



**AgGrow**  
AGRONOMY + RESEARCH



# LONG TERM TILLAGE AND ROTATION TRIAL Merriwagga 1999-2015

# LONG TERM TILLAGE & ROTATION TRIAL

## 2015 Results

### KEY POINTS

- No till treatments, for all rotations, were slightly higher yielding than the conventional tillage treatments for wheat. The yield of peas, in rotation 2, was very low in this trial as a result of the season and Sakura® damage.
- Rotations including a fallow, such as the WFW treatment, had lower weed numbers compared to continuous cropped rotations. The continuous wheat rotation, both conventional and no till treatments, had a large number of ryegrass, even with Sakura®.
- Profit and income for 2015 was highest in the no till wheat/ley/fallow/wheat rotation, and lowest in Rotation 2.
- 17 years of no till wheat on wheat is still second for profitability.

### BACKGROUND

Established in 1999 and now in its 17<sup>th</sup> year, the Merriwagga tillage and rotation trial was set up to compare no till farming techniques against conventional farming methods over 5 different cropping rotations.

In 2015 the site was managed by Ag Grow Agronomy and Research, on behalf of Merriwagga growers and our research partner Central West Farming Systems Inc.

### TRIAL DETAILS

Situated 10km west of Merriwagga NSW, the site consists of a total of 30ha. There are 10 treatments in total replicated 3 times, with each plot 1ha in size.

The treatments consist of:

#### 2 tillage treatments

1. No-Till: where all weed control is by either herbicides or narrow windrow burning, the plots are sown with a NDF single disc seeder and stubble

retained where possible.

2. Conventional: where weed control is both by herbicides and cultivation, the plots are sown with a NDF single disc seeder and stubble is incorporated.

#### 5 Rotations

1. Continuous wheat

2. Rotation 1 - Two cereals followed by a break crop such as peas or canola.

3. Rotation 2 - Two cereals followed by a break crop such as peas or canola, not in synchronisation with continuous rotation 1.

4. Wheat - Fallow - Wheat

5. Wheat - Ley - Fallow - Wheat: this rotation has been Wheat - Fallow - Wheat since 2005, and alternates with the above wheat - fallow - wheat rotation.

A summary of the treatments and rotations for the past five years are shown in Table 1.

Table 1: Treatments and Rotational history for the past five years..

| Treatment                | Tillage      | Rotation |        |        |        |        |
|--------------------------|--------------|----------|--------|--------|--------|--------|
|                          |              | 2011     | 2012   | 2013   | 2014   | 2015   |
| wheat/ley /fallow /wheat | conventional | Wheat    | Fallow | Wheat  | Fallow | Wheat  |
|                          | no till      | Wheat    | Fallow | Wheat  | Fallow | Wheat  |
| rotation 1               | conventional | Canola   | Wheat  | Wheat  | Lupins | Wheat  |
|                          | no till      | Canola   | Wheat  | Wheat  | Lupins | Wheat  |
| rotation 2               | conventional | Wheat    | Canola | Wheat  | Wheat  | Peas   |
|                          | no till      | Wheat    | Canola | Wheat  | Wheat  | Peas   |
| wheat/fallow/wheat       | conventional | Fallow   | Wheat  | Fallow | Wheat  | Fallow |
|                          | no till      | Fallow   | Wheat  | Fallow | Wheat  | Fallow |
| continuous wheat         | no till      | Wheat    | Wheat  | Wheat  | Wheat  | Wheat  |
|                          | conventional | Wheat    | Wheat  | Wheat  | Wheat  | Wheat  |

\*note: Wheat/ley/fallow/wheat rotation is now an alternating wheat/fallow/wheat rotation

## RESULTS AND DISCUSSION

The wheat used in this trial was Suntop. It was sown 2<sup>nd</sup> May, with 50 kg/ha MAP and with a NDF disc. The peas in the trial were Sturt and were sown 2<sup>nd</sup> June with 70 kg/ha MAP/SOA.

Total rainfall for 2015 was 273mm, with 222mm falling in the growing season (April to October).

This report will focus on the measurements and assessments taken in 2015 as well as the key outcomes of nutrition, weeds and economics.

Establishment, weed pressure, grain yield and

quality, were all assessed in 2015 and the results are below.

