Farming Systems trial economics 2008

Ben Jones *(Mallee Focus and BCG)*

Aim

To compare performance of four different farming systems, over the years 2003-08, using prices appropriate for 2009.

To use a machinery inventory and relevant costings compared with contract pricing for operations.

Take home messages

- *Lower grain and higher meat prices in 2009 will see systems with fallow (chemical and/or mechanical) and livestock being more profitable, unless wetter (decile 4+) growing seasons are experienced*
- *Farmers considering changing systems need to consider possible time delays and resource issues, particularly with re-introduction of fallow and livestock*
- *For some farmers, changes within systems could be just as powerful as changing between systems. Assistance may be required to figure out what to change*
- *The machinery inventory approach has shown less difference between systems than would be suggested by contract pricing. At some point, all systems required similar capacity in many machines.*

Method

Farming Systems trial

The BCG Farming Systems Trial compares four representative farming systems, under the guidance of four local farmer 'champions':

Fuel Burner – mainly cereals, regular use of tilled fallow (1-2 of 5 plots) commenced prior to harvest, low intensity livestock mainly for fat lambs, full-disturbance tillage at sowing.

Hungry Sheep – intensive cropping (mainly cereals) and intensive grazing, winter lambing with stocking rate decided in May and feeding to fill feed gap, sheep trading over summer to take advantage of stubbles and control weeds, early sown cereal/pasture forage for feed (1 of 5 plots), generally full-disturbance tillage at sowing.

No-Till – minimum soil disturbance seeding with knife points and press-wheels on 30cm spacing (has varied prior to 2007), no livestock, initially high use of break crops, now mainly cereals and some chemical fallow (commenced prior to harvest).

Reduced Till – flexible approach, can use tillage/full disturbance sowing but has mainly been chemical weed control and same seeding system as No-Till, mix of cereals, canola and lower-value break crops, some livestock on agistment over summer.

Livestock grazing has also been a feature of the trial. All systems except No-Till included grazing up to 2006, but since then most sheep have been in the Hungry Sheep system.

Each champion has five 1ha plots on a heavy calcarosol soil, 25km north of Birchip.

Economics

The methods are as per the 2008 analysis (see BCG 2007 Season Research Results), although some key prices have been updated to reflect expectations for 2009 (Table 1).

Table 1. Prices of some key factors used in the analysis.

Factor	Price	Unit
APW wheat	$250.00	/t
Canola	$500.00	/t
Lentil	$650.00	/t
Cast-for-age (CFA) ewe	$40.00	/hd
CFA ram	$50.00	/hd
Lamb meat	$4.00	/kg
Lamb skin	$8.00	/hd
Maiden ewe	$80.00	/hd
Ram	$400.00	/hd
Wool 22.6 micron dirty	$6.50	/kg
Dicamba 500	$14.50	/L
Glyphosate 450g/L	$7.50	/L
MAP	$875.00	/t
MCPA 500	$6.60	/L
Trifluralin 480g/L	$5.85	/L
Diesel (after rebate)	$1.00	/L

A change since 2008 has been calculation of actual cost of operations, rather than use of contract rates. This has been done by assuming a farm size of 2000ha, and a machinery inventory for each farm according to the pattern of operations used in the trial between 2003 and 2008 (see article 'Farming Systems trial machinery'). The machinery costings include fuel consumption according to Nebraska tractor tests and adjusted for different operations, servicing, tyres (both according to hours worked), an annual repairs and maintenance allowance as a percentage of new value (higher for second-hand machinery), driveaway, yearly and hour-related depreciation according to an updated version of Tozer (2005), and interest on salvaged capital. Harvest is now performed if cost of fuel for harvest (rather than contract harvest cost) is less than the grain return off a plot.

In scaling up to the farm level, one plot is assumed equal to one fifth of the farm area. Variable costs have been allocated to relevant plots, and fixed costs split equally across the farm.

Results

Machinery

The change from contract to machine-based costing is a major one for the Farming Systems trial economics. With contract costing, machinery costs vary exactly in proportion with usage, whereas for farmers that 'own' machinery, there is a substantial fixed cost that is incurred each year (whether financed or at some future point when a replacement machine is bought).

With the machinery for the different systems chosen according to their needs (for 'wants' see Best 2002), fixed costs were greater in the No-Till and Reduced Till systems (Table 2). Most of the difference was related to 2cm GPS guidance (Table 3, with steering on header and seeding tractor) chosen to match what is being done in the trial. Newer seeding and spray machinery costs in the No-Till and Reduced Till systems were higher, but offset against ownership costs of extra tillage equipment in the Fuel Burner and Hungry Sheep systems. Fixed costs were lowest in Hungry Sheep,

which reflected a saving from using a small boomspray compared with Fuel Burner (Table 3), offset by a less expensive seeding machine (second-hand cultivator) turned over more rapidly (five- vs ten-year lifespan).

