

Farming Systems trial 2003



Summary:

The BCG long-term Farming Systems project was established in 1999. Four different farming systems are being compared; Zero Till, Reduced Till, Fuel Burners and Hungry Sheep, with the aim of the project to identify physical production, economic performance and sustainability indicators for each of the farming systems.

2003 was another tough year at the trial site with a late break and little spring rain (GSR 206mm; decile 3.5 season)

The Reduced Till system was the economic performer of 2003, with an annual gross margin of \$248/ha achieved. This was driven by a 100% cropping intensity with cereals.

Zero Till system achieved the highest cereal yields in 2003 (proving that the planned reduction of canola and pulses in the rotation should improve the economic performance of system)

Early sown crops looked better all year, and yielded more than later sown crops- Zero Till system achieving highest barley and wheat yields. Barley crops out-performed wheat while pulse crops failed again.

Background

The trial area occupies 32 hectares divided into one-hectare plots. Five randomly placed plots have been allocated to each system (with 12 standards). The standard plots run parallel across the trial area in order to assess spatial variation across the trial area. 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 2003

Financial recovery after the drought of 2002 influenced heavily the crop choices made at the systems trial in 2003 (Table 1). The Reduced Till system opted for 100% cropping intensity, sowing 60% wheat and 40% barley. This choice prompted much discussion about the crop options and disease implications for 2004. Risk was managed through sowing different varieties of wheat and barley as well as using a combination of early and late sowing.

The Zero Till system introduced vetch into the rotation for the first time, creating the option to green manure or cut hay, while building soil organic matter levels. The Zero Till system also increased the percentage of cereals in the rotation.

The Fuel Burner system increased its standard cropping intensity from 60% to 80%, with the remainder in fallow.

The Hungry Sheep system made no change to their rotation sowing 60% cereal, 20% lentils and medic pasture 20%.

Table 1. 2003 cropping rotations at the BCG Farming Systems site.

	Zero Till	Reduced Till	Fuel Burner	Hungry Sheep
Paddock 1	Peas (Kaspa)	Wheat (Silverstar)	Wheat (Yitpi)	Wheat (Yitpi)
Paddock 2	Wheat (Yitpi)	Wheat (Yitpi)	Wheat (Yitpi)	Barley (Barque)
Paddock 3	Vetch (Languedoc)	Wheat (Yitpi)	Barley (Vic-Sloop)	Lentils (Nugget)
Paddock 4	Wheat (Yitpi)	Barley (Gairdner)	Wheat (Yitpi)	Medic (self-sown)
Paddock 5	Barley (Schooner)	Barley (Vic-Sloop)	Medic (Mogul)	Wheat (Annuello)

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

Rainfall & seasonal conditions

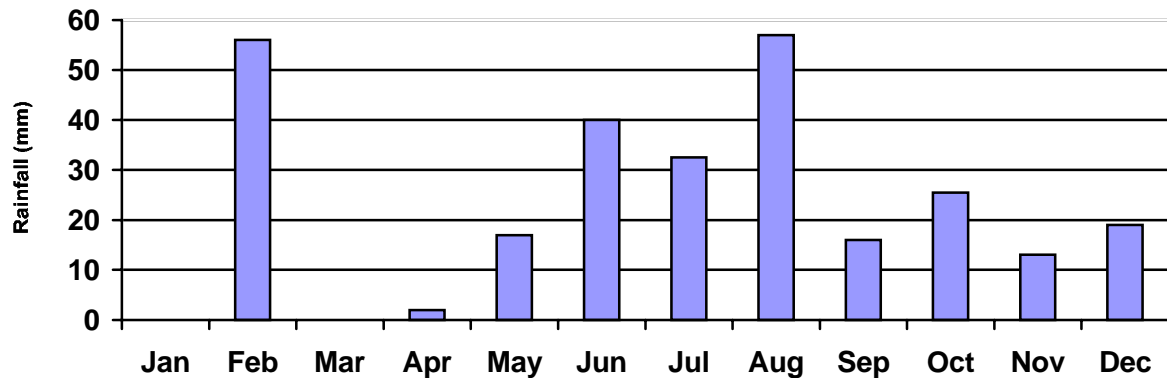


Figure 1. 2003 rainfall at BCG Farming Systems site

Fifty-eight millimetres of summer rainfall between November 2002 and March 2003 meant that the soils were relatively dry at sowing. Growing season rainfall was only 206mm (April 1 to October 30); a decile 3.5 season. The critical spring months of September and October were also well below average and crops struggled towards the end of the season to finish.

