CALCULATING THE ROI FOR THE USE OF A STRIPPER FRONT IN THE MALLEE

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TAKE HOME MESSAGES

- Capital value improvement of $61,000 by using the stripper front.
- The cost per rotor hour of the machine increased as the capital cost went up and the number of hours decreased.
- There was a 24% reduction in fuel usage and a 16% reduction in labour costs.
- Harvest was completed on average two to three days faster with a stripper front.

BACKGROUND

Understanding the whole-farm financial impacts of retaining stubble is vital. Whilst the production and 'systems' benefits are sound, ultimately all farms are businesses, so they need to be aware of the financial hiccups that may result when significant changes are undertaken. As part of the GRDC-funded 'Maintaining profitable farming systems with retained stubble' initiative undertaken by BCG, Southern Farming Systems (SFS), Irrigated Cropping Council (ICC) and Victorian No-Till Farming Association (VNTFA), many of the individual facets of stubble management were addressed through outputs.

What is return on investment (ROI)?

ROI is the measure of the net gain or loss generated from an investment. The formula is relatively simple:

ROI = (net profit/cost of investment) x 100

For example, if you bought a house for $100,000, then I sold it two years later for $140,000, then the net profit would be $40,000. So the ROI = 40,000/100,000 x 100 = 40%. In terms of machinery and agriculture those calculations are more complicated because specific equipment may be a necessity to farm and the profits generated may be attributed to a range of other investments. Seasonal profits are also influenced by many other facets such as weather, management and marketing.

To be able to determine net benefit or ROI of a specific purchase to improve practices of stubble retention, growers should understand and quantify what are the realistic gains that may be achieved through that investment. Quite often, the benefits or specific savings, for example fuel and labour, are exaggerated and never truly quantified against the overall output. Whilst it is commonly understood there are potential yield losses and gains however, these are difficult to reliably quantify and/or overcome through improved operator adjustments etc.

It needs to be mentioned that the decision to purchase a stripper front is quite often part of a greater 'farming system' direction which, in itself is particularly difficult to analyse. Subsequently, the calculations used in this paper do not incorporate those perceptions or benefits, rather have focused on the actual differences observed in this demonstration.

In order to analyse the return on an investment, such as the stripper front, an understanding of the drivers for profit produced by that investment is important. For harvesting equipment; grain yield, grain price, crop type, rainfall during harvest, area covered, fuel prices and labour rates are all major factors.

Based on paddock demonstrations carried out in the Victorian Mallee during 2015 and 2016, an economic analysis was undertaken. This paper will present the findings and the method of calculations for determining the ROI of a stripper front.

About the investment

Header stripper fronts (Figure 1) are a relatively old method of harvesting although now becoming suitable and of significant interest to growers adopting stubble retention. The stripper front can be used on most harvesters and the point of difference is only putting the grain heads through the machine by plucking or removing the heads off the stems. This allows for maximum crop residue to be left standing after harvest rather than be processed through the header and mechanically spread. Some of the perceived advantages and disadvantages for using a stripper front are outlined below (Table 1).

Figure 1. A Shelbourne stripper front designed to harvest grain heads and leave maximum crop residue.

Table 1. Advantages and disadvantages for using a stripper front.

Area	Advantages	Disadvantages
Agronomy	• reduced soil surface evaporation • increased infiltration and water harvestability • promotes microbial activity • can improve harvestability of certain crops such as lentils when inter-row sown	• increased risk of stubble borne diseases • provides an ideal environment for pests such as mice • can act as a physical barrier for herbicide applications • requires a disc seeder to sow through the remaining stubble • limited pre-emergent herbicide options the following year
Machinery operation	• reduced fuel use • faster operating speeds • less labour and rotor hours	• can be prone to higher grain losses • requires post-harvest residue management if using a disc seeder is not an option • higher water rates may be required in the sprayer to compensate for the higher stubble load

AIM

To determine the ROI from using a stripper front compared to a draper front.

METHOD

The data used in this paper has been taken from on-farm demonstrations conducted in 2015 and 2016. It is important to keep in mind that while these figures are facts, they would vary between machines as well as operators.

Assumptions

- Header capital costs (mainly interest) are averaged over the expected life span of the header (seven years) despite figures being based on five years of finance. This is important to include to determine the benefit for reduced machine hours. Farmers will typically already own or have finance.
- Interest was included as farms will typically finance machinery thus, this expense was deemed necessary to include.
- The initial investment into the header is assumed to have some equity from a trade-in. **Purchase price is $500,000 (including draper), trade-in ($175,000).**
- Interest of 5% for all purchases and financed over five years.
- Of the seven years, there will be two below average, three average and two above average years.
- **Farm size is 3143ha**, of which 70% is cereal - **wheat (40%)** and **barley (30%).**
- 70% of the farm is harvested with a stripper versus draper, rest of the farm is assumed to be done with the Draper (90% crop intensity). All header and draper costs will be diluted over the whole farm, whereas the stripper only on the 70%.
- **No grain loss nor downgrades are accounted (needs further confirmation).**
- Labour $35/hr (including superannuation and tax).
- Fuel costs are based on $0.80/L (which includes diesel rebate of $0.40/L).
- Annual repairs and maintenance $8,000. Insurance and registration ego $3,500.

