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Short Note

Effect of Curing Methods on Quality and Storage of Onion (*Allium cepa* L. var. *aggregatum* Don.)

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A field experiment on curing studies in onion was conducted at College Orchard of Tamil Nadu Agricultural University, Coimbatore during 2009. This experiment was laid out in factorial completely randomized design (FCRD) with six treatments and three replications. The influences of different curing methods *viz*., bulbs with tops removed (T_1), bulbs with 2cm neck length (T_2), bulbs with 4cm neck length (T_3), bulbs treated with sulphur fumigation (50g m^{-3}) for three hours (T_4), bulbs treated with gamma rays @ 2kr (T_5), bulbs treated with gamma rays @4kr (T_6) in onion were studied. Among the above curing methods, bulbs with 2cm neck length (T_2) had improved quality parameters such as pyruvic acid (2.67µmol g^{-1}), TSS content (13.77$_o$brix) and moisture content (93.95%). The same treatment recorded lowest physiological loss in weight (1.33 per cent), sprouting (0.09 per cent) and highest shelf life compared to other treatments.

Key words: Curing, keeping quality, aggregatum onion, shelf life.

Onion, the queen of kitchen is valued as a condiment due to its flavour and it is the most important bulbous vegetable crop grown in India. It is one of the potential foreign exchange earners and is one among the vegetables, where India figures prominently in the world's export market. With an area of 0.527 million hectares and an annual production of 7.45 million metric tonnes India stands first in rank sharing eight per cent of the world production (Anon., 2008). As the most special and important condiment vegetable of Tamil Nadu, *aggregatum* onion cv. CO On 5 has higher market preference because of its size and appealing pink hue colour. The only post-harvest treatment required for the long storage of bulb onions is a thorough curing of the bulbs. Onions are considered cured when neck is tight the outer scales are dried until they rustle and bulbs shed 3-5 % of their weight. Curing is an important operation in the post-harvest handling of onion, if properly done, it reduces losses of bulbs vastly.

It helps in reducing post harvest decay and moisture loss due to removal of excess moisture from the outer skin and neck of freshly harvested onion to a level where shrinkage from the interior will be minimum and reduction in microbial infection. Pyruvic acid is used as a measure of pungency, which is a very important character for the better storage qualities and processing of onion bulbs (Pal and Singh, 1987). With this background, the present investigation was carried out to standardize the appropriate curing techniques for better quality and shelf life of onion cv. CO On 5.

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Material and Methods

A field experiment was conducted with pre cured onion variety CO On 5 in factorial completely randomized design (FCRD) with six treatments replicated thrice at College Orchard, Department of Vegetable Crops, Horticultural College and Research Institute, Coimbatore during 2009. The pre-harvest spray was done with Maleic hydrazide @ 2000ppm + Carbendazim @ 1000ppm at 30 days before harvest. The harvested onion bulbs were kept in field for three days and shade for two days, after that the following curing treatments were imposed:

Factor A: Types of curing

T_1 - Bulbs with tops removed (Control)

T_2 - Bulbs with 2 cm neck length

T_3 - Bulbs with 4 cm neck length

T_4 - Bulbs treated with sulphur fumigation (50g m^{-3}) for three hours

T_5 - Bulbs treated with gamma rays @ 2 kr

T_6 - Bulbs treated with gamma rays @4 kr

Factor B: **Period of storage**

P_1 - 15 days after curing

P_2 - 30 days after curing

The bulbs were stored for one month and the biometrical observations were recorded on 15 and 30 days after curing. The observations recorded were physiological loss in weight (PLW), sprouting loss, moisture content, total soluble solids (TSS)

and pyruvic acid content (Randle and Bussard, 1993). Since the observations on pyruvic acid and TSS do not show any variation from 0-15 days after curing, the observations were recorded only on 15 and 30 days after curing. The data obtained from the present investigation were subjected to statistical scrutiny by adopting the standard procedure of Panse and Sukhatme (1985).

