Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; SP1: 2899-2903

Purshotam Singh
Sher-e-Kashmir University of Agricultural Sciences and Technology - Kashmir, India

Manpreet Singh
Sher-e-Kashmir University of Agricultural Sciences and Technology - Kashmir, India

BA Lone
Sher-e-Kashmir University of Agricultural Sciences and Technology - Kashmir, India

Parmeet Singh
Sher-e-Kashmir University of Agricultural Sciences and Technology - Kashmir, India

Sameera Qayoom
Sher-e-Kashmir University of Agricultural Sciences and Technology - Kashmir, India

Latief Ahmad
Sher-e-Kashmir University of Agricultural Sciences and Technology - Kashmir, India

SK Raina
Sher-e-Kashmir University of Agricultural Sciences and Technology - Kashmir, India

RH Kanth
Sher-e-Kashmir University of Agricultural Sciences and Technology - Kashmir, India

Correspondence
Purshotam Singh
Sher-e-Kashmir University of Agricultural Sciences and Technology - Kashmir, India

Various preferred indigenous agricultural knowledge applications in hill agriculture- A step towards organic agriculture

Purshotam Singh, Manpreet Singh, BA Lone, Parmeet Singh, Sameera Qayoom, Latief Ahmad, SK Raina and RH Kanth

Abstract
With the dissemination of modern practices the indigenous practices have started to loose their ground and have been eroded to a large extent. Application of high inputs in agriculture, in terms of chemical fertilizers and pesticides has endangered the sustainability of production system. Indigenous knowledge of agriculture, is the result of farmers' thousands years of experience with nature. Indigenous practices are known to the farmers and are helpful in maintaining and enhancing the quality of the environment. In the hills, farmers still practice farming by following indigenous practices. The study identifies indigenous agricultural knowledge (IAK) of the farmers regarding various aspects of crop production.

Keywords: Indigenous Agricultural Knowledge, Crop Production

Introduction
Indigenous Traditional Knowledge (ITK) is an integral part of the culture and history of a local community. It is evolved through many years of regular experimentation on the day to day life and available resources surrounded by the community.

It is the unique, traditional, local knowledge existing within and developed around specific condition of men and women indigenous to a particular geographical area. The advent of the concept of sustainable agriculture in late eighties in Indian agricultural scenario has evoked interest on indigenous technical knowledge (ITK) that has the element of use of natural products to solve the problems pertaining to agriculture and allied activities. Indian farmers, over centuries, have learnt to grow food and to survive in difficult environments, where the rich tradition of ITK has been inter-woven with the agricultural practices followed by them.

The enhancement of the quality of life of the Indians who in great majority live in and depend on agricultural production systems would be impossible by keeping this rich tradition of ITK aside. The special features of indigenous knowledge are (World Bank, 1998):

1. **Local** in that it is rooted in a particular community and situated within broader cultural traditions; it is a set of experiences generated by people living is those communities. Separating the technical from the non-technical, the rational from the non-rational could be problematic. Therefore, when transferred to other places, there is a potential risk of dislocating indigenous knowledge.
2. **Tacit** knowledge and, therefore, not easily modifiable
3. **Transmitted** orally, or through imitation and demonstration. Codifying it may lead to the loss of some of its properties.
4. **Experiential rather than theoretical knowledge.** Experience and trial and error, tested in the rigorous laboratory of survival of local communities constantly reinforce indigenous knowledge.
5. **Learned through repetition,** which is a defining characteristic of tradition even when new knowledge is added. Repetition aids is the retention and reinforcement of indigenous knowledge.
6. **Constantly changing,** being produced as well as reproduced, discovered as well as lost; though it is often perceived by external observers as being somewhat static.
7. The term indigenous technical knowledge is often camouflaged with the belief that is associated with forthcoming happenings and the innovations made by the farmers to solve specific problems. Some of the related terms are:
8. **Indigenous Knowledge (IK):** is the participants' knowledge of their temporal and social space. Indigenous knowledge as such refers not only to knowledge of indigenous peoples, but to that of any other defined community.

