

# Farming Systems trial - 2004

## Summary

The BCG long-term Farming Systems project was established in 1999. The project aim is to compare the physical production, economic performance and sustainability of four different farming systems : Zero Till, Reduced Till, Fuel Burners and Hungry Sheep.

2004 was another tough year at the trial site with a late break and well below average rainfall (GSR 155mm; decile 1.2 season).

In terms of gross margin analysis the Hungry Sheep came out ahead with a gross margin of \$15/ha. All the other systems made an economic loss. A stock trading profit of \$84/ha in 2004 was the main reason for the Hungry Sheep system's success. Gross margins for the other three systems were -\$55/ha for Zero Till, -\$57/ha for the Reduced Till and -\$32/ha for Fuel Burners.

## Background

The trial area occupies 32 hectares divided into one-hectare paddocks. Five randomly placed paddocks are allocated to each of the four systems, with the remaining paddocks used as standards to determine cross-site variability. Each farming system is championed by a local farmer who is currently practicing one of the four systems on the home farm. All management decisions throughout the growing season are made by the 'champion', while the operations are completed by BCG staff.

## Cropping rotations 2004

2004 crop choice was heavily influenced by a late seasonal break and ongoing recovery from drought in 2002 (Table 1).

- The Reduced Till system opted for 40% wheat, 40% barley and 20% chemical fallow. This choice prompted much discussion about the crop options and disease implications, of having some paddocks in continuous cereal for 4 years and one paddock for 5 years. 2004 risk was managed by sowing different varieties of wheat and barley as well as using a combination of early and late sowing.
- The Zero Till system reintroduced chemical fallow into the rotation after the success of 2003. The Zero Till system dropped pulses and decided on a lower risk cereal options with 40% wheat, 40% barley and 20% fallow.
- The Fuel Burner system returned to its standard cropping intensity of 60% cereal – one third wheat on fallow, and two thirds barley on wheat stubble – and 40% fallow.
- The Hungry Sheep system made the major change in 2004 by dropping pulses and increasing sheep numbers, with a rotation of 60% cereal and 40% medic pasture.

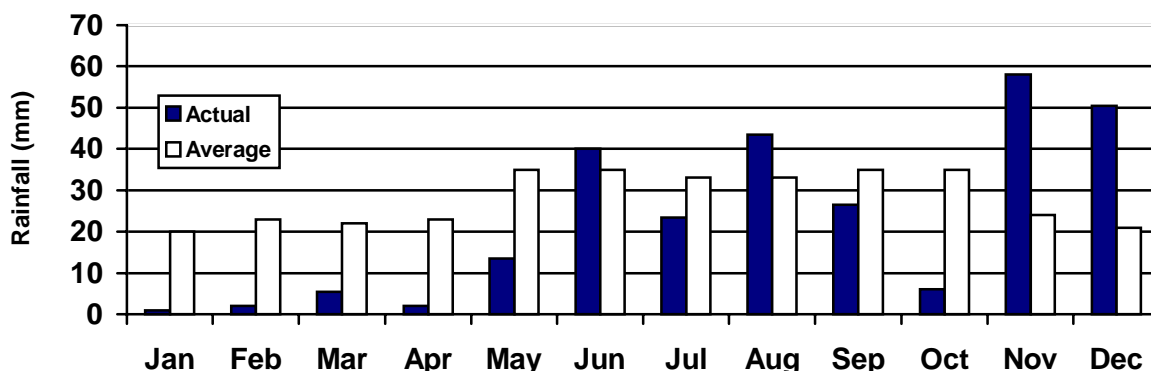
**Table 1.** 2004 rotations at the BCG Farming Systems site.

