Indigenous storage structures

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Indigenous practices play a vital role in sustainable agriculture development and are unique to a given culture of society. An exhaustive survey was conducted in dry tracts of Tamil Nadu to document the indigenous storage structures used by farmers. Information was documented by using participatory Rural Appraisal (PRA) techniques. During survey, various types of indigenous storage structures used at the farm level in Tamil Nadu were identified. Among these, Kodambae (large sized cylindrical structures), Kuthir (medium capacity bins) and mud pots paanai (small capacity storage) are common types of storage systems. Grains are also stored in conventional granary rooms. Bamboo structures, urai indigenously oven is also in use. These structures are designed to enable the grain to be loaded and unloaded, with the possibility of periodic removal of limited quantities of grain, after which the unloaded part was sealed. By this way, the quality of grain was maintained in good condition.

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Indigenous Knowledge is the product of centuries of trial and error natural selection and keen observations that can form a knowledge base on which researchers and extension workers can plan their research strategy and experimental procedures. Indigenous practices emanate from the cultural context of the people concerned and evolve in close contact with specific environmental conditions and are based on traditional societies intimate knowledge of their environment. For small farmers, the main purpose in storing grains is to ensure household food supplies. Farm storage also provides a form of saving; to cover future cash need through sale, or for barter exchange or gift-giving. Grain is also stored for seed and as inputs into household enterprises. One of the innovative ideas developed by the farming community and evolved gradually over the years was to develop a structure, where the grains were stored safely away from storage pests, insects, rodents and birds. The storage needs of small-scale farmers were fulfilled by indigenous grain storage structures designed by farmers themselves with freely available materials at a minimal and affordable cost. These structures were socially acceptable and grain condition maintained without pests and insects attack. The storage structures are made with a variety of locally available materials and differ in design, shape, size and functions. Proper storage of food grains is necessary to prevent spoilage, increase keeping quality and for monetary reasons. The logic behind the use of indigenous structures for storage is that they are user friendly and also associated with scientific reasoning.

Farmers stored the grains to meet their own consumption and for seeds. They stored them either in containers or in bulk. The containers include large earthen pots, jute bags, etc. whereas the grains were also stored in traditional storage structures such as Kuthir, Kodambae, Thombarai, etc. The techniques used in traditional storage are embedded in custom and have passed through generations. There are many good quality storage bins that could be made out of locally available, low cost materials that would successfully protected properly dried stored grain from moisture, mold, insects, rodents and birds.

Methodology
The study was undertaken to identify the various indigenous storage structures. The study was conducted in Virudhunagar, Salem, Tuticorin, Ramnad, Erode, Coimbatore districts of Tamil Nadu. Information was documented by using participatory Rural Appraisal (PRA) techniques like observation and discussion. Key informants including progressive farmers belonging to small, marginal and big farmer

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categories, aged farmers, farm women 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 storage structures used by dry land farmers were documented. Triangulation exercise was also done in the study villages to gather reliable information about indigenous storage structures.

**Results and discussion**

Farmers have designed their own structures and methods for storing grains with locally available materials. These structures made of bamboo, straw and other plant materials, allow free flow of air but cause insect infestation and damage by rodents. Indigenous storage structures used by the farmers of Tamil Nadu were collected and described below.

**Kuthir**

Farmers of Kovilankulam village, Aruppukottai block in Virudhunagar district traditionally store cereal grains in tall mud pots or bins popularly called *Kuthir* (Fig. 1). These mud pots were made up of clay soil and plant fibres. Sometimes husk of cereal grains were also mixed with clay while making such pots to harden the storage structure. The height of the *kuthir* ranges from 1-3 m. The mud pot had a narrow mouth or opening at the top of the *kuthir* closed with a tightly fitted lid. By opening the lid, grains could be drawn whenever needed. In each houses, there are normally one to three *kuthirs* depending on the requirement.

