UNIVERSITY OF SASKATCHEWAN

VEGETABLE CULTIVAR AND CULTURAL TRIALS

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Saskatchwan Agriculture and Food

Demonstration of Herbicides for Weed Control in Onions

Thorough, consistent weed control is essential for successful onion production. Onions remain sensitive to weed competition for the entire growing season – therefore growers must strive for a weed control program that remains effective from seeding until just prior to harvest. Presently onion weed control is achieved through mechanical tillage and/or the application of herbicides. Herbicides have several potential advantages over tillage as a means of controlling weeds in onions. Well timed applications of an appropriate herbicide can provide long lasting weed control - including the weeds growing within the row. Chemical weed control may be achieved at a lower overall cost than repeated tillage operations – especially if hand weeding is required to deal with weeds within the rows that would typically be missed by standard between-row tillage. The challenge facing onion growers is to identify herbicides that will provide the desired broad-spectrum long-term weed control with minimum risk of herbicide damage to the crop.

This project was designed to demonstrate the efficacy and crop safety of a range of herbicides for use in yellow onion production in Saskatchewan.

The project was conducted at the University of Saskatchewan Horticulture Field Research Facility in Saskatoon. This site has been in long term production of horticultural crops and therefore has a "typical" spectrum of weeds seen in vegetable fields – except for the fact that grassy weeds are very uncommon. The field used in the trial had been in summer fallow the previous year. Summer fallowing is a common practice in land designated for onion production, as it reduces the weed pressure. The field was prepared in the spring of 2011 by fertilizing to recommended levels and then rotovating. On May 17 two popular, locally adapted cultivars of yellow onions (Norstar and Copra) were seeded in 5 m long rows spaced 0.5 m apart. Each plot was large enough to have 2 adjacent rows designated for each of the five herbicide treatments. The herbicide treatments were separated by a non-sprayed check row. There were two replicates of all spray treatments for each cultivar. The trial was set up as a randomized complete block design.

Just prior to emergence of the onion crop a 1% solution of the non-selective herbicide glyphosate was applied over the entire plot. This treatment burned off all the weeds that had emerged prior to emergence of the onion crop. This "stale seedbed" approach provided the onion crop with a crucial 2-3 weeks window to develop without any significant weed pressure.

The herbicide treatments were applied in the 2nd week of June, at which time the crop was at 2 true leaf stage. This is the recommended stage for application of the products utilized in this project. The next flush of weeds was just beginning to emerge at this time. The sprays were applied with a CO^2 - powered small plot sprayer equipped with 80-01 nozzles operating at 270 KPa pressure. The sprays were applied in the equivalent of 80L H2O/ha.

The products tested, the rates applied and the recommended crop stage for treatment were;

Trmt 1 - Chateau (51 WDG) (flumioxazin) @ 28-56 g/a. Apply at 4-6 leaf stage.

Trmt 2 - Goal (4SC) (oxyfluorfen) @ 230 ml/a. Apply after 2 leaf stage.

Trmt 3 - Buctril (bromoxynil) @ 94-236 ml/a. Apply at 2-5 leaf stage.

Trmt 4 - Dual Magnum (7.6E) (metolachlor) @ 330-615 ml/a. Apply after 2 leaf stage.

Trmt 5 - Prowl (3.8 ACS) (pendimethalin) @ 340-950 ml/a. Apply after 2 leaf stage.

Where a range of product concentrations were recommended, the first spray application used the lowest concentration of product recommended, while the 2nd application made later in the season used the highest concentration recommended. This decision reflected the fact that herbicide tolerance tends to increase as the crop matures, so low dosages are preferred when treating young plants.

The % ground cover by weeds was evaluated in the last week of June (Fig. 1).

