BUDGETING FOR INVESTMENT IN PASTURE IMPROVEMENT

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1. INTRODUCTION

In this paper we discuss the economics of planning pasture improvement decisions and the procedures for assessing the profitability of pasture development programmes. The emphasis of this discussion is on the application of practical budgeting procedures in evaluating on-farm pasture investment decisions. The examples presented relate to the establishment and maintenance of improved permanent grass-based pastures using prepared seed beds and aerial techniques in the arable and non-arable situations which are characteristic of the New South Wales tablelands.

2. ASSESSING THE ECONOMICS OF PASTURE IMPROVEMENT

Pasture improvement has long been a popular area of economic research in Australia. During the 1950's and 1960's numerous economic studies concluded that investment in pasture improvement offered the greatest potential for permanently increasing livestock production and farm incomes in the grazing areas. In one study, Gruen (1959) suggested that the two main economic components of the pasture improvement decision were:-

(i) how profitable is the investment likely to be?, and
(ii) what is the pasture programme that can be best adapted to the landholder's resources and circumstances?

The period of Gruen's (1959) research was one of generally favourable returns to livestock production (particularly wool) and low cost inflation which combined to make pasture improvement an attractive low-risk farm investment. The present day economic climate is considerably different and it is appropriate to reconsider the components of Gruen's economic question.

Investment in Pasture Improvement. In most situations, permanent pasture improvement represents an on-farm investment over several years in pasture establishment and management to maintain long-term vigour. Such an investment usually requires a significant resource committment, particularly on finance and management. Standard farm budgeting procedures provide appropriate methods for assessing the potential profitability of this investment decision.

The profits from pasture improvement are the differences between the long-term costs and returns. The costs include pasture establishment and maintenance - cultural operations, seed, fertilizer, herbicide, fuel and extra stock - any necessary capital costs (eg. fences, water) and interest on borrowed funds. The returns are the increased value of livestock production from the higher carrying capacities.

Budgeting Methods. Most of the costs fall in the initial year of pasture establishment. There will also be an on-going cost committment to pasture maintenance (eg. using fertilizers, herbicides) over the life of the pasture. An example of the first year costs of establishing a permanent pasture is presented in Table 1. However this budget is simply a statement of initial costs. Assessing the longer term profitability of pasture

improvement requires comparison of the estimated annual costs and returns over time. The cash flow or development budget provides a useful assessment mechanism. This budget details the financial and other resource requirements and the time flow of costs and returns. It is illustrated in Table 2 for an arable pasture situation over a ten year pasture period.

Table 1. First year costs of permanent pasture improvement

		Arable country	Non-arable
Disc plough	(one)	18.00	
Harrow	(twice)	18.00	
Combine/sow	(once)	15.00	
Seed mix		25.00	25.00
Inoculation & lime pelleting		1.65	1.65
Bulk fertilizer (250 kg/ha on ground)		56.25	56.25
2 litres herbicide @ $22.00/1			40.00
aerial spraying @ $15.00/ha			15.00
foam adjuvant			0.80
Aerial Sowing: First with fertilizer			
Second @ $5.00/ha			5.00
Total		133.90	147.70

The conventional procedure is to project the costs and returns estimates in constant terms because future relative changes in these values cannot be accurately predicted (ie. costs will continue to rise but livestock returns will fluctuate over time). This introduces the important consideration of the impact of time over the pasture development period. Because inflation reduces dollar values in real terms over time, it is necessary to convert the budgeted costs and returns to present day values using discount rates. The budget example uses a real discount rate of ten per cent (a real discount rate is the approximate cost of commercial finance less the current rate of inflation). Discounting net returns also enables the risk inherent in pasture improvement to be taken into account. Risk is introduced because of the time lag between sowing a pasture and achieving its stocking potential. Here, a higher discount rate indicates a riskier investment.

Assessment Criteria. These budgeting procedures provide a range of economic information relating to the investment. The cash flow considerations include the amount and timing of debt, the time taken to recover the investment capital, the cash surplus at the break-even point and the cash accumulated at the end of the budget period. The discounting procedures determine the investment's net present value (the present day value of the accumulated net returns over time) and the benefit cost ratio (the ratio of discounted returns and costs). A pasture development proposal is considered to be profitable if its estimated net present value is positive and its benefit cost ratio is greater than one. Estimates of some of these economic criteria are in Table 3.

The cash flow development budgeting approach provides a practical means of economically evaluating pasture improvement decisions at the farm level. However, its validity depends on the availability of improved pasture technology relevant to the individual landholder's situation and of reliable estimates of the animal production - pasture relationships over the pasture development period. A major advantage of this budgeting format is that it can be readily sensitized for differences in the main economic variables - livestock production levels and prices, input requirements and costs. The advent of micro-computer spreadsheets has greatly facilitated the construction of farm budgets of this type and their manipulation.

