MERRIWAGGA CWFS TRIAL RESULTS : 1999-2006

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In Summary

- **Proper rotations (irrespective of tillage methods) incorporating no more than two cereal crops in sequence with the addition of either a break crop or a fallow once in every three years is ideal. This rotation allows a very productive and sustainable farming system in our environment.**
- **The most profitable system since 1999 has been two years of cereal followed by a break crop such as peas under no till.**
- **No till systems are now becoming more profitable in the trial than cultivated systems under every rotation.**
- **No till will work on our problem soils so long as effective weed control is achieved.**
- **Under a continuous cereal rotation, the impact of weeds, diseases, poor nutrition and subsequently lower yields has lowered profitability.**

Background and aims of the trial

A long term farming 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 60cm of the topsoil. These soils are composed of about 20% clay, 10% silt, 42% course sand and 28% fine sand, categorising them as sandy loam surface textures. Average annual rainfall is about 370mm.

The trial is situated on Geoff and Ian Barber's property "Sylvanham" on the corner of Black Stump Rd and Greenhills Rd, approximately 10kms SW of Merriwagga. The Barbers 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 30ha in area.

System treatments

Continuous rotation cropping: This system involves continuous cropping by rotating crop types. When the trial began, this system was not common practice, and it is designed to see if it can be done economically in this environment. Since the beginning of the trial, more growers are now using break crops. In general, a break crop is grown

every second or third year after wheat or barley. The choice of the break crop is mainly determined by the time of break, and disease risks.
Continuous Wheat: This treatment is not common in the area, however growers wanted to see what happens if wheat is grown over a long period of time.
Wheat/Barley /Fallow/Wheat: This system incorporates a fallow instead of a break crop. The aim is to have the system in crop for two years followed by a fallow.
Wheat/Fallow/Wheat: 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.

Tillage treatments

Each system treatment is divided into two tillage treatments.
No tillage: This treatment involves sowing with narrow points or discs into an unprepared seedbed. Weed control is by herbicides and if absolutely necessary burning. Harrowing may occasionally be practiced to remove excess stubble that may hinder sowing.
Multiple tillage: This system uses conventional tillage fallows and tillage to prepare the seedbed and remove/incorporate stubbles. Herbicides are still used in this system, however cultivation is still used as a method of weed control. This treatment aims to emulate common tillage practices of the district when the trial began.

Results and Discussion from 2006

2006 started out as a very dry season, with only 6.2mm falling from January to the end of May. The first rain allowing sowing to commence occurred in early June (same day as 2005).The break was good with 43mm falling in June, allowing most people to get most of their crop in by mid July. Unfortunately however, the season halted in August, and rainfall for the year totalled only 119.8mm, with 98mm falling between April and October. Temperatures in the spring were lower than average, which helped later crops finish without too much stress.

2006 Cropping Details

Wheat sown with 10m John Deere single disc airseeder + press wheels on 25cm rows.
Peas sown dry with 15m flexicoil airseeder + press wheels on 22.5cm rows.

Table 1: Crop details 2006.

Crop	Variety	Rotation	Sowing Rate	Fertiliser	Sowing Date
Wheat	Ventura	Continuous Wheat	35kg/ha	80kg/ha MAP	17th June
Wheat	Ventura	Rotation 1	35kg/ha	65kg/ha MAP	17th June
Wheat	Ventura	W/F/W	35kg/ha	65kg/ha MAP	17th June
Peas	Kaspa	Rotation 2	120kg/ha	55kg/ha DAP	7th June (dry)

Discussion Point 1: Yield and Gross margin

- As expected, rotations that had subsoil moisture at sowing yielded higher than those following a previous crop.
- There was no significant difference in yield between tillage methods for the W/F/W and the continuous wheat rotations.

- No till yielded significantly higher than multiple tillage in Rotation 1 (wheat after peas) and Rotation 2 (peas after wheat).
- The gross margin for no till was higher under every rotation than for multiple tillage.
- Interestingly, the protein levels of wheat were higher under no till rotations, irrespective of yield.

