Effect of Curing and Top Removal Time on Quality and Shelf Life of Onions (*Allium Cepa* L.)

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Keywords: TSS, marketable bulbs, bulb fresh mass, bulb dry mass, sprouting bulbs.

1. Introduction

Onion (Allium cepa L.) is one of the oldest bulb crop, known to humankind and consumed worldwide. It is one of the most important commercial vegetable crop believed to be originated in Central Asia [17] and important vegetable crop grown in most parts of the world as food materials [21]. It is valued for its distinct pungent flavor and is an essential ingredient for the cuisine in many regions. The onion is preferred mainly because of its green leaves, immature and mature bulbs that used either raw or cooked as a vegetable. The bulb used in soups, sauces, condiments, spice, in medicine, seasoning of many foods and for the preparation of value added edible products like powder, flakes and salts [21].

Onion is important in the daily Ethiopian diet and all the plant parts are edible, although the bulbs are widely used as a seasoning or a vegetable in various dishes. It is one of the most economically important horticultural products in the country [1]. Edible alliums have been cultivated since ancient times. According to Boise [5], onion is a high value bulb crop produced by small farmers and commercial growers for both local and export markets in Ethiopia. It is an indispensable part of the daily meal of the Ethiopian dish as it improves the taste and scent of the food. Its production is concentrated in the central rift valley of the country, particularly in the upper Awash and Lake Zeway areas. Most of the farmers currently prefer ‘Bombay Red’ onion cultivar because of its early maturing character and in anticipation of reduction of production cost and time.

According to CSA report in 2006 [7], onion covered about 16578.72 ha of lands and more than 0.17 million tons of bulbs were obtained with an average yield of 10.6 tons/ha. The average yield of onion was 6.5 tons per ha which is far less than from the national and world average yield of 10.5 and 13.4 tons per ha, respectively [7,11].

Since onion is a seasonal crop sometimes with excess production, bulbs are prone to long storage, or farmers will sell in low price due to the postharvest and storage loss. Even farmers who store for next use will not be beneficial because of short storage life. As Biswas et al. [4] stated, after getting a good harvest of onion, farmers face storage problems in all conditions. Being a semi-perishable crop, onion is subject to deterioration during storage. Rotting, sprouting, and physiological weight loss cause storage loss of onions. Significant postharvest or storage losses occur in quality and quantity of onion including sprouting, diseases incidence, rotting and physiological weight loss due to variation in environmental condition, curing and drying method, storage condition etc. The shelf life of onion is influenced by various factors such as dry matter content, pungency, skin color, skin number and quality and length of natural dormancy period of the variety fertilizers and water regime during cultivation, treatment of sprouts suppressants and fungicides and postharvest factors (time and method of harvesting, curing and
storage condition packing materials). Rabbani [23] reported that storage losses in onion could be as high as 66%. Many factors, such as cultivars, bulb maturity, moisture content of the bulb, temperature, relative humidity, etc. are associated with spoilage of onion during storage.

Curing is the most important operation in the post-harvest technology of onion that helps in reducing the post-harvest decay and moisture loss due to the removal of excess moisture from the outer skin and neck of freshly harvested onion to a level where shrinkage from the interior will be less and reduction in microbial infection. Storage methods and condition have their own impact on post-harvest life and keeping quality of onion. Storage temperature and relative humidity are related with sprouting, rotting, and physiological weight loss and with storage periods.

The purpose for curing onion is to remove excess moisture from onion scales and neck, thereby reducing infection from disease carrying organisms, and minimizing shriveling by removing moisture from the interior [28]. FAO [9] reported that, it is not recommend to cut-off the green tops of bulb onions for small-scale producers because it greatly increases the risk of losses from decay if the bulbs cannot be dried quickly under controlled conditions. In large-scale commercial production, where the green tops are cut-off mechanically before harvest, drying is often carried-out using artificial heat with forced ventilation. This technique is not economical for small-scale production. Field-dried onions for small-scale production can be stored for up to two months under ambient conditions in well-ventilated trays on pallets or in a field windbreak. As stated by Fritz et al. [13], if onions are to be bulk-stored it is best to store them without their tops.