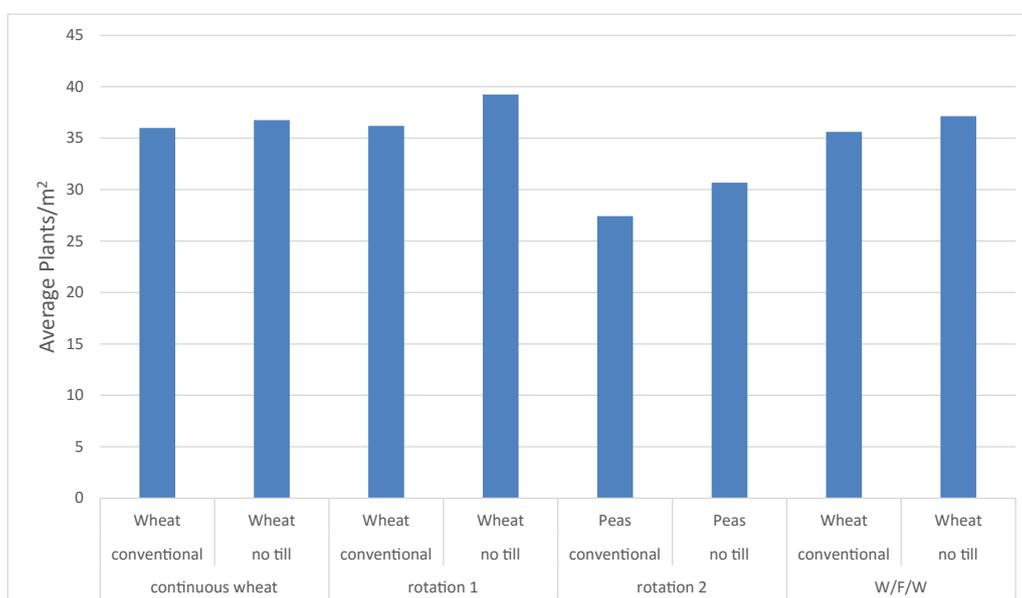
### Establishment

Plant counts were taken early July. Establishment was relatively even across the treatments.

Plant counts for the wheat plots ranged from 36 plants/m<sup>2</sup> for the conventional wheat/fallow/wheat to 39 plants/m<sup>2</sup> for the no till rotation 1.

For peas, as part of rotation 2, plant counts were 27 plants/m<sup>2</sup> for the conventional treatments and 31 plants/m<sup>2</sup> for the no till treatments (figure 1).

Figure 1: Establishment counts for each treatment of the long term trial 2015.



## Weeds

Each treatment was assessed for the type and density of the main weeds, as shown in table 2.

The main weeds observed in the trial were ryegrass, black oats, fumitory, mustard and turnip. Other weeds in the trial included clover, milk thistle, heliotrope, skeleton weed, lupins, brome grass and spiny emex.

Differences in weed numbers and weed spectrum have been measured in this trial between rotations and tillage.

As observed in previous seasons, where rotations include a fallow, as in the WFW treatment, weed

numbers tended to be lower.

The continuous wheat rotation, for both conventional and no till, had a large number of ryegrass, as did the conventional treatment of rotation 2, which was wheat last year. Rotation 1, coming out of lupins last year had a large number of broadleaf weeds in 2015.

For all treatments conventional tillage had a higher population of ryegrass than the no-till. This is likely as a result of the pre-emergent herbicides not working as well in a cultivated system. Broadleaf weeds, such as fumitory, were generally higher in no till across the treatments.

**Table 2: Weed counts for each treatment of the long term trial, measured before post emergent herbicides were applied in 2015.**

| Treatment        | Tillage      | Average Weeds per treatment (weeds/m <sup>2</sup> ) August 26th |            |          |         |        |       |
|------------------|--------------|---|------------|----------|---------|--------|-------|
|                  |              | Ryegrass  | Black Oats | Fumitory | Mustard | Turnip | Other |
| WFW              | conventional |   |            | 5        | 56      | 15     | 28    |
|                  | no till      |   |            | 1        | 26      | 36     | 21    |
| Rotation 1       | conventional | 7   | 2          | 41       | 142     | 34     | 34    |
|                  | no till      |   | 2          | 47       | 232     | 66     | 34    |
| Rotation 2       | conventional | 247   | 5          | 11       | 8       | 2      | 30    |
|                  | no till      | 42  | 24         | 107      | 32      | 4      | 9     |
| WFW              | conventional | Fallow sprayed  |            |          |         |        |       |
|                  | no till      | Fallow sprayed  |            |          |         |        |       |
| Continuous wheat | conventional | 528   | 5          | 9        | 58      | 6      | 14    |
|                  | no till      | 145   | 8          | 16       | 107     | 22     | 10    |

## Grain Yield and Grain Quality

The average grain yield of wheat in this trial in 2015 was 2.13 t/ha.

