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STUDIES ON EFFECT OF DIFFERENT CURING METHODS ON PHYSICAL PARAMETERS OF ONION DURING STORAGE

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Abstract

The investigation was carried out to study the effect of different curing methods on storability of onion. The different curing methods used were *viz*., curing under forced hot air dryer with foliage, curing under forced hot air dryer without foliage, curing under poly tunnel with foliage, curing under poly tunnel without foliage, curing under 35 per cent shade with foliage, curing under 35 per cent shade without foliage, curing under 100 per cent shade with foliage, curing under 100 per cent shade without foliage. Among them the bulbs cured under 35 per cent shade with foliage followed by 35 per cent shade without foliage showed minimum physiological loss in weight, sprouting, rotting and maximum per cent of marketable bulbs.

Key words : Onion, curing, poly tunnal, shade and storage.

Introduction

Onion (*Allium cepa* L.) is an important commercial crop grown almost all over the country. It belongs to family Alliaceae and was originated in Central Asia. Onion is valued and consumed throughout the world due to its characteristic flavour, taste and pungency. The pungency in onion is due to a volatile compound known as allyl-propyl disulphide. Onion has many uses as folk medicine and reports suggests that onion play an important role in preventing heart diseases and other ailments (Augusti, 1990). India ranks second in area (10.64 lakh ha) and production (151.18 lakh mt) after China and third in export (11.63 lakh mt) after Netherlands and Spain. The major onion growing states are Maharashtra, Bihar, Karnataka, Gujarat, Andhra Pradesh, Uttar Pradesh, Orissa and Madhya Pradesh (Anon, 2011).

Onion is a seasonal crop and has low storability. The bulbs have to be stored for longer periods due to seasonal glut in market. A significant loss in quality and quantity of onion occurs during storage, especially in tropical countries like India. Storage is an important aspect of post harvest management. The post harvest loss occurs due to physiological loss in weight, sprouting, rotting etc. Therefore, proper storage is necessary to extend its period of availability through arresting metabolic breakdown and microbial spoilage. Curing is the most important post harvest operation to reduce the post harvest losses to a larger extent. Goburdhan (1980) reported that field curing for 21 days extended the storage life from three months (control) to five months and this was further prolonged by artificial curing at 37°C. It is a drying process intended to dry off the neck and outer scale leaves of the onion bulbs to prevent the loss of moisture and attack by microbes during storage. The essentials of curing are heat, good ventilation preferably with low humidity. It removes the field heat and detachment of soil adheres to the roots. It also helps in shedding of dried roots and removal of foliage leaving 2.5-3 cm was found beneficial after curing which helps in reducing the post harvest losses. Curing may be done in sun, shade, and artificially. A properly cured onion bulbs can be stored for longer duration.

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Materials and Methods

The present investigation was carried out in Department of Post-harvest Technology, Kittur Rani Channamma College of Horticulture, Arabhavi (Karnataka), India during *kharif* and *rabi* seasons of 2010-11. This experiment was carried out in Completely Randomised Design with eight treatments and three replications.

Treatment details

T_1- Curing under forced hot air dryer with foliage

T_2- Curing under forced hot air dryer without foliage

T_3- Curing under poly tunnel with foliage

T_4- Curing under poly tunnel without foliage

T_5- Curing under 35 per cent shade with foliage

T_6- Curing under 35 per cent shade without foliage

T_7- Curing under 100 per cent shade with foliage

T_8- Curing under 100 per cent shade without foliage

All the bulbs were kept in respective condition till the bulbs cured and time taken for curing of bulbs was recorded and expressed in hours.

Then a composite sample of five kg well cured bulbs from each plot was drawn and packed in thin gunny bag for storage studies under ambient conditions.

The following observations are recorded during storage of bulbs. Initial observations were recorded before imposing the treatments. The physiological loss in weight, sprouting, rotting and per cent marketable bulb was recorded 10 days interval upto 60 days of storage. These parameters were calculated by using the formula given below.

Physiological loss in weight (%)

$$PLW(\%) = \frac{P_0 - P_1 \text{ or } P_2 \text{ or } P_3 \text{ or } P_4 \text{ or } P_5 \text{ or } P_6}{P_0} \times 100$$

Where, P_0 = initial weight

P_1 = weight after 10 days

P_2 = weight after 20 days

P_3 = weight after 30 days

P_4 = weight after 40 days

P_5 = weight after 50 days

P_6 = weight after 60 days

Sprouting percentage (%)

$$\text{Sprouting percentage} = \frac{\text{Weight of the sprouted bulbs}}{\text{Initial weight of bulbs}} \times 100$$

Rotting percentage (%)

$$\text{Rotting percentage} = \frac{\text{Weight of the rotted bulbs}}{\text{Initial weight of the bulbs}} \times 100$$

Marketable bulbs (%)

$$\text{Marketable bulbs (\%)} = \frac{\text{Weight of the healthy bulbs obtained}}{\text{Initial weight of bulbs stored}} \times 100$$

Results and Discussion

The time taken for curing of onion bulbs is represented in table 1. The minimum time taken for curing was about 4 hours in onion bulbs cured under forced hot air dryer with foliage and without foliage. The maximum time taken for curing was about 288 hours in bulbs cured under 100 per cent shade with foliage and without foliage.

