

Indigenous and Scientific Knowledge of Manure Management in Tree Farming Practice: an Anthropological Investigation of Northeast Upland Khasi of Bangladesh

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Received on 10.06.2017, Accepted on 28.06.2017

Abstract

Recent scholars and development workers have emphasized on Developing World farmers' farming materials and ethno-ecological knowledge and its potential for practical use in the fields. The northeast upland Khasi of Bangladesh what kind and extent of knowledge and farming materials are being used to augment of soil-nutrient to grow the tree crop in uphill is not uncovered. The aim of the present study was to explore their manure concept, source of manure and management system with practice in tree crop farming how their farming knowledge was integrated with indigenous knowledge and modern scientific knowledge. In this study the data was obtained using qualitative approach through participant observation and in-depth interviews from the local participants of the study area. Later elicited data were analyzed and categorized to find out their system. The findings illustrated that the global changing trend and social, political, economic factors as well as individual initiative bounded Khasi to be influenced and perceived the modern farming phenomenon and assimilated diverse origin farming inputs and knowledge systems. To explore these issues and the impact of prevalent farming concepts, the study investigated these factors, which revealed the inherent consequence of Khasi farmers' soil fertilizing knowledge with tree growth. The result of investigation signified that the Khasi soil-fertilizing procedures are integrated, and closer to the modern agroforestry system, which might be used locally, regionally and nationally as farming packages to other areas.

Keywords: Indigenous Knowledge; Khasi; Manure Management; Globalization; Agroforestry.

Introduction

The global current farming phenomenon is ethnoecological knowledge and natural resource management, how it could contribute to ecofriendly farming system with economic subsistence of local people. The profound farming debate is having any contradiction within native knowledge and modern agroforestry and agrofarming systems in agriculture, or it is supportive to each other to drag sustainable farming. In a voluminous literature on this topic,

some scholars have differentiated indigenous knowledge from modern scientific knowledge based on its separateness of subject matter, world view, methodology and the degree of incorporation of different cultural elements (Chambers, 1983; Howes & Chambers, 1980) (critiqued in Agrawal, 1995; Scoones & Thompson, 1994). Most commonly, scientists have revealed how knowledge from diverse system can have a scientific basis and how modern scientific knowledge can be rendered appropriately in different cultural system (Brodts, 1999, 2001). Indigenous Khasi tree crop farming primarily have

observed, the application of knowledge system is combined, because they integrate diverse elements from multiple knowledge system in the process of creating and recreating their own knowledge.

The knowledge dynamics of indigenous people are not statics and the ethnoecological knowledge has been influenced due to the global changes (Pawluk, Sandor, & Tabor, 1992). Khasi adopt it and incorporate new experiential knowledge in local knowledge and practice it due to global affects alike considering ethnoecological knowledge with surrounding biophysical milieu (Pandey, 2014). Conversely, some global knowledge pieces infuse into the native people due to population increase, outmigration as well as changes in their social world (Salam, Noguchi, & Koike, 2000). The expansion of world view and scientific innovation influences indigenous knowledge, and thereby it is not rigid in the unique nature of practice as preoccupied contextual local knowledge, rather it is intermingled. It is necessary to uncover how knowledge is integrated specially local and global knowledge. Indigenous knowledge is situated practice (Sivaramakrishnan, 2000); all knowledge is practically constructed by actor working at the intersection of specific social political and ecological contact (Kloppenburger, 1991; Knorr-Cetina, 1981; Long, 1989).

Indigenous knowledge is contextual knowledge embedded in nature. It is not decontextual, fragmented, and reductionist (Gandhi, 1982). It could diffuse cross national boundaries, which is prevalent in Indian subcontinent including ethnoecological resources management and conservation. However, many scholars (Guha & Gadgil, 1995; Gupta, 1971; Shiva, 1997) agreed that scientization and modern capitalization has exploited over natural resources and shortage of its farming inputs management system is deteriorated along with threatens of survival valuable of indigenous knowledge. Science, scientific innovation and its implied attributes invade indigenous knowledge through different channels and weaken the local knowledge paradigm in term of development-process. This trend falls upon native peoples' life and livings, including farming, cultural diversity as well as biodiversity. Native people are instigated to understand the farming concepts in connection with diverse knowledge – formal, informal and global aspect, which is symbolically related to humoral ideas and folk concept, observed in Hindu Ayurvedic health philosophy (Dash & Jounious, 1997; Kurin, 1983).

