



## INDIGENOUS STORAGE PRACTICES AND RELATED TRADITIONAL KNOWLEDGE – A CASE STUDY FROM GUJARAT (INDIA)

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### ABSTRACT

Indigenous Knowledge (IK) can be defined as the foundation for the ethnic groups for grass root level decision making in the areas like food security, human and animal health, natural resource management, environment conservation and other vital economic and social activities. IK is the most significant tool that adds into the efficiency, effectiveness and sustainability of the development of the communities practicing that knowledge. The paper deals with the indigenous storage practices for grains, pulse, other agricultural products and food items. It also deals with the related traditional knowledge of those storage practices. The practices discussed in the paper are outcome of various extensive field excursions made within Gujarat state for past 4 years. The techniques and cases discussed in here shows immense traditional wisdom which these indigenous people have earned over generations and have added into it by trial and error. These practices are very easy to follow, ecofriendly, cost effective, and also increase shelf life of seeds. Hence, it is wise to promote these indigenous techniques to assure food security in the areas with tribal population. The findings include 11 different types of traditional storage containers, 5 different grain storage practices, and 5 traditional food preservation practices.

**KEY WORDS:** Indigenous storage practice, agricultural products, traditional knowledge, Gujarat, traditional storage containers, ecofriendly



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## INTRODUCTION

Indigenous storage practices are readily available, cheaper over any scientific storage practice and safe for both man and environment. These practices are actually technologies/skills developed over generations by people as an outcome of their immense interactions with their natural surroundings.<sup>1</sup> Indigenous people have developed this wisdom through observations, experiences, and experiments and have passed it to generation over generation. The tribal people are the integral part of ecosystem and live in great harmony with the nature.<sup>2</sup> Their knowledge on indigenous practices may found to be unique to ethnic groups or communities residing in some particular geographic locations. Variation found among these storage practices are reason of different cultures of knowledge bearing individuals or communities, geographic and climatic conditions, type of grain – pulse, type of insects and pest infestations seen generally. Most of the grain storage practices are practiced by tribal women. Their rich knowledge about indigenous practice, especially in post-harvest often remain unacknowledged due to gender inequality.<sup>3</sup> Around 70% of food grains produced in India is stored in indigenous grain storage structures like traditional bamboo baskets, mud containers, and gunny bags to modern storage containers.<sup>4-5</sup> Effective grains-food storage techniques are necessary to check spoilage, and keep seed viability and germination ratio high. Many user friendly techniques of using natural sources like herbs, ash, and oils are in practice since ages which are still found to be reliable.<sup>6</sup> The result is an outcome of various extensive field excursions made within Gujarat state for past 4 years.

## METHODOLOGY

The study was conducted covering the remote villages of Kutch, Banaskantha, Sabarkantha, Dahod, Panchmahal, Vadodara, Chhotaudepur, Surat, Tapi, Narmada, Dang, Valsad and Junagadh districts of Gujarat with an objective of documenting ethnobotanical wisdom of people. *Bhil, Garasiya, Vasava, Koli, Kharva, Nayakda, Gamit, Varli, Konkana, Kunbi, Rathva, Vasava Jatt* are the major ethnic groups residing in these districts.<sup>7</sup> Participatory Rural Appraisal Technique was adopted to identify and document detailed description about the indigenous storage practices in the selected villages.<sup>8</sup> During the study, various indigenous storage structures and methods were identified; this knowledge is earned by the farmers and ethnic people. The information was collected through personal and group interactions and by following and participating in the activities of the local inhabitants, especially the tribal farmers, farmwomen and elderly people.<sup>9</sup> Necessary information on plants used in the process of storage and mode of administration was carefully recorded.

