Advances in Plants & Agriculture Research

Research Article

# Shelf life of organically grown sand mulched onion under ambient condition


## Abstract

The problem of health hazards and high cost of chemical fertilizers in developing countries is a serious issue of this era. Therefore there is a need to shift toward easily available eco-friendly approaches for crop production. Earlier many attempted has taken to study the production of onion with different organic inputs but the storage of these organically grown onions were rarely addressed. This article studies the shelf life of organically grown onion in ambient condition. The experiment was conducted in the 2012-2013 at IRTDM faculty centre, Ramakrishna Mission Vivekananda University, Morabadi, Ranchi-834008 to study on Shelf life of organically grown sand mulched onion under ambient condition. Different liquid organic manures *viz*. Shashyagavya 20% ($T_1$), Shashyagavya 10% ($T_2$), Sanjivani 20% ($T_3$), Sanjivani 10% ($T_4$), Mustard oilcake solution 12.5% ($T_5$), Cow urine 10% ($T_6$) and only water ($T_7$) as control were used as seven different treatments with three replications for the study. Onion cv. Agrifound Dark Red was used as planting material for the experiment. CRBD were followed for bulb production. The study reviles that initially higher weight loss is noticed and weight loss is very much dependent on environmental condition.


**Keywords:** onion, organic, shelf life, storage, Jharkhand

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Dibyajyoti Nag

PhD Scholar, School of Agriculture and Rural development, India

**Correspondence:** Dibyajyoti Nag, PhD Scholar, School of Agriculture and Rural development, Ramakrishna Mission Vivekananda University, Morabadi, Ranchi, India, Tel (+91)9608806071, Email sssahebb@gmail.com

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## Introduction

The problem of high cost of chemical fertilizers fully meet out nutrient requirement of crop by single source, therefore, integrated nutrients management such as organic matters like farmyard manure, vermicompost, poultry manure and bio-fertilizers use has become necessary. The estimated total potential demand for bio-fertilizers in India is more than million tonnes per year.[1] So, emphasis should be given on easily available resources, which can be made available by the villagers at village level at reasonable price. Cow dung, cow urine and agricultural waste are usually available in most of the Indian villages. So, different organic solutions may be prepared to meet the nutritional need of the crop. The mulching and bulb growth play a vital role to reach the maximum growth of onion plant. Mulch reduces water loss resulting in more conservation of soil moisture. It has been reported and established that the growth of onion increased with the application of mulching.[2,3] Onion is a seasonal crop and has comparatively low storage ability and bulbs are usually stored until the harvest of next season crop or for longer period due to seasonal glut in the market. Significant losses in quality and quantity of onion occur during storage. Storage of onion bulbs has, therefore, become a serious problem in the tropical countries like India. Storing becomes very essential in peak seasons so that onion can be made available in the lean seasons and farmers can fetch more prices.