	<b>Zero Till</b>	<b>Reduced Till</b>	<b>Fuel Burner</b>	<b>Hungry Sheep</b>
<b>Paddock 1</b>	Wheat (Yitpi)	Wheat (Silverstar)	Fallow	Barley (Vic-Sloop)
<b>Paddock 2</b>	Barley (Schooner)	Barley (Barque)	Barley (Vic-Sloop)	Sheep
<b>Paddock 3</b>	Wheat (Yitpi)	Barley (Vic-Sloop)	Medic / Fallow	Wheat (Yitpi)
<b>Paddock 4</b>	Barley (Schooner)	Fallow Chemical/cultivation	Barley (Vic-Sloop)	Wheat (Yitpi)
<b>Paddock 5</b>	Fallow (Chemical)	Wheat (Yitpi)	Wheat (Yitpi)	Sheep

All systems reduced nitrogen and phosphorus fertiliser rates in 2004, except for the Fuel Burners who maintained P rates.

## Rainfall and seasonal conditions

With only 10.5 mm of rain from January until the end of April the soils were very dry at sowing. Growing season rainfall was only 155mm (April 1 to October 30); a decile 1.2 season. The critical spring month of October was very dry and crops struggled towards the end of the season to finish (Figure 1). On October 12, a mid afternoon temperature of 42°C was measured at crop height, this heat wave caused significant damage to late flowering – early grain filling crops. The rain in November came too late for the 2004 crops.



**Figure 1.** Average and 2004 monthly rainfall at the BCG Farming Systems Site

The soils at the systems site are highly sodic, high in salt and boron and although wheat and barley roots can penetrate to a depth of 80cm, they struggle to take up moisture at this depth due to the hostile conditions. All of the barley crops were planted back on wheat stubble with little or no subsoil moisture. Pulses and canola roots are rarely found deeper than 50cm and in seasons with a dry finish there is not enough moisture to finish the crop. Medic appears more tolerant to hostile subsoil conditions and performs quite well in this area and seems to establish roots deep enough for moisture extraction.

All Zero Till crops were planted dry on the 17<sup>th</sup> of May. Half of the Reduced Till crops were sown dry on May 23, with the remainder planted on June 16, after the break. The Hungry Sheep and Fuel Burner systems opted to wait for rain and sowed in early June.

## Results

### Soil moisture and available nitrogen at sowing

Available soil moisture across the site ranged from 12 to 88mm (0 to 70cm depth). The four long term cultivated and fallow paddocks averaged 82mm of soil moisture, whilst other paddocks had a lower soil moisture content, the variability in moisture across paddocks, other than fallow, did not appear to be related to the System or the previous crop or pasture type. There was more moisture available in the deeper sub-soil but due to the sub-soil limitations this moisture is not easily accessed by crops at the site.

Soil available nitrogen levels at sowing ranged between 25 and 190kg N/ha and was correlated to previous crop type (2003 crop type and range in soil available nitrogen: cereal 25 to 70 kg N/ha (one paddock measured 125 kg N/ha which may have been in error); canola 40 to 45 kg N/ha; pulses 50 to 140 kg N/ha and fallow 100 to 190 kg N/ha.

### Crop Yield

Crop yield was very low as you would expect in a decile 1.2 year. The Fuel Burners system had the highest yield for wheat (1.1 t/ha) grown on fallow (Table 2).

All barley grain was feed quality, which was not surprising since all crops were sown on wheat stubble. Low feed prices meant that these paddocks generated very low returns. Wheat quality was reasonably good with grain from most paddocks accepted in the hard classification.

**Table 2.** Farming Systems site- harvest results 2004

Paddock number	Crop Type	Sowing date	Yield (t/ha)	Protein (%)	Screenings (%)
<b>Zero Till</b>					
6	Wheat	17/5	0.61	16	10.8
11	Barley	17/5	0.78	13.9	40
16	Wheat	17/5	0.40	15.7	7.8
22	Barley	17/5	0.82	11	14.7
27	Fallow				
<b>Reduced Till</b>					
3	Wheat	20/5	0.63	14.5	47
14	Barley	20/5	0.74	14.7	25.5
19	Barley	16/6	0.70	14.5	26
24	Fallow				
30	Wheat	16/6	0.70	13.1	16
<b>Fuel Burner</b>					
8	Fallow				
10	Barley	11/6	0.70	12.6	7.1
18	Medic/Fallow				
21	Barley	11/6	0.83	14.1	22.6
29	Wheat	8/6	1.10	15.7	2.2
<b>Hungry Sheep</b>					
2	Barley	11/6	0.70	13.1	21.8
5	Sheep				
13	Wheat	8/6	0.50	15.1	8.2
26	Wheat	8/6	0.30	14.8	5
32	Sheep				

