PRELIMINARY OBSERVATIONS ON THE 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 can 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 four onion varieties at two temperatures on bruise.

Methods

Trial 1

Prior to evaluating variety susceptibility to bruise, 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 it was noted that the damage was in part of the bulb and had the appearance of either 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. The bruise damage was different from typical translucent scale in that the scales were only translucent in the bruised area.

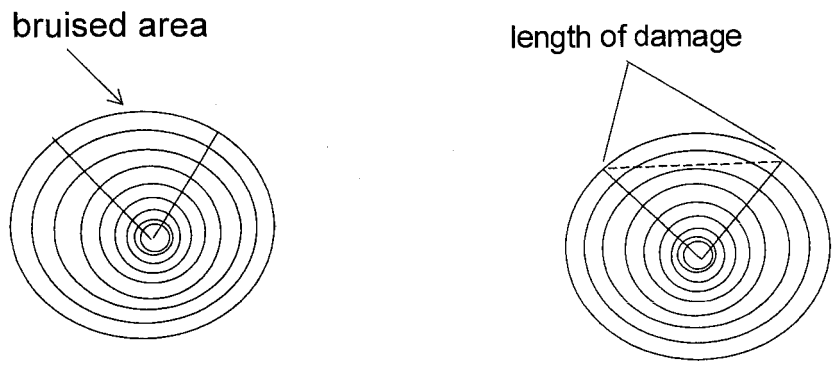

Figure 1. Diagram of onion bulb damage or bruising resulting from a drop from a height of 1 m (3 ft, 4 inches).

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

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		
meters	(feet, inches)	Onions with damage
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 placed in nylon mesh bags (24 bags per variety). Given the availability of bulbs, there were 31 bulbs/bag of 'Delgado' (Bejo Seeds), 34 bulbs/bag of 'Granero', 23 bulbs/bag of 'Vaquero', and 28 bulbs/bag of 'Bandolero' (all three Sunseeds). On January 23, 2004 the bags were placed in two coolers: one at 32°F and one at 38°F. On January 26 and 27, the bags were removed a few at a time from the coolers and were either not handled or handled by dropping all bulbs in each bag on their sides onto a concrete floor from a height of 1 m (3 ft, 4 inches). 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 bags stored in the cooler were rated for bruising. Each treatment was replicated three times (three bags) for each variety (Table 2).

Table 2. Treatments applied to four onion varieties.

Treatment	Pre-treatment 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
8			storage at 38°F

The number and location of the bruised or watery rings was recorded. The length of the bruised area (Fig. 1) was also recorded.

Results

The varieties tested here did not differ significantly in their tendency to bruise with dropping. Bruising from dropping for all varieties, except Bandolero, was significantly higher after storage for 3 days than immediately after dropping (Table 3). The bruised rings became more translucent after storage, making the damage more pronounced and detectable. Averaged over all varieties and over the two temperatures, 66 percent and 80 percent of the dropped bulbs showed bruising before and after short-term storage, respectively.

Averaged over varieties and handling treatments, bulbs that were at 32°F when dropped showed a higher percentage of bruised bulbs than bulbs that were at 38°F. Averaged over the two temperatures and over varieties, the percentage of rings that showed bruising was lower after 3 days of storage than immediately after dropping. Averaged over temperature, handling, and variety, the length of the bruise was lower after 2 days of storage than immediately after dropping.

Discussion

Clearly onions are very sensitive to bruise injury during handling. This bruising could contribute to undesirable bulb quality at arrival for retail sales or processing.

It would be desirable to know the maximum drop onions can withstand and still recover from that injury. 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. We did not evaluate the effects of post-bruising temperature on bulb recovery or fully explore the recovery time necessary for bruising injury to disappear.

Table 3. Effect of pre-handling temperature, handling, and time after handling on onion bulb bruising, Malheur Experiment Station, Oregon State University, Ontario, OR, 2003.

