Merriwagga CWFS Site Results 1999-2004

Barry Haskins, NSW DPI
Lawrence Higgins, CWFS Regional Site Chairman
Sharon Taylor, CWFS

Key points

- Long term gross margin data shows conventional tillage to be more profitable than minimum tillage.
- Long term gross margin data also shows that continuous wheat and rotation l are the most profitable rotations.
- No tillage into a long fallow situation is significantly less profitable than conventional tillage, by $147.oo/ha. This is not the case with no tillage into a stubble situation which is not significantly different to conventional tillage.
- A major factor determining the profitability of the no tillage treatment is effective weed control.
- The threat of root diseases, such as *Rhizoctonia,* is now at a high risk level in the continuous wheat rotation, particularly under no tillage, whereas the risk is minimal in other rotations.

Background and aims

A long term fanning systems trial was established in 1999 aiming to investigate the sustainability and profitability of cropping rotations and tillage methods on Merriwagga soils. The paddock chosen has had a long history of traditional low input cropping. Soils are alkaline red earths (pH 7.2 $CaCl_2$), with a layer of limestone within 60 cm of the topsoil. Average annual rainfall is about 370 mm.

The trial is situated on Geoff and Ian Barber's property "Sylvanham" on the comer of Black Stump Rd and Greenhills Rd, approximately 10 km SW of Merriwagga. The Barber's have allowed the Merriwagga CWFS group to share-farm the trial site, allowing other trial work to be conducted around the core site. The trial is designed so that all operations are conducted using growers' equipment to make it realistic. The trial has been set up with 3 replications of all treatments, totalling 30 ha in area.

Rotation treatments

1. *Continuous rotation cropping:* There are 2 versions of this system (Rotation 1 and Rotation 2). They both involve continuous cropping by rotating crops. When the trial began, this system was not common practice. It was designed to see if it could be done economically in this environment. Since 1999, the beginning of the trial, more growers have been using break crops. Generally in this system, a break crop is grown every second year after wheat. The choice of the break crop is mainly determined by the time of break and disease risks.
2. *Continuous Wheat:* This treatment is not common in the area, however growers wanted to see what happens if wheat was grown over a long period of time.
3. *Wheat/Ley/Fallow/Wheat (W/L/F/W):* This system has traditionally been practiced, however is declining as stock numbers reduce. After harvest the paddock is left as a ley, where naturalised grasses and legumes emerge. The paddock is grazed until it is brought into fallow the following year. Cropping occurs every third year in this system. As of 2005, we will replace the ley with

barley, to make it more relevant for local growers.

4. *Wheat/Fallow/Wheat (W/F/W):* This is also a traditional cropping system still practiced by some growers. The paddock is cropped every second year and fallowed in between aiming to conserve soil moisture, mineralise nitrogen and break disease cycles.

(See Table 1 for further information)

Tillage treatments

Each system treatment is divided into two tillage treatments.

1. *Minimum tillage:* This treatment involves sowing with narrow points into an unprepared seedbed. Weed control is by herbicides and in some cases burning. To the extent of which it is practical, the plots are not tilled in any way. Due to machinery limitations, nitrogen may be predrilled prior to sowing using narrow points, harrowing may occasionally be practiced to remove excess stubble or weed residues that may hinder sowing.

2. Conventional tillage: This system uses conventional tillage fallows and tillage to prepare the seedbed and remove and/or incorporate stubbles. Herbicides are still used in this system, however cultivation is the primary method of weed control. This treatment aims to emulate common tillage practices of the district when the trial began.

Trial Plan

Table 1 shows the cropping history of the long-term trial, whilst Table 2 shows the split plot randomised complete block design, with 3 replicates, used in the trial.

