



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
<http://ageconsearch.umn.edu>
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

38th Annual Conference of the
Australian Agricultural Economics Society
Wellington New Zealand, 9-11 February 1994.

Economics of Dryland Lucerne Pasture Establishment

Brendan Madden, School of Agriculture and Forestry, Melbourne University.
Michael Crawford, Department of Agriculture Victoria.

Abstract

The high water use of lucerne and its ability to access water from deep within the soil profile, has led to its establishment being actively promoted by the Victorian Salinity Program.

Establishment of dryland lucerne pastures is a costly and risky procedure, which many farmers are wary of in the current economic climate. In this study the economic and financial viability of establishing dryland lucerne pastures has been investigated using the results of a four year grazing trial conducted near Benalla in North East Victoria.

The profitability of both wool and fat lamb production were investigated for a range of wool and lamb price scenarios as was the effect of government assistance made available to farmers through the Victorian Salinity Program.

Introduction

Growing deep rooted perennial pastures such as lucerne (*Medicago sativa* L.) has been heavily promoted under the Victorian Salinity Program on the basis of the perceived higher water use and productivity of these species. The increased water use of these plants decreases groundwater recharge, assisting in the control of dryland salinity. The Goulburn and Broken River Catchment Salinity Management Plan targets 4,200ha of recharge areas on which lucerne establishment is a treatment option (Crawford and Ransom, 1993).

In order to investigate the productive potential of lucerne in North East Victoria, a four year grazing trial has been conducted in north-east Victoria (Crawford and Macfarlane, in prep.). These researchers concluded that lucerne will increase both water use and pasture and livestock production relative to the performance of annual pasture.

The establishment of lucerne pastures however is both a costly and risky procedure, which many farmers are wary of in the current economic climate. The 'salinity benefits' from decreased groundwater recharge usually occur off site and are of no financial benefit to the owner of the lucerne paddock. In this report the economic and financial viability of establishing lucerne pastures is investigated on the basis of the increased production reported by Crawford and Macfarlane (in prep.) and Crawford and Ransom (1993).

Trial Details

The grazing trial was located on a farm at Sheep Pen Creek 30km west of Benalla, within the Goulburn Broken River catchment. The soil was a well drained fine sandy clay loam with gravel content of 20%, pH (CaCl₂) of 4.5, pH (H₂O) of 5.6, Al(KCl) of 9 ug/g, Olsen P of 10.7 ug/g and Skene K of 256 ug/g.

Five to six month old merino wethers were grazed on lucerne and annual pastures at stocking rates of 5, 8.75, and 12.5 dry sheep equivalents (dse) per hectare. These six treatments were replicated three times in a randomised complete block. Following chemical weed control, the lucerne plots were direct drilled in June 1987. Some areas initially failed and were resown in August. The plots were first stocked in July 1988. The annual pasture treatments were continuously stocked throughout the trial while the lucerne treatments were subdivided into five equal sized paddocks and grazed on a 2 week on, 8 week off rotation. The wether weaners were grazed for a period of twelve months, shorn and then sold and replaced with a new mob of weaners.

Crawford and Ransom (1993) reported that the highest wool production per hectare was achieved from lucerne pasture stocked at 12.5dse/ha. This stocking rate though was found to be unsustainable on annual pasture and the best long term wool production per hectare on annual pasture would be achieved at 8.75dse/ha. The average annual production figures for these two treatments are shown in Table I.

Table I: Average annual production from the Sheep Pen Creek grazing trial.

	Stocking Rate wethers/ha	Annual Average		
		Wool Cut kg/hd	Fibre Diam. µ	Supplementary Feed MJ/wether
Lucerne	12.5	2.6	19.2	11
Annual Pasture	8.75	2.5	19.4	132

Aims of Study.

This study will attempt to investigate the economic and financial feasibility of upgrading a 20ha paddock of annual pasture to a lucerne pasture, on the basis of the results of the above-mentioned grazing trial. Cash flows, break even levels of key parameters, internal rates of return and net present values of the investment in lucerne pastures will be compared to what could have been earned otherwise from the existing annual pasture.

In the first case scenario the same production schedule is assumed as was used in the trial. i.e. grazing weaner wethers for twelve months, shearing, selling and replacing them. In a farm situation the extra weaners may be carry-over stock, rather than purchases and at the end of the trial these wethers may join the farms wether flock, rather than actually being sold. Regardless opportunity costs are involved.

Many farmers however may not see it to be necessary or worthwhile going to the trouble of establishing lucerne pastures just to raise young weaners for wool production, particularly in the current depressed wool market. Many would believe for the medium term that fat lamb production would offer the opportunity for greater returns than wool, and may justify the risk involved in establishing lucerne pastures. So in the second case scenario the feasibility of establishing dryland lucerne for fat lamb production is examined.

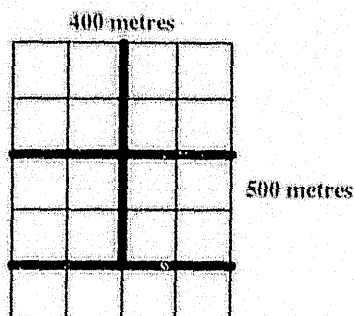
Lucerne Establishment Costs.