## Review of literature

Stage of harvesting and curing play a major role in reducing losses. It is estimated that out of the total production of 41 lakh tonnes of onion, 40 to 50 per cent valued at more than Rs 600 crores are lost due to desiccation, decay and sprouting in storage. This results in raise in their price to the tune of four to five times when they are in short supply.[4] During the storage of onion cultivars, 'Pusa White Round' and 'Pusa Red' under ambient conditions, Pungency and ascorbic acid content decreased, while total antioxidant capacity increased.[5]Kumar and Sreenarayan (2000) found that ascorbic acid content was significantly reduced in all storage methods, whereas sugar content slightly increased during storage. Masalkar et al.,[6] reported that the physiological loss in weight of the bulbs declined significantly in storage with every successive level of potash up to 150 kg/ha in *rabi* season, only up to 90 days of storage at ambient conditions. So, Storage for 1 or 2 months with continuous marketing would provide the required financial benefits. Storage for 3 months or more would be advisable only if the optimum storage bin conditions could be maintained throughout the entire period. The post-harvest losses, *viz*., sprouting, rotting and physiological loss in weight pose a great problem. It is reported that annual storage losses were over 40 per cent[7] and between 40 to 60 per cent[8] in India. This was found in another study assessment of the development of *Aspergillus niger* over a range of humidities showed that growth increased with RH above 80%. Wet ambient conditions in the four to six weeks prior to harvest promote rots caused by aspergillus and penicillium. In the study of[9] this was revealed that, the ratio of unmarketable bulbs 14 days after controlled Aamosphere storage was also lower than that after regular air storage. Presently, the total capacity available in both conventional and scientific storage structure within the country is estimated to be around 7.76 lakh tonnes. Maharashtra, which is the highest onion producing state in the country also reportedly, has the highest storage capacity, which is estimated to be around 3.5 lakh tonnes. But for the present scale of production in the country, the storage capacity requirement is estimated to be around 11.30 lakh tonnes. Thus, there is a shortfall of around three to four lakh tonnes (Kukanoor, 2005). Hence there is an urgent need of innovation of new farming practice for which onion can be stored for a long time in ambient condition. Storage quality of onion bulbs is dependent variable and it is mainly dependent on variety, growing condition and environment of the storing place. It is proved that qualitative parameters like aroma, shelf life increases with organic intervention. The objective of this paper is to find out the best organic liquid solution (made up of easily available materials) to combat the storage problem.

## Materials and methodology

This investigation was carried out at the experimental farm of the faculty centre of Integrated Rural & Tribal Development and Management under the School of Agriculture and Rural Development of Ramakrishna Mission Vivekananda University, Morabadi, Ranchi-834008, Jharkhand, India, during *rabi* season of 2011-12. Agrifound Dark Red was used as based material. Six organic solutions with one control were used as treatment, *viz.* $T_1$= Shashyagavya 20% (Cow dung: Cow urine: Agricultural waste: water= 1:1:1:5), $T_2$= Shashyagavya 10% (cow dung: cow urine: agricultural waste: water= 1:1:1:10), $T_3$= Sanjivani 20% (cow dung: cow urine: water= 1:1:5), $T_4$= Sanjivani 10% (cow dung: cow urine: water= 1:1:10), $T_5$= Mustard oilcake solution 12.5% (250g oilcake shocked in 2 lit water), $T_6$= cow urine 10% and $T_7$= control where only normal water was applied. First 4 solutions were kept in a container 9 days for fermentation, and during that period solutions were stirred twice every day. Solutions were applied every 15 days interval, but watering was done when needed. The bulbs were grown for experiment by complete randomized block design (CRBD) with 3 replications. Sixty days old healthy seedlings were transplanted in flat beds at a spacing of 15 x 10 cm in a plot of 1.8 x 1.2 m during the 2nd week of December. Beds were mulched with a uniform sand (particle size 0.1 to 1.5 mm) layer of 1.2 cm. After harvesting, 5 bulbs (as sample) from each replication were randomly chosen and initial weight of these 15 bulbs were recorded. Every 7 days interval weight of these bulbs was measured until the senescence process took place. Environmental data were taken with the help of digital maximum and minimum hygrometer. Weight loss was calculated with weighing balance. Weight loss percentage (Falayi and Yusuf, 2014) were calculated by following formula

