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Effect of Herbicide Rate and Application Timing on Weed Control in Dehydrator Onions

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Weed control in onions is particularly problematic. Onions are slow to emerge after planting and slow to grow after emergence. Weeds on the other hand often emerge early and grow quickly, effectively competing with the crop for moisture, nutrients and sunlight. Typically, such competition results in severely reduced onion yields; so, early season weed control is critical. The broadleaf herbicides available for post-emergence use in onions are only marginally selective and are most effective if applied when weeds are small. Crop injury is also more likely when these herbicides are applied to very small onions. Thus, onion producers are faced with troubling questions. Should they apply herbicides early to slow the weeds and risk crop injury from the herbicides? Or, would it be better to wait for the onions to get big enough to safely spray and risk crop loss from early weed competition or the weeds getting too large to control? The application of a pre-plant or pre-emergence, soil applied herbicide could help slow early weed emergence, but available soil active herbicides are generally not effective in the high organic matter soils common to the Tulelake area.

A post-emergence herbicide weed control experiment was conducted at the Intermountain Research and Extension Center in an attempt to identify treatments that produce satisfactory weed control with little or no crop injury. The primary herbicides evaluated were Goal and Buctril, applied post-emergence, at various rates, alone and in combination. Sequential applications of low rates were also applied in a strategy that has been successfully tried in onions and other crops. This strategy is designed to slow early weed growth, making weeds susceptible to control with repeat applications later in the season. The strategy is designed to avoid serious crop loss to early weed competition or herbicide injury.

Onions were planted April 12, 2004. The onions generally reached the 2, 3 and 4 true leaf stages on May 26, June 3 and June 11, respectfully. Broadleaf weeds (mostly redroot pigweed, hairy nightshade and lambsquater) began germinating shortly after planting. Herbicide treatments were applied to replicated plots consisting of two-36 inch wide planting beds, 25 feet long. Plots were arranged in a randomized complete block design with four replications. The experimental treatments evaluated are listed on Table 1, along with information on application timing and onion growth stage at application. All treatments were applied broadcast with a handheld CO_2 backpack sprayer in 20 GPA water carrier.

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Other than herbicide applications, the onions were grown using irrigation, fertilizer and pest management practices typical of commercial dehydrator onion production in the Region. Visual weed control evaluations were made June 2, June 11 and June 15. Immediately following the June 15 evaluation, all plots were hand weeded and the plots were maintained weed free for the remainder of the season. On July 1 digital photographs of each plot were taken. These photographs were later used to develop computer assisted estimates of onion ground cover in each plot. The plots were mechanically harvested on October 12 and 13, with the total bulb weight of each plot recorded.

Results

Experimental weed control, crop ground cover and onion yield results are presented on Table 1. Many of the treatments produced acceptable commercial control (>70%). The best control resulted from the combination of Goal (4 oz/a) and Buctril (1 pt/a) applied at the 2 leaf stage followed by repeat applications of Goal (4 oz/a) applied at the 3 and 4 leaf stages (treatment 14). A similar treatment, with slightly modified Goal application rates (treatment 11) produced the second best level of control.

One objective of this research was to estimate the yield effects of herbicide crop injury and yield losses due to weed competition. As seen in Figure 1, there was a significant effect of early season weed control on mid season onion growth (percent ground cover). Remember, after June 15, all plots were maintained weed free by hand weeding. Clearly the presences of early season weeds suppressed onion growth. This reduction in early season growth translated to decreased onion yields as shown in Figure 2. Some of the observed reduction in early season growth may also have been due to herbicide injury. We evaluated the plots a week after the last herbicide application and did not observe stunting attributable to the herbicide treatments. However, when the bulb yield averages for each treatment are plotted against the treatment weed control ratings (Figure 3), the treatments appear to cluster into four groups: Group one (blue), herbicide treatments that did not provide adequate weed control and thus, had reduced yields due to weed competition; group two (green), herbicide treatments that produced commercially acceptable weed control and high yields; group three (yellow), herbicide treatments that produced acceptable weed control but lower yields (perhaps due to herbicide injury); and group four (red), one herbicide treatment, an early application of Buctril at a high rate, that provided fair weed control but clearly hurt crop growth and yield.

Crop injury and yield losses recorded in this trial were not as high as might have been expected from the treatments evaluated. That is, crop injury is often more severe if treatments are applied shortly before or after periods of abnormal temperatures or following wind episodes, which sand blast the onion cuticle. None-the-less, these results confirm the utility of the current practice of applying low rates of broadleaf herbicides at early onion growth stages. The importance of early season weed control to prevent weed competition and yield loss was also confirmed.

Table 1. Herbicide Applications, Weed Control Ratings, Percent Onion Ground Cover and Onion Bulb Yields. Onion Herbicide Evaluation 2005 Intermountain Research and Extension Center.

