

# CONVENTIONAL METHODS OF SEED STORAGE: DOCUMENTATION AND VALIDATION

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## Abstract:

*Green revolution has changed the Production of food grain production scenario and it crossed the 206 mt mark in 2005. The studies conducted herald the fact that the annual losses in storage are to the tune of 25-30 percent. Under the circumstances the importance of storage does not diminish. The selected technologies which the farmers concern mostly were sent for scrutiny. These were circulated to 20 scientists for validating the traditional methods of storage working in the premier institutes of agricultural research, Indian Agriculture Research Institute, Pusa (New Delhi) and Banaras Hindu University, Varanasi, (U.P.) The traditional practice of keeping pulse seed in a sandy earthen pot (Ghaila) was also very common among farmers (52). Regarding protection from insect pest and rodent, mixing pulse seed with oil (edible or non edible) before storage were the most common traditional methods practiced by 93% farmers. It was followed by storing seeds in wheat straw to control storage grain pest (92 %), using container coated with a paste of Neem leaf or dry Neem seed kernel powder (85% farmers), addition of dry Neem leaves and its powder to bags or storage container (86%) and plastering of the floor and room in which the seeds are stored with cow dung (60% farmers). Our young generation is still skeptical to use these traditional methods of storage because they believe in modern techniques only and have doubt regarding the validity of these traditional methods of storage. Efforts need to be taken to break the incompatibility between modern techniques and traditional methods of storage in the forthcoming scenario.*

## Introduction

The food grain production scenario of the country in 1950's was in a very miserable state. To meet the demand, a large quantity was being procured from various parts of the World. Green revolution has changed the scenario and brought country in a position to export the grains to the needy countries of the world, besides meeting local requirements. The Production of food grain has crossed the 206 mt mark in 2005. At the same time human population has grown too many folds.

Under the circumstances the importance of storage does not diminish. Increasing population, natural calamities & uncertain climatic behaviour, lay emphasis on storage for the purpose of consumption or as seed for the next cropping season. About 30 percent of the produce handled by Government agencies & remaining part is retained & stored at farmer level.

([www.indiainfoline.com/stee/feat/naca.html](http://www.indiainfoline.com/stee/feat/naca.html))

Interaction of biotic factors viz. insects, rodents, mites, fungi, micro-organism and abiotic factors such as temperature & relative humidity/moisture content of the grain, lead to qualitative & quantitative losses.

**Factors affecting seed storage:** there are two categories of factor which affect, storage. The factors are deal briefly.

**Biotic Factors** Insects, Rodents, Birds, Mites, Fungi and Bacteria

**Abiotic Factors** Moisture content, Temperature, CO<sub>2</sub> and O<sub>2</sub>

## Disadvantage of Modern Method:

It is true that the modern method really gives visible and quick result, but at the same time it is also true that it has several side effects. Chemicals used during storage like-DDT,



Malathion etc. affect the seed health and also the health of the human being who used to eat it.

It must be borne in mind that the fumigation, particularly repeated fumigation may seriously reduce the vigour and even the germination capacity of seeds. Prophylactic biweekly or monthly fumigation of seed storages can lead to serious germination problems and the cost of the storage also high. All these disadvantages led to emphasis on other method which can supplement or complement this new technology.

### **Traditional Measures**

It is found that only 30% of technologies generated from research institution/agriculture universities have been transformed or adopted (Singh, 1995). So., it shows still the farmers are in touch with their indigenous technical knowledge. Farmers are still using several indigenous methods for storing the seed some are using these methods as they found it very effective and cheap & others as they don't know about the recent advance techniques of storage.

### **Advantage over modern method:**

Cheap i.e. economically viable, Convenient, Having no side effect - Either on stored seed or on the health of the people who are using it and effects are persisting and long lasting. As the modern techniques sometime do not serve the same purpose for which it is applied. For example, some of the chemical pesticide used during storage improves the resistance in the insects and lead to resurgence.

So there is the need to go for any alternative method which can complement these recent technologies. The traditional technologies can fulfill the same. It is true that the relative advantage of chemical method is much more than the Indigenous method and also having more scientific validity but the disadvantages like having side

effect and others, don't meet with the indigenous method and hence the combination of these two will must give a drastic results.

