Emergence timing and management of cleavers in Saskatchewan canola crops

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Project Code: ADF20120028
Final Report: October 2015

In western Canada, field surveys are showing an increased presence of two species of cleavers, which are difficult to control in many crops such as canola. A two-year study was conducted at the University of Saskatchewan to assess the response of cleavers to new herbicides, and whether there were differences among populations. The results showed that clomazone and quinclorac significantly reduced cleaver biomass, cleaver seed contamination, and improved cleavers control in canola.

In western Canada, field surveys are showing an increased presence of cleavers. It was believed that cleavers populations consisted of two Galium (cleavers) species, *G. aparine* and *G. spurium*. These species are difficult to control in many crops, such as canola and can cause downgrading and reduce crop quality. Proper identification and improved control can lead to better management practices for cleavers in canola.

Researchers at the University of Saskatchewan conducted a two-year study to aid growers in managing cleavers by assessing the response of cleavers to new herbicides such as quinclorac and clomazone, as well as their response to common canola herbicides such as glufosinate-ammonium, glyphosate, and quinclorac to determine whether differences among populations existed. Researchers also characterized the emergence and genetic characteristics of cleavers populations in Western Canada.

Field experiments were conducted in 2013 and 2014 at two locations, the Scott Research Farm and the Saskatchewan Pulse Growers research site (SPG) near Saskatoon. An additional site was added at Rosthern in 2014. Eight herbicide treatments were used in this experiment to evaluate their efficacy on cleavers. The herbicide standard for each canola system was used alone and with the addition of quinclorac and/or clomazone. At all sites canola varieties (L130, 73-75, and 45H73), resistant to their respective herbicide system, were seeded into cereal stubble. Cleavers seed was broadcast at 350 seed/m^2 to target a plant stand of 75-100 plants/m^2. Greenhouse dose-response experiments were also conducted to assess whether variability existed between populations in their response to herbicides.

The results of the field trials conducted over two years and at three sites consistently showed that tank-mixing quinclorac with any of the herbicide standards improved cleavers control in canola. Applying clomazone prior to seeding (pre-plant) canola followed by an in-crop application of a herbicide standard also provided acceptable control. The results of the greenhouse dose-response experiments appeared to suggest

that cleavers populations responded similarly to glufosinate-ammonium, imazapyr+imazamox, and quinclorac, despite being from different locations in western Canada. However, further testing and statistical analysis is needed to confirm this.

Nevertheless, this is quite favorable for growers since the field plots showed that clomazone and quinclorac significantly reduced cleaver biomass, cleaver seed contamination, and improved cleavers control in canola crops. Registration of these herbicides will significantly improve cleavers control in western Canadian canola crops over the long term, but it is important to note that as of November 2015, clomazone is not yet registered and quinclorac should not be used due to MRL issues.

As well, cleaver resistance to group two herbicides is already widespread throughout sAlberta and Saskatchewan, and cleavers rank second among weeds likely to develop glyphosate resistance, in the black soil zone. This study showed that spring applied clomazone reduced the size and stage of cleavers found in-crop, and it is known that lower population numbers reduce the risk of developing herbicide resistance. Quinclorac, which can be mixed with any of the in-crop herbicides, also lowers the risk of further developing herbicide resistance by adding a different mode of action to in-crop applications.

Researchers also developed molecular analyses to characterize the differences among cleavers populations in western Canada, and have identified a molecular marker that can be used to differentiate between Galium species. Using this marker, all sampled populations from across western Canada were identified as *G. spurium*, or false cleavers, which is also the species that possesses resistance to group 2 herbicides. Although no *G. aparine* was found in the collected samples, it does not mean there is none present in fields across the prairies.

The molecular analysis also showed that generally the Galium populations exhibited little variation for morphological traits, with the exception of start and end of flowering period and emergence timing. The results showed that emergence timing was significantly different between years in the spring and fall, and that all of the populations exhibited emergence in both spring and fall. These differences suggest growers will need to pay close attention to emergence timing of this weed to ensure the small window for control is not missed. Moreover, a significant proportion of cleavers populations emerged in the fall and therefore, management in the fall is key to the sustainable long-term management of cleavers in western Canada.