International Journal of Advanced Scientific Research
ISSN: 2456-0421; Impact Factor: RJIF 5.32
www.allscientificjournal.com
Volume 1; Issue 8; November 2016; Page No. 06-12

Folk knowledge on indigenous practices in North -West Himalaya with special reference to Himachal Pradesh (H.P.), India

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Abstract
Indigenous practices provide invaluable knowledge and aid in making best use of natural resources as it is dynamic in dissemination and scientific in indigenous experimentation. In the modern days of technological advancement, this knowledge is falling prey to the lure of modernization and urbanization. Indigenous technical knowledge (ITK) forms water resource management, soil fertility management, forest resource management, pest management, organic manuring, soil management, curing of cereals, agricultural tools and implements, ITK for agricultural and horticultural crops *etc*. ITK refers to the art of using natural resources and is passed on generation to generation and is farmer friendly as well as socially accepted. Indigenous knowledge in the Himalayan region is the inter-generational wisdom of local inhabitants to perform their livelihood operations in a most eco-friendly manner under remote, isolated and inaccessible conditions; characterized by harsh climate and limited survival options. This review article depicts some of the important practices of ITK documented by various researchers in northern India with special reference to Himachal Pradesh (H.P.), largely influenced by geographical and environment diversity prevailing in its different zones. ITK is restricted to remote areas, so it is pertinent to document and preserve this invaluable depleting treasure for future generations.

Keywords: indigenous technical knowledge (ITK), watershed management, soil and pest management, farming, water harvesting, kuhl, tillage, organic manuring

1. Introduction

Indigenous knowledge in the Himalayan region is the inter-generational wisdom of local inhabitants to perform their livelihood operations in a most eco-friendly manner under remote, isolated and inaccessible conditions; characterized by harsh climate and limited survival options. Since this knowledge is transferred orally from one generation to the next, it is dynamic in dissemination and scientific in indigenous experimentation; receiving constant stimuli from outside. However, indigenous not only stands for ingrained intrinsic knowledge, but is also amenable to modifications based on latest technical know-how by local inhabitants through native means to suit their daily requirements. Therefore, to discard any indigenous knowledge on connotations of superstition, conservatism, primitivism etc. by modem science would only result into a failure of the developmental networks [1, 2]. These practices are eco-friendly and are one of the finest examples of sustainable development [3]. Throughout Himalayan region, watershed resource use and productivity is based on crops, horticulture, pastures and forestry which is largely influenced by geographical and environment diversity prevailing in its different zones. The wide variations in altitude and other agro-climatic parameters such as rainfall and temperature, broadly classify Himalayan region into four major agro-climatic zones. These include (1) the low hills and valleys near the plains, (2) the middle hills and valleys with sub-humid climate, (3) high mountains and valleys with temperate climate and (4) cold dry desert zone.

Levi-Strauss [4]. argued forcefully against such a distinction on the grounds that human societies could not, for example, possibly have acquired the skills to make water-tight pots without a genuinely scientific attitude and a desire for knowledge for its own sake. ITK, like scientific knowledge should, therefore, be regarded in the first instance as something which became possible as a result of a more general intellectual process of creating order out of disorder, and not simply as a response to 'practical' human needs such as sustenance and health [5].

Some of the knowledge arising in this way would of course have direct practical applications, and equally new knowledge about the way in which the world worked might arise as the result of a process of inquiry triggered initially by the wish to solve a problem of a 'practical' kind. An appreciation of this underlying similarity between ITK and science is important if the full potential of ITK is to be realised. An important difference between science and ITK lies in the way in which phenomena are observed and ordered. The scientific mode of thought is characterised by a greater ability to break down data presented to the senses and to reassemble it in different ways. The mode of ITK, on the other hand, is 'concrete' and relies almost exclusively on intuition and evidence directly available to the senses. A second distinction derives from the way practitioners of the two modes of thought represent to themselves the nature of the enterprise in which they are engaged.

ITK can itself be classified in various ways, including

In terms of the idioms and conceptual tools through which ITK becomes possible. This can be separated into two clusters – the propensity to classify and the propensity to quantify;

- In terms of the objects towards which thought is directed. Possible subdivisions here include: physical/inanimate (e.g. soils, water, climate); biological (e.g. crops, weeds, pests, domestic and other animals, insects); medical; and energy related;
- In terms of knowledge about fabrication and use of artefacts;
- In terms of knowledge of the operation of the social and economic structures within which production is embedded.