	Application Timing, Date and Onion Growth Stage						Weed Control Ratings (1 to 10: 10 = 100% control)			Percent Onion Ground Cover	Yield
	2 True Leaf Applied: 5/26/04		3 True Leaf Applied: 6/3/04		4 True Leaf Applied: 6/11/04						
Treatment Number	Herbicide	Rate	Herbicide	Rate	Herbicide	Rate	6/2/2004	6/11/2004	6/15/2004	7/1/2004	(cwt/a)
1	Goal	2 oz/a	Goal	2 oz/a	Goal	6 oz/a	7.0	6.3	6.5	44.1	511
2	Goal	4 oz/a	Goal	4 oz/a	Goal	4 oz/a	7.3	5.8	5.8	44.7	544
3	Goal	6 oz/a			Goal	6 oz/a	7.8	5.0	6.5	49.9	543
4	Goal	8 oz/a			Goal	4 oz/a	8.5	7.3	6.8	39.2	542
5	Buctril	1 pt/a					8.5	7.5	6.8	45.5	558
6	Buctril	1.5 pt/a					8.8	6.5	5.8	38.0	456
7	Prowl	3.6 pt/a					4.5	3.8	3.0	43.4	535
8	Prowl	4.8 pt/a					3.0	4.0	3.3	37.6	525
9	Goal + Buctril	2 oz/a + .5 pt/a	Goal	2 oz/a	Goal	6 oz/a	8.0	7.0	7.8	46.7	515
10	Goal + Buctril	3 oz/a + .5 pt/a	Goal	3 oz/a	Goal	6 oz/a	8.0	7.3	7.8	40.8	538
11	Goal + Buctril	4 oz/a + .5 pt/a	Goal	4 oz/a	Goal	4 oz/a	9.0	8.8	7.8	42.3	519
12	Goal + Buctril	2 oz/a + 1 pt/a	Goal	2 oz/a	Goal	6 oz/a	9.0	8.6	8.6	44.0	550
13	Goal + Buctril	3 oz/a + 1 pt/a	Goal	3 oz/a	Goal	6 oz/a	9.0	9.3	6.0	36.3	530
14	Goal + Buctril	4 oz/a + 1 pt/a	Goal	4 oz/a	Goal	4 oz/a	8.5	9.5	9.5	48.0	556
15	Goal + Prowl	3 oz/a + 3.6 pt/a	Goal	3 oz/a	Goal	6 oz/a	7.8	7.3	6.8	42.1	530
16	Goal + Prowl	4 oz/a + 3.6 pt/a	Goal	4 oz/a	Goal	4 oz/a	8.5	7.6	7.3	41.5	562
17	Goal + Prowl	6 oz/a + 3.6 pt/a			Goal	6 oz/a	7.3	7.3	7.3	40.3	502
18	Goal + Prowl	3 oz/a + 4.8 pt/a	Goal	3 oz/a	Goal	6 oz/a	8.0	6.8	6.8	45.0	546
19	Goal + Prowl	4 oz/a + 4.8 pt/a			Goal	6 oz/a	8.0	8.3	7.5	46.5	522
20	Goal + Prowl	6 oz/a + 4.8 pt/a			Goal	6 oz/a	8.5	6.8	7.8	43.9	544
21	Outlook	18 oz/a					3.0	2.0	1.8	31.2	477
22	Outlook	21 oz/a					4.0	2.3	2.3	46.1	514
23	Untreated						1.5	1.8	1.8	35.2	516
24	Untreated						1.5	1.3	1.3	34.2	501
					Mean		6.9	6.2	5.9	41.9	527
					CV%		17.1	18.1	23.2	17.3	8.2
					LSD(0.05)		1.7	1.6	1.9	NS	NS

