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 budgeting technique is used to compare investment opportunities for beef fattening in the Wallum of pangola grass with legumes, or with 168 kg N/ha/yr (150 lb N/ac), or with 448 kg N/ha/yr (400 lb N/ac). All alternatives require large investments and are high cost, high turnover systems with low internal rates of return of 2.8% for legumes, 4.5 % for 168 kg N, and 2.6 % for 448 kg N at a beefprice of $0.60 per kg ($0.27 per lb). The internal rates of return can be increased to 5.4, 6.3 and 4.2% respectively by reducing KC1 input to half (125 kg/ha/yr). At full fertilizer rates and a beef price of $0.60 per kg income is insufficient to cover interest in the case of legume based pastures and at 448 kg N; at 168 kg N the peak deficit on 546 ha (1350 ac) is nearly $500,000 and the pay back period is 36 years. The budgets are sensitive to beef price and cost changes.

Taking into account taxation considerations an investor with a non-farm income would be better off to invest in a debenture stock investment yielding 9% per annum than investing in Wallum land development in terms of net terminal pay off after taxation. However, primary producer taxation concessions combined with a large non-farm income over a long period would lead to a higher pay off in the case of legumes and with 168 kg N than non-farm investment yielding 9% per annum. The lower cost legume investment also has a marginally higher net ultimate "sell up" value than the nitrogen ones.

INTRODUCTION

Land development for beef production in the coastal lowland (Wallum) country of south eastern Queensland has almost without exception been based on grass/legume pastures. Most technical research by C.S.I.R.O. at Beewah and the Queensland Department of Primary Industries at Coolum and all published economic studies (Moore 1967; McGuire 1968; McCarthy et al 1970) have concentrated on evaluating this type of pasture.

Experimental grazing trials in the southern Wallum area have indicated that high production of beef is possible from nitrogen fertilized pure grass stands. Evans (1969), for example, has stocked pangola grass at 7.4 beasts/ha and obtained up to 1,275 kg/ha live weight gain per annum. A direct comparison of nitrogen and legumes in a recently finalised Beerwah grazing trial conducted by C.S.I.R.O. (Bryan and Evans 1971) has provided the basic data required for an economic evaluation of the two systems. The trial compared three treatments:

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, 1,106 kg/ha and 507 kg/ha.

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This paper uses the inputs and outputs of these experimental treatments for an appraisal of the three systems as investment alternatives.

DEVELOPMENT ALTERNATIVES AND ASSUMPTIONS

Although many different livestock management systems can be and are practised on Wallum country, it was decided to limit this investigation to the fattening of purchased store cattle, mainly because this permitted the direct application of the experimental results. In all of the budgets the following apply:

1. *Description of the property*

The property is assumed to be a development block of 607 ha (1,500 ac) situated on low rolling ridge type country (e.g. the Glass House landscape of Coaldrake (1961)) in the southern Wallum. Of this area 90% is assumed available for year round grazing, the balance is allocated for house, sheds, yards and holding paddock, access roads and lanes and as undeveloped areas in paddocks for shade clumps, water points or for being too rough or low lying.

2. *The development programme*

The development programme is assumed to extend over 6 years, an average of 109 ha a year being sown down in years 2 to 6.

In the first year, an additional 20 ha is cleared for house and yard areas, while the construction of a manager's residence, sheds, dips, yards, dams and fences is also commenced. Paddock size, and hence subdivisional fencing and water points, is assumed determined by the final stocking rate. For ease of stock handling and management, a maximum herd size of 200 head per paddock is set.

In subsequent development years an additional area of 109 ha is cleared along with required dam and fence construction, while the area cleared in the previous very specific. This must contribute to poor establishment in rough conditions. approximately three months after planting. Provision for additional permanent labour to the manager and casual labour for some jobs is dependent on stock numbers. Additions to stock yards are also dependent on stock numbers.

The build up of stock continues until year 8 when all the pasture is assumed to reach full productivity in terms of carrying capacity.

Table 1 shows development expenditures over the first six years for particular items.

3. *Cost assumptions*

Contract clearing and subsequent cleaning up is assumed to average $74/ha; the initial land preparation at $9.88/ha and the basal establishment and fertilizer at $36/ha applied (based on the use of "straights" rather than the more costly "Wallum mix"). Lime is not assumed to be applied. With the pure pangola systems, establishment nitrogen as ammonium nitrate is applied in two dressings totalling 84 kg N/ha and costed at $18.16/ha.

