THE ECONOMICS OF PASTURE IMPROVEMENT IN THE SPEARGRASS ZONE OF QUEENSLAND

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ABSTRACT

Economic analysis has been used to compare the profitability of "low input" Stylo improvement of native pastures in the Townsville - Bowen region with "higher input" fully sown pasture improvement in the coastal Burnett. Whilst total capital cost, including herd build up investment, for the high input system is around double that of the low input system, profitability criteria are much the same. Rates of return of around 16% (IRR) are possible with both systems when increased stocking rates or herd numbers are included in total investment.

Whilst innovative graziers will be able to achieve higher returns by reducing capital costs, careful timing of investment and good management of pastures, the returns in general are inadequate to encourage widespread adoption by industry in its present stage of development.

INTRODUCTION

The speargrass (Heteropogon contortus) zone of Queensland extends from the lower Central Burnett sub-tropics to the tropical lower peninsular regions of Far North Queensland. Pasture improvement technology evaluated in this paper has, with modification, possible application in the majority of this zone - i.e. non-specific technology is used. Within this constraint, low input Stylo based improvement of native pastures in North Queensland is compared with high input Siratro/Stylo/improved grass pasture improvement of the Coastal Burnett. Within each broad technology area, many variations or options are possible. This paper compares what is generally regarded as the more profitable option in each region:

CB(S/R) - Coastal Burnett (Siratro/Rhodes) - Fully sown siratro (Macroptilium atropurpureum) and Stylosanthes spp. with improved grasses such as rhodes (Chloris gayana) and fertiliser, into a ploughed seedbed on previously cleared open speargrass country east of the coastal range. Regular application of maintenance fertiliser is assumed.

TB(S) - Townsville:Bowen (Stylo) - Aerial application of moderately high seeding rates of Stylosanthes hamata cv. Verano and S. Scabra cv. Seca with superphosphate above the 800 mm rainfall isohyet. Some maintenance fertiliser on a 5 yearly basis is assumed.

ASSUMPTIONS

Pasture improvement cost assumptions

Labour and machinery overhead costs have been included in calculating machinery operating costs (Blomfield 1984). Local contract rates have been used for aerial work and additional fencing and water. No allowance is made for existing improvements or land values, particularly for CB(S/R) which is assumed to be carried out on open, previously cleared native pasture country. Some additional fencing and water points are required in conjunction with pasture improvement. No allowance is made for pasture establishment failure.

Similarly, fencing into workable paddocks of approximately 2500 ha with an additional watering point for each paddock, is assumed to be required for TB(S).

TABLE 1
Capital pasture improvement costs ($/ha)

	CB(S/R)	TB(S)
Initial ploughing	20	-
Cultivation (seeding and fertiliser)	15	-
Seed - 2kg Siratro ($13/kg)	26	
1kg Rhodes ($13/kg)	13	
3kg Stylo (Verano and Seca-$8/kg)		24
Superphosphate - 200 kg ($170/tonne)	34	
- 125 kg ($200/tonne)		25
Aerial contractor ($40/tonne)		6
A. Direct improvement cost	108	55
B. Additional fencing and water	30	15
C. Total improvement cost (C = A+B)	138	70
D. Herd build up(D=D(table 2)-A(table 2) x $300)	150	60
E. Total capital (E= C+B)	288	130

Livestock productivity assumptions

Animal production figures are "best estimates" based on research results of CSIRO and QDPI, commercial experience and the advice of field extension officers. A literature review of CB(S/R) is given in Wicksteed (1982). Animal data for TB(S) is based on Eyde and Gillard (1985), the advice of local extension officers, and in particular the experience of "Woodhouse" station, Clare (J. Ferguson pers. comm.)

Steers used are around one half *Bos indicus*, two to three years of age with assumed mean liveweight of 350 kg.

TABLE 2

Livestock productivity assumptions

	CB(S/R)	TB(S)
Before pasture improvement		
A. Stocking rate (steers/ha)	0.25	0.20
B. Liveweight gain/steer/yr (kg)	120	100
C. Liveweight gain/ha (C = AxB)	30	20
After pasture improvement		
D. Stocking rate (steers/ha)	0.75	0.40
E. Liveweight gain/steer/yr (kg)	170	130
F. Liveweight gain/ha (F = DxE)	127	52
G. Increase liveweight gain/ha (G = F-C)	97	32

ECONOMIC ANALYSIS

Analytical approach

Estimated additional cash inflows (benefits) and outflows (costs) over the native pasture situation, are estimated for each pasture improvement system.

A planning horizon of 15 years is used in this analysis. A project life of 10 years has been used in previous published work (Wicksteed 1978, 1982). The loss of Townsville Stylo pastures (*Stylosanthes humilis*) from Anthracnose and of Siratro from overgrazing and "rust" infection is often quoted by graziers. These factors are reflected in perceived risks associated with investment in pasture improvement. Risk is usually reflected in shorter assumed project life and discounting of residual project values in implicit benefit:cost analysis by graziers. Similarly higher cut off rates of return will be demanded than in the absence of risk.