Figure 1: Treatment yield and protein 2006.

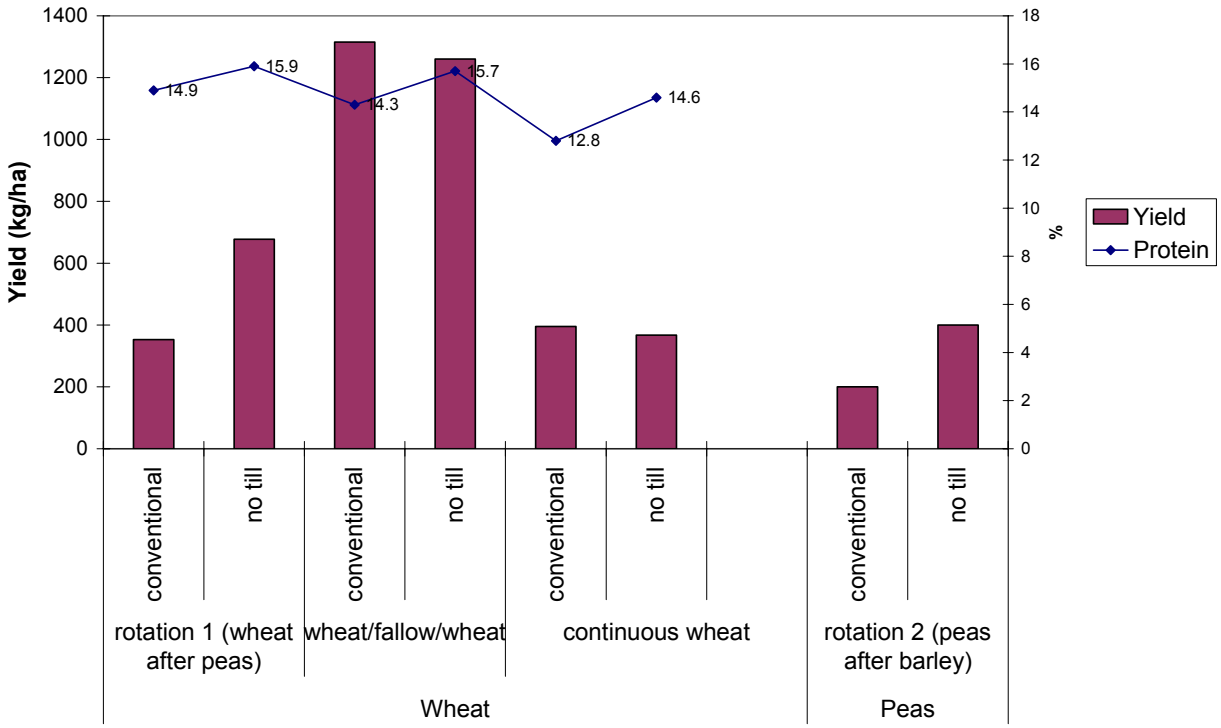
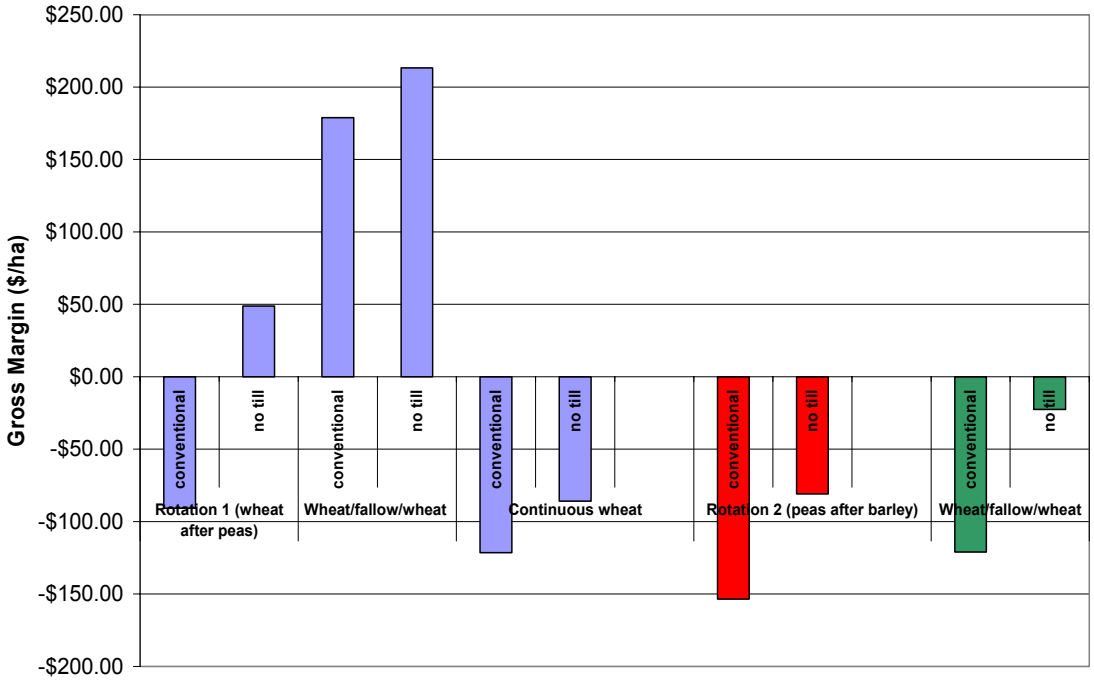