Maintenance fertilizer consisting of 500 kg of superphosphate and 250 kg of potassium chloride/ha/year as in the experiment is assumed in all systems and costed at $33.60/ha applied by contract.

Planting and seed costs of course depend on the system being used. Phasey bean (*Phaseolus lathyroides*) is assumed in all three to permit early grazing. Seed costs for the legume budget amount to $28.49/ha. Pangola runners for all are assumed to be supplied from an initial propagation plot established in the first year of operation. Plant and machinery assumed to be required in the first year include a 65 hp tractor, farm vehicle, trailer, front mounted blade, offset disc plough, pasture

TABLE 1

Wallum development expenditure

Expenditure Type	Year 1	2	3	4	5	6
	$	$	$	$	$	$
Clearing	10,950	8,100	8,100	8,100	8,100	—
Land Preparation	—	1,240	1,080	1,080	1,080	1,080
Planting Costs	—	465/(632)	404/(550)	404/(550)	409/(550)	409/(550)
Establishment fertiliser[1]	—	4,520/(6799)	3,937/(5922)	3,937/(5922)	3,937/(5922)	3,937/(5922)
Pangola Propagation Plot[1]	81/(406)					
Seed and pangola[1]	—	3,574/(1395)	3,113/(1215)	3,113/(1215)	3,113/(1215)	3,113/(1215)
Buildings	2,400	—	—	—	—	—
Accommodation[2]	7,000	—	—	—	3,000	—
Fencing[3]	2,706	578/(674) [757]	578/(674) [757]	578/(674) [757]	578/(674) [757]	578/(674) [757]
Water facilities[3]	980/(1040) [1100]	180/(240) [300]	180/(240) [300]	180/(240) [300]	180/(240) [300]	—
Yards and Dip[3]	2,280/(2280)[2280]	—	—	(1536)/[1984]	1,280	—
Plant and Machinery[2]	13,576	2,565	—	—	100	—
Horses[2]	—	300	—	—	150	—
Total Development Expenditure:						
—Legume Development	39,973	21,522	17,392	17,392	21,922	9,112
—Low, Nitrogen Development	40,358	21,945	17,781	22,567	17,781	9,441
—High Nitrogen Development	40,418	22,088	17,924	23,158	17,924	9,524

[1]Figures in brackets refer to nitrogen fertiliser budgets; [2]The year 5 expenditure shown is for the legume budget; with the nitrogen budgets this occurs in year 4; [3]Unbracketed figures for legumes, rounded brackets for low nitrogen and square brackets for high nitrogen.

roller and sundry necessary workshop and ancillary equipment; while in the second year a mower and seed drill are also assumed to be necessary. A sinking fund provides for the replacement of capital items (equal annual instalments for each item of capital to be replaced are invested at compound interest to enable replacement after a specified number of years).

4. *Beef prices and livestock assumptions*

Fifteen to eighteen months old store cattle averaging 272 kg (598 lb) live weight are assumed to be purchased at a price per kg dw equivalent to the assumed fat price adjusted for freight, plus a $0.08 kg dw margin ($4/100 lb). At the source the calculated cost per animal is $84.19 which is near the average price actually paid for the experimental animals. Inward freight is estimated at 2.4 c/beast/km over a distance of 320 km. Veterinary expenses cover items such as vaccinations, drenching and dipping.

Only one fattening period a year is adopted and the cattle are assumed to be sold in October, thereby gaining maximum advantage of the present seasonal pattern of beef prices. The final weight is in line with the experiment liveweight gains of the trial cattle. As there was no consistent difference in the dressing out percentages or grade of meat from slaughtering statistics kept for the different treatments, the average dressing percentage of 52% is used in calculating dressed weight. Meat from all treatments was predominantly first grade. Fat cattle price is based on an average of $0.60 per kg dw ($27/100 lb) at Cannon Hill, the main Brisbane market outlet. Price is however varied from $0.53 to $0.67 per kg ($24 to /30/100 lb) to test the sensitivity of the budgets to price variations. Selling costs, including freight, slaughter levy, buffalo fly tax and commission, are deducted from the gross sale price.