Farmers are forced to sell the crop immediately after bulbs cured on the field at very low prices because of lack of storage awareness (topping without curing). Among other postharvest practices that can enhance shelf life of onion, proper top removal (neck) at appropriate time, curing for some days and keeping at good storage condition are the major one. However, the exact days of topping and curing need to optimum quality. The problem related to cv ‘Bombay Red’ is shelf life <3 months but proper leaf removal and curing before storing may enhance shelf life provided that it is done properly and timely. In view of the limited information on the appropriate curing and topping studies in the Ethiopian context and the concomitant high post-harvest loss and limited shelf life of Bombay Red, the determination of proper date to top removal and curing will be of paramount importance to producers and handlers. Therefore, the objective of this study was to optimize the number of days required for curing and toping of bulbs of onion cv ‘Bombay Red’ for better shelf life and quality.

II. Materials and Methods

a) Description of the Study Site

The experiment was conducted at Melkassa Agricultural Research Center (MARC) from January to May 2012. Geographically, MARC is situated in the eastern part of Ethiopia, at 8°24’ North and 39°21’ East with altitude of 1550 m above sea level. The mean rainfall for this area is about 928 mm with a mean maximum temperature of 28.5°C and a mean minimum temperature of 12.6°C. The average relative humidity is 56%.

b) Experimental Material

Onion bulbs used for this study were purchased from three local farmers and were all from the cultivar Bombay Red. This cultivar was selected due to the fact that this cultivar is recommended by the MARC because it is well adapted to this area in Ethiopia. Bombay Red is a high yielding cultivar with a growth season of 90-110 days. All bulbs were produced under the same management practices recommended by the MARC. The farmers were selected based on management practice i.e. they were following the management practice recommended by the MARC and they were model farmers. The bulbs were purchased from the farmers’ farm during harvesting. All bulbs were collected on the same day.

c) Treatments and Design

The bulbs were sorted based on uniformity with absence of defects and then cured under shade for 0, 5, 10 and 15 days after harvesting then stored at room temperature (average 22.10°C) under corrugated iron roof with shade iron mesh of onion store constructed at MARC until half of the stored bulbs became unmarketable. Topping was done immediate after harvesting and after curing treatment with the five days interval for 15 days (i.e. none topped (T0), immediate topped after cured (T1), topped after 5 days of cured (T5); topped after 10 days cured (T10) and topped after 15 days cured (T15)). After cured, the bulbs stored at room temperature under corrugated iron roof with shade iron mesh and then topped within five days interval. For storage, 18 kg bulbs from each cured day were taken and further grouped into three equal lots, each representing a replicate. The experiment was laid out in a 4x5x7 factorial experiment curing, toping and storage, respectively. The experimental design was RCBD because one side of the mesh storage room was covered by shade. There was no equal distribution of sunlight.

d) Data Collected and Analysis

Every 15 days interval the data were recorded on bulbs fresh mass loss (%), sprouted bulbs (%), rotted bulbs (%), bulbs dry matter (%), Total soluble solids (TSS) (°B), bulbs color scale, marketable bulbs
The normality test checked; non-normal data transformed into log_{10} and statistically analyzed using SAS version 9.2. Mean separation was carried out using LSD (Least Significance Difference) test at P<0.01 and P=0.5 level.

The sprouting and rotted bulbs were counted separately in each treatment combination with interval of 15 days for 90 days and divided by the total number of bulbs then multiply by 100 to calculate sprouted and rotted percentage. Dry Matter was calculated as three healthy bulbs were randomly selected from each treatment, cut in to pieces, weighted, and dried by oven drier at 70°C for 2 hours and then checked until constant weight has been obtained then follows: dry matter percentage = (fresh weight/dry weight) * 100. Marketable Bulbs were recorded as: marketable bulbs percentage = (marketable bulbs weight/total bulbs weight) * 100. Marketable Bulbs (%) were recorded as:

### III. Results and Discussion

a) **Dry Mass (%)**

The effect of curing, topping and storage combinations with the advancement of storage time showed a highly significant difference (P<0.01) regarding dry mass percentage. It showed that gradual increment in both curing and topping treatments until 75 days storage (Fig. 1). Gradual increment of dry matter content could be resulted from lower moisture content of the bulbs that regardless drying and helped to increase in chemical constituents leading to the ultimate accumulation maximum dry matter. A finding by Hansen and Henriksen [15] showed slight increase in dry matter that was due to loss of moisture from the outer surface whereas the reduction corresponded well to hydrolysis of fructans and termination of the dormancy period where the bulbs began to sprout. This finding is in agreement with Pak et al. [22] who indicated that through storage, fructans were gradually hydrolyzed to fructose increasing dry matter during initial storage weeks and at the time of sprouting, sucrose was synthesized and transported to the sprout and basal plate for growth. Similar finding [32] reported that composition of cured and not-cured shallot bulbs showed that the treatments had highly significant effect on dry matter content of cured bulbs at harvest and during the first two weeks of storage.

