

Traditional food grain storage practices of Punjab

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Increasing environmental concerns and emphasis on evergreen revolution calls for sustainable and ecofriendly practices. Indigenous technical knowledge which is a result of years of experimentation and observations by farmers along with modern scientific technology can meet the above mentioned challenges. A study was conducted in Malwa region of Punjab state of India to identify the traditional practices and to know the scientific basis of these practices, if any. Traditional practices were identified from well experienced farmers from 12 villages through interviews and focus group techniques. Scientific basis was discussed with biological scientists on three point continuum. Majority of the identified indigenous practices were said to be scientifically agreeable, having scientific basis which needs further standardization.

Keywords: Traditional knowledge, Storage structures, Grain storage practices, Traditional storage, Traditional agricultural practices

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A large portion of world's population is dependent on agriculture for their livelihood. Out of this, a majority of population consists of small scale farmers. These farmers represent hundreds of distinct language and ethnic groups. Indigenous knowledge is generated by these farmers with their own experiences and experimentation to meet their needs. These farmers have been engaged in agriculture since very beginning. Since then, they are minutely observing the phenomenon's related to agriculture and are experimenting with locally available alternatives to solve the problem coming across. Whether it is weed management, soil and water management or insect pest control, farmers have accumulated a vast knowledge in every area related to agriculture, animal husbandry, etc. Small farmers across the continents have proven themselves capable of developing new kinds of technologies in such categories as soil conservation, plant spacing and population, intercropping, non-toxic pest and disease control, etc¹. The techniques or practices developed by farmers are also ecofriendly and economical as these involves the use of locally available materials. The traditional knowledge is tightly interwoven with the farmers' beliefs, norms and culture so that it could maintain its identity. Traditional or indigenous knowledge has

the characteristic of having minimum risk, heavy reliance on genetic and physical diversity, exploiting optimum utility of local resources, environmentally healthy, holistic world view, readily available, easily understandable, labour intensive and adaptable to meet multiple community needs². The increasing environmental concerns and emphasis on evergreen revolution call for sustainable and ecofriendly practices. It is stated that need of the hour is sustainable agriculture with more emphasis on biological agents, organic amendments and manipulation in cultural practices³. At this juncture, indigenous knowledge can play an important role. After validation and standardization of indigenous knowledge by physical and biological scientists, these practices can be disseminated to rural people or these practices can be made use to form the basis for further scientific technology generation. Looking into the future, it can not be denied that there is a need for institutionalization of traditional knowledge due to its immense utilitarian value in the development process. Yet very little of this kind has penetrated into modern agricultural knowledge system. Moreover, we are loosing this wealth with the advancement of time. There is a need to preserve the indigenous knowledge as the documentation of traditional knowledge may create a pressure on policy makers to pay due respect for people's knowledge and to incorporate this

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knowledge in rural development planning². Keeping all this in view, the exploratory study was taken to identify and document traditional knowledge regarding insect pest control in storage and to know the opinion of the agricultural experts about the scientific basis of these practices.

Methodology

The study was conducted in Southwestern districts of Punjab. Two districts, Bathinda and Mansa, having low literacy rate were selected as the literature on indigenous knowledge clearly indicates more chances of existence of Indigenous knowledge in area having low literacy rate⁴. From the each selected districts, two blocks and further three villages from each selected block were taken with same criterion. The selected villages were Golewala, Kamalu, Behman Jassa Singh Wala, Kot Guru, Jai Singh Wala, Lool Bai from Bathinda district and Sukha Singh Wala, Gharangne, Rampur Mander, Chak Alisher, Mohar Singh Wala, Dharampura from Mansa district. From each selected village, approximately 15 well experienced/old farmers were randomly selected and contacted to collect the data. Nearly 200 farmers were contacted in both the districts. Old farmers were contacted and discussion was initiated related to indigenous technologies among the group of farmers (focus group technique). The data from 25 individual farmers, who were well known for their traditional wisdom in village, were collected through open ended interview schedule. In addition to this, 5 experts in the field of Entomology from Punjab Agricultural University, Ludhiana were contacted to know their opinion regarding identified indigenous grain storage practices. Opinion was taken on three point continuum, i.e. scientifically agreeable, scientifically disagreeable and which need further investigation.

Results and discussion

During this exploratory study on traditional storage practices, certain indigenous storage structures developed and used by farmers were identified:

Bukhari

It was a square shaped structure constructed with mud or with bricks and cement with an outlet at the ground level. The upper portion was plastered with mud and straw and covered with polythene sheet to protect against moisture.

Bharola

It was an egg shaped earthen storage bin. It had opening at top and was a portable structure. Its storage capacity was up to 40-80 kg (Fig.1).

Kupp

It was used to store wheat straw. In the field, a round and cone shaped structure was constructed with the help of cotton sticks bound together with rope. It was made cone type so as to avoid rain water to enter inside. After construction, it was plastered with mud (Fig.2).