Assumed stocking rates and live weight gains (lwg) per head on pasture from the first to the third year after sowing are shown in Table 2. The stocking rates for the "fully" developed state (year 3) and annual lwg/hd are derived by averaging the last three years of the experimental period (1968 to 1970). In the first two years lwg/hd is based on the 1966 and 1967 average figures while stocking rates are assumed to be one third of the final rate in the first year after sowing and two thirds in the second year.

TABLE 2

Assumed stocking intensities and productivity in average lwg/hd/day by age of pasture

Age of Pasture	Pangola-Legume		Low N Pangola		High N Pangola	
	SR*	LWG	SR	LWG	SR	LWG
(yrs)	(B/ha)+	(kg/hd/day)	(B/ha)	(kg/hd/day)	(B/ha)	(kg/hd/day)
1	1.19	0 57	1.42	0.28	1.86	0.45
2	2.39	0.64	2.85	0.46	3.72	0.68
3	3.58	0.39	4.28	0.49	5.58	0.50

*SR = Stocking rate +B/ha=Beasts per hectare

5. *The Development Alternatives*

(a) (Budget No. 1) Pangola/Legumes

Corresponding to the grass-legume treatment of the trial, pangola is assumed to be planted with the following legumes: *Phaseolus lathyroides* (1.68 kg/ha), *Desmodium uncinatum* (1.12 kg/ha), *Desmodium intortum* (0.56 kg/ha), *Trifolium repens* (1.12 kg/ha), and *Lotononis bainesii* (0.28 kg/ha). The annual application of superphosphate/potassium chloride is twice the amount used in previous experiments (Bryan 1968). Productivity however is also higher, 3.6 beasts/ha producing 507 kg lwg/ha/year compared to 2.5 beasts/ha with about 330 kg lwg/ha/year.

(b) (Budget No. 2) Pangola—Low N

The system is based on a pure pangola grass stand maintained with 168 kg/ha of nitrogen applied as ammonium nitrate in split dressings to suit feed requirements. This fertilizer is in addition to the basal superphosphate/potassium chloride dressing common to all budgets. Ammonium nitrate costs amount to $34.69/ha applied by contract and increases the annual fertilizer bill to $69/ha. Productivity increases to nearly 700 kg/ha at a stocking rate of 4.3 beasts/ha.

(c) (Budget No. 3) Pangola—High N

This budget is similar to (b) except that the annual nitrogen dressing is 448 kg/ha, increasing the fertilizer cost to $123/ha but allowing a final stocking intensity of 5.6 beasts/ha and producing 1106 kg lwg/ha/year.

ANNUAL OPERATING COSTS

Main categories of annual operating costs over the development period for the three budgets are given in Table 3.

TABLE 3

Annual operating cost summary

Item	Years 1	2	3	4	5	6	7	8
	$	$	$	$	$	$	$	$
Budget No 1—Pangola/Legumes								
Labour	2,248	2,288	2,405	2,562	4,757	4,913	4,992	5,070
Pasture Maintenance	—	—	4,216	7,888	11,560	15,232	18,904	18,904
Livestock Costs	—	1,230	3,699	7,398	11,106	14,806	17,274	18,513
Repairs	578	781	824	840	943	954	954	954
Sinking Fund	1,115	1,238	1,247	1,254	1,295	1,326	1,326	1,326
Other Materials & Services	1,633	1,234	1,236	1,240	1,384	1,387	1,389	1,391
Total	5,574	6,771	13,627	21,182	31,045	38,618	44,839	46,158
Budget No 2—Pangola/Low N								
Labour	2,248	2,327	2,445	4,639	4,835	5,030	5,148	5,188
Pasture Maintenance	—	4,352	12,359	19,822	27,285	34,748	38,420	38,420
Livestock Costs	—	1,466	4,409	8,827	13,244	17,662	20,613	22,089
Repairs	580	785	831	943	962	975	975	975
Sinking Fund	1,115	1,241	1,250	1,320	1,330	1,337	1,337	1,337
Other Materials & Services	1,633	1,235	1.237	1,381	1,385	1,390	1,393	1,393
Total	5,576	11,406	22,531	36,932	49,041	61,142	67,886	69,402
Budget No 3—Pangola/High N								
Labour	2,248	2,327	2,484	4,757	4,992	5,227	5,384	5,501
Pasture Maintenance	—	11,327	25,409	38,947	52,485	66,023	69,695	69,695
Livestock Costs	—	1,920	5,761	11,541	17,312	23,082	26,932	28,862
Repairs	580	790	838	961	983	998	998	998
Sinking Fund	1,115	1,243	1,254	1,330	1,341	1,349	1,349	1,349
Other Materials & Services	1,633	1,235	1,238	1,384	1,389	1,395	1,398	1,401
Total	5,576	18,842	36,984	58,920	78,502	98,074	105,756	107,806