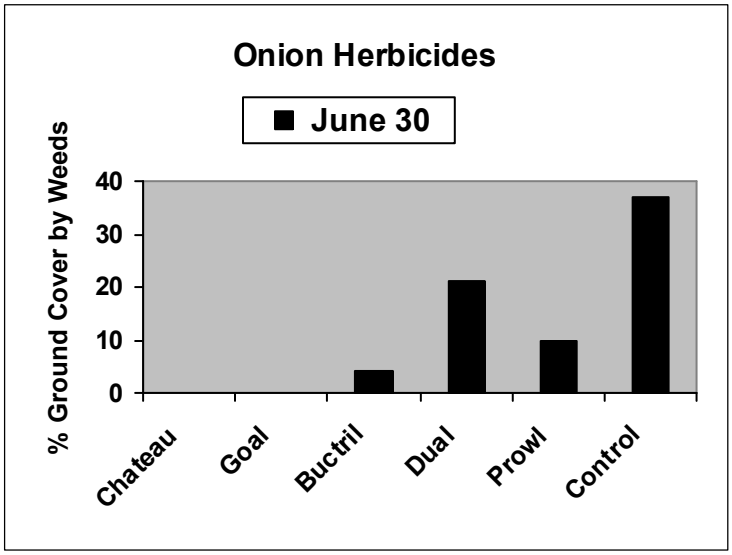

Figure 1. % ground cover by weeds at 2 weeks after application of various onion herbicides.

All of the herbicides were providing at least some degree of control at 2 weeks after application, with the Chateau and Goal providing almost complete weed control.

The efficacy of the treatments was evaluated again at 4 weeks after spraying – this time by harvesting all the weeds growing within the rows, separating the weeds into species, and then weighing each type of weed (Fig 2).

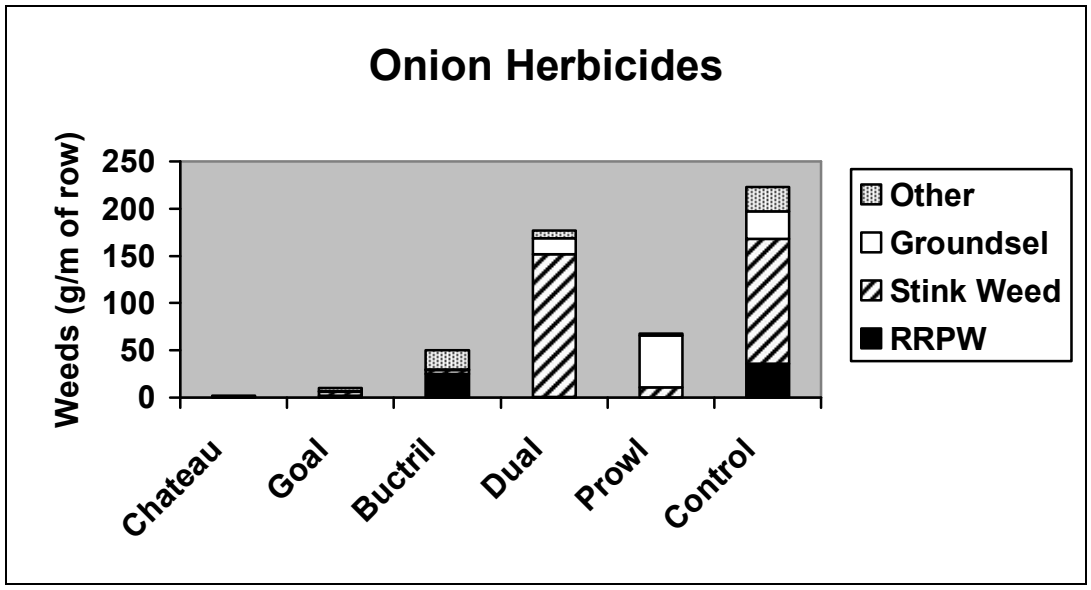

Figure 2. Weed growth in onions treated with various herbicides – 4 weeks after 1st treatment.

Chateau and Goal continued to provide almost compete weed control through 4 weeks after application. Buctril provided excellent control of the stinkweed but was ineffective against red-root pigweed and roundleaf mallow. Dual had little impact on the stinkweed, while Prowl was ineffective against groundsel.