Storage practices in wheat

In case of wheat grain storage, matchbox was kept in the storage bin to protect wheat grains from attack of storage insect pests like *khapra* beetle (*Trogoderma ganarium*) and *Dhara* (*Callosobruchus* sp) (Fig.3)⁵. Two experts (40%) had the opinion that this practice was non-scientific (Table1). However, according to remaining experts, this practice needs to be further investigated. One view was that the head of the matchsticks may have some repellent effect on insect pests. Washing soap was also kept in the stored wheat to avoid contamination. This practice was also scientifically disagreeable to 80% percent of the experts. Only one expert felt that there might be some scientific basis and further investigation should be done. Farmers were well aware about insecticidal properties of *neem* (*Azadirachta indica*) or *aak* (*Calotropis procera*), etc. as they were using these for safe storage of wheat grains (Fig.4)⁶. *Neem* leaves were also rubbed along the wall of the *bukhari* before storage of wheat; all experts confirmed this practice to be scientifically agreeable (Table1). In another case, farmers were keeping *neem* along with grains to protect them from storage insect pests; experts opined that this practice is also scientifically agreeable as *neem* has insecticidal and insect repellents properties. Use of *neem* leaves, husk, salt, camphor is also reported either singly or in combination to prevent food grains from insect infestation⁷. Leaves of *aak* plant were also used for safe storage of wheat. Forty per cent of the experts expressed that this practice needs further investigation, whereas an equal percentage of them responded that the practice has a scientific base as *aak* might act as repellent or may have insecticidal properties. One expert considered that this practice is scientifically disagreeable.

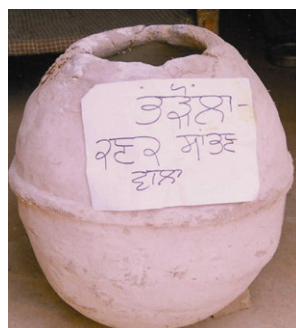


Fig.1 Bhrola



Fig.2 Kupp



Fig.3 Use of matchbox for storage



Fig.4 Use of neem leaves for storage

Table 1— Traditional plant protection practices related to wheat grain storage (n= 5 experts)

Traditional grain storage practices	Scientific justification*		
	NS	SA	NFI
In case of wheat, matchbox was kept in the storage bin to protect wheat grains from attack of insect pests	<i>f</i>	<i>f</i>	<i>f</i>
Washing soap was kept in the stored wheat to avoid insect pest infestation	2		3
<i>Neem</i> leaves were rubbed along the walls of the <i>bukhari</i> before storage of wheat		5	
<i>Neem</i> leaves were kept along wheat grains in the <i>bukhari</i> or any storage bin during storage		5	
<i>Aak</i> leaves were used for safe storage of wheat grains	1	2	2
In case of wheat, storage was done after proper cleaning and drying of grains		5	
Wheat was stored during morning hours	2	1	2
In <i>bukhari</i> , farmers spread the layer of gram seed coat over which wheat grains were stored	3		2
In <i>bukhari</i> , wheat was stored over a layer of sand	2	1	2
Wheat grains to be used as seed were filled in gunny bags and these bags were stored in wheat straw		3	2
Gunny bags were kept on surface of stored grains		3	2
A lighted diva was kept in the grain storage room	1	1	3

*NS-Non-scientific, SA -Scientifically agreeable, NFI -Needs further investigation

Table 2— Traditional plant protection practices related to storage

Traditional storage practices	Scientific justification*		
	NS	SA	NFI
<i>Moong</i> was stored in <i>bukhari</i> on a layer of ash	<i>f</i>	<i>f</i>	<i>f</i>
<i>Moong</i> was stored after smearing it with mustard oil	2	2	1
<i>Moth</i> bean and <i>moong</i> were stored by mixing with ash to avoid the attack of <i>khapra</i> beetle	-	2	3
Onion and garlic were stored at a ventilated place along with their leaves	-	4	1
Wheat straw for animals was stored in <i>kupp</i>	-	4	1

*NS-Non-scientific, SA -Scientifically agreeable, NFI -Needs further investigation

Before storage, wheat grains were dried in sun light and properly cleaned by siftings. The sifting was also done by using indigenously made equipment called as *chajj* in local language. During the sifting, the shriveled, broken and diseased grains were separated which were later on fed to animals; all experts considered this practice as scientifically agreeable. They further explained that if wheat is properly cleaned and dried, chance of attack of storage pest

become less. Moreover, Farmers were used to store grains during night or in morning hours. They had the belief that the grains stored in night or morning were less attacked by storage pests; according to two experts this practice was non-scientific. One expert (20%) found this practice as scientifically agreeable, while two experts could not differentiate the practice as scientific or non-scientific but opined that the practice needed further investigation.

