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Indigenous technical knowledge (ITK) practices by tribal farmers in Sonitpur district of Assam

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Abstract

Technical knowledge (ITK) is the accumulated skill and knowledge of a locality or a community that has been passed down from generation to generation. It is the set of knowledge, skills, and abilities of the local people that have been developed through close interactions with nature and natural resources for their livelihood to minimise crop environmental risks to maintain productivity and sustainability. Most indigenous communities in India possess a unique set of traditional knowledge and technology. These indigenous knowledge and technologies have provided the indigenous communities with comfort and self-sufficiency and are usually at the level of modern knowledge and technology. The traditional knowledge and technologies associated with these communities can contribute greatly to the overall socioeconomic development of the communities. Documentation and preservation of Indigenous Technical Knowledge (ITK) is urgently required for a number of different communities, many of which are on the verge of extinction. The current study is aimed at compiling the Indigenous Knowledge Systems (ITK) used by the tribal farmers in Sonitpur district of Assam in order to document how they are being used in agricultural field. The rationale behind using the ITKs identified in the investigation was purely based on the free opinions of the respondents since they had experience with the results themselves. The ITKs were further analyzed and tabulated based frequency and percentage, and then ranked accordingly. There were 28 nos. of indigenous practices identified for cereals, vegetables, storage pest, fruits etc. which were practiced by different proportions of tribal farmers. The study revealed that out of 10 nos. of practiced ITKs in cereals by tribal farmers, 59.17 percent of the respondents mentioned the practice 'A flame is put on in the rice field in the milky stage of rice (*Oryza sativa*)' as rank I. Further, out of 11 nos. of practiced ITKs in vegetables by tribal farmers, 84.17 percent of the respondents indicated the practice 'Audio tapes are tied around nursery plot' as rank I. However, in controlling storage pest, 71.67 percent of the respondents mentioned the practice 'Neem (*Azadirachta indica*) leaf powder is sprayed in the rice storage structures' as rank I. Furthermore, 81.67 percent of the respondents gave the practice for controlling fruit pest, 'Smoking under mango (*Mangifera indica*) tree at the time of flowering' as top rank. As part of today's agriculture, it is recognized that systematic documentation, refinement, and technology development combining modern knowledge with IT technologies will help in protecting the environment, combat climate change and reduce the impact of environmental degradation. Obtaining proper documentation, validation and developing environmental friendly and location-specific technologies may require the involvement of farmer's organizations, KVKs, Zonal Research Stations and SAUs from different strata. Validating and regulating ITKs at the national level will, on the one hand, ensure the uniqueness of ITKs, while, on the other, creating a base for future research and development in agriculture. Identifying scientifically sound indigenous practices will aid scientists in implementing technology blending programmes and in developing low-cost, location-specific and appropriate technology.

Keywords: Farmer, indigenous, knowledge, tribal

Introduction

In developing countries, indigenous technical knowledge derived from traditional wisdom can be an asset to farmers. It represents the knowledge of a particular community that has developed over an extended period of time spanning multiple generations and continues to evolve over time^[1]. During the course of time, society accepts and validates local knowledge, which then becomes part of people's cultural and social lives and subsequently becomes the indigenous technical knowledge (ITK) of a society. According to Paul Feyerabend^[2], this kind of knowledge is that which is encoded in rituals and everyday practices of a society. A variety of terms are used to describe ITK, including indigenous technological knowledge and people's knowledge. Thus, Indigenous Technical Knowledge (ITK) refers to the sum of all knowledge and practices that are derived from people's experience in dealing with various problems and

situations in various aspects of life, and such knowledge and practices are specific to a particular culture [3].

A vast number of ethnic, cultural, and linguistic groups inhabit India, which is rich in ITK, or indigenous knowledge. According to the 2011 census, India has 700 tribal groups with 104 million people. In Assam, 70% of the population works in agriculture. Rice is the most predominant crop in the region, occupying 80% of the land [4]. As a result of adverse circumstances, they encountered along the way, the farmers from different ethnicities in this state developed their own technology [5]. They are ancient practices of the farming community which are now coming back into vogue. Furthermore, due to rapid urbanization, ethnic groups often lose their traditional knowledge and conservative attitudes. Therefore, the identification and documentation of scientifically sound indigenous practices will be critical to the successful implementation of the technology blending programme, as well as for the development of less expensive, appropriate technologies for the benefit of the farmers. In recent decades, scientists have acknowledged that indigenous people have managed the ecosystems in which they have lived for generations, often without causing significant harm to local ecosystems. Indigenous knowledge, in this view, can serve as a powerful foundation for developing alternative means of managing resources [6]. Understanding the scientific rationale and their communication patterns, and then documenting them, will ensure the continuity of these practices for future generations. Our paper attempts to identify and document Indigenous Technical Knowledge practiced by tribal farmers in the agriculture sectors and their ways of dealing with identified constraints.

