ECONOMICS OF LUCERNE ESTABLISHMENT FOR THE WESTERN WHEATBELT.

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Lucerne is the premier pastoral species supporting livestock and cropping enterprises in the western wheatbelt of New South Wales. The Newell Highway fairly neatly divides the states wheatbelt in two. Unfortunately only 10% of western farmers plant lucerne. Most of the regions' farmers cite the cost and risk of establishment failure, as impediments to the adoption of lucerne.

The successful establishment of lucerne in this region is very dependent on moisture management. Any significant moisture stress event during the first 15 weeks of establishment may have ruinous conse-quences for the long-term viability of the sward.

METHOD OF ESTABLISHMENT

Lucerne is usually established in cultivated paddocks as an elite sward or in conjunction with a cereal crop in the western wheatbelt. Lucerne seedlings lack vigour (compared to annual clovers) and some soil disturbance to a depth of 50 mm enhances establishment.

Lucerne is rarely established by sod-seeding or broadcasting in this region, as swards seldom establish. The local clay soils are inherently hard setting and with a high level of evaporation in the autumn; the soils do not retain sufficient moisture in the top 5 mm, to sustain root growth following germination in this region.

The most effective way to establish lucerne in the western wheatbelt region is to sow it without a cover cereal crop. This practice has been referred to as 'elite establishment'. The elite establishment of lucerne has tangible and proven advantages over cover-cropping in this western region.

Elite establishment failures are uncommon. Most of the problems that have affected elite swards relate to the incorrect depth of seed placement or to an unforeseen insect pest problem, such as aphids or locust. Most western farmers have successfully established elite stands during the drought years of 2002-09, while cover-cropped swards repeatedly failed across the region, due to moisture competition imposed by the crop seedlings.

The undersowing of cereal crops with pasture species is commonly known as 'cover-cropping'. Cover-cropping has been popular with tablelands farmers since the 1960's. Many western farmers have considerable success with cover-cropping short season annual legumes species.

The success rate of cover-cropping lucerne in this region is much lower as it is very dependent on the moisture available at sowing time for root growth, and in spring to aid crown development. Anecdotally, western

farmers have been successful with covercropping lucerne in years when the September rainfall is more than 40 mm in this region.

CLIMATE CONSTRAINTS

Wet springs are uncommon to the western wheatbelt districts. More often the hot westerly winds in mid-September, increases the competition for moisture between the cereal crop at the grain development stage and the lucerne seedlings needing to develop their crowns in a cover-crop situation.

The average September rainfall, as seen in Table 1, is approximately the 33 mm for the region. It is a brutal truth which is ignored by many farmers that over 50% of years (median rainfall) the region receives less than 26 mm in September, which is insufficient for the survival of lucerne seedlings in a cereal crop.

Western Wheatbelt		
Location	**Average (mm)**	**Median (mm)**
Coonamble	32	23
Warren	37	30
Condobolin	29	24
West Wyalong	36	28

Eastern Wheatbelt		
Location	**Average (mm)**	**Median (mm)**
Tamworth	48	43
Wellington	45	39
Cowra	49	43
Wagga Wagga	45	43

Table 1: September Rainfall in the NSW Wheatbelt source Bureau of Meteorology.

The historical rain data provided by the Bureau of Meteorology gave probability of a site receiving 40 mm or more - was 26% for Coonamble (32:122 years); 26% for Warren (33:127); 23% for Condobolin (30:129); and 30% for West Wyalong (35:116). A point of interest was a third of those wet years fell between 1962-1973, which coincided with the adoption of cover-cropping. It also should be noted, that 50% of these wet Septembers have above 60 mm of rainfall. In 2010 when the spring was so wet, the lucerne grew through the crops and impeded harvest. The delay in harvest resulted in yield loss and the down grading of the grain due to sprouting.

COVER-CROPPING SUGGESTIONS

To successfully establish the lucerne under a covercrop in this region, the seedling sward not only needs 40 mm and more of September rainfall; but the moisture competition with the crop needs to be further reduced by employing novel practices.

Advice from the "successful" cover-croppers suggests the cereal crop needs to have its, yield potential reduced by 500 kg/ha, to spare enough moisture, to allow the lucerne seedlings to establish and produce a viable sward. This loss of yield is achieved by using a combination of practices that are known to cause yield loss in cereal crops; such as sowing late, using low seeding rates, and wider row spacing. Wheat is the usual crop of choice because it suffers yield penalties more readily than barley or oats.

To ensure enough moisture is available for lucerne seedling survival, the wheat seeding rate should be reduced to 10 kg/ha. The aim is to establish only 20 to 30 wheat plants per square metre. It is advantageous to sow the wheat on a 35 cm row spacing or wider, with the lucerne planted in between. This is sometimes known as "skip-row" planting.