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 at this depth to take up moisture due to the hostile conditions. 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. Surprisingly medic performs quite well in this area and seems to establish roots deep enough for moisture extraction.

The Zero Till and Reduced Till system decided to sow early with 40% of their crops sown dry in May. The Hungry Sheep and Fuel Burner systems opted to wait for rain and sowed early June.

Results

Soil water and available nitrogen at sowing

Available soil moisture across the site ranged from 35 to 60mm (0 to 40cm depth) and did not appear to be related to the System or the previous crop or pasture type. There was more moisture available in the sub-soil but due to the sub-soil limitations this moisture is not easily accessed by crops at the site.

Soil available nitrogen levels were very high at sowing (range 60 to 150kg N/ha and also did not appear to be related to the System or the previous crop or pasture type. The high soil N did result in wheat and barley crops with high protein at harvest 2003.

Crop Yield

As was observed in the district the early sown crops generally looked better all year and yielded slightly more (Table 2).

The other general observation was that barley performed at least 0.5t/ha better than wheat. The reason for this could be that barley finishes earlier than wheat and with

the dry finish experienced this year it allowed barley to finish (even though screenings were high) whilst wheat struggled at the end.

Table 2. Farming Systems site- harvest results 2003

Paddock number	Crop Type	Sowing date	Yield (t/ha)	Protein (%)	Screenings (%)
Zero Till					
6	Peas	11/6	0		
11	Wheat	21/5	2.1	11.9	4.5
16	Vetch	18/6	0.2		
22	Wheat	21/5	1.6	12.3	3.6
27	Barley	21/5	3.1	13.3	17.8
Reduced Till					
3	Wheat	12/5	1.7	15.2	0.9
14	Wheat	3/6	1.7	15.2	7.1
19	Wheat	12/5	2.0	14.5	5.6
24	Barley	29/5	2.5	11.5	3
30	Barley	3/6	2.6	12.2	9.4
Fuel Burner					
8	Wheat	4/6	1.9	14.6	2.2
10	Wheat	4/6	1.7	15	4.4
18	Barley	12/6	2.3	15.6	10.7
21	Wheat	4/6	2.0	14.4	2.2
29	Medic				
Hungry Sheep					
2	Wheat	4/6	1.2	15.3	3.9
5	Barley	29/5	3.0	9.1	5.4
13	Lentils	4/6	0.2		
26	Medic				
32	Wheat	4/6	1.4	15	2.3

Weed burden

At this stage there is very little difference between the systems in weed type or amount of weeds. Marshmallow is the only weed that is difficult to control and appears to be more common in the Zero Till system compared to the other systems. However, at this stage it is still only found as isolated occurrences. The most common in-crop weeds found in all the systems are wild oats, mustard and medic and these are all easily controlled in-crop.

Disease

All plots were soil tested pre-sowing for DNA root disease levels. DNA soil results showed low disease risk coming into the 2003 cropping season.

- CCN was detected at low levels in Hungry Sheep 32 and Reduced Till 24
- Take-all was detected at a high levels in Fuel Burner 18. Low levels were detected in Hungry Sheep 2 and Reduced Till 19.
- Rhizoctonia was present at low levels in Fuel Burner 21, Hungry Sheep 13 and 32, and Reduced Till 24.
- *Pratylenchus neglectus* was detected in all paddocks at either a low or medium rating except for Hungry sheep 26 where it was detected at a high level rating. *Pratylenchus thornei* was not present in any plots.