- **Indigenous knowledge system (IKS):** delineates a cognitive structure in which theories and perceptions of nature and culture are conceptualized. Thus it includes definitions, classifications and concepts of the physical, natural, social, economic and ideational environments. The dynamics of IKS takes place on two different levels, the cognitive and the empirical. On the empirical level, IKS are visible in institutions, artifacts and technologies.
- **Indigenous Technical Knowledge (ITK):** is specifically concerned with actual application of the thinking of the local people in various operations of agriculture and allied areas.
- **Belief:** change in behaviour of insects, animals and vegetation indicating a forthcoming event without any scientific rational but could be true in happening.
- **Innovation**: outside the arena of ITK, but scientifically based development of practices using the locally available resources to solve specific problems.

The differences between traditional knowledge system and scientific system are indicated below.

Traditional Knowledge system	Scientific System
All parts of the natural world are regarded as animate, all life forms as interdependent.	Human life is generally regarded as superior, with a moral right to control other life forms
Knowledge is transmitted largely through oral Media	Knowledge is transmitted largely through the written word
Knowledge is developed and acquired through observation and practical experience	Knowledge is generally learned in a situation, which is remote from its applied context
Knowledge is holistic, intuitive, qualitative and Practical	Knowledge is essentially reductionist, quantitative, analytical and theoretical.
Knowledge is generated by resource users in a diachronic (long term) time scale	Knowledge is generated largely by specialist researchers on a synchronic (short term) time scale
The nature and status of particular knowledge is influenced by socio cultural factors such as spiritual beliefs, and is communally held	The nature and status of particular knowledge is influenced oy peer review, and is held by individual specialists
Explanations behind perceived phenomena are often spiritually based on subjective	Explanation behind perceived phenomena are essentially rational and objective
Knowledge is used to make suitable decisions under variable conditions	Knowledge is used to put forward hypothesis and to verify underlying laws and constants

Diversity of Indigenous Knowledge

Indigenous knowledge systems are:

- Adaptive skills of local people usually derived from many years of experience, that have often been communicated through oral traditions and learned through family members over generations.
- Time-tested agricultural and natural resource management practices, which pave the way for sustainable agriculture.
- Strategies and techniques developed by local people to cope with the changes in the socio-cultural and environmental conditions.
- Practices that are accumulated by farmers due to constant experimentation and innovation.
- Trial-and-error problem-solving approaches by groups of people with an objective to meet the challenges they face in their local environments.
- Decision-making skills of local people that draw upon the resources they have at hand.

Characteristics of ITK

- ITK is not static but dynamic
- Exogenous knowledge and endogenous creativity brings change to ITK
- ITK is intuitive in its mode of thinking
- TK is mainly qualitative in nature
- ITK study needs a holistic approach
- ITK, if properly tapped, can provide valuable insights into resources, processes, possibilities and problems in particular area
- ITK is recorded and transferred through oral tradition
- ITK is learned through observation and hands-on experience
- ITK forms an information base for variety
- ITK reflects local tradition 4

Classes of ITK in agriculture

- Climatology
- Local soil and taxonomy
- Soil fertility
- Primitive cultivar
- Inter cropping
- Agronomic practices
- Irrigation and water management
- Plant protection
- Post-harvest technology and methods.

Roles of ITK

- ITK can aid development efforts
- ITK can facilitate local people's participation
- ITK is a valuable source of developing appropriate technologies

Agriculture is not only a means of survival but also a way of life. The application of high input technologies in intensive agriculture has undoubtedly increased agricultural production, but, now realizing the plateau in the growth, there is serious concern over their adverse effects on environment quality. Sustainable agriculture aims at achieving permanence through utilization of renewable resources. Indigenous knowledge is the knowledge acquired by the local people through their past experience, evolved over the time under the influence of traditional knowledge, external factors and agents, and individual innovations[1]. Knowledge, skill and survival strategy of farmers operating with low external inputs have often been ignored to promote modern agriculture.[2] Farmers-based indigenous/traditional knowledge has scientific rationale and great deal of relevance for agricultural productivity and sustainability. Various scholars have highlighted the importance of indigenous knowledge in developing low cost, location specific and appropriate technology for resource poor farmers[3-9].