The herbicides were applied for a second time on July 16. The crop was 12" tall and in the 4-6 leaf stage at this time. This is still within the recommended crop maturity window to avoid damage by these products – except perhaps Buctril which is only recommended for use through the 4 leaf stage. Because all weeds were harvested on July 11 to evaluate early weed control, the herbicides applied on July 16 went onto "weed-free" ground. This weed harvest would also have rendered the non-sprayed control treatments "weed-free" again at this time.

Weed control achieved using the 2nd herbicide application was not as thorough as with the 1st application – this could reflect the rapid development of weeds missed in the 1st round of spraying and hand weeding. Curled dock and dandelion were especially problematic. At one month after the 2nd herbicide application (Aug. 11) the weeds in each plot were harvested and weighed (Fig.3). As dandelion and curled dock were dominant in all plots, no effort was made to weigh each species separately.

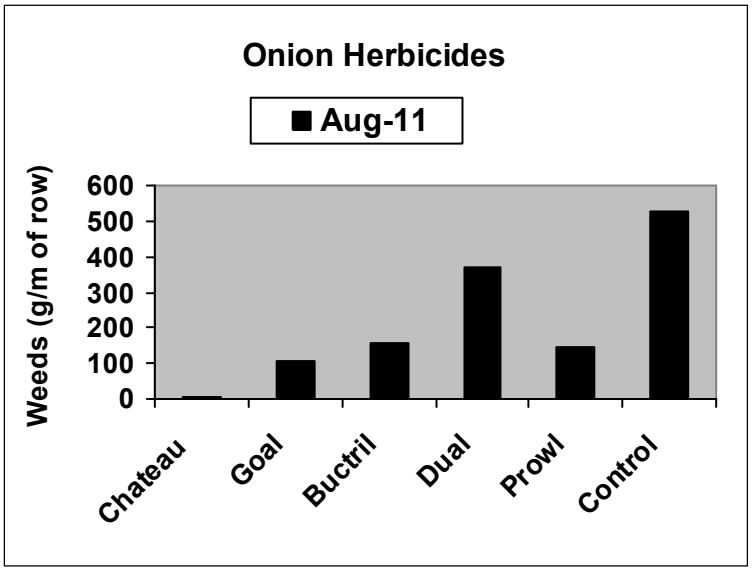

Figure 3. Weed growth in onions treated with various herbicides - 1 month after 2nd application.

All of the herbicides reduced weed growth relative to the non-treated controls - with the Chateau treatment providing superior weed control relative to all other products.

On September 22 the crop was lifted and topped. The crop was allowed to field cure for 2 weeks and then the number and weight of bulbs in each row was determined. Crop quality was excellent but the average bulb size was relatively small. Overall yields were around 20t/a - which is below average. In part the low yields may reflect the relatively wide between-row spacing required to keep the spray effects separate.

The observed effects of the herbicides on yields did not correspond with expectations. The Goal and Chateau treatments produced no yield advantage relative to the controls (Fig. 4), yet both these products had provided excellent weed control. While Buctril and Dual had provided at least some degree of weed control, yields in both these treatments were actually lower than in the weedy controls. Only the Prowl treatment produced yields higher than the controls.