Table 2: Budgets for each treatment 2006 (note all costs are calculated at contract rates).

	Crop	Tillage	Yield (kg/ha)	Income	Expenses	Gross Margin
Rotation 1	*Wheat after peas*	conventional	352	$98.70	$189.35	-$90.65
		no till	677	$189.69	$140.92	$48.77
Wheat/fallow/wheat	*Wheat after fallow*	conventional	1315	$368.26	$189.35	$178.91
		no till	1260	$352.91	$139.68	$213.23
Continuous wheat	*Wheat after wheat*	conventional	395	$110.60	$232.00	-$121.40
		no till	367	$102.76	$188.71	-$85.95
				$0.00		
Rotation 2	*Peas after barley*	conventional	200	$56.00	$209.47	-$153.47
		no till	400	$112.00	$192.96	-$80.96
Wheat/fallow/wheat	*Fallow after wheat*	conventional	-	$0.00	$121.06	-$121.06
		no till	-	$0.00	$22.56	-$22.56

Figure 2: GM analysis for treatments at harvest 2006.



Impact of rotation and tillage on disease

- Leaf diseases were not an issue in 2006 under any rotation or tillage treatment. This has been the case since the trial began.
- Rhizoctonia seems to be the biggest disease risk, especially in the continuous cereal rotation.
- Whilst the risk of rhizoctonia is higher under a no till system, a break crop such as peas or even a fallow seems to lower the risk of the disease considerably.
- Pratylenchus neglectus nematodes seem to follow a similar risk pattern to rhizoctonia, where numbers are higher under no tillage, continuous cereal systems. These two pathogens seem to link closely together, but as stated before can be minimised by proper rotations.

Figure 3: Rhizoctonia levels apparent in all treatments from 2003 to 2006 measured by Predicta B root disease tests.