The farmers in the hills of Uttaranchal are mostly marginal

farmers; practicing low external input based production system. Agriculture, horticulture, livestock, forestry and combined with animal husbandry provides opportunities for optimum utilization of the resources available in the system. It may be a blessing in disguise, the ill effects of synthetic chemical based agriculture are very limited here, the soil has not been polluted and the environment is clean and green with abundant biodiversity. If efforts are not being made at this juncture, this sustainable system may follow the same path of high external input agriculture. The present investigation has been thus, carried out to identify and document the indigenous agricultural knowledge (IAK) of the farmers.

1. Farmers wisdom of soil classification

Farmers in the study area have been found to characterize different soils based on the experience and understanding of local conditions.

- It has been common observation that dark colored soil are more productive soil.
- Fine textured soil has been reported to be better as it has capacity to hold water and nutrients.
- Farmers reported that soil that have more stones also contain white grub (*Holotrichia consanguinea*) called as *Kurmula* by local people. The white grub was not able to survive in fine textured soil.
- Presence of earthworm (called as *Kitaul* in local dialect) is sign of productive soil.

2 Indigenous nutrient management practices

2.1 Application of farmyard manure (FYM)

Farmyard manure prepared with the animals' dung has been the main soil additive in the region. The manure has been prepared by collecting animal excreta with the dried leaves and grasses spread on the floor of the animal shed for making bedding material. The dried leaves absorb the urine of the farm animals. This material has been kept with the dung in form of a heap and after decomposition it become ready for application in the field. The heap has been generally kept in open (the decomposition is thus aerobic decomposition). These heaps have been prepared generally near the animal shed. The grasses, straws and leaves used for bedding of the animals have been also mixed with the dung and urine, and kept in the heap.

The main sources of the dung have been cows, bullocks and buffaloes. Cow dung was believed to be of better quality. Goats and sheep were secondary source.

2.2 Spreading of farmyard manure (FYM)

The manure prepared by aerobic decomposition has been carried to the fields in *Daliya* (a container made up of Bamboo, used for carrying manure, grass, straw, etc.). Women generally perform this task. The manure has been broadcast in the field before the ploughing of the field. During ploughing the manure get mixed into the soil. In high hills of some villages the manure has been spread over the field. The reason for the practice may be to save the sown seed from cold and very low temperature during the winter.

In some areas it has been found that farmers use to make a number of small heaps of FYM in the fields. Due to unavailability of labour they use to carry the FYM from their animal sheds to the fields throughout the year, especially during lean period. The FYM from these small heaps has been spread into the field just before ploughing. This practice of saving labour and storing manure/compost is defective. The small sized heaps remain exposed to the sun and rain for a long period of time, which results in considerable loss of nutrients.

In few villages, it has been reported by the farmers that they collectively carry the FYM to their fields. All the farmers (in which women have been in large maturity, as most of the transportation of FYM had been carried out by the women) of the village work together for one farmer by sharing FYM load with one another. In this method all the FYM of the farmer have been transported to his/her fields in one or two days. This manure then spread in the field by broadcasting just before the ploughing of the field. This method is helpful in conserving the nutrients of the FYM, as the manure have not been exposed to the sun and rainfall for a longer period of time. Farmers told that this method of working together also increase their work efficiency.

For judicious use of FYM localized placement has also been used, especially in vegetables and fruit crops. Well rotten FYM has been spread around the plants.

2.3 Use of mixture of ash and manure

In hill areas, wood obtained from forest has been major fuel. Ash dust is a product obtained after the burning of fuel wood. The kitchen ash, thus obtained has been mixed with the farmyard manure and applied into the field. This practice is quite common in vegetable crops, especially potato. The organic manure improves the soil structure and water holding capacity in addition to supply of nutrients. The ash dust contains phosphorus, which may be helpful in supplying phosphorus to the crop. Moreover, the farmers reported that mixing of ash is helpful in spreading of manure into the field.