So, there is a need to identify the traditional technology and preserve. There is a danger of extinction of these technologies with the death of the owners of these technologies because it is not well known to others & it is not properly documented or written. In case of seed storage, there are lots of Indigenous technologies followed by the farmers in various localities. They are also having success stories behind the use of these technologies. Albeit, it takes time to render effects, their effects are persisting and long lasting.

So compilation of this knowledge will be a great contribution to the history of agriculture. At present this information pass from generation orally and in the wake of intensive intervention are likely to be lost as the people become old or leave this earth. Thus like many knowledge of the ancient Indian which was passed from generation to generation through oral communication, has been lost this also would be lost.

### **What Need To Be Done**

- Value and respect Traditional Knowledge, folk wisdom and belief system.
- Documentation and validation of Traditional Method.
- Refinement and blending with modern technology.

### **Methodology**

The study was conducted in purposively selected Darbhanga district of Bihar state. A multistage random sampling procedure was applied for the selection of blocks (2), villages (4) and respondents (60). The respondents were categorized on the basis of land holding and seed production.

The selected technologies which the farmers concern mostly sent for scrutiny. These were circulated to 20 scientists for validating the traditional methods of storage working in the following



institutions Indian agriculture research Institute, Pusa (New Delhi) and Banaras Hindu University, Varanasi, (U.P. ) The data were collected by using a well structured interview schedule and were compiled, tabulated and subjected to simple statistical analysis such as mean, percentage and standard deviation.

## Results and Discussion

### Documentation of Traditional Methods of Storage

(SRISTI) for sustainable technologies and institutions has documented over 9,000 “green” innovations based on indigenous biodiversity knowledge, creativity and innovation as a follow up to documentation, SRISTI has set up Grassroots innovation Augmentation network in collaboration with the state Government to develop innovations into products and then into enterprises. SRISTI’s work has further culminated in the launch of National Innovation Foundation a grassroots eco-innovation multimedia database.

**Table 5: Documentation of traditional method of storage**

Traditional method of storage farmers	N=60	
	Number of farmers (Using the practice)	Number of (Not using the practice)
<b>1. Drying of grains</b>		
1) Expose in thin layers of solar radiation on a cemented floor or on a black polythene surface to reduce the moisture content for safe storage (very frequently once every one or two months)	60	0
<b>2. Maintenance of dryness during storage</b>		
1) Jute bags are used to store the seed and these bags are further kept in a room completely filled with a Bhusi (wheat straw) and having no window for ventilation Rice, Wheat and Pulse seed)	38	22
2.) Potato seeds are stored on a layer of sand on pucca surface and are turn up and down regularly at an interval of 5-6 days	48	12
3) To maintain dryness –storage structure are filled to a quarter capacity with dry wood ash	10	50
4) Every kg of seed 500 gm of fresh dry wood ash that has cooled, after the seed have been put in the container in which seed are going to be stored (for vegetable seed)	10	50
5) In case the container is opened frequently, change the wood ash, every time it is opened	10	50
6) Seeds are kept on a thick layer of wheat’s straw i.e. Bhusi and again covered with a thick layer of wheat straw (pulse, rice, wheat, mustard seed)	58	2
7) Seeds are kept in a structure made up of mud mixed with Bhusi called as ‘KOTHAR’. The outer and inner layer of this structure is plastered with cowdung (Rice and wheat seed)	60	0
8) Pulse seed are kept in a sandy earthen pot called as Ghaila	52	8
9) A structure made up of only Bamboo sticks and lined by straw (Rice straw) is used to store the seed. There is no gap between the sticks used (Rice and wheat)	34	26
10) Seeds are kept in a cloth made up of cotton (generally black colour); are tied with the ceiling of the roof at kitchen room, where the practice of cooking is done with the help of cowdung cake and fuel wood	43	17

Documentation is the conversion of traditional knowledge information provided by communities into written documents. The main aim of such documentation is to ensure that information is not lost and to protect communities by showing that such information is prior Art.

