

EFFECT OF ONION BULB TEMPERATURE AND HANDLING ON BRUISING

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Introduction

There is some evidence that onion handling after harvest can bruise bulbs and cause symptoms similar in appearance to translucent scale. Several shippers have suggested that the effect of handling on bruise may be influenced by bulb temperature during handling and by length of time after handling before the onions are checked. This trial tested the effect of handling 4 onion varieties at 2 temperatures on bruise and on bulb recovery after 3 days storage at 38°F.

Methods

Trial 1

Prior to evaluating variety susceptibility to bruise in January 2004, a preliminary test of the effect of drop height on bruise was conducted. Fifteen onions from mixed varieties were each dropped on their sides onto a concrete floor from heights of 0.8 m (2 ft, 7 inches), 1 m (3 ft, 4 inches), 1.2 m (3 ft, 11 inches), or 1.4 m (4 ft, 7 inches). The onions were cut equatorially and rated for damage. During rating we noted where in the bulb the damage occurred and whether the appearance was of translucent or watery, mushy rings. The damaged or bruised area had the form of a triangle (Fig. 1) which extended from the surface to the center of the bulb. When the affected scales were translucent, the damage was different from typical translucent scale in that the scales were only translucent in the bruised area.

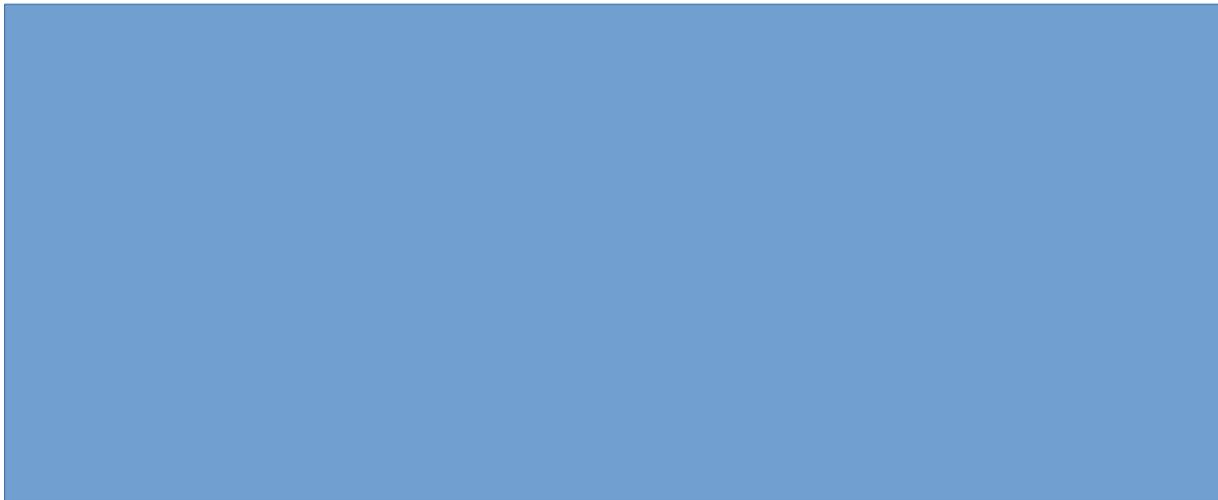


Figure 1. Diagram of onion bulb damage or bruising resulting from a drop of 1 m (3 ft, 4 inches).

All drop heights resulted in bulb damage (Table 1). The lowest drop height of 0.8 m (2 ft, 7 inches) resulted in less pronounced damage.

Table 1. Number of onions out of 15 with visible damage or translucent scale after being dropped on a concrete floor from different heights.

| Drop height | | Onions with damage |
|-------------|--------------|--------------------|
| meters | (ft, inches) | |
| 0.0 | 0 | 0 of 15 |
| 0.8 | 2'7" | 10* of 15 |
| 1.0 | 3'4" | 8 of 15 |
| 1.2 | 3'11" | 10 of 15 |
| 1.4 | 4'7" | 11 of 15 |

*damage was less pronounced.

Trial 2

Onions of four varieties were randomly placed in nylon mesh bags (24 bags per variety). Given the availability of bulbs, there were 24 bulbs/bag of 'Delgado' (Bejo Seeds), 28 bulbs/bag of 'Granero', 27 bulbs/bag of 'Vaquero', and 30 bulbs/bag of 'Bandolero' (all three Nunhems). On January 13, 2005 the 24 bags of each variety were placed in 2 coolers: 12 at 32°F and 12 at 38°F. Three days later the bags were removed a few at a time from the coolers and were either not handled or handled by dropping each bulb from each bag individually on its side onto a concrete floor from a height of 1 m (3 ft, 4 inches). The spot of impact was marked on the onion bulb. After the handling treatments, half of the bags were put in a cooler at 38°F and the bulbs in the other half of the bags were immediately cut equatorially and rated for bruising. Three days after dropping, the onions in the bags stored in the cooler were rated individually for bruising. The number of bruised bulbs and the number of bruised rings in bruised bulbs was recorded. The width of the bruised area (Fig. 1) was also recorded. Rings with a watery appearance were judged to be bruised. Each treatment was replicated three times (three bags) for each variety (Table 2).