In Khasi tree-cop faming, manure usage systems are linked to the aspect of diverse origin of knowledge,

especially traditional/indigenous knowledge, folk/craft skill knowledge and global scientific knowledge. To understand the necessity of diverse manure these knowledge systems explain the hot/cold, food/nutrition, and health/disease humoral concepts. For example, villagers use folk science concepts of hot/cold to explain cowdung application in the field as soil nutrients as well as the global scientific practice of urea application. This way diverse farming inputs and soil-fertility, along with trees' health are explained by the aforementioned concepts. The knowledge amalgamation is happening on the basis of local actors, multiple opportunities, and resource availability of the locality (Brodt, 2002). To understand Khasi soil-nutrient and manure management system in tree crop cultivation have been prioritized on primary level concrete practice, secondary level concept and third phase knowledge system. While natural resource is not adequate farmer accumulate different categories of farming material as his/her understanding of farming ideas and concepts, which is some way belong in different categories of knowledge and inter and cross-related with each other. In Khasis' case, how knowledge is hybridized and practice centring indigenous resource as well as commercial inputs in manure management practice that is portrayed.

The Study Site

Khasi indigenous people reside mainly at the greater Sylhet Division in the North-eastern region and border of Bangladesh. The study was conducted among them. For the study purpose Kulaura and Rajnagar sub-districts were selected considering Khasis' uphill tree-crops farm field with forest surroundings. The area lies between latitude 24°01' to 25°15' north and longitude 91°05' to 92°15' east. The north-eastern part of Sylhet is a broad, level valley. Indian Khasi and Jaintias' hills to the north form a barrier the base of which builds the district border. The study area was situated in a remote place and far from the district town of Sylhet, surrounded by forest, hill-hillocks, a number of streams and rivers. The soil, including clayey and sandy loams of hilly ground is especially fertile. The climate of Sylhet district is warm and humid, mean maximum and mean minimum temperatures are 33°C and 18°C respectively. Mean humidity is 80% and mean annual rainfall is 3800 mm (Ahasan, Chowdhary, & Quadir, 2010). There were five *punji* (villages) under this study, namely Singuir Punji, Islachara Punji, Amchari Punji, Aynachara Punji and Indanagar Punji. The population of these villages (*punji*) is near about 1000 to 1100. Preliminary the study

investigated these villages and finally took two villages of them specially, Singuir Punji and Amchari Punji. The inhabitants' source of livelihood is forest, traditional hill-farming and tree-crop cultivation system.

Selected two main villages – Singuir Punji and Amchari Punji, were interesting site, because of having physical proximity, one is dominated by unclassified State forest and other one is controlled by a reserve forest of Forest Department. Villagers farming items that mean categories of trees, system, concept, geographical location and landscape with secondary natural forest are almost similar. However, for looking similarities and contrast in tree-crop farming system of indigenous knowledge along with modern knowledge as well as authority's domination and policies both villages were selected.

Khasi ethnically maintains tree plantation with fruit-bearing tree farming system surrounding the homestead and farm field for their necessities as well as heritage. This practice is prevalent in all Khasi *Punjis* (village) in different ways as adequacy of natural resources and quality of soil with topography. Khasis' tree-crop farming practice and forest resource management is happening inter-cropping and multi-cropping system following forest ecology and ethnoecological knowledge. They lead to a distinct and diverse farming practice which is usually not observed in other community people. Their way of life and livelihood strategy and farming system in all extent based on floristic environment. The Khasi *punji* (village) could be an interesting place, for anyone taking an interest this ethnic community with a diversified way of life.

