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Comparative Study of Different Improved Low Cost Storage Structure of Onion

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ABSTRACT

Onion play important role in Indian cuisine, but due to insufficient low cost storage facilities, small and marginal farmers are compelled to sell it at lower price soon after its harvesting. Before creating awareness among these farmers about improved low cost onion storage structure developed by NHRDF a study was conducted to compare the storage losses in different storage structure. For short duration storage, improved structure was better in comparison to local structure with total 5.66 % storage loss during one month of storage. However, for long duration storage (three months) improved structure showed 12.66 % spoilage loss in compare to chali structure with 5.22 % spoilage loss. The total losses including spoilage loss, physiological weight loss, sprouting loss and skinning loss was minimum in chali structure i.e. 19.5 %, whereas 27.78 % in improved structure . Chali structure is already very common in this district and onion are stored upto the height of one feet whereas in improved structure onion is stored up to the height of one meter which may be basic cause of more spoilage loss during hot weather.Therefore, People who store onion in less quantity prefer to store it on floor but it does not show good result due to covering of too much space.

Keywords Onion, Storage structure, Chali, Bamboo, Gunny.

INTRODUCTION

Onion (*Allium cepa* L.) is one of the India's main commercial vegetable crops grown for economic and domestic consumption and ranks 2nd in area and production (Kondal 2014). It is an important crop as year-round regular diet. Typically the mature bulbs were used to prepare traditional dishes in either fresh or dried form and for extended use (Endalew *et al.* 2014). Onion production occurs in three seasons i.e., *kharif,* late *kharif* and *rabi* and considered as most important source of incomes for every class of farmers who has engaged in the production-consumption chain (Kukanoor 2005). However due to the semi-perishable, high water content and fragile nature of the crop, the produce cannot be stored. Onion bulbs can be stored at low temperatures (0-5°C) or at high temperatures (25-30°C) and maintain relative humidity at 55%-70% (Chope 2006, Kukanoor 2005).

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It is one of India's most important commercial vegetable crops in an area of 12.85 lakh hectares (2017-18), which is around 12.75 % of the total area under vegetable cultivation (as per the 2018 National Horticulture Mission). The country's onion production is 23262 thousand tonnes, representing 12.58 % of total vegetable production. Out of the ten major onion-producing states, in terms of yield Bihar stood at fourth position (1240.59 metric tonne) only after Maharashtra, Madhya Pradesh and Karnataka (Horticultural Statistics 2018).Out of ten major onion producing district in Bihar, Muzaffarpur occupies third position during 2012-13 and 2016-17 after Nalanda, Patna and Katihar in terms of production, which shares 5.38 %, 12.84 %, 6.49 % and 4.89 % in total production respectively. Muzaffarpur was producing 69319 metric tonnes of onion in an area of 2690 ha of land (Report No. 46).Sowing of onion in Bihar takes place after mid-November. After about two month of sowing i.e., after mid-January, transplanting takes place whereas, after three month of transplanting harvesting takes place i.e., after 15 April (Bhise *et al*. 2014).

In spite of production development advances, the post-harvest losses during storage have been significant constraints on productivity enhancements. Due to the seasonal bulbous nature of the crop it will be stored before crop is harvested next season. Longer storage of crops triggers seasonal surplus in the marketplace. During storage major losses in the consistency and quantity of the onion occur (Priya *et al.*2014). In the tropical countries storing of onion bulbs has become a serious problem. Post-harvest losses, that is, sprouting, rotting and weight loss in physiology, pose a major problem. Due to a lack of adequate storage facilities, the onion bulbs had harvested during March-April and sold within 1-2 months (Falayi and Yusuf 2014). Many farmers carry onion directly to the market after harvest, since adequate storage facilities are inaccessible. The existing storage capacities are insufficient and the majority of units available are conventional and unscientific. Onions are processed for a period of 4-6 months either in loose or in bags (Kumer 2011). Maximum storage losses consist of physiological weight loss (PLW) i.e. loss and shrinkage of moisture (30-40%), rotting (20-30%) and sprouting (20-40%) (Mishra *et al*. 2018).