The time taken for curing in different treatments ranged from 4 hours to 288 hours. The lesser time of curing is due to high temperature of 50^0C with a rate of air flow 222m^3/min in the forced hot air dryer (Satish and Ranganna, 2002). The maximum time taken for curing was observed in bulbs cured under 100 per cent shade with and without foliage due to less temperature (18 to 25^0C).

Significant differences were observed among the curing methods on the physiological loss in weight of the bulbs throughout the storage period (table 1). There was a significant increase in the per cent physiological loss in weight of onion bulbs during storage period of 60 days in all the treatments. The physiological loss in weight values increased progressively from 2.16 per cent at 10 DAS to 26.84 per cent at 60 DAS.

Among the treatments, significantly minimum per cent of physiological loss in weight was recorded in **T_5** onion bulbs cured under 35 per cent shade with foliage (2.16, 6.83, 8.71, 10.88, 12.64 and 15.21%), which was on par with the T_6 onion bulbs cured under 35 per cent shade without foliage (2.35, 6.52, 8.92, 11.21, 14.31 and 16.86%) at 10, 20, 30, 40, 50 and 60 DAS, respectively. However, maximum physiological loss in weight was found in **T_2** onion bulbs cured under forced hot air dryer without foliage (8.06, 10.24, 14.86, 18.16, 22.58 and 26.84 %) at 10, 20, 30, 40, 50 and 60 DAS, respectively. The least physiological loss in weight may be attributed due to the proper drying of the outer scales and formation of tight neck checking further escape of moisture and thus reduced the weight loss during storage. Similar findings were reported by Kukanoor *et al*. (2006), who observed that maximum physiological loss in weight may be due to absence of foliage resulting in full exposure of the bulbs

Table 1 : Influence of different curing methods on time taken for curing (hours), physiological loss in weight (%) and sprouting (%) in onion bulbs during storage.

Treatment	Time taken for curing (hours)	Days after storage										
		Physiological loss in weight (%)						Sprouting* (%)				
		10	20	30	40	50	60	20	30	40	50	60
T_1	4	6.18	9.40	13.49	16.24	20.14	24.61	3.42	9.11	12.14	14.27	16.15
T_2	4	8.06	10.24	14.86	18.16	22.58	26.84	3.94	8.93	12.35	14.59	16.47
T_3	240	2.23	7.74	8.32	12.61	14.31	17.07	2.26	9.25	13.22	15.96	17.27
T_4	240	2.48	8.12	10.84	13.73	17.80	19.24	2.80	9.57	13.44	16.22	17.66
T_5	264	2.16	6.83	8.71	10.88	12.64	15.21	1.46	8.24	11.92	13.06	14.09
T_6	264	2.35	6.52	8.92	11.21	14.31	16.86	2.76	8.55	12.00	13.33	14.24
T_7	288	3.24	8.24	11.48	14.01	18.34	20.16	6.22	11.07	14.27	16.76	18.15
T_8	288	3.19	8.89	12.36	15.31	19.55	21.64	6.81	11.24	14.86	17.95	19.24
S.E m±	-	0.029	0.068	0.032	0.410	0.423	0.427	0.035	0.026	0.028	0.416	0.474
C.D. @ 5%	-	0.088	0.204	0.096	1.230	1.270	1.282	0.107	0.078	0.085	1.247	1.421
C.D. @ 1%	-	0.117	0.270	0.128	1.629	1.682	1.698	0.141	0.103	0.112	1.652	1.883

*upto 10 days there was no sprouting of bulbs

T_1- Curing under forced hot air dryer with foliage
T_2- Curing under forced hot air dryer without foliage
T_3- Curing under polytunnel with foliage
T_4- Curing under polytunnel without foliage
T_5- Curing under 35 per cent shade with foliage
T_6- Curing under 35 per cent shade without foliage
T_7- Curing under 100 per cent shade with foliage
T_8- Curing under 100 per cent shade without foliage

Table 2. Influence of different curing methods on rotting (%) and black mould incidence (%) in onion during storage.