Research Methodology

For my academic dissertation purpose, I gathered data for this study over a period of nine months from 2014 to 2016. I engaged over 120 village inhabitants in open-ended interviews administered in Bengali language. The study used a purposive/criterion sampling strategy considering the entire farming population, those engaged in upland tree crop farming, aged between 15 to 55 years. In some instances informants were selected through criterion and snowball sampling techniques. The criterion sampling technique was employed to recruit in-depth interviewees/participants those directly related to farming practices. The snowballing strategy is adopted to recognize the knowledgeable and potential key informants to tree gardeners in the community, who were interviewed asked for further

names, and so on. In other ways they were selected with the help of community leaders to cover a broad spectrum of socioeconomic classes, ethnic religious groups, gender, and age group as well as formal and informal education, certain experience and material culture. In different cases, especially remarkable home gardens or field plantings were noticed and the owner then defined as an interviewee. Using a general interview guide that was openly changed as new situations and information arose; I discussed tree cultivation technique, source and preparation of manure, land fertilizing, soil organizing, information source, modes of learning, about tree and crop management, and background of pieces of landscape with the inhabitants, frequently while walking through their farm fields for direct observations.

Interviews were open-ended nature, though not all topics were sheltered in all interviews, but each main topic was at least covered by a large adequate sample to be flexible to some form of analysis. While the concentration of the study surrounded by tree-cultivation practice, discussion often also turn to general to acute farming issues, which provided additional information of manuring system and insight into tree cultivation. I also took details information of diverse farming inputs, which is concurrently used to augment of soil-nutrient as well as to increase tree cop production. The native tree residues and plant litters' diverse use, accumulation, transformation and other household and commercial farming elements were also recorded.

This study employed the combination of insider (emic) and outsider (etic) approaches to understand the inherent quality of data, because the way in which they were elicited and the method in which they were analyzed. The open-ended nature of interview questions permitted the informants to use their own phrase in describing their knowledge, and particular words and terms were often jotted down verbatim in order to protect emic nature and farming culture. But real generalization and conceptualization of these individual, insider views into a widespread system was in large part carried out later by myself from an etic perspective.

Results

Knowledge Combination of Different Origin

The study area is situated on a major long-distance from divisional Sylhet town, and even closer to Maulvi Bazar district town; the villages (*punji*) are by no means entirely isolated from external influences. Especially men could occasional visit to nearby town

and even often to Maulvi Bazar to sell tree-crops and to make special purchases. On the other hand, the Forest Department, vendors of farming materials, extension agents, and mass media provide scientific information from outside the immediate vicinity. In addition, some people have indirect contact with such external influences; some well-off farmers have much contact with local extension agents. Some people have radio, television and mobile phone with literacy. So, most of the indigenous people could access the modern information and farming knowledge. More elite villagers like Head man, potential persons have much access to global information while poor residents have very little, but a good number gets at least some information filtered through other local people.

The resulting mixture of indigenous and outer global information sources leads to a situation in which many people possess a hybrid of knowledge elements having potentially diverse origin, which signifies weaker dichotomy of knowledge. In this research, the probable sources of knowledge pieces are various. They might exist in the global sciences, which could be referred as international science because of its creation and use around the world by scientists who can impart to one another in a global village. The Indian health medicine Ayurveda is one kind of formal science, which is different from global science, but produced, codified, and dispersed in its own formal institutions. However, other potential knowledge origin like indigenous, folk and craft skill knowledge are less formal, less codified that are produced and disseminated by people or farmers through practicing the craft skill of farming, forestry and so on.

Khasi normally domesticate livestock and maintain horticulture, look after homestead farm and field employing ethnoecological knowledge and natural resources as well as global inputs. The forest dwelling Khasis' lives and livelihood basically depend on tree cultivation practices. Recently the expansion of overpopulation and massive exploitation of natural resources degraded the soil, air, water and overall farming environment in the locality. They apply local and integrated approach and techniques to sustain soil-fertility of top soil, planting various categories of native nitrogen fixing trees and fruiting trees by using domesticated animal dung and household debris. Khasis' tree management activities are verily old and special land-use system, introduced as gardening practice; it provides household consumption, cash need, and preserve forest environment. Their farming paradigm is ecofriendly, though non-interval uses of land, soil

is exhausted, additional manure is added by using folk knowledge, craft skill knowledge and intelligence. Recently, their farming system as well as tree-nursing and land fertilizing process is local and in some extent also modern.