The lowest yielding treatment was the conventional continuous wheat yielding 1.67 t/ha. The highest yielding treatment was the no till WFW yielding 2.66 t/ha (figure 2).

For each of the rotations the no till treatments were slightly higher yielding than the conventional tillage treatments.

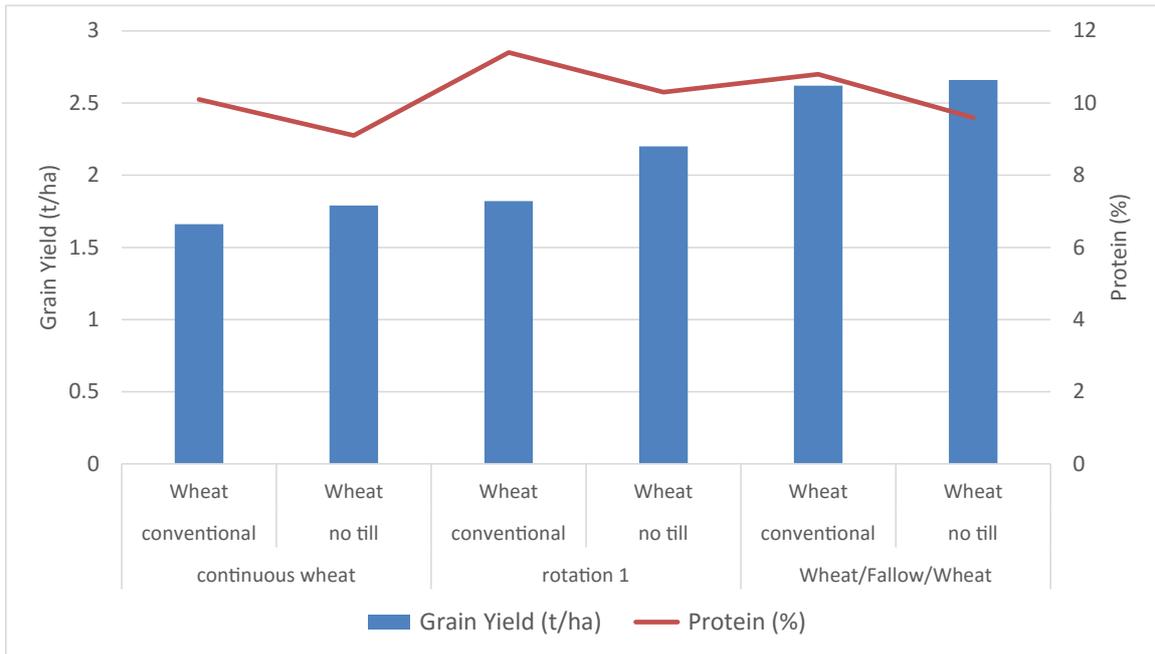
As a result of the season and herbicide damage, yields of the peas in rotation 2 were very low yielding, yielding less than 0.5 t/ha.

Grain protein of the wheat ranged from 9.4% for the conventional continuous wheat rotation to 11.4% for the conventional rotation 1 treatment (figure 2).

Protein was higher for all the conventional tillage treatments, with an average of 10.8%, compared to 9.7% for the no till treatments.

The average grain protein overall was 10.21%.

Figure 2: Grain Yield for each wheat treatment of the long term trial 2015.