$$Weight\ loss\ (\%) = \frac{Po - Pn}{Po} \times 100$$

Where, Po, Initial weight of 15 bulb

$Pn_,$ Weight after nth day

## Results and discussion

Significant differences were noticed for weight loss of onion bulbs in different treatments. First senescence started (42 DAH) (Table 1) in bulb that were grown with cow urine 10%. This was probability happened due to presence of higher amount of plant available nitrogen compound in its cultural medium. Poor storage life also recorded in control plot (49 DAH) also. Senescence did not start even up to 77 DAH in bulbs, which grown with Sanjivani 10% solution. Shashyagavya 20% solution also had shown a good result in this storage concern. This was probability happened due to presence of higher amount of plant available nitrogen compound in its cultural medium. Poor storage life also recorded in control plot (49 DAH) also. Senescence did not start even up to 77 DAH in bulbs, which grown with Sanjivani 10% solution. Shashyagavya 20% solution also had shown a good result in this storage concern. These solutions were able to provide all the required nutrition to the plant in an easy consumable form, resulting long term storage under ambient condition. Such types of findings under ambient condition were previously mentioned by Masalkar et al.,[6]. This result revealed that a balanced source of plant nutrition is pre-requisite for a fully developed onion bulb, which could be stored for a long time. Figure 1, clearly depicted that at the initial stages higher weight reduction had recorded in every treatment, but gradually this weight loss got reduced. Humidity played an important role in the context of onion storage. As the humidity increases, bulbs absorb moisture, which leads towards swelling and contraction of onion bulbs. These causes racking of the outer skin, Table 2 weight loss and gain and change in physical appearance like greening and black d[7]ots.[8] In first 7 days of curing process highest weight loss percentage of bulb found in control plot (3.53%) followed by Sanjivani 20% (2.87%) whereas this was lowest in the case of mustard oil cake solution (1.93%). Though the weight loss percentage get reduced gradually but at the last stages (before starting the senescence process) of every treatment the weight loss percentage get little momentum. In control plot as only water was given, this directly made significant effect on its bulbs weight loss, probably due to higher percentage of water content in onion bulb. In every 7 days interval, significant weight loss was recorded for the bulbs harvested from this treatment. This table proved the clear relationship between weather condition and bulb weight loss. More weight loss was found whenever the temperature increased and relative humidity decreased and vice a versa. It was also found that during the last weeks temperatures become fluctuating but relative humidity was continuously high, resulting starting of bulb's senescence process. This data clearly indicate that senescence process highly related with relative humidity, whereas weight loss of bulbs related with temperature. This relation between high humidity and rotting of onion bulbs earlier mentioned by Maude et al.,[9–13]

**Table 1** Maximum, minimum and mean Relative humidity of every 7 days under ambient storage condition

| Days after harvesting (DAH) | Maximum temperature (0C) | Minimum temperature (0C) | Relative humidity (%) |
|---|---|---|---|
| 7 DAH | 37.86 | 23.22 | 43.57 |
| 14 DAH | 39.58 | 25.06 | 32.38 |
| 21 DAH | 41.05 | 25.9 | 26.13 |
| 28 DAH | 40.93 | 26.73 | 39.5 |
| 35 DAH | 39.88 | 26.93 | 38.67 |
| 42 DAH | 38.44 | 25.34 | 57.14 |
| 49 DAH | 30.23 | 23.15 | 83.13 |
| 56 DAH | 35.21 | 24.61 | 64.14 |
| 63 DAH | 30.1 | 22.97 | 86.43 |
| 70 DAH | 31.71 | 23.06 | 84 |
| 77 DAH | 28.87 | 22.37 | 89.57 |
| 84 DAH | 29.04 | 22.81 | 90.57 |

**Table 2** Storage life of onion as recorded from stored onion bulbs derived from different treatments under the ambient conditions of store house