Within Khasi tree crop farming abstraction, soil, manure and tree are interrelated to the overall manure management system. Local peoples' ethnoecological knowledge, practical experience, physical efforts and intelligence could generate and control manure optimally. Their uninterrupted tree crop production systems have been facing a shortage of natural soil-nutrient; to overcome it, frequently amalgamated diverse knowledge is being practiced. Within this practice, diverse origin farming inputs, their understanding, farming concept are used in connection with informal, formal and global knowledge system. These types of knowledge are directly or indirectly explained and related to humoral Ayurvedic philosophy and Unani Tibb medicine. Khasi explain trees' growth and soil-potency/vitality in metaphorical imagery through some concept such as *penthap/piththap* (hot/cold), *khani* (food/nutrition), *bol-shokti* (energy), *bemar* (health/diseases and *teria/kawaryan* (wet/dry). It is related to formal and informal knowledge; informal knowledge signifies local knowledge with folk and craft skill knowledge, which is less codified, less formal. Conversely, formal traditional knowledge, which has a sort of institutional identity and more codified like Ayurveda, and global knowledge is modern scientific knowledge.

In manure management practices at tree cop farming methods, three levels are viewed, primary concrete practice level, secondary abstract concept level and knowledge systems. The more fundamental level I termed as primary level, consist of several pieces of information coming from simple understanding of materials in physical settings and also incorporate information about cause and effect relationship such as in a knowledge system of manure management at farming, this stage adds the information that trees will be green if old cow dung is used to the tree root or soil at particular period. The secondary level that is abstract conceptual level, which verily theorizes from the information level clarify and unify the information pieces into a meaningful knowledge system as a whole. Concepts can indicate and carry out idea such as cow dung holds special nutrients element for tree health, that hot and cold must be optimum within living being due to sustain trees health. The concrete practice level is closely rooted to physical reality and the conceptual level is one step far from

physical as well as highly cultural constructs (Horton, 1982; Kalland, 1994).

Manure Management Knowledge and Practice

Diverse origin manure management concept and knowledge are shown in figure 1 and it explains complex knitting that happens when knowledge from these different types is brought together in the minds of persons in this study area. At primary level different concrete practice and secondary level conceptual abstract are integrated and this way it would be difficult to predict from isolate understandings of the individual knowledge systems involved. As an example, most farmers in this study at primary level practice both cow dung and commercial fertilizers as soil improvements in tree crop fields. Domesticated animal manure is commonly practiced in farming over the world, and,

has been practiced in Bangladesh for centuries, can be accounted a traditional folk practice. Scientific chemical fertilizer, however, was expanded in the global agricultural sciences and is commercially produced. These two types of manure use, though coming out of different domains of knowledge, are illustrated at the conceptual level by the same two concepts, which are similarly different in their potential origin. The initial of these concepts engages the physiological (humoral) idea that hot and cold must be balanced in living organisms and microorganism for optimal development.

Most of the villagers explained that chemical fertilizer is very hot for plants as well as soil while old cow dung is much cooler and fresh one is too hot. Heat is amalgamated with potency or energy, but when very strong can cause of harmful for soil and plants. When moderated by cold, heat can provide

