



FINAL REPORT 2015

PROJECT CODE : DG_12-02

PROJECT TITLE

A new approach to grass weed control for durum wheat

PROJECT DURATION

Project Start date	1 July 2012
Project End date	30 June 2015

PROJECT SUPERVISOR CONTACT DETAILS

Title: Mr	First Name: John	Surname: Green	
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Office Use Only

Project Code	
Project Type	

ADMINISTRATION CONTACT DETAILS

Title: Mr	First Name: John	Surname: Green	
Organisation: Southern Australia Durum Growers Association			
Mailing address:			

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PROJECT REPORT

Executive Summary

The South Australian durum industry is poised to benefit from recent new variety and pre-emergent chemical releases. The purpose of this research was to validate and renew existing practices for weed control in durum wheat in respect to varietal competitiveness, pre-emergent chemical application, seed placement and seed size. This research has provided durum growers in Southern Australia with information that will enable them to increase production and assist in controlling weed populations.

Key Findings:

- In Mace wheat and DBA Aurora durum, increasing crop seeding rate reduced rye grass head set and decreased screening percentage.
- Durum varieties Saintry and DBA Aurora showed they had been similar in ability to reduce ryegrass seed set through competition when compared to Mace wheat.
- DBA Aurora and Saintry were the best choice of durum variety for weed competitiveness
- Varying seeding rates can change the amount of crop yield loss under high weed pressure.
- Sakura® is unlikely to be registered for use in durum as it shows high levels of crop damage
- Although some initial damage can occur, a package combining higher seeding rates large seed size and Boxer Gold® were the best available chemical and agronomic practices for pre-emergent weed control.

Project Objectives

This project aimed to develop a new and integrated approach to improve grass weed control in durum wheat by developing a set of agronomic management protocols that improve the effectiveness and net benefit of commonly used herbicides and the herbicide safety of currently grown durum varieties.

Overall Performance

The project was primarily led and managed by the SA Durum Growers Association, headed by Mr John Green, (Project manager, SADGA). Over the 3 years of the project, several different field trials were conducted at sites including Bordertown, Tarlee, Hart, Paskeville, Roseworthy and Turretfield. Trials were conducted by SARDI NVA staff based at Waite with assistance from the South-east and Clare NVA groups.

The field trial component of the project, data collection and analysis was conducted by SARDI from July 2011 led by Mr Rob Wheeler, Principal Research Scientist, SARDI, Waite with assistance from Mr Simon Goss Research Officer, SARDI Waite and Mr Kenton Porker Research Officer, SARDI Waite.

In 2012, field trials were planned and conducted at four locations (Hart, Tarlee, Roseworthy, and Paskeville) in accordance with KPI #1. All trials were successful, sites were harvested, ryegrass, crop growth measurements taken throughout the season. The trial at Hart suffered from severe Crown Rot infection, resulting in reduced yields and increased trial variability; nonetheless the weed competition data was still very useful. Results were summarised and findings were presented to the DGA committee on the 13th of February, published into relevant farming system magazines, and presented to farmers at the annual durum growers' forums to complete KPI #2.

In 2013 field trials were planned and conducted at four locations (Hart, Tarlee, Turretfield, and Paskeville) in accordance with KPI #1. All trials were successful, sites were harvested, ryegrass, crop growth measurements taken throughout the season.

A small extension trial at Paskeville suffered from a seeding issue that influenced some of the treatments; as a result, this experiment was re-sown at the Turretfield Research Station to ensure reliable data could be produced.

Results were summarised and presented to the DGA committee on the 30th of Feb, and published into relevant farming system magazines including the HART field site group, Crop Science Society, and presented to growers at the annual durum grower forums to complete KPI #2.

In 2014, best practice grass weed control demonstration field trials were planned and conducted at four locations (Hart, Tarlee, Turretfield, and Bordertown) in accordance with KPI's #1 and #3. One of these trials, at Hart, was mostly successful whilst sites at Turretfield and Bordertown were harvested with ryegrass, and crop growth measurements taken throughout the season showing inconclusive results due to poor seasonal conditions. The remaining site at Tarlee was abandoned due to delayed seeding, water logging and herbicide damage.

All results were summarized published into relevant farming system magazines including the Hart field site group Annual report, at the Adelaide GRDC advisor update and presented to growers at the annual durum grower's forums to complete KPI #2.