Small differences in fixed costs of tractors and harvesters were related to different amounts of hour-related usage, and different salvage values as a result.

Table 2. Total annual machinery costs and components.

Cost	System			
	Fuel Burner	**Hungry Sheep**	**No-Till**	**Reduced Till**
Driveaway depreciation	$3,765	$3,117	$ 9,163	$ 9,163
Yearly depreciation	$31,646	$32,959	$34,832	$35,305
Interest on salvaged capital	$7,700	$6,838	$ 9,522	$11,067
Total	$43,111	$42,914	$53,517	$55,534

Table 3. Total annual fixed machinery cost related to each machine.

Machine	System			
	Fuel Burner	**Hungry Sheep**	**No-Till**	**Reduced Till**
Tractor				
Case 9230 S/H	$5,362	$5,507	$5,634	$5,583
FWA 120Hp S/H	$5,069	$5,066	$5,031	$5,043
Seeding bar				
12m no-till bar	-	-	$8,882	$ 8,882
12m cultivator w/ air kit	$3,590	-	-	-
12m s/h cultivator w/ air kit	-	$5,448	-	-
Air cart				
2 bin air-cart	$3,738	$3,738	$3,738	$3,738
Boomspray				
30.5m new boomspray	-	-	$5,385	$5,385
30.5m s/h boomspray	$4,635	-	-	-
24.4m s/h boomspray	-	$2,443	-	-
Other tillage				
12m s/h chisel plough	$4,096	$4,096	-	-
18m prickle chain	$3,034	$3,034	-	-
Harvester				
2388 S/H	-	-	-	$10,189
2188 S/H	$8,186	$8,174	$8,131	-
Guidance				
2cm RTK	-	-	$9,740	$9,740
Steering (4WD + header)	-	-	$2,045	$2,042
10cm	$3,896	$3,896	$3,896	$3,896
Steering	$1,018	$1,027	$1,035	$1,036
Sub metre visual	$487	$487	-	-
Total	$43,111	$42,914	$53,517	$ 55,534

Performance 2003-2008

Compared to the analysis for the 2007 manual, this analysis used lower grain prices ($250/t compared to $300/t in 2007), higher meat prices ($3.50/kg in 2007), lower herbicide prices and similar fertiliser prices. Operation prices now include no labour or profit component (compared to contract prices). This change has, on the whole, favoured the Hungry Sheep system, which had similar profitability on average to Fuel Burner (Table 4), less than Reduced Till and more than No-Till. These results held when machinery ownership costs were added.

All systems were profitable in the 'wet' growing season years of 2003 and 2005, to varying degrees (Table 4), but there were many interesting differences in the other drier years. Most of the margin between Reduced Till and other systems was made in 2003, while Fuel Burner's consistency has been threatened by the poor result in 2008. Hungry Sheep has also been quite consistent, apart from the loss in 2006.

Table 4. Total annual gross margin for each system, also including machinery ownership cost.

System	Gross margin for year						
	2003	2004	2005	2006	2007	2008	Average
Fuel Burner	$500,591	$106,350	$492,795	$(53,868)	$185,889	$(108,323)	$187,239
Hungry Sheep	$498,137	$66,697	$583,375	$(142,900)	$78,161	$53,190	$189,443
No-Till	$381,337	$(27,115)	$575,205	$(134,291)	$(4,194)	$(127,334)	$110,601
Reduced Till	$870,499	$11,973	$619,167	$(131,811)	$41,996	$(1,499)	$235,05
Including machinery ownership cost:							
Fuel Burner	$457,480	$63,239	$449,684	$(96,979)	$142,778	$(151,434)	$144,128
Hungry Sheep	$455,223	$23,782	$540,461	$(185,815)	$35,247	$10,276	$146,529
No-Till	$327,820	$(80,632)	$521,689	$(187,808)	$(57,711)	$(180,851)	$57,085
Reduced Till	$814,965	$(43,561)	$563,633	$(187,344)	$(13,538)	$(57,033)	$179,520

Systems specifics

The Fuel Burner has been most profitable in all dry years except 2008 (Table 4). Exceptional profitability for Fuel Burner in 2007 resulted from good grain yields and early sown vetch cut for hay after a wet autumn/winter (Table 5), but a similar program in 2008 with a dry autumn/winter led to a large loss.