The establishment program is critical to the success of a new lucerne pasture. Crawford (1993) recommends a program which includes herbicide application, cultivation, seed inoculation, 250 kg/ha super phosphate/lime, and application of Lemat insecticide after sowing. The costing for this program (Table II) was developed from supplier price lists, with tractor operations being costed at \$15/hr, and the workrates taken from Madden (1993).

In the trial some lucerne failed to establish in some areas at the first try. These areas had to be resown, but no extra fertiliser or chemicals were required. Such a failure would cost \$43.80/ha in extra seed, inoculation and sowing costs. As well as the establishment cost per hectare, there are also a number of capital costs which will be incurred in preparing the paddock or rotational grazing once the lucerne has established. These will include alterations to fencing and stock water supplies.

Table II:- Costings for the establishment of dryland lucerne in North East Victoria.

Operation	Amount	Cost (\$)	\$/ha
Roundup	1.25 l/ha	16.50 /l	20.63
Spray Application	9.8 ha/hr	15.00 /hr	1.53
Agro ploughing	2.0 ha/hr	15.00 /hr	7.50
Scarifying	2.4 ha/hr	15.00 /hr	6.25
Fertiliser	250 kg/ha	0.25 /kg	62.50
Seed	6 kg/ha	6.00 /kg	36.00
Seed Inoculation	6 kg/ha	0.30 /kg	1.80
Sowing	2.5 ha/hr	15.00 /hr	6.00
Lemat Insecticide	0.05 l/ha	46.00 /l	2.30
Spray Application	9.8 ha/hr	15.00 /hr	1.53
Total			\$146.04



If the paddock was shaped as in the diagram above, then 1200m (1.2km) of subdivisional fencing would be required in order to produce five paddocks for a 2 week on 8 week off rotation, as was used in the Sheep Pen Creek Trial. To fence this using star posts, ringlock and two barbed wires would cost \$1200/km for materials and \$800/km for contractors fees. Presuming there was already one trough in the paddock then a further four troughs as well as approximately 500 metres of polythene pipe would be required.

Government Grants.

As part of the implementation of the Goulburn Broken River Catchments Salinity Management Plan incentives are made available under the Land Protection Incentives Scheme for works which assist the control of groundwater recharge. These include \$60/ha for the establishment of deep rooted perennial pastures and \$1.20 per metre for materials for related fencing. These grants are available on sites with groundwater recharge rates in excess on 1m/day.

Scenario One: Lucerne for Wool Production.

Introduction

A farmer has a 20ha paddock currently under annual pasture with similar soil characteristics to the Sheep Pen Creek trial site. The paddock is currently stocked at 8.75 dse/ha, the highest sustainable wool producing annual pasture stocking rate (Crawford and Ransom, 1993). The farmer is interested in establishing lucerne pasture on this paddock so the stocking rate can be raised and a greater percentage of the weaners produced annually can be retained.

The farmer currently has a bank overdraft at 12% interest, which would have to be extended in order to cover the extra capital required to establish the lucerne pasture. The profits earned from later production will then be used to help pay off the overdraft, effectively earning 12%.

Current Annual Pasture Budget.

The nominal budget of costs and returns over nine years in Appendix 1a was prepared for a 20ha paddock of annual pasture raising weaner wethers, and is to be used as the base to which lucerne establishment options will be compared.

At the current clean wool price of \$6/kg the 20ha of annual pasture had an average gross margin of \$69/ha producing a net return of \$1,383 in the first year.

At a discount rate of 15% the production from the annual pasture over the nine years has a Net Present Value of \$6,661 at a wool price of \$6/kg. The NPV at other wool prices are shown in Table III.

Table III:- Net present value of returns over nine years from wool production on current annual pasture.

Clean Wool Price (\$/kg)	\$3.00	\$4.00	\$5.00	\$6.00	\$7.00	\$8.00	\$9.00
Annual Pasture NPV (15%)	\$1,569	\$3,463	\$5,357	\$7,250	\$9,144	\$11,038	\$12,932

Results

Cash flow budgets (Appendix I) were done for the establishment and production of lucerne pasture, on the basis of the results shown in table I and the following assumptions.

Annual maintenance fertiliser cost of \$25/ha.

Inflation of costs of 3% p.a.

Lucerne pasture given one year to establish before grazing.

Lucerne pasture has a life of eight years of grazing.

Extra management labour provided by landowner.

Weaners brought into the system at six months at a cost of \$18.

Wethers sold out of the system after shearing at 18 months for \$24.

Annual mortality rate of 3%

Annual variable costs of \$5 per wether

Clean wool price of \$6/kg.

Wool selling costs and taxes of 15% of gross receipts.

The farm has a capital cost of 12%.

A range of wool prices were used in these budgets and the results are shown in the tables and figures which follow.

Figure II:- Return on capital invested.