Key Performance Indicators (KPI)

No.	KPI	Date to be completed
1 & 2	Plan and conduct trials	30 Dec 2012/2013 - completed
1 & 2	Results published in farming system magazines	30 March 2013/2014 - completed
3	Plan and conduct best management practice trials	30 Dec 2014 - completed
3	Publish and extend results to growers	30 March 2015 - completed

Technical Information

Grass herbicide and agronomic options to improving crop safety for grass control

The Paskeville field trial in 2012 evaluated the potential for crop recovery from herbicide damage using improved plant nutrition (extra applied N, trace elements, and both). At this site there was herbicide damage from all soil applied herbicides in terms of plant

establishment, growth, and yield (table 1). The improved nutrition treatments did not offer any enhancement to crop safety or growth recovery compared to the unfertilised treatments. Sakura® (which is not registered in Durum) was the most damaging herbicide overall, reducing growth and yield. Boxer Gold® reduced plant density to a similar extent to Sakura® but managed to recover yield even when applied at double the recommended rate (5L/ha). The prolonged growth retardation of Sakura throughout the growing season is highlighted by the NDVI results and, translated to yield penalties of up to 37%.

Table 1. Plant establishment, crop growth, and grain yield (t/ha) expressed as a percentage of the nil herbicide control averaged across all nutrition treatments (NS) at Paskeville 2012.

	Plants/m ²	Growth (NDVI)	
		GS 22)	Yield (t/ha)
<i>NilHerbicideControl</i>	100 (188)	100	100 (2.54)
Avadex® 3 L/ha	92	94	95
BoxerGold®2.5L/ha	80	88	99
Boxer Gold® 5L/ha	72	82	95
Sakura® 118g/ha	72	67	74
Sakura® 236g/ha	71	64	63
Herbicide (LSD 5%)	8%	11%	10%
Nutrition	NS	NS	NS
Herbicidexnutrition	NS	NS	NS

An additional trial at Paskeville showed the potential to improve crop safety by sowing seed below the herbicide band, and using larger seed (figure 1). Boxer Gold® treated plots yielded similar to the nil herbicide control when combined with larger seed and deeper sowing, whereas shallow sown small seed suffered a yield penalty. Yield penalties were observed in all Sakura treatment plots, however large seed and deeper sowing minimised the penalty. These yield differences can be explained largely by the differences in plant density and growth resulting from herbicide damage at seeding. Shallow sown, smaller seed, suffered the largest establishment losses from herbicide application. As outlined previously, Boxer Gold® is likely to reduce plant numbers but have minimal impacts on growth, therefore depending on the season plants can often recover yield. In addition to sowing deeper and using larger seed, increasing seeding rates may be another option to minimise further yield losses from Boxer Gold® treatment.

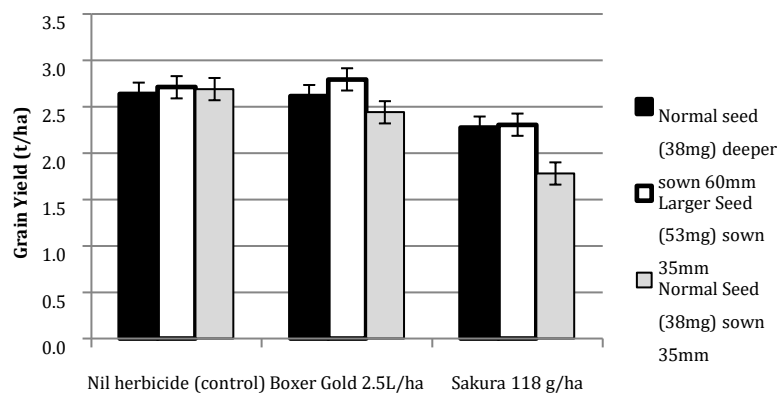


Figure 1. Grain Yield of Tjilkuri Durum at Paskeville, when treated with pre-emergent herbicides and sown in conjunction with different seed sizes and sowing depths

