



## **MacKillop Farm Management Group**

**“Maintaining profitable farming systems with retained stubble in the South-East and KI regions”**

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## **Abstract**

The GRDC funded project “Maintaining profitable farming systems with retained stubble in the South-East and KI regions” aimed to produce localised guidelines to allow those farmers who want to retain stubble to do so in a manner that is profitable.

Stubble retention across the South-East (SE) and Kangaroo Island (KI) regions of South Australia (SA) often presents challenges due to the high stubble loads that are often generated and the diversity of farm businesses.

Key challenges in retained stubble systems that were identified by growers were weeds, pests, disease and nutrition, along with the physical aspects of managing stubble at harvest, during the fallow period, at seeding and in-crop.

A combination of small plot trials, farmer scale trials and demonstrations, and extension activities were held over the five years to provide farmers with both the knowledge and practical skills to enable them to implement some of the strategies required to improve the level of management in retained stubble systems on their farms.

This work, combined with research collaboration and support has culminated in the production of ten guidelines each addressing different aspects of stubble management that were seen as challenges to retaining stubble systems in the SE and KI regions of SA.

## Executive Summary

The project “Maintaining profitable farming systems with retained stubble in the SE and KI regions” was instigated to address key identified issues in retained stubble systems across the regions and to explore ways to try and resolve or minimise the impacts of these issues in a profitable manner.

Conservation farming has been widely adopted across the SA/Vic Bordertown Wimmera AEZ with the majority of crops across the regions being sown in one pass. Although conservation tillage equipment has been widely adopted in the MFMG and AgKI areas, it is not believed that these areas have the level of adoption of stubble retention reflected in the GRDC 2012 Farm Practices survey. The SE and KI regions are comprised of mixed farming systems and as a result the stubbles (often greater than six tonnes per hectare) are generally grazed by livestock. The management of such stubble loads then poses significant issues during seeding the following year with machinery unable to pass through and poor establishment issues often resulting.

Key local issues arising with stubble retention include crop establishment, nutrient management, weed control, disease control and pest management (snails being the major issue with slugs, millipedes and earwigs also being an issue in some areas). These issues can have a huge impact on production and farm profitability. When these issues arise, growers find that retaining stubble is often difficult to justify and is not the preferred option in local farming systems.

Trial and demonstration programs were developed to look at local topics and issues arising from challenges in stubble retention across the SE and KI regions. The work varied from small plot replicated trials to large farmer scale demonstration activities and locations varied depending on the issue being targeted. This program was developed in conjunction with growers, and protocol development was done in conjunction with SARDI and additional research support from CSIRO and University of Adelaide.

The trial and demonstration programs were supported with extension activities designed to assist growers with the skills and knowledge to implement some of the activities required to maintain profitability in retained stubble systems. Extension activities were often 'hands-on' with growers being shown not only why they should make changes, but showing how they to implement changes in their system for improved outcomes.

There was also the opportunity as part of the Stubble Initiative project to collaborate and add value to other research that was occurring in the region by providing additional monitoring and expanding these trials and demonstrations to allow for increased local outcomes where the topics aligned with the stubble management issues that were being explored as part of the project.

Locally specific guidelines were produced containing local research and development activities addressing individual issues and supporting findings from other research to allow growers to make more informed decisions when managing retained stubble systems.

The project has demonstrated that high levels of stubble can successfully be retained in the system, however there remains certain instances where removal may be required. The grower's ability to deal with issues will depend on both the issue being addressed and the individual farming system. Small changes may be able to be implemented immediately (e.g. improving spray deposition, rotating herbicides or improving bait distribution). Other changes may require new machinery or a large-scale change to the system which may require additional financial resources and may not be as readily achievable.

A key outcome has been the ability to validate farmer practice change; it provided support for the innovators to develop strategies around machinery use, and provided them with knowledge that allowed them to implement change immediately to fine tune their systems and maximise the benefit of the investment. This information was then extended to other growers, providing the early adopters with knowledge required to implement changes.

The benefits of crop rotations in sustainable systems has been demonstrated and the role of break crops in weed and disease management and crop nutrition explored. The need to implement an integrated weed management (IWM) approach, and the importance of soil testing, knowing your soil nitrogen (N) levels and understanding how that information can be used to improve nitrogen management in the system has been demonstrated.

The project has benefited industry by providing a level of environmental stewardship; encouraging and developing practices that will assist in reducing wind and water soil erosion, returning carbon to the soil improving the management of nitrogen in the system.

Throughout the life of the project, there has been a reduction in the total removal of stubble (through burning) with a decrease from 8.5% (2011) to 1.7% (2016). (Source: GRDC Farm Practices Survey Report 2016).