Economic performance

As was expected given 100% cereal cropping intensity, the Reduced Till system came out in front from an economic perspective (see Figure 2) having a good return off every paddock. The champion of this system opted for cheap weed control with Glean[®], restricting re-cropping options in 2004. The overall average gross margin achieved in 2003 by the Reduced Till system was \$248/ha. This gross margin was positively influenced through the agistment of store lambs after harvest. The economic implications of 100% cereal in 2003 on crops in 2004 are yet to be seen. The limited crop choice based on disease risk as well as Glean[®] carryover may well see this year's economic gain take a step backwards in season 2004. The four -year average gross margin is \$118/ha.

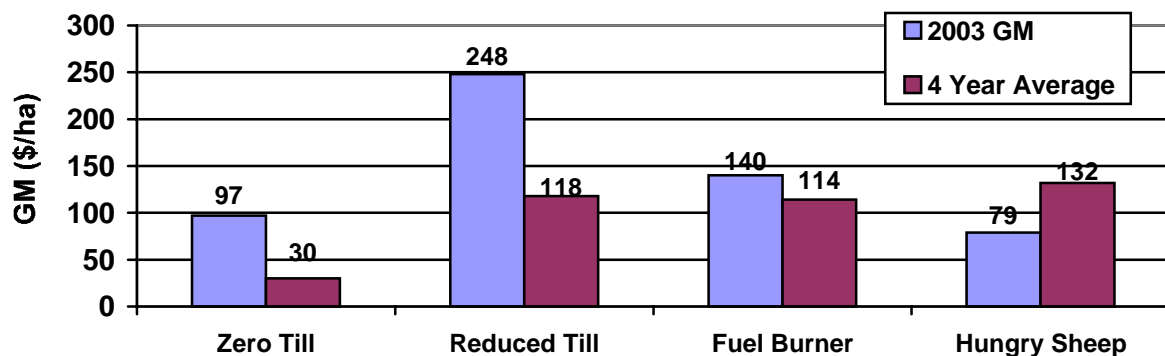


Figure 2. Economic Performance of BCG Farming Systems trial

The Zero Till system increased the cereal intensity within the cropping rotation which was a good decision, with cereal paddocks achieving relatively higher yields and better returns, compared to pulse and canola crops. Financial losses were incurred on the vetch and pea crops both returning a negative gross margin of -\$139/ha and -\$137/ha respectively. The overall average gross margin achieved by the system in 2003 was \$97/ha, moving the Zero Till four year average gross margin to \$30/ha. It is expected with a reduced emphasis on pulses and canola that the planned continuous cereal rotation will provide improved returns in the future, with economic figures reflecting benefits of the zero till system rather than crop choice.

The Fuel Burner system was again the consistent financial performer with an average gross margin of \$140/ha. This gross margin was reduced through lower yields received. The Fuel Burner system also received income through the agistment of store lambs after harvest. The four year average gross margin is \$114/ha.

In 2003 the Hungry Sheep system returned an average gross margin of \$79/ha. While this is much lower than previous seasons there were a number of influencing factors. The Hungry sheep system was forced to reduce stocking rates due to the late break and low feed availability throughout May. Consequently high supplementary feed costs were incurred. Increasing the livestock costs of the system was the purchase of two ewes to boost the stocking rate over summer and season 2004. The Hungry Sheep system incurred a loss on the lentil paddock of -\$59/ha. Also to be noted is that none of the 2003 lambs have been sold. This income will be included in the 2004 cropping season. The four year average gross margin is \$132/ha.

Economic summary - Farming Systems trial

One of the key aims of the BCG Farming Systems trial is to analyse over time, the economic drivers of four different farming systems practiced commercially in the southern Mallee. The four farming systems compared in the trial include Zero Till, Reduced Till, Conventional tillage (Fuel Burners) and a cropping system which includes a high intensity sheep operation (Hungry Sheep).