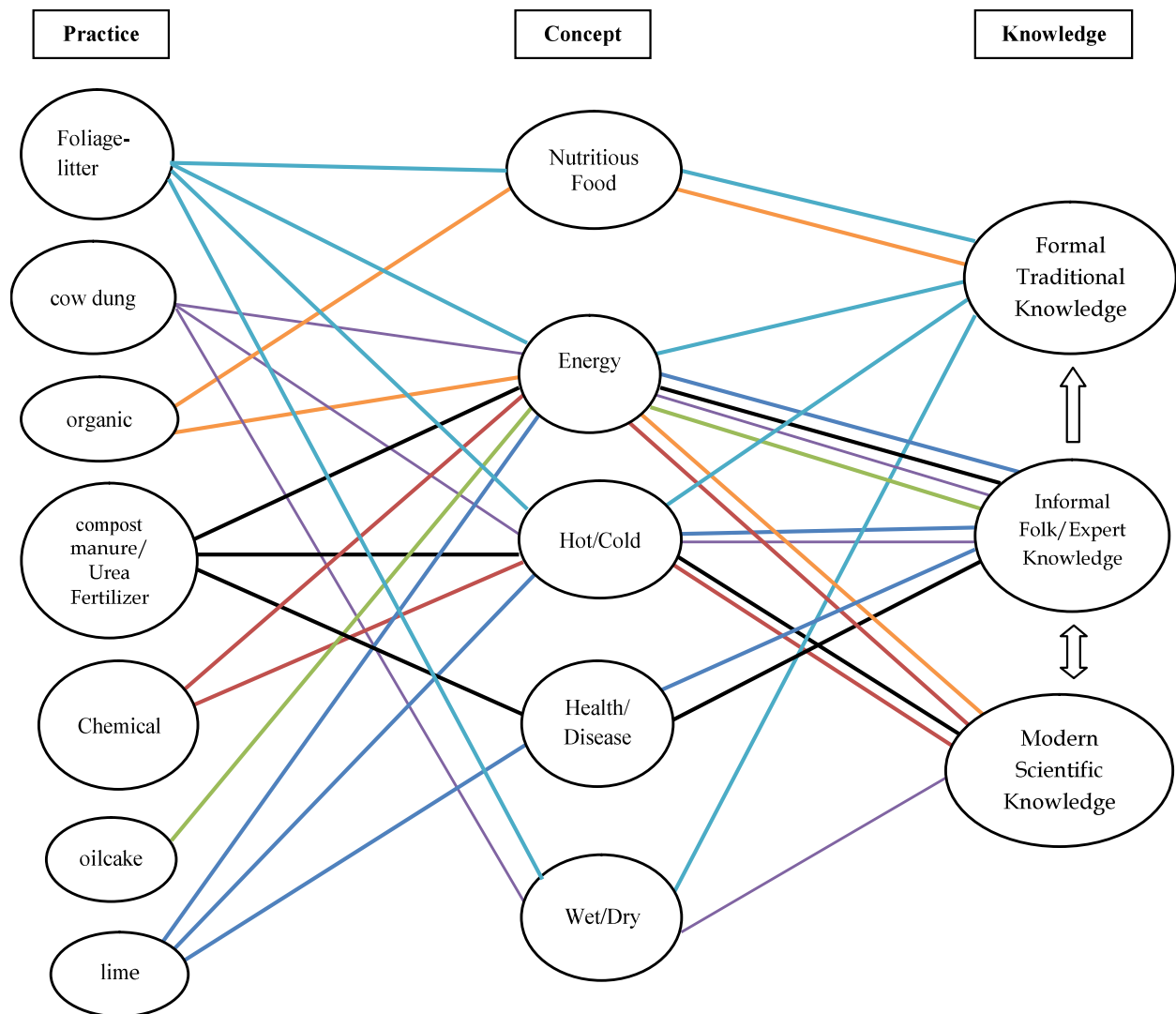


Fig. 1: Structure of knowledge system of manure management in tree crop farming practice

good result for plant growth as well as soil-potency and fertility. However, this concept is established in Indian theories of health medicine in Ayurveda, and even in forming a part of agricultural folk knowledge in India and Pakistan (Kurin, 1983). In this process, *khani* (food and nutrition) all have *bol/shoktti* (energy), also explained as potency/vitality, which can be either hot or cold (Dash & Jounious, 1997). However, the concept is broadly accepted in formal traditional knowledge as well as informal folk knowledge entirely Bangladesh, including formally literate urban people who tell foods as holding heating or cooling effects on the body. At farming aspect the primary practical form is material, which is used for soil-nutrient such as *jabra* (accumulated twigs, plants & shrubs litter). The accurate origins of the concept for example, whether it is entered the formal traditional knowledge, Ayurveda or from informal expert knowledge or concurrently emerged from both knowledge. It is, therefore, difficult to assume the exact point of origin. Ellen & Harris (1997) assert that little tradition of native folk knowledge have been methodically immersed into the grand traditions of formal academic knowledge. This idea governs individuals to conclude that it is possibly that Ayurveda adopted the hot/cold idea from folk traditions. It also could be mentioned that a hot/cold concept exists in humoral ideas in many countries over the world as remain in Indian subcontinent. This concept metaphorically exists in manure practices surrounding soil-microorganism to tree and human organism growth and development.