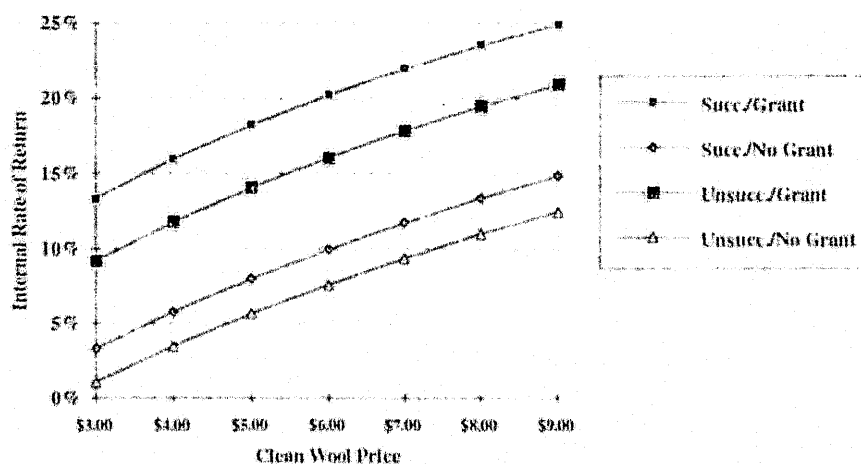


Figure III:- Net Present Value of lucerne and annual pasture returns at a 15% discount rate

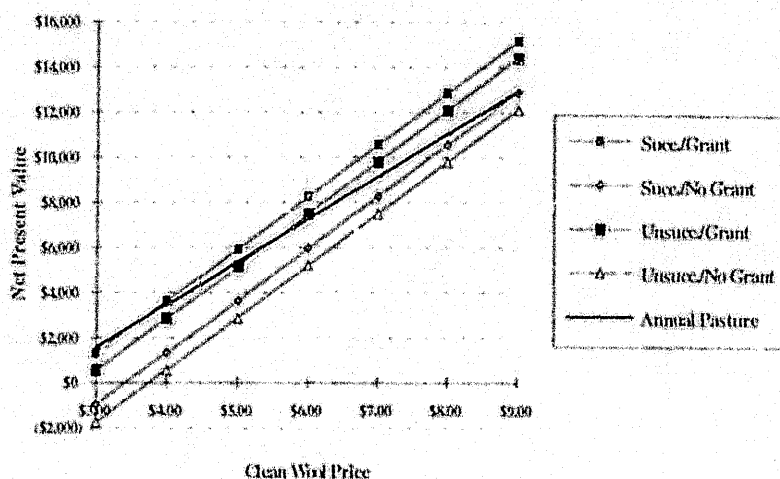


Figure IV:- Net Cash Flows from wool production at \$6/kg clean wool price.

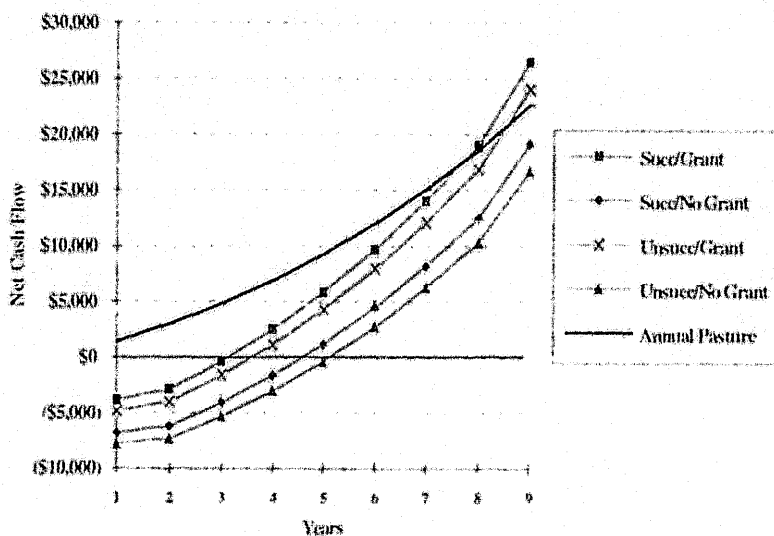


Table VI:- Break-even periods for lucerne pasture establishment.

Break Even Period		Clean Wool Price						
		\$3.00	\$4.00	\$5.00	\$6.00	\$7.00	\$8.00	\$9.00
Successful Establishment	grant	10	10	9	9	9	8	8
	no grant	10	10	10	10	10	10	10
Unsuccessful Establishment	grant	10	10	10	10	9	9	9
	no grant	10	10	10	10	10	10	10

Discussion.

At the expected clean wool price of \$6/kg the establishment of lucerne pasture on the 20ha paddock generates a return on the extra capital invested of 20%. An establishment failure would only reduce the return to 16%, though without government grants the return would fall to 10%.

Assuming the capital has to be borrowed at 12% interest then the return on capital needs to be greater than 12% in order for the project to be feasible. At a 12% return borrowing costs could be covered but there would be no margin for risk or nothing left as a profit for the farmer. Given the risk involved in the establishment of lucerne, and the subsequent increased exposure to drought as a result of higher stocking rates there would also need to be a risk margin of at least 3% on top of the 12%. In figure II it is shown that at wool prices above \$4/kg lucerne can generate returns in excess of 15%, but if an establishment failure occurred a wool price above \$6/kg would be required. If government grants were not received then even at a wool price of \$9/kg and a successful establishment a return of 15% cannot be earned.

In figure III the net present value of the future returns which could be expected from both annual and lucerne pastures at a discount rate of 15% are shown. At a \$6/kg wool price the lucerne pasture has an NPV of \$8,246, which compares favourably with the annual pasture NPV of \$7,250. An establishment failure would result in almost equal NPV, while without government grants the lucerne NPV falls well below the NPV of annual pasture.