Results from 2004

2004 was again a very tough year in the Merriwagga region. The first rainfall event that sparked sowing occurred at the end of May, so all sowing operations were quite late. This made pre-sowing weed control difficult and also wrote off the chance of growing either lupins or canola as a break crop. We were left with the choice of either peas or barley, so we went with barley aiming to minimise disease risks because of the previous pea history in the paddock. Little to no subsoil moisture was evident at sowing, however this proved not to be the case for the fallowed systems. The sowing details are provided in Table 3.

The total rainfall for the year was just 241mm, with only 121mm falling in the growing season (Apr-Oct).

Table 1. Cropping history for Merriwagga, 1999-2005.

Farming System Treatments	Cropping Timetable						
	1999	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*
Wheat/Fallow/Wheat	Fallow	Wheat	Fallow	Wheat	Fallow	Wheat	Fallow
Rotation 1	Peas	Wheat	Canola	Wheat	Wheat*	Barley	Peas
Continuous Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat
Wheat/Lev/Fallow/Wheat	Ley	Fallow	Wheat	Ley	Fallow	Wheat	Barley*
Rotation 2	Wheat	Peas	Wheat	Peas	Peas*	Wheat	Barley

*Note change of cropping sequence as a result of failed crops in 2002, and changes to district practice.

Table 2. Split plot randomised complete block with 3 replicates

Plot	Treatment	Tillage
31	wheat/ley /fallow /wheat	conventional
30	wheat/ley /fallow/wheat	no till
29	rotational continuous 1	conventional
28	rotational continuous 1	no till
27	rotational continuous 2	conventional
26	rotational continuous 2	no till
25	wheat/fallow/wheat	conventional
24	wheat/fallow/wheat	no till
23	continuous wheat	no till
22	continuous wheat	conventional
21	wheat/ley /fallow /wheat	conventional
20	wheat/ley /fallow /wheat	no till
19	wheat/fallow/wheat	conventional
18	wheat/fallow/wheat	no till
17	rotational continuous 1	no till
16	rotational continuous 1	conventional
15	rotational continuous 2	conventional
14	rotational continuous 2	no till
13	*tree* ***plot***	
12	continuous wheat	conventional
11	continuous wheat	no till
10	rotational continuous 2	conventional
9	rotational continuous 2	no till
8	wheat/fallow/wheat	conventional
7	wheat/fallow/wheat	no till
6	rotational continuous 1	no till
5	rotational continuous 1	conventional
4	continuous wheat	conventional
3	continuous wheat	no till
2	wheat/ley /fallow /wheat	no till
1	wheat/ley /fallow /wheat	conventional

Table 3. 2004 sowing details for the Merriwagga regional site. All plots were sown with Flexi coil airseeder using knife points.

Crop	**Variety**	**Sowing Rate**	**Fertiliser**	**Sowing** Date	Average **Yield**
Barley	Baudin	25 kg/ha	65kg/ha Maximize®	10th June	0.74 t/ha
Wheat	Drysdale	40 kg/ha	80kg/ha Maximize®	10lhJune	0.79 t/ha

Yield and Gross Margin - 2004

The yield and gross margin results for the Merriwagga trial (Figures 1 & 2) show significant differences between the system treatments and tillage treatments. The main points from these figures are:

1. The W/F/W and W/L/F/W rotations with conventional tillage had wheat yields (Figure 1), and subsequent gross margins (Figure 2), significantly higher than all other treatments. This is probably due to some moisture being stored and held from the previous season. An observation was made that weed control using herbicides in the minimum tillage fallows proved ineffective. This would have led to stored moisture being used by the weeds. 2. In rotation 1 the highest barley yields were achieved in the conventional

tillage treatment These are significantly higher than the no tillage treatment. 3. In comparing rotation 2 and continuous wheat, in conventional tillage, it can be seen that wheat following field peas (rotation 2) yielded significantly higher, by 35%, than wheat after wheat (continuous wheat). This was not the case in no tillage treatments. It is thought that this was because weeds such as common heliotrope were not controlled early in the minimum tillage system resulting in water use by weeds and lower yields in the 2004 wheat crops.