Methodology

The study was carried out in Sonitpur district of Assam. A multistage sampling design using snowball technique was followed in the present study. For the study, ten (10) tribal villages from the district were selected randomly. A total of 120 respondents were selected from ten (10) villages in Sonitpur district. Respondents were tribal farmers who practiced ITKs in the selected district. Each farmer was asked to mention the indigenous practices he/she was practicing during the past five years in the checklist to assess the extent to which those practices had been adopted. ITKs expressed by an individual respondent were recorded during data collection. The ITKs were further analyzed and tabulated based frequency and percentage, and then ranked accordingly.

Materials and Methods

Participatory rural appraisal (PRA) and interview methods were used to collect the data for the study. Individual and group interviews with farmers were also conducted as a part of the survey. PRA techniques such as transect walks and semi-structured interviews, were conducted with the farmer groups of each village. With the help of a checklist of questions administered along the transect walk and during the interviews, the task of identifying indigenous practices was accomplished. The selected villages were Bhokua Mari Gaon, Douli Guri Pathar, Dala Bari Kachari, Joor Pukhuri Gaon, Laigang Para, Kerimari Betbari, Balisaha Kachari, Bahbari Gaon, Niz-bahbari, Naharani Pathar under Bihaguri, Borchalla and Rangapara development blocks of Sonitpur District of Assam. An inventory of indigenous practices was prepared after locating the practices.

Results

From the study, it was found that 28 nos. of indigenous practices were practiced by tribal farmers to control different pest and diseases of cereals, vegetables, storage pest, fruits etc. The study revealed that out of 10 nos. of practiced ITKs in cereals by tribal farmers, 59.17 percent of the respondents mentioned the practice 'A flame is put on in the rice field in the milky stage of rice (*Oryza sativa*)' as rank I. The other practices are 'During rice transplanting seedling tip are chopped off' (rank II) followed by 'Leaves of turmeric (*Curcuma longa*) are applied to rice field' ranked III, 'Leaves of neem (*Azadirachta indica*) are spread in the field of kharif or summer rice' (rank IV), 'Solid excreta of goats are applied to the field' (rank V), 'Jute (*Corchorus capsularis*) ropes are dipped in kerosene and pulled across the paddy crop field' (rank VI), 'Neem (*Azadirachta indica*) seeds are powdered and then tied in a piece of cloth. Then this is to be dipped in water for 24 hours. Later, that water can be used for spraying crops' (rank VII), 'Cut pieces of immature pummel (*Citrus maxima*) peel are swept through out the rice field' (rank VIII), 'Jarmoni (*Eupatorium odoratum*) pat is swept over rice field' (rank IX) and 'Toad or frog is tied to a bamboo (*Bambusa spp*) stick' as rank X [Table no.1].

Further, out of 11 nos. of practiced ITKs in vegetables by tribal farmers, 84.17 percent of the respondents indicated the practice 'Audio tapes are tied around nursery plot' as rank I followed by 'Storage of potato (*Solanum tuberosum*) seed tubers in between the layers of wild dhokia (*Diplazium esculentum*) leaves' (rank II), 'Cow urine is sprayed in crop field' (rank III), 'In bottle gourd (*Lagenaria siceraria*) field one bottle is placed after filling it with paste of jiggery and banana (*Musa acuminata*). Then make one hole in that bottle and put one bottle gourd water in that hole and kip the lid close. The smell attracts the flies and when they enter inside the bottle and get trapped inside the bottle' (rank IV), 'Powdered tobacco (*Nicotiana tabacum*) is sprinkled on the foliage of crops like brinjal (*Solanum melongena*), cabbage (*Brassica oleracea*)' (rank V), 'The nest of red ants (*Myrmica rubra* group of species) is applied to crops' (rank VI), 'A heap of grass is kept in the vegetable fields at night time and burnt at day time' (rank VII), 'Pointed gourd (*Trichosanthes dioica*) is pierced in the main stem at 1 ft. away from the base by a stick vertically' (rank VIII), 'Application of wood ash in vegetables like brinjal (*Solanum melongena*)' (rank IX), 'Application of black tobacco (*Nicotiana tabacum*) leaf pieces in the cabbage (*Brassica oleracea*) field' (rank X) and 'In case of gourd cultivation base of the plants are holed with thorns of citrus (*Citrus limon*)' ranked XI. [Table no.2]