The labour component includes the salary of the overseer, casual labour for pasture establishment and some livestock operations and permanent hired labour when necessitated by expansion of stock numbers.

Pasture maintenance includes the annual 750 kg/ha of superphosphate/ potassium chloride and also nitrogen fertilizer in the case of the pure grass budgets.

Livestock costs cover veterinary expenditure and inward freight.

Repairs to fixed improvements and the sinking fund to replace some capital items are listed separately, while all other general operating costs such as rates, rent, insurance, accountancy, etc. are included in other materials and services.

Pasture maintenance costs dominate in all systems, especially the nitrogen budgets where it amounts to approximately two thirds of total operating costs, excluding livestock purchase.

BUDGET COMPARISONS

Table 4 sets out the calculated annual cash flows over the development period for the three budgets using a fat beef price of $0.60 per kg. 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 readily enable comparisons of the different investments. Zero initial equity is assumed in calculating peak deficits and payback periods.

It is apparent from the results presented in Tables 4 and 5 that all budgets reflect high cost—high turnover systems, the very intensive high N system in particular. Although net incomes after development are high, up to $89/ha, the development expenditures required and the lag before returns build up lead to enormous peak deficits of $945/ha under the same situation.

Comparing the three budgets, budget 2 (low N) gives slightly the best economic performances of the three and at the medium beef price it is the only one with a finite payback period, although involving a peak deficit of nearly half a million dollars requiring 36 years to break even on the investment. With a beef price of $0.53/kg, incomes are insufficient to cover interest on the outstanding debts in all three budgets and hence total debts always increase with the passage of time. Even at a relatively high beef price of $0.67 kg repayment periods are estimated to be 28, 22 and 26 years respectively for budgets 1, 2 and 3. Peak deficits range from $346,000 for legumes up to $597,000 for high N.

Calculated internal rates of return (I.R.R.) at $0.60/kg are relatively unattractive; 2.8% for legumes, 4.5% for low N and 2.6% for high N. At $0.67/kg there is a marked improvement. Budget 2 is still the highest ranked (7.3%) but budget 3 (high N) is now slightly better than legumes (6.5% compared to 5.9%).

The effects on the budgets of changes in beef price and the price of store cattle (assuming fat stock prices remain steady at the $0.60/kg level) are shown in figures 1 and 2 respectively.

The steepness of the lines in both graphs indicate the sensitive nature of the outcome of the budgets (as measured by I.R.R.) to changes in product price and the cost of store cattle; only relatively small decreases in price or increase in cost of 'stores' would be needed to drive IRR's to zero. Conversely, as stores become cheaper or price of 'fats' increases returns improve rapidly. The very intensive high nitrogen input budget is rather more sensitive to beef price changes. As beef price increases it results in a higher IRR than legumes but falls below the legume returns as price drops. The results are slightly conservative in so far as the daily liveweight gains/head in years 1 and 2 (Table 2) were obtained from what proved to be inadequate nitrogen fertilizer application at the low N rate. At a more adequate N supply (168 kg/ha) daily gains could possibly increase by 0.1 kg/head, equivalent to about 32 kg extra beef over the two years.

TABLE 4

Cash flow summary for development period
(Beef Price $0.60/kg d.w.)