**Nutrition**

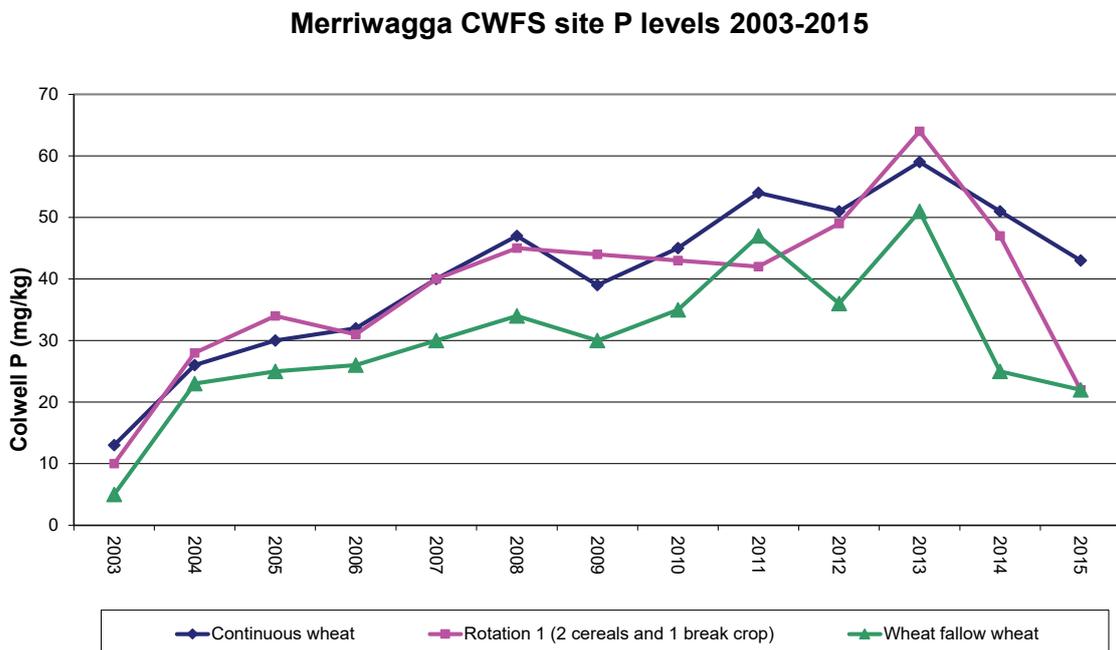
The trend in soil P levels at the trial site for the past 13 years is shown in figure 3.

Unlike the drought years, where we saw an increase in soil P levels as a result of adding more phosphorous than what was being taken out, the last

few years has seen a decrease in soil P levels at the site.

The only treatment that remains above 25 mg/kg in 2015 and would be considered adequate is the continuous wheat rotation.

Figure 3: Soil P Curves for each treatment from 2003 to 2015.



## Economic Comparisons

The costs, income and profit of each treatment in 2015 is shown in table 3.

In 2015 the no till treatments all had a higher income and profit compared to the conventional treatments.

Profit and income for 2015 was highest in the no till wheat/ley/fallow/wheat rotation, with an income of \$585.20 and a profit of \$240.40.

Rotation 2, although not having the lowest income

had the lowest profit of all the treatments with a loss of \$209.70 for the conventional treatment and a loss of \$174.70 for the no till treatment.

The only other treatment to have a negative profit in 2015 was the wheat/fallow/wheat treatment, which was in fallow in 2015.

**Table 3: Costs and profit for each treatment in 2015. Note WFW was in fallow, hence no yield recorded.**

| Treatment                | Tillage      | Costs 2014 | Costs 2015 | Total Costs | Income | Profit  |
|--------------------------|--------------|------------|------------|-------------|--------|---------|
| wheat/ley /fallow /wheat | conventional | 77.56      | 302.24     | 379.8       | 576.4  | 196.6   |
|                          | no till      | 77.56      | 267.24     | 344.8       | 585.2  | 240.4   |
| rotation 1               | conventional |            | 302.24     | 302.24      | 400.4  | 98.16   |
|                          | no till      |            | 267.24     | 267.24      | 481.8  | 214.56  |
| rotation 2               | conventional |            | 277.7      | 277.7       | 68     | -209.7  |
|                          | no till      |            | 242.7      | 242.7       | 68     | -174.7  |
| wheat/fallow/wheat       | conventional |            | 118.41     | 118.41      | 0      | -118.41 |
|                          | no till      |            | 83.41      | 83.41       | 0      | -83.41  |
| continuous wheat         | no till      |            | 267.24     | 267.24      | 393.8  | 126.56  |
|                          | conventional |            | 302.24     | 302.24      | 365.2  | 62.96   |

Table 4 shows the individual gross margins for each year the trial has been running as well as the long term gross margins for the past 17 years.