In figure four it is shown that the after four years the lucerne cumulative net cash flow will be positive but it still takes until the end of year eight to surpass the cash flow generated by annual pasture. It is unlikely that this situation would not be acceptable to farmers more concerned with shorter term cash flows, especially given that the lucerne would be expected to be at the end of its life by this time. A long term wool price rise to \$8/kg would decrease the break-even time to year eight which would still be considered far too long by most farmers, especially given the potential risk of establishment failure or wool price declines. With an unsuccessful establishment the shortest break-even period is nine years, and without government grants the lucerne will never match the annual pasture cumulative cash flow.

If government grants are available the establishment of lucerne pasture has the potential to achieve acceptable returns at wool prices above \$4/kg. Even under these circumstances an establishment failure would require a wool price of at least \$6/kg. It will still take up to nine years though before the cumulative cash flow from lucerne surpasses that from annual pasture. If government grants were not available then lucerne pasture establishment fails to produce acceptable returns and is unable to break-even with annual pasture cash flows within the life of the annual pasture.

Scenario Two: Lucerne for Fat Lamb Production.

Introduction.

A farmer has a 20ha paddock currently under annual pasture with similar soil characteristics to the Sheep Pen Creek trial site. The paddock however is currently carrying first cross ewes and lambs stocked at 8.75 dse/ha. The farmer is interested in establishing lucerne pasture on this paddock so as he can turn off more lambs, and lambs of better quality. He believes that with lucerne he will be able to produce more lambs, carry them longer and receive a premium on the sale price.

As with scenario one the farmer currently has a bank overdraft at 12% interest, which would have to be extended in order to cover the extra capital required to establish the lucerne pasture. The profits earned from later production will then be used to help pay off the overdraft, effectively earning 12%.

Current Annual Pasture Budget.

The nominal budget of costs and returns over nine years in Appendix IIa was prepared for a 20ha paddock of annual pasture raising fat lambs, and is to be used as the base to which lucerne establishment options will be compared.

The expected case of \$30 per lamb and \$6/kg of wool this system has a gross margin of \$75/ha producing a net return of \$1509 in the first year. At a discount rate of 15% the returns from the paddock over the next nine years have an NPV of \$7,979, this only represents a NPV/ha of \$399.

Table V: Net present value of returns over nine years of fat lamb production on the current annual pasture.

Fat Lamb Price (\$/hd)	\$20	\$25	\$30	\$35	\$40
Annual Pasture NPV (15%)	\$3,725	\$5,852	\$7,979	\$10,105	\$12,232

Results

Cash flow budgets (Appendix Two) were done for the establishment and production of lucerne pasture on the basis of the following assumptions.

Land value of \$1,500/ha.

Annual maintenance fertiliser cost of \$25/ha.

Inflation of costs of 3% p.a.

Lucerne pasture given one year to establish before grazing.

Lucerne pasture has a life of eight years of grazing.

Extra management labour provided by landowner.

Replacement ewe cost of \$30/head.

Cull ewe sales of \$12/head.

Ewe life of 4 years.

100% lambing percentage.

Annual mortality rate of 3%

Annual variable costs of \$5 per wether

Ewe wool cut of 3kg/ha on both annual and lucerne pasture.

Clean wool price of \$6/kg.

Wool selling costs and taxes of 15%

The farm has a capital opportunity cost of 12%, i.e. any extra borrowings will be charged 12% and any profits can pay off current loans at 12%.

A range of wool prices were used in these budgets and the results are shown in the tables and figures which follow.

Figure V:- Return on capital invested, without price premium.

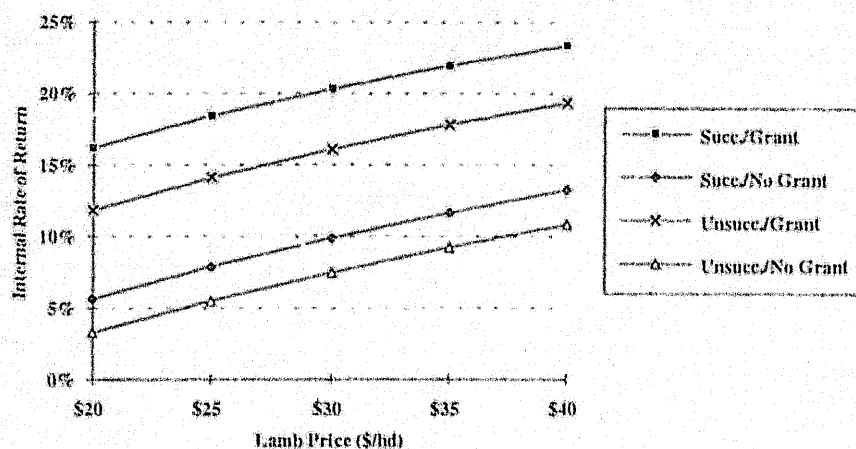


Figure VI:- NPV (15% discount rate) of lucerne and annual pasture returns with no price premium.