Treatment	Days after storage									
	Rotting* (%)					Black mould incidence ** (%)				
	20	30	40	50	60	20	30	40	50	60
T_1	4.00	8.32	9.25	11.63	13.44	2.00	2.66	3.50	4.50	6.00
T_2	3.80	8.04	9.37	11.06	13.07	2.50	3.00	4.00	5.20	6.50
T_3	3.41	6.91	8.18	9.83	11.67	3.20	3.86	4.50	5.73	7.06
T_4	3.61	7.02	9.10	10.62	12.07	3.50	4.50	5.40	6.20	7.86
T_5	2.41	4.81	6.34	8.82	9.22	1.00	2.00	3.00	3.50	4.16
T_6	3.22	5.95	7.32	8.92	9.62	2.00	2.50	3.50	4.13	5.83
T_7	2.81	6.046	8.62	10.41	11.32	3.20	4.00	5.00	5.50	6.50
T_8	3.00	5.32	7.37	9.87	10.12	3.83	4.50	5.60	6.00	7.00
S.E m±	0.144	0.126	0.336	0.311	0.212	0.058	0.063	0.035	0.033	0.098
C. D. @ 5%	0.432	0.380	1.008	0.932	0.636	0.176	0.190	0.105	0.099	0.295
C.D. @ 1%	0.573	0.503	1.335	1.235	0.842	0.233	0.251	0.140	0.132	0.391

*upto 10 days there was no sprouting of bulbs

T_1- Curing under forced hot air dryer with foliage
T_2- Curing under forced hot air dryer without foliage
T_3- Curing under polytunnel with foliage
T_4- Curing under polytunnel without foliage
T_5- Curing under 35 per cent shade with foliage
T_6- Curing under 35 per cent shade without foliage
T_7- Curing under 100 per cent shade with foliage
T_8- Curing under 100 per cent shade without foliage

to the temperature leading to increased surface temperature of the bulbs helping to hasten the process of moisture reduction. Similar findings were reported by Thompson *et al*. (1972) and Sidhu and Chadha (1986) who observed that physiological loss in weight was lesser in cured bulbs during storage.

There was no sprouting observed upto 10 days of storage in all the treatments (table 1). Significantly maximum percentage of sprouting (2.26, 9.25, 13.22, 15.96 and 17.27%) was recorded in T_4 onion bulbs cured under poly tunnel without foliage followed by T_3 curing under poly tunnel with foliage (2.80, 9.57, 13.44, 16.22 and

Table 3 : Influence of different curing methods on marketable bulbs (%) of onion during storage.

Treatment	Days after storage						
	Marketable bulbs (%)						
	10	10	20	30	40	50	60
T_1	6.14	93.82	83.18	69.08	62.37	53.96	45.80
T_2	6.23	91.94	82.04	68.16	60.12	51.77	43.62
T_3	6.44	97.77	86.59	75.52	65.99	51.98	52.59
T_4	6.42	97.52	85.47	72.57	63.73	55.36	51.03
T_5	6.68	97.84	89.30	78.24	70.86	65.48	61.48
T_6	6.52	97.65	87.50	76.58	69.47	63.44	59.28
T_7	6.36	96.76	82.73	71.49	61.80	54.49	50.37
T_8	6.38	96.81	81.30	71.07	62.46	52.63	49.00
S.E m±	0.101	0.388	0.532	0.499	0.563	0.596	0.511
C.D. @ 5%	0.304	1.164	1.596	1.496	1.688	1.789	1.533
C.D. @ 1%	0.402	1.542	2.113	1.981	2.236	2.369	2.030

T_1- Curing under forced hot air dryer with foliage
T_2- Curing under forced hot air dryer without foliage
T_3- Curing under polytunnel with foliage
T_4- Curing under polytunnel without foliage
T_5- Curing under 35 per cent shade with foliage
T_6- Curing under 35 per cent shade without foliage
T_7- Curing under 100 per cent shade with foliage
T_8- Curing under 100 per cent shade without foliage

17.66%) at 20, 30, 40, 50 and 60 DAS, respectively. However, minimum sprouting (1.46, 8.24, 11.92, 13.06, 14.09 %) was seen in T_5 onion bulbs cured under 35 per cent shade net with foliage, which was on par with the bulbs cured under 35 per cent shade net without foliage (2.76, 8.55, 12.00, 13.33 and 14.24%) at 20, 30, 40, 50 and 60 DAS, respectively. Sprouting is one of the major causes for qualitative as well as quantitative deterioration of stored onion bulbs. Sprouting leads to transfer of both dry matter and water from the edible fleshy scales into the sprouts resulting in increased shrivelling and loss of market quality of such bulbs. The sprouting per cent was significantly influenced by different curing methods at all the stages of observations. Among the different curing methods, bulbs cured under 35 per cent shade with foliage (T_5) was recorded significantly minimum sprouting due to moderate temperature of 32 to 36^{0}C inside the shade net. This may be due to thin neck and suppression of sprout growth. Similar kind of results was also observed by Associated Agricultural Development Foundation, Nasik. These findings were in accordance with the Kukanoor *et al*. (2006) and Katherine *et al*. (2009).

