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A Field Study on Evaluation of Different Varieties of Traditional Storage Practices of Finger Millet [*Eleusine coracana* (L.)] in Southern Dry Zone of Karnataka for Seed Traits

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ABSTRACT

Current field survey study was conducted with the main aim to evaluate the traditional storage practices being practiced in southern dry zone of Karnataka viz. Mysore, Mandya, Hassan, Tumkur & Chamarajanagara districts and to identify the best storage practices being followed in these districts. Field survey was undertaken during work period in major finger millet growing region of all five districts of Southern Dry Zone of Karnataka. Information was documented by using Participatory Rural Appraisal (PRA) technique like observation and discussion. The survey was continued for different stages of crop and season (Kharif, Rabi and summer) for collecting the sample to assess the safe storage method. During the Survey it was observed that the Traditional storage structure practices to identify and gather description that are prevalent in the five viz. Mysore, Mandya, Hassan, Tumkur & Chamarajanagara districts of Southern Dry Zone of Karnataka. The data on various methods was collected by contacting the respondents through one to one interaction and group discussion methods, the indigenous technologies used by dry land farmers for storage of seed were documented. Findings of our study demonstrated that traditional technical skill teaches us how best the utilization of natural sources could be useful for storage and protection of life of grains or seeds. Furthermore, findings of our field survey study conducted at Mysore, Mandya, and Hassan, Tumkur & Chamarajanagara regions of southern dry zones of Karnataka revealed majorly earthen bin/pot, mud house, and vade type of traditional storage practices being followed for the storage of finger millet [*Eleusine coracana* (L.). In addition, precautionary measures before storage, during storage, and after receipt of grains highlighted in our study were being practiced by farmers in these regions to ensure protection from spoilage of grains.

Keywords: Finger millet [*Eleusine coracana* (L.)], Traditional storage, earthen pot, Mud house, Vade type structure

INTRODUCTION

Food grains form an important part of the vegetarian Indian diet. Grain production has been steadily increasing due to advancement in production technology, but improper storage results in high losses in grains. According to World Bank Report, post-harvest losses in India amount to 12 to 16 million metric tons of food grains each year, an amount that the World Bank stipulates could feed one-third of India's poor. The monetary value of these losses amounts to more than Rs 50,000 cores per year.[1] Agriculture is the backbone of Indian economy that plays a vital role in its development. Almost 54.6% of the engaged directly or indirectly in agriculture and allied activities. In coarse cereal crop, Finger millet

crop is one of the major crops and its production is not only in terms of food security, but also in creating better nutrient for people.

Finger millet [*Eleusine coracana* (L.)] is one of the most important millet crops belonging to family Poaceae and sub family Chloridoidae.[2] Finger millet is originally native of the Ethiopian highlands and was introduced into India approximately 4000 years ago.[3] India is the largest cultivator of finger millet, which is primarily grown in the states of Karnataka, Tamil Nadu, Andhra Pradesh, Orissa, Maharashtra, Uttar Pradesh, Bihar and Gujarat. Among the Indian states that produce finger millet, Karnataka is the largest producer, accounting for 58% of the country's production. It is main dietary component in dry land region of southern Karnataka particularly in districts of Bangalore, Kolar, Chikkaballapura, Tumkur, Mysore, Chamrajanagar, Hassan, Mandya and Chitradurga.[4] Finger millet is rich in protein, calcium, phosphorus, iron, fiber and vitamin content. The calcium content is higher than all cereals and iodine content is considered to be highest among all the food grains. Ragi has best quality protein along with the presence of essential amino acids, vitamin A, vitamin B and phosphorus.[4] Finger millet contains higher proportion of carbohydrate which is the form of non-starchy polysaccharide and dietary fiber, which provides several nutritional and physiological benefits.[5] Finger millet contains Moisture (13.10gm), Protein (7.30gm), Carbohydrate (7.00gm), Fat (1.30gm), and Energy (328.00Kcal).[5]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 due to insect and pest infestation.[6] Indigenous knowledge is a type of knowledge which has evolved within the community and has been passed on from one generation to another.[7] Furthermore, Indigenous knowledge is eco-friendly and safe both to man and his environment. It is estimated to 60-70% of food grain produced in the country is stored at home level in indigenous structures ranging from bamboo baskets to mud structure, gunny bags and modern bins. Proper storage of seed is necessary to protect from spoilage, increasing keeping quality, germination % and viability% of the seeds. There is evidence of ash, sand, herbs used in ancient civilization, which have been credited with mystical power for increasing storage life of seed.[8]Since Finger millet is believed to be one of the few special cereal crop that supports the world's food supplies. It is a hardy crop that can be grown in diverse environments. The grains can be stored for years without insect damage, which makes it a valuable crop for famine-prone areas. Although grown under dry lands, an assured harvest makes it an indispensable crop in the semi-arid, arid and rainfall limited hill agro-ecosystems. Seed treatment and storage comprise of one of the most important aspects of agriculture. The seed treatment practices have to appropriate to get good germination, plant establishment, and crop protection in early stage of crop growth.[9] With this scenario, we conducted the present field survey study with the main purpose to evaluate the traditional storage practices being practiced in southern dry zone of Karnataka viz. Mysore, Mandya, Hassan, Tumkur & Chamarajanagara districts and to identify the best.