The India-based Honey Bee Network operated by the Society for Research and Initiatives



11) Storage structure are not kept directly on the surface, but either on a small round brick wall on a flat wooden	60	0
<b>3. Protection from insect pest and rodents</b>		
1. Neem leaves dried in shade and powdered, added to bags or container (in which the grain is stored)	52	8
2.) Container (gunny bags) coated with a paste of neem leaf or dry neem seed kernel powder	54	6
3) The floor and room in which the seeds are stored is plastered with cowdung to keep the pest away	36	24
4) Pulse seed are mixed with oil (edible or non-edible) than storage is done. But before further use drying is done in solar rays	56	4
5) Every kg of seed, 50 gm of lime is used mixing is done in the same container in which the seeds are going to be stored (veg. seed)	35	25
6) Powder of crushed dried fruit of black pepper is mixed with pulse and oil seed. The amount of black pepper powder is 1/100 <sup>th</sup> of the total seed stored	20	40
7. Storage of seed in wheat straw controlled storage grain pest (Red rust flour beetle)	55	5
8.) A small quantity of lime is mixed with equal part of. Wheat and chick pea flour and baits made from this mixture are used for killing of rat	25	35
9) Small quantity of human hair is put in the hole opened by Rat and covered with a thin layer of mud or even dry soil. Rat never used to come again in that hole	10	50
10) Mercury and cement are mixed in equal proportion to make chapati like structure. This combination protect wheat from Red rust flour beetle.	30	30
11) Dried seeds are kept in a cloth of cotton and these bags are tied with the ceiling of the roof. It is used to protect seed from the rodents	42	18
<b>4. Before further sowing</b>		
1) Seed together with Bhushi are taken out from storage room 1-2 week before the sowing and dried in sun rays	42	18
2) Separation of seed from Bhushi is done and again drying of seed is done in solar ray	50	10
3) Seeds are poured in a chemical (which enhance germination) and transplantation is done without washing with water	60	0
<p>Regarding Traditional methods undertaken in the study following conclusion draw in the following paragraph: Exposure of grain after harvest on cemented floor or on a black polythene surface to reduce the moisture contain for safe storage was most common traditional method for grain drying, practiced by sixty (60) farmer in the present study.</p> <p>Regarding maintenance of dryness during the storage, keeping seeds in KOTHAR which is made up of mud mixed with Bhushi (Wheat straw) and keeping the storage structure on round brick wall were found the most common traditional methods which were practiced by sixty (60) farmers. Further it was found that many farmers (58) under study, were keeping seeds on thick layer of wheat straw which again covered with a thick layer of wheat straw.</p> <p>In addition to this, the traditional practice of keeping pulse seed in a sandy earthen pot (Ghaila) was also very common among farmers (52). They</p>		



believed that the store pulse grain remains save during storage period. Also storage of potato seed on a layer of sand on pucca surface with regular turn up and down at 5-6 days intervals as well as keeping seeds in a cloth made up of cotton tied with the ceiling of roof of kitchen were found popular among farmers (48 farmers and 42 farmers respectively). Although use of jute bag to store seed in air tight room, filling storage structure to a quarter capacity with dry wood ash and using structure made up of Bamboo sticks lined by straw is quite effective for maintainance of dryness during storage but practiced by few farmers only.

Regarding protection from insect pest and rodent mixing pulse seed with oil (edible or non edible) before storage was the most common traditional method practiced by fifty six (56) farmers out of study (60). It was followed by storing seeds in wheat straw to control storage grain pest (55 farmers), using container coated with a paste of Neem leaf or dry Neem seed kernel powder (54 farmers), addition of dry Neem leaves and its powder to bags or storage container (52 farmer) and plastering of the floor and room in which the seeds are stored with cow dung (36 farmers). Besides mixing of 50 gram of lime with every kg of seeds, mixing of powder of dried fruit of black pepper with pulse and oil seed, mixing of small quantity of lime with equal part of wheat and chick pea flour, putting small quantity of human hairs at the hole opening of Rat and covering the hair with thin layer of mud, mixing mercury and cement baits with seeds and keeping dry seeds in cotton cloth tied to the roof were very effective against storage pest but used by few farmers only. It may be because of either the practice is costly or is not known.

Regarding the practice before further showing all the three Traditional method were found to be wide practiced by farmers. Although all three practices are various steps from storage to further showing. But the practice involving pouring seeds in chemical (which enhance germination) and

transplantation is done without washing with water was found the most commonly practiced one (60 farmers) which was followed by separation of seeds from Bhusi and then drying the seed in sun ray (50) and taking seeds together with Bhusi from storage room 1-2 weeks before sowing and dried in sun ray (42). Thus all farmers were using chemical which enhanced germination of seeds during further sowing. It reflects how scientific knowledge incorporated in our traditional knowledge.

