UPDATED BUDGETARY COMPARISONS BETWEEN PANGOLA GRASS/ LEGUME PASTURE AND NITROGEN FERTILIZED PANGOLA PASTURE FOR BEEF PRODUCTION IN THE SOUTHERN WALLUM

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ABSTRACT

A revised budgeting technique incorporating the latest available data is used to compare investment opportunities on the Wallum for beef fattening on Pangola grass with legumes, with 168 *kg N/ha/yr* (150 *lb N per acre*), *or with* 448 *kg N/ha/yr* (400 *lb N per acre*). *The main reasons for updating the original paper are to examine the effects of the recent increases in beef prices as well as other influences which have created a new cost input/price output regime, the now almost complete absence of seasonality effects on local beef prices, and the changes in land use opportunities and thus the market values of undeveloped Wallum land. Unlike the initial budgets, no cashing in of the land assets is assumed at the end of the twenty year period. As previously noted, all alternatives require large investments and are high cost, high turnover systems with attractive internal rates of return of* 9.7% *for legumes,* 11.3% *for* 168 *kg N, and* 12.9% *for* 448 *kg N at a beef price of* $0.88 *per kg* ($0.40 *per lb*). *The internal rates of return can be increased significantly by reducing KCl input to half* (125 *kg/ha/yr*). *At full fertilizer rates and a beef price of* $0.88/*kg, payback period ranges from fifteen to eighteen years, while the peak deficit on* 546 *ha reaches* $550,000 *for the* 448 *kg N system.*

All budgets are very sensitive to beef price and cost changes.

INTRODUCTION

Land development for beef production in the southern Wallum has been based principally on grass/legume pastures and as a consequence, published economic studies have been based on evaluating this type of pasture (Moore 1967, McGuire 1968, and McCarthy *et al* 1970).

Grazing trials to date have clearly indicated that high stocking rates of beef cattle can be attained from nitrogen fertilized pure grass stands (Evans 1969). A direct comparison of nitrogen and legumes from a Beerwah grazing trial conducted by C.S.I.R.O. (Bryan and Evans 1971) provided the basic data required for the initial evaluation of the two systems. An economic analysis (Michell, Bryan and Evans 1972) found all of the systems to have low internal rates of returns and very long, if not infinite payback periods. The authors did point out, however, that the budgets were sensitive to beef prices and cost changes. Since the initial budgets were calculated, beef prices have risen considerably and have thrown a completely different light on to the evaluation of the systems as investment propositions.

The experimental grazing trial compared three treatments for fattening beef cattle:

1. Pangola grass with a relatively low annual nitrogen input of 168 kg N/ha (Low N).
2. Pangola grass with a high annual nitrogen input of 448 kg N/ha (High N).
3. Pangola grass with legumes.

The respective annual mean liveweight gains were 699 kg/ha, 1106 kg/ha and 507 kg/ha. In this paper the physical inputs and outputs found to apply in these experimental treatments are used for an appraisal of the three management systems of continuous grazing.

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1. *Cost assumptions*

The same contract clearing and initial land preparation treatments together with the basal establishment and fertiliser costs have all been adjusted to April 1973 prices by B.A.E. price index numbers.

Maintenance fertilizer consisting of 500 kg of superphosphate and 250 kg of potassium chloride/ha/yr, as in the experiment, is assumed to be applied in all systems at the costs of $23/tonne delivered for super and $77/tonne for muriate of potash. The costs of application are included in the contract labour component.

Seed costs for the legume budget amount to $26.78/ha. Pangola runners for all systems are obtained from an initial propagation plot established in the first year of operation. The assumptions regarding plant and machinery are updated by charging the appropriate increase in cost to the individual items. A sinking fund provides for the replacement of capital items.

2. *Beef prices and livestock assumptions*

Fifteen to eighteen months old store cattle averaging 272 kg liveweight are assumed to be purchased at a price per kg which gives a zero market margin between fat cattle and stores, after allowing for freight to the property.

Because of the absence of seasonal patterns of beef prices at local markets, the cattle would be sold on finishing, regardless of time of year.

The dressing out percentage of 52% is retained in calculating dressed weight. Meat from all treatments was predominantly first grade; consequently, fat cattle price is varied from $0.66/kg d.w. to $0.88 per kg d.w. at Cannon Hill, the main Brisbane market outlet. Calculations based on the top of this range ($0.88/kg) are presented since average prices for fat bullocks have not dropped below this figure since March 1973.