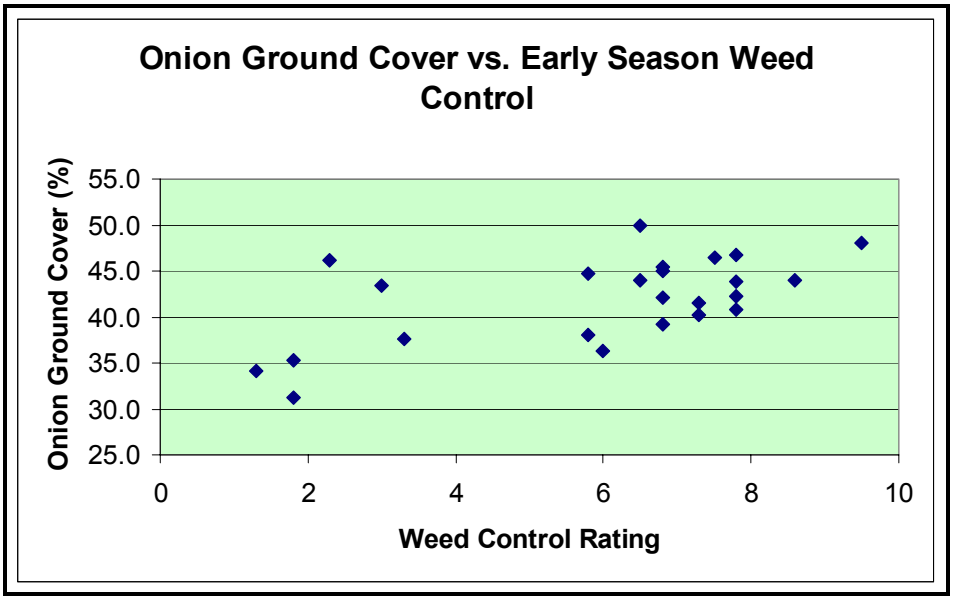

Figure 1. Relationship between weed control rating on 6/15/2005 and onion growth (percent ground cover) on July 1, 2005 (all plots were hand weeded after the 6/15/2005).

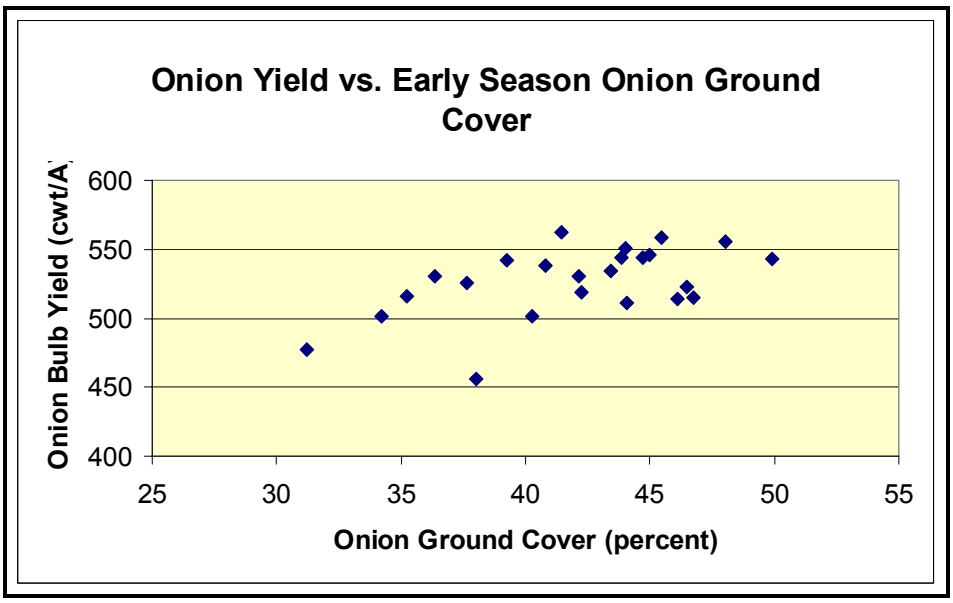

Figure 2. Relationship between onion ground cover on July 1, 2004 and final onion bulb yields.

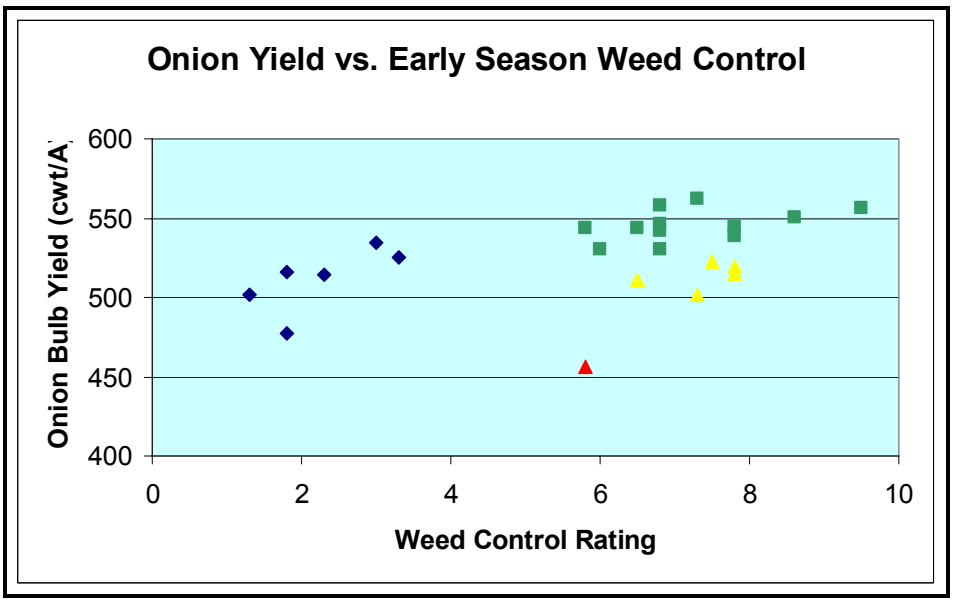

Figure 3. Effect of weed control by herbicide treatment on final onion bulb yield. See text for notes on colored clusters.