2.4 Crop rotation and fallow land

Farmers told that soil get exhausted due to continuous crop production in the same piece of land. The system of crop rotation and leaving fallow has practiced in such a manner that only half of the fields remained fallow and only for *Rabi* season. The *Rabi* season has been chosen for it, because most of the crops have been grown during *Kharif* season due to availability of soil moisture and suitable temperature in that season. In *Rabi* season half of the fields were left fallow and in remaining half of the fields wheat crop has been taken. In the next *Kharif* season crops like paddy, chilly, potato, etc. (which demands more nutrition and water and are high value crops) has been cultivated in the fields, which had been left fallow in the preceding *Rabi* season. In the fields where wheat crop had been grown during *Rabi* season, crops like *Mandua*, (Finger millet=*Eleusine coracana* L.) *Gahat*, *Bhatt* (black sybean) have been sown in the *Kharif* season. *Mandua* is a hardy crop, which can tolerate nutrient and water stress when sown in already exhausted field. *Gahat* and *Bhatt* are leguminous crops, which are capable of fixing atmospheric nitrogen into soil, and can grow in low moisture condition. These crops increase the productivity of the soil. Thus, every field has left fallow once in two year and within this time period crops grown on the field have been rotated. The practicing of crop rotation and leaving fallow is helpful in enhancing the nutritional status of the soil.

2.5 Grazing of farm animals in fallow land

It has been found that every farmer has some farm animals. Bullocks have performed ploughing operation over the entire hill region. Buffaloes and cows have been reared for milk production. Many farmers have also reared goat and sheep. These animals have been taken to the fallow crop fields for grazing. The fallow fields during *Rabi* season serves as

grazing ground for farm animals. The excreta of these animals dropped during grazing, add organic matter to the soil. This organic matter increases soil fertility. Farmers told that earlier people used to shift to the fallow fields and stayed there with their animals. They used to live in a tent, which used to be temporary home for them, in their fallow fields. Then they shifted to other field after about one or two weeks. This method helped them adding more organic manure to their fields as human excreta had also been utilized in increasing the organic matter in the fields.

2.6 Burning the residue of crops

The residues left over in the field after the harvesting has been burnt. The ash obtained from burning has been mixed in the soil by ploughing. The dry organic matter of the harvested crop takes long time in its degradation that is why farmers prefer to burn it.

3. Land preparation and method of sowing

Land preparation has been done with the local implements. The village *Purohit* for starting ploughing of the land has announced some dates. Among these dates farmers start ploughing according to the condition of rain fall and other factors like maintenance of plough, etc. A lighter shower has been preferred a day before ploughing, but heavy rain fall makes movement of bullocks and farmer difficult in the field and the soil become too heavy to plough it. In such condition farmers wait for few days and delay the ploughing.

It has been found that land has been ploughed first to incorporate the left over residues of the previous crop. (When it has not been burnt) This ploughing after harvesting of previous crop helps in mixing the stubs of the previous crops into the soil (It incorporate ash into the soil if the stubs had been burnt).

For sowing of paddy crops farmers plough the field two times. While for hardy crops like *Mandua* (finger millet) single ploughing has been followed, for wheat, mustard, chilly, *Gahat* (a pulse crop), *Bhatt (*black soybean*),* etc. ploughing has been carried out only once. Farmers reported that earlier two to three ploughing were followed for every crop. In valley areas, where water is available for irrigation, two to three ploughing have been followed for paddy cultivation. Pudding of soil has been carried out in these areas. For puddling *Desi* plough and *Patela* (Pod breaker) have been used.

For sowing of most of the crop broadcasting of seed has been carried out. Potato has been sown in rows, drawn with the help of *Desi* plough. The seed has been broadcast in the field then it has been ploughed. In rain- fed areas paddy crop has been sown with the same method. In areas where irrigation facility has been available, transplantation of paddy has been performed. Direct sown paddy is more popular due to unavailability of irrigation facilities. Chilly crop has been transplanted in few areas.

4. Seed treatment

The practice of seed treatment before sowing has not been followed by most of the farmers. Farmers know that earlier seed treatment had been followed for pulse crop and wheat. The seed had been treated with the mixture of ash of cow dung and cow urine. Farmers believe that this helped in enhancing productivity and minimizing damage to the seed by the pests.

5. Date of sowing

Some farmers reported that they chose one day from the auspicious days announced by their *Purohit* for that season. Farmers in other village reported that they remember the date of sowing of the crop for past three-four years and the date, which has given better results, have been preferred for sowing in the current year. There could be some modifications in the date of sowing depending on the present year weather. One respondent reported, "In the year 2000 the sowing of wheat was done on 1st of *Kartik* month, in 2001 on 4th of *Kartik* and in 2002 on 9th of *Kartik* month. The yield was not good in year 2001 and was better in 2002. So this year the date of sowing would be around 9th of *Kartik* month".