Selling costs including commission and levies are deducted from the gross sale price.

Assumed stocking rates are based on the experimental trial but are adjusted for the period of pasture establishment.

3. *The development alternatives*

The basal and annual superphosphate and potassium chloride dressings are common to all budgets. The timing of development remains the same as in the previous budgetary analysis.

ANNUAL OPERATING COSTS

Six main categories of annual operating costs viz. labour, pasture maintenance, livestock costs, repairs, sinking fund and other materials and services are used, priced at 1973 levels. Over the development period, costs naturally vary from year to year but remain constant after the eighth year.

Pasture maintenance costs are by far the largest proportion of operating costs, especially in the nitrogen budgets.

BUDGET COMPARISONS

Table 1 sets out the annual cash flows over the development period for the three budgets using fat beef prices of $0.66, $0.77, and $0.88 per kg dressed weight.

Annual Gross Income is total sales less selling costs (outward freight, commission, levies etc.). Annual cash balances are analysed by discounted cash flow techniques to allow comparisons of the different investments to be made. Zero initial equity is assumed in calculating peak deficits and payback periods.

TABLE 1(a)

Annual cash flow at beef prices of $0.66/kg for the three budgets

	Year 1	2	3	4	5	6	7	8	9
BUDGET No. 1—									
Pangola/Legumes	$	$	$	$	$	$	$	$	$
Gross income	—	—	19,922	62,159	113,693	165,357	216,892	248,504	257,932
Develop	45,169	24,320	19,653	19,653	24,772	10,297			
Op. costs	6,076	7,380	14,853	23,088	33,839	42,094	48,874	50,312	50,312
L/stock purch.	—	12,159	36,572	73,145	109,810	146,382	170,795	183,048	183,048
Net outflow	51,245	43,859	71,078	115,886	168,421	198,773	219,669	233,360	233,360
Annual cash bal.	—51,245	—43,859	—51,156	—53,727	—54,728	—33,416	—2,777	15,144	24,572
BUDGET No. 2—									
Pangola/Low N									
Gross income	—	—	18,435	62,315	129,568	196,877	264,186	313,103	336,543
Develop	45,605	24,789	20,093	25,501	20,093	10,668			
Op. costs	6,078	12,433	24,559	40,256	53,455	66,645	73,996	75,648	75,648
L/stock purch.	—	14,497	43,588	87,268	130,948	174,630	203,813	218,404	218,404
Net outflow	51,683	51,728	88,240	153,025	204,496	251,943	277,809	294,052	294,052
Annual cash bal.	—51,683	—51,728	—69,805	—90,710	—74,928	—55,066	—13,623	19,051	42,491
BUDGET No. 3—									
Pangola/High N									
Gross income	—	—	28,281	95,943	184,987	273,885	362 784	423 402	444,639
Develop	45,672	24,959	20,254	26,169	20,254	10,762			
Op. costs	6,080	20,538	40,313	64,223	85,567	106,901	115,274	117,509	117,509
L/stock purch.	—	18,987	56,963	114,113	171,170	228,225	266,294	285,376	285,376
Net outflow	51,752	64,485	117,530	204,505	276,991	335,126	381,568	402,885	402,885
Annual cash bal.	—51,752	—64,485	—97,276	—108,562	—92,004	—61,241	—18,784	20,517	41,754

TABLE 1(b)