However, in controlling storage pest, 71.67 percent of the respondents mentioned the practice 'Neem (*Azadirachta indica*) leaf powder is sprayed in the rice storage structures' as rank I followed by the practice 'Storage of seeds mixed with ash' ranked II. [Table no.3]

Furthermore, 81.67 percent of the respondents gave the practice for controlling fruit pest and others, 'Smoking under mango (*Mangifera indica*) tree at the time of flowering' as top rank followed by 'Wastes of fish are placed below citrus plants' (rank II), 'Fishery ponds are stirred with bamboo poles' (rank III), 'Pseudostem of banana (*Musa acuminata*) is allowed to decay in the field' (rank IV) and 'Turmeric (*Curcuma longa*) paste is applied on wounds on cattle body' ranked V. [Table no.4]

The results also highlighted the rationale based on their experience.

Discussion

From the table no. 1, it can be revealed that 59.17 percent of the respondents mentioned the practice 'A flame is put on in the rice field in the milky stage of rice (*Oryza sativa*)' as rank I and indigenous practice 'Toad or frog is tied to a bamboo (*Bambusa spp*) stick' ranked X in relation to the ITKs followed for cereals. This may be due to the fact that most of the tribal farmers in the district are rice growers and more concerned about easy access to available material. Further, ranked I practice is experienced from many years as compared to rank X practice. The other reasons may be the attack of Gundhi bug is more prominent in the selected area. When the farmers put the flame on the rice field, the gundhi bugs move towards the light and they burn themselves. Hence, this pest is of economic importance from flowering to milking stage of rice crop. Gundhi bug is active from May to October coinciding with high atmospheric temperature and humidity. Weeds, volunteer rice and wild rice act as collateral host for this pest. Round the year, rice cultivation in lower Assam also favours their perpetuation. In Assam, Boro, Early Ahu, Ahu and Sali season rice are affected by this pest. Since, this pest damage the crop at flowering and early grain filling stage, spraying of insecticides is not desirable from the residual toxicity point of view [7]. Hence, they may go for using this type of ITKS as most common.

Further, table no.2 indicated that out of 11 nos. of practiced ITKs in vegetables by tribal farmers, 84.17 percent of the respondents indicated the practice 'Audio tapes are tied

around nursery plot' as rank I and another practice 'In case of gourd cultivation base of the plants are holed with thorns of citrus (*Citrus limon*)' was ranked XI. This may be due to the reason that the ranked I practice is more popular in the community and effective as per them. It was noticed that apart from pest and diseases, the occurrence of birds and their attack in vegetable crop is more severe as compared to others. As the tribal farmers are more concern about the detrimental effects of insecticides, pesticides as well as nature sensitive behaviour reflects the use of ITKs in their field.

However, table no.3 highlighted that in controlling storage pest, 71.67 percent of the respondents mentioned the practice 'Neem (*Azadirachta indica*) leaf powder is sprayed in the rice storage structures' as rank I and practice 'Storage of seeds mixed with ash' as rank II. This is due to the easy access of neem leaf in nearby area. Further, they are available at low cost. By using this ITK, quality of the grain for feeding remains same. According to Chahal [8], the post harvest losses of food grains and oilseeds are estimated to be 10 to 20 percent in India. Hence, this kind of ITKs will surely help the farmers in controlling storage pest.

More than half (81.67 percent) of the respondents revealed the practice for controlling fruit pest *i.e* 'Smoking under mango (*Mangifera indica*) tree at the time of flowering' as first and other practice 'Turmeric (*Curcuma longa*) paste is applied on wounds on cattle body' as their last preference (Table no.4). This resembles the reason that mango cultivation is predominant as compared to turmeric cultivation and the respondents found the ranked I practice as more economical and easy as compared to others.