Khasi study participants also explained chemical fertilizer and cow dung both as *bol-shokti* (energy) concept at secondary level. The idea of plant *bol-shoktti* (energy) is needed as human bodies need to trees growth and development. Therefore, for soil amendment needs organic manure and commercial fertilizer. In fact, energy concept more abstract concept and one step far from practice level farming inputs, which provide potency to soil and trees. It is usually practiced widely, even by formal plant scientists.

In primary practice level, materials of manure some extent combine based on local environment with social, economic and political causes and effects. Though, it belongs to different knowledge systems—formal, informal folk/expert knowledge, and modern scientific knowledge. As mentioned earlier *jabra* (foliage litter) one kind of raw elements of organic manure, derive from plant, shrubs, foliage and leaf litter, which can work as a direct form of manure and mulch. It contains moisture, which is used in tree-

root; in that sense *jabra* might be explained by dry/wet concept of traditional knowledge. As field participants, manure is directly related to the secondary concepts *khani* (food/nutrition), *bol-shokti* (energy), *penthap/piththap* (hot/cold), and *teria/kawaryan* (wet/dry). Conversely, these concepts fall into formal traditional knowledge system of Ayurveda and informal folk/expert knowledge system and global science. Compost manure consist of different categories of floral residues, which is used for soil-nutrient to grow trees in the fields understanding the concept *khani* (food/nutrition) and *bol-shokti* (energy) of formal traditional knowledge, Ayurveda. Cow dung and urea or chemical fertilizers are used understanding the concept of hot and cold

The village participants also use oilcake and limestone powder, the both practices are explained by *bol-shokti* (energy) concept, farmers use it to the soil to increase land fertility, provide energy to the soil with the cooling effects in folk and craft practice and knowledge. On the other hand, limestone powder purifies toxicity of soil as well as control the pest and diseases. It is the outcome of practical, experiential skill and craft knowledge of farmers, which derives from neighbour tea-garden farming practices with lowlanders' agriculture.

Native Tree Plantation and Manure Process

Khasi socioeconomic, environmental factors as well as knowledge of local settings induce to select farming landscape with diverse quality of land, if the land is not enough fertile and have shortage of natural resources, they adopt own local strategies. Landscapes of greenery bushes are preferred to Khasi for cultivation, as its greenness and healthy growth, which indicate fertile soil. Though sometimes surrounding situation forces them to clean and cultivate semi-fertile and non-fertile land. This time Khasi keep naturally germinated quality native trees, clean the rest farm field, and plant economic and timber-value native seedlings, including different categories of fruit-bearing trees. The plantation techniques have a scientific basis and validation because of its intercropping and multi-cropping system as well as line, space and distance of tree organization. Their farming techniques allowed adequate shade, sunlight and air in the fields. Besides this, year round cultivation, tending, and harvesting gives chance to provide flower litter to soil for land fertility as well as economic benefit to farmers. Many scholars (Brokensha, Warren, & Werner, 1980; R. Chambers, Pacey, A., & Thrupp, L., 1989; Shiva, 1997; Thrupp, 1989) assert that modern agroforestrys'

major attributes are seen indigenous peoples' aged old land use and farming systems. Therefore, indigenous people farming practice is closer to trained scientist what they introduced with popular term agroforestry. The study participants are local experts and they know which categories of trees are more nutritive for soil amendments as well as for food, fodder and fuel. Khasi's views that domesticated animals, birds and mammals preferred trees, shrubs and fruiting-trees are more helpful for soil; its leaf litter provides more nitrogen to the soil. However, they usually do not cultivate exotic trees in the farm field, because, non-suitable for soil-fertility and surrounding trees' growth with fodder. They classify the soil as their experience and granted commonsense knowledge and plant different categories of trees to protect and improve soil fertility. Besides this, the pruning, trimming, thinning and selective felling with bark ringing and root-cutting are particularly supportive in the overall land fertilizing process. The outputs of these activities, plant residues work well as organic manure. In the field, tree management technique and organizing system of local knowledge provide a substantial consistency to manage manure, which is inherent in the process.

