EVALUATION OF HERBICIDES FOR LONG-TERM WEED CONTROL IN ROW MIDDLES

The rows of many horticultural crops are widely spaced to provide room for eventual crop growth and/or access by equipment and pickers. Consistent weed control in the space between rows (row middles) is necessary; otherwise the weeds will compete with the crop and/or interfere with the harvest. At present, most growers rely on tillage to control weeds in the row middles. However, tillage tends to stimulate the germination of weed seeds – necessitating repeated tillage operations over the course of the growing season. Repeated tillage is time consuming, burns fossil fuels, degrades the soil structure and contributes to the depletion of soil organic matter reserves. Tillage between the rows also becomes progressively less practical as the crop grows into the row middles.

Fig. 1. Weed free row middles

Use of soil applied herbicides that provide long-term residual weed control may represent a more effective, cost efficient and environmentally benign approach for achieving consistent and persistent weed control in row middles. As the herbicides are not applied directly to the crop (but rather way from the crop into the row middles) they are not subject to the rigorous approval standards required of products that are designed to be applied to the crop.

The overall objective of this project was to demonstrate the potential to use herbicides to achieve long-term weed control in row middles.

The trial were conducted at the U of S Horticulture Field Research Station in Saskatoon. This site has been in long term production of horticultural crops and therefore the weed population and species spectrum is typical of commercial horticultural operations.

June trial – the clay soil at the Saskatoon site was rotovated in early May to simulate standard production practices. This tillage would have controlled emerged winter-annual weeds but would also have triggered germination of spring annuals. Repeated rain events from mid-May through early June provided near ideal soil moisture conditions for weed germination. The herbicides were not applied until early June – as this is when growers would begin to focus on weed control in the row middles. Some spring annual weeds had begun to emerge at this time. To test the herbicides for control of newly emerged weeds as well as for the prevention of germination of weeds, each plot was divided in half – with one half rotovated again to produce a weed-free starting point and the other half left with the newly emerged weeds intact.

The range of herbicides tested was based on previous U of S work and suggestions from the industry;

a) Weedy control – no tillage beyond the initial field prep
b) Clean Start = Aim (carfentrazone) @ 14ml/a + Roundup (glyphosate) @ 0.5 l/a

c) Chateau (flumioxazin) @ 75g/a
d) Sencor (metribuzin) @ 200 g/a
e) Lorox (linuron) @ 1.9 L/a
f) Authority (sulfentrazone) @ 100 ml/a
g) Edge (ethafluralin) @12 kg/a
h) Goal (oxyflurfen) @ 500 ml/a
i) Corn gluten @ 1200 kg/a

All rates represent the amount of product applied.

All of the herbicide treatments were applied at the high end of label recommended rates for weed control within crops. The corn gluten represents an organic weed control option. All products except the Edge and the corn gluten were applied using a CO_2 power small plot sprayer equipped with 80-02 flat fan spray nozzles. The Edge granules and corn gluten were evenly spread over the plot area and then lightly incorporating using a rake.

Each treatment block was 2m wide (width of a typical row middle) and 5 m long. The treatments were replicated 4 times in a randomized complete block design. Rainfall or irrigation within 1 week of application is required to activate a number of the herbicides. In 2010 several light rain events occurred soon after treatment of the plots.