Table 1: Indigenous Technological Knowledge (ITK) practices in cereal crops

SI No	Practiced ITKs	Purpose	Explanation by respondent	Frequency	Percentage	Rank
1	A flame is put on in the rice field in the milky stage of rice (<i>Oryza sativa</i>)	For controlling Gundhi bug (<i>Leptocorisa acuta</i>) when population build up is more during the milky stage of rice.	Gundhi bug (<i>Leptocorisa acuta</i>) gets attracted to the flame and gets killed.	71	59.17%	I
2	Solid excreta of goats are applied to the field.	Manure as well as plant protection measure.	Goat excreta have some protective measure.	47	39.17%	V
3	Toad or frog is tied to a bamboo (<i>Bambusa spp</i>) stick.	Pest infests the toads and crop infestation is less.	Insects are attracted towards dead matter more easily and crop is spared.	35	29.17%	X
4	Jute (<i>Corchorus capsularis</i>) ropes are dipped in kerosene and pulled across the paddy crop field.	To control Rice caseworm (<i>Nymphula depunctalis</i>)	Kerosene acts on the insects.	45	37.5%	VI
5	Neem (<i>Azadirachta indica</i>) seeds are powdered and then tied in a piece of cloth. Then this is to be dipped in water for 24 hours. Later, that water can be used for spraying crops.	Acts as insect repellent.	Neem (<i>Azadirachta indica</i>) seeds have insecticidal properties.	42	35%	VII
6	Leaves of turmeric (<i>Curcuma longa</i>) are applied to rice field.	Control rice hispa (<i>Discladispa armigera</i>)	Insecticidal properties in turmeric (<i>Curcuma longa</i>).	54	45%	III
7	During rice transplanting seedling tip are chopped off.	Control rice hispa (<i>Discladispa armigera</i>)	Hispa (<i>Discladispa armigera</i>) lay eggs on the leaf tip.	57	47.5%	II
8	Leaves of neem (<i>Azadirachta indica</i>) are spread in the field of kharif or summer rice.	To control pest and disease especially stem borer (<i>Scirpophaga incertulas</i>)	Insecticidal properties of neem (<i>Azadirachta indica</i>) are well established.	50	41.67%	IV
9	Cut pieces of immature pummel (<i>Citrus maxima</i>) peel are swept through out the rice field.	To control insects.	It has insect repellent properties.	40	33.34%	VIII
10	Jarmoni (<i>Eupatorium odoratum</i>) pat is swept over rice field.	Pest and disease management.	Jarmoni (<i>Eupatorium odoratum</i>) pat checks the rice hispa (<i>Discladispa armigera</i>) population.	36	30%	IX

Table 2: Indigenous Technological Knowledge (ITK) practices in vegetables.

(n=120)

Sl. No	Practiced ITKs	Purpose	Explanation by respondent	Frequency	Percentage	Rank
1	A heap of grass is kept in the vegetable fields at night time and burnt at day time.	Killing pests like cutworm (<i>Spodoptera exigua</i>).	Cutworm (<i>Spodoptera exigua</i>) is nocturnal in nature and takes rest at daytime in the heap of grass and it can be killed easily by burning the heap.	61	50.84%	VII
2	The nest of red ants (<i>Myrmica rubra</i> group of species) is applied to crops.	To control specific pests in crops like Pumpkin (<i>Cucurbita moschata</i>), Ridge gourd (<i>Luffa acutangula</i>).	Red ant (<i>Myrmica rubra</i> group of species) act as predators of the specific insects that attack such crops.	68	56.67%	VI
3	Powdered tobacco (<i>Nicotiana tabacum</i>) is sprinkled on the foliage of crops like brinjal (<i>Solanum melongena</i>), cabbage (<i>Brassica oleracea</i>).	To control insect pests.	Tobacco (<i>Nicotiana tabacum</i>) contains niacin which probably effects the respiratory system of insect pests	72	60%	V
4	Audio tapes are tied around nursery plot.	To scare away birds.	Reflection as well as noise production confuses the birds.	101	84.17%	I
5	Storage of potato (<i>Solanum tuberosum</i>) seed tubers in between the layers of wild dhekia (<i>Diplazium esculentum</i>) leaves.	To protect seed tuber from potato tuber moth (<i>Phthorimaea operculella</i>) infestation.	Wild dhekia (<i>Diplazium esculentum</i>) has insecticidal properties.	95	79.17%	II
6	Cow urine is sprayed in crop field.	To control pests.	Cow urine has some insecticidal properties.	82	68.34%	III
7	Pointed gourd (<i>Trichosanthes dioica</i>) is pierced in the main stem at 1 ft. away from the base by a stick vertically.	To reduce vegetative growth and increase fruiting and bearing.	That is done to reduce the C: N ratio which increases fruiting.	56	46.67%	VIII
8	Application of black tobacco (<i>Nicotiana tabacum</i>) leaf pieces in the cabbage (<i>Brassica oleracea</i>) field.	To prevent occurrence of diseases and to control insect.	It has insecticidal as well as disease resistant property.	41	34.17%	X
9	In bottle gourd (<i>Lagenaria siceraria</i>) field one bottle is placed after filling it with paste of jiggery and banana (<i>Musa acuminata</i>). Then make one hole in that bottle and put one bottle gourd water in that hole and kip the lid close. The smell attracts the flies and when they enter inside the bottle and get trapped inside the bottle.	To control fruit fly (<i>Drosophilla melanogaster</i>) population.	It acts as trap for fruit fly (<i>Drosophilla melanogaster</i>).	78	65%	IV
10	Application of wood ash in vegetables like brinjal (<i>Solanum melongena</i>).	To control aphid (<i>Aphis gossypii</i>) and other insects.	Insecticide properties of wood ash.	48	40%	IX
11	In case of gourd cultivation base of the plants are holed with thorns of citrus (<i>Citrus limon</i>).	To increase production.	The plant is not able to take up nutrients for further development. As a result vegetative growth stops and production of fruit is earlier.	35	29.17%	XI