Approximately 30% of years have severe dry springs in this region. Substantial amounts of money can be lost in dry years because the undersown lucerne seedlings will still use moisture and phosphorus before they die. This competition for moisture and phosphorus between the two species has significantly lowered crop yields.

Moisture competition in a dry spring can also impact on the crop's grain quality, reducing a prime hard wheat or malt barley crop to a lower value feed grade due to the excessive screening levels and low grain test weights. To minimise the financial penalties associated with pinched grain, select varieties that mature quickly and that have a consistently large seed size.

FINANCIAL ANALYSIS

Farming is a business and it is essential have an objective picture. The merits of the two establishment techniques require an incisive economic evaluation. The 2-year transition period of both systems needs to be evaluated to establish an accurate picture. Start by producing the relevant budgets. Four example budgets are supplied in the tables, below.

It is necessary to observe comparable agronomic practices, in order to produce an impartial economic assessment. It is very important to eliminate any bias that maybe rooted in old beliefs. Both systems need an equal standard of weed control and nutrition.

Income					($/ha)
Yield	2.0 tonnes/ha APW Wheat			@$200.00/tonne	$400.00
			Total Income		**$400.00**
Variable Costs					
Tractor Costs	1.00	hr/ha	130 PTO KW	@$44.00/hour	$44.00
Seed	50	kg/ha	Wheat	@0.20/kg	$10.00
Fertiliser	50	kg/ha	Starterfos	@0.80/kg	$40.00
Herbicide	20	g/ha	Glean®	@0.05/g	$1.00
	1.0	L/ha	MCPA 500®	@$5.00/L	$5.00
Harvesting	0.24	hr/ha		@ $47.13/hr	$8.71
Cartage			Del. Silo	@ $10.00/tonne	$20.00
			Total Variable Costs		**$128.71**
			Gross Margin/Ha		**$271.29**

Table 2. Wheat Budget 2010

With much of this region averaging 230 mm of rain between 1 May & 31 October; the dryland wheat crops that are dependant on in-crop-rainfall only have an average yield potential of 2.0 tonnes/ha for early sown May crops.

Delaying sowing reduces the length of the growing season which subsequently lowers crop biomass and grain yield. The yield potential of wheat crops in this region declines by 0.8 to 1% each day that sowing is delayed.

Crops sown in June; and that are undersown with a pasture, are commonly 30% lower yielding than early May sown crops. Delayed sowing will reduce yield and the water-use efficiency of a wheat crop; but that is not the same as ensuring moisture will be spared for the undersown pasture seedlings.

Most cover-cropping farmers are Phase-farming. That is the paddocks have a cropping phase of three or four years; after which the paddock is returned to a pasture phase for three to ten years. The lengths of both phases are dependant upon local rainfall, the paddocks "natural" productivity and the farmers' financial disposition.

Cover-croppers usually have 25-30% of their total crop area undersown, in most years. Lowering crop yield does not always guarantee that moisture will be spared for the undersown seedlings, but it will en-sure significantly lower financial returns for the farm.

Income					($/ha)
Yield	1.5 tonnes/ha APW Wheat			@$200.00/tonne	$300.00
			Total Income		**$300.00**
Variable Costs					
Tractor Costs	1.00	hr/ha	130 PTO KW	@$44.00/hour	$44.00
Seed	25	kg/ha	Wheat	@0.20/kg	$5.00
	3	kg/ha	Wheat	@$7.00/kg	$21.00
Fertiliser	50	kg/ha	Starterfos	@0.80/kg	$40.00
Herbicide	0.8	L/ha	Teflan 480®	@6.75/L	$5.40
	2.0	L/ha	Brominil®200	@$12.00/L	$24.00
Insecticide	100	ml/ha	Le-mat 290®	@$40.00/L	$4.00
Harvesting	0.24	hr/ha		@ $47.13/hr	$8.71

Table 3 continued over page...

Cartage			Del. Silo	@ $10.00/tonne	$20.00
			Total Variable Costs		**$167.11**
			Gross Margin/Ha		**$132.89**

Table 3. Cover-Cropped Wheat & Lucerne Budget 2010

Variable Costs		**$/ha**	**Totals ($/ha)**
Tractor Costs	2 x Scarifyings	$14.96	
	1 x Sowing	$9.24	
	2 x Sprayings	$3.52	$27.72
Seed	3 kg Lucerne seed (farmer dressed)	$21.00	
Fertiliser	50 kg Starterfos (11 kg P)	$40.00	
Herbicides	0.8 L Treflan 480Ò (wireweed & grasses)	$5.40	
	1.0 L Diuron 500Ò	$6.00	
	0.5 L Uptake OilÒ/100 L water	$2.00	
Insecticide	100 ml Le-mat 290Ò (earthmites)	$4.00	
		Total Variable Costs	**$106.12**

Table 4. Cost of Elite Lucerne Establishment 2011.

