Improved herbicide efficacy and longevity in southern no-till farming systems

**PROJECT DETAILS**

**PROJECT CODE:** UA00144  
**PROJECT TITLE:** IMPROVED HERBICIDE EFFICACY AND LONGEVITY IN SOUTHERN NO-TILL FARMING SYSTEMS  
**START DATE:** 30.06.2013  
**END DATE:** 30.06.2016  
**SUPERVISOR:** CHRISTOPHER PRESTON  
**ORGANISATION:** UNIVERSITY OF ADELAIDE  
**CONTACT NAME:** CHRISTOPHER PRESTON

**Summary**

This research aimed to identify alternative herbicide products in partnership with industry to provide more effective control of grass weed species. A total of seven pot trials investigated 18 compounds to identify potential new herbicides for the control of grass weeds in winter grain crops. The majority of these are herbicides not used in Australia. Of the herbicides, 10 were actively sourced by the project with the other eight obtained after the project was approached by agrichemical companies to explore their compounds. Field trials examined seven of the herbicides. At least four of the herbicides examined will be registered in the next few years.

**Report Disclaimer**

This document has been prepared in good faith on the basis of information available at the date of publication without any independent verification. Grains Research & Development Corporation (GRDC) does not guarantee or warrant the accuracy, reliability, completeness or currency of the information in this publication nor its usefulness in achieving any purpose. Readers are responsible for assessing the relevance and accuracy of the content of this publication. GRDC will not be liable for any loss, damage, cost or expense incurred or arising by reason of any person using or relying on information in this publication. Products may be identified by proprietary or trade names to help readers identify particular types of products but this is not, and is not intended to be, an endorsement or recommendation of any product or manufacturer referred to.
Conclusions

This research has explored 18 active ingredients not currently used for control of grass weeds in no-till grain production for their ability to control grass weeds in grain crops. Two herbicides with different modes of action were identified by the project that could be used to control grass weeds in canola and both are being developed by industry with release from 2018. A third product provided by industry was shown to be able to control annual ryegrass in canola and is likely to be safe in wheat as well. A fourth product has been registered independent of this project for pre-emergent control of annual ryegrass in canola.

If all of these products come to market, there will be four additional herbicides for pre-emergent grass weed control in canola allowing good rotation of modes of action.

The only products effective for brome grass control will be registered in canola only. Sakura® plus Avadex Xtra® remains the best control for pre-emergent brome grass control in wheat, however, the cost of this product makes it prohibitive in low yielding areas where brome grass is the major problem.

Only one of the new products appears to have significant activity on barley grass. There are no new herbicides for barley grass control in wheat and the best option for pre-emergent control of barley grass will be Sakura® plus trifluralin®.

There is the opportunity to control spring germinating windmill grass and feathertop Rhodes grass by applying Stomp® at sowing of cereals.

Recommendations

When attempting to control grass weeds with pre-emergent herbicides, particularly brome grass, growers should consider the likelihood that the grass weeds have germinated, but not emerged and should change their management practices, including pre-emergent herbicides if necessary to avoid a failure.

Outcomes

Economic benefits.
Weeds cost the grains industry at least $3.3 billion per year. Approx. 22% of this cost is due to residual weeds remaining in fields. Better weed control early in the season could reduce these costs. Increasing herbicide resistance will increase the costs associated with residual weeds. This project has identified two new herbicides for pre-emergent or post-emergent control of grass weeds in canola that are being developed by industry with the first product due for registration in 2018. It also provided additional field data for one product identified by industry for the pre-emergent control of annual ryegrass in canola and possibly wheat. These new herbicides should help manage the threat of herbicide resistance to Group D herbicides currently widely used in canola.

Environmental benefits
No-till has major environmental benefits including better soil structure, reduced erosion, better water infiltration, lower...
energy costs, better soil health and greater carbon (C) storage. No-till farming systems are very reliant on herbicides to control weeds during the crop phase. Herbicide resistant weeds pose a significant risk to no-till farming systems and their environmental benefits. Without a herbicide to provide early season control, growers may have to revert to tillage for weed management. This project, by aiding the development and adoption of new herbicides for grass weed control in canola, will assist in maintaining the benefits of no-till agriculture.

Achievements/Benefits

Grass weeds continue to be a major concern for crop production across Australia. Resistance in grass weed species to post-emergent herbicides makes their control more difficult. In addition, the biology of brome and barley grass in continuously cropped areas has changed with these grass weeds now emerging after the crop has been sown. The lack of alternative effective chemistry for certain grass weed species, such as brome grass and windmill grass, hampers their control. Grain production in Australia is overwhelmingly using no-till seeding systems, with significant benefits in terms of soil structure, increased stubble retention, reduced erosion and timely crop seeding. However, no-till systems also encourage the proliferation of these grass weed species. This research was intended to identify new herbicide uses for the control of brome grass, barley grass and windmill grass.

For grass weeds in winter grain crops, a total of 18 active ingredients not currently registered for use in grain production in Australia were examined. These represented seven different modes of action. Ten of these active ingredients were sourced directly by the project based on their use overseas, or their potential to control grass weeds. The other eight active ingredients were obtained as a result of approaches from chemical companies. While the focus of the project was on developing new herbicides for the management of brome grass and barley grass, feedback from the chemical industry was that without efficacy on annual ryegrass and safety in major field crops, it would be unlikely that products would be registered for Australia. Therefore, all products were tested for the ability to control annual ryegrass, as well as barley grass and brome grass.