## Contents

<b>Abstract .....</b>	<b>2</b>
<b>Executive Summary .....</b>	<b>3</b>
<b>Table of Contents .....</b>	<b>5</b>
<b>Background.....</b>	<b>6</b>
<b>Project Objectives .....</b>	<b>7</b>
<b>Project Guidelines .....</b>	<b>8</b>
<b>Project Trials.....</b>	<b>9</b>
MacKillop Farm Management Group.....	11
2013 Crop Sequencing .....	11
2014 Sherwood Pre-Emergent Herbicide Efficacy .....	19
2015 Wolseley Pre-Emergent Herbicide Efficacy.....	23
2015 Keith Speed tiller Demonstration .....	28
2015 Millicent Speed tiller Demonstration.....	32
Impact of Grain Yield on Stubble Residue .....	36
Effect of canola harvesting methods on snails in the grain sample .....	39
2017 Hatherleigh Soil Humification Trial .....	40
Ag KI .....	45
2014 Wheat Nitrogen Trial .....	44
2014 Canola Variety Trial.....	49
2015 Canola blackleg fungicide Trial .....	54
2016 Nitrogen x Sulphur Management in Soft Wheat .....	59
2017 Influence of stubble height on broad bean physiology and disease .....	63
<b>Extension Activities .....</b>	<b>65</b>
<b>Key Impacts .....</b>	<b>66</b>
<b>Acknowledgements.....</b>	<b>67</b>

## 2015 Canola blackleg fungicide trial

Canola generally performs well compared to other crops on Kangaroo Island and as a result it has appeared relatively frequently in the Kangaroo Island crop rotation. Growing canola more frequently in a rotation increases the risk of the fungal disease blackleg. The 2015 canola fungicide trial funded through the GRDC Stubble Initiative project is designed to assess the efficacy of foliar, on-seed and on-fertiliser commercially available fungicides on blackleg control in retained stubble systems. Blackleg infection, yield and grain quality were measured.

Table 1 summarises the 8 treatments in the trial. All fungicide treatments are based around the district standard use of Jockey seed treatment. The exception being the control (no fungicide at all) and the Intake Hiload Gold treatments that did not receive any seed treatment.

**Table 1 -fungicide treatments, application timing, rate and active chemical**

Fungicide treatment	Treatment details	Active chemicals
Control	No fungicide	-
Jockey Stayer	Seed treated with 20 L/tonne of Jockey Stayer. This treatment appeared twice in the trial.	Fluquinconazole
Jockey plus Amistar Xtra	Seed treated with 20 L/tonne of Jockey Stayer, 1L/ha Amistar Xtra applied on 9th July (4-5 leaf stage)	Fluquinconazole and Azoxystrobin
Jockey plus Prosaro	Seed treated with 20 L/tonne of Jockey Stayer, Prosaro 450 ml/ha applied twice, once on 9th July (4-5 leaf stage) and once on 15th Aug (bud formation with some flowering started)	Fluquinconazole and Prothioconazole + Tebuconazole
Intake Hiload Gold 400	400 ml/ha Intake Hiload Gold applied on fert in furrow at seeding	Flutriafol
Intake Hiload Gold 200	200 ml/ha Intake Hiload Gold applied on fert in furrow at seeding	Flutriafol
Jockey plus Tebuconazole	Seed treated with 20 L/tonne of Jockey Stayer, Tebuconazole 290 ml/ha applied twice. Once on 9th July (4-5 leaf stage) and once on 15th Aug (bud formation with some flowering started)	Fluquinconazole and Tebuconazole

The trial was located on a well drained site on Matt Lovering's property on Three Chain road in Haines. The soil was sand over clay with moderate fertility. It had Colwell P of 19mg/kg, Colwell K of 108mg/kg and Sulphur of 12.9mg/kg. The soil was acidic with a pH (CaCl<sub>2</sub>) of 4.6.

The trial received 394mm of rain for 2015 compared to the average for the area of 475mm. The trial did not get waterlogged but suffered moisture stress at flowering/grain fill receiving 28mm for September and 5mm for October. Soil moisture was poor early and as a result sowing occurred on the 26<sup>th</sup> of May which was later than most of the Island's cropping districts in the 2015 season.