Durum varietal competitiveness with ryegrass

Trials at Hart and Tarlee in 2013 focused on agronomic management to reduce weed seed set using competitive varieties, seeding rates, and other management strategies such as row spacing and seed bed utilisation. The results from both 2013 trials were consistent with 2012 findings and *suggest there are significant differences in varietal weed competitiveness*. Tjilkuri and Tamaroi have been consistently identified as moderate to poor weed competitors, Yawa, Hyperno, and WID802 as poor and Saintly as one of the better competitors. Durum has a reputation for being less competitive than bread wheat so therefore it is useful to use bread wheat as the benchmark level of competition that durum growers should aim to achieve. *Saintly has demonstrated a level of competitive ability more similar to bread wheat (Mace) when grown under the same conditions and seeding rate*. At Tarlee in 2013, the new durum variety DBA Aurora sown at the current practice of 200seeds/m² also showed improved competitiveness similar to Saintly (figure 1). The variety differences in weed suppression were less pronounced with of the pre-emergent herbicide Boxer Gold®, however the relative rankings of varieties still held a similar pattern and the more competitive varieties still performed better than non-competitive varieties.

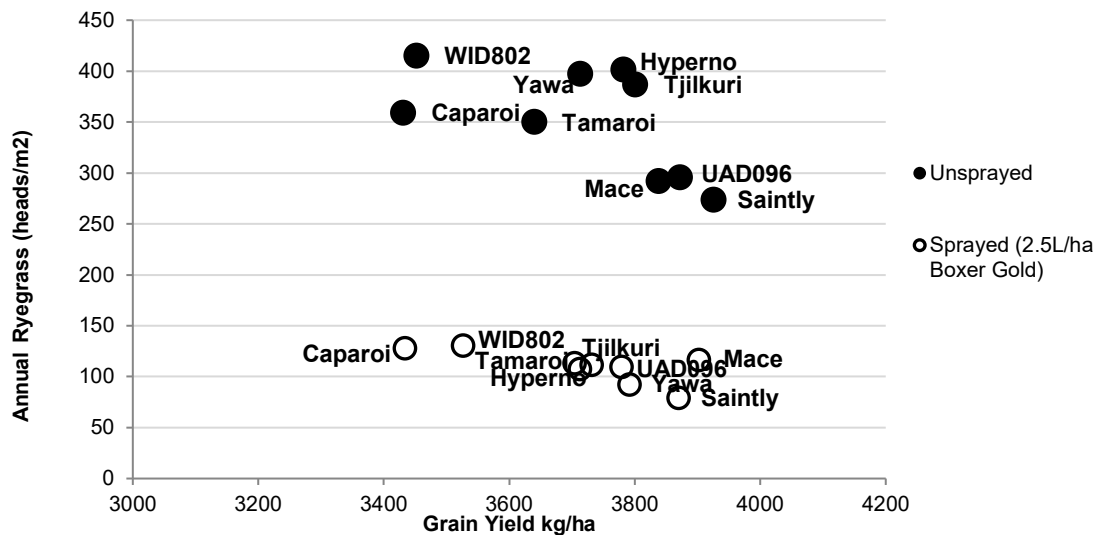


Figure 2. The effect of plus and minus pre-emergent herbicide BoxerGold® at 2.5L/ha on the amount of Annual ryegrass (heads/m²) and grain yield (kg/ha) of durum varieties at Tarlee, 2013.

Comparing new durum variety DBA Aurora to Mace wheat with varying agronomic practices to maximize grass weed control

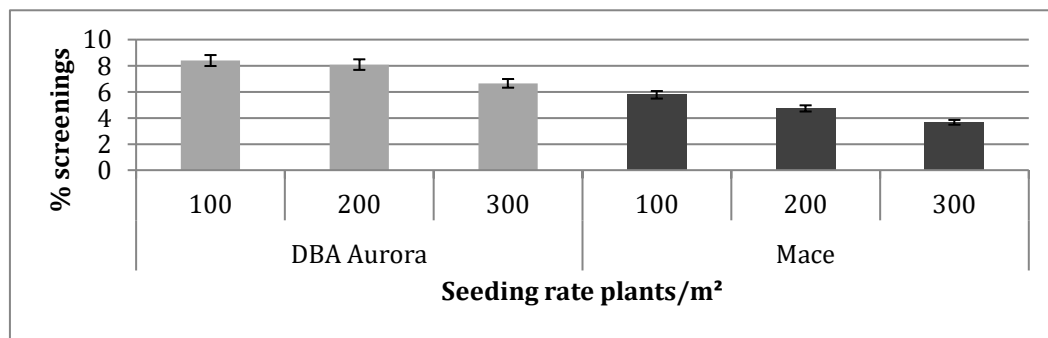
A trial was conducted in 2014 at the Hart Field Site which aimed at comparing DBA Aurora to Mace wheat to see what management packages worked best and how the two crop types fared against each other. This trial was used to demonstrate to growers that under the best practices durum can compete with weeds in a similar manner to bread wheat. This trial was also designed to show the effects of increasing seeding rates and using different seed placement systems. This was conducted by firstly spreading rye grass over the site at a rate of 10kg/ha. Selected plots were then treated with a pre-emergent herbicide, to

create plots which were under varying weed pressure. Several different treatments were applied to test the effect of seeding rates and normal and spreader seeding boots