MATERIALS AND METHODS

Study area

Karnataka is divided in to 10 agro climatic zones as per Soil, rainfall and other aspects are as follows 1) North eastern transition zone 2) North eastern dry zone 3) Northern Dry zone 4) Central dry zone 5) Eastern Dry zone 6) Southern dry zone7) Southern transition zone 8) Northern transition zone 9) Hilly zone 10) Coastal zone.[8]

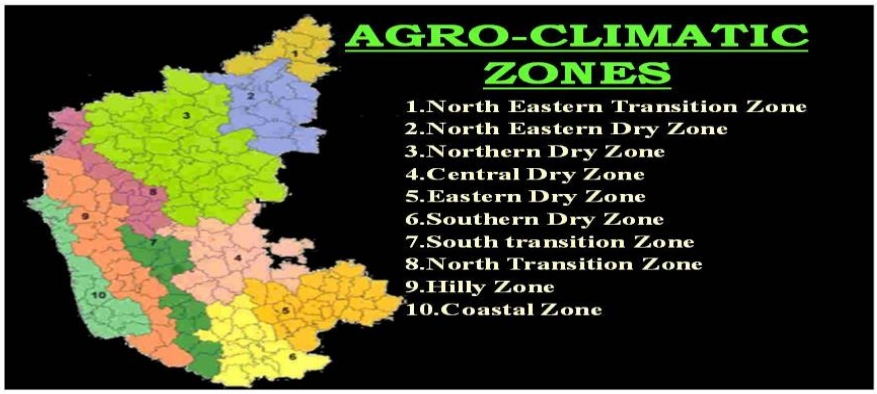

Figure 1: Southern dry zone of Karnataka

The present field study was conducted Mysore, Mandya, Hassan, Tumkur & Chamarajanagara districts of southern dry zone of Karnataka. Storage practices being followed in these districts.

Field Survey

Field survey was undertaken during work period in major finger millet growing region of all five districts of Southern Dry Zone of Karnataka. Information was documented by using Participatory Rural Appraisal (PRA) technique like observation and discussion.[10] The survey was continued for different stages of crop and season (Kharif, Rabi and summer) for collecting the sample to assess the safe storage method.

Observation

During the Survey it was observed that the Traditional storage structure practices to identify and gather description that are prevalent in the five viz. Mysuru, Mandya, Hassan, Tumkur & Chamarajanagara districts of Southern Dry Zone of Karnataka. The data on various methods was collected by contacting the respondents through one to one interaction and group discussion methods, the indigenous technologies used by dry land farmers for storage of seed were documented.

RESULTS AND DISCUSSION

Types of structure used, length and purpose of storage, grain treatment (e.g., parboiling) and pre-storage practices are all important variables affecting storage losses. The importance of these regional and crop variations immediately determines certain necessary characteristics of crop storage research micro-organisms. A large number of insect pests have been reported to be associated with stored grains. The occurrence and numbers of stored grain insect pests are directly related to geographical and climatic conditions. Furthermore, for a country like India, it is necessary to minimize the storage losses. As of now storage losses in India is 10% which is abnormally high as compared to other developing countries. Grain is generally stored either in bags or in bulk. A combined system of bag-cum-bulk storage is also practiced in some parts of the country. In villages the bulk storage system is more common than the storage in bags which is considered to be a practicable method of storing grain in the government godowns as well as in trade.[11] Natural contamination of food grains is greatly influenced by environmental factors such as type of storage structure, temperature, pH, moisture, and etc.[12] Moreover. Our field survey study delineated the following traditional practices being practiced in southern dry zone of Karnataka viz. Mysore, Mandya, Hassan, Tumkur & Chamarajanagara districts. There are mainly following three types of storage practices being followed for storage of finger millet grains.

