

FINAL REPORT

Herbicide tolerance of barley and wheat cultivars in NR (phase III)

DAQ00106

Project Details

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- **Supervisor:** Steven Walker (Associate Professor)
- **Organisation:** Queensland Alliance for Agriculture and Food Innovation
PO Box 2282 Toowoomba QLD 4350
- **Contact Name:** Steven Walker
Phone: 07 4639 8838
Email: s.walker11@uq.edu.au

Summary

During the past 10 years, this project tested 23 barley and 51 wheat varieties with 19 and 34 registered herbicides, respectively. It concentrated on new varieties and herbicides.

The research highlighted that Northern Region (NR) wheat and barley varieties differed considerably in their sensitivity to these herbicides.

Overall, 9 per cent of wheat variety x herbicide combinations and 6 per cent of barley variety x herbicide combinations had significant yield losses (3 to 38%) from herbicides at recommended rates and crop stages. In addition, 21 to 23 per cent had significant yield losses from herbicides at double rates, indicating a narrow margin of crop safety.

This information is available on Queensland's Department of Employment, Economic Development and Innovation (DEEDI) and National Variety Trials (NVT) websites.

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Old Reports

The subject matter in this report may have been revisited or may have been wholly or partially superseded in subsequent work funded by GRDC or others (check completion date).

Conclusions

1. Herbicides can be used safely for 70 percent of the possible NR cultivar x herbicide combinations in the NR environment.
2. The wheat herbicides that had no adverse impact on yield when applied at the recommended rate were Achieve[®], Axial[®], Boxer Gold[®], Bromicide MA[®], Crusader[®] + MCPA LVE[®], Glean[®] pre-plant, Hotshot[®], Logran[®], Logran B-power[®], MCPA amine[#], Precept[®], Tordon 75D[®] + 24D[#], Torpedo[®], Tristar Advance[®] and Wildcat[®].
3. The barley herbicides that had no adverse impact on yield when applied at the recommended rate were Achieve, Ally[®], Ally + MCPA[#], Amicide[®], Axial, Boxer Gold, Bromicide MA, Decision[®], Hotshot, MCPA amine, Torpedo, and TriflurX[®].
4. Yields of the following wheat cultivars: Carinya[^], EGA Gregory[^], EGA Hume[^], EGA Stampede[^], EGA Wentworth[^], EGA Wills[^], GBA Sapphire[^] and Sunzell[^] were not adversely affected by any herbicide at the recommended rate.
5. EGA Wills[^] was the only wheat cultivar with yields not affected by any herbicide at the double rate.
6. Yields of the following barley cultivars: Capstan[^], Fitzroy[^], Fleet[^], Gairdner[^], Grout[^], Kaputar[^], Skiff[^], Tantantaga[^] and Vlamingh[^] were not adversely affected by any herbicide at the recommended rate.
7. Skiff[^] and Vlamingh[^] were the only barley cultivars with yields not affected by any herbicide at the double rate.
8. The wheat cultivars most affected were Cunningham, EGA Wylie[^], Ellison[^], Giles[^], Jandaroi[^], Petrie[^], Rees[^], QALBis[^], Sunlin[^], Ventura[^], Wollaroi[^] and Yallaroi[^].
9. The barley cultivars most affected were Grimmett[^] and Mackay[^] and to a lesser extent Binalong[^], Cowabbie[^], Lindwall[^] and Tallon[^].
10. The herbicides having the greatest adverse impact on yield were Ally, Amicide, Cadence[®], Glean, Husar[®], Mataven[®] SST (wheat) and Bromicide 200[®], Cadence and MCPA LVE, Tristar Advance (barley).

Recommendations

1. Growers and agronomists should consult the brochure 'Sensitivity of barley and wheat cultivars to herbicides' or the spreadsheet on the NVT website, before making decisions on cultivar and herbicide choices. These information sources clearly outline the safest cultivars and herbicides that have not caused any yield losses.
2. Growers should avoid using those herbicides that have been found to cause significant yield losses on their chosen cultivars, by either choosing alternative and safer herbicides or choosing alternative cultivars for their effective herbicides.
3. Growers should also consider their options for those herbicide x cultivar combinations that have only a narrow safety margin. The information packages now outline the extent of yield loss expected and the probability of this happening. If these herbicide x cultivar combinations are to be used, then growers need to be vigilant that the herbicides are applied under optimum conditions, using the minimum effective rate, and avoid any spraying overlaps.