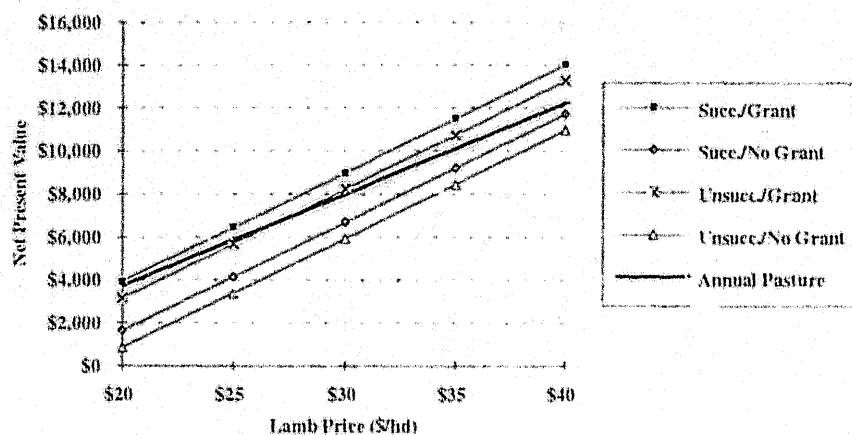


Table VII:- Break-even period for the establishment of lucerne pasture for fat lamb production with no price premium.

Break Even Period		No Increase				
		\$20	\$25	\$30	\$35	\$40
Successful Establishment	grant	9	9	8	8	7
	no grant	10	10	10	10	10
Unsuccessful Establishment	grant	10	9	9	9	8
	no grant	10	10	10	10	10

Figure VII:- Return on capital invested, with 15% price premium.

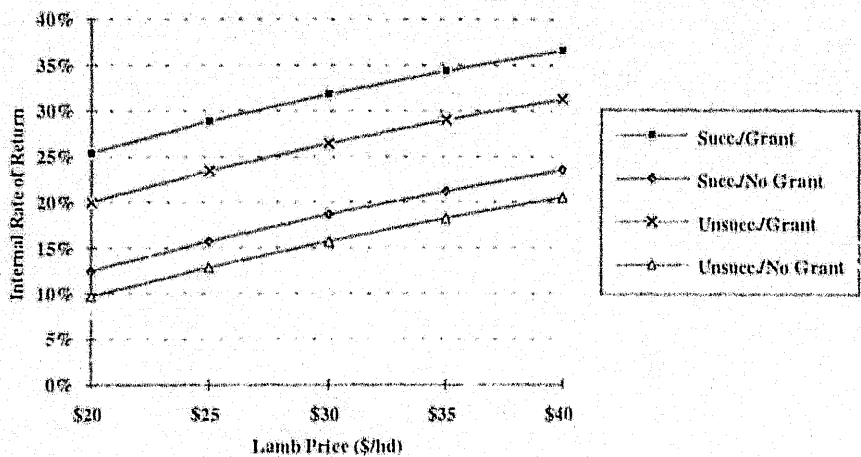


Figure VIII:- NPV (15% discount rate) of lucerne and annual pasture returns with a 15% price premium.

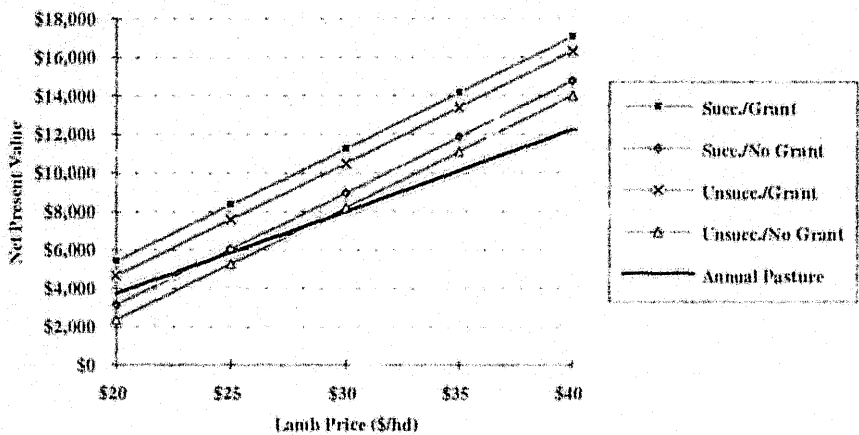


Table VI:- Break-even period for the establishment of lucerne pasture for fat lamb production with a 15% price premium.

Break Even Period		15% increase				
		\$20	\$25	\$30	\$35	\$40
Successful Establishment	grant	7	6	6	5	5
	no grant	10	9	9	8	7
Unsuccessful Establishment	grant	8	7	7	6	6
	no grant	10	10	9	9	8

Discussion.

As with scenario one, the establishment of lucerne pasture needs to return at least 15% in order to cover the cost of borrowing the necessary capital and the risk involved. In figures V & VI and table VI the results are shown for the case where there is no price premium received for the lambs produced by the lucerne pasture. In these figures it is shown that the establishment of lucerne pasture generates returns in excess of 15% for all lamb prices above \$20/hd. If an establishment failure was to occur a the lamb price would need to rise to \$30/hd in order to earn the necessary returns. Without the government grants even a lamb price of \$40/hd would fail to return 15% on the capital invested.