## **VALIDITY SCORES AND PERCENTAGES OF SELECTIVE TRADITIONAL METHODS OF STORAGE**

All documented ITK were selected for validation based on farmer's emphasis. These selected techniques were sent to twenty scientists of 2 institutes. Based on their judgment, validity scores and validity percentages were worked out. Maximum score was 50 and minimum score was 10. The selected traditional methods of storage, with their validity scores and validity percentages are given in Table 6 and traditional methods of storage, with their high validity scores and validity percentages are given in Table 7 (Serelan (2003)).

### **JUST BEFORE STORAGE**

**Dying of grains:** Seed are exposed in a thin layer to solar radiation on a cemented floor or on a black polythene surface. This practice brings down the moisture contents of grains up to a safe level for storage. This had been supported by most of the scientist. But according to scientist suggestion it should not be in practice during West Wind. This result is supported by 100 percent of scientist of the BHU and 100 Percent scientist of IARI also corroborated this result. The average for this result from both the institute is 5. Similar practices were reported by (Singh et al, 1983; Vyas, 2002).

### **MAINTENANCE OF DRYNESS DURING STORAGE**

The Jute bags are used to store the seed and these bags are further kept in a room completely filled



with Bhusi i.e. wheat straw and having no window for ventilation. This practice is done to store the seed of rice, wheat and pulse. This technique is supported by 76 percent scientist of the BHU as valid and 56 percent scientist of IARI also supported this. The average support for this result from both the institute is 3.3.

Potato seed are stored on a layer of sand on a Pucca surface and are turn up and down regularly at an interval of 5-6 days. Farmer told this prevents the rotting of potato seed and if there is any rotting than further helps in reducing the spreading of it. This practice was reported to be valid as 68 percent of the scientist of the BHU and 88 percent scientist of IARI also supported this.

The storage structures are filled to a quarter capacity with dry wood ash. For every kg of seed 500 gm of fresh dry wood ash that has cooled, is added in the container after the seed have been put in same container. Farmers told this practice is suitable mainly for storing vegetable seed. As the dry wood ash has good moisture absorbing capacity. So it prevents the moisture to reach at the level of stored seed and keep the stored seed safe. This technique is supported by 76 scientist of the BHU as valid and 60 percent scientist of IARI also supported this. The average support for this result from both the institute is 3.4. Nagnur et al, (2004) reported similar practice.

In case the container is opened frequently, the wood ash is changed every time it is opened. Farmers told that the seed remains safe for a longer time. According to scientist by frequently opening of container, a situation comes when the wood will lost it's moisture absorbing capacity and it harms the seed directly. So it is better to replace the wood ash every time as it is opened. This practice was reported to be valid as 68 percent of the scientist of the BHU and 56 percent scientist of IARI also supported this.

Seed are stored on a thick layer of wheat's straw i.e. Bhusi and again covered with a thick layer of wheat straw. Farmer used this practice for storage

of Rice, Wheat, Pulse and also the mustard seed. This practice is adopted by most of the farmer as there is a general belief that it is a best method as it has wider adaptability and keeps the stored seed in the similar moisture condition that was present preventing at the time of storage

According to scientist the moisture absorbing capacity of the wheat straw (Bhusi) is several times more than the grain: Hence the straw keeps the stored seed safe by absorbing most of the atmospheric moisture. But according to them the Bhusi should be completely dry. This practice was reported to be valid as 100 percent of the scientist of the BHU and 100 percent scientist of IARI also supported this.

Seed are kept in a structure made up of mud mixed with Bhusi called as 'KOTHAR'. The outer and inner layer of this structure is plastered with cow dung. Farmers told that they are using this practice only for rice and wheat grain & they belief the grain remains safe. This practice was also reported to be valid as 100 percent of the scientist of the BHU and 100 percent scientist of IARI also supported this. Similar method was mentioned by Atwal (2002)

Pulse seed are kept in a sandy earthen pot (locally called as Ghaila). This is believed that it helps in maintenance of moisture during storage and also prevents insect pest infestation. This technique is supported by 88 scientist of the BHU as valid and 80 percent scientist of IARI also supported this. The average support for this result from both the institute is 4.2. Atwal (2002) reported not the same but some what similar practice like pulse seed should covered in bulk with 7 cm layer of sand and not the sandy earthen pots.

