Traditional storage practices

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Indigenous knowledge has two powerful advantages over scientific knowledge like it has little or no cost, and is readily available. Indigenous knowledge is the accumulated knowledge, skills and technology of the local people, derived from the direct interaction of human beings and their environment. The study was conducted at remote villages of Coimbatore, Salem, Erode, Krishnagiri, Dindigul, Villupuram, Ramnad and Virudhunagar districts of Tamil Nadu with an objective of documenting the indigenous storage techniques adopted by the dry land farmers. Documentation of traditional storage practices was done by direct interview and group discussion methods. Triangulation exercise was also done in the study villages to gather reliable information about Indigenous Technical Knowledge of the dry land farmers of Tamil Nadu. In the paper, some of the identified important indigenous storage practices adopted by the dry land farmers are described.

Keywords: Traditional storage, Indigenous technologies, Storage pests

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Farmers and traditional grain processors have been evolving number of traditional practices through trial and error method, to avoid huge loss that are occurring in stored pulse grains due to insect and pest infestation1. Women folk have accumulated knowledge of household practices over generations by observation, experimentation and by handling age old people’s experiences and wisdom. Certain practices are unique to a given culture of a society and vary between countries, regions, villages and even communities. Indigenous practices emanate from the cultural contact of the people concerned and evolve in close contact with specific environmental conditions and are based on traditional societies intimate knowledge of their environment. These reasons imply that indigenous knowledge is ecofriendly and safe both to man and his environment. It is estimated that 60-70% of food grains produced in the country is stored at home level in indigenous structures ranging from bamboo baskets to mud structures, gunny bags and modern bins2,3. Indigenous Knowledge is a type of knowledge, which has evolved within the community and has been passed on from one generation to another4. Proper storage of food grains is necessary to prevent spoilage, increase keeping quality and for monetary reasons. The practice of using natural sources for storage of various household items dates back to the very earliest periods of known history. There is evidence of ash, sand and herbs used in ancient civilization, which have been credited with mystical power for increasing storage life. Many of these practices find their credibility even in the modern era. The logic behind the use of this material is that they are user friendly and are also associated with scientific reasoning5. Hence, the study was carried out with an objective to document the traditional storage practices adopted by the dry land farmers of Tamil Nadu.

Methodology

The study was conducted in the selected villages of the dry tracts of Tamil Nadu, viz. Coimbatore, Salem, Erode, Krishnagiri, Dindigul, Villupuram, Ramnad and Virudhunagar districts. In these locale, the villages were selected by appraisal of several indicators namely rainfall, overall agricultural development, cropping intensity besides consultation with Assistant Director of Agriculture, Agricultural Officer and Assistant Agricultural Officer of the respective village. Participatory Rural Appraisal techniques were adopted to identify and gather description about the indigenous grain storage practices that are prevalent in the selected villages. Key informants including progressive farmers

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belonging to small, marginal and big farmer categories, aged farmers, farmwomen and farm labourers were involved during the process of data collection. By contacting the respondents through one to one interaction and group discussion methods, the indigenous technologies used by dry land farmers for storage of grains and seeds were documented. Triangulation exercise was also done in the study villages to gather reliable information about Indigenous Technical Knowledge of the dry land farmers of Tamil Nadu.

**Traditional storage practices**

A detailed description of the indigenous technologies being followed by farmers in dry tracts of Tamil Nadu for storing grains and seeds were collected and presented below:

**Red gram storage with common salt**

Farmers with their indigenous knowledge used common salt in red gram (Cajanus cajan) grains storage. They had utilized a common available ingredient table salt in their house for storage purpose. In this practice, about 200 gm of salt was mixed for a kg of red gram grains manually. These treated grains were then stored in jute gunny bags and the bags were stitched. Due to this practice, insects were kept away from the stored grains. As salt had abrasive action on insect skin prevents its movement inside the storage containers. Farmers believed that this practice stored red gram grains, for short-term duration of 6-8 months. Farmers perceived this practice to be moderately effective and affordable in cost.

**Ash seed treatment in sorghum**

Ash was mixed with the sorghum (Sorghum bicolor) seeds at the ratio of 1:4. After the ash treatment, sorghum seeds were tied airtight in the jute gunny bags. During storage, grains were subjected to losses by various insects, e.g. rice weevil (Sitophilus oryzae), rodents (Tatera indica) and mite (Oligonychus indicus). Farmers strongly believed that ash application controlled these losses considerably up to an extent of 80%. Farmers using this technology stored the sorghum grains for 6 months without any storage pest problems.

