

FINAL REPORT

DAQ00197

Cultural management options for herbicide resistant weeds

PROJECT DETAILS

PROJECT CODE: DAQ00197

PROJECT TITLE: CULTURAL MANAGEMENT OPTIONS FOR HERBICIDE RESISTANT WEEDS

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Summary

Heavy reliance on herbicides for in-crop weed management nationally has resulted in widespread herbicide resistance. Growing competitive crops can suppress in-crop weeds and often results in reduced weed numbers and reduced weed seed production. This research involved a comprehensive and national literature review on existing crop competition studies, a meta-analysis of existing data, identified knowledge gaps and developed recommendations for future national research, including a protocol for improved research and development (R&D) for crop competition. A final report was submitted and a draft brochure was developed to promote crop competition as an effective weed management tactic.

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Old or Archival Reports (Projects that concluded in 2007 or earlier)

The information contained in these older reports is now several years old, and may have been wholly or partially superseded or built upon in subsequent work funded by GRDC or others. Readers should be aware that more recent research may be more useful for their needs. Findings related to agricultural chemical use are also potentially out of date and are not to be taken as a recommendation for their use.

Conclusions

Priority weed species:

- Common weeds across the regions are annual ryegrass, wild radish, wild oats and fleabane.
- Windmill grass and feathertop Rhodes grass are emerging problems.
- Weeds specific to regions include brome grass and prickly lettuce for the GRDC Western and Southern Regions, and sweet summer grass for the Northern Region.

Literature review for each region:

- More research has been done in the GRDC Western and Southern Regions compared with the Northern.
- Most of the research has been done on wheat.
- Most of the research has been done on the crop competition factors of density, row spacing and variety.
- Mimic or sown weeds were commonly used to establish uniform stands (e.g. oats, millet, canola).

Meta-analysis of pooled data:

- An increase in crop density commonly resulted in a decrease in weed growth. This was consistent across crops and regions and for different weed species.
- Varieties can differ in their competitive ability across crop species with more competitive varieties resulting in a decrease in weed growth measures. However, not all studies show a difference between varieties and the effects of different varieties can be inconsistent as affected by season.
- A row orientation of east-west, as opposed to north-south, generally results in a reduction in weed growth measures, especially in the Western Region. However, results are inconsistent.
- A decrease in row spacing generally resulted in a decrease in weed growth measures. This effect was consistent across crop species and regions.
- Skip rows research has only been conducted in the Northern Region. Generally, solid planting reduces weed growth measures compared with skip rows.
- An early sowing time generally reduced weed growth. However, there has been little research on this crop competition factor.

National research, development and extension (RD&E) needs

- Breeding for and evaluation of competitive ability of the most important crops is required. Also, understanding of the traits and genetics that influence competitive ability (e.g. allelopathy, early vigour). Varieties in National Variety Trials (NVT) should be rated on early ground cover.
- Can gains be made in the competitive ability of weakly competitive crops (e.g. pulses)? Such crops represent a weak phase in the crop rotation (in terms of crop competition) and therefore gains should be pursued.
- Varietal differences - there are new varieties being released periodically and therefore this type of research should

continue as a routine process, maybe as part of the NVT.

- Fertiliser rates and more efficient fertiliser placement (horizontally and vertically) to favour the crop over the weed, measuring impact of crop competitiveness ability on weed control.
- There are insufficient data across all regions on key weed species. For example, in the west, most research is on annual ryegrass and wild radish. This is a major issue across all regions.
- The effect of the timing of weed emergence on the efficacy of crop competition.
- Do specific crop rotations outcompete weeds compared to others?
- Growers need more guidance, demonstration and extension as to how to use crop competition and how to best fit it in the farming system. How to integrate into an integrated weed management (IWM) system.
- If crop and variety competitiveness information is available, it should be in crop production agronomy guides.

Recommendations

- Future crop competition research requires national funding, coordination and communication for:
 - National breeding for competitive ability traits,
 - Regional packages for agronomy,
 - Research consistency to improve the quality of research outputs
- That GRDC supports a National Crop Competition Program to improve communication, coordination and quality of RD&E on crop competition for the Australian grains industry.
- A monograph (scientific refereed literature review) of the project technical report be produced in conjunction with a short (4-8 page) extension document, to promote nationally, crop competition as a weed management tactic.
- Specific research needs: While the principles underpinning agronomy of crop competition are well-understood, basic research on traits for breeding is needed. In addition, strategic and applied research on crops by competition factors at the regional level.

Outcomes

Herbicide resistance is a major limiting factor in the effective management of in-crop weeds. Growing a competitive crop provides an economic tactic for improved weed management in-crop while reducing reliance on herbicides.

This project has identified key principles for the use of crop competition as a weed management tactic and has identified key knowledge gaps that require further research to ensure crop competition is optimised across regions, cropping systems and weed species. A final technical report and brochure have been prepared and submitted to GRDC. The brochure is designed as a tool to promote crop competition as an effective weed management tactic.

The scoping study provides a framework for GRDC future investment in RD&E to optimise communication, collaboration and coordination of investments across Australia. The findings of the study are described in the project's final technical report.

Achievements/Benefits

The aim of this project was to build the capacity of growers and advisers (provide knowledge and create understanding) to effectively integrate or utilise crop competition as a tactic for improved weed management. By 2020, it is planned that there will be a 20% increase in growers effectively using cultural weed management (crop competition) as a tactic to reduce current economic losses and to minimise control costs.

This scoping study was conducted by weed experts from each of the three regions (Western, Southern, Northern). It involved a comprehensive review of literature, a meta-analysis of available data and a knowledge gap analysis of needs for future RD&E.

A final technical report was submitted to GRDC and includes:

- identified priority weed species.
- a literature review for each region.
- a meta-analysis of pooled data.
- a knowledge gap analysis.
- identified future RD&E needs, and
- a protocol for future improved R&D for crop competition.

A brochure suitable for on-line publication was developed and submitted to GRDC for approval.

The technical report helps to inform future research priorities and the brochure, based on the desk-top study, will inform growers of the benefits of crop competition as a weed management tactic.

Other research

Possible collaboration with NVT projects and agronomy projects to increase breeding for and data collection on crop competitive ability.

Possible collaboration with extension or communication projects to assist in developing regional packages to further promote crop competition as an effective weed management tactic.

Possible collaboration with grower solutions groups and regional research agronomy groups to demonstrate the application and efficacy of crop competition as an effective weed management tactic.

Use the final technical report to prepare a monograph (scientific refereed literature review) of the project in conjunction with a short (4-8 page) extension document to nationally promote crop competition as a weed management tactic.