- All machinery widths are constant (12m or 40ft).
- In **above average** years (3.5-3.7t/ha), the stripper front will be able to go faster than draper fronts by **40% (wheat)** and **45% (barley).**
- In **average seasons** (2.2-2.4t/ha), the stripper front will be able to go faster than draper fronts by **15% (wheat)** and **45% (barley).**
- In **dry years** (1.0-1.2t/ha), the stripper front will be **equally as effective** as the draper.

Calculating the capital costs

The capital costs are those costs that are typically fixed. These include the purchase price, repairs and maintenance, insurance and lubricants (Table 2). As the farm would still require the use of a draper front to harvest other crops not suitable for the stripper front, the cost of this front has remained. Due to the increase initial investment, the capital cost is higher and if there were any efficiency gains that lead to less rotor or machine hours being incurred, then the costs per hour will also be higher. Below is a comparison on the analysis.

Table 2. Table summarising costs taken into account in calculations.

Capital costs	**Draper front**			**Stripper front**		
Season	Below avg	Avg	Above avg	Below avg	Avg	Above avg
Area (total cropped)	2,829ha					
Repairs ($/ha)	2.55					
Repairs ($)	8,000					
Insurance and lubricants ($)		3,500			4,000	
Capital costs per hour ($)	279	239	181	343	330	274
Purchase price ($)		577,437			724,437	
End value ($)		175,000			255,000	
Years owned	Seven					
Annual capital cost ($)		60,991			71,062	
Total header capital costs ($)		68,991			79,062	
Capital costs/ha ($)		24.39			27.95	
Total costs/hr ($)	316	270	205	382	368	305

RESULTS AND INTERPRETATION

What changes were observed in the operating costs?

When the yield of the crop increases, the running cost for that header will increase as the process is generally slower. It should be noted that the price per tonne of grain will generally decrease (rule of supply versus demand).

By having the additional capital costs, the stripper front appears to work out more expensive on a per rotor hour basis. It is also important to note that the faster operating speeds meant that harvest was completed in less hours which maintains its end value, but means the cost is not diluted.

When comparing on a per hectare basis, the stripper front was cheaper in barley compared to wheat. This is simply due to barley generally having a lower harvest index (grain to biomass ratio). More biomass generally means less efficiency because the header goes slower in order to process the crop. In wheat, the conventional draper front was cheaper than the stripper on both per hectare and per rotor hour basis.

Comparison over the seven hypothetical seasons show that the stripper front would have saved just under $15,000 in fuel use, and just over $10,000 in labour (Table 3), which sounds attractive on a seven year basis, but annually the advantages are obviously less valuable. The greatest benefit occurred in those higher yielding seasons, where harvest with a draper front was significantly slower than a stripper front. This does suggest that for the Mallee environment, the return on investment for a stripper front is going to be a lot less compared to a higher yielding environment.

Table 3. Summary of factors contributing to net value over a hypothetical seven year period.

Seven year comparison	Draper	Stripper	Difference	Value ($)	%
Machine hours	1,877	1,578	299	61,322	16
Harvest days	125	105	20		16
Avg machine hours per year	268	225	43		
Total fuel use	80,982	61,921	19,062	15,250	24
Total labour	65,691	55,219	10,472	10,472	16
			Net value	87,043	
			Net value/year	12,435	16

The analysis also found that by using a stripper front, the total number of days for harvest was reduced (20 days earlier, or an average of two to three days per year). Applying the difference in machine hours at the end of the seven year period and then recalculating on a revised capital cost, (to include a less depreciated header), the benefit for using the stripper front was only then observed (Table 4).

Table 4. The total header costs comparing the draper and stripper fronts and a contractor. The revised stripper front is where the end value of the header has been changed to reflect the lower machine hours, which obviously changes the dynamics.

Crop type	Total header cost							
	Draper		Stripper		Revised stripper		Contractor	
	$/ha	$/hr	$/ha	$/hr	$/ha	$/hr	$/ha	$/hr
Barley								
Low yield	29	389	29	449	26	407	37	488
Avg yield	32	347	30	438	28	397	46	492
High Yield	39	287	36	380	33	346	68	497
Wheat								
Low yield	29	437	32	486	29	440	32	486
Avg yield	31	367	33	475	30	431	41	489
High yield	33	292	34	403	31	367	56	494

While the costs per hour still remain higher than the draper front, the costs per hour are cheaper for both crops, especially in barley (Table 6) when using the stripper front.

Table 5. Wheat calculation workings of cost comparing draper, stripper and contractor methods.