## RESULT AND DISCUSSION

### Traditional grain storage structures

#### *Kothi*

These storage containers, mostly known as *Kothi* (pic. a), are made out of leaner bamboo strips. They are

generally cylindrical in shape and vary in height and weaving pattern. Weaving patterns depend upon the size of the grain to be stored. Small sized grains are stored in a complexly weaved *Kothi* to prevent spillage. They are known by different names in different parts of the state such as *Mosti* (pic. h) in Vadodara and Chhotaudepur districts, *Porsi* and *Porso* (pic. f) in Panchmahal and Dahod districts, *Kothi* in Sabarkantha, Vadodara, Narmada, Tapi, Surat, Valsad and Dang districts. The outer surface of the storage structure is generally covered with fine mixture of loam, cow dung and husk. It prevents spillage and strengthens the storage structure. It also provides protection against insect infestation. *Mosti* is generally rounded square shaped at the base which gradually grows into a cylindrical structure weaved using leaner bamboo strips. They have many spokes, generally made from strong culm of *Dendrocalamus strictus* (Nees). *Mosti* have no collar and lid and so as *Porsi*, they are quite similar in shape. Though *Porsi* have less number of spokes as compared to *Mosti*. *Porsi* and *Porso* are usually of 4 feet tall with capacity of almost 100kg grain storage. *Mosti* is almost 5 feet tall and with 200kg grain storage capacity. After filled with grains, top of these structures are covered with dry *Tectona grandis* L leaves and sealed with fine mixture of loam, cow dung and husk. Sometimes the whole storage is covered with that mixture and sundried. *Porso* possess similar structure as *Mosti* but it always has a collar like structure on its top and a lid to cover the top. Also, the bamboo strips used to make *Porsi* are slender as compared to the strips used to make *Mosti*.

#### *Folding Kothi*

A few communities in Dang district use folding grain storage containers. They look like carpets weaved using leaner bamboo strips only. These carpets are rectangular in shape but they have two bamboos weaved at their ends, what seems like these bamboos are knotted together, which makes a cylinder to store grains (pic. b). This kind of grain storage structures are almost 6 feet tall and 200kg to 250kg grain storage capacity and have no permanent base or lid. Instead of that, a base is made on the ground using fine mixture of loam and cow dung. The structure is placed on this base in such a way that it forms a cylindrical storage structure. Just like other *Kothi*, it is also covered entirely with fine mixture of loam, cow dung and husk. Top is also covered with dry *Tectona grandis* L leaves and sealed with fine mixture of loam, cow dung and husk.

#### *Nagli ni kothi (Kothi for Eleusine coracanaL)*

*Nagli (Eleusine coracana L)* and *Vara (Panicum sumatranse Roth)* are lesser known cereal crops planted mostly in central and south Gujarat. These grains are very small in size hence, stored in very complexly woven storage containers. These containers are smaller in size, almost 2 feet tall, and dome shaped with flat base, movable and light weight. Instead of spokes, these containers have a very complexly laced linear bamboo strips weaved all together as spokes. Containers have only one hole at the top used to pour grains in and out. Instead of sealing these containers, farmers usually place a thick layer of paddy husk at the top to protect the stored grains (pic. i)

**Kanthi ni Kothi (Kothi made of *Nyctanthes arbortristis* L)**

All the above mentioned storage containers are made either from *Dendrocalamus strictus* (Nees) or from *Bambusa arudinacea* (Willd). But there are a few locations where the local inhabitants use plants apart from bamboo to make grain storage containers. *Bhils* from Sabarkantha district use *Nyctanthes arbortristis* L to make almost 8 feet tall cylindrical grain storage containers. These containers are immovable and used for decades all together and are less in diameter and more in height as compared to those made out of bamboo strips. *Nyctanthes arbortristis* L is a very common plant species found abundantly in the forests of Sabarkantha districts especially in the forest areas of *Trishuliyo Ghat*, *Vijayanagar*, and *Polo*. *Nyctanthes arbortristis* L wood bears low fuel quality; even leaves are not used as fodder. But ethnic people use it to make grain storage containers due to its easy availability and termite resistant wood quality. Outer surface is covered entirely with fine mixture of loam, cow dung and husk to strengthen the structure, prevent spillage and pest infestation (pic. d).

**Dudhi ni Kothi (Kothi made of *Wrightia tinctoria* R Br)**

Some tribes of Vadodara, Chhotaudepur and Narmada districts use *Wrightia tinctoria* R Br twigs to make huge cylindrical grain storage structures. Due to the high amount of latex present in the plant makes the containers termite resistant. These *Kothi* are usually 5 feet tall and mounted on a platform made of mud and interwoven fresh twigs of *Wrightia tinctoria* R Br. These storage containers get stronger as the twigs dries. These containers are usually covered with a very thin layer of fine mixture of loam, cow dung and husk inside out (pic. e).