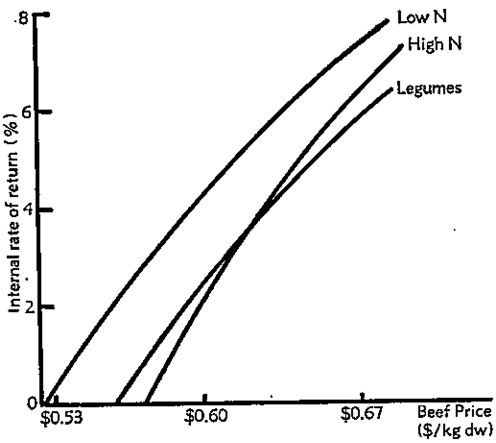
	Year 1	2	3	4	5	6	7	8	9
	$	$	$	$	$	$	$	$	$
Budget No. 1—Pangola/Legumes									
Development Expenditure	39,973	21,522	17,392	17,392	21,922	9,112	—	—	—
Operating Costs	5,574	6,771	13,627	21,182	31,045	38,618	44,839	46,158	46,158
Livestock Purchase	—	10,944	32,918	65,837	98,839	131,757	153,731	164,760	164,760
Net Outflow	45,547	39,037	63,937	104,411	151,806	179,487	198,570	210,918	210,918
Gross Income	—	—	17,932	55,949	102,334	148,837	195,222	223,676	232,162
Annual Cash Balance	−45,547	−39,037	−46,005	−48,462	−49,472	−30,650	−3,348	12,758	21,244
Budget No. 2—Pangola/Low N									
Development Expenditure	40,358	21,945	17,781	22,567	17,781	9,441	—	—	—
Operating Costs	5,576	11,406	22,531	36,932	49,041	61,142	67,886	69,402	69,402
Livestock Purchase	—	13,049	39,233	78,549	117,865	157,183	183,450	196,583	196,584
Net Outflow	45,934	46,400	79,545	138,048	184,687	227,766	251,336	265,985	265,986
Gross Income	—	—	16,593	56,089	116,623	177,207	237,791	281,821	302,919
Annual Cash Balance	−45,934	−46,400	−62,952	−82,009	−68,064	−50,559	−13,545	15,836	36,933
Budget No. 3—Pangola/High N									
Development Expenditure	40,418	22,088	17,924	23,158	17,924	9,524	—	—	—
Operating Costs	5,578	18,842	36,984	58,920	78,502	98,074	105,756	107,806	107,806
Livestock Purchase	—	17,090	51,272	102,712	154,068	205,423	239,689	256,864	256,864
Net Outflow	45,996	58,020	106,180	184,790	250,494	313,021	345,445	364,670	364,670
Gross Income	—	—	25,455	86,357	166,505	246,521	326,538	381,100	400,215
Annual Cash Balance	−45,996	−58,020	−80,725	−98,433	−83,989	−66,500	−18,907	16,430	35,545

TABLE 5

Budget results for three beef prices

	Unit	Budget No 1 Pangola/Legumes	Budget No 2 Pangola/Low N	Budget No. 3 Pangola/High N
A. *With Beef Price $0.53/kg dw*				
Internal Rate of Return	%	—	0.7	—
Payback Period	Yrs	∞	∞	∞
Peak Deficit	$'000	∞	∞	∞
Post Development:				
—Gross Income	$'000	206	269	355
—Net Income	$'000	12	24	18
B. *With Beef Price $0.60/kg dw*				
Internal Rate of Return	%	2.8	4.5	2.6
Payback Period	Yrs	∞	36	∞
Peak Deficit	$'000	∞	499	∞
Post Development:				
—Gross Income	$'000	232	303	400
—Net Income	$'000	21	37	36
C. *With Beef Price $0.67/kg dw*				
Internal Rate of Return	%	5.9	7.3	6.5
Payback period	Yrs	28	22	26
Peak Deficit	$'000	346	483	579
Post Development:				
—Gross Income	$'000	258	337	446
—Net Income	$'000	30	50	54

∞ = infinity



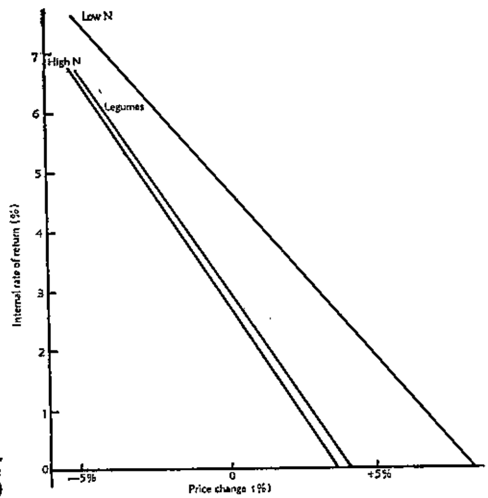


FIGURE 1 (left).
Effect of beef price on internal rate of return.

