10]. In fact the word "Ethnopedology" itself was not coined until the early 1980's, a time when other ethnoscience were already highly developed and refined. Often, indigenous soil and land knowledge appears as an exotic collection of information of primitive human experience and attitudes related to the soil resource. During recent decades, ethnopedology has gained importance because it gives a better understanding of local community practices and thus improves the chances of successful development interventions.

Modern transformation, assimilation and globalization have threatened the integrity of many cultures. Certainly, a number of cultures and their heritage of knowledge have already been lost, and many others are at risk. It is important that the rights of local/indigenous peoples be recognized and protected. Parallel with the importance of language in cultural identity is the heritage of land and environmental knowledge which is essential to cultural viability. With this in view the objective of the study is to find out the farmers' ethnopedological classification of three tribal communities; their comparative analysis of ethnopedological knowledge and to validate the ethnopedological knowledge of the soil based on the physico-chemical properties of the soil determined from laboratory soil testing.

## 2. Materials and Methods

The study was conducted in the Churachandpur district in Tuibuong Block of Manipur State, and a list of 50 villages under it was first examined. Out of which three villages were selected, Molnom village for the Thadou- Kukis; Khawmawi Village for the Hmars and Saipum Village for the Vaipheis. The three tribes namely the Thadou-Kuki, Hmar, and Vaiphei were selected purposively for the data collection. The three tribes are among the major tribes residing in the district and the researcher's close proximity with the people and their culture was found favourable for conducting the study. The data has been collected through Key Informant Focused Group Interviews. The primary data in the present study was collected through a Transect walk and Key informant-focused group interview. The data generated were corrected supplemented and refined through brainstorming involving the knowledgeable farmers as well as other participant farmers. A survey was conducted to examine the indigenous soil classification, planning, and land management systems among the Thadou-Kuki, Hmar, and Vaiphei tribes. The methodology for the exploration of the local ethnopedological knowledge among the tribes includes participatory identification and classification of local land types with the farmers on site. Village elders who are knowledgeable and responsible for land classification in the village were selected for this purpose.

**2.1. Soil sample collection and Soil Testing:** For the collection of soil samples, composite soil sampling was followed. Soil samples were collected from a number of furrow slices collected from the area using a spade and the samples thereby collected are thoroughly mixed. The furrow slices collected from each site are of uniform volume and all the furrow slices were taken in random. Six random sites were selected from each area as heterogeneity of the soil decreases with increasing number of furrow slices. The soil samples taken were tested for their pH, electrical conductivity, organic carbon, available phosphorus and available potassium in the soil. Conventional soil survey methods were employed and representative soil samples were collected from each land. With the help of the farmers, soil properties that are important in the local classification method were identified and selected as fertility indicators. For this purpose, soil texture and depth of the different horizons were determined and recorded during the field survey.

**Table 1:** Comparative parameters of the 3 tribes (Thadou-Kuki, Hmar and Vaiphei)

| Name of the Tribe<br>Comparison Parameters | The Thadou-Kuki Tribe | The Hmar Tribe | The Vaiphei tribe |
|---|---|---|---|
| 1. Etymology of the soil | Same as Vaiphei tribe | Different | Same as Thadou-Kuki tribe |
| 2. Common parameters used | Colour, Land use, location | Texture, Location, Origin | Land use, Colour |
| 3. Indicator plants | Thatch grass, gooseberry, climbing hemp for red soils Pennyworth, milk thistle, Bermuda grass for sandy soil. | Thatch grass and Bermuda grass for red soils. Bermuda grass and goatweed for sandy soil. | Thatch grass, climbing hemp for red soil Bermuda grass and goose grass for sandy soil. |
| 4. Fertility indicator. | Same as the other tribes | Same as the other tribes | Same as the other tribes |
| 5. Suitable crops for soil. | Pineapple, Maize for red soil. | Pine trees and oak trees for red soil | Pineapple, green gram, black gram for red soil. |
| 6. Soil conservation practices | Green vegetation near water bodies Rock lining on slopes Bamboos and bananas on jhum field for wind breaks | Rock lining ear river Rock lining on slopes. Unds on jhum field. Bamboos for wind breaks | Closely spaced fences near rivers. Stone lining only on loose soils on the slope. Bunds on jhum field. |
| 7. Cultivation practices | All types of crops grown near river banks. Colocasia and rice on jhum fields. | Mono cropping of mustard or rapeseed. Maize and other types of crops on jhum field except for rice. | Mustard, maize, colocasia on river banks. All types of crop on jhum field |
| 8. Jhumming practices. | Jhumming on all types of soil except for the red soils. Jhumming is not practiced on the upper slope soils | Jhumming only on the lower end of the slope. | Jhumming on all types of soil except for sandy soil near river banks. |
| 9. Colour indicator | Same as the other tribes. | Same as the other tribes. | Same as the other tribes. |
| 10. Perception of the erodibility of the soil. | Poor erodibility for red soil. | Highly erodible especially if it is on the slope | Highly erodible for red soils |