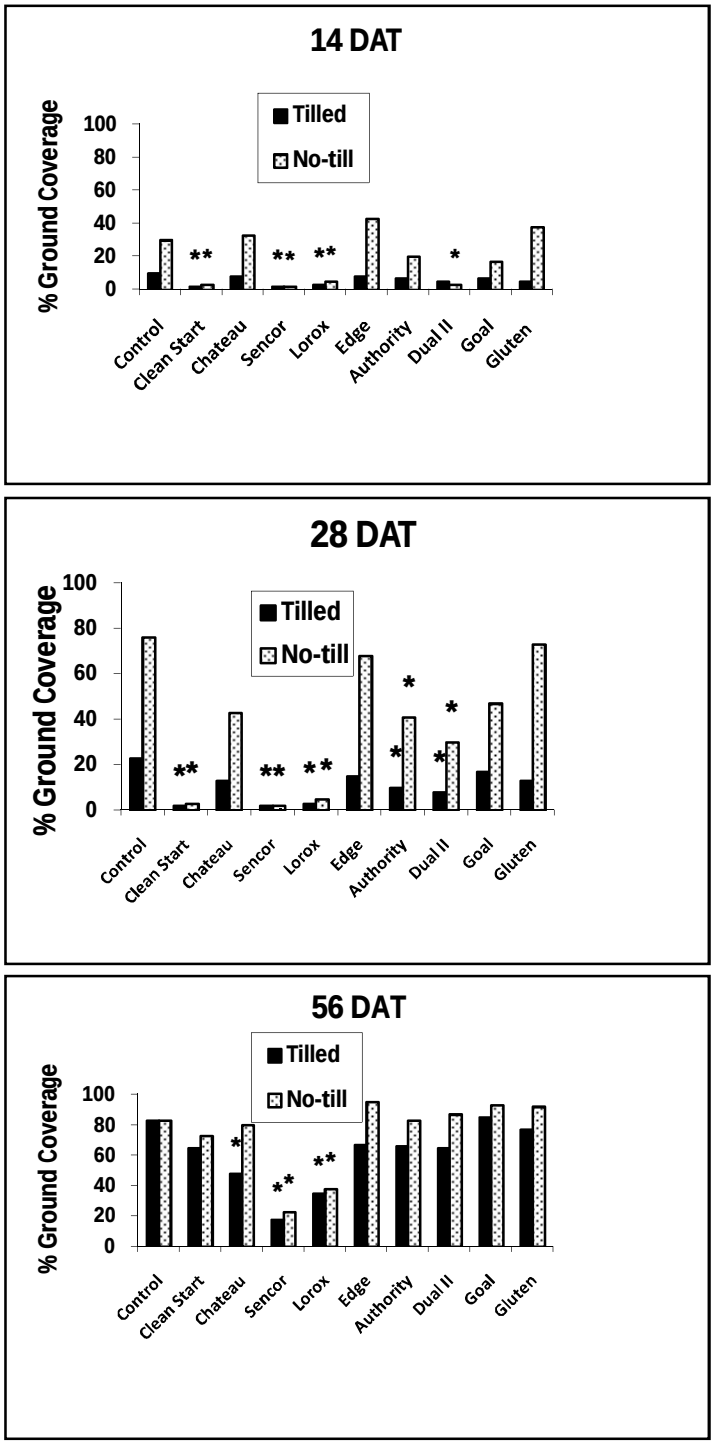
Efficacy of the herbicide treatments was determined by evaluating the number of weeds present, the weed species present and the % of the plot surface covered by weeds at increasing intervals after application of the herbicide treatments (14, 28 and 56 DAT).

August trial – this second trial was used to confirm the efficacy of the "best" treatments identified in the June trial. The trial was established August 21 on two plots of recently rotovated land at the U of S Horticulture Research Station in Saskatoon. The plan was to have one of the plots managed in the standard manner, while the other plot would serve as a dryland site – to test the importance of moisture in activating the herbicides. However there were repeated rainfall events after establishment of this trial and no irrigation was required to activate the herbicides.

The herbicide treatments tested in this trial were;

a) Control = Roundup
b) Clean Start = Aim (carfentrazone) + Roundup
c) Chateau (flumioxazin) + Roundup
d) Sencor (metribuzin) + Rounpdup
e) Lorox (linuron) + Roundup

The earlier trial had indicated than the herbicide treatments that had provided the best long-term weed control were relatively ineffective at controlling emerged weeds. As many dandelions had survived the rotovation step used to prepare the plots prior to spraying, it was decided to add Roundup to all treatments as a means to deal with these emerged weeds. The herbicides were applied at the same rates using the same equipment as previously described. Each plot was 2 m wide and 5 m long, with 4 replicates of each treatment arranged in a randomized complete block design. Weed control was evaluated as previously described at 14, 28 and 56 DAT.