Wheat	Draper			Stripper			Contracting		
Yield (t/ha)	0.8	2.2	3.5	0.8	2.2	3.5	0.8	2.2	3.5
Area (wheat)		1,200			1,200			1,200	
Tonnes	960	2,640	4,200	960	2,640	4,200	960	2,640	4,200
Time (hours)	80	100	137	80	83	102	80	100	137
Width (Front)	12	12	12	12	12	12	12	12	12
Hectares/hr	15	12	8.75	15	14.5	11.8	15	12	8.75
t/hr	12	26.4	30.625	12	31.9	41.3	12	26.4	30.625
Speed	12.5	10	7	12.5	11	9.8	12.5	10	7
Labour	35	35	35	35	35	35			
Total labour	2,800	3,500	4,800	2,800	2,897	3,559			
Labour ($/ha)	2.3	2.9	4.0	2.3	2.4	3.0			
Labour($/t)	2.9	1.3	1.1	2.9	1.1	0.8			
Fuel (L/hr)	45	49	55	40	44	48	45	49	55
Fuel costs ($/hr)	36	39.2	44	32	35.2	38.4	36	39.2	44
Fuel costs ($/ha)	2.4	3.3	5.0	2.1	2.4	3.3	2.4	3.3	5.0
Total fuel ($)	2,880	3,920	6,034	2,560	2,913	3,905	2,880	3,920	6,034
Cost ($/hr)	437	367	292	486	475	403	486.0	489.2	494.0
Cost ($/ha)	29	31	33	32	33	34	32	41	56

Table 6. Barley calculation workings of cost comparing draper, stripper and contractor methods.

Barley	Draper			Stripper			Contracting		
Yield (t/ha)	1	2.4	3.7	1	2.4	3.7	1	2.4	3.7
Area (barley)		1,000			1,000			1,000	
Tonnes	1,000	2,400	3,700	1,000	2,400	3,700	1,000	2,400	3,700
Time (hours)	76	93	137	64	69	95	76	93	137
Width (front)	12	12	12	12	12	12	12	12	12
Hectares/hr	13.2	10.8	7.32	15.6	14	11	13	11	7.32
t/hr	13.2	25.92	27.1	15.6	35	39	13	26	27
Speed	11	9	6.1	13	12	8.8	11	9	6.1
Labour ($/hr)	35	35	35	35	35	35			
Labour ($/ha)	2.7	3.2	4.8	2.2	2.4	3.3			
Labour($/t)	2.7	1.4	1.3	2.2	1.0	0.9			
Total labour	2,652	3,241	4,781	2,244	2,431	3,314			
Fuel (L/hr)	48	52	59	40.8	44.2	50	48	52	59
Fuel costs ($/hr)	38.4	41.6	47.2	32.64	35.36	40	38.4	41.6	47.2
Fuel costs ($/ha)	2.91	3.85	6.45	2.09	2.46	3.79	2.91	3.85	6.45
Total fuel	2,909	3,852	6,448	2,092	2,456	3,788	2,909	3,852	6,448
Cost ($/hr)	388.96	346.66	287.15	449.63	437.97	379.95	488.4	491.6	497.2
Cost ($/ha)	29.47	32.10	39.23	28.82	30.41	35.98	37	46	68

Rainfall analysis

One of the advantages of harvesting faster is the shorter harvest window. Decreasing the time from the start of harvest to the end may reduce the risk of rain that may fall, affecting yield and quality of specific crops (Table 7). Based on the past 50 years, the two to three days earlier is unlikely to greatly change the growers risk to pre-harvest sprouting or quality downgrades. The table below illustrates the rainfall ranges and probabilities of rainfall events (>15mm) occurring during harvest.

Table 7. Rainfall defined as existing day with rainfall above 15mm, or two consecutive days with rainfall above 10mm each day within the 2-week period.

	Early Oct	Late Oct	Early Nov	Late Nov	Early Dec	Late Dec
Years with rainfall incident	21.67%	15%	30%	23.33%	20%	21.67%
Minimum rainfall	0mm	0mm	0mm	0mm	0mm	0mm
Maximum rainfall	93.8mm	105.9mm	111mm	69.4mm	107.4mm	55.4mm

COMMERCIAL PRACTICE

The evolution of no-till farming has motivated growers to search for better ways to retain stubble. In the Mallee, one of the greatest challenges for stubble retention, is the ability to produce enough stubble, especially after harvest. Some growers have been investigating whether the stripper front may lead to not only more stubble being retained, but also greater cost savings.

The results found that the perception of fuel saving and labour saving may be overstated by comparing across seasons. Whilst there may be advantages in harvest costs, they are subjective to what the machine value will be at the end of the period (in this case seven years). The findings of this study have not included changes to agronomic inputs and potential needs for changes in other machinery such as the purchase of disc seeders. Growers need to incorporate these findings when considering the overall benefits to retain more stubble, and potentially the challenges that also may arise such as mice and seeder trash flow etc.

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