Throughout Himalayan region, ITK is based on agricultural crops, horticulture, pastures and forestry, watershed and soil management *etc.* which is largely influenced by geographical and environment diversity prevailing in its different zones. The wide variations in altitude and other agro-climatic parameters such as rainfall and temperature, broadly classify Himalayan region into four major agro-climatic zones. These include (1) the low hills and valleys near the plains, (2) the middle hills and valleys with sub-humid climate, (3) high mountains and valleys with temperate climate and (4) cold dry desert zone.

2. Materials and Methods

The data pertaining to Indigenous technological knowledge of North-West Himalaya with special reference to Himachal Pradesh has been noted from various books and journals and the unique and authenticated cases have been reviewed to provide the information about this fast depleting knowledge.

3. Observations

Observations are based on the different researches. The information is meagre and work of Verma, 2008; is highly appreciated in this field with special reference to Himachal Pradesh.

3.1 ITK for vegetable cultivation: Some unique cases in northern India (with special reference to Himachal Pradesh)

a) Root spreading for surface feeding in vegetable plantation

In Ladakh, Lahaoul-Spiti and Kinnaur, a small wooden structure called the *tokhre is* used for digging the soil facilitating the horizontal spread of roots in cabbage and other vegetable crops thereby increasing production. This practice facilitates enhanced moisture/nutrient uptake along with the removal of weeds. The wooden structure protects roots from mechanical damage which could result from an iron implement [6].

b) Osmoconditioning of pea seeds

In Kinnaur, Spiti and higher reaches of Shimla in Himachal Pradesh, the garden pea is a significant commercial crop. The crop sown in the month of October-November, before it snows, shows relatively better/early germination when compared with seeds sown in the month of March/April. Sowing in winter allows adequate time for the physiological activities to occur within the seed, resulting in an early crop. The early germination may also be attributed to a better hydrothermal regime during February-March for the crop sown in the month of October-November. The additional advantage is that the produce can be transported to the plains to secure excellent economic returns [6].

c) Crop rotation and double cropping

This practice is specific to remote locations of Lahaul (Miar *nallah*) in Himachal Pradesh. Rotation starts with barley in the first year, and buckwheat during the second year. The rotation sequence is governed by the quantity of available manure. Ordinarily one-third of the total holding is thoroughly manured during the year for barley cultivation. In the following year the soil retains a good deal of fertility for buckwheat for which no additional manure is added. In the third year the same field wheat is sown. The remaining two thirds of the holdings are similarly treated in succession. Barley requires heavy doses of organic manure for better crop harvest However, the organic content of the soil after the harvesting of barley is sufficient to raise a good produce of millets followed by wheat this helps to meet the challenges of limited availability of organic manure for successful management of soil fertility levels [6].

d) Crop threshing employing animals

Animals, particularly *dzos, are* used for threshing crops by trampling, in the West Himalayan cold deserts. A large circle of packed earth (about 10 in diameter) forms the threshing floor. A number of animals are tied in a line to a central pole. *Dzos* once stirred, continuously circle the central pole for hours without showing any fatigue. Often there is a combination of animals, as many as twelve, with the *dzos* forming the inner circle while horses and donkeys circle along the outer edge. Threshing is accompanied by singing. To prevent the soiling of the grain by animal dung, a container is used for collecting the dung [6].

e) Crop thrashing employing animals

Even in the lower Spiti areas animals (commonly *chum*) are used for the threshing of crops (wheat/barley). After harvesting of crops from August to September, the same are left to dry in a common courtyard (*Khaliyan*). After complete drying, it is spread in circular heap formed around a central pole. Two pairs of *chum* are used for trampling the dried crop. However, it is also observed in the Tod Valley that inorder to increase the weight *of churu* a weight of 30-40 kg (made of wooden and husk straw, sealed in gunny bags) is tied to it. Then the *chum* tramples the crop for one hour after which the crop is turned over so that it may be trampled upon completely. This process of turning the crop over, continues for 5-6 hours. After which the crushed material is collected and piled into a heap. The grain is then separated by air winnowing. The grain is subsequently stored in houses mainly for home consumption.In Shimla districts of Himachal Pradesh crop thrashing by employing oxen and mule is done on a thrashing floor of about 5 mm diameter This is further facilitated by thrashing with a 3 to 4 m long flexible green oak sticks[6].