- Earthen bin type of storage
- Earthen pot type of storage
- Mud house type of storage
- Vade type of storage

Earthen bin/pot type of storage

Earthen bin/pot type storage structures are generally round or cylindrical in shape and are used for storage of finger millet grains or seed in most regions of southern dry zone of Karnataka viz. Mysore, Mandya, Hassan, Tumkur & Chamarajanagara districts. Earthen bin/pot type storage structures generally have capacities between 3.5 to 18 tones; however, smaller capacity structures also exist. Earthen bin/pot type storage structures are generally made up of mud alone or by mud and bamboo. The cylindrical storage structures were raised above the ground (Figure 1 and Figure 2)

Figure 1: Earthen bin type of storage practices

Figure 2: Earthen pot type of storage practices

Mud house type of storage Mud house type of storage practices being followed by some of farmers in Mysore, Mandya, Hassan, Tumkur, & Chamarajanagar districts of Southern dry zones of Karnataka was

as represented in Figure 3. These types of storage practices are very common in the rural areas belonged to southern dry zone of Karnataka for storage of finger millet grains or seeds. The capacity of mud house varies between 1 to 20 tones.

Figure 3: Mud house type of storage practices

Vade type of storage In some other regions of Mysore, Mandya, Hassan, Tumkur & Chamarajanagara belonged to southern dry zones of Karnataka vade type of storage being practices are most common. Mud vade type of storage structures are as represented in Figure 4. These structures are kept inside and made of burnt mud.

Figure 4: Vade type of storage practice

Kumar *et al.* revealed that farmers perceived that grains and seed materials when stored in earthen pot prevent most of the storages pests. For this they had made mud pot 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 made of paddy straw on the floor. Above that ring they placed the pots filled with grains, and the pot 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 pest for nearly 6 months. After 6 months the grains were taken out and subjected to sun drying and again stored in mud pots. In addition, Kumar et al., revealed that Indigenous knowledge is eco-friendly and safe both to man and his environment. It is estimated to 60-70% of food grain produced in the country is stored at home level in indigenous structures.[8]

Furthermore, literature reports revealed various types of traditional practices being followed by farmers for the storage of cereals, grain, sorghum, and agricultural products for future use. Kiruba et al., studied the basic design, the type of materials used and the ingenuity of the storage systems have been elucidated with the view of modifying such a system to suit the present day storage needs.[13] Karthikeyan *et al.*, isolated on the traditional storage practices was done by direct interview and group discussion methods triangulation exercise was done in the study villages to gather reliable information and indigenous technical knowledge of the dry land farmers of Tamilnadu.[14]

Wambugu *et al.*, studied on seed security are key to the attainment of household food security among resource poor farmers in developing countries. The traditional methods included hanging cobs over the fireplace and storing in gunny bags with cow dung ash as the seed treatment. They also follow the principle of airtight, though not new, should be used to design low cost seed storage containers for resource-poor farmers which will result in better seed quality. And also shows that cow dung which is freely available in most homesteads is a good seed protect ant and is effective in maintaining seed quality in storage. Cow dung ash should therefore be combined with air tight storage to increase the seed longevity.[15]

Stored product pests can be managed either behaviorally (traps viz., probe traps, light traps, pitfall traps etc…) or with several preventive and curative measures (both chemical and non-chemical methods). Once a facility is obtained, a number of steps are to be taken to ensure safe storage of grains. These steps comprised as follows; (i) checking for leakage of rain water and sufficiency of drainage facilities,

(ii) cleanliness of the facility and environment, (iii) assessment of capacity of the facility, (iv) pesticidal treatment, (v) security and firefighting arrangements and (vi) repairs to available equipment are some of the important steps to be followed before storage of grains.

During the storage of grains, steps to be tracked as follows; (i) maintenance of cleanliness, (ii) ensuring aeration where necessary, (iii) checking for leakage after rains, (iv) inspection for insects, rats and mites at fortnightly intervals, (v) watch for advancement in deterioration, if any, (vi) pesticidal treatments necessarily based on observations, (vii) ensuring disposal where called for, (viii) arrangement for segregation, salvage and processing, wherever, damage owing, and (ix) checking for leakage of water and other causes might.

While, during the receipt of grains from storage following steps to be undertaken; (i) inspection for variety and soundness of quality, (ii) inspection carefully for infestation, it any, and when present, for type and extent of infestation, (iii) inspection whether grain has excess moisture, whether it had been heated up in earlier storage and has any musty or rancid odor, and (iv) any grain rendered wet or damaged to be segregated and salvaged with facilities available and check the weight received.

CONCLUSION

In conclusion, findings of our field study conducted at Mysore, Mandya, Hassan, Tumkur & Chamarajanagara regions of southern dry zones of Karnataka demonstrated that traditional technical skill teaches us how best the utilization of natural sources could be useful for storage and protection of life of grains or seeds. Furthermore, findings of our field survey study conducted at Mysore, Mandya, and Hassan, Tumkur & Chamarajanagara regions of southern dry zones of Karnataka revealed majorly earthen bin/pot, mud house, and vade type of traditional storage practices being followed for the storage of finger millet [*Eleusine coracana* (L.)]. Precautionary measures before storage, during storage, and after receipt of grains highlighted in our study were being practiced by farmers in these regions to ensure protection from spoilage of grains.

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