EFFECTS OF ONION PLANT DAMAGE AND FIELD HEAT STRESS ON TRANSLUCENT SCALE IN ONION BULBS

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Introduction

Onion translucent scale is a physiological disorder in which the bulb scales or rings acquire a translucent or watery appearance. Causes of translucent scale remain unknown. Research has shown that field curing and artificial drying can be associated with translucent scale (Solberg and Boe 1997). The objective of this trial was to elucidate the influence of plant top damage and temperature in the field on translucent scale development in the Treasure Valley of Oregon and Idaho. The effects of temperature were investigated prior to lifting and during curing.

Methods

The procedures for the cultural practices for growing the onion crop can be found in the following report "Effects of heating and freezing on translucent scale in onion bulbs" in the section "Procedures for field 2."

Procedures for Heat Treatments

The field was divided into 20 plots that were 30 ft long and 4 rows wide. Each plot was allocated to one of four treatments (Table 1) consisting of foliar damage and attempts at enhancing solar heating of the soil surface and onion bulbs in mid-August. On August 13 one-half of the total height of foliage was cut and removed from the foliar damage plots. On August 14, transparent plastic was laid between the onion double rows in the heated soil plots. Temperature sensors (TMC20-HA, Onset Computer Corp., Bourne, MA) were installed in each plot center at 0.4 inch depth and approximately 1 inch from the onion row. Temperature sensors were connected to HOBO H8 4-channel dataloggers (Onset Computer Corp., Bourne, MA) and read every hour. On August 20, the plastic was removed from the plots.

Table 1. Treatments applied to onions in August, 2001. Malheur Experiment Station, Oregon State University, Ontario, OR.

Treatment	Plastic mulch	Leaf damage
1 (check)	none	none
2	yes	none
3	yes	yes
4	none	yes

On September 11 the onions were lifted to field cure. Also on September 11, transparent plastic was laid over half (15 ft) of each plot, resulting in 40 subplots. The plastic was laid as a continuous sheet, covering all the onions. Temperature sensors were installed in each plot half on the soil surface. Temperature sensors were connected to HOBO H8 4-channel dataloggers and read every hour. On September 13, the plastic was removed from the plots.

On September 18, onions from the middle two double rows in each subplot were topped and bagged. The bags were placed into storage on September 21. The storage shed was managed to maintain an air temperature of approximately 34°F. The bulbs from each subplot were divided into six sample bags. The bags were weighed and placed into storage. One bag from each subplot is being weighed and evaluated monthly for loss of weight and the occurrence of translucent scale. Each bulb is cut equatorially and checked for translucent scale. The number and location of translucent scales in each bulb is recorded.

Results and Discussion

Onions grew well, yielding 965 cwt/acre. The temperature treatments applied in mid-August prior to onion lifting did not significantly increase the soil temperature at 0.4-inch depth (Table 2). The temperature treatments applied in mid-September after lifting also did not significantly increase the temperature on the soil surface (Table 3). The temperatures recorded for the untreated check were surprisingly high. The check treatment was subject to a total of 15 noncontinuous hours of soil temperatures above 115°F before lifting and to a total of 9 noncontinuous hours of air temperature above 115°F during curing.

The field-applied temperature treatments did not significantly increase the incidence of translucent scale, despite the high temperatures reached (Table 4). The percent of bulbs with translucent scale and the number of translucent scales per bulb increased significantly between December and January, independent of the treatments.

References

Solberg, S.O. and E. Boe. 1997. The influence of crop management on watery scales in onions - a survey in south-eastern Norway. In: Translucent and leathery scales in bulb onions (*Allium cepa* L.), Norwegian Crop Research Institute, Doctor Scientarum Theses 30.

Table 2. Temperature statistics for mid-August, 2001 field heat treatments. Temperature sensors were buried at 0.4-inch depth. Malheur Experiment Station, Oregon State University, Ontario, OR.

Treatment	Plastic mulch	Leaf damage	Maximum temperature, °F	Hours above 110°F	Hours above 115°F
1 (check)	none	none	118	23	15
2	yes	none	118	22	15
3	yes	yes	97	16	7
4	none	yes	111	14	9
LSD (0.05)			NS	NS	NS

Table 3. Temperature statistics for mid-September, 2001 post-lifting field heat treatments. Temperature sensors were located on the soil surface. Malheur Experiment Station, Oregon State University, Ontario, OR.

Treatment	Plastic	Leaf damage	Maximum temperature, °F	Hours above 110°F	Hours above 115°F
1 (check)	none	none	116	14	9
2	none	yes	120	14	7
3	yes	none	124	13	10
4	yes	yes	123	6	5
LSD (0.05)			NS	NS	NS

Table 4. Effect of temperature treatment before lifting and during curing on onion translucent scale. Malheur Experiment Station, Oregon State University, Ontario, OR, 2001-2002.

	Pre-lifting		Post-lifting	Percent of bulbs with translucent scales				Average number of translucent scales*				Average location of translucent scales†			
Treatment	Plastic mulch	Leaf damage	Plastic	Oct.	Nov.	Dec.	Jan.	Oct.	Nov.	Dec.	Jan.	Oct.	Nov.	Dec.	Jan.
1	yes	none	none	0.0	0.0	0.0	0.0								
2	yes	none	yes	0.0	0.0	2.7	3.2			2.3	3.7			7	5
3	yes	yes	none	1.0	1.2	0.0	7.1	1.0	2.0		3.3	1.0	4.5		5.5
4	yes	yes	yes	0.0	0.0	1.6	3.3			6.0	6.8			3.5	3.9
5	none	none	none	0.0	0.9	0.0	3.2		1.0		5.3		10		4.5
6	none	none	yes	0.0	0.0	0.8	5.7			5.0	4.2			4.8	2.6
7	none	yes	none	0.0	0.8	0.0	3.9		2.0		2.8		10.5		3.3
8	none	yes	yes	0.0	0.0	0.9	12.3			2.0	5.7			9.5	4.0
Mean				0.13	0.35	0.75	4.83	0.03	0.13	0.59	1.81	0.03	0.63	0.88	4.11
LSD (0.05) Treatment				NS	NS	NS	N	NS	NS	NS	NS	NS	NS	NS	NS
LSD (0.05) Month				2.41				0.87				NS			
LSD (0.05) Trt. X Month				NS				NS				NS			

*Average number of translucent scales in bulbs with translucent scales.

† Scale number counted from bulb outside.