**Gara ni Kothi (Kothi of Mud)**

Kutch is the far North-Eastern district of the state with diffused scrub forest and arid to semiarid climatic conditions. It is difficult to find resources like *Dendrocalamus strictus* Nees or *Bambusa arudinacea* (Retz) Willd naturally in Kutch due to the climatic conditions. Hence, residents of this district have come up with a solution of storage structures majorly made of mud. Such storages are fixed, very huge in size and looks like cupboards with a huge intake at the top to pour grains in the storage and one or more small outlets at the bottom to take the grains out. These storage structures are made of loam, donkey dung, wheat husk, and yellow salty clay typically found in Kutch. All these ingredients are soaked together and mixed well by tapping on it repeatedly. Layer by layer the sticky lumpy mixture is placed which makes a very strong storage structure when gets dried. Almost a foot tall layer is laid everyday. Thus, it usually takes almost two weeks to make a 6-7 feet tall storage container. The storage containers are fixed and almost one foot elevated from the ground level. These *Kothi* are then decorated with small waste pieces of colored glasses and painted with lime. Such storages last for generations (pic. j).

**Gara ni char-paiee Kothi (Four legged Kothi of Mud)**

Dwellers of Sabarkantha district use this kind of storage structures which are difficult to make as compared to the structures made of Bamboo. They are entirely made of loam, cow dung, and wheat husk and very heavy in weight yet movable. These structures are cylindrical in shape, almost 5 feet tall with a huge intake at the top to pour grains in and four legs at the bottom which keep the storage container elevated from the ground. These storage structures are highly durable and used for generations (pic. g).

**Dangar ni Kundi (Kundi for Paddy storage)**

These storage structures are reported from Sabarkantha district which are used to store paddy. They look like *char-paiee Kothi* and made of loam, cow dung, and wheat husk but small in size with a huge intake at the top and three or four legs at the bottom which keeps the storage elevated from the ground (pic. c). They are 1-1.5 feet tall, movable and long-lasting.

**Methods of Grain Preservation**

Many domestic grain storage practices are followed in Gujarat. Most of them have one or more ecofriendly natural resource used to store grains round the year.

**Castor Oil**

It is the most common practice followed in which sundried grains are smeared with a little amount of castor oil. Wheat, Rice, and a variety of pulses are stored using castor oil. Excess amount of castor oil changes the natural taste of grain and so it is made sure that the seeds are just smeared with oil. Almost 1kg oil is needed to preserve 100kg of grains.

**Leaves of *Azadirachta indica* A Juss**

Dried leaves of *Azadirachta indica* A Juss are mixed with sundried grains and stored into traditional storage containers. This practice is common in most areas of the state. Aspiration cleaning is must before using seeds. *Bhils* of Central Gujarat use *Azadirachta indica* A Juss leaves in a different way, by adding dried leaves of *Azadirachta indica* A Juss to the mixture of loam, cow dung and husk which is used to cover inner and outer surfaces of storage containers which provides protection against pest.

**Leaves of *Calotropis procera* (Ait) R Br**

Fresh leaves of *Calotropis procera* (Ait) R Br are collected and dried in shed. These leaves are spread on the inner surface of the storage containers such a way that they cover the whole inner surface of the container.

**Para ni Thepli (Dice made of Mercury)**

This is an interesting technique which includes a heavy metal – Mercury. Take 100gm of Fuller's earth (Multani Mitti), 200gm of clay and 200gm of dried cow dung powder. Mix it well and add 10ml of Mercury in it. Then add some water and make dough. Make small round shaped *thepli* (dices) out of this dough and sundry them. Put almost 50 of such *thepli* with every 100 kg of grains. This *thepli* can be used for 10 to 15 years.

**Cow dung ash**

Cow dung is burned on a clean surface and ash is collected. This ash is mixed with grains while storing

them in the storage containers. For that a 3inch layer of ash is made at the bottom of the container. On which, almost 10inch of layer is made of the grains. Then again a 3inch layer of ash is spread over. Whole structure is filled with grains and ash likewise, layer by layer. Aspiration cleaning is must before using seeds.