The impact of "risk" on this investment analysis is minimised by assuming project life of 15 years and residual value of one half total improvement cost (Table 1). Briefly then, in this analysis the technology is given the "benefit of the doubt". The value of herd build up is fully reflected in project residual values.

The investment analysis approach demonstrated by Firth *et al*. (1974) is used. Benefits and costs are budgeted over the 15 year project life and discounted to the present to calculate internal rate of return (IRR). Pay back period, (PBP) the time taken at current interest rates, to repay the original investment, is also calculated.

It is assumed that there is a constant relationship between benefits and costs for the life of the project and that any decline in terms of trade (ratio of prices received to prices paid) is compensated by productivity improvements.

Taxation has been omitted in this part of the analysis. The IRR calculated, therefore, represents a "before tax" rate. A "before tax" interest rate is used to calculate PBP.

Improved pasture use is assumed to be growing and finishing steers. Analysis of commercial data has shown this to be the most profitable use of improved pasture (Wicksteed and Nicol 1982).

Budgeted cash flows

The relationship between prices for finished and store cattle is shown in Table 3. Analysis of market price data has confirmed this general relationship (Wicksteed 1980; B. Alcock unpublished data) i.e. at high bullock prices store cattle prices per kilogram liveweight are higher than bullock prices and vice versa for very low bullock prices. The initial analysis assumes any increase in stocking rate is represented by total herd number increase or investment in herd build up. In this respect market price data in Table 3 is used. The assumption of investment in herd build up may be incorrect or only partially correct in some areas, particularly in North Queensland. This assumption is "dropped" in later analysis to test the affect of herd build up investment on profitability of pasture improvement.

TABLE 3
Budgeted cattle prices

Bullock price ($/kg L.Wt)	1.00	0.90	0.80	0.70	0.60
Store price ($/kg L.Wt.)	1.12	0.98	0.84	0.70	0.56
A. Bullock value at 500 kg L.Wt. ($)	500	450	400	350	300
B. Store value at 330 kg L.Wt. ($)	370	323	277	231	185
C. Margin/beast (C = A-B) ($)	130	127	123	119	115
D. Margin/kg L.Wt. change (D = C÷170)	0.77	0.75	0.73	0.70	0.68

Additional cash flow attributed to pasture improvement is calculated in Table 4.

TABLE 4
Budgeted cash flows

	CB(S/R)	TB(S)
Before pasture improvement		
A. Direct animal costs - health, mortalities, labour ($/steer)	15	20
B. Direct animal costs/ha (B = AxA(table 2)) ($)	4	4
After pasture improvement		
C. Direct animal costs - health, mortalities, labour ($/steer)	7.50	7.50
D. Direct animal costs/ha (D=CxD(table 2)) ($)	6	4
E. Gross return/ha (E=G(table 2) x $0.72/kg (table 3)) ($)	70	23
F. Change in direct animal costs/ha (F=D-B)	2	-
G. Gross margin gain/ha before fertiliser (G=E-F)	68	23
H. Fertiliser - superphosphate 100kg/yr	20	
100kg/5 yrs		5
I. Gross margin gain/ha (I=G-H)	48	18

Budgeted cash flow and results

Budgeted cash flow streams and the results of the discounted cash flow analysis (IRR, PBP) are shown in Table 5.

TABLE 5
Budgeted cash flows, IRR and PBP

Year	0[1]	1-14[2]	15[3]		
Results				IRR	PBP
CB(S/R)	-288	+48/yr	+267	16.2%	15 yrs
TB(S)	-130	+18/yr	+113	13.2%	Never

1 E - Table 1

2 I - Table 4

3 I - Table 4 + D (Table 1) + 0.5 x C (Table 1)

Sensitivity analysis

Important variables in determining profitability of pasture improvement are direct pasture improvement costs, productivity of pasture, fertiliser prices and beef prices. All variables, except beef prices, have been separately increased by 20 per cent to determine the sensitivity of IRR to such changes. The results of this sensitivity analysis are shown in Table 6.

Contrary to previous published work (Firth <u>et.</u> <u>al.</u> 1974; Evans 1975; Robinson & Sing 1975; Wicksteed 1978), commercial experience and market price analysis have shown the profitability of growing and finishing of cattle to be insensitive to changes in bullock price (Table 3). This phenomena is incorporated in this analysis where increased carrying capacity associated with pasture improvement is reflected fully in investment in permanent herd build up. Beef prices, as a result are excluded from sensitivity analysis at this stage.

TABLE 6
Changed IRR following a 20 per cent increase in key variables
(original IRR shown in brackets) (%)

	CB(S/R)		TB(S)	
Variables				
Direct pasture improvement cost	14.6	(16.2)	11.7	(13.2)
Fertilizer prices	14.3	(16.2)	11.8	(13.2)
Pasture productivity	21.2	(16.2)	17.2	(13.2)

Profitability is shown to be most sensitive to animal productivity on pasture and relatively insensitive to fertiliser prices and pasture improvement costs. It is important to note however that a steady increase in these costs over time will cumulatively have a marked affect on profitability. It is interesting to note in this respect that this analysis of CB(S/R) with less restrictive assumptions has yielded a lower IRR than a previous equivalent analysis (Wicksteed 1978). This indicates a gradual decline in the profitability of pasture improvement investment over time.

