Improving Weed Management for Saskatchewan Growers

Christian Willenborg, Eric Johnson, University of Saskatchewan

Project Code: CARP ADF 2015.154
Final Report: April 2019

Herbicides represent a major expense to growers, with Saskatchewan growers spending an estimated $800 million or more in 2014, and now represent the second most expensive crop production input after fertilizers. Ongoing weed research is required to: minimize input costs, manage and delay herbicide resistance, ensure low environmental impact, and enable crop and economic diversification. Researchers from the University of Saskatchewan's Weed Science Program conducted a broad multiple-project three-year research program consisting of several experiments concurrently run throughout the growing season, with funding from multiple partners. A total of 142 trials were conducted in 16 different crop species and comprising 2122 treatments, and saw five M.Sc. students successfully defend their thesis and graduate.

Herbicides are the still the most effective method of weed management utilized by growers in Saskatchewan, despite improvements in crop competitive ability and cultural weed management. Herbicides represent a major expense to growers, with Saskatchewan growers spending an estimated $800 million or more in 2014, and now represent the second most expensive crop production input after fertilizers. At the same time, the number of herbicide resistant weeds continues to increase, with new cases, such as glyphosate resistant kochia demonstrating the need for improved herbicide regimes, new herbicide options, and alternative methods of weed management. Ongoing weed research is required to: minimize input costs, manage and delay herbicide resistance, ensure low environmental impact, and enable crop and economic diversification.

Researchers from the University of Saskatchewan's, Department of Plant Sciences Weed Science Program conducted a broad multiple-project three-year research program focusing on priorities of a mix of chemical, cultural, and integrated weed management research on a diversity of crop species, with funding from multiple partners. The core funding enabled weed control research projects in wheat, canola, field pea, lentil, soybean, fababean, flax, sainfoin, cicer milkvetch, timothy, hybrid bromegrass, slender wheatgrass, tall fescue, sweetclover, and field corn. This project consisted of several experiments concurrently run throughout the growing seasons in 2016, 2017 and 2018, with a total of 142 trials conducted in 16 different crop species and comprising 2122 treatments. In addition, five M.Sc. students successfully defended their thesis over the duration of this funded project.

Broadly, the project goals were to fill the following six major information gaps:
1. To generate unbiased, third party information on herbicide efficacy, crop tolerance and herbicide residue carry-over for dissemination to Saskatchewan crop producers.
Over the 3 years of this project, 83 private industry, commodity group, and publicly funded studies comprising of 1129 treatments were conducted on herbicide efficacy, crop tolerance and herbicide residue carry-over. Herbicide studies were conducted on the following crops: wheat, canola, field pea, lentil, soybean, fababean, flax, sainfoin, cicer milkvetch, timothy, hybrid bromegrass, slender wheatgrass, tall fescue, sweetclover, and field corn.

2. To continue to develop new weed management options for growers to mitigate herbicide resistant weeds.
Over the 3 years of this project, a long-term wild oat management study was maintained and brought to conclusion, and, a new rotation study was initiated to investigate management of weeds in flax. A number of integrated weed management trials in pulses were initiated, including:

- the effect of seeding date, row spacing, and pre- and post- herbicides in controlling RR canola in RR soybean;
- the integration of seeding rate and PRE- herbicide application in fababean;
- the integration of seeding date, row spacing, seeding rate, mechanical weed control, and PRE- herbicide application in fababean;
- the integration of seeding rate and PRE-herbicides in field pea;
- collaboration on a long-term integrated weed management system for harvest weed seed control, led by AAFC, Lacombe;
- recruitment of two PhD candidates that have commenced studies on weed seed predation.

3. To assist plant breeding efforts at the Crop Development Centre towards the development of herbicide-resistant crops.
Through the project, technical expertise was provided to plant breeder Dr. Pierre Hucl to develop herbicide resistance in canaryseed. The project resulted in the identification of some lines with higher levels of tolerance to fenoxyprop. Dr. Hucl has expanded his efforts to identify lines with improved resistance to a number of herbicides and the Weed Science Program will continue to work with him on this initiative. Although there are currently no hemp breeders at the Crop Development Center; the project also included a study on bromoxynil tolerance in hemp cultivars, which will assist hemp breeders in selecting for bromoxynil tolerance.

4. To support the Saskatchewan Minor Use Co-ordinator through participation in the annual provincial priority setting meetings.
The data generated from the previous ADF Project (20120029) and this current project assisted in the registration of fall applied flumioxazin in lentil. The data was supplied to Ron Pidskalny, Prairie Pesticide Minor Use Consortium Procurement Officer for the following Pesticide Minor Use Submissions:

- Viper ADV in fababean;
- Authority in fababean;

- Heat pre-seed in fababean;
- data from the hemp trial was made available to the Minor Use Center to assist in the registration of bromoxynil in hemp;
- other potential Minor Use registrations include: pyroxasulfone in fababean; pyroxasulfone + sulfentrazone in fababean; pyroxasulfone + flumioxazin in fababean; saflufenacil (Heat) as desiccant in fababean; glufosinate as a desiccant in fababean; and quinclorac in hemp.
- In addition, data was generated to support up to 15 potential Minor Uses in forage seed.

5. To conduct focused research on specific weed problems such as Group 2 resistant cleavers and wild mustard, and Group 9 resistant kochia, Group 1 resistant wild oat, and others as the need arises.
A number of field studies were conducted on the following alternative modes of action: Groups 5, 12, 13, 14, 15, and 27.

6. To provide weed control extension support to the Saskatchewan Ministry of Agriculture extension service, various commodity organizations and the farm supply industry.
Over 40 extension activities were conducted by the Weed Science Lab over the three years of the project.

Overall, some of the key practical findings from the various experiments are that:

- Glyphosate does not seem to create issues for oat yield or residues if used at less than 30% seed moisture content;
- Optimal integrated weed management tactics have been identified for flax production;
- Flumioxazin is now registered for fall application prior to seeding lentil;
- Data has been generated that could lead to 15 to 20 new Pesticide Minor Use registrations;
- Hemp cultivars vary in their tolerance to bromoxynil. Tolerance to quinclorac was also identified.
- Preliminary observations indicate that inter-row spraying may be viable as an IWM tool in managing herbicide resistant weeds in lentil.

The project included a second main objective, which was to leverage the core project funding to obtain funding from multiple industry and producer groups to maintain a viable weed science research program. Overall, researchers successfully leveraged close to $2M for a 5-year period (2016 to 2021) to support the weed science research program, which is continuing to provide ongoing weed research for industry and producers.