b) **Bulb Skin Color**

The color development of stored bulbs showed a statistical difference (P<0.01) with the combination of curing, topping and storage (after curing) time. At the beginning of storage, the bulbs were light pink color then it changed to pink (15 days after storage) and light red (30 days after storage) in curing and topping combination (Fig. 2). Light redness was constant until 90 days for all combinations. The bulbs color changes might be the reduction of flavonol and anthocyanin glucoside concentrations found in the skin tissue during storage [29].

c) **Total Soluble Solids (TSS)**

The combination effect of curing, topping and storage (after cured) time showed a significant difference (P=0.05) on TSS value. There was no clear trend on TSS value during 90 days storage after curing. However, the maximum (15.67) TSS was observed in with the combination of C5T1, C15T0 and C15T10 during 15 days storage; C15T0 during 30 days storage; C15T0 during 45 days storage and C15T0 and C10T0 during 60 days storage (Table 1). According to EARO [11], the TSS of Bombay Red is 9.00 – 11.00 °Brix. The maximum value of TSS might be due to proper drying of the bulbs and the conversion of polysaccharides into soluble form of sugars [26]. According to the finding of Wheeler et al. [31], lowest level of TSS appeared with uncured and non-topped bulbs and the highest for cured and non-topped bulbs, which was 13.17 % and 15.87 %, respectively stored for 400 days. These authors described that the difference for TSS was the movement of TSS from the foliage to the bulb until total fall over of the top and that bulb loss moisture by curing increase concentration of soluble solids of the bulb.

d) **Marketable Bulbs**

Curing, topping and storage (after curing) time combination significantly (P=0.05) affected the percentage of marketable bulbs. The percentage of marketable bulbs started to decline after 15 days of storage (Figure 3). On the 60th day, 60% of the treatments had 70 to 80% of marketable bulbs. On the 75 days, 5% treatments had 70 & 80% marketable bulbs. On the 90th day, 90% of treatments recorded a value of <50%. The minimum value of 15.3 % was recorded in bulbs without curing and topped after 15 days of curing during 60 days of storage. The maximum marketable bulbs were recorded curing for 10 days and without topping (65.56%) during 60 days of storage. This might be due to immediate or topping after curing may favor for rot diseases, which increase rotted bulbs (Figure 4). Storage (90 days) without curing or storing after 5 days curing would also not be suitable for long time storage. It also may create good environment for disease development.
e) **Bulbs Fresh Mass Loss**

The effect of curing, topping and storage (after curing) combinations showed a significant difference ($P=0.05$) on bulb fresh mass loss. With the advancement of storage period, the bulbs fresh mass loss was increased (Figure 5). Except bulbs cured for 10 days and none topped bulbs in which the fresh mass loss was 34.43 % on the 90 days of storage. The maximum fresh mass loss was 71.33 % on the 90 days of storage when the bulbs were cured for 15 days and topped after 5 days of curing.

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**Fig. 1**: Effect of curing and topping time on percent dry mass of onion cultivar ‘Bombay Red’ $C_0 =$ not cured, $C_5 =$ cured for 5 days, $C_{10} =$ cured for 10 days, $C_{15} =$ cured for 15 days, $T_0 =$ not topped, $T_1 =$ topped immediately of curing, $T_{5} =$ topped 5 days after curing, $T_{10} =$ topped 10 days after curing, $T_{15} =$ topped 15 days after curing

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**Fig. 2**: Effect of curing, topping and storage (after curing) time on bulb color of onion cultivar ‘Bombay Red’

Color scale: 5 = Deep Red, 4 = Red, 3 = Light Red, 2 = Pink and 1 = Light pink, $C_0 =$ not cured, $C_5 =$ cured for 5 days, $C_{10} =$ cured for 10 days, $C_{15} =$ cured for 15 days, $T_0 =$ not topped at all, $T_1 =$ topped immediately of curing, $T_{5} =$ topped 5 days after curing, $T_{10} =$ topped 10 days after curing, $T_{15} =$ topped 15 days after curing
After 90 days of storage, 90% of the most of curing and topping combinations showed >50.00% bulb fresh mass loss. Bulbs cured for 10 days without topped recorded 34.43% of bulbs fresh mass loss, which was the least loss. The least fresh mass loss may be attributed to the proper curing of bulbs that makes the outer scales and tight neck checking further escape of moisture and thus reduced the fresh weight loss during storage.

