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DS Vitnor
Department of Vegetable Science, College of Horticulture, SD Agricultural University, Sardarkrushinagar, Gujarat, India

LR Varma
Department of Vegetable Science, College of Horticulture, S. D. Agricultural University, Sardarkrushinagar, Gujarat, India

Yogesh Pawar
Department of Vegetable Science, College of Horticulture, S. D. Agricultural University, Sardarkrushinagar, Gujarat, India

Corresponding Author:
Yogesh Pawar
Department of Vegetable Science, College of Horticulture, S. D. Agricultural University, Sardarkrushinagar, Gujarat, India

Influence of methods of harvesting and time of curing on yield and storage life of Rabi onion Cv. Agrifound light red

DS Vitnor, LR Varma and Yogesh Pawar

Abstract
Onion is popular bulbous crop which is consumed round the year. Being perishable in nature, a considerable loss occurs during storage. As a matter of fact pre harvest and post-harvest crop operations influence the shelf life of horticultural produce. The present investigation is an attempt to examine the effect of last irrigation and curing on yield and post-harvest losses of rabi onion. Irrigation before harvesting affect the shelf life of all the crops especially for the underground crops. Moreover, in case of onion curing is much an important operation that may decide the storage capacity. One of the practical significance for onion growers to fetch the better price it needs a long storage. The results of present study revealed that yield per hectare (363.61 q) and marketable yield per hectare (339.95 q) were recorded with treatment of irrigate the crop before two days of harvesting (m_1). Maximum yield per hectare (368.88 q) and marketable yield per hectare (341.10 q) were recorded with c_5 (No curing), while the minimum unmarketable yield per hectare (10.38 q), maximum recovery of fresh onion after three month of storage life (14.856 kg), minimum weight of dry scales (0.014kg), weight of rotted and sprouted onion (1.081 kg) were recorded with c_2 (Four days curing in field condition).

Keywords: Curing, harvesting, irrigation, onion, storage life and yield

Introduction
Onion is an important part of our daily diet. The onion is a rich source of phosphorous, calcium, sulphur, sodium and fiber with no fat and is an important component of folk medicine (Nayerabi *et al*., 2001; Marwat *et al.*, 2011) [10, 9]. Besides medicinally richness and usefulness, onion has an important role in national economy. Fresh onion has share in export of 18.6 per cent among all the horticultural produce. Moreover prices of onion are at important index to finalize the inflation rate. Prices of onion mainly depend upon the quantity and quality of stored onion at either grower's level or trader's level.

The onion crop cannot be stored safely under ambient conditions because of its perishable nature, yet considerable deterioration may occur during storage due to rotting, sprouting and physiological weight loss and storage losses could be as high as 66% (Biswas *et al*., 2010) [3]. Out of the total onion production, most of produce is stored for daily requirement is lean season. There are several factors or operations during crop raising in the field like withholding last irrigation and curing under field or shade greatly influence the storability of onion. Curing in the field or shade for the purpose of removal of excess moisture from the outer skin is the prime technology to obtain under sized skin for avoiding moisture loss, disease infection and degradation in quality. Though, irrigation before harvesting and curing after harvesting are very important factors of cultivation practices which finalize the fate of storage life of onion. Unfortunately these factors have not been touched by research workers. Looking significance of crop and it's storage present experiment was planned and executed at Department of Vegetable Science, College of Horticulture, S. D. Agricultural University, Sardarkrushinagar. Very limited information on these aspects is available for agro-climatic conditions of Gujarat. However, the experiences gained in the previous experiments should also be kept as the base line of this trial.

Material and Methods
The trial was conducted at Department of Vegetable Science, College of Horticulture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar (Gujarat). The soil of experimental site was loamy sand in texture having pH of 7.8, low in available N (149 kg/ha), medium in available P_2O_5 (26 kg/ha) and K_2O (287 kg/ha). The seeds of variety Agrifound Light Red were procured from NHRDF, Nashik (MH). Experiment consists of total fifteen treatment combinations with three methods of harvesting *viz*., irrigate the crop before two days

of harvesting (m_1), irrigate the crop before three days of harvesting (m_2) and harvesting without irrigation (m_3) and five time of curing *viz*., two days curing in field condition (c_1), four days curing in field condition (c_2), two days curing in shade condition (c_3), four days curing in shade condition (c_4) and no curing (c_5).