#### **Other Storage practices**

##### **Bamboo shoots preservation**

Tribes of South Gujarat are fond of curry made of bamboo shoots.<sup>10</sup> (Arunbhai) Bamboo shoots are harvested only in monsoon. Later it is very difficult to find bamboo shoots in nature. Hence, most of the people preserve freshly harvested bamboo shoots. For that, an earthen pot is taken with a small hole at the bottom. The shoots are laid in along with huge amount of salt. For that a layer of salt and on it a layer of bamboo shoots is laid. Likewise, layer by layer, shoots are kept. Salt will dehydrate the shoots and the excess water will drain out from the hole at bottom of the pot. Shoots preserved in salt remains edible for a couple of years all together. These shoots are soaked in water for a day before using to remove excess salt.

##### **Hibiscus sabdariffa L leaves preservation**

Freshly harvested leaves of *Hibiscus sabdariffa* L are washed properly and blanched for 5 minutes and then suddenly plunged into cold water. Water is removed after a timid interval and the leaves are dried in shade. These dried leaves remains green for almost a year and are used as taste enhancer in traditional curries and Daal, and also cooked separately as Chutney.

##### **Earthen vegetable preservation**

*Colocasia esculenta* (L) Schott, *Dioscorea alata* L (Ratalu), *Amorphophallus campanulatus* (Roxb) H ex Decne are earthen vegetables. *Dioscorea bulbifera* L bulbs are also widely used as vegetables. They are preferred not to be washed unless being consumed immediately because excess moisture may lead the bulbs sprout or increase the chance of fungal infestation. They are stored in gunny bags in cool, dark and dry place.

##### **Preservation in Salt**

Under tropical climatic conditions, most of the fruits and vegetables are available in particular seasons only. This preservation method makes the fruits and vegetables available round the year. Fruits like *Emblica officinalis* Gaertn, *Tamarindus indica* L etc. and vegetables like *Abelmoschus esculentus* (L) Moench, *Cucumis callosus* (Rottl) Cogn, *Momordica charantia* L, *Momordica dioica* Roxb, *Psoralea corylifolia* L etc. are mixed with salt and sun dried. With this practice fruits and vegetables can be preserved for the whole year. It is necessary to soak the preserved fruits/vegetables in water overnight to remove excess salt before using.

##### **Fruit preservation in saltwater**

Preservation of fruits in saltwater is a very simple process. In which, mature yet unripe fruits are harvested, washed with water, and stored in a glass bottle containing saltwater. *Garuga pinnata* Roxb, *Bridelia retusa* (L) Spr, *Emblica officinalis* Gaertn, *Phyllanthus acidus* (L) Skeels, *Capparis decidua* (Forsk) Edgew, *Dillenia pentagyna* Roxb, *Mangifera indica* L fruits are preserved in saltwater. These fruits can be consumed for a month after harvesting if preserved properly.



a. *Kothi*  
b. *Folding Kothi*  
c. *Dangar ni Kundi*  
d. *Kanthi ni Kothi*



e. *Dudhi ni Kothi*,  
f. *Posro*  
g. *Gara ni char-paiee Kothi*  
h. *Mosti*

i. *Nagli ni Kothi*j. *Gara ni Kothi*

## CONCLUSION

The findings show that the natural resources used to make storage structures depends on the geographic locations, climatic conditions and the natural availability of those resources within the region. Also the weaving pattern diverges according to the grain to be stored. Small grain are stored in complexly weaved storage structures. In most of the cases, storage containers are covered with a very fine mixture of loam, cow dung and husk to prevent spillage and pest invasion. The grain preservation techniques are actually the knowledge that is acquired by ancestors and has been passed on from generation to generation. Making of these structures takes efforts and it is very time consuming as well. Maintenance at regular intervals is also required hence,

the young generations do not show keen interest to learn or practice this indigenous knowledge and prefer readily available modern grain storage containers and chemical pesticides over these ecofriendly indigenous techniques. It is also observed that the knowledge of making various kinds of traditional grain storage structures is not evenly spread among the ethnic groups. In most of the cases, elders of the ethnic groups are the living repositories of these indigenous grain storage techniques. Thus, the knowledge is less spread and in safe hands but efforts to promote and document it is recommended.

## CONFLICT OF INTEREST

Conflict of interest declared none.

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