**Ragi storage with neem and thumbai leaves**

Ragi (Eleusine coracana) is the main food grain crop grown by many people especially in the dry areas of Tamil Nadu. Farmers used neem (Azadirachta indica) leaves and thumbai leaves in the storage of ragi. The strong odour of these leaves keep the storage pests like lesser grain borers (Rhyzopertha dominica), saw toothed beetle (Oryzaephilus surinamensis) and flat grain beetle (Cryptolestes minitus) away. Being very cheap and simple most of the farmer followed this technology to get rid of storage pest than to relay on costlier chemical treatments. Neem leaves and thumbai being organic repellants were also safe to use.

**Paddy storage**

Farmers constructed the granary rooms with perfect plan during the construction of house itself. The granary rooms locally called Macchu would run along the corner inside the house at a height of 198.12 cm from ground. The platform of this granary room was made of wooden boards while its sides had brick and cement walls. It has an opening or a net protected door like structure for ventilation. The grains to be stored were spread in the wooden platform and an earthen pot ¾ of its volume filled with water was kept inside the granary rooms. This would attract and kill the rice moth (Corcyra cephalonica). The loading and unloading of the grains was done using a ladder through a door provided at the side of the granary room. Since, this structure was at 243.84 cm height from the ground, rodents (Bandicota bengalensis) and other pest damages were found to be comparatively less and also the grains were found moisture free.

**Storage of grains using camphor**

Both cereals and pulses attracted a wide range of storage pests. Hence, farmers indigenously practiced simple method in grain storage. In this practice, about 1gm of camphor piece per 5 kg of grains was placed as such in the jute gunny bags. This practice of placing camphor inside the grain storage bag repelled the storage pests due to the strong odour emanated from camphor. A short-term storage of grains up to 3 months was possible with this traditional storage method and after that the grains were to be sun-dried and then kept with fresh camphor pieces for subsequent storage.

**Storage of seeds with lime**

Farmers traditionally followed a practice of storing pulse grains along with lime powder. In this practice, farmers dusted about 10 gm of lime per kg of grains. After thorough mixing they stored them in jute gunny bags. The lime had a property of emitting irritating
odour that repelled insects and prevented the grains from damage. By this way, grains could be stored for even one year.

Gingelly seeds storage
Post harvest losses are notoriously high in oil seed storage like gingelly (Sesamum indicum) seeds. At farm level storage, farmers through their experience practiced many simple method of pest control. In gingelly seeds storage, mixing a handful of (nearly 100gm) paddy (Oryza sativa) in storage container significantly reduced the infestation of Indian meal moth (Plodia interpunctella) and prevented the damage of seeds for the next three month storage period. This was possible because the larvae of Indian meal moth had a habit of webbing the gingelly seeds with its secretion. Just before pupation, larvae pass through a ‘wandering’ phase spinning more silk threads, which in heavy infestations could form webbing that completely cover the grain surface. But paddy being sharp edged prevented the larvae in webbing of gingelly seeds. Hence, these pests avoid the feeding of gingelly seeds stored along with paddy. Farmers when needed gingelly seeds, used sieves to separate the seeds from paddy.

Neem oil in seed storage
Farmers practiced indigenous post harvest procedures that usually not required a high degree of technical skills and much cost. One such practice was the use of neem (Azadirachta indica) oil in the seed storage treatment. For 1 kg of pulses seed 20 ml of neem oil was used. Manually farmers applied the neem oil over the seeds to coat the seeds uniformly. Neem oil acted as repellent against several insects such as weevils, red flour beetles (Tribolium castaneum), Long headed flour beetle (Latheticus oryzae) and fig moth (Ephestia cautella), etc. It destroyed a variety of insects mostly attacking legumes at the egg stage itself. The farmers had perceived the specific properties of neem oil like repellence, feeding and ovipositional deterrence, growth inhibition, etc. and used them against the storage pests. Some farmers used neem oil mixed with coconut oil/castor oil (1:1) for treating the seed materials against the storage pests.