Annual cash flow at beef prices of $0.77/kg for the three budgets

	Year 1	2	3	4	5	6	7	8	9
BUDGET No. 1—									
Pangola/Legumes	$	$	$	$	$	$	$	$	$
Gross income	—	—	23,061	71,950	131,602	191,404	251,055	287,647	298,560
Develop	45,169	24,320	19,653	19,653	24,772	10,297			
Op. costs	6,076	7,380	14,853	23,088	33,839	42,094	48,874	50,312	50,312
L/stock purch.	—	14,074	42,333	84,666	127,107	169,440	197,698	211,881	211,881
Net outflow	—	45,774	76,839	127,407	185,718	221,831	246,572	262,193	262,193
Annual cash bal.	—51,245	—45,774	—53,778	—55,457	—54,116	—30,427	4,483	25,454	36,367
BUDGET No. 2—									
Pangola/Low N									
Gross income	—	—	21,339	72,130	149,977	227,888	305,799	362,422	389,554
Develop	45,605	24,798	20,093	25,501	20,093	10,668			
Op. costs	6,078	12 433	24,559	40.256	53,455	66,645	73,996	75,648	75,648
L/stock purch.	—	16,781	50,454	101,014	151,574	202,137	235,917	252,806	252,807
Net outflow	—	54,012	96,106	166,771	225,122	279,450	309,913	328,454	328,455
Annual cash bal.	—51,683	—54,012	—74,767	—94,641	—75,145	—51,562	—4,114	33,968	61,099
BUDGET No. 3—									
Pangola/High N									
Gross income	—	—	32,735	111,055	214,125	317,026	419,928	490,095	514,676
Develop	45,672	24,959	20,254	26,169	20,254	10,762			
Op. costs	6,080	20,538	40,313	64,223	85,567	106,901	115,274	117,509	117,509
L/stock purch.	—	21,977	65,936	132,088	198,131	264,174	308,240	330,327	330,327
Net outflow	51,752	67,474	126,503	222,480	303,952	381,837	423,514	447,836	447,836
Annual cash bal.	—51,752	—67,474	—93,768	—111,425	—89,827	—64,811	—3,586	42,259	66,840

TABLE 1(c)

Annual cash flow at beef prices of $0.88/kg for the three budgets.

	Year 1	2	3	4	5	6	7	8	9
BUDGET No. 1—Pangola/Legumes	$	$	$	$	$	$	$	$	$
Gross income	—	—	26,575	82,916	151,659	220,576	289,319	331,488	344,064
Develop	45,169	24,320	19,653	19,653	24,772	10,297			
Op. costs	6,076	7,380	14,853	23,088	33,839	42,094	48,874	50,312	50,312
L/stock purch.	—	16,219	48,784	97,570	146,479	195,264	227,829	244,174	244,174
Net outflow	51,245	47,919	83,290	140,311	205,090	247,655	276,703	294,486	294,486
Annual cash bal.	—51,245	—47,919	—56,715	—57,395	—53,431	—27,079	12,616	37,002	49,578
BUDGET No. 2—Pangola/Low N									
Gross income	—	—	24,591	83,124	172,835	262,621	352,406	417,659	448,926
Develop	45,605	24,798	20,093	25,501	20,093	10,668			
Op. costs	6,078	12,433	24,559	40,256	53,455	66,645	73,996	75,648	75,648
L/stock purch.	—	19,339	58,143	116,410	174,676	232,945	271,873	291,336	291,337
Net outflow	51,683	56,570	102,795	182,167	248,224	310,258	345,869	366,984	366,985
Annual cash bal.	—51,683	—56,570	—78,204	—99,043	—75,389	—47,637	6,537	50,675	81,942
BUDGET No. 3—Pangola/High N									
Gross income	—	—	37,724	127,981	246,760	365,344	483,929	564,790	593,119
Develop	45,672	24,959	20,254	26,169	20,254	10,762			
Op. costs	6,080	20,538	40,313	64,223	85,567	106,901	115,274	117,509	117,509
L/stock purch.	—	25,327	75,985	152,219	228,355	304,437	355,219	380,672	380,672
Net outflow	5,175	70,824	136,552	242,611	334,176	422,100	470,493	498,181	498,181
Annual cash bal.	—5,175	—70,824	—98,828	—114,630	—87,416	—56,746	13,436	66,609	94,938

TABLE 2

Budget results for three beef prices

	Unit	Pangola/Legumes	Pangola/Low N	Pangola/High N
A. With beef price $0.66/Kg d.w.				
Internal rate of return	%	3.14	4.91	3.12
Payback period	Yrs.	∝	33	∝
Peak deficit	$'000	∝	550	∝
Post development:				
—Gross income	$'000	258	337	445
—Net income	$'000	25	42	42
B. With beef price $0.77/Kg d.w.				
Internal rate of return	%	6.60	8.30	7.35
Payback period	Yrs.	25	21	22
Peak deficit	$'000	387	537	350
Post development:				
—Gross income	$'000	299	390	515
—Net income	$'000	36	61	67
C. With beef price $0.88/Kg d.w.				
Internal rate of return	%	9.66	11.32	12.90
Payback period	Yrs.	18	16	15
Peak deficit	$'000	383	536	550
Post development:				
—Gross income	$'000	344	449	593
—Net income	$'000	50	82	95

