ONION TOPPING AND HEAT TREATMENT FOR STORAGE, 1996-1997

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Ontario, Oregon, 1997

Purpose

Onion growers would like to reduce harvesting cost and still achieve high quality onions out of storage. This trial compared hand topped, flail topped, and untopped Valdez sweet Spanish onions for decay and weight loss from all sources during storage. Onions with each type of topping were either heat treated to a pulp temperature of 90 ^{o}F or not heat treated after harvest and before storage.

Procedures

The 1996-1997 onion storage trial was grown on the Malheur Experiment Station on an Owyhee silt loam following wheat. The soil had 1.2 percent organic matter and a pH of 7.3. The wheat stubble was shredded and the field deep-chiseled, disked, irrigated, moldboard-plowed, roller harrowed, and bedded in the fall. Before the plowing operation in the fall, 100 lbs/ac of P_2O_5, and 60 lb N/ac were broadcast. After bedding, the field was left until spring without further tillage.

Valdez onion seed was planted April 9 in 22-inch single-row beds. Seed was planted using four cone-seeders mounted on John Deere Model 71 Flexi-planter units equipped with disc openers.

The onions were furrow-irrigated as needed during the growing season. The first irrigation was applied on April 13 to supply the soil with moisture for seed germination. Between May 28 and June 1 the seedling onion plants were thinned by hand to a plant population of four plants per foot of row (3-inch spacing between individual onion plants). On June 3, 100 lb N/ac as Urea was sidedressed along both sides of every row. On June 15, a second sidedressing 100 lb N/ac as Urea was applied.

The trial was managed to avoid yield reductions from pests. Dacthal was applied pre-plant and Lorsban 15G was applied for onion maggot control on May 11. Weeds were controlled with cultivations and low rate herbicide applications as needed until layby. On July 5, layby herbicides Buctril, Goal, Poast, and Prowl were applied, with Warrior insecticide for thrips control. On August 7, Lannate was aerially applied.

Onion topping treatments consisted of flailed, hand topped, and untopped bulbs in a randomized complete block design with seven replicates. Ten 70 to 80 lb boxes of onions were harvested from each plot. The gross weight of each box plus onions was determined out of the field. After weighing, half of the boxes (5) from every plot

received heat treatment with forced air at 105 °F. Heat treatment continued for up to 2 hours until the onion pulp temperature 1 cm deep in the bulb tissue reached 90 °F. The other 5 boxes from each plot did not receive the heat treatment.

Onions were flailed when the plants were near maturity on September 10. The onion bulbs were lifted on September 11 so they could finish drying in the field. On September 15, 0.10 inches of rain fell, followed by 0.44 inches of rain on September 16. The onions were hand-topped on October 2 and the onions from all treatments were placed into slatted wooden crates. The crates were transported to storage October 7 to 9, where they either were or were not heat treated. Afterwards the crates were placed into wooden bins (4 x 4 x 6 feet) for storage.

The onions were removed from storage, and graded on January 2, 1997. Bulbs were graded according to their diameter and quality. Size categories were 2¼ to 3-inch (medium), 3 to 4-inch (jumbo), and 4-inch and larger (colossal). Bulbs rotted by *Botrytis* neck rot, plate rot, and black mold during storage were separated and weighed. The percent of rotten bulbs from each disease was calculated. Empty crates were weighed to allow the calculation of additional weight loss from tops, skins, water, respiration, and dirt during storage and grading.

Treatments were compared using ANOVA and least significant differences at the 5 percent level, LSD (0.05).

Results and Discussion

The environmental conditions following the rainfall in mid-September were favorable for onion curing. Averaged over all treatments, 94.19 percent of the onion weight into storage was recovered as marketable onions on January 2, 1997 (Table 1). Total losses averaged only 5.81 percent and were as follows: black mold (0.05 percent), plate rot (2.55 percent), neck rot (0.51 percent), and losses of tops, skins, water, and dirt (2.70 percent). Due to the very low incidence of neck rot in these onions, no response to heat treatment would be expected, and none was found.

As expected, untopped bulbs lost slightly more weight to the loss of tops, skins, water and dirt than hand-topped and untopped onions.

Untopped-unheated onions had one of the highest recoveries of marketable bulbs (95.74 percent) in this trial. Untopped-heated bulbs had one of the lowest recoveries of marketable bulbs, yet the recovery was still relatively high in industry terms at 92.61 percent. Untopped-heated bulbs suffered more plate rot and other weight loss during storage in this trial.

This trial should be repeated over several years, so that these treatments can be evaluated when the incidence of neck rot is high. The experiment could be enhanced by the addition of onions topped by a "topper-loader".

Table 1. Storage loss of Valdez onions subjected to variable topping and heat treatments. Onions were stored from late September 1996 to January 2, 1997.

		Loss by type					
		Black mold	Plate rot	Neck rot	Other loss	Total loss	Sound onions
		---------- % ----------				%	%
Topping Method							
Flail topped		0.04	2.58	0.6	2.35	5.57	94.43
Untopped		0.11	2.23	0.32	3.16	5.82	94.18
Hand topped		0	2.85	0.61	2.57	6.03	93.97
LSD (0.05) topping		ns	ns	ns	0.55	ns	ns
Heat treatment							
Unheated		0.02	2.28	0.55	2.59	5.44	94.56
Heated to 90°F		0.07	2.83	0.47	2.8	6.17	93.83
LSD (0.05) heating		ns	ns	ns	ns	ns[§]	ns
Treatments							
Topping method	Heat treatment						
Flail topped	Unheated	0	2.87	0.71	2.28	5.86	94.14
	Heated	0.09	2.29	0.5	2.4	5.28	94.72
Untopped	Unheated	0.07	1.39	0.22	2.58	4.26	95.74
	Heated	0.15	3.07	0.42	3.75	7.39	92.61
Hand topped	Unheated	0	2.57	0.73	2.91	6.21	93.79
	Heated	0	3.12	0.49	2.24	5.85	94.15
Overall averages		0.05	2.55	0.51	2.7	5.81	94.19
LSD (0.05) topping x heating		ns	1.16	ns	0.77	1.5	1.5

[§]significantly different at P=0.10