## 3. Results and Discussion

### 3.1 Indigenous Soil Classification of the Thadou - Kuki tribe

Farmers of the Kuki Tribe base their broad classification system mainly on colour, texture, and land use which is similar in parts to that found in other regions in the tropics. (Tabor *et al.*, 1990; Kante and Defoer, 1994; ICAR, 1998, Tenywa *et al.* 1999) [16, 9, 6 & 17]. The Kuki tribal farmers name the soils on the basis of these major criteria or a combination of any two. These criteria are important to the farmer in the sense that they are visible and practical in terms of his management of the soils in the course of the crop production on his farmland. The Kuki farmers classify their soils based on the top soil characteristics only which are similar to that found in Northern Ghana by Mikkelsen and Langorhr, 2004 [13]. In terms of their colour, the farmers

classify the soils according to red, black, brown, and grey soils with grades of each colour for comparison purposes, e.g., very red or light brown. However, the farmers do not have a separate name for these grades. As Tabor *et al* (1990) [16] found out in the Eastern Province of Kenya, farmers throughout this region distinguish similar types of soil and group them according to their management. These soil groups usually include numerous soils with different scientific classifications. In terms of texture, the farmers classify the soil on the basis of the sand and clay content. A combination of the two forms the basis for naming the soil. As Kante and Defoer (1994) [9] found out in southern Mali, the texture of the topsoil is also used to differentiate between land types. In this way, using this textural differentiating criterion, sandy soils are called Neldi Lei and Clayey soils Phai Lei. The degree of soil adhesion to tillage implements can be a hindrance and this, to a large extent is dependent on texture. Coarseness is used further to differentiate the sandy soils called Lei San and Lei Eng. Farmers of the Kuki tribe further describe soils according to a number of characteristics which are stickiness, hardness, water retention capacity, drainage, erodability, cracking, fertility, crops suitable for them, etc. Apart from the major criteria and characteristics used in naming a soil type, farmers also describe soil in terms of management constraints, and practices (to overcome the constraints). The position of the soil on the catena is also another important criterion used extensively by the farmers of the Kuki tribe to differentiate and classify the soils of the area. One simple and broad base used for the classification of the soils by the Kuki tribal farmers was land use or geophysical location. The soils found in the hills are called Zou Lei, which may be at the apex or at the slope. Those soils found in the plains are called Phai Lei. Zou Lei consists of the red soils predominantly found in the hills like Lei San and Lei Eng as well as the brown soils like Changpal Lei and Lei Si. Phai lei consist of the soils found in the plains or the hill valleys which are more sandy in texture as compared to the soils of the hills. The Kuki farmers did not use indicator plants extensively. However, as reported by Ettema (1994) [3] in Malaysia, the Kuki farmers also use weeds like Centella Asiatic (Indian Pennyworth) and other such weeds to identify the fertility of the soil.