The onion seedlings of 8 weeks of uniform size were transplanted at the spacing of 15cm x 10 cm and harvested in second week of May during the year. A uniform dose of 50 kg N, 50 kg P_2O_5 and 50 kg K_2O/ha was mixed in soil before transplanting and 50 kg N/ha was applied at 30, 45 and 60 days after planting in three equal splits. Last irrigation was applied as per treatments and after harvesting. Curing in open field and shade was done as per treatment and produce was stored for three months in ambient condition. The retention of onion bulb quality during storage depends on the bulb maturity and variety. 20 kg of onion in each treatment of uniform shape and size were selected for storage life. The mean data were subjected to statistical analysis following analysis of variance technique Gomez and Gomez (1984) [6].

Results and Discussion

Influence of methods of harvesting on yield

Data pertaining to yield of onion are presented in Table 1. The result revealed that the significantly maximum yield per hectare (363.60 q) and marketable yield per hectare (339.95 q) were recorded with treatment m_1. The leaves were drying very slowly and gradually and were not fully dried even at harvest time. The bases of foliage near the neck of bulbs were green. Hence, it may be predicted that the flow of photosyntates or substrates in the foliage continued to the bulbs. These results are in conformity with the findings of Trevisan *et al.* 1999 [14] in onion. Minimum unmarketable yield per hectare (11.78 q) were recorded with treatment m_3, whereas maximum unmarketable yield per hectare (24.65 q) were recorded with treatment m_1.

Influence of time of curing on yield

Data presented in (Table. 1) further indicated that different time of curing was observed significant. The maximum yield per hectare (368.88 q) were recorded with treatment c_5, which was statistically at par with treatment c_3, while minimum yield per hectare (328.81 q) were recorded with treatment c_2. The maximum yield of bulb are due to excess moisture content in bulb without cured treatment and less moisture content in properly cured onion. This result is in close agreement with the findings of [10, 9, 11] in onion. Minimum unmarketable yield per hectare (10.38kg) were recorded with treatment c_2, whereas maximum unmarketable yield per hectare (27.77 q) were recorded with c_5. During this process excessive moisture is removed from the outer covering and neck of the bulbs. These findings are in close accordance with finding of [9, 7] in onion.

Table 1: Influence of methods of harvesting and time of curing on yield and storage life of onion

Treatment	Yield (q/ha)	Marketable yield (q/ha)	Unmarketable yield (q/ha)	Neck thickness at the time of storage (cm)	Weight of fresh (kg)	Weight of dry scales (kg)	Weight of rotted and sprouted (kg)	Per cent weight loss (%)
Methods of harvesting (M)								
m_1	363.60	339.95	24.65	1.165	11.647	0.026	1.797	41.76
m_2	348.64	333.07	15.57	0.995	12.605	0.025	1.651	36.97
m_3	328.47	316.69	11.78	0.892	14.541	0.023	1.095	27.29
S.Em ±	5.41	5.23	0.85	0.014	0.168	0.001	0.034	0.84
C.D. at 5%	15.67	15.16	2.46	0.040	0.487	0.002	0.097	2.43
Time of curing (C)								
c_1	338.13	322.00	16.12	1.013	12.970	0.021	1.533	35.15
c_2	328.81	318.43	10.38	0.952	14.856	0.014	1.081	25.72
c_3	352.18	334.40	19.42	1.000	12.436	0.024	1.647	37.82
c_4	346.56	333.58	12.98	1.013	13.450	0.020	1.523	32.75
c_5	368.88	341.10	27.77	1.104	10.946	0.044	1.789	45.27
S.Em ±	6.99	6.76	1.10	0.018	0.217	0.001	0.043	1.08
C.D. at 5%	20.24	NS	3.17	0.052	0.629	0.002	0.126	3.14
Interactions (M X C)								
S.Em ±	12.10	11.71	1.90	0.031	0.376	0.001	0.075	1.87
C.D. at 5%	NS	NS	NS	0.091	NS	0.004	0.218	NS