Traditionally, onion was grown in different parts of the world, using conventional methods. Which involves hanging in Maharashtra, Kup or Tat in Haryana, Delhi, Meda in Gujarat and pattarai in Tamilnadu along with tops in bunches or in various forms of godowns known as Chawls (Ranpise *et al.* 2001). The physiological weight loss can be minimized by harvesting at the right time and subsequent storage at the optimal temperature and humidity. The rotting losses in the initial months of storage were usually the greatest, during the summer when high temperatures were combined with high humidity (Anonymous 2012).

It was estimated that more than Rs 600 crores had been lost from the total production of 41 lakh tons of onion due to desiccation, decay and sprouting in storage (Kukanoor 2005). Considering above, in this district, the current experiment conducted a comparison of traditional onion storage methods with low cost enhanced structure developed by NHRDF to reduce the rate of decay.

MATERIALS AND METHODS

This study was conducted at Saraiya and Paru block of Muzaffarpur District. Baraka gaon from Paru whereas, Anandpur and Saraiya Kothi from Saraiya block. The various local onion storage structures were selected for analysis in order to compare the storage loss with the improved low cost onion storage structure developed by NHRDF. Under On Farm Trial, this improved low cost onion storage structure created by NHRDF was installed in farmer's field.The capacity of improved onion storage structure constructed for study was 1300 kg and can be stored up to1m height. About 5200 kg onion procured for storage in each structure whereas 1300 kg onion was kept to store. The height of onion stored in improved structure was at1m height, 0.30 m height for chali and 0.15 m height for floor storage.

Treatment details

The study was laid out in five replication and four treatments. The treatments details were as follows- T_1 – storage at cemented floor, T_2 – Bamboo structure locally known as Chali with bottom ventilation, T_3

Table 1. Spoilage of onion.

Traits/Days	15 days	30 days	45 days	60 days	75 days	90 days
Chali	0.21	0.94	1.34	1.56	3.55	5.22
Improved	0.10	0.67	1.67	2.24	9.71	12.66
Floor	0.46	5.37	3.64	3.48	5.13	6.95
Gunny floor	0.32	5.12	3.98	4.40	4.79	6.14
SE/plot	0.33	0.74	0.63	0.55	1.39	0.94
SE diff mean	0.27	0.61	0.51	0.45	1.14	0.77
CD	3.39	7.71	6.52	5.71	14.43	9.75
CV	2.57	5.85	4.95	4.33	10.95	7.39

– Gunny mat on floor, T_4– Improved low cost onion storage structure with bottom and side ventilation developed by NHRDF.

Onion storage structure

The availability of the appropriate storage structures plays a crucial role in the handling of onions after harvest. Prolonged storage of onion bulbs is supported by structures. There are many local onion stroke structures available but most of them have a severe deficiency, i.e. lack of proper aeration. Storage systems ranged from simple shelters to protect against rain and sun and well-insulated houses with heaters to avoid freezing into cold storage rooms that have continuous low temperature conditions. In certain areas, onion bulbs are stored in some outdoor enclosures consisting of canopy roof, pole methods, sika method, split bamboo storage structure, conventional single-tier storage structure, conventional two-tier storage structure, turbine air ventilated storage structure and forced air ventilated storage structure, Nasik storage and storage infrastructure based in Holland.

Common storage structure in Muzaffarpur District

Bamboo structure locally known as Chali–This is most common widely used structure in Muzaffarpur and other district of Bihar. This prevalent practice of storing onion at the farm level by way of bamboo structure locally known as chali (in several tier) made of bamboo erected above floor (0.15 m- 0.30 m). In this practice, the produce is retained/stored up to six month by turning the produce weekly or fortnightly (as the case may be) from bottom layer to upper layer and vice- versa. During turning, if there was decayed onion then it was removed.