The Hungry Sheep system also did well in most dry years, particularly 2007 with good grazing opportunities from the early sown oat paddock, and subsequently from stubbles (lambs sold in 2008, Table 6). In 2008 the early sown paddock failed, stock numbers were reduced and fed in a containment area for early winter and late spring. In 2006, livestock profits were modest because of high feed costs, but the poor performance of Hungry Sheep in that year resulted also from poor grain receipts (Table 5) as sowing was delayed to provide sheep feed.

The No-Till system is best compared with Reduced Till, which has been similar in many respects between 2003 and 2008. Both have used mostly cereal crops, typically 80 percent, with the balance fallow or low-cost break crops (pea, vetch, canola). Economically, the results were similar in 2005 and 2006, but otherwise Reduced Till has tended to be ahead, strikingly so in 2003. The average result (Table 4) has been Reduced Till being most profitable, and No-Till least profitable of the systems.

The main difference between No-Till and Reduced Till in most years was grain receipts (Table 5). The advent of Hindmarsh barley at the site in 2008 (not used in No-Till or Reduced Till) has demonstrated, by contrast, how poorly Sloop Vic has performed in dry years. Having a large proportion of crop in Sloop Vic in dry years seems to be part of the reason behind No-Till's lower profits, compared to Reduced Till. Delayed sowing in some plots (eg. plot 16) in order to control anticipated grass problems (which never came) may also be a component of the problem, as may be (and is impossible to rule out) spatial variation between plots.

Table 5. Total income and expenditure by type for cropping.

	in year						
Cost/Return	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**Average**
Fuel Burner							
Grain sale	$802,169	$266,554	$635,388	$60,893	$329,790	$67,227	$360,337
Hay sale	-	-	-	-	$99,000	-	$16,500
Chemical	$(29,220)	$(26,476)	$(38,615)	$(16,834)	$(50,896)	$(49,308)	$(35,225)
Fertiliser	$(98,802)	$(54,945)	$(60,192)	$(56,430)	$ (50,787)	$(37,105)	$(59,710)
Seed	$(42,924)	$(34,191)	$(22,913)	$(34,426)	$(41,030)	$(29,282)	$(34,128)
Operations	$(54,047)	$(32,664)	$(31,049)	$(25,604)	$(36,175)	$(32,742)	$(35,380)
Depreciation	$(15,042)	$(9,044)	$(8,066)	$(7,495)	$(12,050)	$(9,707)	$(10,234)
Contracting	$ -	-	-	-	$(15,840)	-	$(2,640)
Harvest	$(38,922)	$(17,925)	$(30,826)	$(9,467)	$(22,761)	$(14,160)	$(22,344)
Depreciation	$ (1,043)	$ (479)	$(826)	$(251)	$(608)	$(376)	$(597)