Animal Dung and Household Debris Management

While the surrounding natural resources deteriorate, Khasi do not forget sustainable tree crop farming, use traditional and craft skill knowledge with modern scientific knowledge. They amalgamate diverse farming inputs optimally through trial and error basis, which is sometimes cost-effective than pure modern farming inputs (IIRR, 1996). Though they practice and accumulate it with modern materials as native people to protect local ecology, culture, and hold on traditional livelihood strategy. Along with plant-manure, domesticated animal dung has been used as traditional folk practice. Nowadays villager includes old poultry excreta with the plant-manure because of floral crisis as well as expansion of the market. This category of old dung is preferred to use closer household homestead and farm fields to avoid shoulder and head carrying to distance field. At the time of seedling plantation in the pits of barren distance fields, even initially animal and poultry dung are used. Khasi in a household farming field very frequently uses decomposed household debris, including ashes, fish-bones, and meat-bones, vegetable remaining and fruits peels. It is used as organic manure, which is carrying a lot of nutritive-elements like modern commercial fertilizer such as nitrogen, potassium, phosphorous, and other

nutrients. The participants do not use ashes separately in the field due to steep-hill and torrential run off. This category of manure, including other sources of manure is distributed, manage and control as local knowledge and modern scientific knowledge. Global scientific knowledge is mixed with embedded local knowledge, which is immersed in the locality through mass media, different extension agents and arranged training program. But the usage way, ratio and quantity of manure are determined by the local peoples' experience and texture of soil and topography.

Discussion

Villagers either poor or rich they practice hybrid nature of knowledge in manure use and preparation process of the tree crop cultivation system (Brodt, 1999). They are generating own multi-staged knowledge systems through interknitting elements from several levels of the various pre-existing systems, there they have access. In addition, numerous knowledge elements of manure are utilized in this locality, which have, both technical and abstract levels, do not have apparent roots in particular system. Rather, it seems to recur in the stores of many different knowledge systems. It is difficult to categorize clearly, but not impossible.

One important thing appears from these categorizations of indigenous knowledge of manure management that as open system many knowledge systems may be well viewed rather than firmly identified closed categories. The use of knowledge categories like global science or indigenous knowledge imply border that encompass particular elements while excluding others. As mentioned in this study, where one knowledge system ends and another starts may be very unclear base. When identified through individual line of thought in one assumed knowledge system often extend beyond specific limits until they are exposed to be part of other knowledge system. As instance, the same material idea of in one system as holding necessary plant nutrients may also be used in another, but with the description of conveying coolness to plants. In the meantime, individuals in the middle may familiar with both systems. They may take into account both properties as applicable characteristics of that material. As an example, many farmers in the study, who talked about the effects of industrial fertilizer (urea) and cowdung.

The village participants farming and manure practice knowledge profile is integrated, influenced

by external pressure as well as internal need, behind of its social, political and ecological factors contribute (Kloppenborg, 1991 & Knorr-Cetina, 1981). The more fundamental knowledge of native people is local traditional folk and craft knowledge, its basis is surrounded by biophysical environment. Villagers' constructed knowledge is very old, evolves usually over many centuries and transmitted from generation to generation. However, their recent knowledge paradigm is included with trial, experience, and modern scientific knowledge. The deterioration of natural resources occurred due to various factors (environmental degradation), global knowledge makes space into local knowledge. Though traditional knowledge is embedded to a great some of local environmental issues like plant and animal species, including soil and weather, and a detailed of map of the local topography.