**Kodambae**

Farmers of Malamanur village, Mecheri Block in Salem district practiced an indigenous method of storing grains in storage structure called *Kodambae* (Fig. 2). Farmers after selecting a suitable site on backyard of farm/home placed big stones at the base of the floor in concentric form. Above the stones, wooden sticks were placed connecting the stones to form a flat platform. The walls were raised at 1m height (capacity of holding 1,000 kg of produce) using clay and red soil or sometimes cement and bricks were also used. The top portion of the structure was covered with conical shaped roof using bamboo sticks and palm or coconut thatches. One side of the roof had a small door like opening. Inside the door, there was a space made of wooden board convenient for a person to enter and collect the stored produce. Another person may stand outside and collect it. There was a wooden stick for keeping the door open. Usually, a ladder was used for climbing the roof opening from the ground. Farmers inverted a pot at the tip of the roof to avoid the draining of rainwater inside the storage structure during rainy season. These storage structures are durable even up to 100 yrs.

**Thombarai**

Farmers of Melathulukankulam village, Kariyapatti block in Virudhunagar district practiced an indigenous method of storing grains in storage structure called *Thombarai* (Fig. 3). The storage structure was made up of wood (*Acacia* sp) and of rectangular in shape. Usually *Thombarai* was built at the height of 1m from the ground with four supporting wooden structures at the bottom. Farmers constructed *Thombarai* with the dimensions (2.43×1.52 m) and capacity of holding 1,000 kg of grains. The top of the structure had a small door like opening for dropping and recollecting grains. Usually, a ladder was used for climbing the structure from the ground. Since the structure was erected at the height of 1m, it avoided the storage pests and rodents damage in stored grains.

**Kalangiyam**

Farmers of Aavalnatham village, Kovilpatti taluk in Tuticorin district had practiced an indigenous method of storing grains in storage structure locally called *Kalangiyam* (Fig. 4). In this practice, rectangular brick walls are constructed with the strong concrete base/stone inside their house. Earthen base was not followed because it might permit termites and rodents to enter the structure. The brick walls are 20 cm thick and the construction was similar to the walls of a house. The dimension widely adopted was 2.43×1.82 m of length and breadth with 2 m height and this dependent on the domestic requirements of farm family. The walls are rendered as smooth as possible both inside and outside to offer refuges for insects and their larvae. The top of the structure had a removable wooden lid, which permitted easy loading and unloading of the grains. These structures are potentially expensive for poor farmers, which could be considered seriously only when other traditional storage bins could not be practically applied. This practice had been widely adopted and produced good results when loaded with properly dried grains.

**Macchu**

Farmers of Sundanaenthal village, Paramakudi taluk in Ramnad district constructed granary rooms
inside their houses at a height of 2.43 m and desired length. The granary rooms locally called Macchu would run along the top at corner of the house (Fig. 5). It has an opening or a door like structure (net protected) for ventilation. These granary rooms were well protected from rodents as it was constructed at 2.43 m height from the ground. The platform of this granary room was made of wooden boards while its sides had brick and cement walls. The grains to be stored were spreaded in the platform and a vessel filled with water was kept inside the granary rooms to attract and kill the moth insects. The loading and unloading of the grains was done using a ladder through a door provided at the side of the granary room.

Paanai

Earthen pots are most commonly used in villages for storing seed and grains for consumption purpose (Fig. 6). These small capacity containers were made with clay were available to convenient sizes. Having a small opening, they could be made hermetic by sealing the walls both inside and outside with liquid clay and closing the mouth with stiff cow dung paste reinforced with cloth. The pots were arranged one above the other vertically in descending order based on of its size from the bottom. The practice reduced the space requirement for keeping these pots. Also farmers placed dried cow dung (varatti) with their finger prints for identification of seed variety. Marking were also made on the pots for identity.

Urai

Farmers with their knowledge and locally available materials constructed their own storage structures. One such practice was the use of storage baskets made with the locally available bamboo sticks (Fig. 7). After drying the grains, they were stored in these bamboo baskets of different capacity. The baskets usually resembled a long jar and were manually oven with bamboo sticks leaving a narrow mouth/opening. The mouth of the basket was closed with a lid made of same materials (bamboo sticks). After loading the grains, the lid was closed and the whole basket was sealed using cow dung paste. This would avoid spillage of grains and entry of pests and insects. Farmers stored the grains inside this basket even up to 1 yr. The storage structure has a medium shelf life of 4-5 yrs.

Sakku pai

Dry land farmers of Vattamalai Village, Kangeyam block in Erode district preferred to store the seed materials for future cultivation in jute gunny bags rather than gunny bags of any other kind (Fig. 8). The jute gunny bags were bit cool whereas, the polythene gunny bags (usually fertilizer bags) were not preferred by farmers because these bags would provide a conducive atmosphere (heat will be generated inside the bag) for the multiplication of storage pests. Another advantage revealed by villagers was that the seeds stored in jute gunny bags would be better performers in terms of germination and quality than the seeds stored in any other kind of bags.