The returns from lucerne pasture have a greater NPV at all lamb prices above \$20/hd with successful establishment. If an establishment failure occurs, the NPV's would be almost equal at a lamb price of \$30/hd. Without the government grants annual pasture has a higher NPV at all lamb prices investigated.

In table VI it is shown that the shortest break-even period possible is seven years, but this requires a \$40/hd lamb price. At lower prices it will take 8 to 9 years for the net cumulative cash flow from lucerne pasture to surpass what could have otherwise been achieved from annual pasture. If the government grants were not available the lucerne cash flow could not surpass the annual pasture cash flow within the life of the lucerne pasture.

As with scenario one the establishment of lucerne pasture can achieve acceptable returns when government grants are available. The break-even period though is still in the eight to nine year region which is likely to be considered far too long by those farmers concerned with shorter term cash flows.

In figures VII & VIII and table VII the results are shown for the case where the lucerne pasture is able to carry the lambs further into the summer and thus the farmer is able to receive a premium price. This premium is estimated to be 15% of the sale price for lambs from the annual pasture.

In figure VII it is shown that even with an establishment failure lucerne pasture is able to earn returns in excess of 15% at all wool prices above \$20/hd. Without the government grants a lamb price of at least \$30/hd would be needed to ensure a 15% return, in the case of an establishment failure.

At a discount rate of 15% returns from lucerne pasture have a greater NPV than annual pasture at all lamb prices investigated. Even without the government grants a lamb price between \$25 to \$30/hd is enough to produce a higher NPV for lucerne establishment.

In table VII it is shown that the net cumulative cash flow generated from lucerne establishment is able to surpass that from annual pasture after 6 years at a \$25/hd lamb price, and in even shorter times at higher lamb prices. An establishment failure would only extend this period by one year. Without government grants the shortest possible break-even period is 7 years at a \$40/kg lamb price with successful establishment.

If no price premium is obtained the returns generated from lucerne establishment are of a similar nature to those from scenario one. If the lucerne can carry lambs further into the summer and a price premium is obtained then very attractive returns are available. If government grants are also received then the break-even periods could be as low as 5 to 6 years which may appear more attractive to those farmers interested in short term cash flows. Without the government grants feasible returns are generated at lamb prices above \$25/hd, but the break-even periods are still in the seven to nine year bracket.

Conclusions.

The grazing trial of Crawford and Macfarlane (in prep.) demonstrated the possibility to raise stocking rate by almost 4dse/ha with the establishment of lucerne pasture. It would appear though that the costs and risks involved in the establishment of these pastures may deter farmers.

With the aid of government grants the establishment of lucerne has the potential to generate viable returns on the extra capital invested. In financial terms though the break-even period with annual pasture is in the eight to nine year bracket, particularly for wool production. Unless a price premium can be obtained the production of fat lambs has similar returns on capital and break-even periods. If there is the possibility of a price premium, returns from lucerne establishment are very good and the break-even period shortens to approximately six years.

Without the aid of government grants the establishment of lucerne pastures is unviable on both economic and financial grounds. The return on capital is less than the opportunity cost of the capital the NPV is less than the NPV of returns from the existing annual pasture and the break-even periods are often longer than the life of the lucerne pasture.

References.

- Crawford, M. (1993). 'Lucerne' in Pastures for north-east Victoria, their establishment and management, ed. Stapleton, P., Department of Agriculture Victoria.
- Crawford, M. (in prep.). 'Lucerne pasture increases water use and animal production in a high recharge area,' in preparation for submission to the *Australian Journal of Experimental Agriculture*.
- Crawford, M. and Ransom, K. (1993). 'The role of lucerne in dryland salinity control.' *Proceedings of the national conference on land management for dryland salinity control*, eds Taylor, J. and Clifton, C. Department of Conservation and Natural Resources, Victoria.
- Madden, B. (1993). 'Budget guide for pasture establishment' in Pastures for north-east Victoria, their establishment and management, ed. Stapleton, P., Department of Agriculture Victoria.

Appendix One:-

Economics of Dryland Lucerne Pasture Establishment Grazing Weaners

Both Enterprises			
Paddock Size	20 ha		
Lucerne Establishment Cost	\$146 /ha		
Lucerne Failure Cost	\$44 /ha		
Maintenance Fertilizer	\$25 /ha		
Variable Costs	\$5 /wether		
Weaner Cost	\$18 /hd		
Wether Sales	\$24 /hd		
Mortality Rate	3%		
Clean Wool Price	\$6.00 /kg		
Wool Selling Costs	15%		
Opportunity Cost of Capital	12%		
Inflation	3%		
Successful Establishment	yes		
Grants Received	yes		
	Lucerne	Annual	
Wool Cut	2.57	2.5	
Stocking Rate (wethers/ha)	12.5	8.75	
Supplementary Feed (\$/hd)	\$0.16	\$1.94	
Capital Costs			
Fencing Materials	1.2 km	\$1,200 /km	\$1,440
Fencing Contractor	1.2 km	\$800 /km	\$960
Stock Watering Facilities			\$750
Total			\$3,150 /ha
Government Assistance			
Fencing Rebate		\$1.20 /m	
Pasture Establishment Grant		\$60 /ha	
RESULTS			
IRR on Marginal Capital	20.24%		
NPV of lucerne (15%)	\$8,246		
NPV of annual (15%)	\$7,250		
Years to break even	8		