Grain cartage	$(31,452)	$(10,673)	$(24,911)	$(2,230)	$(12,755)	$(2,869)	$(14,148)
Sub-total	$490,717	$80,157	$417,990	$(91,847)	$185,889	(108,323)	$162,431
Hungry Sheep							
Grain sale	$592,103	$146,219	$810,659	$3,550	$142,938	$81,822	$296,215
Chemical	$(16,873)	$(5,479)	$(39,068)	$(22,215)	$(41,738)	$(14,970)	$(23,391)
Fertiliser	$(47,910)	$(53,190)	$(66,625)	$(74,860)	$(44,916)	$(31,619)	$(53,187)
Seed	$(37,412)	$(61,290)	$(34,650)	$(48,733)	$(36,926)	$(32,527)	$(41,923)
Operations	$(32,682)	$(20,823)	$ (29,004)	$(22,367)	$(27,660)	$(17,735)	$(25,045)
Depreciation	$(9,777)	$(7,378)	$(9,901)	$(7,589)	$(9,398)	$ (6,958)	$(8,500)
Contracting	$(1,576)	-	-	-	-	-	$(263)
Harvest	$(33,269)	$(15,534)	$(38,959)	$(4,292)	$(19,358)	$(18,471)	$(21,647)
Depreciation	$(890)	$(414)	$(1,044)	$(114)	$(515)	$ (490)	$(578)
Grain cartage	$(23,250)	$(5,989)	$(31,569)	$(130)	$(5,444)	$(3,309)	$(11,615)
Sub-total	$388,463	$(23,878)	$559,839	$(176,749)	$(43,016)	$(44,256)	$110,067
No-Till							
Grain sale	$703,286	$216,302	$855,436	$42,592	$285,116	$37,905	$356,773
Chemical	$(70,926)	$(73,428)	$(80,383)	$(45,612)	$(126,097)	$(62,110)	$(76,426)
Fertiliser	$(94,525)	$(76,615)	$(58,108)	$(55,720)	$(60,944)	$(41,790)	$(64,617)
Seed	$(44,055)	$(28,912)	$(24,342)	$(32,332)	$(27,450)	$(16,855)	$(28,991)
Operations	$(26,840)	$(22,042)	$(23,751)	$(18,624)	$(26,599)	$(22,611)	$(23,411)
Depreciation	$(12,973)	$(10,637)	$(11,412)	$(9,086)	$(12,704)	$(10,895)	$(11,284)
Contracting	-	-	-	-	-	-	-
Harvest	$(43,151)	$(21,753)	$(45,136)	$(13,529)	$(22,875)	$(9,223)	$(25,945)
Depreciation	$(1,270)	$(638)	$(1,331)	$(395)	$(672)	$(269)	$(762)
Grain cartage	$(28,209)	$(9,393)	$(35,768)	$(1,586)	$(11,969)	$(1,485)	$(14,735)
Sub-total	$381,337	$(27,115)	$575,205	$(134,291)	$(4,194)	(127,334)	$110,601
Reduced Till							
Grain sale	1,156,769	$249,590	$932,317	$29,875	$336,516	$161,187	$477,709
Chemical	$(70,676)	$(54,234)	$(63,150)	$(38,117)	$(94,566)	$(53,005)	$(62,291)
Fertiliser	$(44,676)	$(87,361)	$(88,555)	$(59,203)	$(69,650)	$(29,054)	$(63,083)
Seed	$(39,490)	$(36,491)	$(55,226)	$(30,186)	$(47,306)	$(25,283)	$(38,997)
Operations	$(36,844)	$(25,353)	$(30,721)	$(18,055)	$(31,397)	$(21,472)	$(27,307)
Depreciation	$(17,390)	$(12,155)	$(14,749)	$(8,822)	$(15,036)	$(10,374)	$(13,087)
Harvest	$(42,237)	$(18,362)	$(34,302)	$(14,211)	$(22,695)	$(16,464)	$(24,712)
Depreciation	$(1,406)	$(607)	$(1,141)	$(466)	$(750)	$(543)	$ (819)
Grain cartage	$(43,081)	$(10,456)	$(32,828)	$(1,222)	$(13,119)	$(6,491)	$(17,866)
Sub-total	$860,971	$4,570	$611,644	$(140,407)	$41,996	$(1,499)	$229,546

