FINAL REPORT

GRDC Grains Research & Development Corporation

Continued delivery of applied solutions to weed issues in central Queensland

DAQ00105

Project Details

- **Project Code:** DAQ00105
- **Project Title:** Continued delivery of applied solutions to weed issues in central Queensland
- **Start Date:** 01.07.2006 **End Date:** 30.06.2011
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Summary

In the mid-2000s, three areas requiring more research were identified and became project objectives. These objectives were:

1. management of problem weeds - feathertop Rhodes grass (FTR);
2. weed management in wide-row crops; and
3. improvement of herbicide efficacy under sub-optimal conditions.

A fourth objective was added in 2009:

1. identification of the weed issues and related research, development and extension needs of northern and central Queensland (QLD) and near-coastal farming systems.

This project completed 28 small plot/pot trials to address objectives (a) to (c), and eight half-day workshops and field surveys to address objective (d).

Tactics and strategies from the project were evaluated and communicated via peer-reviewed articles, updates and field walks and a comprehensive scoping study report was submitted.

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The subject matter in this report may have been revisited or may have been wholly or partially superseded in subsequent work funded by GRDC or others (check completion date).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

Managing feathertop Rhodes grass (FTR)

- Applying glyphosate# alone is no longer an effective option for control of FTR unless the target weed is small (2-4 leaf) or the chemical is applied well before tillering.
- Once tillering starts, the double knock approach (glyphosate followed by paraquat#) provides most consistent and reliable control (>95%).
- Adding residual herbicides to the second knock improves the knockdown by the paraquat and provides residual control of future cohorts of FTR (for 1-3 months).
- Group A herbicides show high levels of efficacy across all growth stages. Fluazifop# appears to be the best but is very costly. Imazapic# and atrazine# with s-metolachlor# are the stand-out residuals.
- Crop sequencing will be the key to managing FTR over the longer term as it allows for rotation of a range of effective residuals and use of group A in-crop. Sorghum cropping tends to exacerbate FTR problems.
- Seedbanks appear to be short-lived (7-12 months) and seeds are significantly impacted by tillage, particularly if buried below 5cm.

Weed management in wide-row crop systems

- Irvin boom and WeedSeeker technology can be effectively and safely used in wide row broadacre crops for inter-row weed management. The presence of standing crop stubbles did not inhibit the effectiveness of these technologies.
- Paraquat and/or glyphosate were effective options for the inter-row when using shielded spray technology with and without WeedSeeker fitted.
- In very wide row sorghum, paraquat can be effectively applied using Irvin booms without shields or shrouds. Any crop contact by the herbicide is minimal resulting in minor transient damage.
- While wide rows (1m or greater) reduce crop competition, the wider gap between rows allows for easier inter-row weed control whether by tillage or by post-emergence herbicides. Wider rows also better facilitate use of shielded spray equipment.
- Banding residuals over the row and utilising knockdowns or tillage between rows can provide up to 66% reduction in physical amount of residual herbicide used (equates to cost savings and less herbicide available for movement off-target).

Herbicide efficacy improvement under sub-optimal conditions

- In this single study, of the 12 adjuvants tested (nine singly and three mixes), only ammonium sulphate# significantly improved the efficacy of glyphosate applied using very coarse droplets. An added benefit was recorded where a 100% non-ionic wetter (such as Chemwet 1000) was added in conjunction to the ammonium sulphate.
- The same study showed no gains/improvements in glyphosate efficacy by adding fulvic acid, contrary to the claim being made by a couple of CQ growers.
- Efficacy of either 2,4-D# or MCPA# is not significantly compromised by using coarse to extra coarse droplet spectra. However, when using extra-coarse droplets, efficacy is improved when water volumes are kept higher (60L much better than 40L/ha).

Scoping study

- 134 weeds, 83 weed issues and 46 research, development and extension (RD&E) needs identified from seven regions of study (Bundaberg, Innisfail, Atherton Tablelands including the Mareeba-Dimbulah irrigation area, Burdekin, Mackay-Whitsundays, Central Highlands and Dawson-Callide Valleys).
- Recommendations for weeds RD&E investment were made along with identification of three key areas for multi-region across-industry (collaborative GRDC, Horticulture Australia, Sugar Research and Development Corporation, Cotton Research and Development Corporation) co-funding opportunities.