The findings of Thamps on et al. [30], Sidhu and Chadha [27] showed that fresh bulbs weight loss was lesser in cured bulbs during storage than the not-cured bulbs stored for 87 days. The maximum fresh bulbs weight loss may be due to absence of foliage resulting in full exposure of the bulbs to the radiant temperature leading to increased surface temperature of the bulbs helping to hasten the process of moisture reduction. This result is in agreement with the results obtained by Satish and Ranganna [25] and Kukanoor [17].

f) Rotted Bulbs

The effect of curing, topping and storage (after curing) time combinations showed a significant difference ($P=0.05$) on rotted bulbs. Until the 30 days of storage, there were not rotted bulbs observed in all treatment combinations and on the 45th days of storage none cured bulbs and topped after 15 days of curing recorded 0.50% and 0.52% of rotted bulbs, respectively (Figure 5). No rotted bulbs were recorded until 90 days of storage in none cured bulbs and none topped and topped immediately of curing (T1), bulbs cured for 5 days and none topped bulbs and bulbs cured for 10 days with topped immediately. On the other hand, bulbs cured for 10 days with none topped bulbs no rotted bulbs were recorded until 90 days of storage after cured. At the end of the storage period (90 days), the maximum percentage of rotted bulbs were recorded in bulbs cured for 15 days and without topped (4.71%) followed by bulbs cured for 15 days and topped after 10 days of curing (4.41%). While the minimum were in bulbs cured for 10 days and none topped bulbs (0.00%).

Kukanoor [17] and Sidhu and Chadha [27] observed similar findings. The least rotting percentage may be because of dried and closed bulb neck, which helps in reducing the chances of microorganism entry into the bulbs and lower order of pathological decay of microorganisms due to reduction in the moisture content of the onion bulbs. Maude et al. [19], Fenwick and Hanley [12] and Srivastava [28] stated that curing dries the thin outer layers of the bulb to form one or more complete outer skins and these outer skins act as a barrier against infection from pathogens (rot). Metthananda [20] estimated that bulb rot contributes to 10 – 15% of storage losses of different varieties during three months storage period Rajapakse and Eidrimanna [24].

g) Sprouted Bulb

The effect of curing, topping and days of storage showed a statistical difference ($P=0.05$) regarding to sprouted percentage ‘Bombay Red’ (Figure 6). Sprouting leads to the 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. Kukanoor [17] reported that, sprouting is one of the major causes for qualitative as well as quantitative deterioration of stored onion bulbs.
With regard to sprouted bulbs percentage from the effect of days of storage, no sprouted bulbs were recorded until 15 days of storage in all treatment combinations. The percent of sprouted bulbs were increasing with the advancement of storage period (45 days) and the maximum percentage of sprouted bulbs were recorded at the end of the storage period (90 days) which was 68.09% in bulbs cured for 10 days and topped 15 days after cured. The lowest bulbs sprout (23.5%) was observed in bulbs cured for 10 days and without topped.

As reported by Anike [2], the end of onion dormancy can be judged by the appearance of internal sprouting which eventually extends from the neck of the bulb. According to the findings of Benkeblia et al. [3], onion sugar content and dormancy are related with sprouting of onions. TSS in onion bulbs stored under ambient condition between 5 and 7 weeks coincided with the onset of sprouting [3]. In the same study, the reduction in TSS coincided with sprouting after 5 - 8 weeks storage at both 10°C and 20°C. Wheeler et al. [31] reported that sprouting in storage was associated with lower levels of total water-soluble solids in the center of bulbs.

The combinations of curing, topping and storage (after curing) time showed highly significant difference (P<0.01) regarding the total loss of bulbs. The maximum percentage of total bulb loss were recorded after 90 days storage in bulbs cured for 10 days and topped after 15 days of curing (71.9%) followed by bulbs stored without cured and then topped 15 days after curing (61.2%) (Figure 7). On the other hand, the minimum bulb loss was recorded in bulbs cured for 10 days and stored without topping (23.5%) at the end of storage (90 days).

The mean storage loss of onion bulbs in this study comprised of physiological weight loss and sprouted bulbs ranked in their order of importance. Since the experiment has conducted from January to May when the temperature is high (19.32-23.42°C) and low humidity that resulted highest bulb fresh loss and lower sprouted. Tripathi [8] reported that 40 to 50% of the stored onion never reaches to the consumers because of various types of losses. These losses are comprised of bulbs fresh loss and shrinkage (30-40%) and sprouting (8-10%).

The highest storage loss was from bulbs fresh mass loss followed by sprouted and rotted bulbs. This was due to the highest temperature and low humidity during the experimentation.