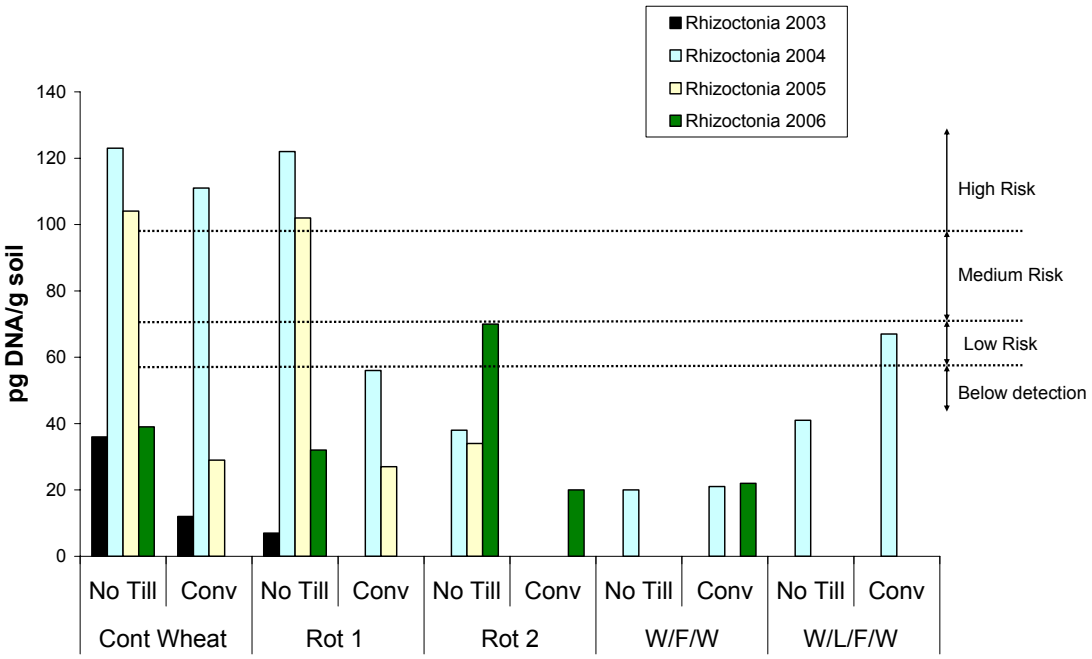
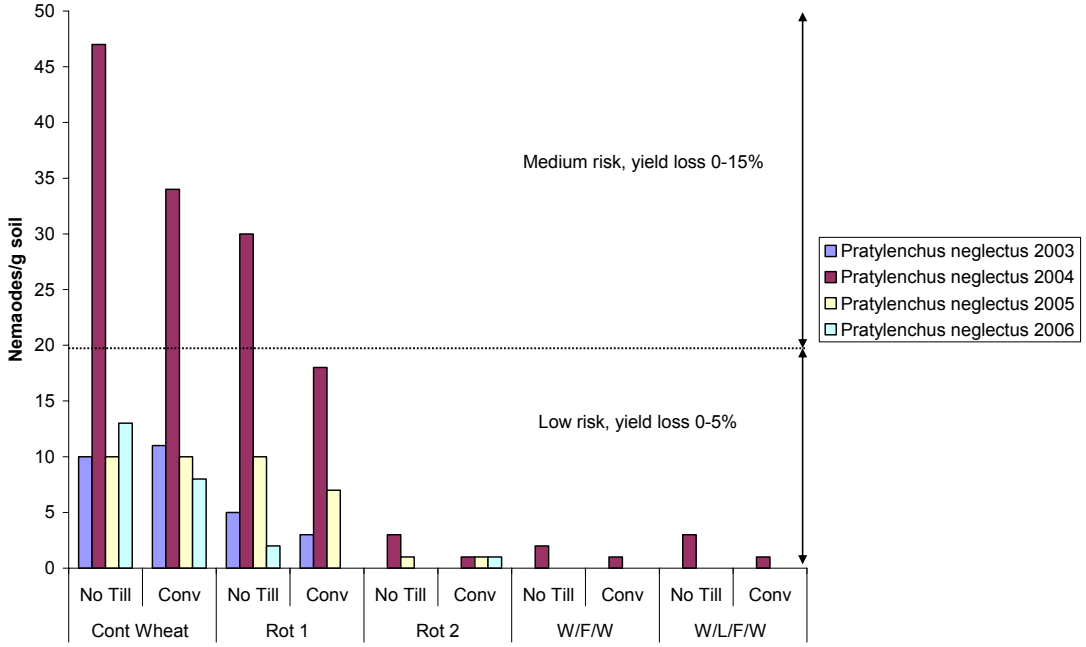


Figure 4: Nematode levels (P.neglectus) in all treatments from 2003 to 2006 measured by Predicta B root disease tests.