Note: Costs are based on 2010 price for a 160 HP tractor. Total tractor hours 0.63 hr/ha @ $44.00/hr.

WEED MANAGEMENT

The need for effective weed control in the wheat crop (Table 2) the year prior to sowing lucerne is fundamental to success. Glean® or Logran® is used to control the common regional weeds such as annual ryegrass, wireweed, fumitory, spiny emex, Paterson's curse, mustards, turnips and wild radish.

There is usually a post-emergent application of MCPA 500® to control capeweed and thistles — especially saffron thistles which are common to the region, which are not controlled adequately by the sulfonylurea herbicides.

That same standard of weed control must also be observed in the 2010 cover-crop program (Table3). Glean® cannot be applied to control the ryegrass, fumitory and wireweed in lucerne. It is more appropriate to use Treflan 480Ò to control these three weed species in both seedling lucerne situations.

MCPA cannot be used on lucerne, so for equivalent broadleaf weed control as in Table 2, bromoxynil is applied to the cover-cropped lucerne at the 3-leaf stage to control spiny emex, capeweed, Paterson's curse, thistles, mustards, and other broadleaf weeds.

The elite lucerne requires a diuron application for equivalent broadleaf weed control, as seen in Table 4. Diuron is not registered for use on lucerne in a cover-crop situation.

NUTRITION

The same standard of crop and pasture nutrition must be observed. The cover-cropped wheat had 50 kg Starterfos/ha applied in 2010. However, 80% or more of that phosphorus was removed in grain. This will need replacing in the lucerne in 2011 if the pasture is to have an adequate supply of phosphorus to sustain an equal level of productivity.

Variable Costs	**$/ha**
Tractor Costs 0.07 hrs/ha @ $33.12/hr	$2.32
Spreader $100/day hire – 16 ha/hr work rate	$1.00
Fertiliser 50 kg/ha Starterfos	$40.00
Total Variable Costs	**$43.32**

Table 5. Cost of Topdressing Cover-Cropped Lucerne 2011.

Note: Tractor Cost is based on 2010 price for 90 HP Tractor.

The elite established lucerne had 50 kg Starterfos/ha applied at sowing in 2011.To maintain comparable pasture and livestock productivity, the lucerne that was established with the cover-crop in 2010 will re-quire topdressing in 2011.

Topdressing with 50 kg Starterfos/ha, will cost $40.00/ha for fertiliser and $3.32/ha for spreading as seen in Table 5. The costings are based on treating 100 ha. The spreader's hire cost would increase to $2.00/ha if only 50 ha were treated.

COMPARATIVE ANALYSIS

System	GM/ha 2010	VC/ha 2011	Net GM/ha
Cover Cropped	$132.89	$ 43.32	$ 89.57
Elite Establishment	$271.29	$106.12	$165.17

Table 6. Comparison of Lucerne Establishment Systems Over Two Years.

Note: GM = Gross Margin. VC = Variable Cost.

The financial difference between the two establishment methods when costed over 2 years in Table 6 above will surprise most farmers:

- The 2010 cover-crop program had a gross margin (GM) of $132.89/ha. Deducting the 2011 top dressing cost of $43.32/ha leaves a net or final GM of $89.57/ha over two years.
- The elite program had a 2010 GM of $271.29/ha produced from the wheat less $106.12/ha for lucerne sowing in 2011, giving a final GM of $165.17/ha.
- Elite establishment has a $75.60/ha advantage over cover-cropping when costed over two years. The elite establishment was nearly twice as profitable as cover-cropping when properly costed.

In lower rainfall areas of the region, where yield potentials of crops are 0.5 t/ha lower; the grower can simply deduct $100.00/ha from the values in the 2010 GM/ha and the Net GM/ha columns in Table 6 to ascertain the viability of cover-cropping.

In the east, where the average district yield potential of wheat crops are 3.0 t/ha or higher, the practice of cover-cropping becomes more economically feasible, as the yield loss is proportionally less.

In actual practice the financial advantage of the elite establishment program may be larger again when the wheat produced in 2010 is assessed for grain quality. In 2010 the APW price was $245.00 local depot. The elite wheat was grown on a soil with a high nitrogen history, in a paddock that was previously lucerne in 2007. There may also be premiums for higher protein wheat to be paid to the elite system that are not shown in this exercise.