f) Crop thrashing in "Khaliyan" made of stone

Thrashing by animals is preferred by the farmers as mechanical threshers are not available in these remote areas and are also costly. Additionally, the general feeling is that wheat straw/barley husk crushed by the mechanical thresher is not palatable to cattle stock because it is reduced to a fine texture. Also mechanical threshers crack more grains which is obviously not preferred by the farmers [6].

g) Extraction of fibre and seeds from *Bhang* (*Cannabis*)

Bhang (*Cannabis*) is cultivated in the Chhota/Bada Bhangal of Kangra district and Karsog area of Mandi district of Himachal Pradesh for the extraction of fibre and seeds. Its green leaves are used for extracting narcotics which is very addictive and its cultivation is also illegal. After maturation the harvested crop is set aside to dry. After drying, the seeds are collected and the fibre is separated from the stems and branches. Its fibre, being stronger than jute, is used for making ropes of varying thickness. Besides its acknowledged strength, it is one of the cheapest materials for rope making [6].

3.2 ITK for horticultural crop

a) Localised greenhouse conditions in grape cultivation

Grapes are cultivated in the Nubra valley by regulating the temperature of basins using local stone (called bricks), grasses, warm clothes, gunny bags or wooden baskets. Grapes are grown only in sunny niches. Pits are filled with locally found stone, grasses and soil. The white brick pieces help in warming the otherwise cool sandy soils in die basin. Grape vines are covered with warm clothes or gunny bags or wooden baskets to shield them against the cold and animals attacks, especially during the initial one to two years. This method indicates the use of localized greenhouse conditions for grape cultivation and subsequent fruit sweetening [6].

b) Apricot grafting

In the Nubra valley of Ladakh, apricot grafting (seedlings) is commonly practised. Scions (sweet types) are grafted over bitter forms of wild apricot. This job is carried out by three to four experts (free of charge) in a village. Local techniques are known as *Kalam*and *Dambu.* In *Kalam* half lamina along with the petiole is inserted into the peeled part of the stock and the removed bark is then used to secure the union. A two to three years old scion is preferred. *Dambu* is practiced on one year old seedlings. In this case a cut is made in the bark at the point of bud with a deliberate slow rotatory movement and the entire piece of cylindrical bark is removed much like the cap of a pen. It is then rewrapped and secured so that the petiole region of the scion is properly united with the stock. Protection of two to three vital veins in the petiole region is regarded as essential for the success of this graft.

The use of peeled off bark as a piece in *Kalam* and *Dambu* displays local wisdom for providing moisture to the grafted union. The use of the half leaf lamina is a check against possible damage to the union due to strong blowing wind, a common phenomenon in the region. Protection of specific veins indicates a knowledge of the nutritional linkage between scion and stock [6].

c) Enhancing soil fertility

Animal bones are hurried in the basin area of the plants. The animal bones improves soil fertility by adding phosphorus to soil [6].

3.3 Indigenous technology knowledge for watershed management in north-west Himalayas of India

a) Construction of kuhls (water channels)

In Himachal pradesh kuhls (water channels) are built along the hill gradient for maintaining proper gravity for irrigation. Kuhls are commonly found in West Himalayas cold deserts. The technique for the preparation of kuhls for irrigation purposes seems to have originated since Babylonian times, it is still one of the commonest ways of bringing water to the crops. If the river has a steep gradient, water is diverted into a canal some distance upstream and led along a contour so that it can flow to fields by gravity [6, 7, 8].

In west Himalayan cold deserts for the optimum harnessing of water for irrigation, water channels are constructed along the natural gradients. The irrigation channels (kuhls) are diverted from river tributaries by making use of the natural gradients thus the level of water is higher than that of the cultivated fields.