All the budgets (particularly the high N system) reflect, by Australian grazing standards, high cost—high turnover systems. To illustrate this point, net incomes after development are as high as \$70/ha, \$110/ha, \$156/ha with beef prices at \$0.66/kg, \$0.77/kg and \$0.88/kg respectively. Peak deficits reach a high of \$905/ha which are due to an accumulation of development expenditures occurring prior to the returns building up.

Comparing the three budgets (Table 2) at the \$0.88/kg beef price, the best economic performance is given by the high N system. It is noted that all three budgets have finite payback periods, being 18 years, 16 years and 15 years, for budgets 1, 2 and 3 respectively, while the peak deficit ranges from \$383,000 for legumes to \$550,000 for the high N system.

Calculated internal rates of return (I.R.R.) at a price of \$0.88/kg appear very attractive: 9.7% for legumes, 11.3% for low N and 12.9% for high N, I.R.R. being that rate of return that brings the accumulated annual cash balances at present worth to zero.

The effects on the budgets of changes in beef price is shown in Figure 1.

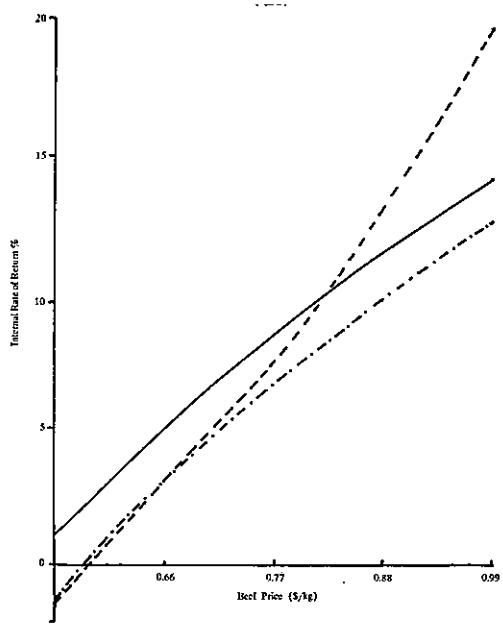

FIGURE 1

Effect of beef price on internal rate of return for the three pasture systems.

——— Low N
— — — High N
—·—·— Legumes

As indicated by the steepness of the lines in Figure 1, the outcomes of the budgets measured by I.R.R. are very sensitive to changes in the product price and this is far more important than the associated changes in the cost of store cattle. The high nitrogen budget is by far the most sensitive to beef price changes as indicated by the

slope of the curve. At low beef prices e.g. \$0.55/kg, the low N system provides the highest return, the other systems showing negative I.R.R.'s. At this low price, the input costs for the high nitrogen budget outstrip returns by a considerable margin. As beef price increases, I.R.R. for the low N and legume budgets increase at a very similar rate whereas I.R.R. for the high N system rises at an accelerated rate. At about \$0.69/kg beef price, the rate of return for the legume and high N budgets would be approximately 4.9% but at \$0.77/kg, the figures become 6.6% for legumes and 7.4% for the high N system. Above \$0.84/kg the I.R.R. for the high N system is greater than that for the low N system and continues to increase at a greater rate than the other two budgets, which clearly illustrates the response to the higher beef prices (increasing returns to the marginal input).

POSSIBILITY OF COST REDUCTIONS

All the budgets are high cost systems. In an economic analysis of another Beerwah grazing experiment (Firth, Evans and Bryan unpublished data), a lower fertilizer input of 250 kg of superphosphate and 63 kg of potassium chloride/ha/year on grass-legume pasture stocked at a lower rate of 1.65 beasts/ha was assessed at internal rates of return of up to 20% depending on the value placed on undeveloped land. Although productivity in terms of liveweight gain per hectare were considerably below that from pangola-legumes in this trial, the lower level of inputs led to significantly lower cost systems.