### 3.2. Indigenous Soil Classification of Hmar Tribe

The Hmar farmers generally based their classification on their origin, color, texture, and land use. The Hmar farmers name their soils based on these major criteria or a combination of any two of them. This is similar in parts to that found in other regions in the tropics. (Tabor *et. al.*, 1990; Kante and Defoer, 1994; ICAR, 1998, Tenywa *et. al.* 1999) [16, 9, 6, 17]. These major criteria are important to the farmers because they are visible and are considered practical in terms of the management of the soils in the course of their farming. In terms of their color, the farmers of the Hmar tribe classify their soils into red, brown, and grey soils. The farmers also have different grades of each color for the soil for comparison purposes. However, the farmers do not have separate grades for these grades. Different scientific classifications may be observed on the soil groups which usually include numerous oils under them. This apparent consistency is because the scientific classification system distinguishes the soil complex while farmers' classification does not (ICAR, 1998) [6]. As Tabour et al (1990) [16] found out in the Eastern province of Kenya, farmers of the Hmar tribe distinguish similar types of soil and classify them according to their management. In terms of their texture, the Hmar tribe also classifies their soils on the basis of their sand and clay content. The combination of the two in the soil complex constitutes the basis for naming the soil. The texture of the topsoil is predominantly used to differentiate between land types. This was also reported by Kante and Defoer (1994) [9] in southern Mali. Based on this textural differentiating criterion, sandy soils are called Phaiphin pil, and clayey soils are called Thlak pil. The farmers also classify the soil based on their ease of ploughing during land preparation. The degree of soil adhesion to the tillage implements can be a hindrance and this, to a large extent is dependent on the texture of the soil. Coarseness of the soil is used to differentiate the sandy soils into Phaiphin pil and Tuitha pil. The cultivation of such soils usually requires the removal of the soil from the implement which is usually graveled. Hardness, stickiness, water retention capacity, drainage, and erodibility are some of the characteristics used by the Hmar farmers to describe their soil further. Cracking, fertility, and crops suitable for them are also some criteria used to differentiate their soils. Farmers also describe soils in terms of their management constraints and their practice to overcome the constraint. Another important characteristic used for their soil description is the position of the soil in the soil catena. This criterion is found to be informally used extensively by the Hmar farmer in describing as well as classifying the soils of their land. One simple and broad base criterion used by the Hmar farmers for their soil classification was the location of the land where the soil is found. The soils located at the hills are called Chungzang pil where jhumming cultivation is practiced.

### 3.3. Indigenous Soil Classification of Vaiphei Tribe

Colour, texture, land use, and the crops with which the soil is associated form the base of the Vaiphei tribe. This is also quite similar to the classification system found in other regions in the tropics (Tabor *et al.*, 1990; Kante and Defoer, 1994; ICAR, 1998; Tenywa et al, 1999) [16, 9, 6, 17]. The soil classification of the Vaiphei tribe is based on these major criteria or a combination of any two of the criteria. The visibility and the practicality of these criteria in terms of his management of the soils in the course of crop production in his agricultural field makes these criteria an important attribute for the farmers for the classification of the soil. The Vaiphei tribal farmers classify their soils, in terms of their colour, into Red, brown, and grey along with the shades for each colour for comparison purposes. One important fact, however, is that the farmers do not have a separate name for these grades. The farmers throughout the region also distinguish similar types of soil and they classify and group them according to their management. This was also reported by Tabor *et al.* (1990) [16] in the Eastern province of Kenya. The soils grouped together in this classification system usually include numerous soils with different scientific classifications. This apparent consistency may be because the scientific classification distinguishes the soil complex whereas the indigenous or the farmers' classification does not (ICAR, 1998) [6]. In terms of texture, the farmers classify the soils of the region on the basis of the clay and sand content. The basis for naming the soils consists of the combination of the two forms. As reported by Kante and