Results and Discussion

Quality Parameters

Among the different curing treatments tried, the highest values of pyruvic acid (2.71µmol g^{-1}), TSS (13.97^{o}brix) and moisture content (94.63%) were recorded in bulbs with 2cm neck length and the significantly lower values of pyruvic acid (2.45µmol g^{-1}), TSS (12.89^{o}brix) and moisture content (90.88%) were found in bulbs treated with gamma rays @4kR. Since the 2 cm neck portion above the bulb play a major role in reduction of moisture losses and microbial activities. As the storage period increased from 15 to 30 days, the pyruvic acid and moisture content decreased from 2.64 to 2.53µmol g^{-1} and 93.93 to 92.51%. The moisture content of onion bulbs is about 97 per cent at the time of harvesting and reduced to 90.08 per cent upon proper curing (drying). Curing heals wounds and strengthens general skin condition of the bulbs. It will be conditioned by relatively high temperature and involves the suberisation of the outer tissues followed by the development of a wound periderm which act as an effective barrier against infection and reduce the level of water loss (Booth, 1974). Curing of onion bulbs specially involves drying of superficial scales to protect the bulbs against subsequent microbial infection. The highest values of pyruvic acid (2.64µ mol g^{-1}) and moisture (93.93%) content was recorded in 15 days after curing and the lowest values (2.53 µmol g^{-1} and 92.51%) were recorded in the 30 days after curing. As the storage period increased from 15 to 30 days, TSS content increased from 13.26 ^{o}Brix (15 days) to 13.58 ^{o}Brix (30 days). In the case of interaction effects, between method of curing and storage period, the highest value of pyruvic acid (2.77 µmol g^{-1}) and moisture content (95.23%) was recorded in bulbs cured with 2cm neck length for the storage period of 15 days. The lowest value of pyruvic acid (2.40 µmol g-1) and moisture (90.08%) contents was registered in bulbs treated with gamma rays @4 kr for the storage period of 30days (Table 1 & 2). There was gradual decrease of pyruvic acid content throughout the curing period, which may be attributed to the entry of pyruvic acid into oxidative pathway by pyruvate dehydrogenase

Table 1. Effect of curing treatments on pyruvic acid (µmol g^{-1}) and TSS (°Brix) content in onion bulbs

Treatment	Pyruvic acid (µmol g^{-1})			TSS (°Brix)		
	P_1 (15 days after curing)	P (30 days after curing)	Mean	P_1 (15 days after curing)	P (30 days after curing)	Mean
T_1- Bulbs with tops removed	2.64	2.56	2.60	13.18	13.95	13.57
T_2- Bulbs with 2 cm neck length	2.77	2.65	2.71	13.87	14.07	13.97
T_3- Bulbs with 4 cm neck length	2.71	2.60	2.66	13.73	13.83	13.78
T_4- Bulbs treated with sulfur fumigation (50g m_3) -3 hrs	2.66	2.54	2.60	12.97	13.67	13.32
T_5- Bulbs treated with gamma rays @ 2 kr	2.54	2.44	2.49	12.95	13.03	12.99
T_6- Bulbs treated with gamma rays @ 2 kr	2.50	2.40	2.45	12.83	12.95	12.89
Mean	2.64	2.53	2.59	13.26	13.58	13.42
	T	P	T x P	T	P	T x P
SEd	0.003	0.002	0.005	0.009	0.005	0.013
CD (0.05)	0.007	0.004	0.010	0.018	0.010	0.026

Table 2. Effect of curing treatments on moisture (%) content in onion bulbs

Treatment	Moisture (%)		
	P_1 (15 days after curing)	P_2 (30 days after curing)	Mean
T_1- Bulbs with tops removed	94.73 (76.74)	93.23 (74.92)	93.98 (75.83)
T_2- Bulbs with 2 cm neck length	95.23 (77.39)	94.03 (75.86)	94.63 (76.63)
T_3- Bulbs with 4 cm neck length	94.95 (77.02)	93.73 (75.51)	94.34 (76.27)
T_4- Bulbs treated with sulfur fumigation (50g m_3) -3 hrs	93.90 (75.70)	92.17 (73.75)	93.04 (74.73)
T_5- Bulbs treated with gamma rays @ 2 kr	93.07 (74.74)	91.83 (73.40)	92.45 (74.07)
T_6- Bulbs treated with gamma rays @ 2 kr	91.68 (73.24)	90.08 (71.65)	90.88 (72.45)
Mean	93.93 (75.81)	92.51(74.18)	93.22(75.00)
	T	P	T x P
SEd	0.021	0.012	0.029
CD (0.05)	0.042	0.024	0.059

Table 3. Effect of curing treatments on physiological loss in weight (%) and sprouting (%) content in onion bulbs

Treatment	Physiological loss in weight (%)			Sprouting (%)		
	P_1 (15 days after curing)	P_2 (30 days after curing)	Mean	P_1 (15 days after curing)	P_2 (30 days after curing)	Mean
T_1- Bulbs with tops removed	3.08 (10.57)	3.37 (10.57)	3.23 (10.57)	0.12 (1.96)	0.18 (2.45)	0.15 (2.21)
T_2- Bulbs with 2 cm neck length	1.25 (6.42)	1.30 (6.55)	1.28 (6.49)	0.00 (0.91)	0.03 (1.04)	0.02 (0.97)
T_3- Bulbs with 4 cm neck length	1.97 (8.06)	2.17 (8.46)	2.07 (8.26)	0.09 (1.72)	0.13 (2.09)	0.11 (1.91)
T_4- Bulbs treated with sulfur fumigation (50g m_3) -3 hrs	3.15 (10.22)	3.37 (10.57)	3.26 (10.40)	0.15 (2.22)	0.23 (2.77)	0.19 (2.50)
T_5- Bulbs treated with gamma rays @ 2 kr	3.55 (10.86)	3.98 (11.51)	3.77 (11.19)	0.23 (2.77)	0.32 (3.23)	0.28 (3.00)
T_6- Bulbs treated with gamma rays @ 2 kr	3.96 (11.48)	4.13 (11.73)	4.05 (11.61)	0.32 (3.23)	0.37 (3.47)	0.35 (3.35)
Mean	2.83 (9.60)	3.05 (9.90)	2.94 (9.75)	0.15 (2.14)	0.21 (2.51)	0.18 (2.32)
	T	P	T x P	T	P	T x P
SEd	0.016	0.009	0.022	0.016	0.009	0.023
CD (0.05)	0.031	0.018	0.044	0.032	0.018	0.045