Outcomes

The overall outcome is that the adverse impacts of herbicides on barley and wheat productivity will be reduced for NR growers.

Economic:

Using the information from this research, growers and agronomists can select safer herbicide options for their sown cultivar and select more-tolerant cultivars for their important herbicides. The information generated from this project

has the potential to save approximately 20 per cent crop income, as indicated by the 3 to 38 per cent significant yield losses measured for certain cultivars from registered herbicides at the recommended rates. Chemical companies will be able to better promote their new products for safe use on certain cultivars and highlight risks for some other more-sensitive cultivars. In addition, seed companies will be able to better promote their new cultivars, alerting growers and agronomists to their sensitivity and tolerance to the commonly used herbicides.

Environmental:

The information provided to farmers will allow best herbicide management options for safe weed control in crops, which is essential for maximising crop yields and protecting the surrounding environment.

Achievement/Benefit

This is the third herbicide tolerance project since crop tolerance research was initiated in NR in 1999. During the past 10 years, 23 barley and 51 wheat varieties with 19 and 34 registered herbicides respectively have been tested. This research highlighted that NR wheat and barley varieties differed considerably in their sensitivity to these herbicides.

The barley varieties tested were: Baudin^A, Binalong^A, Buloke^A, Capstan^A, Commander^A, Cowabbbie^A, Flagship^A, Fitzroy^A, Fleet^A, Gairdner^A, Gilbert^A, Grimmer^A, Grout^A, Hindmarsh^A, Kaputar^A, Lindwall^A, Mackay^A, Schooner^A, Shepherd^A, Skiff^A, Tallon^A, Tantangara^A and Vlamingh^A.

The wheat varieties tested were: Batavia 2^A, Baxter^A, Braewood^A, Caparoi^A, Carinya^A, Cunningham, EGA Bellaroi^A, EGA Bounty^A, EGA Burke^A, EGA Kidman^A, EGA Gregory^A, EGA Hume^A, EGA Stampede^A, EGA Wentworth^A, EGA Wills^A, EGA Wylie^A, Ellison^A, GBA Combat^A, GBA Hunter^A, GBA Ruby^A, GBA Sapphire^A, Giles^A, Hartog^A, Hybrid Mercury, Jandaroi^A, Janz^A, Kamilaroi^A, Kennedy^A, Lang^A, Leichhardt^A, Livingston^A, LR Crusader^A, LR Dakota^A, LR Hornet^A, Merinda^A, Pelsart^A, Petrie^A, QALBis^A, Rees^A, Strzelecki^A, Sunbri^A, Sunbrook^A, Sunco^A, Sunlin^A, Sunstate^A, Sunvale^A, Sunvex^A, Sunzell^A, Ventura^A, Wollaroi^A and Yallaroi^A.

The following registered herbicides have been tested on barley and/or wheat: Achieve[®], Ally[®], Ally + MCPA[#], Amicide 500[®]/625, Atlantis[®], Atlantis OD[®], Axial[®] 100EC, Boxer Gold[®], Broadside[®], Bromicide MA[®], Bromicide 200[®], Cadence[®], Crusader[®], Crusader + Hotshot[®], Crusader + MCPA LVE[®], Crusader + Hotshot + MCPA LVE[®], Decision[®], Glean[®] pre-plant, Glean, Hotshot[®], Hussar[®], Hussar OD[®], Logran[®], Logran B-power[®], Mataven 90[®], Mataven 90 (SST)[®], MCPA 500[®], MCPA LVE, Precept[®], Starane 200[®]/Advanced, Topik 240EC[®], Tordon 242[®], Tordon 75D[®] +24D, Torpedo[®], TriflurX[®], Tristar Advance[®] and Wildcat[®].

Overall, 250 barley cultivar x herbicide combinations and 890 wheat cultivar x herbicide combinations have been evaluated, with the majority of these repeated in several environments (sites or years).

Also in 2008, four chickpea cultivars (Flipper^A, Jimbour^A, Kyabra

and

Yorker^A) plus one breeding line were tested with four herbicides (Balance[®], Balance + simazine[#], simazine, and simazine + Spinnaker[®]).

The results from this and the previous projects have identified those cultivar x herbicide combinations that may cause significant yield losses at the herbicide recommended rate and timing. Overall, we found that nine per cent of wheat cultivar x herbicide combinations and six per cent of barley cultivar x herbicide combinations were found to have significant yield losses (3 to 38%) from herbicides at the recommended rates and crop stage. These losses would result in substantially reduced farm profit.