Of these 18 active ingredients, seven were examined in field trials. A total of 13 field trials were conducted from 2013 to 2015 at Roseworthy, Balaklava, Baroota and Mambray Creek in South Australia (SA) and at Culgoa, Gama and Ultima in Victoria (VIC). Trials were conducted on barley grass (3), brome grass (6) and annual ryegrass (7). Some trials contained more than one grass weed species.

For the herbicides examined in field trials, AGF3500 was sourced on the basis that it is used overseas in mixtures either pre-emergent or post-emergent in cereals. In pot trials, it was more effective used PRE than POST. In field trials, it proved to be effective against brome grass, particularly when mixed with other herbicides, such as Avadex Xtra®. However, it caused a large amount of crop damage to cereals under some circumstances. Adama is no longer pursuing a registration for this herbicide in Australia.

F9600 was obtained following an approach from FMC Australia. F9600 is a new pre-emergent herbicide with a mode of action not currently used in grain production. In pot trials, this herbicide proved to be effective against brome grass, particularly when mixed with other herbicides, such as Avadex Xtra®. However, it caused a large amount of crop damage to cereals under some circumstances. Adama is no longer pursuing a registration for this herbicide in Australia.

Experimental 1 was sourced on the basis that it was likely to have grass weed activity. It is not used in grain production systems anywhere in the world. It belongs to a mode of action that is already in use in Australia. In pot trials it proved to be safe in canola, but damaged cereals and pulse crops. It was more effective on annual ryegrass than other grass weeds and effective both pre-emergent and post-emergent. Field trials showed it was safe in canola. It was effective on both brome grass and annual ryegrass both pre-emergent and post-emergent. However, activity is very dependent on adequate soil moisture and it struggled in very dry years. This herbicide is being developed by Arysta for grass weed control in canola. The likely date of introduction is 2019 to 2020.
Experimental 6 was sourced on the basis that it is used post-emergent overseas, but is not sold in Australia. It has a mode of action not otherwise used in grain production. In pot trials, it proved to be damaging to cereals, but safe in canola and pulse crops. It had activity on all grass weeds, but activity was better on brome grass and barley grass. In field trials, it performed relatively poorly when used as a post-emergent herbicide on annual ryegrass, but was more effective used as a pre-emergent herbicide. This herbicide is being developed by Adama for pre-emergent use in canola with a proposed launch in 2018.

Experimental 3 was obtained following an approach from a company. This is a herbicide used overseas for the control of weeds pre-emergent or post-emergent in canola. In pot trials, Experimental 3 proved to be safest in canola and pulses. It was most effective as a pre-emergent herbicide on grass weeds. In field trials, Experimental 3 had mixed results. It struggled on high populations of grass weeds. While the original company is not pursuing a registration in Australia, BASF has independently registered this herbicide as Butisan® for pre-emergent use in canola.

The other two herbicides used in field trials, Experimental 2 and Experimental 8 provided insufficient control of grass weeds in field trials and are not being pursued. Experimental 15 was only used in pot trials, but showed safety in cereals and control of annual ryegrass. This herbicide was poor on other grass weeds on its own, but very effective in mixtures. This herbicide is from a mode of action not used against grass weeds in grain production and development continues.

A problem with pre-emergent herbicides is that they can fail if the moisture conditions are poor. Pot trials established that trifluralin® applied in situations where grass weeds have already germinated prior to sowing was likely to fail. Pyroxasulfone® (Sakura®) was also affected, but to a lesser extent. The problem was more acute with brome grass than it was with annual ryegrass, with herbicides more likely to fail on brome grass. One way of managing this problem is to use pre-emergent herbicides before rains have started to germinate grass weeds.

Pot trials with the Chloris species, windmill grass and feathertop Rhodes grass showed that S-metolachlor® (Dual Gold®) used prior to germination would provide effective control. However, the relatively short persistence of S-metolachlor means it can only be used in the fallow period to control these weeds. However, there is not yet a label for use of S-metolachlor in fallow.

Pot trials with the same species showed that pendimethalin® (Stomp®) applied in early winter is able to inhibit germination of feathertop Rhodes grass and windmill grass in summer. This provides the opportunity to apply this herbicide at sowing in cereal crops and thereby reduce emergence of these difficult to control weeds. This strategy will need to be tested with field trials.

Other research
There is a need to test the ability of autumn and winter applications of pendimethalin® to control emergence of windmill grass and feathertop Rhodes grass in spring. If these are successful, this will be an easy and inexpensive way of reducing the problems of these weeds in fallows.

S-metolachlor® was an effective herbicide for control of feathertop Rhodes grass if applied just prior to germination. S-metolachlor may be a useful product for fallow use given its relatively short persistence period. There is currently no registration for this herbicide for fallow use. There would need to be trials conducted to determine the rates that are likely to be effective.

Intellectual property summary
The outcomes of this project will be delivered by the agrichemical companies through additional registrations of herbicides for the control of grass weeds in winter cereals. Data from trials have been shared with the companies to facilitate registrations.

Additional information