Impact of rotation and tillage on weeds

- A strong correlation exists between rotations, tillage methods and weed presence.
- As expected, continuous cereal rotations favour higher weed numbers of both ryegrass and wild oats. Broadleaf weeds show a similar trend.
- No till tends to favour ryegrass, where tillage favours wild oats.
- Lowest weed numbers were found when no till was used in a proper rotation, particularly following a chemical fallow.

- Higher weed numbers in continuous cereal rotations favour the build up of herbicide resistance, which has now become an issue after 6-7 years of continuous wheat.

Figure 5: Effect of rotation on weed density and type.

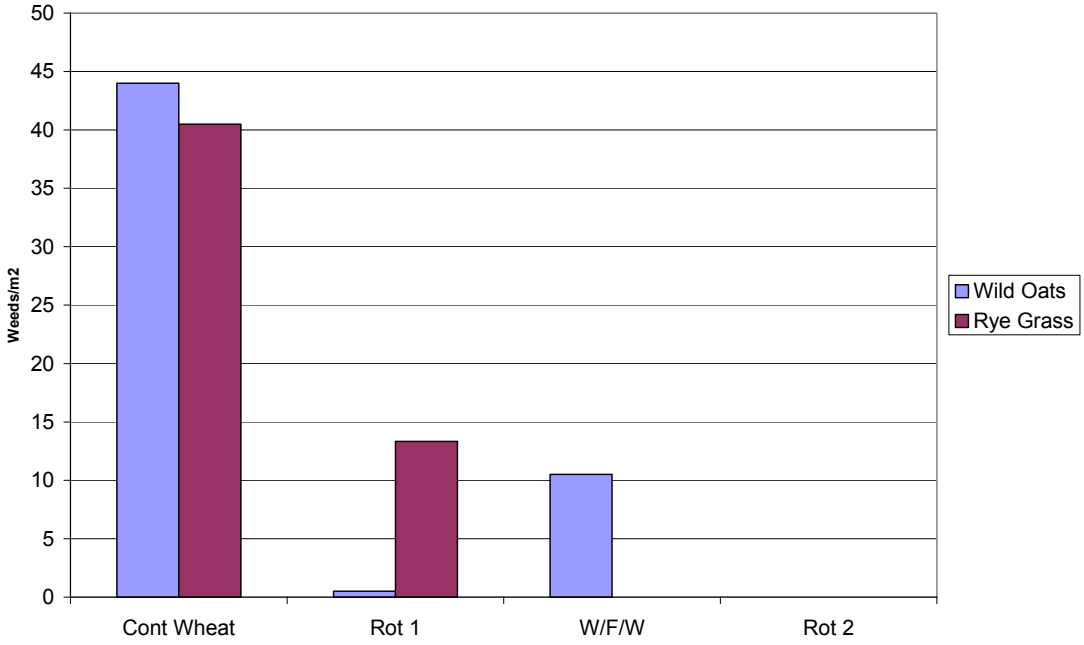
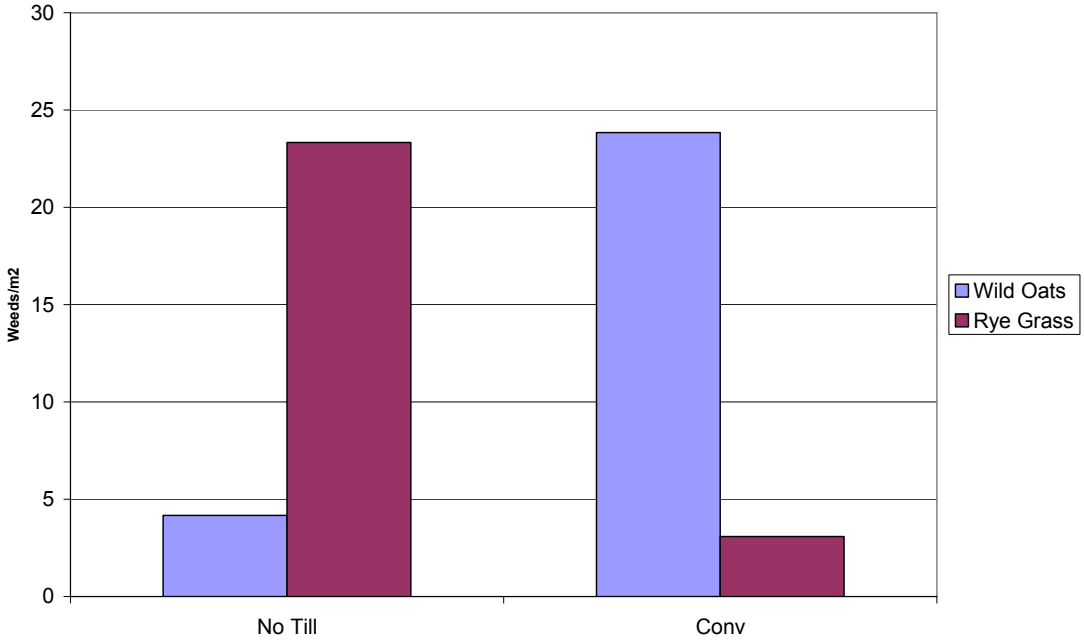