### Trial management

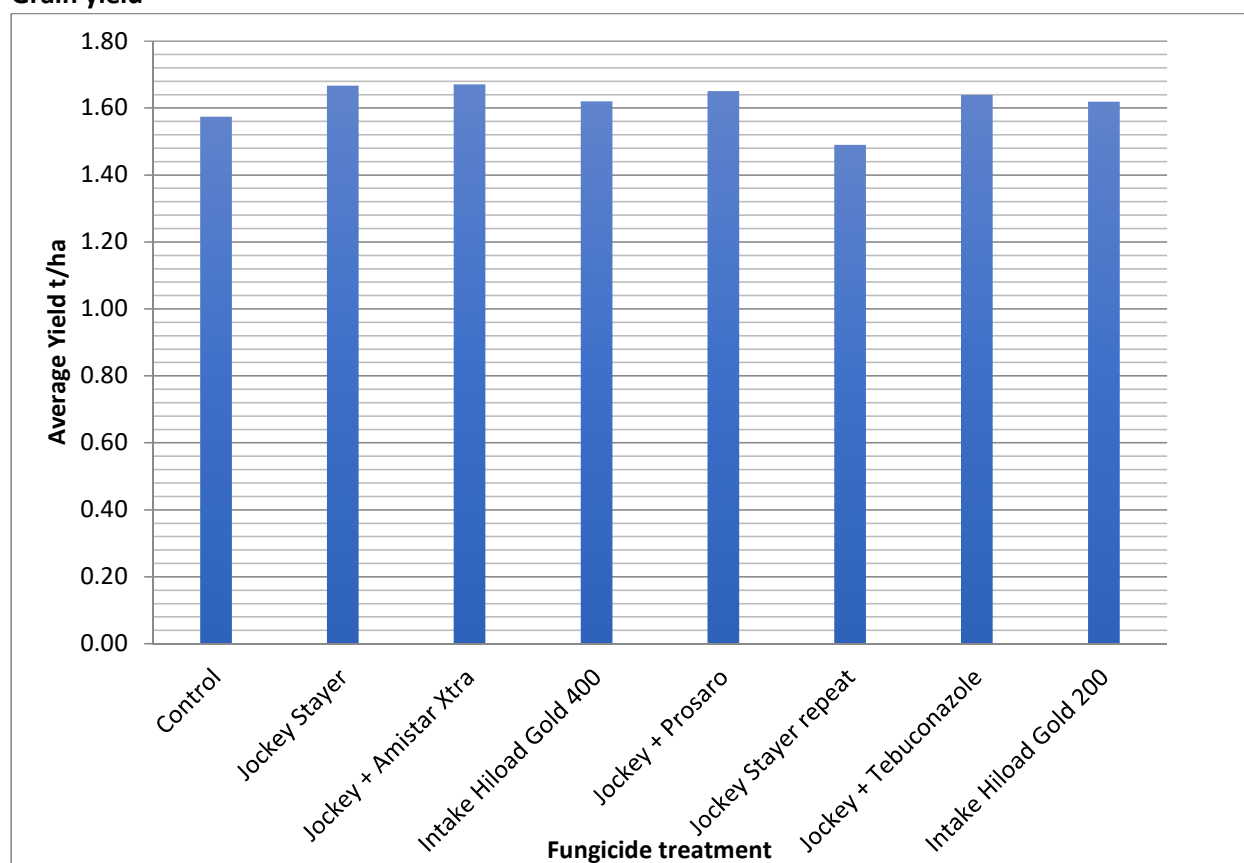
The trial site was sown to canola in 2013 and wheat in 2014, providing a one year break between canola crops. The trial was sown into a raked stubble as some stubble needed to be removed to allow passage of the trial seeder. This could have potentially reduced blackleg inoculum levels. The small size of the trial site (20m wide) which was surrounded by retained stubble and the mobility of blackleg spores would have ensured the conditions were indicative of a true retained stubble system.

All treatments were sown with Crusher TT canola at 4kg/ha with 90kg/ha of starter fertiliser containing 15.5 units of N, 15.5 units of P and 9.5 units of S per 100kg. In-crop fertiliser was limited to 130kg/ha of Urea AMS blend (33 units N and 12 units S per 100kg) on the 28<sup>th</sup> of July. Grass and broadleaf weed control was excellent with no weed competition.

The trial was a completely randomised block design with 4 replicates. This means that each fungicide treatment appeared 4 times in the trial, once in each of the four blocks. Each plot was 8.5m long by 2.2m wide.

All plots were treated the same with the exception of fungicides. Blackleg infection was scored on the 7<sup>th</sup> November with 10 stems scored from each plot providing 40 scores for each treatment. Plots were harvested to provide yield data on the 30<sup>th</sup> of November. Seed loss from shattering was negligible.