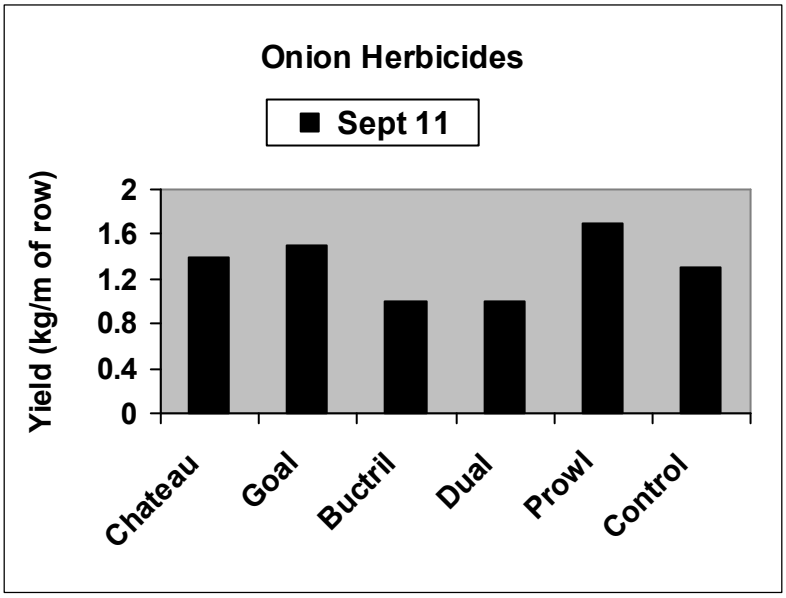

Figure 4. Yields for onions treated with various herbicides.

The results point to a herbicide toxicity effect. Low crop vigor following application of the herbicides had been noted – but could not definitively be attributed to herbicide damage.

The control treatments yielded more onions/m of row than most of the herbicide treated rows (Fig. 5). The high yields obtained in the Prowl treatment may be attributed to it being the only herbicide that did not negatively affect the plant stand. While these results suggest that the herbicides were negatively effecting crop survival – no signs of herbicide damage were noted. The damage may have occurred prior to emergence – as all the herbicides tested work primarily by suppressing the germination and emergence of weeds. It is possible that, while the majority of the crop was at the appropriate growth stage (2-4 leaves) at the time of the 1st treatment, some onion seedlings may not have yet emerged at this time– and these seedlings would have been susceptible to herbicide damage.

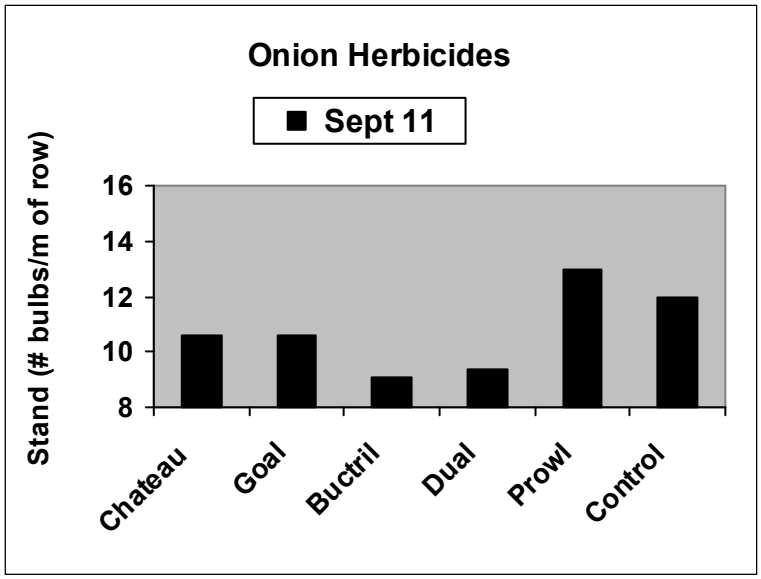

Figure 5. Bulb number in onions treated with various herbicides.

The degree of stand loss observed following application of the herbicides is a concern, as the products were applied under generally favourable conditions to a crop at the recommended stage of development. The amount of product applied also corresponded with the lower end of the label recommended concentration range. If the observed loss of stand was related to herbicide toxicity to emerging seedlings, even greater negative effects might be expected if the products were applied at the higher end of the label approved concentration range or under less ideal conditions.

This project demonstrated the potential to achieve a high degree of control of broadleaf weeds in onions using either traditional or recently registered herbicides. While these products caused no obvious signs of crop damage, plant stands were compromised by most of the herbicide treatments – and this resulted in a yield loss despite the superior weed control achieved using the herbicides. Additional testing is needed to clarify whether these plant stand and yield effects are consistent or whether they represent an anomaly, perhaps related to the crop development stage at the time of application or transient unfavourable field conditions.

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