It is important to note that all costs are calculated at locally validated contract rates. This is very different to the costs a typical farmer would apply, but it allows a very good comparison of the real costs associated with each farming system.

The standout treatment for both conventional and no till for the past 17 years has been rotation 1, two cereals followed by a break crop. This was closely followed by a continuous wheat system.

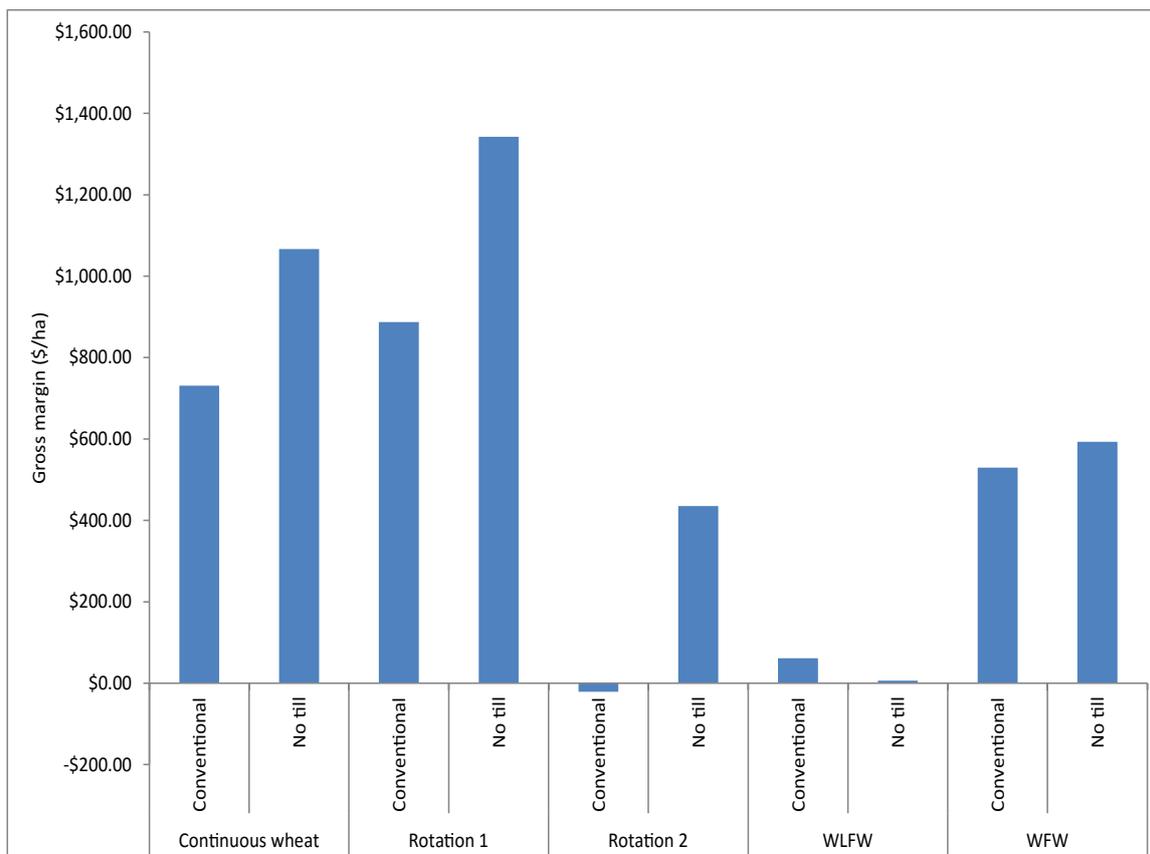
The average gross margin for the past 17 years is \$563.23, with a no till system for rotation 1 having an average gross margin of \$1,342.29 and a continuous wheat no till system having an average gross margin of \$1,066.60. This is also shown in figure 4.

It is important to note that agronomically the continuous wheat rotation has higher risks of crop failure. This is due to the possibilities of higher weed numbers, lower nutrition and subsoil moisture reserves and higher presence of root diseases. This trial however, has proven over the past 17 years that in this environment this rotation has still performed exceptionally well.

The only negative gross margin over the past 17 years has been the conventional system for rotation 2, also two cereals followed by a break crop but not in synchronisation with rotation 1, with a gross margin of -\$20.99.



Figure 4: Long Term Gross margins for each treatment 1999 to 2015.



## ACKNOWLEDGEMENTS

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### Further contacts

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