In addition, 21 per cent and 23 per cent had significant yield losses from herbicides at the double rates for wheat and barley respectively. This indicates a narrow margin of crop safety, particularly when applied under non-ideal growing conditions or outside the recommended crop growth stage.

However, on a more positive note, 70 per cent of all cultivar x herbicide combinations for these crops were safe with a reasonable safety margin.

The following herbicides did not affect yields of any barley cultivar, although some of these have not been tested as extensively as the other herbicides: Achieve, Ally, Ally + MCPA, Amicide^{®#}, Axial, Boxer Gold, Bromicide MA, Decision, Hotshot, MCPA amine[#], Torpedo and TriflurX .

The following herbicides did not affect yields of any wheat cultivar: Achieve, Axial, Boxer Gold, Bromicide MA, Crusader + MCPA LVE, Glean pre-plant, Hotshot, Logran, Logran B-power, MCPA amine, Precept, Tordon 75D + 24D, Torpedo, Tristar Advance, and Wildcat. As with barley, some of these have not been tested as extensively as the other herbicides.

In the past three years, commonly grown cultivars with 12 new barley and 23 new wheat herbicides were tested, of which Atlantis OD, Boxer Gold, Precept, Crusader, Crusader + Hotshot, Crusader + MCPA LVE, Crusader + Hotshot + MCPA LVE, Hussar OD, and Starane^{®#} Advanced are now registered, and a number of other products are close to registration. Our data were (or will be) used to support these registrations. The majority of these showed some differential cultivar sensitivity. As well, several products were found to be phytotoxic, and the companies have decided not to pursue further development and registration, based on our results.

In the past three years, 15 wheat breeding lines were also tested, of which nine are now released - EGA Burke, EGA Wills, EGA Stampede, Merinda, Jandaroi, Caparoi, Livingston, Sunzell and Sunvex. Some of these were sensitive to Ally, Amicide, Glean, MCPA LVE and Tordon 242, but all were tolerant to Starane. Evaluation of six barley breeding lines showed sensitive of some lines to Ally, MCPA LVE, and Tordon 242, but tolerant to Starane, Achieve and Amicide. Commander and Shepherd are now released.

Many of the herbicides caused initial phytotoxic symptoms, ranging from slight to substantial (> 50% biomass reduction). In many situations, the cultivar recovered without significant yield loss, possibly due to favourable growing conditions. In other situations, the cultivar did not recover. However, some varieties did not display any symptoms following herbicide application, but yields were reduced significantly. Thus, it is not possible to predict yield loss from the initial symptoms. As well as using visual ratings to estimate phytotoxic symptoms and biomass reductions, we are now using the new technology 'Green seeker' measuring normalised difference vegetation index, which accurately measures differences in crop biomass.

This information was regularly extended to the grains industry, chemical and seed companies as well as the breeding teams in a variety of media. Each year, a technical report of approximately 50 pages was widely distributed to stakeholders with detailed information on the tested registered herbicides and released cultivars. Individual technical reports were also sent to each sponsoring chemical company with detailed information on the responses of their unregistered products and similarly to the breeding teams. Field days were held regularly, particularly with the chemical industry.

The brochure 'Sensitivity of barley and wheat cultivars to herbicides' was published on the DEEDI website. This brochure was updated annually and promoted widely in the media and at industry forums. Information from this research was also published in DEEDI wheat variety guide, New South Wales DPI 'Weed control in winter crops' booklet, herbicide registration, and various herbicide and variety promotional packages.

A recent development was the publication of this project's data on the NVT website, making the information more accessible. The format for presenting the data was modified to be consistent nationally and to include additional information.

In summary, the outputs from this and the previous projects have been extensively promoted to ensure that end-users in NR, and to a lesser extent all cropping regions, are able to make more-informed decisions. Feedback from the NR grains industry and chemical companies indicates that there is widespread use of this information.

Other Research

This project has confirmed that research on this topic is essential, and needs to continue with particular emphasis on screening advanced breeding lines. This is the focus of the new project submitted to GRDC. There will be closer collaboration with NVT in the new project and the herbicide tolerance of those lines in the NVT trials will be tested.

The preliminary trial with chickpeas highlighted that there is potential differential varietal tolerance. This aspect will be explored in the new project.