### Grain yield



**Figure 1- the effect of fungicide on yield**

L.S.D 0.05 equals 0.21t/ha. Therefore we can be 95% confident that average treatment yields differing by more than 0.21t are statistically significantly different. There are no yields that differ by more than 0.21t/ha and hence we conclude that the fungicides treatments did not have an effect on yield at this location in the 2015 growing season. This does not mean that these fungicides cannot produce a yield benefit when used at a different site or in a different season. The coefficient of variation for the trial was 8.9% which suggests the results are reliable.

## Grain quality

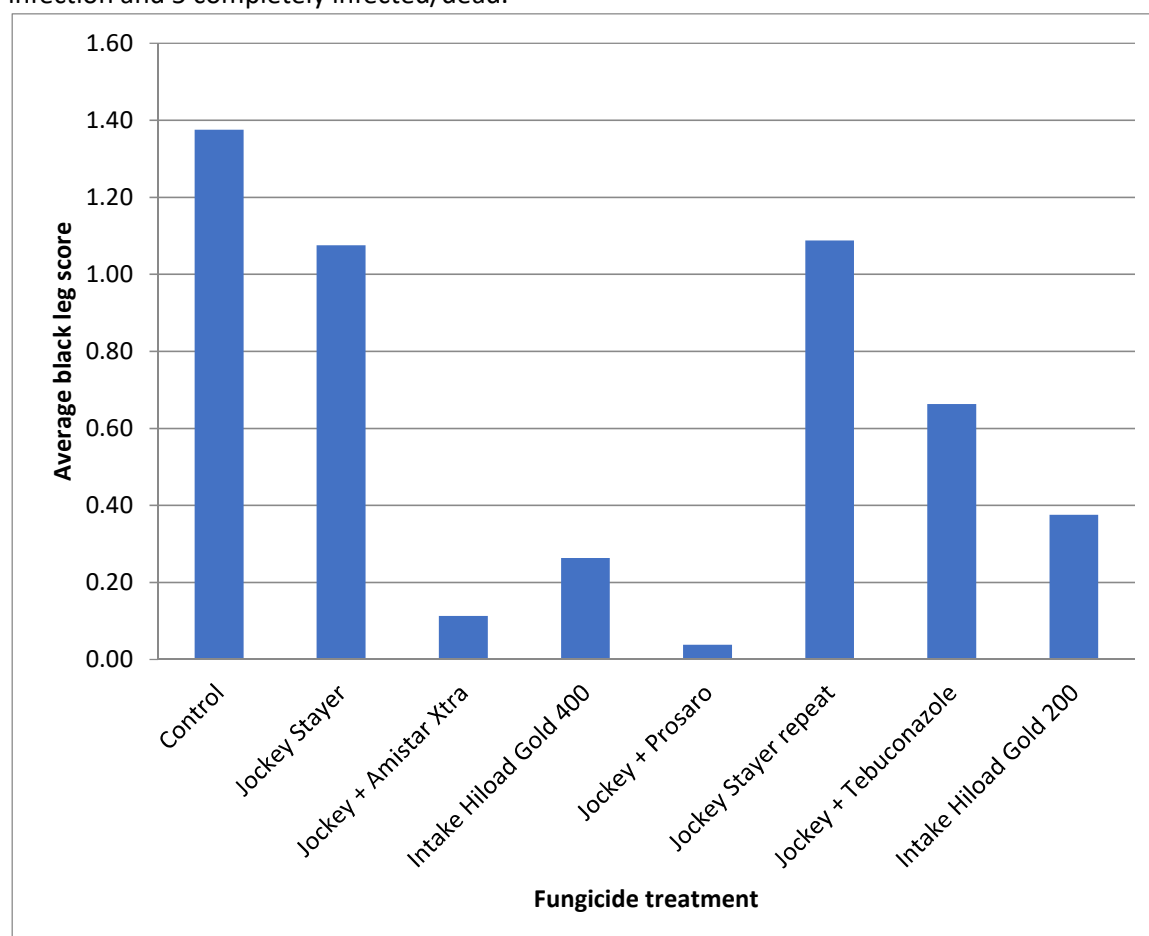
Table 2 shows oil content of the different fungicide treatments. There is a range of 2.7% between the lowest and highest oil concentrations (43.3% for the Jockey + Prosaro treatment and 46% for the control). Although we have no statistics on oil content (the data is not replicated) it is unlikely that this difference is statistically significant. Oil content had no impact on the gross margin calculations as KIPG offered no premiums or discounts for oil in 2015.

**Table 2- Grain oil content**

Treatment	Oil content (%)
Control	46
Jockey Stayer	45.4
Jockey + Amistar Xtra	44.8
Intake Hiload Gold 400	43.8
Jockey + Prosaro	43.3
Jockey Stayer repeat	44.9
Jockey + Tebuconazole	44.9
Intake Hiload Gold 200	44.4

## Blackleg

Figure 2 shows average blackleg scores for each fungicide treatment out of 5, with 0 indicating no infection and 5 completely infected/dead.