Summary

- Flexibility a driver of profit
- Hungry Sheep long-term average gross margin is \$132/ha
- Zero Till long-term average gross margin is \$30/ha
- Fuel Burner long-term average gross margin is \$114/ha
- Reduced Till long-term average gross margin is \$118/ha

Background

The BCG Farming Systems trial has completed four years of a cropping cycle and is starting to produce some interesting economic results. Analysis of input costs such as herbicides, fertilisers and machinery costs has been carried out as well as how the ability of each system to achieve yields is affecting the economic performance of each system. Measuring the economic impact of livestock in a system has also been an integral aspect of the trial.

When interpreting the results generated to date it is important to keep in mind that to really gain a true insight into economic sustainability over time, each system must be given at least one more year to complete a full cropping cycle.

Methods

Economic analysis of the farming systems trial has included:

- Calculating average annual gross margins per hectare for each farming system
- Calculating average annual gross margins per crop type used in each systems rotation.
- Cumulative average gross margins overtime have then been calculated.
- Analysis of input costs such as herbicides, fertiliser and machinery.

Results

Long-term gross margins have been calculated for each of the systems and are represented in the table below.

Table 1. Long-term gross margins for each system.

Year	Zero Till (\$/ha)	Reduced Till (\$/ha)	Fuel Burner (\$/ha)	Hungry Sheep (\$/ha)
2000	42	163	158	295
2001	105	202	251	314
2002	-124	-140	-92	-160
2003	97	248	140	79
4 Year GM	30	118	114	132

Individual Paddock Gross Margins

Zero Till

Year	Paddock 6 (GM \$/ha)	Paddock 11 (GM \$/ha)	Paddock 16 (GM \$/ha)	Paddock 22 (GM \$/ha)	Paddock 27 (GM \$/ha)
2000	200.3 (Barley)	222.1 (Wheat)	-93.5 (Canola)	-22.8 (Lentils)	-98.1 (Faba Beans)
2001	-117.9 (Lentil)	243.2 (Barley)	231.7 (Wheat)	260.4 (Wheat)	-91.1 (Canola)
2002	-190.1 (Wheat)	-125.2 (Lentils)	-123.8 (Barley)	-22.5 (Barley)	-158.0 (Wheat)
2003	-137 (Peas)	269 (Wheat)	-139.3 (Vetch)	174.8 (Wheat)	317.3 (Barley)

Reduced Till

Year	Paddock 3 (GM \$/ha)	Paddock 14 (GM \$/ha)	Paddock 19 (GM \$/ha)	Paddock 24 (GM \$/ha)	Paddock 30 (GM \$/ha)
2000	266 (Barley)	289 (Wheat)	6.5 (Chem/fallow)	304 (Wheat)	-51 (Lentils)
2001	-58 (Chem/fallow)	299 (Barley)	200 (Wheat)	347 (Barley)	224 (Wheat)
2002	-291 (Wheat)	-219 (Wheat)	-60 (Barley)	15 (Chem/fallow)	-146 (Wheat)
2003	253 (Wheat)	223 (Wheat)	299 (Wheat)	186 (Barley)	280 (Barley)

Fuel Burner

Year	Paddock 8 (GM \$/ha)	Paddock 10 (GM \$/ha)	Paddock 18 (GM \$/ha)	Paddock 21 (GM \$/ha)	Paddock 29 (GM \$/ha)
2000	372 (Wheat)	-24.2 (Field Peas)	-27.51 (Medic/fallow)	425 (Wheat)	43 (Medic/fallow)
2001	4 (Medic/fallow)	420 (Barley)	480 (Wheat)	-23.5 (Medic/fallow)	373 (Wheat)
2002	-136 (Wheat)	-82.3 (Vetch)	-92 (Vetch)	-136 (Wheat)	-12 (Medic/fallow)
2003	222 (Wheat)	171 (Wheat)	127 (Barley)	235 (Wheat)	-57 (Medic/fallow)