In upper Kinnaur, the channels (kuhls) are simply dug in the ground to regulate the flow of water. However, where the digging of channels is difficult or the channel has to pass through a village path, underground channels covered with slates are constructed. However, in some parts the wooden channels are also used which are put like a bridge over the path. These channels are made by making a deep grove in the tree trunk or a thick branch [6, 7, 8].

b) Indigenous drip irrigation

The practice of using pitcher water as a source of irrigation on new fruit plantation in sandy loam/loamy sand soils, in areas of canty rainfall is prevalent in temperate districts of Himachal Pradesh. The pitcher is placed in soil and the new plant is planted close to it. The pitcher is filled with water during summer months (April-June) and stone/slate lid is placed on the top. The roots draw moisture/water from pitcher which is turn reduces the mortality. The pitcher once filled, supply sufficient moisture for atleast two weeks and then again it is filled with water [6, 8].

c) Bamboo drip irrigation system

In this system of irrigation bamboo channels (open) are used for irrigating the fields. This system is common in North-East regions of India. Small holes are made at the internodes of open bamboo channels, from where water gets trickled down in the field. These channels are placed along the natural gradients. In these channels, no uniform head for water trickling is maintained [6].

3.4 Water harvesting methods

a) Small ponds for spring water collection

Another method is the collection of spring water in small reservoirs scattered at intervals on the high uplands and then drawing water from these ponds when required. It is a common practice in cold deserts and temperate wet Himalayas. Water from these ponds is used for irrigating crops and also for drinking purposes [7, 8, 11].

b) Roof water harvesting

In the lower areas of Himachal Pradesh during the rainy season, roof water is collected in dugout structures which are known as "diggi" in Kangra district and "'Khati" in Hamirpur and Bilaspur districts these structures are dug in hard rocks. Not only roof water but also surface water is collected in dugout structures [6, 7, 8, 11].

c) Water harvesting in dugout structure called 'khati' or 'diggi'' Harvesting of rain water

In the hills, rains are erratic and torrential. Relatively high percentage of rain water goes as run-off and stream flow. It

carries fertile soil and plant nutrients which makes the soil degraded and barren. In some areas this excess water is stored directly in the farm ponds, depression or stream flow or is diverted to safer points where it is stored.

The stored water in ponds and depressions is used for irrigational purposes, as a life saver or for supplementary irrigation during lean periods. It is also stored in dugout structures. In some areas during summer, it is used as drinking water humans, livestock and for other domestic purposes. The ponds with time are sealed, with silt and clay particles thus infiltration/percolation losses are reduced and ponding time and volume of water is increased [6, 7, 8, 9, 11].

d) Harvesting of water from snow melting

Harvesting of water is also done by constructing water ponds and water is collected in these ponds from melting snow. In Spiti grass is used as the inner lining of zings (water ponds) and irrigation kuhls for checking percolation losses. The use of spang grass which is growing profusely in Spiti, explains its non-permeability properties similar to that of polythene sheet or cement lining. Its chemistry is required to be analysed, as the farmers claim its utility in water retention is far superior than the polythene/cement [6].

3.5 Soil management

a) Cultural practices

In West Himalayan region, in the month of March/April, when snow melts and weather condition improves, the bunds and comers of the fields are dug-out and weeds and grasses are removed with the help of spade and clods. The grasses or weeds are beaten up and then soil is separated from these clods and collected in lower fields. This practice of removing weeds and grasses from bunds and corners by digging helps in weed control in the cultivated fields. Secondly area under crops remains the same as that of previous crop i.e. area is not wasted for weeds and grasses. Thirdly the soil added in lower fields from the bunds of upper field is rich in nutrients and it improves the soil fertility [8].

b) Traditional rainfed farming

In the hilly areas, most of the area is rainfed except for a few pockets in valleys where irrigation facilities are existing. The choice of crop and rotation, completely depends on crops which require less volume of water. For rotation, legumes are important as mixed crop. During rotation, when rainy season erosion permitting crops are grown, such as cowpea, 'kuth', these form integral part of the mixed cropping system. The crops are chosen as per their nutrition e.g. from old ages protein rich pulses are part of cropping pattern. The coarse grains like 'phaphra', 'chulai' are also grown very commonly which are very rich in nutrition. Within the premises of the house it is mandatory to have fruit plants such as citrus, mango, anar which provide seasonal fruits rich in vitamin C., carbohydrates etc. The fields are well protected with biofence of thorny shrubs or their cut pieces. The traditional rainfed farming is done irrespective of land with respect to slope and other characteristics. There are chances of sheet erosion but with traditional knowledge, crop rotation is adopted in such a way that during peak runoff periods sowing of close growing crops provide protection to the soil. Terracing is also important in this case [6].

c) Use of maddim (a plain wooden structure) for field levelling.