Need seed kernel extract dip jute gunny bags
Farmers preferred jute gunny bags in the short-term storage of grains used as seed materials for future sowing. The practice of treating the jute gunny bags with neem (Azadirachta indica) seed kernal extract was followed among the farmers. The practice involved the preparation of neem seed kernal extract (NSKE) and then treating the jute gunny bags with NSKE solution before storage. For this practice, about 10 kg of neem seed kernels was powered well and soaked in 100 L of water for nearly 24 hrs. After that, the extract was filtered. Jute gunny bags to be used in storage were then dipped in the NSKE solution for 30 min and shade dried. Later, these NSKE treated jute gunny bags were used in storing seed materials of paddy (Oryza sativa), pulses and oil seeds. Farmers believed that the strong odour of neem would repel the storage pests. Another advantage revealed by the farmers was that seeds stored in jute gunny bags would be the better performers in terms of germination and quality.

Storage of vegetable seeds with cow dung
Vegetable growers stored the seeds indigenously, which may be later used for sowing in next season. Farmers had their own methods for assessing the amount of moisture in seeds. Some of these provided a fairly reliable estimate of seeds suitability for safe storage. These methods include pressing the seed with the thumb; biting the seed, obtaining the feel of the grain by smelling a handful and shaking it with long experience farmers could judge whether the seed was suitable for storage. After proper drying, the seeds were stored in cow dung. Farmers collected fresh cow dung and made plate like round shaped structures by tapping it with hand locally called varati. Vegetable seeds such as ash gourd (Benincasa hispida), bitter gourd (Momordica charantia), bottle gourd (Lagenaria siceraria), etc. were then embedded in the cow dung and then dried under sun for 2-3 days. After drying, the seeds get stuck on to the Varati. These Varaties were then stored in open / inside wooden boxes. The farmers stored the vegetable seeds by this method even up to one year. Farmers believed that cow dung has pesticidal property, which would keep the seeds away from storage pests. Also believed that cow dung’s immunostimulant properties increased the germination (90%) and viability of the seeds considerably. Fresh cow dung has to be used for effective storage.

Pungam leaves in paddy storage
In this age old practice, fresh pungam (Pongamia glabra) leaves were placed as layers in between the gunny bags arranged one above other in storerooms. These leaves acted as a repellent against angoumois
grain moth (Sitotroga cerealella) and rice weevils (Sitophilus oryzae). The strong odour released from pungam leaves avoided the pest attack. Some farmers placed these pungam leaves directly in the gunny bags and stored the grains.

Neem leaves against storage pests

Both pulses and oilseeds attracted a wide range of storage pests, viz. pulse beetles (Callosobruchus maculatus), lesser grain borers (Rhyzopertha dominica), etc. Farmers, hence, practiced an indigenous method of keeping neem (Azadirachta indica) leaves along with the stored grains in gunny bags to overcome the problem. From time immemorial farmers were aware of the insecticidal properties of neem. The farmers were of the opinion that when neem leaves was added with the grains during storage, it repelled storage pest effectively. Farmers perceived this method to be very economical and moderately effective (50%) in protecting the storage grains from pests pulse beetles (Callosobruchus maculatus), lesser grain borers (Rhyzopertha dominica) and other borers. Grains could be stored in this method even up to one year.

Pulse grains storage with ash

This was an age old practice being practiced for more than 50 yrs. Farmers indigenously stored pulse grains in earthen mud pots. For safe storage of grains, seeds were filled in earthen pot to its 3/4 th volume and then remaining top 1/4 th top was then covered with ash (wood/ cow dung ash). By this way, wide ranges of storage pests like pulse beetles (Callosobruchus maculatus), and fig moth (Ephestia cautella) were kept under the control for a period of 6-8 months. After 6 months, the grains were exposed to sun and then the ash was spread above the grains surface and kept for storage.

Paddy husk in managing storage pests

Farmers faced many difficulties in the storage of grains due to damage caused by rodents, pests, diseases and insects. In paddy (Oryza sativa), Angoumois grain moth (Sitotroga cerealella) and rice weevil (Sitophilus oryzae) damage was severe. Farmers stored the paddy grains in earthen pods and placed paddy husk in top layer (5cm) above it. Farmers had found that storage pests unpreferred these earthen pots stored with paddy husk.

Mud pots in grain storage

Farmers perceived that grains and seed materials when stored in earthen pots prevented most of the storage pests. For this, they had made mud pots of different capacity and size with the help of clay and soil. In this practice, grains and seed materials were sun dried and cleaned before storing in pots. First, farmers placed a circular ring like structure locally called Pirimana\, made of paddy (Oryza sativa) straw on the floor. Above that ring, they placed the pots filled with grains. The pots were arranged one above the other and the top most pot was then closed with a lid. This arrangement was usually made inside the house at the corner region. The grains or seed materials stored in this mud pots were kept safe away from wide range of storage pests for nearly 6 months. After 6 months the grains were taken out and subjected to sun drying and again stored in mud pots.