Native people subsistence strategy as well local culture are related to the farming system, as Khasi mainstay is tree-crop farming, they have no fallows land due to insufficiency of land. Year-round cultivated exhausted land has been rejuvenated employing ethnoecological knowledge, which is viewed in their intercropping and multi-cropping system with diverse native tree plantation. It may nominate by the term of 'native forestry' or 'gardening' system, which is economically viable, as well as for household consumption, and for flower litter to soil. Khasi major selective trees are included to ecofriendly farming paradigm, which is alike to modern agroforestry (Shiva, 1997). While non-interval cultivation occur or local farming surroundings is not viable, and even the farming outputs are not adequate, then villagers rigorously motivate towards scientific knowledge and farming inputs. They link their farming thought and concept with diverse knowledge and faming inputs (Brodt, 2002), what they learned from local environment in different contexts that is practiced in the field for growing better crops, sustaining soil quality.

Many indigenous people in south East Asia practice traditional folk and craft knowledge in agricultural systems. They have innate farming ideas and own perspective explanation, which is very informative indicate and unify the information pieces into a meaningful knowledge system (Brodt, 2001), which is used in practice through concrete material. Scholarly observation and generalization classify this information into knowledge category e.g. informal, formal, and global scientific knowledge. Most traditional formal knowledge has humoral character of Ayurvedic philosophy. Informal folk and craft knowledge is less codified than Ayurvedic

philosophy as well as traditional formal knowledge, but produced and disseminated by farmers actually practicing the crafting of farming and forestry (Chambers, 1983). Global science for its logical acceptability in the world is global science. Villagers farming concept hot/cold, food/nutrition and health/disease are related to farming material of diverse origin, including science, which is inter and cross-related to the aforementioned knowledge systems. These farming concepts all about are used to augment of soil-nutrient and tree growth by using natural farming resources, including animal and poultry dung, household debris and industrial fertilizer.

Khasi use diverse farming material by understanding the attributes of that material. The main objective of the villagers is to use materials' potency and energy adequately for the growth of living organisms and increase soil-fertility. As geographical location and types of landscapes, usage natural farming material varies, which is observed in the Khasi farming community, but the cultivation concept is a local cultural construct and link to diverse knowledge and farming-material. As an example, Khasi use plant-manure (*jabra*), cow dung, compost manure, organic & chemical mix manure, oilcake, household debris, limestone powder and commercial fertilizer. Manure preparation process, usage technique and procedures are local ethnoecological knowledge and resource base.

Conclusion

Khasi depend on the tree crop farming system and forest products, including forest resources. Ethnoecological knowledge and natural resources were once used to maintain tree-crop farming system. However, recent global expansion and industrialization have immensely changed their overall indigenous farming way of life. They integrated scientific farming system, agriculture, and agroforestry due to scarcity of natural resources. This study focused how Khasi combined old and modern knowledge and farming elements with local surrounding in Khasi region. The emerged study findings showed a substantial pattern of the Khasi tree crop faming system in global changes.

This research found that the Khasi farmer maintained integrated traditional and modern knowledge system, including diverse sub-system of knowledge. Khasi practiced this knowledge with hybrid farming materials to grow better and higher-yielding tree cops in the fields. This practice is

performed understanding the surrounding settings and the local environment, allowing shortage of natural resources with internal needs and external farming influences. Khasi synthesised diverse domain of farming knowledge and concept in connection with socioeconomic, political and ecological aspect and linked it to local opportunities of farming elements. They explained the diverse farming concept in humoral aspect like *penthap/piththap* (hot/cold), *khani* (food/nutrition), and *bol-shokkti* (energy) *sastho/bamar* (health/diseases), *kawaryan/teria* (dry/wet) and use in practice level. These concepts have been connected with diverse higher level abstraction and lower concrete level farming practice. Khasi used inherent potential meanings of this farming concept in manure management optimally mixing with other domain manure such as *jabra* (plant-litter), *batkha* (compost manure), cow dung, oilcake, lime powder and industrial fertilizer. The same concepts and ideas are used to tend, nurse and grow tree crop in the fields adopting local setting considering the availability local and global resources.

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