Maddim is used for levelling ploughed lands. A heavy stone is put on the maddim for increasing the pressure required for levelling. Sometimes, a man may also sit instead of a heavy stone. Such an indigenous technology for field levelling is called planking. With this practice, there is very good seed soil contact and very good germination of the crops. Secondly, there is moisture conservation in the fields. Thirdly small soil clods are pressed and broken into finer particles and this way soil structure is improved [6, 8].

d) Conserving productive soil layer against wind erosion

In west Himalayan cold deserts, fields are irrigated in autumn so that the top layer is prevented from being blown away. In spring the moistened soil eases ploughing. The productive soil layer, which is very thin, needs conservation against heavy wind erosion, a common feature of the cold deserts. This appropriate soil conservation technique also helps in easy and timely ploughing for meeting the requirement of short growing season. The moist upper layer of soil which gets frozen in winter also serves as a protection against wind erosion [6].

e) Contouring of slopy lands: Ethno-engineering for soil conservation

In west Himalayan cold deserts farmers have developed this technology for cultivation of slopy lands by constructing terraces comprising of plots and sub-plots by using small stones. Stone wall fencing is also constructed for individual land holdings. Terracing of slopy lands helps in conserving soil and moisture and prevents soil erosion. This also helps to carry out other field operations including proper use of irrigation water for checking the surface runoff [6, 8].

f) Organic manuring, collection and management

Organic manures derived from plant and animal resource, are valuable byproducts of farming and allied industries. Organic manures which is bulky in nature but supply the plant nutrients in small quantities are termed as bulky organic manures e.g. farm yard manure, rural and town compost, night soil, green manure etc., whereas those containing higher percentage of major plant nutrients like nitrogen, phosphorus and potash are known as concentrated organic manures e.g. oil cakes, goat manure, sheep and poultry manure, blood and meat-meals, etc. Flocks of sheep and goats, contribute towards tribal economy by way of milk, meat, wool and manure. These flocks when taken for grazing are tied with small bags which cover their anal parts so that the excreta falls right into the bag. This region is highly sandy with low soil fertility status. The collection of dropping of sheep and goats by tieing bags is indicative of indigenous wisdom to meet out the shortage of manure. This manure of the droppings of sheep and goats contains 3% nitrogen, 1% phosphorus and 2% potassium [6, 8].

g) Use of ash

i) Nutrient recycling

The inhabitants of this entire region use cattle dung, shrubs and bushes as the main source of fuel. Ashes available, there upon, are mixed either with household waste or human excreta. Sometimes ashes are also broadcasted in the fields. Mixing of ash with household waste aids in nutrient availability and

recycling. Ash primarily meets the deficiency of potash. Availability of phosphorus is also ensured. In addition to this, human excreta and household waste also contains good amounts of nitrogen, phosphorus and potassium. Through this practice upper layers of soils are not only softened but their fertility status is also improved, as ash contains phosphorus [8].

h) Green manuring

In Bharmour area the practice of green manuring is localized in a few villages (paddy growing). Leaves and twigs of wild bushes such as basuti and kaimal are used **6**.

i) Biofencing with seabuckthorn (*Hippophae rhamnoides*)

This practice is prevalent in Spiti and other regions. There is a common practice to provide biofencing with seabuckthorn in cold deserts in general and Spiti in particular. The biofence of seabuckthorn being thorny in nature protects crop from stray animals. Its multipurpose utility as a nitrogen fixer, checks against soil erosion, conservation of soil and moisture, source of fuelwood and indigenous drug (rich source of vitamin C) makes it a promising plants for eco-economic rehabilitation of the region [6].

j) Drought power according to soil texture

In west Himalayan cold deserts, ploughing is generally carried out by dzos, however in sandy situations horses are employed for its speedy completion. In Turpuk of Nubra valley ploughing is done by a single horse. Sandy soil have less soil strength than clayey soil. Due to this reason, the drought power requirement for ploughing varies according to soil texture **8**.