6. Intercultural operations and plant protection

6.1 Aphid attack on mustard

In case of aphid attack on mustard crop cow urine has been spread over the infected plants. Ash obtained from firewood has also been broadcast for control of aphid problem in mustard.

6.2 White grub (Holotrichia spp.) problem

White grub has been found causing damage to crops in the hilly areas especially in rain fed regions. The damage has been maximum during *Kharif* season. Farmers reported that earlier the problem of white grub was not every serious but now it has become the major pest for all the crops. The damage has been done by its caterpillar, which remains in soil and feed itself on the roots of crop plants. Crops like potato, reddish, etc have to face maximum damage.

To control white grub farmers use Table salt. One kilogram of Table salt has been broadcasted in one *Nali* area of land. The other method is to leave the field fallow for one season, which breaks the life cycle of the pest. Farmers found that use of *Pirul* (dried leaves of *Pinus spp.* called as C*hir* by local people) in farmyard manure and use of non-decomposed manure in the crop fields increases the problem of white grub, so these practices should be avoided. Farmers know that only well rotten manure should be used in the fields. The use of raw manure serves as food for the caterpillar and increases the problem.

6.3 Application of wood ash on cut surface of potato

Large size potato tubers have been cut into two or three pieces, depending on the number of eyes (growing buds) on the tuber. This practice saves the potato seed. The cut potatoes when placed in the soil have been exposed to the pest present in the soil. To prevent it, farmers apply ash on the cut surface of the potato. The cut potatoes have been taken in a *Daliya* and ash has been spread over it and mixed properly. The ash makes a layer over the cut surface. This layer acts as a physical barrier for the pest present in soil. As the ash has been obtained from burning of wood it has been free from any type of microorganisms.

7. Post-harvest operations

7.1 Post harvest ripening of mustard

The farmers have harvested mustard crop before it reaches to full ripening stage. The crop has been harvested in green stage because harvesting of fully matured crop results in considerable loss of the grain due to shattering. The farmers then collect the harvested plants and make a pile of these on threshing floor. These green plants have not been spread on the threshing floor, as grains have not been ripened properly. So the pile has been left as such for about one week period. After one week the harvested plants have been spread on the threshing floor and dried under the sun. Scientists reported that the reason for ripening of the grains when kept in a pile is

ethylene production by the crop. Ethylene is a plant hormone, which has been released by the crop during the ripening stage and piling of the crop increases the ethylene concentration, which further helps in crop ripening.

7.2 Threshing by bullock trampling

For bullock trampling sun dried crop plants have been spread on thrashing floor. This crop has been covered with a layer of straw. Then bullocks made to walk over the crop in a circle. Care should be taken to collect the dung at the time of operation. The layer of straw help in separating the dung from the threshed grains.

7.3 Use of dried leaves for storage of food grains

Food grains have been dried properly for storage while storing the food grain leaves of *Akharot* (*Juglans regia* Linn.), *Bithon* (a tree of Neem family) or *Tun* (*Toona ciliata* M. Roem.) have been used. The leaves of these plants have been taken and kept under the sun for one day. Then the dried leaves have been crushed and mixed in the food grains. The food grains have been kept in storage structures. When the grain needs to be consumed the crushed leaves have been separated from the grains.

7.4 Use of mustard oil for storage of pulses

In pulses storage problem has been very serious. For storage of the pulses, leaves of the plants mentioned above had been used. In addition to it, the farmers know the practice of applying mustard oil on the pulses. Farmers reported that 10-20 ml of mustard oil is sufficient to be applied on one *Nali* of the pulse (one *Nali* is approximately two kg. This unit of measurement is based on volume. There is a container made of wood which is called *Nali*).

7.5 Use of ash for storage

Ash obtained from burning of fuel wood has been mixed with the food grains. The probable reason for its use may be its ability to absorb moisture, which otherwise will be absorbed by the grains and make them prone to pest attack. Moreover, ash acts as a physical barrier for movements of pests from one grain to another.

