Applying the results from the farming systems trial 2000-07, to your farm in 2008

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Take home messages

- *Using 2008 prices with 2000-07 data, the keys to modest, less variable profits with minimal complexity and less reliance on skill or luck have been:*
- *Moderate intensity (60-80%) of profitable, reliable crops: cereal after fallow or a forage break*
- *A modest but profitable livestock enterprise*
- *Fallow either tilled or chemical (does not appear to be key to the result)*
- *Better profits at higher risk can be had with:*
- *Higher crop intensity - requires skill or luck in picking the years in which to sow more crop and especially break crops*
- *Higher livestock intensity - requires skill or luck to increase the returns from trading livestock, and to work out when it is profitable to feed sheep*
- *More intensive systems may be ahead if there is a modest improvement in growing seasons in the next few years. If low GSR (<decile 3) years remain frequent, less intensive systems will be well ahead.*

There may be some doubt about climate change, but recent changes in input prices have been far more definite. Change may be a catalyst for farmers to reconsider their choice of farming system. The aim of this article is to consider how the system choices in the BCG farming systems trial over the past eight years would play out with likely 2008 prices, and to highlight some of the consistent lessons that can be applied on-farm, to farming systems change in 2008.

The BCG farming systems trial has been running now since 2000, comparing the 'fuel burner', 'hungry sheep', 'reduced till' and 'no till' farming systems. Each system is managed by a farmer champion, who directs crop and management choices on five paddocks each year.

The four systems are quite different. The fuel burner sows mainly cereals, includes tilled fallows, and has occasionally had lightly stocked (two ewes/ha) sheep for fat lamb production or agistment. The hungry sheep system sows intense cereals, and uses high stocking rates on fallows and early sown forage/medic pasture. Livestock are used for fat lamb production (2-5 ewes/ha) and fattening trade lambs, with supplementary feeding to maintain stocking rates. The no-till system uses minimum-disturbance establishment, and relies on herbicides for weed control. It now has a predominantly cereal rotation with a single fallow, but in 2000-2 sowed a high proportion of high-value, non-cereal grain crops that were poorly adapted to the site. The reduced-till system is flexible, tending to use a range of sowing dates and crop types, and minimum-disturbance establishment though with the option of using tillage for weed control. The reduced-till system may also take livestock on agistment over summer.

The soil is a cracking, Gilgai (crab-hole) clay, which in the past has grown good medic pasture and has high residual fertility. The results of the trial are immediately applicable to areas of the Mallee and Wimmera with heavier soil types, and low GSR years. The principles should be applicable in all areas.

Methods

Previous economic analyses have been 'historical' – given the prices at the time, and the production achieved, how would the cash flow in the systems have accumulated to the present? These analyses are good for describing 'how have the systems performed?', but are less applicable to other farms, in the future. This analysis is 'prospective' – if 2008 was a random selection from any of the past eight years, with identical management and production but prices that might be expected now, how would the different systems perform and why?

The analysis used the production and paddock record data for the four systems since 2000. Where possible, all items were costed (eg. components of a spray mix, sheep husbandry items) and applied at the time costs were incurred or items produced. Input prices were obtained from Birchip (M & P Jolly) in January, 2008. Possible 2008 prices for production are given in Table 1.

Table 1. '2008' production prices used in the analysis.

Item	Price	
APW wheat	300.00	$/t
Malt barley	324.00	$/t
Feed barley	252.00	$/t
Canola	500.00	$/t
Faba bean	539.50	$/t
Lentil	650.00	$/t
Pea	390.00	$/t
Vetch hay	300.00	$/t
Lamb meat	3.50	$/kg
Lamb skin	8.00	$/skin
Wool 22.6 micron dirty	6.50	$/kg
Maiden Ewe	80.00	$/head
CFA Ewe	40.00	$/head
Ram	400.00	$/head
CFA Ram	50.00	$/head

Machinery operations used 'contract' pricing, which means that the fixed ('ownership') component of machinery costs depends on how many times they are used each year. Ideally in future analyses the fixed and variable ('operating') costs of machinery will be separated. The current arrangement means that the ownership cost of some machines is likely to be under-estimated, for example when no crops are harvested there is no price paid for owning a harvester.