Improved low cost onion storage structure developed by NHRDF-The National Horticultural Research and Development Foundation (NHRDF) has developed an improved low-cost structure for the storage of onion. This structure is surrounded by four sides from the bottom along with bamboo stripes and thatched for better aeration with local grass known as Gurhan. It was built with bottom ventilation on raised platform. Air circulation free and faster, avoiding the formation of hot and moist pockets between the onion layers. The structure's size was 1300 kg with 1.52 m height, 1.22 m width, 1.52 m side height, 1.98 m center height and 30 cm ground height. Onion can be stored in this structure up to 1 m height.

Cemented floor- Spread onion on floor for delayed

Table 2. Physiological weight loss of onion.

Traits/Days	15 days	30 days	45 days	60 days	75 days	90 days
Chali	3.14	5.95	6.53	9.19	11.32	13.15
Improved	2.43	4.91	6.82	8.91	10.52	12.81
Floor	3.53	6.80	12.98	15.93	18.51	20.72
Gunny floor	3.45	6.28	13.12	14.54	17.33	19.50
SE/plot	0.02	6.28	0.02	0.02	0.04	0.04
SE diff mean	0.02	0.01	0.02	0.01	0.03	0.03
CD	0.22	0.07	0.18	0.17	0.44	0.40
CV	0.17	0.06	0.14	0.13	0.33	0.30

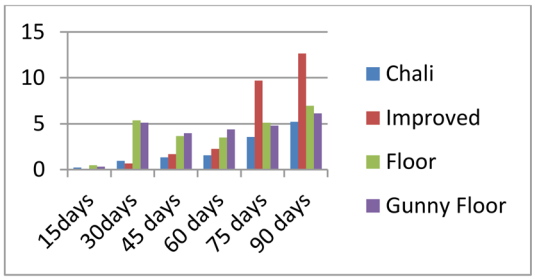

Fig. 1. Spoilage of onion.

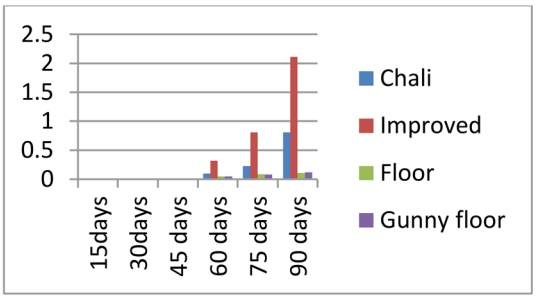

Fig. 2. Sprouting of onion.

spoilage for storage. They generally use veranda for this purpose.

Gunny mat spread above cemented floor–To protect onion from heat and moisture farmers spread gunny mat above floor for storage of low amount of onion.

RESULTS AND DISCUSSION

The result revealed that the total loss includes spoilage loss, physiological weight loss, sprouting loss and skinning loss (Tables 1-4, Figs. 1-4).The storage result showed that at early period of storage the physiological weight, loss was minimum for improved structure i.e., 2.43 % only and nearly same for all other three structure ranging from 3.14 to 3.45 %. The weight loss increased sharply after one month of storage and it was nearly 13 % for onion stored on floor but 6.53 % to 6.82 % for chali and improved structure respectively. After three month of storage, the improved structure and chali showed good result with nearly 13 % weight loss. The weight loss was maximum for floor-stored onion with and without gunny mat with 19.5 to 20.72 % weight loss. The total weight loss of fresh bulbs of Nasarpur variety after three month of storage on open floor (fully ventilated from all sides) was 19.38 % and 4.98 % after 15 days storage (Soomrol and Jamali 2016). Two-row storage structure ventilated at the bottom and side and ventilated single-row storage structure for storage of onion at low cost. The results as per consonance of Mishra *et al.* (2018). Physiological weight loss rises slowly with changes in days following storage in every form of storage system due to further fluctuations in temperature and relative humidity day by day (Endalew *et al*. 2014).