7.6 Use of Table salt

Due to problem of storage, farmers used to store paddy instead of rice grains, as rice grains are more susceptible to the store grain pests. To store rice grains Table salt had been mixed with these grains. About 50 gm of the salt had been mixed with one kilogram of the grains. This practice has been reported to be helpful in storage by the farmers.

7.7 Storage of food grains in airtight containers

Airtight containers had been prepared for storage of food grains by using locally available materials. These containers were made up of bamboo sticks, which were woven in a shape of oblongated sphere. These containers had air passages. These air passages were filled with the paste of mud, cow dung and cow urine. The paste had been prepared by mixing clay soil with equal amount of cow dung (Dung from other animals had been taken when cow dung was not available). Cow urine had been used to make a paste of the mixture. The container had been plastered with this paste from both the sides i.e. inside and outside. This container had been dried in the sun. Food grains had been kept inside it. This container had been covered with a lid. The same paste had been used for plastering the lid over the container so that the air space between the lid and the container had been filled with the paste. This container had been dried. Thus, the container become airtight and it had been safe to store food grains in such container for a longer period of time. *Bhakar* is a large sized structure made up of wood.

8. Conclusion

The farmers have been practicing agriculture by following indigenous methods known to them. This pool of knowledge is of great significance in conserving the environment and maintaining the sustainability of the agricultural production system. The problem with this production system is that it is unable to meet the present requirement of the farmers in terms of production. As a result, the new generation is loosing interest in farming itself. The need of the hour is to identify the location specific indigenous practices and modify them by conducting location specific field trials. Modern practices should be blended with the indigenous practices, so that the production can be enhanced without hampering the sustainability of the system.

9. References

1. Simpson B. *Systematic integration of knowledge system: an under-utilized potential for agricultural development in marginal areas*, in: Systems Oriented Research in Agriculture and Rural Development, International Symposium Montpellier, France, 1994, 599-602.
2. Haverkort B, de Zeeuw H. *Development of technologies towards sustainable agriculture: Institutional implications*, in: W M Rivera and D J Gustafson, ed *Agricultural Extension: Worldwide Institutional Evolution and Forces for Changes*, (Elsevier Science Publishing Company, New York), 1992, 231-242.
3. Padaria RN, Singh RP. Risk adjustment and traditional wisdom in dry land farming, Indian J Ext Edu. 1990; 26(3, 4):1-7.
4. Kloppenburg Jack Jr, Social theory and the de/reconstruction of agricultural sciences: local knowledge for an alternative agriculture, Rural Sociology. 1991; 56(5):19-48.
5. Reijntjes C, Haverkort B, Waters Bayers A. *Farming for the future: An Introduction to Low-extent–input and sustainable Agriculture*, (Mac Milan Education, London and Basingstobe), 1992.
6. Scott CA, Walter MF. Local Knowledge and Conventional Soil Science approaches to erosion processes in Shiwalik Himalayas, *Mountain Res Dev*, 1993; 13:61-72.
7. Bunders J, Loeber A, Broerse EWJ, Haverkort B. *An Integrated approach to Biotechnology development* in: ed Bunders J, Haverkort B and Hiemsta W *Biotechnology, Building on Farmers' Knowledge*, (MacMillan Education. London and Basingstobe), 1996.
8. Acharya CL, Sood MC, Sharma RC. *Indigenous Nutrient Management Practices in Himachal Pradesh*, in *Indigenous Nutrient Management Practices–Wisdom Alive in India*, ed Acharya CL, Ghosh P K and Rao A (Indian Institute of Soil Science, Nabibagh, Bhopal), 2001, 121-146.
9. Gupta RK, Rajput RP. Indigenous Nutrient Management Practices in Madhya Pradesh, in *Indigenous Nutrient Management Practices–Wisdom Alive in India*, ed Acharya C L, Ghosh P K and Rao A., (Indian Institute of Soil Science, Nabibagh, Bhopal), 2001, 205-228.
10. Bahal Ram, Indigenous knowledge systems to sustainable agriculture, National Seminar on Indigenous Technology for Sustainable Agriculture, IARI, New Delhi. 1993; 18:23-25.