Table 2: The effect of seed rate and normal and spreader seeding boots on grain yield (t/ha) and grass seed set (heads/m²) when sown to DBA-Aurora durum wheat and Mace wheat at Hart in 2014. (Yield loss percentage is the difference between plots with high weed pressure compared to no weed pressure).

Variety	Seeding boot	Seeding Rate	Yield-loss %	RyeGrass heads/m ²	Yield t/ha
DBA Aurora	Normal Boots	100	9.2	138	2.29
DBA Aurora	Normal Boots	200	12.2	90	2.44
DBA Aurora	Normal Boots	300	8.2	29	2.95
Mace	Normal Boots	100	9.6	100	3.02
Mace	Normal Boots	200	11.5	79	3.52
Mace	Normal Boots	300	3.9	52	3.75
DBA Aurora	Spreader Boots	100	18.3	104	2.41
DBA Aurora	Spreader Boots	200	10.8	67	2.75
DBA Aurora	Spreader Boots	300	9.2	54	3.02
Mace	Spreader Boots	100	8.3	138	3.19
Mace	Spreader Boots	200	8.7	90	3.75
Mace	Spreader Boots	300	7.4	29	3.83
	LSD		2.6	30	0.27

Figure 2: Effect of seeding rate and crop variety on screenings percentage (%<2.0mm) when grown in the presence of rye grass



From a statistical analysis at a 95% confidence interval the following findings were made from the 2014 trials;

- In Mace wheat and DBA Aurora durum, increasing the seeding rate reduced rye grass head set and decreases screening percentage (as seen figure 2).
- DBA Aurora and Mace wheat were similar in ability to reduce ryegrass seed set.
- Mace had less yield loss than DBA Aurora when under high weed pressure.

- Varying seeding rates can change the amount of crop yield loss under high weed pressure.

No significant difference was found between normal and spreader seeder boots in these trials

Conclusions Reached &/or Discoveries Made

The most influential discovery made concerning farmers is determining the best and most effective pre-emergent chemical to use before sowing. A very popular chemical amongst growers in bread wheat is Sakura®. With many producers being tempted to use this before durum it is important for them to see the amount of damage that it can cause to Durum wheat. Through this project, trials were conducted where it was found that Boxer Gold® is the best choice for pre-emergent chemical application in durum wheat. This however was still found to cause some seedling mortality.

All current durum varieties were tested against each other as well as some bread wheat's to compare their competitive ability. It was shown that new variety DBA Aurora and Saintly were the best performing durum varieties which was comparable to bread wheat Mace.

Trials showed that increasing seeding rates to 300 plants/m² increased competition and reduced rye grass numbers compared to 100 and 200 plants/m² respectively. The use of these higher seeding rates and using a larger seed size also helped to reduce the impact of pre-emergent herbicide damage without compromise to grain quality.

Intellectual Property

All findings will be made freely available to grain producers and agribusiness community.

Application / Communication of Results

From the 3 years of trials the following findings have been made:

- In Mace wheat and DBA Aurora durum, increasing the seeding rate reduced rye grass head set and decreases screening percentage (as seen figure 2).
- Durum varieties Saintly and DBA Aurora showed they had were similar in ability to reduce ryegrass seed set compared to Mace wheat.
- New variety DBA Aurora and Saintly best choice of durum variety for weed competitiveness
- Varying seeding rates can change the amount of crop yield loss under high weed pressure.
- Sakura® is never likely to be registered for use in durum as it shows high levels of crop damage
- Although some initial damage can occur using higher seeding rates and large seed size makes Boxer Gold® the best available chemical option for pre-emergent weed control

The path to market for the outcomes of this project are through:

- The ongoing communication of the best weed management practices will continue to be demonstrated at field days, seminars, grower meetings. Durum research is continuing in 2015 through a self-funded venture and is aiming to research the same agronomical practices studied in 2014, to develop a stronger dataset of results. This Durum Growers Association driven project will continue to highlight and reference all of the outcomes from this research in subsequent publications and related research programs to inform the durum industry about the possibilities for improved production with new durum varieties and weed management.
- Outcomes will be further promoted at the annual Southern Australia Durum Growers Association forums.
- The final report from the 2015 work will continue to be widely promoted at crop walks and field days amongst the durum industry and is available online at the SADGA website: ([URL:www.durumgrowerssa.org.au](http://www.durumgrowerssa.org.au)) where results can be accessed by any members of the public.

<u>Name of publication</u>	<u>Presenter</u>	<u>Type of publication</u>	<u>Target audience</u>	<u>Date</u>
Southern Australia Durum Growers Association – Kaniva update	Kenton Porker	Oral Presentation and article	Growers industry leaders	March 2013 March 2014
Southern Australia Durum Growers Association – Blyth update	Kenton Porker	Oral Presentation and article	Growers industry leaders	April 2013 April 2014
Hart Field Day	Kenton Porker	Oral Presentation and article	Growers industry leaders	September 2012
Mid North High rainfall Field day	Kenton Porker	Oral Presentation and article	Growers industry leaders	October 2012 October 2013
Southern Australia Durum Growers Association – Mid north Crop walk	Kenton Porker	Oral presentation	Growers and industry leaders	September 2012 September 2013
Southern Australia Durum Growers Association – South East crop walk – Kaniva/Bordertown	Kenton Porker	Oral presentation	Growers and industry leaders	October 2012 October 2013
Southern Australia Durum Growers Association – Kaniva update	Kenton Porker	Oral Presentation and article	Growers industry leaders	March 2014

Mid North High rainfall winter walk	Rob Wheeler	Oral Presentation	Growers industry leaders	July 2012
Southern Australia Durum Growers Association – Blyth update	Rob Wheeler	Oral Presentation and article	Growers industry leaders	April 2014
Southern Australia Durum Growers Association – Kaniva update	Simon Goss	Oral Presentation and article	Growers industry leaders	March 2015
Southern Australia Durum Growers Association – Blyth update	Simon Goss	Oral Presentation and article	Growers industry leaders	April 2015
Southern Australia Durum Growers Association – Mid north Crop walk	Simon Goss	Oral presentation	Growers and industry leaders	September 2014
Southern Australia Durum Growers Association – South East crop walk – Kaniva/Bordertown	Simon Goss	Oral presentation	Growers and industry leaders	October 2014
Hart field day	Simon Goss	Oral Presentation and article	Growers and industry leaders	September 2014
Mid North High rainfall field day	Simon Goss	Oral Presentation and article	Growers and industry leaders	October 2014
GRDC update for advisors - Adelaide	Simon Goss	Oral Presentation and article	Advisors, growers and industry leaders	February 2015

As well as the above feature articles and presentations, the results are continually updated and published on the Southern Australia Durum Growers website where access for growers is easily accessible. The path to market of the results has been excellent with numerous field days and articles made available at events and publications which are targeting at areas which traditionally grow durum. Implications for uptake of these results would be if farmers are not regular field day attendees or if they are not currently involved and interested in the durum industry. The aim of the final year of project studies was to entice new and previous growers into the industry with the lure of new and best practice grass weed control, as growers have grappled with this issue in recent years.

POSSIBLE FUTURE WORK

An experiment has been implemented in 2015 in order to conclusively demonstrate the best practice weed control principles achieved within the first two years of the project. 2014 experiments were mostly successful at Hart, however due to seasonal conditionals similar results were not able to be demonstrated to farmers at other sites. On good will, a demonstration trials designed in 2014 is being repeated in 2015 under hopefully more “normal” seasonal conditions to validate the combined principles of good grass weed control found in the first two years of this project.

Other issues facing the industry include attracting growers to the industry. Several exporters indicated that a more consistent production and supply of durum from the state would bring about higher prices. A campaign may be required to attract more growers to take up growing durum wheat and its potential to be a very high profitable crop.

AUTHORISATION

Name: Mr John Green

Position: Project manager, SADGA

Signature:

Date:

Submit report via email to admin@sagit.com.au as a Microsoft Word document in the format shown ***within 2 months*** after the completion of the Project Term.