Storage of tamarind with salt

This practice was being followed from more than 35 yrs. Farmers stored tamarind (Tamarindus indica) by mixing salt with it. After harvest, tamarind was removed from its pods and then stored in earthen pots in layers. Farmwomen indigenously practiced spreading of salt in between the tamarind layers. For this practice, about 10 gm of salt was used for per kg of tamarind. By this way of storage, storage pests like beetles and Indian meal moth (Plodia cautella) were prevented. Also the salt help in loosening of the tamarind flesh easy for handling during looking.

Storage of grains with sweet flag

This method was being practiced for more than 40 yrs. Farmers practiced an indigenous way of storing grains with sweet flag (Acorus calamus) In this practice, sweet flag was powered and mixed with grains and seeds of pulses, cereals and oil seeds. For treating 1 kg of grains, about 10 gm of sweet flag powder was used. The grains could be stored effectively for 6 months without any pest attack. The strong odour emitted from sweet flag acted as a repellant against all the storage pests.

Oil storage practices

Farmwomen practiced an indigenous method of storing groundnut (Arachis hypogaea) oil by placing tamarind (Tamarindus indicus) in the oil storage container. In this practice, for storing 5 L of groundnut oil, about 1/4 kg of tamarind was placed inside the oil container. The mouth of the container/vessel was then tightly closed with cotton cloth. Some farmers also sealed the small opening in the oil container with the help of tamarind.
Farmers stored oil after its extraction by using various indigenous methods. One such practice was the use of coriander (*Coriandrum sativum*) seeds and salt in oil storage. In this practice, for a litre of oil, farmers placed 100 gm of coriander seeds and a spoon of salt inside the oil stored tin container. The oil was exposed to sun for few hrs and kept closed in airtight condition. Coriander seeds produced pleasant odour in the oil, whereas salt was believed to reduce rancidity and spoilage of oil. Farmwomen preserved groundnut (*Arachis hypogaea*), coconut (*Cocus nucifera*), gingelly (*Sesamum indicum*) oil in their household using traditional storage methods. In this practice, to avoid the spoilage of oil about 2 gm of salt and 10 gm of tamarind (*Tamarindus indicus*) was added per litre of any edible oil. Farmers while storing oil in narrow mouthed containers closed the opening with tamarind. This practice reduced the spoilage of oil and preserved the oil for long-term period of 6-12 months.

Gingelly (*Sesamum indicum*) oil is widely used as cooking oil in Tamil Nadu. Farmers extracted oil after the harvest of gingelly crop and stored them in tins for household consumption. Farmers had practiced an indigenous method of oil storage. One such practice was gingelly oil storage with jaggery pieces. For long time, storage and to overcome rancidity problem farmers had kept the palm jaggery pieces in the tins as indigenous storage practice. For oil tins of 15 L capacity about ½ kg of palm jaggery pieces was used. Oil could be stored by this method even up to 1½ yrs. Farmers noticed bad odour emitted from the gingelly (*Sesamum indicum*) oil when stored continuously for several months. They locally called it as *Kaaral*. Farmwomen practiced an indigenous method of storing oil to control the bad odour. In this practice, a long iron rod of 8 cm width and 6.96 cm length was exposed in fire (using an earthen stove) for 30 minutes. When the iron rod turned to reddish tinge, it was dipped in the stored oil for just 5 minutes. Then, the mouth of the oil container was closed with the help of cotton cloth tightly. This practice preserved the oil from rancidity. Farmwomen stored oil for their household purpose after heating them. In this practice, farmers heated the oil containing mud pots with the help of local earthen stove for 15 minutes. Warm heating of oil help in removing the fresh odour of the oil and also preserved it without spoilage. Some farmers had also kept this oil containing vessel under direct sun rays for 2 days. After, the mouth of the container was closed with a cotton cloth to avoid dusts. Farmers stored oil by this way even up to one year.

**Conclusion**

The protection of stored agricultural products against insect attack is essential for safe and steady supply of high quality food. Insect damage in stored grains and pulses may amount to 10-40%. In the past, insect infestation was often a less serious problem because farmers cultivated traditional varieties, which, although low yielding, were generally more resistant to attack by insects. However, the introduction of high yielding varieties has resulted in increased storage losses, as these varieties are usually susceptible to insect damage. Hence, storage of grains and seeds without pest infestation is essential. Indigenous practices has advantages over outside knowledge, it has little and no cost and is readily available.

**References**