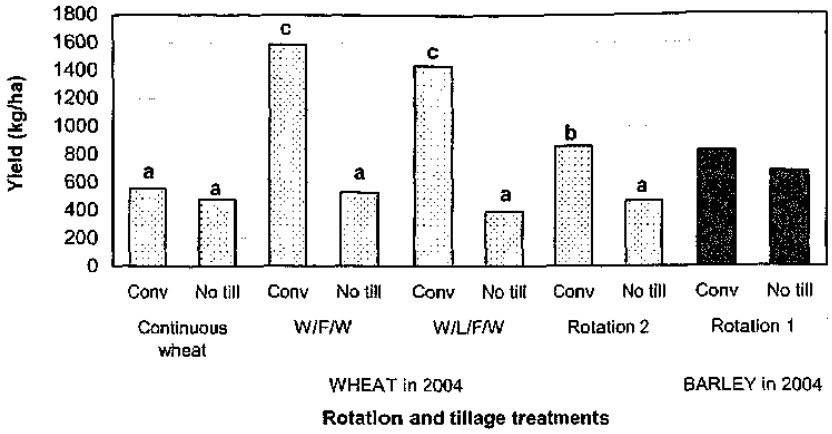

Figure 1. Merriwagga CWFS yield results 2004

Note: For wheat, columns with the same letter are not significantly different. For barley, columns with different roman numerals are significantly different.

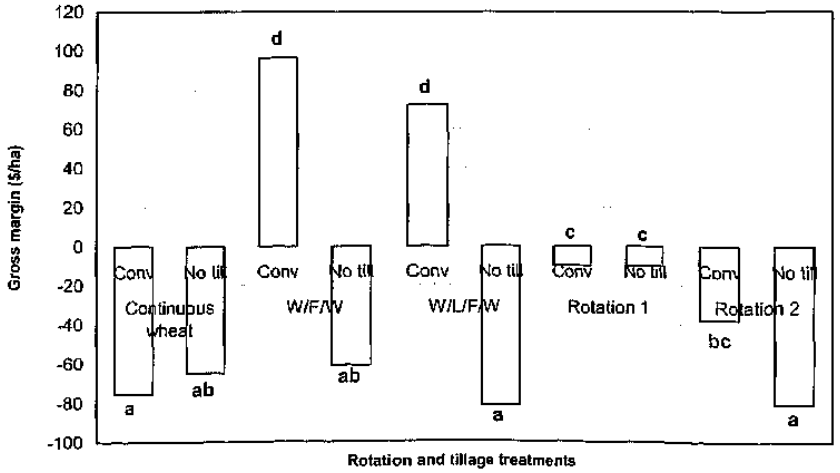

Figure 2. Merriwagga gross margin analysis 2004

Note: columns with the same letter are not significantly different. All costs involved in the gross margin budget are at contract rates, which decreases the returns from what you would expect using your own gear.

Having a look at tillage comparisons

A look at tillage differences over the first 4 years (1999-2002) and then the last two years (2003-2004) of the trial show interesting profit trends (Tables 4 & 5).

In the continuous wheat system (Table 4), conventional tillage is more profitable then no tillage in the first 4 years. In the last 2 years, however, the profit differences have become not significant. This is due to their similar wheat yield (Figure 1). It will be interesting to see how these profits change in the future.

In the W/F/W system (Table 5), conventional tillage is again more profitable in the first 4 years, however, it is also more profitable in the last two years. This result may have occurred because of weed control issues in the fallow phase of the no tillage system leading to lower yields. In dry years weed control with herbicides has proved to be less effective than cultivation and subsequently yield losses due to weeds have been significant. Again, it will be interesting to see what happens in this situation when conditions improve.

Table 4. Tillage differences in the continuous wheat system

Continuous Wheat	**1999-2002**	**2003-2004**
Conventional	$292 .00 b	$ 187.80
No Tillage	$146.00 a	$ 215.70
Significant	*Yes*	*No*
I.s.d	*66.8*	

Table 5. Tillage differences in the W/F/W system.