As Goburdham [14] reported, Curing of onion bulbs specifically involves drying of external scales to protect the bulbs against subsequent microbial infection. Moreover, Goburdham [14] concluded that the storage life bulbs cured for 14 to 21 days and stored at the room temperature, could be extended up to two months over the control. Purpose of curing is the removal of excess moisture from the outer skin and neck.

Fig. 4 : Effect of curing, toping and storage (after curing) time on bulb fresh loss of ‘Bombay Red’

C0 = not cured, C5 = cured for 5 days, C10= cured for 10 days, C15= cured for 15 days, T0= not topped at all, T1= topped immediately of curing, T5= topped 5 days after curing, T10= topped 10 days after curing, T15= topped 15 days after curing.
portion of onion that helps in reducing the infection of diseases. This also helps in minimizing shrinkage due to moisture loss from the interior portion. Further, curing is an additional measure for the development of skin color. It is also practiced to remove field heat before onion bulbs are stored. Onions are considered for curing when neck is tight and outer scales are dried until they rustle and curing can take place either in field or in open sheds or by artificial means before or in storage even if the time length required for curing operation largely depends on the weather condition.

![Effect of curing, topping and storage (after cured) time on rotted bulbs of ‘Bombay Red’](image)

**Fig. 5:** Effect of curing, topping and storage (after cured) time on rotted bulbs of ‘Bombay Red’

C0 = not cured, C5 = cured for 5 days, C10 = cured for 10 days, C15 = cured for 15 days, T0 = not topped at all, T1 = topped immediately of curing, T5 = topped 5 days after curing, T10 = topped 10 days after curing, T15 = topped 15 days after curing

**Table 1:** Effect of curing, topping and storage (after curing) time on TSS of bulb of onion ‘Bombay Red’

<table>
<thead>
<tr>
<th>Curing (C) and Topping (T)</th>
<th>Days after curing</th>
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<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>C0</td>
<td>14.67(2.11)c</td>
</tr>
<tr>
<td>T1</td>
<td>12.67(2.10)c</td>
</tr>
<tr>
<td>T5</td>
<td>13.00(2.11)c</td>
</tr>
<tr>
<td>T10</td>
<td>13.00(2.11)c</td>
</tr>
<tr>
<td>T15</td>
<td>12.67(2.10)c</td>
</tr>
<tr>
<td>C5</td>
<td>14.00(2.16)b</td>
</tr>
<tr>
<td>T1</td>
<td>14.00(2.15)b</td>
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<tr>
<td>T5</td>
<td>14.33(2.16)ab</td>
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<tr>
<td>T10</td>
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<td>T15</td>
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CV (%) 18.39

LSD (5%) 0.61
Fig. 6: Effect of Sprouted bulbs of Bombay Red during 90 days of storage

C0 = not cured, C5 = cured for 5 days, C10 = cured for 10 days, C15 = cured for 15 days, T0 = not topped at all, T1 = topped immediately of curing, T5 = topped 5 days after curing, T10 = topped 10 days after curing, T15 = topped 15 days after curing

CV (%) = 44.09
LSD = 0.77

Fig. 7: Effect of curing, topping and storage (after curing) time on bulbs total loss of ‘Bombay Red’

C0 = not cured, C5 = cured for 5 days, C10 = cured for 10 days, C15 = cured for 15 days, T0 = not topped at all, T1 = topped immediately of curing, T5 = topped 5 days after curing, T10 = topped 10 days after curing, T15 = topped 15 days after curing

CV (%) = 28.99
LSD = 0.69
IV. Conclusions and Recommendations

During the storage period of 90 days, the maximum values of Dry Matter (14.9 %) were observed in bulbs cured for 15 days and topped after 15 days of curing. Maximum total soluble solid (15.330B), marketable bulbs (65.56 %) were observed in bulbs cured for 10 days and without topped. The minimum physiological weight loss (34.44%), rotted bulbs (0 %), sprouted bulbs (23.50 %) and total loss (23.5 %) were recorded in bulbs cured for 10 days and without topping. Therefore, bulbs cured for 10 days and none topped until 90 days storage time would recommended as the best practice to maintain quality, solve the shelf life problem and prolong the shelf life of Bombay Red to encourage the cultivation.

Competing Interests

Authors have declared that no competing interests exist.

References Références Referencias


29. Terry L, Downes K, Chope G. Relationship between colour and biochemical composition of skin from 'Red Baron' onion bulbs cured at different temperatures. in VI International Postharvest Symposium 877. 2009.