Recommendations

1. For the effective herbicides identified in the project trials, product labels need to be amended to have uses on feathertop Rhodes grass included and therefore registered. Until this occurs, the use of these products is illegal under agricultural chemical-use laws. These amendments might occur by direct submission from the chemical company (product owner) or via Category 25 registration submissions proposed by industry. In either case, data generated in this project are offered to support such submissions. This has already occurred with Syngenta for their s-metolachlor# products.
2. Further in-depth research needs to be undertaken on feathertop Rhodes grass to fill knowledge gaps and improve understanding of the weaknesses and strengths in the plant's life cycle and how it responds to stress. Weaknesses in the plant's biology and ecology provide the most ideal targets or opportunities for management.
3. Further detailed research of *Tridax* daisy biology and management needs to be undertaken. This perennial species is steadily increasing in density and distribution in cropping paddocks and is not easily controlled by commonly used herbicides. Insufficient resources and lack of suitable trial sites during the past five years have limited the attention given to this emerging and increasing problem.
4. The regional development and extension (Grower Solutions) projects need to take the research results generated in this project and upscale them to commercial practice and validate them on-farm so as to foster and promote wider grower adoption. This includes not only the feathertop Rhodes grass management work but also the weed management techniques deemed effective in the wide row crop management research undertaken in this project. Unfortunately the latter will occur only if and when the issue is identified as a priority need by regional growers and agronomists.

Outcomes

Feathertop Rhodes grass is now a major summer grass weed in cropping systems throughout Queensland and northern New South Wales (NSW). It is also a problem in Victoria (VIC), South Australia (SA) and Western Australia (WA). Cropping systems have selected for this glyphosate#-tolerant species. Moderate densities of FTR may cause up to 60% crop yield loss so it is critical that effective management is achieved. FTR is an insidious weed that has the potential, if not controlled, to force changes in land-use (cropping to pasture) as cropping could become unviable.

This project has identified and tested a range of fallow and in-crop chemical and non-chemical tactics to effectively control the weed. Better managed FTR including the seedbank will have positive profitability impacts through increased crop yields and/or reductions in production costs over the long term, and this should occur without adversely impacting on the environment. The direct interaction through on-farm activities (albeit limited in this project) has assisted in building growers' capacity to solve this issue. Over the next three to four years, this will increase as the regional Grower Solutions projects apply the development and extension component to this research to foster greater Best Weed Management (BWM) practice adoption/change.

Similarly, the weed management strategies for wide-row systems and practices to improve herbicide efficacy under sub-optimal conditions determined and evaluated in this project, when adopted, have the propensity to reduce production costs. Zonal weed management in wide row systems could see a 50-66% reduction in residual herbicide use because the residual is banded only on the row. If shielded WeedSeeker technology is used for the inter-row, post-emergence herbicide use may be reduced by 50-70% (weed density dependent) without compromising good weed control. These much reduced herbicide use patterns will also greatly reduce the potential risks to the environment - grains and pulse industries become cleaner and greener and more socially acceptable to the wider community.

The scoping study has presented some ideas and opportunities for across industry funding to solve common problems/issues (three areas were identified). Several agencies sharing the R&D cost, but fully benefiting from the outcomes, has advantages compared to going/doing it alone. This has the potential to provide much greater return on dollars invested for each participating agency.

Achievement/Benefit

Background and the issues addressed

Central Queensland (CQ) dryland farming systems have a suite of weed management issues that require an integrated systems approach. Developing practical solutions to existing and new weed issues and communicating these and other recently developed strategies are the foci of this follow-on (from DAQ00064) project.

Priority problematic or difficult to control weeds such as feathertop Rhodes grass (FTR) require the evaluation and development of BWM practices (herbicide and non-herbicide tactics) for effective management. Wide row cropping has also presented new weed management issues and in some instances this will require more emphasis on smart herbicide management and use. Studies on the adaptability and effectiveness of Irvin boom and WeedSeeker technology use in-crop for zonal weed management along with application of strategic tillage in the inter-row zone are needed. Likewise, the need to maximise herbicide efficacy in hostile sub-optimal application environments is necessary to reduce costs and avoid off-target herbicide movement, but how is this best achieved?

Finding and applying solutions to these issues will provide significant benefits to growers. Seed banks and weeds will be better managed, providing potential increases in crop yields and/or reduction in production costs over the longer term, while minimising adverse environmental impacts. The project has potential to impact on at least 250,000ha of CQ cropping country and the outcomes may also be realised in other grain production areas of the northern region.

A late addition to project outputs included a scoping study of the weeds and issues, and the related weeds RD&E needs of northern, central and near-coastal farming systems of Queensland.

The project's objectives were:

1. Develop BWM practices for key difficult-to-control weeds such as FTR grass.
2. Develop strategies for effective weed management in wide-row crop systems.
3. Develop strategies to maximise herbicide efficacy under adverse conditions.
4. Conduct a scoping study of weed issues and the R,D&E needs of northern, CQ and near-coastal farming systems that include grains and pulses.

Major achievements of the project

Across all aspects of the project, 33 trials/experiments (small plot replicated field, pot and incubator studies) were conducted, with 28 completed during the 4-5 year project term.

Communication activities were undertaken to deliver the research results to various audiences. These included one radio interview, five press releases, 15 newsletter/grower-targeted articles, one weed management brochure (BWM guide), three Update papers/presentations, nine conference, forum and symposium papers with presentations, one scoping study report and presentations at 21 field day/trial inspection/grower shed meetings.