In *Bukhari*, farmers spread the layer of seed coat of gram over which wheat grains were stored. This was done as a preventive measure for insect pest attack; 60% of the experts confirmed this practice as non-scientific, while two experts (40%) opined that there is a need to further investigate these practices. Yet in another case, sand was used for safe storage of grains. In *bukhari*, wheat was stored over a layer of sand; majority of the experts (60%) could not find the scientific basis behind this practice. While one expert (20%) was of the opinion that this was scientifically agreeable practice, another expert (20%) had the opinion that this practice needs to be further investigated. However, they opined that sand may act as simple barrier or its chemical composition may have some repellent effect. Wheat grains to be used for the purpose of seed were filled in gunny bags and these were stored in wheat straw to avoid the attack of *Dhara* (*Callosobruchus* sp) and *khapra* beetle (*Trogoderma ganarium*). It was also done to keep the moisture low to avoid diseases; majority of experts (60%) were of the opinion that this was a scientific practice. One expert explained insect attack is less when wheat stored in straw and it may act as insulation against moisture while according to another expert (20%), there was a need to investigate this practice. Farmers were also using gunny bags to control the attack of *khapra* beetle (*T. ganarium*). During the practice, farmers put gunny bags over the surface of attacked grains as they believe that *khapra* beetle (*T. ganarium*) moves to the gunny bags from the grains and thus it can be easily controlled. Experts opined that some insect shows thigmotaxic behaviour and *khapra* beetle (*T. ganarium*) is one of them. They further explained that insects showing thigmotaxic behaviour used to move towards the rough surface. Thus, if we put gunny bags over the grains, this insect can move to the gunny bags, due its attraction towards to rough surface, where it can be further controlled easily. Further, they were also keeping the lighted *diva* (burning oil lamp) in the room where grains were stored as they believed this has the inverse effect on the attack of insect pest. Experts explained that this may be possible as this may help in checking insect pests as this will consume the oxygen which is necessary for the life of the insect and thus can effect the insect pest infestation inversely.

Storage practices in other crops

Moong (*Vigna radiata*) was stored in *bukhari* over a layer of ash; according to two experts this practice

was non-scientific while two other experts (40%) viewed this practice as scientific⁸. One expert explained that ash has silica content which is harmful to insects. One expert could not confirm this practice to be scientific or non-scientific but opined that this practice needs to be further investigated. It has been reported that farmers in Rajasthan were also using ash to prevent the attack of storage pests⁹. It was reported that in *kandi* areas of Punjab, premixing of sand seed with sufficient quantity of ash was done¹⁰. *Moong* (*Vigna radiata*) was stored after smearing it with mustard oil; two experts found this practice to be scientifically agreeable as oil can make the grain surface slippery which prevented the insect to crawl or breed on grain. However, they did not give the reason, while three experts were of the opinion that this practice needs to be further investigated. Smearing of grain with oil or melted butter or coating of grain with red earth was also reported¹¹. *Moth* bean and *moong* (*V. radiata*) were also stored by mixing with ash to avoid the attack of *khapra* (*Trogoderma ganarium*) beetle; majority of the experts (80%) considered this practice as scientific. According to experts, ash contains silica (SiO_2) which act as repellent and silica in ash is also harmful to insect pests. According to one expert (20%), a layer of ash over the surface of *moth* bean is recommended practice but this needs to be further investigated. Rubbing ash or dry sand on green gram seeds for their safe storage was also reported¹². Onion and garlic were stored at ventilated places along with their leaves; according to 4 experts, this practice was scientific while another view was that storage at ventilated places prevents rotting caused by fungal attack. One expert (20%) was of the opinion that this practice needs to be further investigated. It has been found that women in Punjab used to burn the stem of onion while storing them in hanging basket for their safe storage¹³. A common practice found in the villages to store wheat straw for animals was *kupp* binding. Majority of the experts (80%) expressed that the practice was scientifically agreeable as rain water cannot enter the *kupp* and thus there is no fear of fungus development on straw due to low moisture while one experts opined this practice to be scientifically disagreeable.

Conclusion

The study on traditional knowledge shows vast knowledge of farmers regarding the storage practices. Similarly, there are other area's also like insect pest

control in field situations, soil and water management, etc. for which there is need to identify and document indigenous knowledge. There are some practices like use of *neem* leaves to control the insect pest infestation, to which all the experts agree. These practices or indigenous technical knowledge can form a basis for sustainable agriculture after further standardization and validation. At the same time, opinion of experts also vary about certain practices like the practice of using *aak* to avoid attack of insect pest and practice of storing wheat in the morning hours, etc. These indigenous practices also need to be evaluated to know the scientific rationale behind these practices, if any. So, based on the study on indigenous knowledge regarding grain storage practices, it is desired to scientifically validate and standardize these practices to disseminate among farming community. On the other hand, farmers need to be educated about the non-scientific practices to dissuade them from using them.

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