Penalties may also have been incurred against the cover-crop system for pinched or sprouted grains. Penalties ranged from $20.00/t in 2009 for pinched grain when grain supplies were short due to drought, to $90.00/t in 2010 for sprouted grain when there was an over-supply of feed grain on the domestic market.

POST-HARVEST MANAGEMENT

Another important point in favour of elite lucerne establishment is the value of post-harvest wheat stubble. There is typically 2% of wheat spilt in front of the harvester's comb, or approximately 40 kg grain/ha. This usually provides about 3 weeks of grazing at 5 DSE/ha post-harvest; and is valued on average at $10.00/ha for grazing the stubble.

The cover-crop of wheat leaves weak and spindly lucerne seedlings post-harvest, which should not be grazed until there is sufficient crown development, which may not be until March 2011. By then the grain amongst the stubble has germinated and rotted away. In dry summers the grain residues in these pad-docks can sustain large mice populations.

Weak undersown lucerne plants often grow slowly and use moisture slowly; and in wet summers these paddocks are often overrun with weeds. These weak swards often contain potentially deadly infestations of white heliotrope, caltrope or witch-grass/hairy panic. These poisonous weeds will kill sheep, and they can significantly reduce a farm's livestock profits. Controlling summer broadleaf weeds in these weak swards is almost impossible.

CONSTRAINTS TO ADOPTION

Many farmers who cover-crop lucerne cite time constraints, and the need to reduce wear and tear on their tractor as reasons for not using elite establishment methods. The total time required to establish an elite sward is about 40 minutes/ha of tractor time, and it is spread over an 8 to 12 week period, and accounts for the pre-sow-preparation, sowing and spraying, see Table 4.

The labour requirement needs to account for the tractor hours and downtime/maintenance. For each hour the tractor is in the paddock, there is a 30 minute allowance for downtime. This is a total of 60 tractor hours and100 man-hours per year to establish 100 ha of lucerne. At a seeding rate of 10 ha/hr; 100ha of lucerne can be planted in a day.

Cover-cropping farmers say it's the extra day to sow an elite pasture; it is a day when they do not have the time to spare at the peak crop planting-time and this is why they must cover-crop. To save the "time", most of these farmers sow their cover-cropped paddocks last and the sowing is often in June. This is to lower a cereal crops' yield potential and to hopefully spare water for the under-sown lucerne seedlings.

Unfortunately the June rainfall can be rather extreme in this region. When it is wet in May the following June is often very dry. While the cereal seed may be placed 50 mm deep in moist soil, the lucerne seed is placed in the top 10 mm of soil, which is dry. The lucerne seed may not germinate until early August, when it has to compete with a tillering cereal plant.

If the cover-crop is sown last does the farmer actually save time in the overall sowing program? If time or labour is limited, an elite lucerne stand could be dry-

sown before the break in mid to late April, when there are little other crop activities. These dry sown elite swards should then be well established in early to mid May. With average winter rainfall events the grazing of new lucerne swards may commence in early August.

An extra day sowing an elite pasture may save the time that is later spent on four months in hand feeding over summer. Time is like money, use it well. Time and labour needs to be efficiently managed not saved.

With respect to the wear and tear on the tractor, the elite system, may add 300 hours to a tractor's working life over ten years. However these extra hours are unlikely to reduce the trading value of a ten year old tractor that would otherwise have 5,000 hours on the clock.

SUMMARY

Growers view should financially compare the economic impact of both establishment systems over the whole farm, across several years. Account for the differences in grain production and also consider:

- The elite farm that has 100% of pastures successfully established with lucerne;

Versus;

- The farm using cover-cropping methods usually has only 20% of pastures with lucerne and the other 80% of the farm's pastoral area is composed is mostly annual crop weeds because the lucerne failed to establish.

Looking at the larger financial picture, the cover-cropping farm would have significantly lower levels of animal productivity; increased hand feeding costs and labour/time required. Weedy pastures can make for weedy crops and increased herbicide expenditure.

The cover-cropper also would need to purchase urea to maintain comparable crop yields and grain protein levels. The actual cost of cover-cropping may be as high as $20,000 per year in lost productivity. It is important to consult with a financial advisor or accountant and work through the figures, in Tables 2 to 6, using your own data and evaluate the impact of changing activities across the whole farm business.

With limited spring rainfall cover-cropping is not a practical method for establishing lucerne in the western wheatbelt. In a semi-arid region it is uneconomical for western farmers to use a high-rainfall tablelands practice like cover-cropping to establish lucerne. To sacrifice 500 kg/ha of grain yield, is about equal to the cost of elite establishment, in most years.

RECOMMENDED READING

Primefact 118. Economics of Pasture Improvement in the Western Wheatbelt.

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