Results

June trial - The dominant weeds in the non-sprayed control treatments were typical of the vegetable growers' fields in Saskatchewan - common groundsel (*Senecio vulgaris*), annual sow-thistle (*Sonchus oleraceus*), dandelion (Taraxacum officinale), portulaca (*Portulaca oleraceae)* and red-root pigweed (*Amaranthus retroflexus*). At the first evaluation (14 DAT), weed growth (% ground coverage) in the non-tilled control plots was substantially greater than in the adjacent tilled plots. (Fig. 2) This trend persisted through the 2nd evaluation at 28 DAT but by the final evaluation at 56 DAT the ground was almost completely covered by weeds in both the tilled and non-tilled control treatments. At 14 DAT the weed control provided by the Clean Start, Sencor and Lorox treatments was superior to the non-treated control in both the tilled and non-till plots. At the 2nd evaluation (28 DAT), the Clean Start, Sencor and Lorox treatments were still providing a very high degree of weed control, with the Authority and Dual II treatments providing a lesser but still significant degree of control.

Fig. 2. Influence of herbicides on % ground cover by weeds at increasing intervals after treatment - June trial. * = % ground cover is significantly different (*P*=0.05) from the control.

At the final evaluation (56 DAT) only the Lorox and Sencor treatments were still providing a level of weed control that was significantly superior to the non-treated control in both the tilled and non-tilled plots. Portulaca and common groundsel represented the majority of weed escapes in the treatments that had earlier provided some degree of weed control. The Sencor treatment appeared to provide a superior level of portulaca control relative to all other treatments.

August trial – wet cold weather from mid-August through mid-September delayed development of the weeds in this trial. At the 14 and 28 DAT evaluations there was basically no weed growth in any treatment. Good weather from mid-September through early October allowed some weed growth (24% ground coverage in controls) by the final evaluation at 56 DAT. Dandelion, common groundsel and annual sow-thistle were the dominant weeds in the control treatments. Treatment responses were similar at the two sites and the data were therefore combined. All of the selected herbicide treatments provided a very high degree of weed control (Fig. 3) – although none of the treatments was consistently effective at controlling established dandelions.

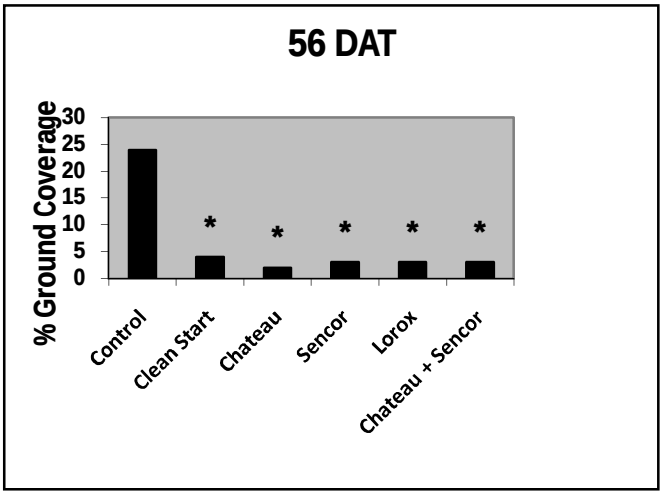


Fig. 3. Influence of herbicide treatments on % ground cover by weeds – August trial. * = % ground cover is significantly different (*P*=0.05) from the control.

Conclusion – this project illustrated that a high degree of control of the broad spectrum of weeds commonly found in vegetable fields could be achieved by applying long-lasting soil active herbicides such as linuron and sencor to the row middles. These products were most effective when applied prior to weed emergence but very effective control of emerged weeds could be achieved by mixing the sencor or linuron with a non-selective contact herbicide such a glyphosate or carfentrazone. The maximum duration of efficacy observed in this project was about 2 months. This would be more than enough time to allow a vine crop like cucumbers or pumpkins to become well established with the vines filling in the row centers, effectively eliminating the need for any further weed control. In slower growing or more upright crops like tomato or peppers a second application might be required in mid-July to keep the row middles weed free for the duration of the growing season. Late season applications of herbicides with a long soil residence time can raise concerns about the potential for herbicide damage to sensitive crops seeded into the treated area early in the next growing season.

This project was made possible by support from the ADOPT program of Saskatchewan Agriculture