### Weed burden

At this stage there is very little difference between the systems in weed type or amount of weeds. Marshmallow has been recorded in the Zero Till system but only as isolated plants. The most common in-crop weeds found in all the systems are wild oats, mustard and medic and all were controlled. We may see some difference in weed types over summer with the 100 + mm of rain over the last 8 weeks of the year.

### Disease

All paddocks were DNA tested before sowing for root disease. DNA soil test results showed low disease levels coming into the 2004 cropping season.

- Rhizoctonia was present at high levels in Hungry Sheep 32 (Wheat in 2003) and moderate levels in Hungry Sheep 5 and 26 (Barley and Medic in 2003), Reduced Till 19 (Wheat in 2003) and Zero Till t 11 and 27 (Wheat and Barley in 2003).
- *Pratylenchus neglectus* was detected in all paddocks at either a low or medium rating.
- *Pratylenchus thornei* was not present in any paddock.
- Cereal Cyst Nematodes levels were negligible.

At this stage there are no long term trends in root disease levels between the different systems. Moderate *Rhizoctonia* levels measured in some of the paddocks prior to sowing, did not result in a high incidence of *Rhizoctonia* levels in-crop.

## Economic performance

Economic performance of each system was calculated for each year of production (Table 3). Gross margins per hectare were calculated for each season from the income received from the crops and the variable costs related to production (using standard contract rates for machinery operations). Sheep gross margins for the Fuel Burner and Reduced Till systems were calculated on an agistment basis, whereas for the Hungry Sheep system sheep income and costs were calculated using a trading account.

**Table 3.** Yearly crop and sheep gross margins for each system (\$/ha), (2000-04)

	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>
<b>Fuel Burner</b>					
Crop Income	272	334	182	309	55
Crop Variable Cost	147	111	133	175	93
<b>Crop GM</b>	<b>125</b>	<b>223</b>	<b>49</b>	<b>134</b>	<b>-37</b>
Agistment Income	9	9	12	1	5
<b>Sheep GM</b>	<b>9</b>	<b>9</b>	<b>12</b>	<b>1</b>	<b>5</b>
<b>TOTAL GM</b>	<b>134</b>	<b>232</b>	<b>61</b>	<b>135</b>	<b>-32</b>
<b>Hungry Sheep</b>					
Crop Income	312	325	0	194	37
Crop Variable Cost	140	150	131	109	103
<b>Crop GM</b>	<b>172</b>	<b>175</b>	<b>-131</b>	<b>85</b>	<b>-66</b>
Sheep Trading Profit	110	22	-30	45	81
<b>Sheep GM</b>	<b>110</b>	<b>22</b>	<b>-30</b>	<b>45</b>	<b>81</b>
<b>TOTAL GM</b>	<b>282</b>	<b>197</b>	<b>-161</b>	<b>130</b>	<b>15</b>
<b>Reduced Till</b>					
Crop Income	274	323	0	392	66
Crop Variable Cost	125	149	146	149	126
<b>Crop GM</b>	<b>149</b>	<b>174</b>	<b>-146</b>	<b>243</b>	<b>-60</b>
Agistment Income	5	7	11	1	3
<b>Sheep GM</b>	<b>5</b>	<b>7</b>	<b>11</b>	<b>1</b>	<b>3</b>
<b>TOTAL GM</b>	<b>154</b>	<b>181</b>	<b>-135</b>	<b>244</b>	<b>-57</b>
<b>Zero Till</b>					
Crop Income	225	295	0	256	66
Crop Variable Cost	183	190	124	159	121
<b>Crop GM</b>	<b>42</b>	<b>105</b>	<b>-124</b>	<b>97</b>	<b>-55</b>
<b>TOTAL GM</b>	<b>42</b>	<b>105</b>	<b>-124</b>	<b>97</b>	<b>-55</b>