FIGURE 2 (right).
Effect of percentage change in price of store cattle on internal rate of return.

POSSIBILITY OF COST REDUCTIONS

As noted earlier all the budgets are high cost systems. In an economic analysis of another Beerwah grazing experiment (Evans 1970), 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 beast/ha was assessed at an IRR of about 11% at the medium beef price used here and with the actual experimental liveweight gains obtained. Although productivity in terms of liveweight gain per hectare is considerably below that from pangola/legumes in the higher fertilizer input trial, the lower cost leads to a lower peak deficit, shorter period of debt and a higher return on the investment.

From experience with another trial (Evans 1970) it is very likely that the potassium chloride maintenance dressing could be halved without unduly affecting production. Table 6 summarises the results of the revised budgets assuming a lower fertilizer input of 500 kg superphosphate and 125 kg potassium chloride/ha/year.

TABLE 6

The probable effect of reducing maintenance fertiliser input on budget outcome (500 kg Superphosphate/125 kg Potassium chloride/ha/year)

	Unit	Budget No. 1a Pangola/Legumes	Budget No. 2a Pangola/Low N	Budget No. 3a Pangola/High N
A. *With Beef Price $0.53/kg dw*				
Internal Rate of Return	%	1.7	2.8	—
Payback Period	Years	→	→	→
Peak Deficit	$'000	→	→	→
B. *With Beef Price $0.60/kg dw*				
Internal Rate of Return	%	5.4	6.3	4.2
Payback Period	Years	31	26	40
Peak Deficit	$'000	334	473	585
C. *With Beef Price $0.67/kg dw*				
Internal Rate of Return	%	8.1	9.0	7.4
Payback Period	Year	21	19	22
Peak Deficit	$'000	326	461	557

→ = infinity

The results demonstrate the relative sensitivity of this beef production system to pasture maintenance costs. A reduction in annual cost of $10.28/ha from the reduced fertilizer input results in an increase in I.R.R. of about two percentage points. At high beef prices the results indicate a relatively attractive investment, at the medium price the returns are marginally attractive; while at $0.53/kg the economics of the system are unworthy of consideration as an investment proposition. In comparing returns from the budgets in this paper with, for example, bank rates it is important to note that IRR calculated here assume no cashing in of assets at the end of the period. The effect of liquidating the investments would be to increase the estimated IRR by about one percentage point.

The saving in outlay on maintenance fertilizer represents proportionately more of a cost saving in the legume budget and as a result legumes and low N move closer together. At the lowest beef price there is little change from the basic budgets but at the $0.60/kg level all budgets have a finite repayment period and the payback period for low N is reduced by 10 years. With the highest beef price the legume investment is now slightly more profitable than high N but marginally below the low N system. Repayment periods and peak deficits are still high.

Peak deficits and repayment periods presented in Tables 5 and 6 were based on zero initial equity—an assumption which regards all capital involved in the system as attracting interest charges. Obviously, an investor with his own capital, in practical terms, would not have to pay interest on that capital contributed to the system by himself. Table 7 shows the effect of different levels of starting capital on the basic set of budgets. At the lowest beef price large amounts of starting capital are obviously required before a less than infinite repayment period is possible. However, at the highest equity level very short debt periods and low levels of peak debt occur. It is emphasised that the payback period is the number of years required to get out of debt but not reimburse the owner's initial starting capital. With higher initial capital there are substantial reductions in the period and peak level of indebtedness as a result of the lower overdraft requirements and subsequently lower interest bill.