Mara thombai

The method was being in practice for more than 40 yrs. Farmers indigenously used many storage bins that could be made of locally available low cost materials (Fig. 9). One such wooden structure used in large scale storage of grains was called locally Mara thombai. It appeared to be well suited to farmer's storage requirements that would successfully protect grains from insects, moisture, mold, rodents and birds. The wall of rectangular thombai was constructed with wooden boards and of 1.5-2 m height. The floor had to be fixed at least 80 cm above ground level and that stand was made of four straight wooden poles. Its size includes 2.13 m height × 1.21 m width and had a capacity to hold even 1,000 Kg of grains. The whole unit was separated into 4 equal parts and each single unit as used in drawer like fashion. This arrangement helped in altering the height of the structure by either removing or adding the rows in the single structure. A small outlet was also provided in their base for the easy removal of grains. These traditional storage structures were made more secure from thieves by providing each compartment with a lockable outlet at its base and were placed safely inside the house. The tight wooden board was placed as the roof protecting the grains from moisture and insect pests.

Vengaya pattarai

This was an age-old practice used from time immemorial. Farmers constructed an indigenous storage structure locally called Vengaya pattarai for onion storage (Fig. 10). These structures were made manually using bamboo sticks. In the leveled field, farmers first placed stones of equal size in rectangular fashion (kept at the distant of 2 feet between each stone). The wooden board made of neem (Azhadiracta indica) wood was placed over the stones to provide a flat platform. Then the three sides of were closed with bamboo sheets (these sheets were made of bamboo
strips wove manually). The structure as filled with onion and the fourth end was also closed with the same bamboo sheaths or jute gunny bags. A roof was constructed over this structure with the help of coconut thatches to prevent the damage of stored onion from rainfall and intense heat. Farmers extend these structures according to the requirement and convenience. Convenient storage capacity and good ventilation of onion inside this storage structure prevented its spoilage.

Arisi petti
Storing of grains in Arisi petti was practiced from time immemorial by farmers of Narasipuram village of Coimbatore district. Farmers used many good quality storage structures that could be made out of locally available, low-cost materials, which would protect stored grains from storage pests. One such thing was the usage of wooden boxes for grain storage (Fig. 11). These compact square shaped boxes are made of Acacia sp wood with the capacity of holding 100 kg of grains. These structures are of 1.21 m height and 0.91 m width. Wooden boxes avoided the entry of pests like bruchids, weevils, and moths and insects thereby reduced the storage loss up to 60%. Farmers found that seed materials stored in these wooden boxes escaped moisture and preserved the quality of seeds (germination percentage, viability) also. Farmers brought wooden boxes of different capacities from the local carpenters in the villages.

Saal
Farmers traditionally stored cereal grains in tall mud pots or bins popularly called Saal (Fig. 12). These mud pots were made up of clay soil and plant fibers. Sometimes husk of cereal grains were also mixed with clay while making such pots to harden the storage structure. The height of the Saal ranges from 1 m to 3 m. This mud pot had a narrow mouth or opening at the top which was closed with a tightly fitted lid. By opening the lid grains could be drawn whenever needed. In each houses, there are normally one to three Saal depending on the requirement. Farmers usually place Saal over a circular ring like structure locally called Pirimanai made of paddy straw on the floor. This would help in keeping the structure straight and safe from disturbance. These structures conveniently placed inside the house occupying lesser space can store larger quantity of grains. Cheap and effective in storage, grains can be stored away from the storage pests and rodents.

Conclusion
With the passage of time, traditional storage structures are diminishing and being replaced by metal bins. Rural people feel that traditional storage structures are fixed, require regular maintenance and need local skilled persons for their construction, whose number is decreasing day by day. These storage systems obviated the need for employing residual insecticides and fumigants with the accompanying hazards they posed to the users and the environment. On the other hand they had certain disadvantages too. There has also been much wastage, with stores often being inadequately located, inappropriately designed, and poorly managed and maintained. Integrating these indigenous knowledge systems into the research could develop appropriate new modern techniques for storing the grains in dry tracts. When this proved is practically feasible then the improved technology would be made available at affordable cost for the dry land farmers in future.

References