Previous economic analyses have used a 'trading account' for livestock economics, with estimates of ewe depreciation and joining costs, and prices achieved when stock were sold/bought. This has given the 'hungry sheep' system some credit for trading skill (or lack of it). So that the economics can be applied to other farmers, without assuming trading skill, trading returns have been calculated with constant meat prices (thus the return is only to liveweight gain). Lamb production has been calculated on a 'flock' basis, given 90% weaning, from a flock containing 1-4 year old ewes and constant prices for maiden and cast-for-age ewes and rams. Lamb production was calculated pro-rata to the period a number of ewes was on the site, to give estimates relevant to the real situation where ewes must be maintained on-farm for the whole year.

Those who have particular skills with livestock, grain or machinery trading will need to adjust the results accordingly.

Livestock feed has been cost at 80% of the silo price, assuming feed will be accumulated on-farm when the sale price is low.

Allowance must also be made for the effect of price change on decisions – eg. with high grain prices, supplementary feeding may be less likely, similarly with high glyphosate price, it may have been less readily used. The analysis assumes the effect is neutral across the systems.

Results

System response to rainfall

Apart from 2000, the system gross margins are closely related to rainfall when '2008' prices are used with historical production and input use (Figure 1). The poorer growing season rainfall efficiency in 2000 may relate to some initial problems with management, as some champions and BCG staff were on a steep 'learning curve' with the site.

There were no significant differences between systems in response to rainfall (excluding 2000). On average across the systems, gross margin increased $4.22/ha per mm growing season rainfall (±$0.37/ha/mm, R2=82.4%).

When '2008' prices are used, there is a regular pattern (apart from 2005) of the fuel burner system tending to have highest or second-highest gross margins (Figure 1, Table 2). In 2002, 04 and 07, there was little to differentiate the remaining systems (at most $35/ha), but in other years the differences were bigger. The reduced-till system had highest gross margins in 2003 and 2005 (equal with no-till), but in other years (2000-01, 06) tended to be second-lowest. Apart from 2005-06, the no-till system has had the lowest average gross margin in all other years. Hungry sheep had highest average gross margin in 2000, did well in 2001 and 2005, but in other years had similar performance to no-till.

If you think a repeat of each of 2000-07 are equally likely in 2008, then the probability of a loss is lowest in fuel burner (2/8 years), intermediate in reduced till (3/8 years) and highest in no-till and hungry sheep (4/8 years). The losses all occur in the low-GSR years (<160mm, 2002,04,06,07).

If you are optimistic and think high-GSR years are more likely (>195mm, 2000-01,03,05), then the probability of a loss is 0 for all systems. Excluding the early choice of poorly-adapted break-crops by the no-till system in 2000-01, the average gross margins of all systems in the later high-GSR years (2003,05) are almost identical for all systems except reduced-till (Table 2). Reduced-till in 2003,05 had highest gross margin in both years because all paddocks were sown to profitable crops (other systems had lower intensity and/or less profitable crops).