## **Figure 2- the effect of fungicide on blackleg infection**

The LSD 0.05 for average blackleg score is 0.53 (half a score). This means that for average blackleg scores that differ by more than 0.53 of a score we can be 95% confident that the fungicide is more effective at controlling blackleg at this trial site in the 2015 season. Essentially all fungicide treatments provided statistically significantly better blackleg control than the control treatment (no fungicide) and Jockey only treatment. Intake Hiload gold, Prosaro and Amistar Xtra were the most effective at controlling blackleg.

Yield loss from blackleg infection occurs when more than half the stem is black or discoloured (GRDC Australian blackleg management guide 2012). This equates to a blackleg score of 2.5 out of 5. The results show that even the highest blackleg score- the control treatment with a score of almost 1.4 is well below the 2.5 benchmark. This supports the data which suggests that while we achieved good blackleg control with some of the fungicides, none of the fungicides produced a statistically significant yield benefit. The yield results may have been different if the trial was repeated under higher blackleg pressure.

This is possibly oversimplifying the assessment of severity of blackleg pressure at the trial site. If we take, say, the control treatment average score of 1.4, there were some stems that were scored higher and some lower (1.4 is the average score not maximum). The raw data shows some stems in some of the less effective treatments had blackleg scores of 4 and 5. But this equates to a small percentage of plants and hence is unlikely to have a large impact on yield.

The cost of the fungicide treatments (including application for foliar sprays) can be seen in Table 3. The Amistar Xtra and Prosaro treatments were the most expensive but also provided the most effective blackleg control. Prosaro is registered for sclerotinia control possibly providing some additional value if sclerotinia is a problem. There was no sclerotinia observed in the trial. Intake Hiload Gold was slightly less effective than Prosaro and Amistar Xtra on Blackleg but much cheaper, requiring a smaller yield increase to cover the cost of the chemical. Intake Hiload Gold at 400ml per ha was more effective than 200ml/ha (note these differences are not statistically significant).

### **Gross margin**

From Table 3 it can be seen that there are only relatively small differences in gross margins. When interpreting the gross margins it is important to remember that the yield differences were not statistically significant and hence it is likely that the gross margin differences attributed to yield are not either. The Jockey + Prosaro treatment had the poorest gross margin even though its yield was relatively high. This is due to the high costs of the fungicide treatment. It is likely that these fungicide treatments used under higher blackleg pressure would produce different gross margins. The fungicides that were good on blackleg control (see figure 2) are the more expensive treatments. These more expensive treatments require a large yield benefit to justify the economics of their use.

**Table 3- Yield, fungicide cost and gross margin for the different fungicide treatments**

Fungicide treatment	Average Yield (t/ha)	Fungicide cost \$/ha	Gross income/ha*	Gross margin/ha^
Control	1.57	\$-	\$779	\$329
Jockey Stayer	1.67	\$2.6	\$825	\$373
Jockey + Amistar Xtra	1.67	\$37.5	\$827	\$340
Intake Hiload Gold 400	1.62	\$9.6	\$802	\$342
Jockey + Prosaro	1.65	\$76.0	\$817	\$291
Jockey Stayer repeat	1.49	\$2.6	\$737	\$285
Jockey + Tebuconazole	1.64	\$20.0	\$811	\$341
Intake Hiload Gold 200	1.62	\$4.8	\$801	\$346

\*Based on KIPG estimated pool returns on farm Feb 2015 less storage and handling, less freight to mailand, less freight to KIPG silo (\$495/t).

^Gross margin based on cost of \$450 per ha to grow crop excluding fungicide

Note application cost of \$5/ha included for foliar fungicides

### Take Home messages

- Amistar Xtra, Intake Hiload Gold and Prosaro provided effective blackleg control.
- No significant yield increase from these fungicides
- Need to consider economics- high cost fungicides aren't justified if blackleg risk is low
- Last year's work indicates variety selection also a good tool for blackleg control
- Blackleg is a problem in retained stubbles, fungicides and variety choice are 2 of many tools for blackleg control
- More info on blackleg [www.grdc.com.au/uploads/documents/GRDC-FS-BlacklegManagementGuide-Revised.pdf](http://www.grdc.com.au/uploads/documents/GRDC-FS-BlacklegManagementGuide-Revised.pdf)

### Sponsors and contributors

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- L & C Berry for providing seed for the trial
- KIPG for testing grain

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