Table 2. Treatments applied to four onion varieties in January 2005.

| Treatment | Pretreatment storage | Handling treatment | Post-treatment storage |
|-----------|----------------------|--------------------|------------------------|
| 1 | 32°F | Drop | no storage |
| 2 | | | storage at 38°F |
| 3 | | No Drop | no storage |
| 4 | | | storage at 38°F |
| 5 | 38°F | Drop | no storage |
| 6 | | | storage at 38°F |
| 7 | | No Drop | no storage |

Results

Averaged over varieties and pretreatment storage temperatures, 82.2 percent of the dropped bulbs showed bruise damage compared to 1.6 percent of the bulbs that were not dropped (Table 3). There was no significant difference in the percentage of bruised bulbs before or after storage. In 2004, the percentage of bruised bulbs was higher after storage, because the affected rings became more translucent and hence more detectable. In 2005, the damage before storage, in the form of mushy, watery rings, was easy to detect. Averaged over varieties, the percentage of dropped bulbs that showed bruise damage after storage was similar in 2004 (80.4) and in 2005 (81.6).

Averaged over varieties, there was no significant difference in percentage of bruised bulbs that were at 32°F (81 percent) when dropped compared to bulbs that were at 38°F (83.2 percent). In 2004, there was a small but significant difference between the percentage of bruised bulbs that were at 32°F (75.6 percent) when dropped and bulbs that were at 38°F (70.8 percent). Averaged over varieties, the percentage of rings that showed bruising in bruised bulbs was higher in bulbs stored at 38°F (69.9 percent) than at 32°F (64.9 percent). In 2004, the percentage of rings that showed bruising in bruised bulbs was higher in bulbs stored at 32°F (91.8 percent) than at 38°F (89.4 percent).

Averaged over temperature, variety, and handling treatment, the percentage of rings that showed bruising in bruised bulbs was lower after 3 days of storage (53.1 percent) than immediately after dropping (81.6 percent). In 2004, averaged over temperature and variety, the percentage of rings that showed bruising in bruised bulbs was also lower after 3 days of storage (82.4 percent) than immediately after dropping (98.8 percent), but the difference was smaller than in 2005. Averaged over temperature and variety, the width of the bruised area was narrower after 3 days of storage than immediately after dropping.

There was no significant difference between varieties in the percentage of bruised bulbs. Averaged over temperature and time, Granero had the highest percentage of bruised rings in bruised bulbs, and Vaquero had among the lowest percentage of bruised rings. The width of damage in bruised bulbs was widest for Granero. Granero was the only variety that did not have a lower percentage of rings that showed bruising in bruised bulbs after storage. In 2004, Vaquero had the highest percentage of bruised bulbs and Bandolero was among the lowest in percentage of bruised bulbs. In 2004, Bandolero and Vaquero were among the lowest in percentage of bruised rings in bruised bulbs.

Discussion

Onions are clearly very sensitive to bruise injury during handling, which could contribute to undesirable bulb quality at arrival for retail sales and processing. The influence of bulb temperature at dropping on bruising was small in 2004 and 2005. Bruising damage can become more evident over time after dropping, as in 2004. However, both in 2004 and 2005 a healing process started, as shown by the lower percentage of bruised rings

in bruised bulbs after 3 days of storage. It would be desirable to explore the recovery time necessary for bruising injury to disappear.

There were differences between the varieties in susceptibility to bruising injury, but the differences were small and not consistent between years. The full range of variability in variety susceptibility to bruising injury is not known. Observations were made only on four varieties in this preliminary trial.