W/F/W	**1999-2002**	**2003-2004**
Conventional	$134.00 b	$ 39.00 b
No Tillage	$ 16.00 a	$-108.00 a
Significant	*Yes*	*Yes*
Is.d	*93.6*	*62.1*

Results Summary 1999-**2004**

Since the beginning of the trial in 1999, and 6 crops, only 2 of the 6 years have had average or better growing season rainfall. This has made obtaining good results difficult, however it has still allowed a general trend to emerge.

Rotation summary

Continuous wheat and rotation 1 are the most profitable cropping sequences over the past 6 years (Table 6). As diseases and weeds impact on the continuous wheat rotation, the advantages of adding a broadleaf crop into the rotation is expected to strengthen further.

In the W/F/W and W/L/F/W rotations it is thought that the risk of growing a crop after fallow is lesser than after a crop as in a continuous cropping system. The greatest issue with these rotations is the fact that only one crop is harvested every two (or three) years, which is limiting the rotations' current income. For these rotations to be more economic, a tighter cropping sequence would be necessary.

The long-term gross margins (Table 6) also show that Rotation 1 & 2 are significantly different to each other, with rotation 1 more profitable. The difference in these two rotations exists because of the choice of crop grown in both 2000 and 2003. In both years rotation 1 had wheat crops with higher profits than rotation 2 that had field pea crops.

Table 6. Long-term gross margin for the rotation treatments.

Rotation	**Gross Margin ($/ha)**
Continuous wheat	$421.00 c
W/F/W	$41.00 b
W/L/F/W	-$44.00 a
Rotation 1	$393.00 c
Rotation 2	$44.00 b
Significant	*YES*
l.s.d	*69.4*

Tillage summary
A gross margin difference between no tillage and conventional tillage still exists in the trial (Table 7). After six years the conventional tillage treatment has a significantly higher gross margin than the no tillage treatment.

Table 7. Long-term gross margins for the tillage treatments

Rotation	Gross Margin ($/ha)
Conventional	$248.00 b
No tillage	$94.00 a
Significant	*YES*
l.s.d	*43.9*

Rotation and tillage summary
The most profitable rotation and tillage system over the past 6 years is continuous wheat with conventional tillage (Figure 3). This system has a gross margin significantly higher than all other systems, except for rotation 1 with conventional tillage. On the other hand, the least profitable rotation and tillage system is W/L/F/W with no tillage, which is not significantly different from W/F/W with no tillage.

The advantages of no tillage are beginning to show, but only in rotation 1, where the conventional and no tillage treatments are statistically the same. No other rotations have the tillage treatments statistically the same.

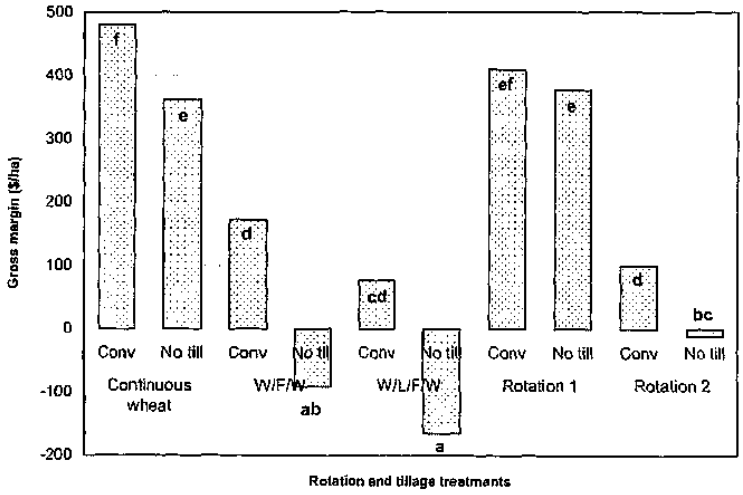

Figure 3. Merriwagga long-term gross margins 1999-2004

Note: columns with the same letter are not significantly different.