Table 3: Indigenous Technological Knowledge (ITK) practices in storage pest control.

(n=120)

Sl. No	Practiced ITKs	Purpose	Explanation by respondent	Frequency	Percentage	Rank
1	Storage of seeds mixed with ash.	Controls storage pests.	Ash causes desiccation of the exoskeleton of insects.	78	65%	II
2	Neem (<i>Azadirachta indica</i>) leaf powder is sprayed in the rice storage structures.	Effective against storage pests.	Insecticidal properties of neem (<i>Azadirachta indica</i>) are scientifically established.	86	71.67%	I

Table 4: Indigenous Technological Knowledge (ITK) practices in fruit crops and others

(n=120)

Sl. No	Practiced ITKs	Purpose	Explanation by respondent	Frequency	Percentage	Rank
1	Pseudostem of banana (<i>Musa acuminata</i>) is allowed to decay in the field.	Pest and disease management.	It kills larvae and pupae of hibernating insects.	74	61.67%	IV
2	Smoking under mango (<i>Mangifera indica</i>) tree at the time of flowering.	To repel insects like stone borer (<i>Sternochetus mangiferae</i>), mango mealy bug (<i>Rastrococcus invadens</i>) etc.	Smoke drives away the insects and prevents them from depositing the eggs.	98	81.67%	I
3	Wastes of fish are placed below citrus plants	To attract fruits sucking moths (<i>Othreis fullonia</i>)	Strong smell of fish attracts the insect	94	78.34%	II
4	Turmeric (<i>Curcuma longa</i>) paste is applied on wounds on cattle body	To repel insects and cure wounds in cattle.	Turmeric (<i>Curcuma longa</i>) has both insect repelling effect as well as antiseptic effects, thus helping in curing wounds.	64	53.34%	V
5	Fishery ponds are stirred with bamboo poles.	To provide favourable pond environment to fish	Stirring overcomes O ₂ deficiency in the pond, thus preventing fish death	82	68.34%	III

Conclusions

Indigenous Technical Knowledge (ITK) has positive social implications, is financially accessible, sustainable, involves minimal risk and emphasizes the efficient use of eco-friendly resources. Grassroots innovations rely heavily on indigenous technical knowledge. In practice, there is a possibility that traditional knowledge experts may be able to create more effective solutions for contemporary problems through flexibility, modification, mutual respect and trust with scientists from modern scientific institutions. Present-day circumstances make it imperative for indigenous innovations to be evaluated and popularized. Considering that ITKs are organic in nature, extension personnel may be able to utilize the documented ITKs when planning and executing different integrated modules. Therefore, it can be concluded that the ITKs, which have been used by farmers for centuries, if organized and used scientifically, could also be effective in the creation of eco-friendly, location-specific, economically viable and socially acceptable technologies. Indigenous Technical Knowledge (ITK) is the information gained over generations transmitted through word of mouth from generation to generation. Hence, it is imperative that ITKs to be properly documented and preserved by a multitude of communities in order to prevent their extinction. Researchers can refer to these documented ITKs for further study to determine their scientific rationality and effectiveness.

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Conflict of Interest

There is no conflicting interest amongst the authors as well as respondents.

Author(s) Contribution

The study was carried in Sonitpur district of Assam. Whole concept of documentation was visualized by both the author. Data's were collected through face to face interview. The collected data were tabulated and analysed by the author RB. The reviews were collected by the author RS. Finally, both the author dissected the different parts according to each author's convenience.

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