k) Use of walnut and sweetflag leaves against pests in stored grains

In rural areas of Himachal Pradesh, it is an old practice to use walnut leaves and leaves of a pond weed, commonly known as sweetflag, *Acorus calamus* as a protection for both grain and clothes against insect damage. To achieve protection a layer of leaves of walnut is spread over grain stored in gunny bags. Likewise, shade dried leaves of sweetflag are powdered and put over grain stored in gunny bags to protect it from damage due to stored grain pests. Walnut leaves are astringents and the aqueous extract of fresh leaves possesses bactericidal action while mature leaves contain 9-11 per cent tannin. Tannins are known to act as feeding deterrents. Sweetflag leaves and rhizomes have many chemical ingredients including an essential oil, the oil of *calamus*, which primarily contains *asarone.* Depending upon quantity of *asarone* (*cis* as well as *trans*), its effect on insects may be attractant, antifeedant, repellent, antigonadal or insecticidal. However, since the active principal is present only in meagre amounts (in the leaves) this treatment may not be able to afford protection for long periods [8].

l) Use of *neem* leaves/turmeric/mustard oil in storage

The use of *Neem* as a pesticide is now well documented. Similarly Walnut, *Bhera* and Mint leaves also seem to possess certain antimicrobial or pesticidal properties, which help in grain storage. The antimicrobial substance in mustard is allyl isothidcyanate. The turmeric powder also appears to perform a similar function. Some of the uses to which these natural products are put are enlisted below:

Grain is mixed with leaves of Neem/Walnut/*Bhera*/Mint (*Pudina*) and then stored in bins.

For storing pulses, specially *Urad*, the grains are mixed with turmeric powder or smeared lightly with mustard oil and then sealed in air tight containers.

Storage of pulses after soaking in cow urine followed by drying is also practised in some parts of the Himachal.

However, the scientific basis for storing pulses after soaking them in cow urine is yet to be explained [6, 7].

m) Storage of tuber crops

In the tribal belt as well as in some other parts of Himachal, at the on-set of winter, root crops like potato, ginger, turmeric, colocasia (*arbi*) *etc. are* stored in underground pits and the top is covered with thatch and soil. These products are consumed up to the next summer. Storage of cabbage heads, meant for seed crop in done, in underground pits dug in the fields. This is a common practice in Kinnaur. Apart from other storage benefits, the crop is also protected from the hazards of snow. In Mandi district, a thin layer of grass is spread at the base of the pit to serve as a cushion, prior to storage of the root crops, *the* top of the pit (up to 6") is covered with grass and soil and is raised slightly above ground level to prevent entry of rain water into the pit In some areas, the top of the pit is plastered with cow dung. Storage of ginger in pits for seed crops is stall prevalent in Sirmour and some part of Solan and Bilaspur districts. The pits in these areas are known as *Khatti*.

These methods of storage provide cool conditions for storage of these commodities, ensuring freshness for prolonged use. However, it has been observed recently that storage of ginger in pits (*Khatties*) leads to spoilage of almost the entire crop, which might be attributed to a buildup of pathogenic inoculum due to long and continuous use of same pits for the same crops. Therefore, digging of new pits is recommended and lighting a fire inside the pit, prior to storage. This is done for creating hygienic conditions inside the pit **6**, **9**. Storage structures such as Lokulu, Tunn, Kuthar *etc*. Are well documented [6, 9, 10]. Thimbi for grain measuring is documented in Kangra [9].

3.6 Storage of fruit crops

a) *Citrus* Fruits

In Mandi district, ripe *galgal* fruit (*Citrus pseudolimon*) *is* stored in pits dug in the fields. At the base, a layer of ash is spread and then the fruits are placed in alternate layers of ash and fruit. The top of the pit is covered with ash and soil. Ash seems to possess antifungal properties, which help in checking spoilage. Storing in cool pits enhances the shelf life of this citrus fruit [6].

b) Storing of citrus fruits in underground pits

Another method of storing citrus fruit is the use of a pitcher (earthen pot). The citrus fruit are placed in wide mouthed pitchers and then the pitcher is placed in an underground pit. The top is covered with about a 6" thick layer of soil. Using this technique, citrus fruit can be stored for 25-30 days without any spoilage. This practice is in vogue in the Nurpur (Kangra) area of the State [6].

c) Apple

The apples are stored in the tribal areas of Lahaul-Spiti and Kinnaur districts in the underground pits, prior to the onset of

winter. Apples are packed into wooden boxes which are then placed in underground pits and the mouth of pits is covered with thatch and soil. In this way, the apples can be stored up to summer time without any appreciable loss in quality.