Agronomy

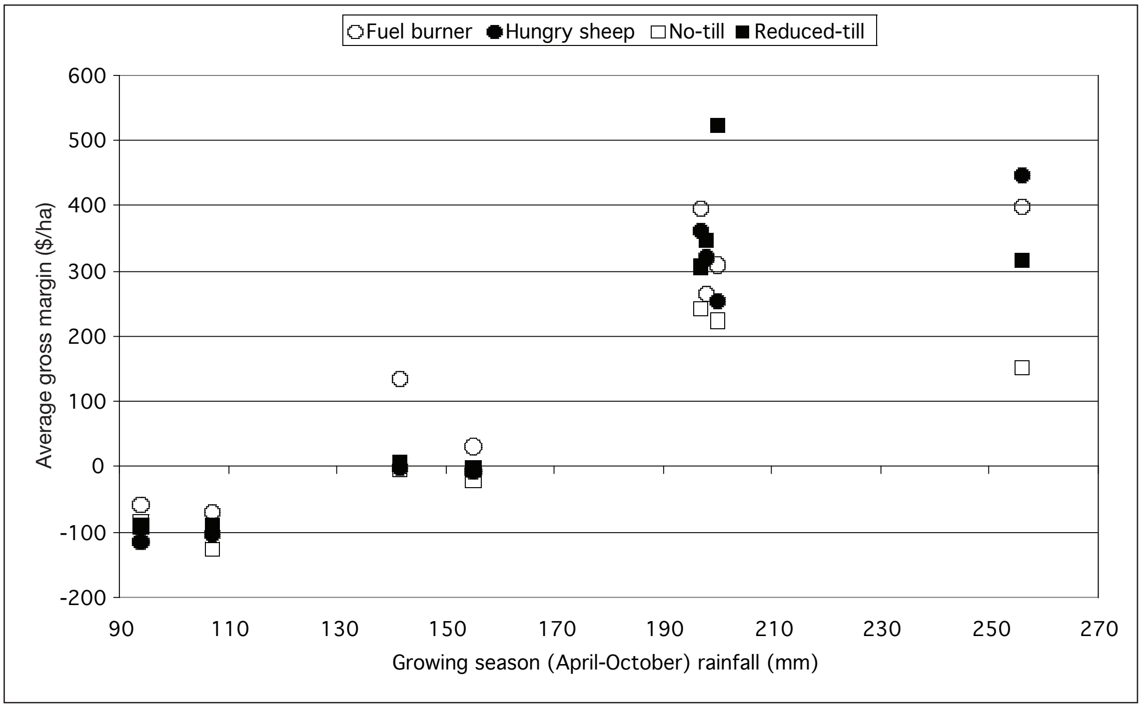

Figure 1. Average gross margin vs. growing season (April-October) rainfall for the four systems, 2000-2007. This analysis used '2008' prices.

If you are pessimistic and think low-GSR years are more likely, (<160mm, 2002,04,06,07), then the probability of a loss is highest in no-till and hungry sheep (4/4 years), intermediate in reduced-till (3/4 years) and lowest in fuel burner (2/4 years). On average in severe drought years (2002,06) losses are more severe in hungry sheep and no-till systems, slightly less in reduced-till, and least severe in fuel burner. In the less severe years (2004,07) the fuel burner system is clearly ahead.

If the gross margins are averaged over all years to produce an 'average' estimate of performance for 2008, the result depends mostly on performance in the better years (Table 2). Across 2000-07, fuel burner is $10/ha ahead of reduced till, $30/ha ahead of hungry sheep, and $85/ha ahead of no-till. Allowing for the changes in the no-till system since early years, across 2003-07, reduced till is $20/ha ahead of fuel burner, and $65/ha ahead of hungry sheep and no-till. The fuel burner system has consistently low variability in income whether calculated across 2000-07 or 2003-07. The reduced-till system attains higher income but is more variable; no-till and hungry sheep are more variable still.

Causes of the differences between systems

Differences in performance between systems can be traced back to one of a few key factors: how much is produced (quantity), how much is it worth (quality), and how much did it cost to grow (input cost). Ideally fixed costs (of running the business, mainly differing in machinery ownership here) would also be considered; their amalgamation in this analysis into 'contract rates' needs to be born in mind and it is planned to extend the analysis in future.

Crop production and quality

The fuel burner has been the most reliable income producer of the four systems. This has resulted from sowing mainly cereal crops, and using fallows. Although fewer crops have been harvested in the fuel burner system in many years (because of the inclusion of fallows), a minimum of two crops have been harvested in all years (Figure 2a). The crops (being mainly cereals) have often yielded substantially more (Figure 2b), compensating for lower price-per-ton. The fuel burner cereal–fallow yield advantage has dropped away in later years as other systems have sown more cereals and used fallows (no-till). In 2007 fuel burner cropping incomes were boosted by cutting a paddock of vetch hay, which has not been included in Figure 2.

Table 2. Average gross margin for the farming systems in the BCG farming systems trial, 2000-2007, using '2008' prices. The years are ordered by growing season (April-October) rainfall. Averages are also given for particular combinations of years.