Defoer (1994) [9] in southern Mali, the texture of the topsoil is also sometimes used by the Vaiphei tribe to differentiate the land types. Using this textural differentiating criterion, in this way, sandy soils are called Nel lei, and clayey soils are called Tuilou lei. Coarseness is also used to differentiate the soils into Nel lei, Tuilou lei, and Tuitha lei. The degree of soil adhesion to the tillage implements can be a hindrance to land preparation during cultivation and this, to a large extent, is dependent on the texture of the soil. The Vaiphei tribal farmers also further describe the soil based on a number of parameters or characteristics which are stickiness, hardness, water retention capacity, drainage, cracking, crop suitability on them as well as erodibility. Apart from the major criteria and characteristics used in naming a soil type, farmers also describe and classify soils in terms of their management constraints, and practices to overcome the constraints. The Vaiphei farmers also basically classify their soils into Lei check for those soils having poor drainage and Lei hul for those with high drainage. Lei eng and Lei san as well as Nel lei are usually referred to as Lei hul whereas Tuilou lei and Tuitha lei are usually referred to as Lei chek. The position of the soil on the catena is also another criterion used to differentiate and classify the soils by the Vaiphei tribal farmers. One important parameter used by the Vaiphei tribal farmers in their indigenous classification is the crop plants with which the soil is considered favourable. Kang Lei is generally used for those soils found at the slopey hill on which jhumming is carried on.

**Table 2:** Pairs of soil quality indicators mentioned by farmers of the three tribes during the Transect walk and Brainstorming

| **'Positive' attributes/ indicator** | **'Negative' attribute/ indicator** |
|---|---|
| **Soil Properties** | |
| Black, brown soil colour | Yellow, white colour |
| Absorb water easily | Water does not infiltrate easily |
| Deep soil (More than two hands pans) | Shallow soil (Less than two inches) |
| Fertile | Sterile |
| Not many stones | Many large stones |
| Loamy texture | Clayey texture |
| Yellow hardpan layer | White hardpan layer |
| Moist soil in summer | Dry soil in summer |
| Soil with litter layer | Soil without litter layer |
| SOI with rich vegetation | Soil with poor vegetation |
| **Other factors** | |
| Unburnt | Burnt |
| Earthworm, white grubs | No soil fauna |
| Less steeply inclined | Steeply inclined |

## 4. Conclusion

Ethnoecology or indigenous soil knowledge consists of two dimensions namely the physical dimension which concerns knowledge which is derived through the observable characteristics of soil like colour and texture and the perceptual dimension which consist of those factors like soil workability, crop suitability, land use, etc. Colour and texture were the most common parameters used by the 3 tribes. In terms of the perceptual dimension, other parameters commonly used are the fertility and location of the soil. The indigenous Thadou-Kuki, Hmar, and the Vaiphei tribe of Manipur possess rich culture and tradition. Ethnopedological knowledge which has accumulated in the culture of these tribal communities cannot be ignored. The indigenous tribal farmers, through years of experience and experimentation, have created a reservoir of local knowledge that is useful in developing classification schemes that are simple, creative, socially acceptable, and extremely useful for extension work and the formulation of socially relevant and sustainable production technologies. The effective exploitation of these age-old resources is necessary for achieving the goal of sustainable agriculture. Our country, India, with its diverse agro-climatic condition, has a vast diversity of culture and tradition in which ample ethnopedological knowledge is embedded. Efficient and effective extraction and utilization are required on the part of the researchers and the scientist so that these rich resources can be tapped in a useful manner. It should also be mentioned that the local indigenous soil knowledge can advance the scientific knowledge of the soils and vice versa but it should never be viewed as a perfect substitute for scientific methods. Although local indigenous knowledge is now widely used in a variety of disciplines, capturing indigenous knowledge is not easy. The research demands the presence of another soil scientist for assistance in the identification and validation of the soil sample collected. It is therefore concluded that the integrated use of indigenous and scientific knowledge should be encouraged to enable an interactive flow of data between the two knowledge systems. Indigenous soil knowledge can provide a long-term perspective on land use and management not available otherwise and it will help in the evaluation of the land use in relation to soil quality for sustainable agriculture. This will contribute meaningfully to the efforts to develop new paradigms for sustainable development among the tribal communities in Manipur in particular and in India as a whole.

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