A structure made up of Bamboo sticks and lined by straw (Rice straw) is used to store the seed. The structure avoids any gap between the sticks and having only two opening one is inlet (big) and other is outlet (small) and these opening always remains closed by mud. This technique is supported by 80% scientist of the BHU as valid and 70 percent scientist



of IARI also supported this. The average support for this result from both the institute is 3.75. Similar method was mentioned by Atwal (2002)

Storage structures are not kept directly on the surface, but either on a small brick wall or on any wooden structure. Farmers believe that the use of brick wall or any wooden structure prevents the storage structure from absorbing the moisture from the ground. The brick or wood act as an insulating material. Seed being hygroscopic desiccants the first of bottom seeds absorb the moisture entering through the floor. Therefore they lose germination long before the upper seeds. This result is supported by 60% scientist of the BHU as valid but 100 percent scientist of IARI supported this. The average support for this result from both the institute is 4.0. Agrawal (1977) reported the similar practice.

Seeds are kept in a cotton cloth and are tied with the ceiling of the roof of kitchen room. There is a general belief that it helps in moisture conservation and also from the incidents by insect pest and rodents: The fumes from cow dung cake and fire/wood containing CO (Carbon Mono-Oxide) and it works as a fumigant. Besides CO (Carbon Mono-Oxide) as fumigants the heat from fumes helps in maintaining the moisture content of seed to desired level.

**Table 6: Validity scores and percentages of selective traditional method of storage N=20**

Indigenous Technical knowledge percentage	Scientifically valid Average										Not valid		Validity score		Validity	
	I.A.R.I.	B.H.U.	I.A.R.I.	B.H.U.	I.A.R.I.	B.H.U.	I.A.R.I.	B.H.U.	I.A.R.I.	B.H.U.	I.A.R.I.	B.H.U.	I.A.R.I.	B.H.U.	I.A.R.I.	B.H.U.
<b>1. Drying of grains</b>	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
1) Expose in thin layers of solar radiation on a cemented floor or on a black polythene surface to reduce the moisture content for safe storage (very frequently once every one or two months)	10	10	-	-	-	-	-	-	50	50	100	100	100	100	5	5
<b>2. Maintenance of dryness during storage</b>																
1) Jute bags are used to store the seed and these bags are further kept in a room completely filled with a Bhusi (wheat straw) and having no window for ventilation	4	6	1	2	5	2	28	38	56	76	3.3					
Rice, Wheat and Pulse seed)																
2.) Potato seeds are stored on a layer of sand on pucca surface and are turn up and down regularly at an interval of 5-6 days	7	5	3	2	-	3	44	34	88	68	3.9					
3) To maintain dryness –storage structure are filled to a quarter capacity with dry wood ash	4	6	2	2	4	2	30	38	60	76	3.4					



- 4) Every kg of seed 500 gm of fresh dry wood ash that has cooled, after the seed have been put in the container in which seed are going to be stored (for vegetable seed) 4 3 2 6 4 1 30 34 60 68 3.2
- 5) In case the container is opened frequently, change the wood ash, every time it is opened 3 3 3 6 4 1 28 34 56 68 3.1
- 6) Seeds are kept on a thick layer of wheat's straw i.e. Bhusi and again covered with a thick layer of wheat straw (pulse, rice, wheat, mustard seed) 10 10 - - - 50 50 100 100 5
- 7) Seeds are kept in a structure made up of mud mixed with Bhusi called as 'KOTHAR'. The outer and inner layer of this structure is plastered with cowdung (Rice and wheat seed) 10 10 - - - 50 50 100 100 5
- 8) Pulse seed are kept in a sandy earthen pot called as Ghaila 6 7 3 3 1 - 40 44 80 88 4.2
- 9) A structure made up of only Bamboo sticks and lined by straw (Rice straw) is used to store the seed. There is no gap between the sticks used (Rice and wheat) 5 6 3 3 2 1 35 40 70 80 3.75
- 10) Seeds are kept in a cloth made up of cotton (generally black colour); are tied with the ceiling of the roof at kitchen room, where the practice of cooking is done with the help of cowdung cake and fuel wood 10 2 3 6 2 2 50 30 100 60 4.0
- 11) Storage structure are not kept directly on the surface, but either on a small round brick wall on a flat wooden 10 10 - 10 7 80 50 100 100 5.0

