Crop Injury And Yield Response Of Quinoa To Applications Of Various Herbicides

Purpose:

Quinoa is growing in popularity in Canada due to its perceived nutritional benefits and ability to grow in a variety of environmental conditions. Farmers are interested in growing quinoa for the expanding market but there is limited crop management information available in Canada. Poor weed management can significantly reduce grain yield and quality. There are no herbicide products currently registered in Canada to manage weeds in Quinoa. Therefore, growers are without any chemical weed control options in Quinoa. A study was conducted to evaluate Quinoa sensitivity to applications of 7 different herbicides

Methods:

One field trial was conducted in 2015 at the Elora Research Station, University of Guelph. The study was established as a randomized complete block design with four replications. Each plot was 3 m wide by 5 m long and replicated four times. The cultivar used was called Brightest Brilliant (OP) and was planted on May 25, 2015 with a Wintersteiger plot seeder. The seeds were planted in 35 cm rows at a rate of 11 kg/ha at a depth of 1 cm. Plant populations were thinned down to a density of 1 plant every 10 cm (approximately 250,000 plants/ha).

All plots were kept weed free by hoeing throughout the season as new weeds emerged. Fourteen herbicide treatments were applied both pre and post emergence and are listed in Table 1. Pre-emergent herbicides were applied on May 28th and the post-emergent herbicides were sprayed on June 17th. All herbicide treatments were sprayed with a CO_2 pressurized backpack sprayer using XR Teejet 110-02 flat fan nozzles delivering a spray volume of 150 L/ha at 207 kilopascals of pressure.

Visual crop injury ratings were taken at 3, 7, 14, and 28 days after application. Plant heights were also taken 8 weeks after pre-emergent herbicide applications. Measurements were taken from the soil surface to the top of the budding head.

Plots were hand harvested on September 20th. Following harvest, the seeds were physically removed from the seed heads using a belt harvester and then weighed.

Summary:

Quinoa only survived two active ingredients, s- metolachlor/benoxacor (Dual II Magnum) and Pendimethalin (Prowl H2O) when both were applied to emerged Quinoa. There was minimal crop damage when both rates of s-metholachlor/benoxacor were applied and the plots remained clean throughout the season (Figure 1). Pendlimethalin applied at 1000 gai/ha caused minimal injury initially but at later evaluations, plants were stunted when compared to the un-sprayed control. The 2000 gai/ha rate increased plant injury with symptoms that included leaf discoloration, distortion and stunting. However, there was no statistical significant reduction (α=0.05) in plant height and density between both rates of s-metolachlor, pendimathlin and the weed-free un-sprayed control.

Table 1: Herbicide treatment, active ingredient and rate, application timing and crop injury to Quinoa at 8 weeks after application.

Treatment	Active Ingredient	g AI/ha	Application Timing	% Crop Damage
Control	N/A	N/A	N/A	0
Dual II Magnum	s- metolachlor/benoxacor	1600	Post- emergent	20
Dual II Magnum	s- metolachlor/benoxacor	3200	Post-emergent	20
Prowl H2O	pendimethalin	1000	Post- emergent	40
Prowl H2O	pendimethalin	2000	Post- emergent	80
Zidua	pyroxasulfone	125	Pre- emergent	100
Zidua	pyroxasulfone	250	Pre- emergent	100
Authority	sulfentrazone	105	Pre- emergent	100
Authority	sulfentrazone	210	Pre-emergent	100
Nortron SC	ethofumesate	3960	Pre- emergent	100
Nortron SC	ethofumesate	7960	Pre- emergent	100
Command	clomazone	576	Pre- emergent	100
Command	clomazone	1152	Pre- emergent	100
Permit Agral 90 (non-ionic surfactant)	halosulfuron	35 0.25 v/v	Post- emergent	100
Permit Agral 90 (non-ionic surfant)	halosulfuron	70 0.5 v/v	Post- emergent	100

Figure 1: Quinoa plant stand 4 weeks after a post-emergent application of Dual II Magnum, to the right is an un-treated check.

Quinoa stage at the time of s-metolachlor/benoxacor and pendimethalin application varied from the cotyledon to 6 leaf stage and appeared to influence the level of injury (data not shown). Younger plants were more injured then larger plants and never fully recovered resulting in variable heights within the plant stand. Halosulfuron was the other post-emergent herbicide evaluated and it caused significant damage 7 days after application and complete plant death 14 days after.

Pre-emergent herbicides were applied after the crop was planted but before the plants had emerged above the soil surface. All pre-emergent herbicides caused unacceptable crop injury. One week after pre-emergent herbicide applications, both sulfentrozone and clomazone caused complete plant death. The remaining pre-emergent treatments caused unacceptable levels of crop injury but did not completely eliminate all plants. However, Quinoa damage was so severe that the remaining plants did not survive any of the pre-emergent herbicides at 14 days after application.

Next Steps:

Plant staging at the time of application is critical as the herbicides can have detrimental effects on younger plants and they do not recover as the growing season progresses. More studies should be done on these two herbicides to understand the effect on Quinoa crop stage at the time of application and its impact on crop injury and grain yield.

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Location of Project Final Report:

This is the first year of a multi-year project.