Disease summary
As a core part of the trial we have aimed to measure the potential risk of yield losses through root diseases. We have done this by measuring a number of root diseases using the Predicta B® root disease tests. This test quantifies a number of root diseases present in a soil sample, however the main disease we are concerned about is *Rhizoctonia* root rot.

We have found that more than two years of cereal crops in sequence result in a high risk level of *Rhizoctonia* in the following year. By adding a break crop such as peas, or even a fallow, we can reduce the risk of the disease. We have also found that cultivation reduces the risk of yield loss attributable by *Rhizoctonia* in a manner similar to adding a break crop. When both a break crop and cultivation are added, *Rhizoctonia* levels are below detection.

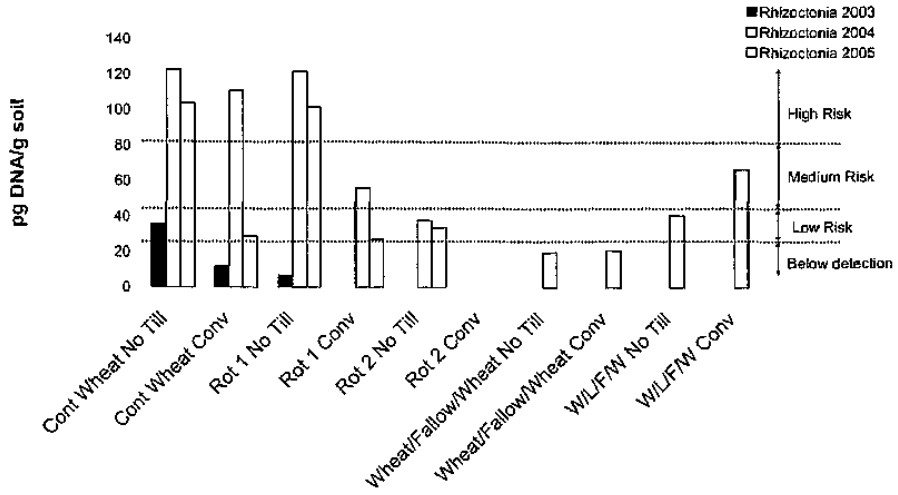

Figure 4. Rhizoctonia disease levels 2003-2005

Note: Only systems going into crop are measured for root disease risks.

Conclusions

The trial has now given some very good results that can be used and relied upon by growers to undertake beneficial change.

By rotating cereals with a broadleaf crop we have shown that the cropping rotation has become more sustainable. After 6 years the difference in the profitability between rotation 1 and continuous wheat is negligible.

If the long fallow system was tightened (W/F/W) so that there were more crops grown and less fallows, this system too could also be an alternative to growing broadleaf crops.

The trial has also shown that conventional tillage is more profitable then no tillage over the past 6 years. The difference between these two tillage methods may become insignificant as the trial continues in the future.

The success of no tillage is largely dependent upon effective weed control during the summer months. If this cannot be achieved with herbicides, then cultivation is essential to maintain yield in the following crop.

Acknowledgements and Thanks

A huge thankyou to the Barber family, the dedicated committee, and the local site sponsors who donate time, money and products that have allowed this trial to progress into what we have today.

NSW DPI, Elders, Rawlinson and Brown, Landmark Griffith, Yenda Producers, Agrichem, AWB, Bayer, C-Qentec, Case Intersales, CropCare, Codemo Machinery, Commonwealth Bank, ECOM Commodities, Dow AgroSciences, Dupont, Farmoz, Harrison Spray Contracting, Harry Shaddock Seed Grading, HiFert, Incitec/Pivot, Mobil, Nufarm, RABO Bank, Pioneer, Syngenta.

Editor's Note

In March 2005, the Merriwagga Regional Site won a Special Award in the GRDC Grower Group Awards. Congratulations to all involved in the Merriwagga Regional Site.