Table 3. Effect of prehandling temperature, handling, and time after handling on onion bulb bruising, Malheur Experiment Station, Oregon State University, Ontario, OR, 2005.

| | Prehandling | | Bruised bulbs | | | Affected rings in bruised bulbs | | | Width of damage in bruised bulbs | | |
|-------------------|------------------------|---------|---------------|------|------|---------------------------------|------|------|----------------------------------|-----|-----|
| | °F | | ----- % ----- | | | ----- % ----- | | | ----- cm ----- | | |
| Delgado | 32 | Drop | 91.7 | 87.5 | 89.6 | 92.1 | 51.9 | 72.0 | 5.4 | 4.8 | 5.1 |
| | | No Drop | 4.2 | 0.0 | 2.1 | 18.2 | 0.0 | 9.1 | 1.4 | 0.0 | 0.7 |
| | 38 | Drop | 76.4 | 90.3 | 83.4 | 84.8 | 58.1 | 71.5 | 5.8 | 5.0 | 5.4 |
| | | No Drop | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Avg | Drop | 84.0 | 88.9 | 86.5 | 88.4 | 55.0 | 71.7 | 5.6 | 4.9 | 5.3 |
| | | No Drop | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Granero | 32 | Drop | 85.7 | 65.5 | 75.6 | 83.6 | 51.3 | 67.5 | 5.9 | 3.9 | 4.9 |
| | | No Drop | 1.2 | 3.6 | 2.4 | 25.0 | 17.9 | 21.5 | 1.0 | 1.2 | 1.1 |
| | 38 | Drop | 81.0 | 97.6 | 89.3 | 80.4 | 78.8 | 79.6 | 5.2 | 5.7 | 5.5 |
| | | No Drop | 6.0 | 1.2 | 3.6 | 41.7 | 19.4 | 30.6 | 2.5 | 2.0 | 2.3 |
| | Avg | Drop | 83.3 | 81.5 | 82.4 | 82.0 | 65.1 | 73.6 | 5.6 | 4.8 | 5.2 |
| | | No Drop | 3.6 | 2.4 | 3.0 | 33.4 | 18.7 | 26.1 | 1.8 | 1.6 | 1.7 |
| Vaquero | 32 | Drop | 84.0 | 72.8 | 78.4 | 80.4 | 40.8 | 60.6 | 5.6 | 5.0 | 5.3 |
| | | No Drop | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 38 | Drop | 81.5 | 69.1 | 75.3 | 78.9 | 34.1 | 56.5 | 5.6 | 3.3 | 4.5 |
| | | No Drop | 6.0 | 1.2 | 3.6 | 41.7 | 19.4 | 30.6 | 2.5 | 2.0 | 2.3 |
| | Avg | Drop | 82.7 | 71.0 | 76.9 | 79.6 | 37.4 | 58.5 | 5.6 | 4.2 | 4.9 |
| | | No Drop | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Bandolero | 32 | Drop | 77.8 | 83.3 | 80.6 | 76.3 | 42.8 | 59.6 | 5.0 | 4.9 | 5.0 |
| | | No Drop | 0.0 | 2.2 | 1.1 | 0.0 | 12.8 | 6.4 | 0.0 | 2.0 | 1.0 |
| | 38 | Drop | 83.3 | 86.7 | 85.0 | 76.6 | 67.2 | 71.9 | 5.1 | 5.0 | 5.1 |
| | | No Drop | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Avg | Drop | 80.6 | 85.0 | 82.8 | 76.4 | 55.0 | 65.7 | 5.1 | 4.9 | 5.0 |
| | | No Drop | 0.0 | 1.1 | 0.6 | 0.0 | 6.4 | 3.2 | 0.0 | 1.0 | 0.5 |
| Over all averages | 32 | Drop | 84.8 | 81.6 | 81.1 | 83.1 | 46.7 | 64.9 | 5.5 | 4.7 | 5.1 |
| | | No Drop | 1.3 | 1.4 | 1.4 | 10.8 | 7.7 | 9.3 | 0.6 | 0.8 | 0.7 |
| | 38 | Drop | 80.5 | 85.9 | 83.2 | 80.2 | 59.6 | 69.9 | 5.5 | 4.8 | 5.2 |
| | | No Drop | 3.0 | 0.6 | 1.8 | 20.9 | 9.7 | 15.3 | 1.3 | 1.0 | 1.2 |
| | Avg | Drop | 82.7 | 81.6 | 82.2 | 81.6 | 53.1 | 67.4 | 5.5 | 4.7 | 5.1 |
| | | No Drop | 2.2 | 1.0 | 1.6 | 15.8 | 8.7 | 12.3 | 0.9 | 0.9 | 0.9 |
| LSD (0.05) | Handling | | | | 3.9 | 5.1 | | | | 0.3 | |
| | Temperature | | | | NS | 1.7 | | | | NS | |
| | Time | | | | NS | 1.7 | | | | 0.1 | |
| | Temp. X Time | | | | NS | 2.4 | | | | NS | |
| | Variety | | | | NS | 2.4 | | | | 0.2 | |
| | Temp. X Variety | | | | NS | 3.3 | | | | 0.2 | |
| | Time X Variety | | | | NS | 3.3 | | | | 0.2 | |
| | Temp. X Time X Variety | | | | NS | 4.7 | | | | 0.3 | |