Hungry Sheep

Year	Paddock 2 (GM \$/ha)	Paddock 5 (GM \$/ha)	Paddock 13 (GM \$/ha)	Paddock 26 (GM \$/ha)	Paddock 32 (GM \$/ha)
2000	267 (Wheat)	396 (Wheat)	339 (Medic/fallow)	134 (Lentil)	337 (Wheat)
2001	201 (Oats/Medic)	608 (Barley)	274 (Wheat)	392 (Wheat)	95 (Lentils)
2002	-181 (Wheat)	-142 (Oats/Medic)	-133 (Lentils)	-148 (Barley)	-196 (Wheat)
2003	124 (Wheat)	296 (Barley)	-60 (Lentils)	-151 (Medic/fallow)	187 (Wheat)

Cost Analysis

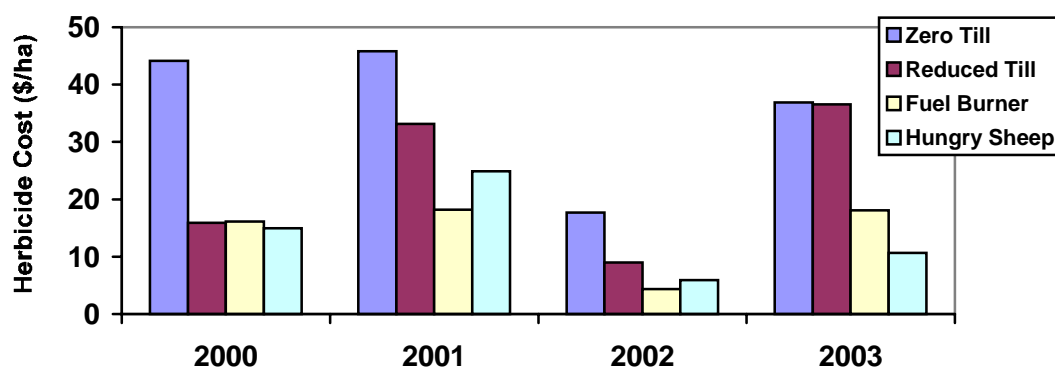


Figure 1. Annual herbicide costs at the Farming Systems site (2000-2003)

Heavy reliance on herbicides in the Zero Till system is reflected in the high annual expenditure on herbicide (Figure 1). Yearly expenditure per hectare is around \$40-45. In contrast the Hungry Sheep system uses sheep for weed control. The use of mechanical fallow ensures the herbicide costs of the Fuel Burner system are always relatively low.

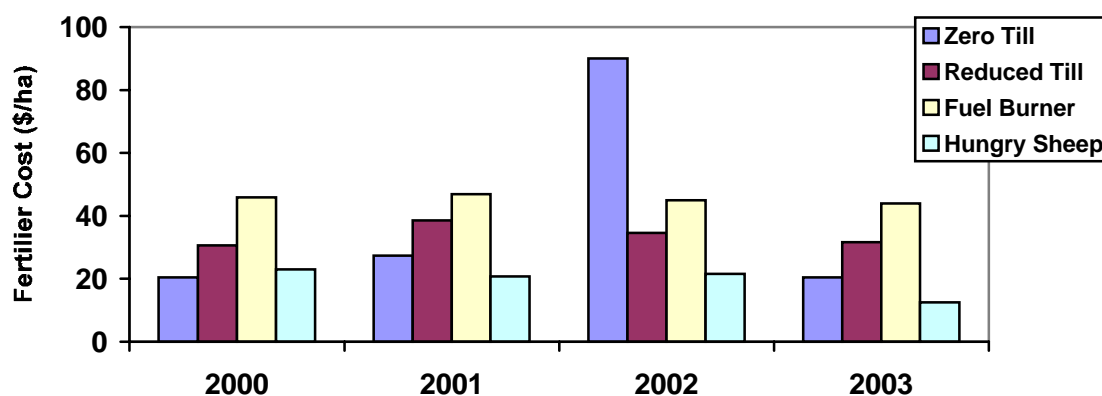


Figure 2. Annual fertiliser costs at the Farming Systems site (2000-2003)

With the exception of 2002, the Fuel Burner system has spent more money per hectare on fertilisers than all other systems over the four-year life of the project, averaging around \$42/ha (see Figure 2). This is made more interesting by the fact that only 60% of the plots are being cropped every year.