Annual Pasture

	Number	Value	Total		Number	Value	Total
Opening				Sales			
Births	0			18 month old Wethers	170	\$24	\$4,080
Purchases				Deaths	5		
6 month old Weaners	175	\$18	\$3,150	Closing			
Trading Profit/Loss			\$930				
	175		\$4,080		175		\$4,080

Lucerne Pasture

	Number	Value	Total		Number	Value	Total
Opening				Sales			
Births	0			18 month old Wethers	242	\$24	\$5,808
Purchases				Deaths	8		
6 month old Weaners	250	\$18	\$4,500	Closing			
Trading Profit/Loss			\$1,308				
	250		\$5,808		250		\$5,808

Existing Annual Pasture Budget

YEAR	1	2	3	4	5	6	7	8	9
COSTS									
Establishment	0								
Fertilizer (kg/ha)	500	515	530	546	563	580	597	615	633
Stock Costs	875	901	928	956	985	1014	1045	1076	1108
Supplementary Feeding	340	350	360	371	382	394	405	418	430
Wool Selling Costs	383	394	406	418	431	443	457	470	485
TOTAL COSTS	2097	2160	2225	2291	2360	2431	2504	2579	2656
RETURNS									
Wool Sales	2550	2627	2705	2786	2870	2956	3045	3136	3230
Stock Trading Profit	930	958	987	1016	1047	1078	1110	1144	1178
TOTAL RETURNS	3480	3584	3692	3803	3917	4034	4155	4280	4408
NET RETURNS	1383	1424	1467	1511	1557	1603	1651	1701	1752
ECONOMIC ANALYSIS									
Net Present Value	5%	\$10,990							
	10%	\$8,825							
	15%	\$7,250							
	20%	\$6,078							
FINANCIAL ANALYSIS									
Net Returns	\$1,383	\$1,424	\$1,467	\$1,511	\$1,557	\$1,603	\$1,651	\$1,701	\$1,752
Interest		\$166	\$357	\$576	\$826	\$1,112	\$1,438	\$1,809	\$2,230
Cummulative Cash Flow	\$1,383	\$2,973	\$4,797	\$6,884	\$9,267	\$11,982	\$15,072	\$18,581	\$22,563

Lucerne Pasture Development Budget

YEAR	1	2	3	4	5	6	7	8	9
COSTS									
Establishment	1,720								
Fencing	960								
Water Facilities	750								
Extra Stock		1,350							
Fertilizer (kg/ha)		515	530	546	563	580	597	615	633
Stock Costs		1,288	1,326	1,366	1,407	1,449	1,493	1,537	1,583
Supplementary Feeding		41	42	44	45	46	48	49	51
Wool Selling Costs		577	594	612	630	649	668	688	709
TOTAL COSTS	3,430	3,770	2,493	2,568	2,645	2,724	2,806	2,890	2,977

RETURNS									
Wool Sales		3,844	3,959	4,078	4,200	4,326	4,456	4,589	4,727
Stock Trading Profit/Loss		1,347	1,388	1,429	1,472	1,516	1,562	1,609	1,657
Salvage Extra Stock									1,710
TOTAL RETURNS	0	5,191	5,347	5,507	5,672	5,842	6,018	6,198	8,094
NET RETURNS	-3,430	1,421	2,854	2,939	3,027	3,118	3,212	3,308	5,119

ECONOMIC ANALYSIS

Net Present Value	5%	\$15,425
	10%	\$11,209
	15%	\$8,246
	20%	\$6,116

Annual Pasture Returns	1,383	1,424	1,467	1,511	1,557	1,603	1,651	1,701	1,752
Lucerne Pasture Returns	-3,430	1,421	2,854	2,939	3,027	3,118	3,212	3,308	5,118
Extra Returns	-4,813	-4	1,386	1,428	1,471	1,515	1,560	1,607	3,366

Internal Rate of Return 20.24%

FINANCIAL ANALYSIS

Net Return	(\$3,430)	\$1,421	\$2,854	\$2,939	\$3,027	\$3,118	\$3,212	\$3,308	\$5,118
Interest	(\$412)	(\$467)	(\$346)	(\$45)	\$302	\$702	\$1,160	\$1,685	\$2,284
NET CASH FLOW	(\$3,842)	(\$2,882)	(\$374)	\$2,520	\$5,850	\$9,671	\$14,043	\$19,036	\$26,438

Years to Break Even 8

Appendix II:

Economics of Dryland Lucerne Pasture Establishment Fat Lamb Production

Both Enterprises

Paddock Size	20 ha
Lucerne Establishment Cost	\$146 /ha
Lucerne Failure Cost	\$44 /ha
Maintenance Fertilizer	\$25 /ha
Stock Variable Costs	\$5 /dse
Replacement Ewe Cost	\$30 /hd
Cull Ewe Sales	\$12 /hd
Lamb Price	\$30 /hd
Ewe Life	4 years
Ewe dse equivalent	2.00 dse
Ewe Wool Cut	3.00 kg/hd
Lambing Percentage	100%
Stock Selling Costs	5% of sales
Mortality Rate	3%
Clean Wool Price	\$6.00 /kg
Wool Selling Costs	15%
Opportunity Cost of Capital	12%
Inflation	3%
Successful Establishment	yes
Grants Received	yes