The method appears to be a modification of the pit storage procedure described earlier, since here the direct contact of fruit and soil in the pit is prevented. A pitcher or wooden box placed in a pit creates a cool store. The development of the zero energy cool chamber (ZECC) appears to have its genesis in this technology [6].

d) Banana

Banana fruit wrapped in grass/cloth is also ripened in soil pit and also enhances its storage period. The shelf life of fruit and vegetables is also enhanced by wrapping them in moist gunny bags through the cooling effect generated by evaporation [6].

e) Drying of unripe mango slices

This is a common practice in the lower areas where *in situ* mango varieties are found in abundance. The mature but unripe mangoes are sliced and placed in bamboo baskets (*changer or Chharolu*) which are then kept in the open sun for drying. The dried product called Bukarian is stored in earthen pots and used as an acidulent.

f) Apricot-drying on the trees

In the high altitude dry areas e.g. Malling, Nako, Pooh, etc. in Kinnaur district, apricots are not harvested fresh but allowed to dry on the tree itself. Due to very low relative humidity, the apricots dry rather well on the tree. The dried product is of excellent quality, not obtained even after adopting modem techniques of drying (e.g. checking, sulphuring and mechanical dehydration). The apricots dried on the trees are approximately two to three times more expensive than sun dried apricots.

The prevalence of low temperature and dry weather conditions help first in the accumulation of sugar in the fruits and then in the subsequent drying of the fruit to develop a rich colour and sweetness in the product. This is one example of low temperature drying under natural conditions [6].

g) Drying of cucumber and Pumpkin seeds

He drying of cucumber seeds, using ash is practised in Mandi district of the state. In this method, seeds are mixed with wood ash and then placed on a plate, (*Thali*) in the open sun. The procedure is considered to aid fast drying of seeds since wood ash probably absorbs excess water from the seeds and prevents them from sticking together. The segregation of each seed leads to increase the surface area which results in faster drying [6].

h) Dried ginger (*Sonth*)

In Shillai and Renuka areas of Sirmour district, ginger is also sun dried. Fresh ginger upon soaking in water is rubbed against a gunny bag or placed in bamboo baskets to remove the peel. The coarsely peeled ginger is then dipped in lime solution followed by warmth for faster and better fermentation [6].

i) Miscellaneous

Cow urine in combination of *Vitex negundo*, *Ferula asafortida*, *Aloe vera* and *Nicotiana tabecum* as pesticide is a highly appreciated work [13]. Similarly works on indigenous liquid detergent from *Zea mays* [13], and indigenous herbal shampoos [3], have been reported from Shivalik hills of H.P. and are unique in nature.

4. Conclusions

NW Himalaya along with Himachal Pradesh (H.P.) in terms of Indigenous technical knowledge (ITK) is considered one of the richest due to its geographical diversities and many ethnic communities. All these communities have some kind of traditional knowledge associated with their life from time immemorial. ITK practices are farmer friendly, socially accepted and environmentally sound suited to local conditions. In the present report, different indigenous practices of NW Himalaya with special reference to H.P. have been documented and discussed. The documented practices are mainly associated with agriculture and horticulture, soil and watershed management, forest resource management, organic farming *etc.* ITK practices are neglected and often disregarded on the pretext of being unscientific.

ITK practices may have some weaknesses, problems and constrains but it should not be forgotten that farmers have survived in past under extreme conditions based on local knowledge. These practices are eco-friendly and are one of the finest examples of sustainable development. Some conventional approaches to research have serious limitations for eliciting ITK but full-scale anthropological methods of observer-participation can overcome these difficulties but they are time-consuming and probably rarely cost-effective. Methods of investigation are needed which are open-ended, quick, and reliable. Stock of ITK can be used either to economise on the use of scarce trained scientific manpower or to extend the range of observations.

ITK can contribute to the generation and exploitation of technology to benefit rural populations with some of the proposals already discussed in the report. Proposals for using the stock of ITK and for local involvement in R and D can only be adopted easily when lack of awareness is the only constraint while some of the unresolved questions are discussed in the discussion part of the report. So, at last it is suggested that these practices are depleting at a fast rate and are restricted only to elder generation so it is pertinent to document these practices for future generations.

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