(a) Difficult to control weeds (with feathertop Rhodes grass focus)

Eight fallow field trials and seven crop/fallow phases in a single long-term rotation trial were successfully completed to determine BWM for FTR. These were supported by three pot, three incubator trials and one long term tillage trial to generate a better understanding of the species' biology and ecology. An interim BWM guide was developed and delivered mid-way through the project and an updated version is currently being developed for delivery in early 2012. The FTR research outcomes generated by this project have also been utilised by the regional Grower Solutions projects to foster and drive greater grower adoption.

The fallow field trials have demonstrated the effectiveness of several knockdown and residual herbicides for FTR management at various growth stages and stress conditions. The double knock technique, with and without residual herbicides included in the second knock, has been evaluated. Crop phases of the long term rotation trial have examined effects of crop competition from sorghum, sunflower, mungbeans, wheat and chickpeas in conjunction with in-crop herbicide use (both pre- and post-emergence herbicides). The tillage trial has shown the effects of different tillage types and depths, with and without residual herbicide use, on FTR seedling recruitment over time (seedbank impacts). The in-ground pot studies have examined the impact of burial depth and time on seed persistence (viability/longevity) and germination.

(b) Wide row weed management

Seven small plot replicated field trials were completed during the course of the project to determine if zonal weed management (using different strategies on the row to that used in the inter-row) can be effective at reducing overall herbicide use without sacrificing good weed control. Two conference papers (2008 and 2011) were presented to industry covering this project component. These papers concisely indicate the outputs, outcomes and potential impacts of this research for the northern grains region.

(c) Maximising herbicide efficacy under sub-optimal conditions

Three field trials were completed for the project. Work in this area was deliberately scaled back due to the increased efforts and delivery of similar information (locally and elsewhere) by spray application experts Bill Gordon and Graham Betts. The project trials examined the effectiveness of adjuvants for glyphosate# efficacy improvement and the effects on coarse droplet spectra, water volumes and application speeds on the efficacy of 2,4-D# and MCPA#.

(d) Scoping study of weed issues and R,D&E needs in northern and CQ and near-coastal farming systems

Eight half-day workshops were conducted with regional growers and cropping industries in north QLD, CQ and coastal farming areas. The information gathered was further supported by half-day field inspections in all locations to determine the weeds surviving the current applied management regimes. A comprehensive 72-page report was written and submitted to GRDC highlighting all of the identified weed issues, current weed species and current practices. A listing of participant-identified weeds and R,D& E needs was also included. The needs were also prioritised according to impact on production and likelihood of solutions if given some investment.

Industry benefits

Feathertop Rhodes grass and its seedbank will be better managed, leading to improved crop yields and/or reduction in productions costs over the longer term, while minimising the environmental footprint of farming. These two benefits will enhance the sustainability of farming systems.

Growers will be able to achieve better weed control with less off-target movement by adjusting their application parameters (nozzles, speed, boom height, water volumes, etc.) to maximise efficacy of their glyphosate and phenoxy# herbicide applications.

Results generated in this project have been made available to industry (Syngenta) to provide support to herbicide label registration changes for metolachlor# use on feathertop Rhodes grass in fallow and sorghum. This will allow legal and safe (responsible) use by growers. The data will also be used to support Category 25 registration submissions (via Pathways to Registration project) for other herbicides not currently registered for use on feathertop Rhodes grass in fallow and main CQ crops.

Other Research

A major focus of the new central Queensland Grower Solutions Project (CQGS, DAQ00170) 2011-2015 is on-farm development of integrated weed management (IWM) for feathertop Rhodes grass and sweet summer grass. This is an expanded follow-on from similar work undertaken in the final 12 months (2010) of the previous central Queensland farming systems project, which started to upscale and validate the research results generated in the small plot trials of this project (DAQ00105). This up-scaling and on-farm validation is necessary to foster and drive the adoption of the original research.

Project DAQ00105 involved some basic biology and ecology research on feathertop Rhodes grass but this work only scratched the surface. Further ecology and management research focused studies have been incorporated into the new 'Improving WM practices in the northern region' project (2001-2016) and will address feathertop Rhodes grass and windmill grass (both are *Chloris* species). Similarly, further research and development effort is required for cost effective management and biology/ecology studies of *Tridax* daisy.

Additional Information

New information on FTR ecology and management updated brochure on FTR is available at

http://www.daff.qld.gov.au/__data/assets/pdf_file/0010/51040/Feathertop-rhodes-grass.pdf

Further information:

http://www.qaafi.uq.edu.au/content/Documents/2013/CPS/FACT-SHEET-DK-for-controlling-summer-grasses.pdf

http://www.grdc.com.au/~/media/974AB1F85D01410682960520623B2957.pdf