	Lucerne	Annual
Lamb Price Increase	0%	
Stocking Rate (dse/ha)	12.5	8.75
Supplementary Feed (\$/hd)	\$0.16	\$1.94

Capital Costs

Fencing Materials	1.2 km	\$1,200 /km	\$1,440
Fencing Contractor	1.2 km	\$800 /km	\$960
Stock Watering Facilities			\$750
Total			\$3,150

Government Assistance

Fencing Rebate	\$1.20 /m
Pasture Establishment Grant	\$60 /ha

RESULTS

IRR on Marginal Capital	20.33%
NPV of lucerne (15%)	\$8,974
NPV of annual (15%)	\$7,979
Years to break even	8

Annual Pasture

	Number	Value	Total		Number	Value	Total
Opening				Sales			
Mixed Age Ewes	88	\$21	\$1,848	Cull Ewes	22	\$12	\$264
				Lambs	85	\$30	\$2,550
Births	85			Deaths	3		
Purchases							
Replacement Ewes	25	\$30	\$750	Closing			
Trading Profit/Loss			\$2,064	Mixed Age Ewes	88	\$21	\$1,848
	198		\$4,662		198		\$4,662

Lucerne Pasture

	Number	Value	Total		Number	Value	Total
Opening				Sales			
Mixed Age Ewes	125	\$21	\$2,625	Cull Ewes	31	\$12	\$372
				Lambs	121	\$30	\$3,630
Births	121			Deaths	4		
Purchases							
Replacement Ewes	35	\$30	\$1,050	Closing			
Trading Profit/Loss			\$2,952	Mixed Age Ewes	125	\$21	\$2,625
	281		\$6,627		281		\$6,627

Existing Annual Pasture Budget

YEAR	1	2	3	4	5	6	7	8	9
COSTS									
Establishment	0								
Fertilizer (kg/ha)	500	515	530	546	563	580	597	615	633
Stock Costs	875	901	928	956	985	1014	1045	1076	1108
Supplementary Feeding	340	350	360	371	382	394	405	418	430
Stock Selling Costs	141	141	141	141	141	141	141	141	141
Wool Selling Costs	230	236	243	251	258	266	274	282	291
TOTAL COSTS	2085	2143	2203	2265	2329	2394	2462	2532	2603
RETURNS									
Wool Sales	1530	1576	1623	1672	1722	1774	1827	1882	1938
Stock Trading Profit	2064	2126	2190	2255	2323	2393	2465	2538	2615
TOTAL RETURNS	3594	3702	3813	3927	4045	4166	4291	4420	4553
NET RETURNS	1509	1559	1610	1662	1716	1772	1829	1889	1949
ECONOMIC ANALYSIS									
Net Present Value	5%	\$12,112							
	10%	\$9,718							
	15%	\$7,979							
	20%	\$6,684							
FINANCIAL ANALYSIS									
Net Returns	\$1,509	\$1,559	\$1,610	\$1,662	\$1,716	\$1,772	\$1,829	\$1,889	\$1,949
Interest		\$181	\$390	\$630	\$905	\$1,219	\$1,578	\$1,987	\$2,453
Cummulative Cash Flow	\$1,509	\$3,249	\$5,249	\$7,541	\$10,162	\$13,154	\$16,562	\$20,438	\$24,840

Lucerne Pasture Development Budget

YEAR	1	2	3	4	5	6	7	8	9
COSTS									
Establishment	1,720								
Fencing	960								
Water Facilities	750								
Extra Stock		1110							
Fertilizer (kg/ha)		515	530	546	563	580	597	615	633
Stock Costs		1288	1326	1366	1407	1449	1493	1537	1583
Supplementary Feeding		41	42	44	45	46	48	49	51
Stock Selling Costs		200	200	200	200	200	200	200	200
Wool Selling Costs		337	347	357	368	379	390	402	414
TOTAL COSTS	3430	3490	2446	2513	2582	2654	2728	2803	2881

RETURNS									
Wool Sales		2,243	2,311	2,380	2,451	2,525	2,601	2,679	2,759
Stock Trading Profit/Loss		3,041	3,132	3,226	3,323	3,422	3,525	3,631	3,740
Salvage Extra Stock									1,406
TOTAL RETURNS	0	5284	5442	5606	5774	5947	6125	6309	7905
NET RETURNS	-3430	1794	2997	3093	3191	3293	3398	3506	5023

ECONOMIC ANALYSIS

Net Present Value	5%	\$16,477
	10%	\$12,078
	15%	\$8,974
	20%	\$6,735

Annual Pasture Returns	1509	1559	1610	1662	1716	1772	1829	1889	1949
Lucerne Pasture Returns	-3430	1794	2997	3093	3191	3293	3398	3506	5023
Change in Net Returns	-4,939	235	1,387	1,430	1,475	1,521	1,568	1,617	3,074

IRR on Marginal Returns 20.33%

FINANCIAL ANALYSIS

Net Return	-3430	1794	2997	3093	3191	3293	3398	3506	5023
Interest	-412	-461	-301	22	396	827	1321	1887	2535
Net Cash Flow	(\$3,842)	(\$2,509)	\$187	\$3,302	\$6,889	\$11,009	\$15,728	\$21,121	\$28,679

Years to Break Even

8