In general, no loss of bulbs due to rotting was observed in any of the treatments upto 10 DAS. The different curing methods showed significant difference with respect to per cent rotting during the entire storage period. Among all the curing methods experimented, maximum loss of onion bulbs due to rotting (4.00, 8.32, 9.25, 11.63 and 13.44%) was observed in (T_1) onion bulbs cured under forced hot air dryer with foliage which was on par with the onion bulbs cured under T_2 forced hot air dryer without foliage (3.80, 8.04, 9.37, 11.06 and 13.07%) at 20, 30, 40, 50 and 60 DAS, respectively.

However, minimum rotting (2.41, 4.81, 6.34, 8.82 and 9.22%) was observed in onion bulbs cured under 35 per cent shade with foliage followed by onion bulbs cured under (T_6) 35 per cent shade without foliage (3.22, 5.95, 7.32, 8.92 and 9.62%) at 20, 30, 40, 50 and 60 DAS, respectively. The per cent loss of bulbs due to black mould incidence increased progressively with advancement in storage period. There was no black mould incidence upto 10 DAS in all the treatments, whereas minimum percentage of black mould was recorded in bulbs cured under 35 per cent shade with foliage T_5 (1.00, 2.00, 3.00, 3.50 and 4.16 %) followed by bulbs cured under 35 per cent shade without foliage T_6 (2.00, 2.50, 3.50, 4.13 and 5.83%), while maximum black mould percentage was seen in T_4 bulbs cured under poly tunnel without foliage (3.50, 4.50, 5.40, 6.20 and 7.86 %) at 20, 30, 40, 50 and 60 DAS, respectively (table 2).

The least rotting percentage and black mould incidence may be due to the fact that the neck of the bulb was completely dried and closed, which helps in reducing the chances of microorganisms entry into the bulbs and lower order of pathological decay of microorganisms due to reduction in the moisture content of the onion bulbs. Similar findings were observed by Sidhu and Chadha (1986) and Kukanoor *et al*. (2006a) in onion.

The percentage of marketable bulbs irrespective of curing methods decreased throughout the storage period (table 3). The significant differences were observed among different methods of curing at all the stages of storage. The maximum percentage of marketable bulbs were observed in bulbs cured under 35 per cent shade with foliage (97.84, 89.30, 78.24, 70.86, 65.48 and 61.48%) followed by bulbs cured under 35 per cent shade without foliage (97.52, 85.47, 72.57, 63.73, 55.36 and 51.03%) at 10, 20, 30, 40, 50 and 60 DAS, respectively whereas bulbs cured under forced hot air dryer without foliage showed minimum percentage of marketable bulbs (91.94, 82.04, 68.16, 60.12, 51.77 and 43.62 %) at 10, 20, 30, 40, 50 and 60 DAS, respectively.

The highest marketable bulbs may be attributed to

minimum physiological loss in weight, rotting and sprouting in bulbs cured under 35 per cent shade with foliage ($\mathbf{T_5}$) and in bulbs cured under 35 per cent shade without foliage. However, the lowest per cent marketable bulbs obtained were observed in bulbs cured under forced hot air dryer without foliage. This could be due to highest weight loss, rotting and sprouting in bulbs cured under forced hot air dryer. This may be due to high temperature of 50^0C for a longer period of five hours which made the bulbs loose more in weight, highest per cent of rotting and sprouting. These results were in similar with findings of Kukanoor *et al*. (2006).

References

Anonymous (2011). India Horticultural Database, 2011. http://www.nhb.gov.in

Augusti, K. T. (1990). Therapeutic and medicinal values of onion and garlic. In *Onion and Allied Crops*. Ed. Brewster, J. L. and *Rabi*nowith, H. D., Baco Ratani, Florida, CRC Press, **3** : 93-108.

Goburdhan, S. (1980). Aspects of warm temperature storage of onion. *Horti. Abstracts*, **24** : 6.

Katherine, D., A. Gemma and L. A. Chope (2009). Effect of curing at different temperatures on biochemical composition of onion (*Allium cepa* L.) skin from three freshly cured and cold stored UK-grown onion cultivars. *Postharvest Biol. and Technol*., **54** : 80-86.

Kukanoor, L., N. Basavarajan and A. K. Rokhade (2006). Influence of curing methods on storability of onion. *J. Asian Hort*., **2(4)** : 277-281.

Satish, S. V. and B. Ranganna (2002b). Effect of curing on the physical and mechanical properties of onion. *Mysore J. Agric. Sci.*, **36** : 266-269.

Sidhu, A. S. and M. L. Chadha (1986). Studies on the storage life of *kharif* onion. *Indian Food Packer*, **40(1-2)** : 69-72.

Thompson, A. K., R. H. Booth and F. J. Proctor (1972). Onion storage in tropics. *Tropical Sciences*, **14(1)** : 19-34.