Technical note

An economic comparison of three legume establishment technologies for speargrass dominant pastures

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Introduction

Beef production in the speargrass dominant (*Heteropogon contortus*) region of southern Queensland is subject to strong economic pressures, due to increasing production costs relative to prices received, and inherent low productivity of native pastures. Significant production gains are possible when these pastures are improved by the introduction of suitable legume species together with appropriate pasture management. However, the low capital value of the pastures combined with climatic and market risk, requires that such improvement be low cost and able to withstand the risk of occasional establishment failure.

A benefit-cost analytical approach (MacLeod & Johnston 1990) is applied to a representative example of three techniques for the establishment of legumes into speargrass pastures. These include two conventional pasture improvement techniques, (i) a fully cultivated seedbed (FCS), and (ii) surface-broadcast sowing (SBS); as well as (iii) BandSeeding (BS), a new technique developed to overcome shortcomings that exist with conventional pasture establishment techniques applied to sub-tropical rangeland areas. A simple sensitivity test was conducted to examine the impact of a complete establishment failure on the economic outcome for each treatment. For this exercise, the initial treatment cost was incurred

in each of the first two years and livestock production responses were lagged by one year. The analysis presents a 'private' economic evaluation of the relative efficiencies of the three techniques to landholders rather than an overall 'social' assessment of their respective merit.

Assumptions

The analysis for each treatment is based on 15 year cash flows for a steer fattening enterprise. The unit is a single paddock, and results are presented on a per hectare basis. This marginal approach is justified by both data limitations and the heterogeneity of pastoral enterprises in the southern speargrass region. These constraints limit the generality of a 'typical' enterprise required for a whole-property case study.

Standard evaluation measures of net present value (NPV), benefit-cost ratio (B/C), internal rate of return (IRR) and discounted payback period (PBP) are calculated for each option (MacLeod and Johnston 1990). A discount rate of 10 percent is used to calculate net present value, benefit-cost ratio and the payback period. This rate was seen to be appropriate to real market rates at the time of writing, and sensitivity of the results to different discount rate assumption can be inferred from the size of the respective IRR calculations.

Detailed budgets for the initial treatment cost for each establishment technique are reported elsewhere (Walsh, Cook and Page 1990), and a summary is presented in Table 1. The total cost per hectare includes direct costs of materials and all field operations, labour and a proportion of machinery ownership costs directly attributed to the pasture development options. Livestock budgets are based on the purchase of beef steers for fattening at a starting weight of 330 kg. Specific assumptions used to derive net livestock returns for the 15 year cash flow analyses are summarised in Table 2.

Table 1. Establishment costs for three alternative pasture establishment techniques

Item	Treatment[1] FCS	SBS	BS
	($/ha)	($/ha)	($/ha)
Seed-legumes	35.50	35.50	13.65
-grass	18.00	0.00	0.00
Fertiliser	27.00	27.00	10.53
Chemicals	0.00	0.00	13.50
Machinery[2]	43.79	5.41	12.77
Labour and overheads	45.03	4.02	17.42
Total Establishment Costs	169.32	71.93	67.87

[1] FCS = fully cultivated seedbed
SBS = surface-broadcast sowing
BS = BandSeeding
[2] Proportion allocated to pasture establishment.
Source: Walsh, Cook & Page (1990)

Table 2. Assumptions used to construct cash flow budgets

Treatment[1]	Unimproved native pasture	Established pasture FCS	SBS	BS
Stocking rate (b/ha)	0.30	1.00	0.80	0.80
Price finished ($/kg)	1.25			
store ($/kg)	1.35			
Store weight (kg/hd)	330			
Annual cost ($/hd)	24.63			
Annual gain (kg/hd)	100	170	150	150
Annual gain (kg/ha)	30	170	120	120
Gross margin ($/hd)	100.37	187.87	162.87	162.87
Gross margin ($/ha)	30.11	187.87	130.30	130.30
Pasture cost ($/ha)[2]		27.11	27.11	27.11
Land value ($/ha)[3]	200.00	350.00	300.00	300.00
Years to full development		4	8	5

[1] FCS = fully cultivated seedbed
SBS = surface-broadcast sowing
BS = BandSeeding
[2] Fertiliser spread in years 3 & 7
[3] Used to terminate the cash flow analysis in year 15

Results

Results for each of the legume establishment techniques are presented in Table 3. Because the analysis is based on a combination of quantitative and qualitative data the conclusions must remain indicative rather than definitive. The analysis shows that each of the techniques is economically feasible (ie. each has a positive NPV). For cases in which development capital available to landholders is not limiting, and/or site conditions allow its selection, a fully cultivated seedbed is superior to the other options (ie. has the highest NPV). However, BandSeeding is reasonably competitive with the fully cultivated seedbed, and does perform significantly better than the surface-broadcast sowing option. For cases where

Table 3. Results of economic analysis

Method[1]	Net Present Value[2]	Benefit-cost Ratio[2]	Internal Rate of Return	Payback Period[2]
(a) Initial Establishment Success				
FCS	$565/ha	1.7	27.6%	7 years
SBS	$223/ha	1.9	21.6%	10 years
BS	$407/ha	2.4	30.6%	6 years
(b) Initial Establishment Failure				
FCS	$284/ha	1.2	16.6%	12 years
SBS	$112/ha	1.4	14.9%	14 years
BS	$267/ha	1.8	20.8%	9 years

[1] FCS = fully cultivated seedbed
SBS = surface-broadcast sowing
BS = BandSeeding
[2] Discount rate used for the analysis is 10%

development capital is limiting or landholders are relatively risk averse, BandSeeding is particularly attractive (ie. higher B/C, IRR and shorter PBP). This conclusion holds for the case where allowance is made for the possibility of an initial establishment failure. Therefore, BandSeeding is seen to be an economically robust option.

Conclusion

An exploratory economic assessment was conducted for three legume establishment options, including the recently developed technique of BandSeeding. Each option was seen to be economically robust, in the sense that conventional investment appraisal criteria yielded positive scores (NPV > 0, B/C > 1, and IRR > market interest rates) under the assumed factor levels, including the extreme event of a complete establishment failure.

Where development capital is limiting, or for field conditions which are not amenable to full seedbed establishment techniques, BandSeeding is an attractive investment. These conditions would seem to apply to a significant area of the speargrass dominant region of the sub-tropical rangelands, and so the technique offers considerable scope for expanding the area of sown legume pastures.

References

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