However, the spoilage loss result was different from physiological weight loss and it showed that at initial period of storage i.e., one month improved structure showed best result ranging from 0.1 % to 0.67 % spoilage loss at 15 and 30 days interval respectively. For long duration storage as from 90 days the spoilage percentage was highest i.e., 12.66 %. Onion stored at chali showed best result and only 5.22 % spoilage loss after 90 days of storage. Onion stored on floor also showed better result in compare to improved structure for long duration storage. Onion spoilage may be attributed to unpredictable environmental condition and bacterial and fungal incidence. The above finding was in agreement of Orpin *et al.* (2017), Roopa *et al*. (2014).

The sprouting loss was very less for this district and there was no any sprouting loss till two months. It was maximum i.e., 2.11 % in improved storage structure after three month of storage and minimum for floor stored onion i.e., 0.11 % only. Skinning loss was maximum in case of floor-stored onion and after three month of storage the loss was 0.42 % and minimum for improved structure. The overall storage loss after three month was minimum in case of chali, which was 19.5 % and maximum for improved structure and floor storage (nearly 28 %). After 4-5 months of storage in improved structure i.e., during last week of May showed 44 % total weight loss, in which rotting/spoilage loss was 4.3 % and sprouting loss 1.76 %. Sprouting losses may be due to harvesting of onions before attaining 50% maturity stage, splitting of outer scales. The above findings is in

Fig. 3. Onion kept for storage on. cemented floor

Fig. 4. Onion kept for storage on. gunny mat

accordance with Suojala (2001), Boralo *et al*. (2013), Wheeler *et al.* (1998).

The low cost storage structure with typha roofing and bottom and side ventilation showed total weight loss of 22.6 % after 90 days of storage with 12.4 % physiological loss in weight, 7.14 % spoilage loss and 3.05 % sprouting loss. The above findings in accordance with Kukanoor (2005).

CONCLUSION

In improved onion storage structure onion stored upto the height of 1m, so spoilage loss was much more as compare to other structure. In rainy season, heavy rain may also moist onion and deteriorate its quality. In chali structure, farmers store upto the height of one feet or less so spoilage loss was less and it was better for small and marginal farmer as they have sufficient space in chali system. Picking is also easy in this system and after selling the onion farmers remove the chali and stack it, so the room is vacant for other purpose. Therefore, grower should adopt chali system of storage to store the bulb to minimize the losses, there is need to modify the improved onion storage structure for small farmers of this district and at cheaper cost, which is a limiting factor for small and marginal farmers.

Table 3. Sprouting %.

Traits/Days	15 days	30 days	45 days	60 days	75 days	90 days
Chali	0	0	0	0.10	0.23	0.81
Improved	0	0	0	0.32	0.81	2.11
Floor	0	0	0	0.05	0.09	0.11
Gunny floor	0	0	0	0.05	0.08	0.12
SE/plot	0	0	0	0.22	0.08	0.05
SE diff mean	0	0	0	0.18	0.06	0.04
CD	0	0	0	2.26	0.79	0.57
CV	0	0	0	1.71	0.60	0.43

Table 4. Skin sprouting %.

Traits/Days	15 days	30 days	45 days	60 days	75 days	90 days
Chali	0.05	0.08	0.13	0.21	0.32	0.32
Improved	0.04	0.08	0.09	0.13	0.16	0.20
Floor	0.07	0.18	0.23	0.29	0.32	0.42
Gunny floor	0.06	0.11	0.19	0.26	0.31	0.36
SE/plot	0.07	0.04	0.13	0.02	0.04	0.15
SE diff mean	0.06	0.03	0.11	0.02	0.03	0.12
CD	0.72	0.37	1.37	0.22	0.44	1.52
CV	0.55	0.28	1.04	0.17	0.33	1.16

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