There is evidence (Evans and Bryan 1973) that potassium chloride maintenance dressing could be halved without unduly affecting production. A reduction in annual cost of \$15.38/ha from the reduced KCl input results in an increase in I.R.R. of about three percentage points. At \$0.88/kg beef price, the results of between 12–16% indicate a very attractive system; at \$0.77/kg beef price the returns are also attractive at 8–10%; while at the low \$0.66/kg beef price the system is only marginal with returns between 2–8%. The saving in cost on reduced maintenance fertilizer input tends to favour the legume budget and brings it closer to the low N system.

In comparing returns from the budgets in this paper with other investment opportunities, it must be remembered that the internal rates of return calculated here assume no cashing in of assets at the end of the period, because of the difficulties of assuming a future land value. I.R.R. is not strictly comparable with other rates of return e.g. returns to capital or debenture rate of earning; it is based on the assumption that net benefits are immediately reinvested.

Peak deficit and repayment periods (Table 2) are based on zero initial equity—a standardising assumption which regards all capital involved in the system as attracting interest charges. In practical terms, investors would no doubt commence the operation with different amounts of starting capital and this would influence both the peak deficit and payback periods. The payback period is the number of years required to get out of debt, which in the case of the assumption of zero starting equity involves full reimbursal of all capital involved.

MARKET VALUE OF UNDEVELOPED WALLUM LAND

It is difficult to apply a generalised market value to Wallum land for the purposes of budgetary analysis. Normally, this component is treated as a residual. However, different internal rates of return have been graphed against a range of land values (Figure 2). A beef price of \$0.77/kg was assumed. At zero undeveloped land values the I.R.R.'s as shown in Table 2 still apply. As land values increase, so I.R.R.'s decline. For example, Budget No. 1 (legumes) returns only 2% at a land value of \$330/ha. The same system returns a little over 4% at a land value of \$124/ha. No cashing in of assets is assumed at the end of the project in this exercise.

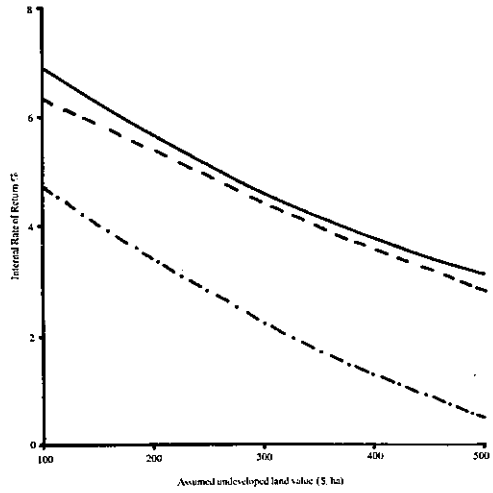

FIGURE 2

The effect of undeveloped land value on profitability of three pasture systems at beef price of $0.77/kg.

——— Low N
— — — High N
—·—·— Legumes

The curves, especially for the high N budget, illustrate the relatively small effect the land input has on the high input cost systems. The slope of the curve for the legume budget is considerably steeper than the other two, indicating that land value is a larger component in the cost system. At a currently more realistic beef price of $0.88/kg, the curves would shift bodily upwards, showing higher returns at all levels of land values.

DISCUSSION

Common features of the three budgets presented are high costs, large peak deficits and fairly long repayment periods. To counteract this, beef production is high and at present ruling beef prices returns on investment are attractive.

The budgets are extremely sensitive to prices received for fat stock. The higher the N level (and consequently the higher the stocking rate) the more sensitive is the budget. At $0.88/kg, the budgeted investment return is 12.9% I.R.R. for the high N system, 11.3% I.R.R. for the low N, and 9.7% I.R.R. for legumes (Table 2). Reducing the maintenance KCl fertilizer input by a half increases these I.R.R.'s by nearly three percentage points. These high returns, due to the prevailing beef prices, are well above those of previous economic analyses (McCarthy *et al* 1970, Michell, Bryan and Evans 1972) which used beef prices of $0.58 to $0.60/kg.

The findings of this paper verify the conclusions of Michell, Bryan and Evans (1972) who emphasised the response of I.R.R. to changing beef prices. Since their paper was written, fat beef prices have risen approximately 47%. Fortunately for the producer, the cost of the inputs necessary for the particular production systems have not increased proportionately. At present day beef prices, all three budgets appear attractive as investment opportunities, provided the market value of the land is not forced to prohibitive levels.

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