Variety	Pre-treatment storage temperature	Handling treatment	Bruised bulbs			Affected rings in bruised bulbs			Length of damage in bruised bulbs	
			Before storage	After storage	Avg.	Before storage	After storage	Avg.	Before storage	After storage
	°F		%			%			cm	
Delgado	32	Drop	64.5	89.3	76.9	99.1	92.3	95.7	5.64	5.64
		No drop	2.2	2.2	2.2	66.7	24.4	45.6	2.33	1.00
	38	Drop	65.6	75.3	70.5	99.7	91.1	95.4	5.77	5.72
		No drop	2.2	0.0	1.1	31.7	0.0	15.9	1.50	0.00
	Average	Drop	65.0	82.3	73.7	99.4	91.7	95.6	5.71	5.68
		No Drop	2.2	1.1	1.7	49.2	12.2	30.7	1.92	0.50
Overall variety average			33.6	41.7	37.7	74.3	52.0	63.2	3.81	3.09
Granero	32	Drop	66.7	87.3	77.0	99.9	85.2	92.6	6.22	5.95
		No drop	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00
	38	Drop	71.6	79.4	75.5	94.7	84.2	89.5	5.89	5.38
		No drop	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00
	Average	Drop	69.2	83.3	76.3	97.3	84.7	91.0	6.05	5.67
		No Drop	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00
Overall variety average			34.6	41.7	38.2	48.6	42.4	45.5	3.03	2.83
Vaquero	32	Drop	79.7	95.7	87.7	99.6	84.1	91.9	6.07	5.80
		No drop	5.8	1.5	3.7	66.7	2.2	34.5	4.33	2.33
	38	Drop	62.3	91.3	76.8	98.4	71.9	85.2	6.61	5.73
		No drop	2.9	2.9	2.9	66.7	2.3	34.5	3.67	1.83
	Average	Drop	71.0	93.5	82.3	99.0	78.0	88.5	6.34	5.76
		No Drop	4.3	2.2	3.3	66.7	2.3	34.5	4.00	2.08
Overall variety average			37.7	47.9	42.8	82.8	40.1	61.5	5.17	3.92
Bandolero	32	Drop	60.7	60.7	60.7	99.4	74.6	87.0	5.74	5.15
		No drop	2.4	4.8	3.6	66.7	34.5	50.6	1.67	3.17
	38	Drop	56.0	64.3	60.2	99.2	75.9	87.6	5.59	5.02
		No drop	1.2	1.2	1.2	33.3	14.3	23.8	1.67	1.67
	Average	Drop	58.4	62.5	60.5	99.3	75.3	87.3	5.67	5.09
		No Drop	1.8	3.0	2.4	50.0	24.4	37.2	1.67	2.42
Overall variety average			30.1	32.8	31.5	74.7	49.8	62.3	3.67	3.75
Over all averages	32	Drop	67.9	83.3	75.6	99.5	84.0	91.8	5.92	5.63
		No drop	2.6	2.1	2.4	50.0	15.3	32.7	2.08	1.63
	38	Drop	63.9	77.6	70.8	98.0	80.8	89.4	5.96	5.46
		No drop	1.6	1.0	1.3	32.9	4.2	18.6	1.71	0.88
	Average	Drop	65.9	80.4	73.2	98.8	82.4	90.6	5.94	5.55
		No drop	2.1	1.6	1.9	41.5	9.7	25.6	1.90	1.25
	32	Average	35.3	42.7	39.0	74.8	49.7	62.3	4.00	3.63
	38	Average	32.7	39.3	36.0	65.5	42.5	54.0	3.84	3.17
		Average	34.0	41.0	37.5	70.2	46.1	58.1	3.92	3.40
LSD	Temperature				2.3			NS		NS
	Handling				NS			NS		0.50
	Time				2.3			8.6		0.50
	Variety				NS			NS		0.70
	Handling X Time				3.2			NS		NS
	Handling X Variety				NS			NS		1.00
	Time X Variety				NS			24.2		NS
	Temp. X Time X Variety				6.4			NS		NS
	Handling X Time X Variety				6.4			NS		NS