Figure 6: Effect of tillage on weed density and type.



Gross margin comparisons since the trial began

- Gross margins are calculated assuming all operations are performed by a contractor. This makes the income generated look lower than expected.
- The most economic system in the trial is Rotation 1 under a no tillage treatment. Interestingly enough, this rotation is not only the most financially viable, but is also very sustainable.
- Figure 8 highlights that the 'lag' period of no till rotations experienced in the first 3 years of the trial have now bounced back in the continuous cropping rotations. This is also the case in the chemical fallow rotations, where wheat has been performing economically better following a chemical fallow rather than a cultivated fallow over the past two seasons.

Figure 7: Long term gross margins/ha from 1999 to 2006.

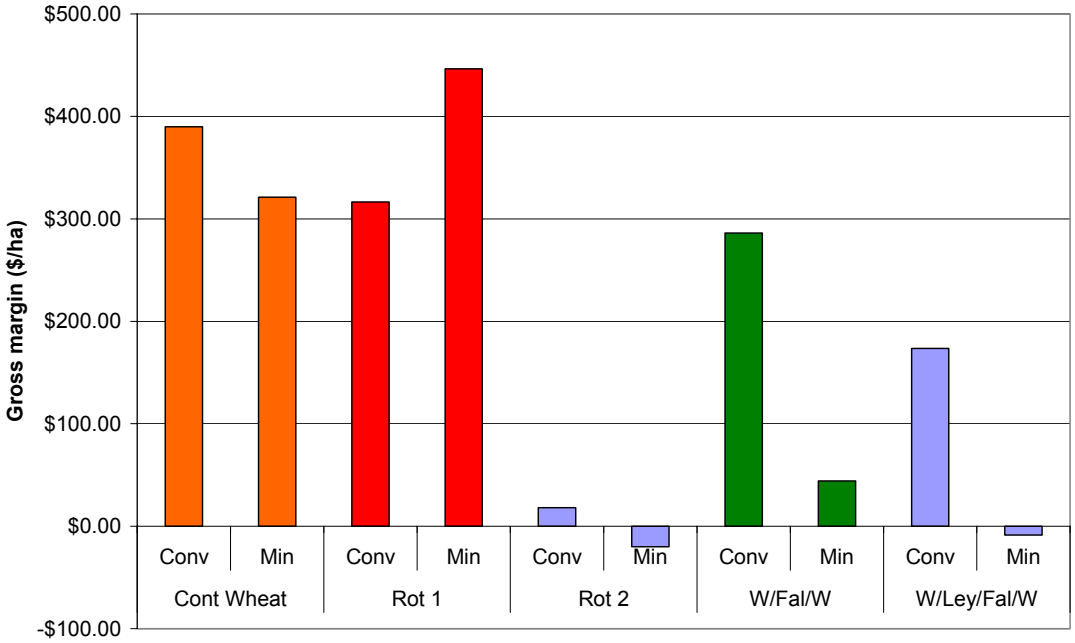
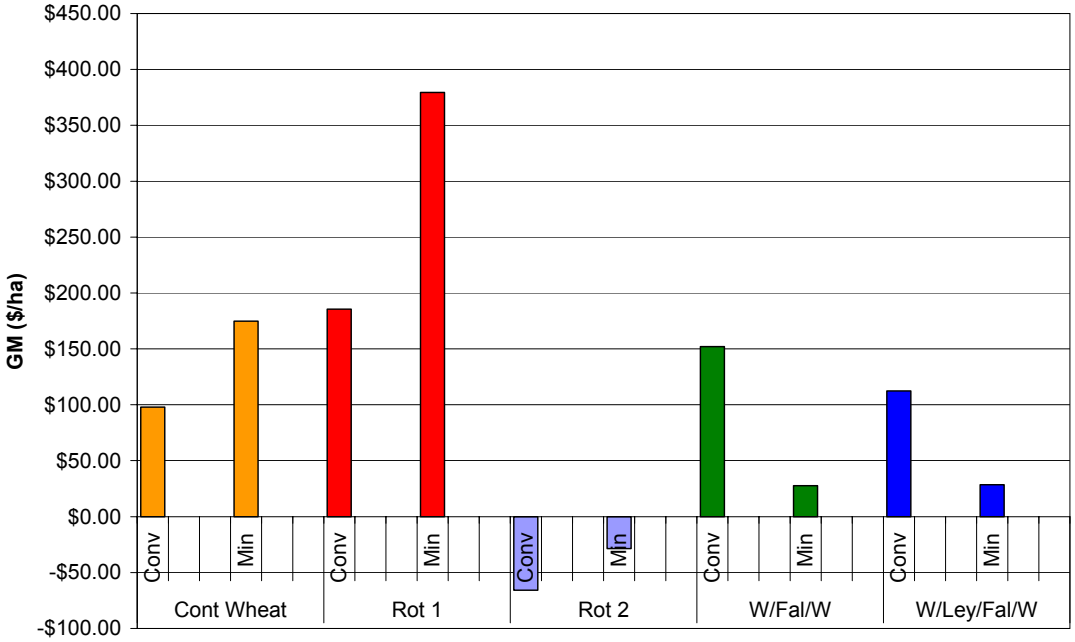


Figure 8: Gross margins from 2003 to 2006, showing the increase in the profitability in no-till farming in continuous cropping over this period.



Impact of rotation and tillage on soil health

- After 8 years, it is still difficult to measure any changes in soil health.
- Soil nutrient levels whilst varying following different rotations, have remained consistent between tillage methods.
- One significant change that has occurred however is the incidence of glomalin, a protein produced by Arbuscular mycorrhizal fungi. Glomalin has been shown to act as a 'glue' in the soil, giving it tilth and stability. The fungi it's associated with have many small hyphae, which cover much more soil area than plant roots. These hyphae supply plant roots with nutrients (particularly phosphorous) and moisture. In return the fungi use carbon from the plant to grow and make glomalin.
  Glomalin levels were measured in 2005, and were significantly higher in no till systems than conventional systems. This is probably because cultivation destroys fungal hyphae. Further testing will continue in 2007.

Site Sponsors

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

NSW DPI, Elders, Rawlinson and Brown, Landmark Griffith, Yenda Producers, Agrichem, AWB Seeds, Bayer, Case Intersales, CropCare, Codemo Machinery, Commonwealth Bank, Concepts Cropping, ECOM Commodities, Dow AgroSciences, Dupont, Farmoz, Harrison Spray Contracting, Harry Shaddock Seed Grading, HiFert, Incitec/Pivot, Intersales, Mobil, Nufarm, GRAINassist, Pioneer Seeds, PlanTech, RABO Bank, Pioneer, Suncorp, Syngenta, Vic Chemical Co, Murrumbidgee and Lachlan CMA's.