The change from costing operations on a contract basis to using a machinery inventory has reduced the difference between Fuel Burner and other systems' operation costs to $8-12,000 on average (Table 5). Hungry Sheep has lower fertiliser costs from 2003-2008, but over the last three years all systems fertiliser costs have been near-identical. Chemical costs are very different between systems, the average cost for the Hungry Sheep system being over $50,000/year less than No-Till. Between No-Till and Reduced Till, chemical costs have diverged since 2003 when they were equal. Higher chemical costs in 2007 particularly reflect in-crop grass control with greater germination because of the wetter autumn/winter.

The Hungry Sheep system has been able to produce reasonably steady meat and wool income, albeit in some years accompanied by a fairly high feed bill (Table 6). The high stocking rates used in the Hungry Sheep system also creates some of the low chemical bills (Table 5), at the cost of decreases in grain receipts. In 2005 and 2006, both Fuel Burner and Hungry Sheep systems were running ewes for meat and wool production, and the less intensive Fuel Burner sheep system was more profitable despite lower stocking rates.

Table 6. Total income and expenditure by type for livestock. The 'core' flock are held year round, whereas 'trade' sheep are bought in and sold.

		in year						
	Cost/Return	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**Average**
Fuel Burner								
Core flock	Meat income	-	-	$52,683	$15,702	-	-	$11,397
	Wool income	-	-	$31,174	$18,905	-	-	$8,347
	Skin income	-	-	$5,698	$3,794	-	-	$1,582
	Costs	-	-	$(7,839)	$(5,219)	-	-	$(2,176)
	Meat sale costs	-	-	$(3,161)	$(942)	-	-	$(684)
	Wool sale costs	-	-	$(1,247)	$(756)	-	-	$(334)
	Depreciation	-	-	$(12,330)	$(8,209)	-	-	$(3,423)
	Feed (both flocks)	-	-	$(12,973)	-	-	-	$(2,162)
Trade	Meat income	$9,536	$22,988	$24,486	$15,938	-	-	$12,158
	Wool income	$266	$2,101	$1,465	$723	-	-	$759
	Costs	$(295)	$(2,328)	$(1,622)	$(971)	-	-	$(869)
	Meat sale costs	$(572)	$(1,379)	$(1,469)	$(956)	-	-	$(729)
	Wool sale costs	$(11)	$(84)	$(59)	$(29)	-	-	$(30)
Agistment		$950	$4,895	-	-	-	-	$974
	Sub-total	$9,875	$26,193	$74,806	$37,979	-	-	$24,809
Hungry Sheep								
Core flock	Meat income	$88,103	$90,706	$69,793	$40,277	$70,718	$61,718	$70,219
	Wool income	$52,134	$57,700	$41,299	$41,489	$51,411	$39,260	$47,216
	Skin income	$9,530	$10,547	$7,549	$8,326	$9,398	$7,176	$8,754
	Costs	$(13,110)	$(14,509)	$(10,385)	$(11,453)	$(12,928)	$(9,872)	$(12,043)
	Meat sale costs	$(5,286)	$(5,442)	$(4,188)	$(2,417)	$(4,243)	$(3,703)	$(4,213)
	Wool sale costs	$(2,085)	$(2,308)	$(1,652)	$(1,660)	$(2,056)	$(1,570)	$(1,889)
	Depreciation	$(20,621)	$(22,822)	$(16,335)	$(18,016)	$(20,335)	$(15,528)	$(18,943)
	Feed (both flocks)	$(12,974)	$(88,068)	$(86,381)	$(97,699)	-	$(22,067)	$(51,198)
Trade	Meat income	$15,006	$68,795	$25,965	$81,060	$31,173	$45,066	$44,511
	Wool income	$828	$5,923	$2,342	$5,249	$614	$1,934	$2,815
	Costs	$(917)	$(7,190)	$(2,820)	$(6,234)	$(680)	$(2,184)	$(3,337)
	Meat sale costs	$(900)	$(4,128)	$(1,558)	$(4,864)	$(1,870)	$(2,704)	$(2,671)
	Wool sale costs	$(33)	$(237)	$(94)	$(210)	$(25)	$(77)	$(113)
Agistment		-	$1,608	-	-	-	-	$268
	Sub-total	$109,674	$90,574	$23,537	$33,849	$121,177	$97,447	$79,376
Reduced Till								
Agistment		$9,528	$7,403	$7,522	$8,597	-	-	$5,508

Interpretation and Application

The latest version of the Systems trial story continues to build on familiar themes in farming. Sometimes plans succeed beyond expectation, in other years the same plans fail miserably. All systems have had their failures. Two systems can be quite similar, yet produce quite different results, and the differences may track back to unintended consequences of an early decision. A system can be tweaked to suit new developments, but not forgetting that it has often been set up to suit an advantage a particular farmer has, and his/her attitude to risk and lifestyle. The best course of action for the future can only be determined in hindsight, and this is a huge problem for anyone planning to change farming systems.

Southern Mallee/northern Wimmera farmers face a real dilemma in systems choice following the dry years of 2006-2008. The conservatism of the Fuel Burner system (longer fallows, either chemical or mechanical) has led to profits in dry years, but as it has been pushed (trying to squeeze vetch in before a fallow phase) in 2007 and 2008 some of the benefits of the conservative strategy have been lost. Farmers shifting from more intensive to less intensive cropping face this challenge too – that the benefits of a fallow phase only arrive 18 months to two years after commencement. The continued profitability of the Reduced Till system depends on more 'wet' (decile 4+ GSR!) years. Continuing with this system is a gamble on better growing seasons in future. The difference between No-Till and Reduced Till systems suggests that small changes to the way things are done can make big differences, if you have a sense of which is the right way to change. Livestock can be profitable, and the difference between Fuel Burner and Hungry Sheep livestock suggests that some of the trade-offs between stocking rate and profitability in this environment are modest in drier years. Finding capital to invest in livestock, and a feed resource in case of dry autumn/winter, could prove challenging in this environment.

This article reports only a brief summary of the 2003-2008 results, with 2009 prices. Other analyses of interest would cover hours worked and distribution of work, and the cost of particular operations (eg. fallow) in different systems. The figures as presented do not include a difference in overlap related to GPS guidance, although the main difference is in spraying (between sub-metre visual and 10cm auto-steer); analysis of the economics of having guidance for particular operations and systems would be interesting.

The change from contract to machine-based costing has shown that the difference in ownership costs between systems is relatively small, because all systems need similar capacity. There is no doubt considerable room for individual approaches to improving (or not) on the yearly cost of particular operations. The analysis also suggests that the cost of tillage is much less than herbicides, again there is considerable scope for individual approaches to getting better use out of both herbicides and tillage than what is possible with label rates and generally the daytime spraying conducted in the Systems trial.

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