### 3. Protection from insect pest and rodents

1. Neem leaves dried in shade and powdered, added to bags or container (in which the grain is stored) 6 10 1 - 3 - 36 50 100 100 4.3
- 2.) Container (gunny bags) coated with a paste of neem leaf or dry neem seed kernel powder 3 7 7 3 - - 36 44 88 88 4.0
- 3) The floor and room in which the seeds are stored is plastered with cowdung to keep the pest away 4 3 4 1 2 6 34 40 68 48 3.4



4) Pulse seed are mixed with oil (edible or non-edible) than storage is done. But before further use drying is done in solar rays	7	6	2	4	1	-	41	42	82	84	4.15
5) Every kg of seed, 50 gm of lime is used mixing is done in the same container in which the seeds are going to be stored (veg. seed)	10	3	-	1	-	6	50	24	100	48	3.7
6) Powder of crushed dried fruit of black pepper is mixed with pulse and oil seed. The amount of black pepper powder is 1/100 <sup>th</sup> of the total seed stored	7	2	2	3	1	5	42	24	84	48	3.3
7. Storage of seed in wheat straw controlled storage grain pest (Red rust flour beetle)	9	10	1	-	-	-	48	50	96	100	4.9
8.) A small quantity of lime is mixed with equal part of. Wheat and chick pea flour and baits made from this mixture are used for killing of rat	2	3	1	2	7	5	20	26	40	52	2.3
9) Small quantity of human hair is put in the hole opened by Rat and covered with a thin layer of mud or even dry soil. Rat never used to come again in that hole	1	2	2	4	7	4	18	26	46	52	2.2
10) Mercury and cement are mixed in equal proportion to make chapati like structure. This combination protect wheat from Red rust flour beetle.	2	2	4	4	4	5	36	27	52	54	2.15
11) Dried seeds are kept in a cloth of cotton and these bags are tied with the ceiling of the roof. It is used to protect seed from the rodents	4	6	-	3	6	-	34	40	52	80	3.3
<b>4. Before further sowing</b>											
1) Seed together with Bhusi are taken out from storage room 1-2 week before the sowing and dried in sun rays	5	2	1	2	4	6	27	22	54	44	2.45
2) Separation of seed from Bhusi is done and again drying of seed is done in solar ray	4	9	3	-	3	1	32	46	64	92	3.9
3) Seeds are poured in a chemical (which enhance germination) and transplantation is done without washing with water	10	10	-	-	-	-	50	50	100	100	5.0



This technique is supported by 100 scientist of the BHU as valid and 100 percent scientist of IARI also supported this. The average support for this result from both the institute is 3.2.

### Protection from insect pest and rodents

Neem leaves dried in shade and powdered are added to bags or container (in which the grains is stored). Farmers beliefs it is effective in giving protecting from insect and pest. Neem products shows a considerable potential in the control of stored grain pest. In case of Pest, it act's as repellent. An terpenoid compound present in Neem called as azadirictin is most important compound in terms of insecticidal property Far instance, if Jute sacs are

treated with Azadirachta rich product grain pests like sitophilus and Tribolium are unable to penetrate them for several months. But according to scientists Neem oil has a better option than using any other product as it has strong ovicidal effect besides acting as antifedent e.g.

Ovicidal effect

Bruchids

Antifeedent

Callosbruchus maculating

This technique is supported by 100 scientist of the BHU as valid and 100 percent scientist of IARI also supported this. The average support for this result from both the institute is 4.3. Similar finding were reported by Srivastava (1996).