MANAGEMENT CONSIDERATIONS

Central Burnett CB(S/R)

Herd build up If investment in herd build up is excluded from the analysis using no taxation and interest rates of 15 per cent then the effect on results is significant (IRR = 34.6%, PBP = 5 years).

This illustrates the value of pasture improvement to properties that are overstocked. Similarly, although indirectly, it illustrates the value of strategically timing investment in the build up of herds e.g. herds should be built up in periods of very low cattle prices or in years when tax rates will be abnormally high.

Stocking rates The downward sloping stocking rate function, which indicates declining animal liveweight gains as stocking rates increase has been accepted for some time and is reviewed by Walker (1977). Commercially some graziers have used very high stocking rates necessitating pasture rejuvenation at intervals. As a permanent policy, if higher stocking rates of 1 steer/ha producing reduced liveweight of 150kg/year are used and costs increased by $7/steer (including $5/steer for supplement) with pasture renovation costs of $15/ha/5 years included then profitability is lower. (IRR = 14.8%, PBP = Never). Gross margin gain/ha, however, is higher at $57 i.e. the reduced IRR has resulted from increased herd build up investment. It follows then, as a short term policy, in periods of drought when unimproved pasture is ovestocked that improved pasture is more profitably grazed at very high stocking rates. This conclusion assumes, of course, that pasture is rejuvenated after the period of excessive grazing, but unfortunately this is not always so. The policy of very high grazing pressure could also be justified when the improved pasture is only a small proportion of the total property and can be utilised without permanent investment in herd build up.

Taxation If a constant 30 per cent average tax rate is assumed, with total improvement costs written off in equal instalments over 10 years, and an after tax interest rate of 10 per cent used then IRR is 16.7 per cent and PBP nine years. The tax rate has the effect of reducing initial investment in herd build up and residual value of herd build up by 30 per cent. Annual cash flows are adjusted downward by the tax and upward by the tax saving value of the establishment cost write off. If the total improvement cost is written off against income in the first year and constant average tax rates of 30 per cent are used then this also has little effect on results (IRR = 16.6%, PBP = 10 years). In reality tax rates are seldom constant and there is an incentive to invest in herd build up and pasture improvement with maximum "write off" in years of high taxable income.

Seeding rate Experience at "Wrotham Park" (Eyde and Gillard 1985) has demonstrated a trade off between seeding rate of Stylos and animal productivity in the initial years. To test the effect of seeding rate on profitability, seeding rate was reduced from 3kg/ha to 1 kg/ha and fertiliser held at the same level. With lower seeding rates animal production (stocking rate and liveweight gain) was assumed to build up over 3 years. This analysis increased profitability slightly to IRR = 16.0 per cent and PBP = 15 years.

Phosphorus supplementation Recent experimental work at Townsville by CSIRO (Gillard and Coates 1984) has indicated the possibility of achieving higher animal liveweight gains from animals supplemented with phosphorus on unfertilised native pastures oversown with Verano and Seca stylos. While these results are somewhat tentative it is worth some analysis using likely parameters. Assume stocking rate was increased to 0.4 steers/ha as for fertilised pasture but a liveweight gain increase from 100 kg to 115 kg/steer was used (50 per cent of the increase used for fertilised pasture of 30 kg). Phosphorus supplement cost of $7/steer/year was used and no fertiliser applied to the pasture. With other inputs held constant profitability was increased from the base model slightly (IRR = 15.1%, PBP = 15 years). This result is dependent however, on assumptions relating to increased stocking rate and animal liveweight gain. The work of Gillard and Coates, while demonstrating similar performance from animals on fertilised pasture is, however, based on similar stocking rates. The yield of unfertilised pasture was significantly lower than for fertilised pasture. Commercially then, the use of phosphorus supplements on unfertilised Stylo infused pasture may be reflected in stocking rates similar to native pasture with some increase in animal liveweight gain. In this analysis, if stocking rate is held the same and liveweight gain increased to 125 kg/steer then profitability is reduced (IRR = 4.7%, PBP = never). Combining low seeding rate, nil fertiliser and three year build up with phosphorus supplements yielded IRR = 11.7 per cent.

Taxation and herd build up The affect of taxation and herd build up investment on profitability is similar to that for CB(S/R). Excluding herd build up investment and taxation and using a before tax interest rate of 15 per cent results were IRR = 25.3% and PBP = 7 years.

Given the existing level of interest rates in the Australian economy, aand the rates of investment return demonstrated in this paper, graziers, in general, would be somewhat indifferent in their attitude to pasture improvement as an investment. This is especially so since this analysis has been "kind" to the technology in assuming a project life of 15 years and residual project values equal to one half the initial improvement cost.

Individual graziers have however profitably included pasture improvement in their management by using low cost establishment techniques, careful timing of pasture improvement and herd build up and good post establishment management of pastures.

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