Year	GSR (mm)	Average gross margin ($/ha)			
		Fuel burner	Hungry sheep	No till	Reduced till
2006	94	-$58.45	-$114.89	-$83.82	-$90.75
2002	107	-$69.82	-$102.92	-$126.40	-$91.05
2007	142	$133.93	-$1.29	-$5.01	$5.39
2004	155	$31.09	-$7.76	-$21.99	-$3.33
2001	197	$395.61	$360.46	$241.66	$305.45
2005	198	$264.49	$319.98	$347.28	$347.02
2003	200	$308.55	$252.49	$223.89	$522.15
2000	256	$397.55	$446.78	$150.94	$315.45
Averages					
Low GSR	124	$9.19	-$56.72	-$59.31	-$44.93
High GSR	213	$341.55	$344.93	$240.94	$372.52
2003,5	199	$286.52	$286.24	$285.58	$434.58
All (2000-7)	169	$175.37	$144.11	$90.82	$163.79
Variability[a]	0.32	1.10	1.56	1.90	1.44
2003-7	158	$135.92	$89.71	$92.07	$156.10
Variability[a]	0.28	1.13	2.08	2.00	1.69

[a.] *"Variability" is calculated as standard deviation / mean.*

In keeping with its 'flexible' nature, the causes for high returns in reduced till have also been 'flexible', but a common element has been sowing all paddocks in years that have turned out to be higher rainfall. In earlier 'high' rainfall years (2000 and 01) fewer crops were sown. In 2003 the crops were all cereal, with higher yield and lower price. In 2005 the crops included pea and canola, giving lower yield but higher price. Non-cereal break crops can be valuable in the 'right' years. In 2005 no-till achieved similar results to reduced-till with four cereals and a fallow.

In 2000-01, hungry sheep yields tended to be similar to reduced till, but with more crops harvested and higher value, the results were better (Figure 2a-c). In the same years, no-till sowed more crops, with higher prices, but not enough to compensate for the low yields. Since 2003, there has been a pattern between hungry sheep and no-till of similar numbers of crops harvested, slightly higher yields in no-till, and slightly higher prices for crops in hungry sheep. The net result has been slightly higher cropping income for no-till, but often also slightly higher cropping costs.

An important contributor to value (using '2008' prices) is the difference between prices for wheat, and feed and malt barley, and the difficulty of achieving malt barley protein specifications at the site. Average barley yields have often been higher than wheat, despite wheat often following a fallow; in all the systems barley usually follows another cereal crop.

Figure 2. Key crop production results for the four systems across 2000-2007, using 2008 prices: a. number of crops harvested, b. average yield of crops harvested, c. and average price per ton. This excludes vetch hay from the fuel burner in 2007.

Cropping costs

Average cropping costs have tended to be low in the fuel burner system (Figure 3a), because fewer paddocks have been cropped, and the relative cost of maintaining fallows has been much lower than sowing crops. Fuel burner wheat crops have themselves tended to be amongst the more expensive of the systems (Figure 4a); fuel burner barley crops have been relatively less expensive (Figure 4b).

No-till cropping costs have been more expensive on an average basis (Figure 3a), especially in 2000-03, reflecting intensive cropping and high input and seed costs for non-cereal crops. No-till wheat crops have themselves been amongst the least expensive (Figure 4a), while barley crops have been more expensive. Reduced-till has been similar. Initial analysis (not shown here) shows that chemical costs tend to be higher, probably related to post-emergent grass weed control; barley is usually sown after wheat in all rotations, whereas wheat crops are often sown after fallow or a break crop.

Hungry sheep cropping costs have tended to be low, both on an average (Figure 3a) and per-cereal-crop basis (Figure 4a, b). Reduced weed control costs have been a benefit of high livestock stocking rates in the hungry sheep system, although sowing times and level of pre-crop weed control are sometimes compromised.

Livestock income and cost

The lower stocking-rate livestock system used by the fuel burner has produced modest but relatively consistent incomes, with generally low costs (Figure 3b). The hungry sheep system has produced much higher incomes, but with high costs in years with dry autumn/winters when supplementary feeding has been necessary. Reduced till has received minor incomes from agistment.