3. HOW PROFITABLE IS PASTURE IMPROVEMENT

A range of economic and other factors directly influence the returns to pasture improvement. The major economic factors are relative movements in farm prices and costs over time, stocking rates and animal production levels which together will influence the overall returns to pasture improvement and the rates at which these returns accumulate. An important non-economic influence is the local environment. Soil fertility and rainfall levels determine the ease of pasture establishment, pasture vigour and stocking rates. Favourable environments enable higher stocking because pastures can be more readily established and maintained. These environmental influences vary significantly throughout the tablelands and there are areas of low rainfall and poor soils in which pasture establishment is difficult. Other influences include seasonal conditions, pests and weeds. In this section, the development budgeting procedures demonstrated in Table 2 are applied in assessing the profitability of pasture improvement under varying economic and environmental conditions. The purpose is to examine the sensitivity of the profitability estimates from the situation assumed in Table 2 to changes in the levels of some of the important variables in the pasture development process. This is done by altering the level of the relevant variables and comparing the new profitability estimates with the previous solutions. The results of these simulations are presented in Tables 3 and 4. The variations considered are differences in sheep stocking rates and wool cuts and soil fertility - rainfall changes where the latter factors are defined as (following Vere and Campbell 1986):

Soil fertility:

High: good quality basaltic soil capable of supporting a highly competitive improved pasture with average annual dry matter production of over 10000 kg per ha;

Medium: good quality soil derived from granite capable of supporting a moderately competitive improved pasture with average annual dry matter production of between 5000 and 10000 kg per ha;

Low: poor quality soil derived from slate and shale that can support only a poorly competitive pasture with average annual dry matter production of between 2000 and 5000 kg per ha.

Rainfall:

High: greater than 700 mm (28 inches)

Medium: between 550 and 700 mm (22-28 inches)

Low: below 550 mm (22 inches)

Table 2. Development Budget for Pasture Establishment on Arable Country

Enterprise Unit (ha) 10.0

Merino Wether Enterprise

Mortality rate (%)	5.00
Culling (%)	10.00
Wool cut (kg)	6.00
Wool price ($/kg)	7.50
Replacements ($/hd)	22.00
Cull wethers ($/hd)	11.00
Variable costs ($/hd)	7.50

Stocking Rate dse/ha

Year 1	2.0
Year 2	5.0
Year 3	7.0
Yr 4-10	10.0

Stocking Schedule

Years	1	2	3	4	5	.....	10
Potential	20	50	70	100	100		100
On hand s/y	0	17	43	60	85		85
Purchases	20	33	28	41	15		15
Culls	2	5	7	10	10		10
Deaths	1	2	3	5	5		5
On hand e/y	17	43	60	85	85		85

Seed Mix

	kg/ha	$/kg	$/ha
Lucerne	0.00	7.00	0.00
Subterranean clover	3.00	1.65	4.95
Cocksfoot	1.00	3.10	3.10
Sirosa phalaris	1.50	5.50	8.25
Commercial phalaris	1.50	2.50	3.75
		Total $	20.05

Fertilizer Programme

1. Single super ($/t) 179.40				2. Mo super ($/t) 193.00						
Cost of application ($/t) 31.10				3. Lime super ($/t) 150.00						
Year	1	2	3	4	5	6	7	8	9	10
kg/ha	250	250	125	125	125	0	125	0	125	0
Type (1,2,3	3	1	1	1	2	1	1	1	1	1

Years			1	2	3	4	5	6	7	8	9	10
Costs ($/ha)												
Plough	@	20.00	200									
Scarify	@	13.50	135									
Rabbit cont	@	0.00	0									
Sow	@	16.00	160									
Seed	@	20.05	201									
Seed treat	@	0.90	9									
Single sup	@	179.40 /t		449	224	224		0	224	0	224	0
Mo super	@	193.00 /t					241					
Lime supe	@	150.00 /t	375									
Fert applic	@	31.10 /t		78	39	39	39	0	39	0	39	0
Allowance for failure				115								
Stock purch	@	22.00/hd	440	726	605	891	330	330	330	330	330	330
Stock costs	@	7.50/hd	150	375	525	750	750	750	750	750	750	750
Total Costs			1670	1742	1393	1904	1360	1080	1343	1080	1343	1080
Returns												
Wool sales			900	2250	3150	4500	4500	4500	4500	4500	4500	4500
cfa sales	@	11.00/hd	22	55	77	110	110	110	110	110	110	110
Salv value	@	22.00/hd										1870
Total returns			922	2305	3227	4610	4610	4610	4610	4610	4610	6480
Net returns			-818	563	1834	2706	3250	3530	3267	3530	3267	5400
Interest			-147	-72	0	0	0	0	0	0	0	0
Cumulative balance			-965	-474	1360	4066	7315	10845	14112	17642	20909	26309
Net Present Value			15124									
Interest on Borrowed Funds				0.18								
Discount rate				0.10								
Present day values of annual net returns			-818	512	1516	2033	2220	2192	1844	1811	1524	2290

Table 3. Estimated Returns to Permanent Pasture Improvement for Varying Soil Fertility and Rainfall Conditions