and TCA cycle enzymes by complete oxidation resulting in ATP production, which can be utilized for other metabolic activities.

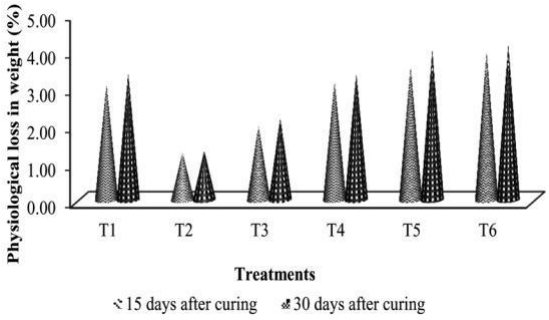

Fig. 1. Effect of curing treatments on physiological loss in weight (%) content in onion bulbs

Curing of bulbs with 2cm neck length for the storage period of 30 days has recorded highest TSS content (14.07$_o$Brix) and the lowest value of 12.83$_o$Brix was recorded in bulbs treated with gamma rays @4kr for the storage period of 15 days. In the present investigation, the TSS of bulbs increased during storage. This is in consonance with Hanoaka and Ito (1975). The increase was more in bulbs with tops of 2 cm neck. This might be due to proper drying of the bulbs and the conversion of polysaccharides into soluble form of sugars (Satodiya and Singh, 1993). Individual treatments played major role during storage of onion bulbs particularly field curing, neck length and shade curing.

Shelf life

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 shriveling and loss of market quality of such bulbs.

Among the different curing treatments, the lowest physiological loss in weight (1.28 per cent) and sprouting (0.02 per cent) were recorded in T_2 (Bulbs with 2cm neck length). The highest per cent of physiological loss in weight (4.05 per cent) and sprouting (0.35 per cent) were recorded in T_6 (Bulbs treated with gamma rays @4 kr) (Table 3).

The lowest value of physiological loss in weight (2.83 per cent) and sprouting (0.15 per cent) were recorded in P_1 (15 days after curing). The highest value of physiological loss in weight (3.05 per cent) and sprouting (0.21 per cent) were recorded in P_2 (30 days after curing).

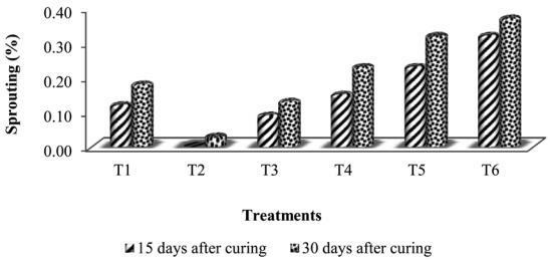

Fig. 2. Effect of curing treatments on sprouting (%) content in onion bulbs

The interaction of T $_2P_1$ (Bulbs with 2cm neck length +15 days after curing) recorded lowest physiological loss in weight (1.25 per cent) and sprouting (0 per cent). The highest physiological loss in weight (4.13 per cent) and sprouting (0.37 per cent) was recorded in T_6P_2 (Bulbs treated with gamma rays @4 kr + 30 days after curing). The least physiological loss in weight may be attributed to the proper dryingof the outer scales and tight neck checking further escape of moisture and thus reducing the weight loss during storage (Fig.1 and 2) as also reported by Chadha and Sidhu (1989) in onion. The lowest physiological loss in weight was due to reduced levels of sprouting and rotting and was in accordance with the earlier findings of Chauhan *et al.* (1995). The highest sprouting loss was observed in control (T_1) indicating the importance of retaining neck and curing under shade for the storage of onion bulbs. Wardae *et al*. (1995) also reported similar results. The higher weight loss

may be due to absence of foliage. Exposure of the onion bulbs to the ambient temperature leads to increase bulb surface temperature and hastens the process of moisture reduction. These results are in conformity with the results obtained by Sathish and Ranganna (2002).

Conclusion

Storing of onion bulbs after keeping the har..... onion is field for three days and shade for two days after harvest and by with 2cm neck length increase the quality parameters such as pyruvic acid (2.67µmol g^{-1}), TSS content (13.77₀brix), moisture content (93.95%),shelf life and reduce the physiological loss in weight (1.33 per cent) and sprouting (0 per cent).

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