**Table 7: Highest validity scores and validity percentage of selected traditional method of storage**

Traditional Method of Storage	Validity score	Validity percentage
<b>1. Drying of grains</b>		
1.) Expose in thin layers of solar radiation on a cemented floor or on a black polythene surface to reduce the moisture content for safe storage (very frequently once every one or two months)	100	100
<b>2. Maintenance of dryness during storage</b>		
6.) Seeds are kept on a thick layer of wheat's straw i.e. Bhusi and again covered with a thick layer of wheat straw (pulse, rice, wheat, mustard seed)	100	100
7) Seeds are kept in a structure made up of mud mixed with Bhusi called as 'KOTHAR'. The outer and inner layer of this structure is plastered with cowdung (Rice and wheat seed)	100	100
11) Storage structure are not kept directly on the surface, but either on a small round brick wall on a flat wooden	100	100
8) Pulse seed are kept in a sandy earthen pot called as Ghaila	90	90
<b>3. Protection from insect pest and rodents</b>		
7) Storage of seed in wheat straw controlled storage grain pest (Red rust flour beetle)	94	94
1) Neem leaves dried in shade and powdered, added to bags or container (in which the grain is stored)	92	92
4) Pulse seed are mixed with oil (edible or non-edible) than storage is done. But before further use drying is done in solar rays	92	92
6) Powder of crushed dried fruit of black pepper is mixed with pulse and oil seed. The amount of black pepper powder is 1/100 <sup>th</sup> of the total seed stored	90	90
<b>4. Before further sowing</b>		
1) Seeds are poured in a chemical (which enhance germination) and transplantation is done without washing with water	100	100

Container or gunny bags coated with a paste of neem leaf or dry neem seed Karnal Powder are used by the farmer to control the insect pest. Farmers told that it is very much

effective in controlling the insect pest of stored grain. The Azadirachtain found in Neem seed acts an antifeedent and hence effective. But according to scientist use of the Neem oil is better theny any



other product of Neem for controlling insect grain Pest during storage. This technique is supported by 88 scientist of the BHU as valid and 88 percent scientist of IARI also supported this. The average support for this result from both the institute is 4. Similar finding were reported by Srivastava (1996).

The floor and room in which the seed are stored is plastered with cow dung. Farmers told that this practice done to keep the pest away. But most of Scientist believe that cow dung have germicidal property and not the insecticidal property. This technique is supported by 48% scientist of the BHU as valid and 68 percent scientist of IARI also supported this. The average support for this result from both the institute is 3.4.

Pulse seed are mixed with oil either edible or non edible and then storage is done, but before further use drying is done in solar rays. The quantity of oil should be very low. Farmers told that this practice protects the stored seed from the storage insect pest effectively. According to scientist storage insect pest of pulse seed need a tight adherence with the seed surface for egg laying and without it the insect can't lay egg. The use of oil on seed surface prevents the most important stage of life cycle of insect pest i.e. the egg laying.

The insect present inside the grain need oxygen for completing its life cycle and even for survival: the oil prevents flow of  $O_2$  from outside environments and hence the insect present inside the seed get killed. Therefore they told that it is very much effective as it protect seed from infestation and further spreading. This result is supported by 84% scientist of the BHU as valid but 82 percent scientist of IARI supported this. The average support for this result from both the institute is 4.15.

For storing vegetable seed 50 gm of lime is done in the same container in which the seeds are going to be stored. This result is supported by 48% scientist of the BHU as valid but 100 percent scientist

of IARI supported this. The average support for this result from both the institute is 3.7.

Powder of crushed dried fruit of black pepper is mixed with pulse and oil seed. The amount of black pepper powder is 1/100<sup>th</sup> of the total seed. The farmer told that it is very effective, but due to height cost of black pepper powder are it is not frequently used. Most of scientists recommend it. But the amount they are (Farmer) using is high it should be 1g per 1 kg of seed. This result is supported by 48 scientist of the BHU as valid but 84 percent scientist of IARI supported this. Similar method was also reported by Nagnur et al (2004).

Seed is stored in wheat straw i.e. Bhusi. This practice is done to protect seed from Red Rust Flour Beetles and other insect too. This result is supported by 100% scientist of the BHU as valid and 96 percent scientist of IARI also supported this. The average support for this result from both the institute is 4.9.

Small quantity of quick lime is mixed with equal part of wheat and chick pea flour and baits made from it is keeps outside but near the storage structure. The belief is that it reduces the population of rat by killing. This result is supported by 52% scientist of the BHU as valid but only 40 percent scientist of IARI supported this. The average support for this result from both the institute is 2.3.

Small quantity of human hair is put in the hole opened by rat and it covered with a thin layer of mud or either dry soil. Farmers told that rat never used to reach again in that hole. This result is supported by 52% scientist of the BHU as valid but only 46 percent scientist of IARI supported this. The average support for this result from both the institute is only 2.2. Small chapatti like structure made up of mercury (Hg) and cerment are mixed with stored seed to protect the seed form Red rust floor beetle (*Toibolium Castameum*). This result is supported by 54% scientist of the BHU as valid and 52 percent scientist of IARI also supported this. The average



support for this result from both the institute is only 2.15.