Much debate has surrounded the cost of machinery for the various systems (Figure 3). To date machinery has been costed using local contracting rates for all operations. These were then compared to cost calculations made for a 1500ha farm whereby the champions of each system chose the necessary equipment to undertake all major operations throughout the year. One machinery overhead cost that has not been calculated but must be considered is the cost of a shearing shed and the overhead costs associated with shearing, such as electricity. All machinery costs have been allocated per cropped hectare.

Results showed that Zero Till and Reduced Till systems were better off owning their own equipment than contracting out each operation. This outcome was perhaps driven by the intensity of rotations and nature of operations throughout the year. The Hungry Sheep system, based on the figures, had similar machinery costs whether

contracting or owning their own equipment. The exception to the rule was the Fuel Burner system where the figures suggested that contracting out all operations would be more cost effective than owning their own equipment. This was perhaps driven by the large equipment purchased for a cropping intensity of only 60%. An issue of over capitalisation was raised.

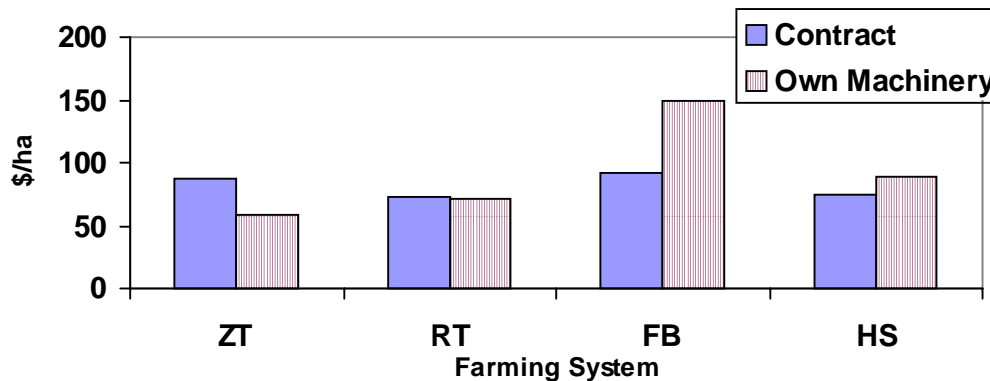


Figure 3. Contract machinery costs vs own machinery costs.

Interpretation

The economic results generated by the BCG Farming Systems site are reflective of a number of key factors over the last four years.

- The systems that have incorporated cereals have been rewarded with consistent yield and quality results. All cereal crops have achieved good returns with the exception occurring during the drought year of 2002.
- High boron levels have negatively impacted upon those systems with a high use of legumes and pulses in the rotation. Lentils for example, have performed poorly every year only returning a positive gross margin for the Hungry Sheep system in 2000 and 2001 (see Table 5). Zero Till responded in 2003 by increasing the percentage of cereals in the rotation. For the Hungry Sheep system these losses and small gross margins have been compensated for by income generated by livestock.
- The incorporation of livestock into the Hungry Sheep system has over the last four years delivered good returns and has kept costs to a minimum with an average herbicide bill of \$14/ha.
- Flexibility within any system is proving to be profitable. This was no more evident than in 2003 when the Reduced Till system opted to crop 100% of available land with cereals. The result was profitable returns off all paddocks. The ability to achieve such profits after a no income year as was 2002 was a huge advantage.
- The Reduced Till and Fuel Burner systems have also used flexibility to their advantage when it comes to stock. Opportunity agistment of stock after harvest and buying in stock to take advantage of an early break has been a diversification strategy implemented by both systems, which has generated positive cash flow.
- The high stocking rates of the Hungry Sheep have had times of profit and loss. Large supplementary feed costs incurred in 2002 as well as having to buy stock back in after de-stocking, created a negative sheep gross margin in 2003. However prior to this, high sheep prices and a resurgence in the wool price brought good profits to the Hungry Sheep system.