Influence of methods of harvesting on storage behaviour

Data presented in table1 pertaining to yield and post-harvest losses revealed that, significantly minimum (0.892 cm) and maximum (1.165cm) neck thickness of bulb was recorded with treatment m_3 and m_1 respectively. Maximum fresh weight of onion (14.541kg), minimum weight of dry scales after three month of storage life (0.023kg), Minimum weight of rotted and sprouted bulb after three months of storage life (1.095kg) were recorded with the treatment of harvesting without irrigation while minimum weight of fresh onion after three month of storage life (11.647kg), maximum weight of dry scales after three month of storage life (0.026kg), maximum weight of rotted and sprouted onion after three months of storage life (1.797kg) were recorded with treatment harvesting without irrigation.

The lowest rotting and sprouted loss in the control treatment may be due to the fact that control plots did not receive irrigation before harvesting that kept the bulbs less succulent and as a result less attacked by bacteria and fungi during storage. This result is in conformity with the findings of Trevisan *et al.* 1999 [14] in onion. Minimum per cent weight loss of onion after three month of storage life (27.29%) were recorded with treatment m_3, while maximum per cent weight loss (41.76%) were recorded with treatment m_1. The temperature and humidity were high during storage that might be attributed to the higher weight loss of stored onion. Rotting and re-growth increase the rate of respiration, heat generation and consequently enhance moisture loss and reduce the shelf life are the major factors of deterioration in onion bulbs during storage Yawalkar and Har (2004) [15]. The results of the present study are close agreement with those of Sharma *et. al*. 2007 [13]; Kale *et al*. 1992 [8]; Pandey and Bhonde (1992) [11] and Trevisan *et al.* 1999 [14] in onion.

Influence of time of curing on storage behaviour

Curing method significantly affected the storage behaviours of onion (table 2). Significantly minimum neck thickness was (0.952 cm) observed under treatment two days curing under field condition and maximum neck thickness of bulb was (1.104 cm) observed under treatment no curing further indicated that different time of curing was observed significant influences at the end of three month of storage. Maximum recovery of fresh onion after three month of storage life (14.856kg) was recorded with treatment four days field curing and minimum weight of fresh onion after three month of storage life (10.946kg) was recorded with no curing,. Significantly minimum weight of dry scales (0.014kg), weight of rotted and sprouted onion (1.081kg) was obtained with treatment four days field curing and maximum dry scales (0.044kg) and rotted and sprouted onion (1.789kg) were observed with treatment no curing at the end of three month of storage life.

Curing of onion after harvesting affects the neck thickness of bulb, due to thin neck of bulb protect from atmospheric high temperature and high humidity and ultimately promote the higher recovery of onion bulb during storage. These findings are in close accordance with the findings of Rao *et al.* 1967 [12]; Bhonde and Bhadauria (1995) [1]; Bhonde *et al*. (1996) [2] and Chadha and Sidhu (1989) [4] in onion. Influence of different time of curing were recorded at the end three month of storage life with respect to per cent weight loss was observed significant variation. Minimum per cent weight loss (25.72%) was observed with treatment c_2 and maximum (45.27%) was recorded with treatment c_5 at the end of three month of storage life. Minimum losses occur at the different stages of storage that is only due to proper cured bulb were put for storing. These findings are in close accordance with the findings of Chadha and Sidhu (1989) [4]; Rao *et al.* 1967 [12]; Bhonde and Bhadauria (1995) [1] and Chauhan *et al*. (1995) [5] in onion.

Thus, on the basis of the data, it can be concluded that highest yield of onion was obtained by irrigate the crop before two days of harvesting (m_1) with no curing while four days field curing significantly improves storage life of onion and which helps to fetch higher market price.

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