Note that the livestock incomes and costs generally come from grazing one or two paddocks in winter/spring, and grazing stubbles outside the growing season, but in Figure 3b have been averaged over all paddocks. When converted back to a per-paddock basis the hungry sheep livestock incomes and costs have often been similar to that of a crop, although the costs have been much higher in dry years. Initial analysis (not shown here) suggests that the fat lamb production part of hungry sheep has been more profitable and less risky; much of the risk has come from feeding to finish trade lambs in autumn. In this part of the enterprise the results are much more dependent on trading skill and availability of low-cost feed.

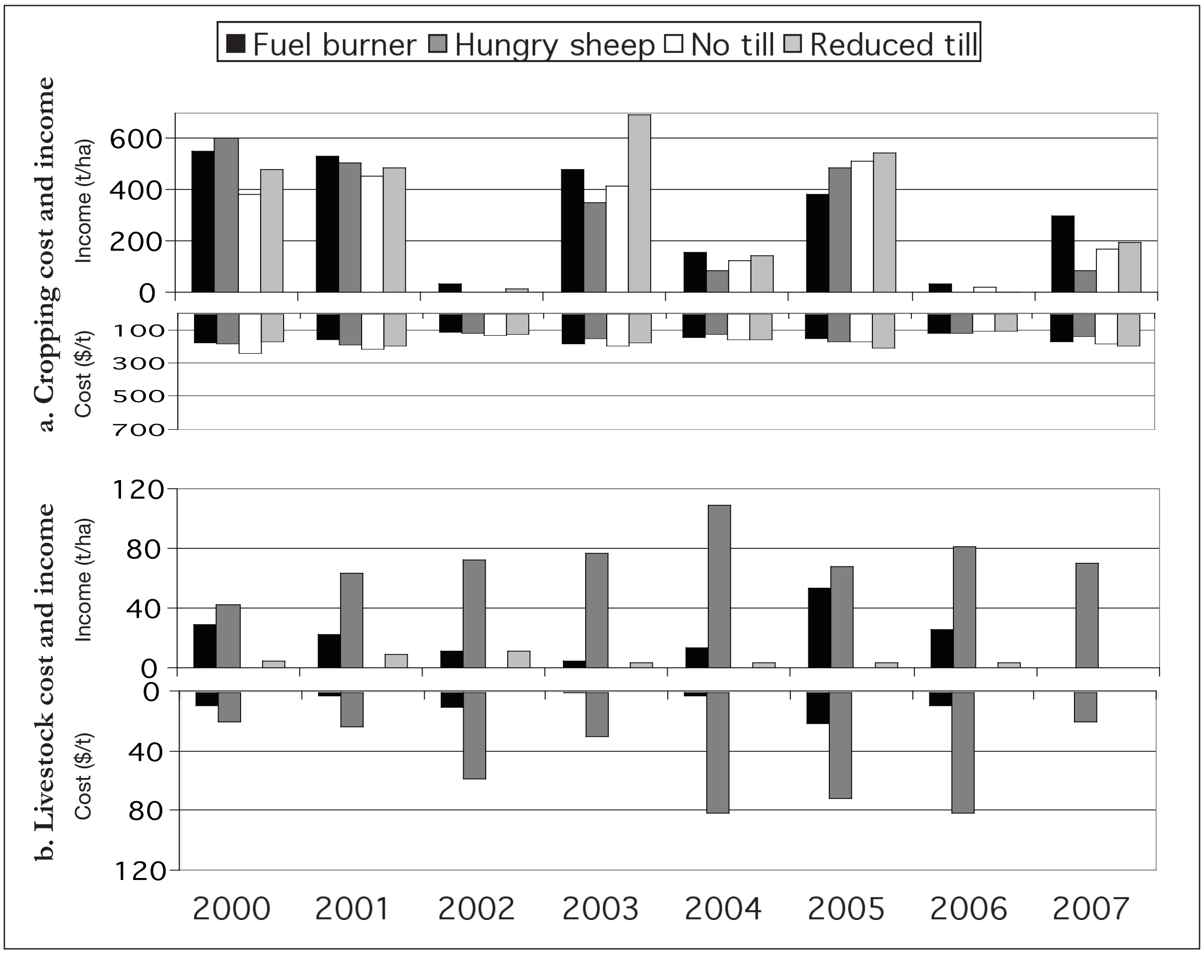

Figure 3. Average (across all paddocks) cropping (a) and livestock (b) incomes and costs, for the four systems across 2000-2007, using 2008 prices. Note the different scales used for cropping and livestock.