(10 year cash flow summaries)

Soil fertility - rainfall category	Average stocking potential (d.s.e./ha)	Average wool cut (kg/head)	Peak debts ($'000)		Years of debt		Net present values @ 10% ($'000)	
			Arable	Non-arable	Arable	Non-arable	Arable	Non-arable
High-high	15.0	6.5	0.00	0.61	0	2	28.06	25.75
High-medium	12.0	6.5	0.32	1.01	2	3	21.74	19.73
High-low	8.0	6.0	0.61	1.31	3	4	11.56	10.21
Medium-high	12.0	6.0	0.22	0.75	2	2	19.81	20.20
Medium-medium	10.0	6.0	0.53	1.20	2	3	15.79	13.54
Medium-low	7.0	5.5	0.72	1.66	3	4	8.41	7.24
Low-high	10.0	5.5	0.40	1.29	2	4	14.26	11.69
Low-medium	7.5	5.0	0.88	1.79	3	5	8.40	6.59
Low-low	5.0	5.0	1.19	2.07	4	6	4.27	3.34

Notes: 10 ha areas; Merino wether enterprise; wool price, $ 7.50 per kg.

These soil fertility rainfall combinations cover most of the pasture improvement situations occurring on the tablelands.

Table 4: Minimum wool cuts and stocking rates required for profitable pasture improvement.

Soil fertility - rainfall category	Minimum wool cut required at stocking rate of 5 dse/ha		Stocking rate required at minimum wool cut of 5 kg/head	
	Arable	Non-arable	Arable	Non-arable
	(kg/hd)		(dse/ha)	
High-high	3.5	3.9	1.7	2.2
High-medium	3.7	4.1	2.0	2.7
High-low	3.7	4.1	2.1	2.9
Medium-high	3.7	4.1	2.0	2.7
Medium-medium	3.9	4.3	2.4	3.2
Medium-low	4.0	4.4	2.7	3.6
Low-high	3.8	4.2	2.2	3.1
Low-medium	4.1	4.5	2.9	3.8
Low-low	4.2	4.7	3.2	4.3

Changes in sheep production levels. The objective here is to determine the minimum wool cuts and sheep stocking rates required for pasture improvement to be profitable under each soil fertility, rainfall situation (stocking rates and wool cuts are not varied together as they are inversely related; ie. more stock reduce wool cuts per head and vice versa). A range of these comparisons is contained in Table 4. The results indicate that for most situations, the minimum production requirements should be readily achievable following pasture improvement. Where soil fertility and rainfall is low, it is questionable whether the production levels could be maintained over all years of the pasture development period. This is because the returns to sheep production in these less favourable situations will be more susceptible to adverse economic and climatic movements.

Differing environments. Table 3 demonstrates the influence of the environment on the profitability of pasture improvement. In areas where rainfall and soil fertility favour rapid pasture growth, net returns are higher, take less time to accrue, and the investment is generally less risky. Conversely, low rainfall and soil fertility render pasture establishment more difficult and less profitable because of low stocking potential and higher risk. However, the general result is that while pasture improvement programmes are initially costly they can become self-financing in relatively short periods. All the assumed pasture development programmes become self financing within six years and most do within two to three years. Similarly all the budgeted situations yield positive net present values over the ten year period.

It should be noted that these estimates do not include the capital costs of providing further watering facilities or fencing which may be required in some circumstances. For the majority of situations, the profitability estimates should be sufficient to cover this additional expenditure, although the payback period is likely to be extended. However, in those

areas least suited to pasture improvement such additional capital costs may render the programme uneconomic.

4. CHOOSING THE BEST STRATEGY

Pasture establishment options are determined by property characteristics and the landholders resource levels and objectives. The method of establishment depends on the nature of the country, rainfall, soil fertility and relative costs. Finance, labour and machinery availability, personal risk preference and attitude to borrowing will impose a limit on the area established in a given period, or in fact, determine if there is to be any pasture improvement at all.

Because the technical and economic recommendations given for improved pasture establishment are based on a number of assumptions they may not be appropriate in each individual situation. Most landholders are forced to operate within set limits (particularly finance) and the pasture programme being considered must be designed accordingly. It is desirable that a progamme be sufficiently flexible to allow inputs to be varied (eg. fertilizer and stock) in accordance with variations in seasonal cash flows and conditions. It is necessary to temper recommendations according to individual circumstances, resources and attitudes to ensure that the proposed programme is realistic and can be accommodated within these constraints.

5. SUMMARY

This paper has described some practical procedures for budgeting pasture improvement programmes. These procedures have been applied to a permanent improved pasture situation with a tablelands orientation. However, we suggest they are equally applicable to other pasture improvement situations. As with most farm development programmes, large amounts of finance are initially required and this is often the most limiting factor with many landholders. However, the cash flow budgets indicate that substantial increases in net farm income are possible from pasture development. Returns are strongly influenced by animal production levels and the prevailing environment.

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