| Treatment (Initial weight) | Parameters | 7 DAH | 14 DAH | 21 DAH | 28 DAH | 35 DAH | 42 DAH | 49 DAH | 56 DAH | 63 DAH | 70 DAH | 77 DAH | 84 DAH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T1 | WL (g) | 21.6 | 41 | 63 | 76.5 | 89.6 | 102.1 | 111.6 | 119.6 | 127 | 133 | SS | … |
| (1009.5 g) | WLP (%) | 2.14 | 4.06 | 6.24 | 7.58 | 8.88 | 10.11 | 11.05 | 11.85 | 12.58 | 13.17 | SS | … |
| T2 | WL (g) | 19.7 | 30.5 | 45.8 | 54.8 | 63.5 | 71.2 | 76.5 | 81.1 | SS | … | … | … |
| (797.7 g) | WLP (%) | 2.47 | 3.82 | 5.74 | 6.87 | 7.96 | 8.93 | 9.59 | 10.17 | SS | … | … | … |
| T3 | WL (g) | 27 | 41.2 | 60.5 | 71.7 | 83.3 | 92.3 | 100.6 | 105.9 | SS | … | … | … |
| (942.3 g) | WLP (%) | 2.87 | 4.37 | 6.42 | 7.61 | 8.84 | 9.8 | 10.68 | 11.24 | SS | … | … | … |
| T4 | WL (g) | 27.4 | 45.8 | 70.1 | 81.54 | 92.97 | 107.9 | 124.6 | 129.9 | 134.2 | 138.5 | 142.4 | SS |
| (1011.8 g) | WLP (%) | 2.71 | 4.53 | 6.93 | 8.06 | 9.19 | 10.66 | 12.31 | 12.84 | 13.26 | 13.69 | 14.07 | SS |
| T5 | WL (g) | 20.1 | 43.2 | 65 | 79.7 | 93.8 | 106.4 | 115.7 | SS | … | … | … | … |
| (1041.2 g) | WLP (%) | 1.93 | 4.15 | 6.24 | 7.65 | 9.01 | 10.22 | 11.11 | SS | … | … | … | … |
| T6 | WL (g) | 19.7 | 41.1 | 62.6 | 71.95 | 80.7 | SS | … | … | … | … | … | … |
| (879.6 g) | WLP (%) | 2.24 | 4.67 | 7.12 | 8.18 | 9.17 | SS | … | … | … | … | … | … |
| T7 | WL (g) | 23.1 | 36.5 | 52.1 | 62 | 71.7 | 81.1 | SS | … | … | … | … | … |
| (654.9 g) | WLP (%) | 3.53 | 5.57 | 7.96 | 9.47 | 10.95 | 12.38 | SS | … | … | … | … | … |

Note: SS, senescence started, WL, weight loss and WLP, weight loss percentage

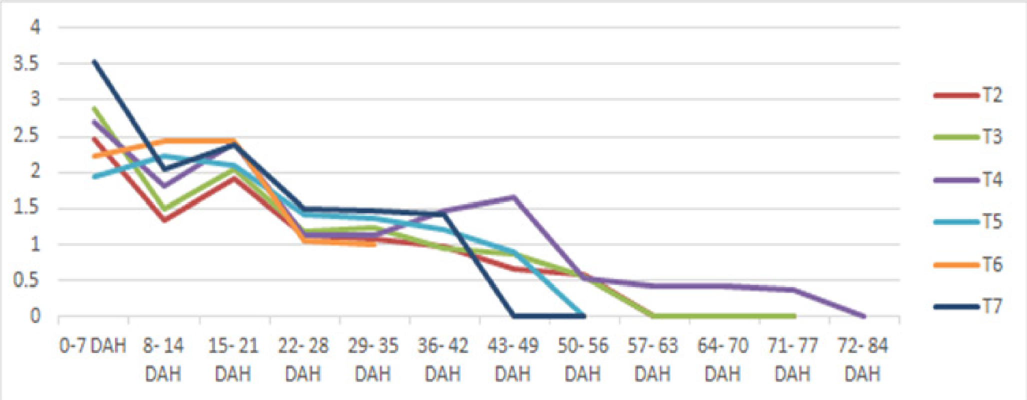


**Figure 1** Percentage weight loss of onion bulbs in every 7 days interval.

## Conclusion

Shelf life of onion is govern by various factors and growing medium is one of them. Under ambient condition, highest shelf-life was recorded for Sanjivani 10% (77 days), followed by Shashgavya 20% (70 days), whereas, lowest shelf-life was recorded for cow urine 10% (35 days). Shelf life of onion is very much influenced by surrounding environment like temperature, humidity etc. and lower relative humidity records than optimum for bulb onion storage.

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## Conflicts of interest

The author declares there is no conflict of interest.

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