Dried seed are kept in a cloth of cotton and these bags are tied with the ceiling of the roof. It is belief that this practice protects seed from the rodents as it makes the stored seed inaccessible to the rodents and hence gives protection. This result is supported by 80% scientist of the BHU as valid but only 52 percent scientist of IARI supported this. The average support for this result from both the institute is 3.3.

### Before further sowings

The seeds those are stored directly with Bhusi taken out from the storage room 1-2 weeks before the sowing and dried in sun rays. Again seed separate out from Bhusi and dried in solar rays. Then seed and mixed with a chemical (Which enhance germination) after that seed are used to sow immediately. Without this practice seed fails to germinate at all. This was found to be most common practice among the formers of the study area.

According to scientist there is no need to dry the grains as cereals and pulse has short dormancy period but treatment with chemical must be done and there should be no washing of seed with water. Scientist told that treatment with chemical is very much effective and they supported this practice fully. But the drying treatment is not necessary for all cereals but it depends on type of seed.

### CONCLUSION

In the present scenario, when the competition in the World Trade is severe and several agreements {SAFTA(South Asian Free Trade Agreement and WTO (World Trade Organization)} to phase out farm subsidy by 2013 by developed country) are made to make the competition fair, there is a good opportunity for us to improve our condition in World Market simply by improving the quality of grain.

There were as many as 27 different traditional methods of storage that were documented and most of the respondents were having rationale behind the use of traditional methods of storage.

There were 12 traditional methods of storage for maintenance dryness during storage and one for drying. Some of these traditional methods of storage are listed below based on their validity scores.

1. Expose in thin layers in solar radiation on a cemented floor or on a black polythene surface
2. Seeds are kept on a thick layer of wheat's straw i.e. Bhusa and again covered with a thick layer of wheat straw (pulse, rice, wheat and mustard seed)
3. Seeds are kept in a structure made up of mud mixed with Bhusa called as "KOTHAR". The outer and inner layer of this structure is plastered with cowdung (rice and wheat seed)
4. Storage structure are not kept directly on the surface but either on a small round brick wall on a flat wooden.
5. Seeds are stored in Aluminum container with tight fitting lids.
6. Pulse seed are kept in a sandy earthen pot

There were some of 11 traditional methods of storage followed for protection for insect pest and rodents. Most of these practices were being adopted by almost all the respondents. Some of the very important practices which were considered as valid by majority of the respondents were listed below in order validity.

- Storage of seed in wheat straw controlled storage grain pest (Red rust, flour beetle)
- Neem leaves dried in shade and powdered, added to bags or container (in which the grain is stored)
- Pulse seed are mixed with oil (edible or non-edible) than storage is done. But before further use drying is done in solar rays
- Powder of crushed dried fruit of black pepper is mixed with pulse and oil seed. The amount of black pepper powder is 1/100th of the total seed stored



It was observed that old aged (>45 years) respondents had a greater tendency to use the traditional methods of storage as compared to middle (36 to 45 years) and young (up to 35 years) categories of respondents. Our young generation is not ready to use these traditional methods of storage because they believe in modern techniques and have doubt regarding the validity of these traditional methods of storage. Therefore, it is very necessary to influence the young respondents and higher caste people. This will be done by documentation of more and more traditional methods of storage and these have to be evaluated in terms of whether they have got any scientific validity of effect in storage practices or not. There is a long stride to go for synthesizing the modern techniques with traditional methods of storage so that there will be a proper blend of traditional methods of storage and modern techniques to have an effective result. Efforts need to be taken to break the incompatibility between modern techniques and traditional methods of storage in the forthcoming scenario.

Our young generation is still skeptical to use these traditional methods of storage because they believe in modern techniques only and have doubt regarding the validity of these traditional methods of storage. Therefore, it is very necessary to influence the young respondents. There is a long stride to go for synthesizing the modern techniques with traditional methods of storage so that there will be a proper blend of traditional methods of storage and modern techniques to have an effective result. Efforts need to be taken to break the incompatibility between modern techniques and traditional methods of storage in the forthcoming scenario.

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