Commercial practice

The fuel burner system stands out as having the desirable combination of reasonable, reliable returns, and low average costs. These come from sowing and harvesting in all years a moderate intensity (60-80%) of profitable cereal crops following fallow or a forage break. A modest livestock enterprise also makes a contribution. The improvements in performance of the no-till system since it has included a chemical fallow suggest that the mechanical fallow that led to the 'fuel burner' name is not key to the result.

The reduced-till, no-till and hungry sheep systems collectively illustrate the opportunities for increasing profit, and the associated risks.

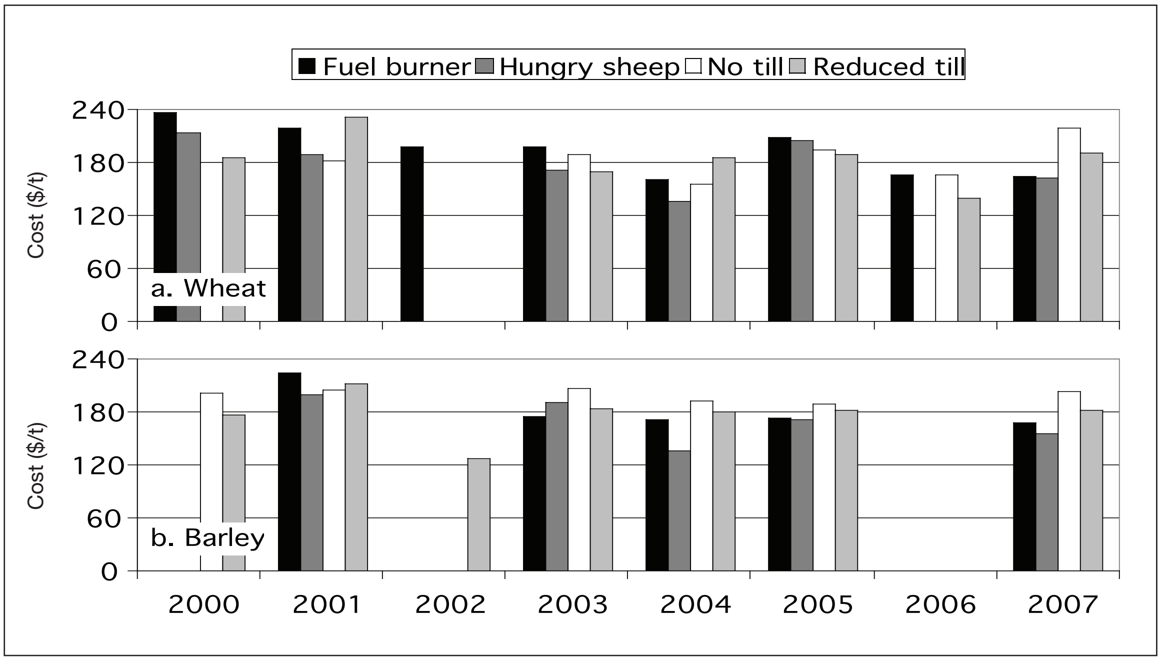

Figure 4. Cropping costs for harvested paddocks of wheat (a) and barley (b) for the four systems across 2000-2007, using 2008 prices.

More intensive cropping is one path to higher profit, but comes with associated management complexity, higher average outlays and income volatility. Skill (or luck) is required to pick the years when it is better to sow more crops, and non-cereal crops, and those when fallow is a better choice.

More intensive livestock is also a path to higher profit, but also comes with management complexity, higher average outlays and income volatility. Skill (or luck) is required to better returns from trading and feeding livestock, and to manage the trade-off between sheep feed, weed control and timeliness in the cropping program.

Without skill or luck, both methods of intensification can easily become paths to lower profit and dramatic losses in low rainfall years.

The impact of system changes made now will depend on the sort of years experienced. If the seasons improve and high-GSR (decile 3 or greater!) years are more likely, all systems will perform well and the more intensive systems will probably outperform the less intensive systems. If low-GSR years continue to be a feature of farming in the southern Mallee, less intensive systems will be well ahead.