Average growing season rainfall at the site is 240mm. Since the trial began, seasonal rainfall has been well below this figure in all but one year (GSR for 2000:256mm; 2001: 197mm; 2002:107mm; 2003:206mm; and 2004: 155mm). Due to the low rainfall conditions crops grown on fallow have performed relatively better compared to crops grown on stubble. The most conservative system – Fuel Burners – where in most years the crop intensity was only 60% (with 40% fallow) has performed the best in terms of yield and income. Alternative

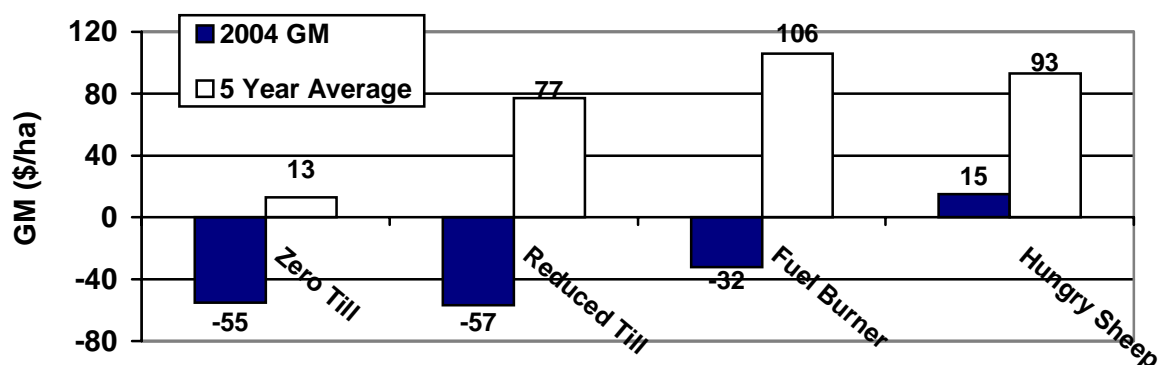
crops such as canola and pulses (peas, faba beans, vetch and lentils) have performed very poorly due to:

- (i) dry seasonal conditions – especially during the spring; and
- (ii) severe subsoil limitations resulting in restrictions in root growth. Limited ability to access subsoil moisture has resulted in these crops being unable to finish in a dry season.

The Zero Till system was especially dependent on canola and pulses in the early years of the Systems site project. Crop failures in dry years have resulted in the replacement of pulses with chemical fallow. Sufficient stubble has now been added to this system to enhance moisture retention and we expect that the cereals grown in this system will now be able to take advantage of improved soil conditions.

Pasture medic does not appear to be affected by the hostile sub-soils and in most seasons medic provided an excellent and abundant source of feed which has benefited the Hungry Sheep system.

The long term gross average gross margins are presented in Figure 4. It must be noted that these gross margins are a reflection of not only crop yield, but also crop selection. The performance of the Zero Till system was initially influenced by having too many pulses and canola crops in the rotation. This system has now changed to a cereal rotation whilst still retaining stubbles and minimizing soil disturbance at sowing.



**Figure 3.** 5 year average gross margin and 2004 gross margin for each system at the BCG systems site (2000-04)

### The future

The current plan is to maintain the system site for at least another three seasons. Prior to sowing in 2005 the site will be intensively sampled for soil condition (including organic carbon); weeds in the seed bank; and soil borne disease carry-over. The systems have now been in place for five years and it will be interesting to see whether there have been any changes in these parameters since the inception of the project.