TABLE 7

Repayment periods and peak deficits with different initial equity levels

Equity level	Legumes		Low N		High N	
	Payback period yrs	Peak Deficit $	Payback period yrs	Peak Deficit $	Payback period yrs	Peak Deficit $
A. *$0.53/kg Beef Price*						
Nil (from Table 5)	∞	∞	∞	∞	∞	∞
$50,000	∞	∞	∞	∞	∞	∞
$100,000	∞	∞	∞	∞	∞	∞
$250,000	8	3,000	15	129,000	>50	245,000
B. *$0.60/kg Beef Price*						
Nil (from Table 5)	∞	∞	36	499,000	∞	∞
$50,000	39	275,000	29	404,000	>50	524,000
$100,000	22	193,000	21	327,000	36	443,000
$250,000	8	na	12	115,000	16	215,000
C. *$0.67/kg Beef Price*						
Nil (from Table 5)	28	346,000	22	483,000	26	479,000
$50,000	21	268,000	20	413,000	22	483,000
$100,000	16	196,000	17	335,000	19	410,000
$250 000	7	na	11	115,000	12	201,000

na = no debt incurred ∞ = infinity

NON-RURAL INVESTOR AND TAXATION CONSIDERATIONS

Large amounts of capital have been shown to be required by anyone contemplating entering into any of the propositions described. It is likely that only those with large financial resources would be interested and prepared to take the risks. For this reason the analysis has been extended to include taxation implications in an attempt to gauge the profitability to an investor seeking primary producer tax concessions.

Taxation of course reduces cash returns but various provisions like averaging, carrying forward of losses, accelerated depreciation and investment allowances are extremely important (Edwards 1968). The provisions tend to attract business and professional men with high taxable incomes to invest in rural development projects; the contribution of tax savings can enhance such investments.

Three levels of non-farm taxable income are arbitrarily selected to give a range of results for different tax rates. This non-farm taxable income is not all available for investment; it is assumed that a certain amount is retained for living costs as set out in Table 8.

The general basic budget assumptions remain unaltered except where modification to fit in with taxation accounting is necessary. The sinking fund approach to capital is replaced with actual yearly depreciation calculations using special taxation rates where applicable. A beef price of $0.60/kg dw is used in the analysis.

Most development expenditure is deductible in the year of outlay (for example, clearing). Others like plant and machinery attract investment allowance and special depreciation.

TABLE 8

Non farm taxable income levels

Non farm taxable income	Assumed living costs	Amount available for investment
$	$	$
15,000	7,000	8,000
25,000	8,000	17,000
45,000	10,000	35,000

Averaging is used in determining tax liabilities but because of the high incomes involved the effects are small because the limits of the averaging provisions are soon exceeded with the combined farm and non-farm incomes. The first year of averaging is taken as the first year when taxable income is equal to or greater than the previous year. In most cases averaging can commence in year 2 since zero income is received for a number of years.

Market selling valuation is adopted in calculating livestock trading profits mainly because of simplicity of operation. Balancing charges arising from the sale of assets are assumed added to gross income.

In brief, an annual taxable income is derived by applying the current taxation legislation to the streams of cost and returns, including the non-farm taxable income. Tax payable plus provisional tax less any credit is then treated as a cash outflow, lagged one year. The effects of different forms of business organisation are not investigated and the analysis assumes an individual investor.

It is also a basic assumption that the property will be sold after a period rather than operated indefinitely as is usually assumed. In the year of sale, the property net worth or net sale value can be determined by adjusting the market value of the property for any outstanding debts or credits.

This payoff can then be compared with alternative investments, for example shares, debentures, fixed deposits, etc. Although there is obviously an optimum time for an investor to keep a property before investing in another block and developing that for a period and so on, this replacement problem has not been investigated. Instead, three time periods are arbitrarily selected, namely 10, 15 and 20 years, and the payoffs from the three land development alternatives compared with a fixed term debenture stock, yielding 9% p.a., at the end of each period.

Terminal values of the debenture investments are determined for the three levels of income and two starting capital levels by accumulating the annual investments with interest at 9% p.a. less taxation commitments.

Table 9 presents a comparison of the net payoffs from each type of investment for investors with different levels of starting capital and annual income available for investment.

Comparing first of all the three rural investments, it is clear that legume development is a better proposition than either of the two nitrogen fertilizer systems given this particular set of investment assumptions. The difference is particularly marked at low starting capital, low income levels and short investment horizons. In some cases the legume payoff is double that of low N while the high N system has a negative payoff in many of the examples examined.

The payoffs for legumes and low nitrogen are a lot closer with the longer 20-year horizon and high levels of annual income for investment but the N is still the inferior investment.

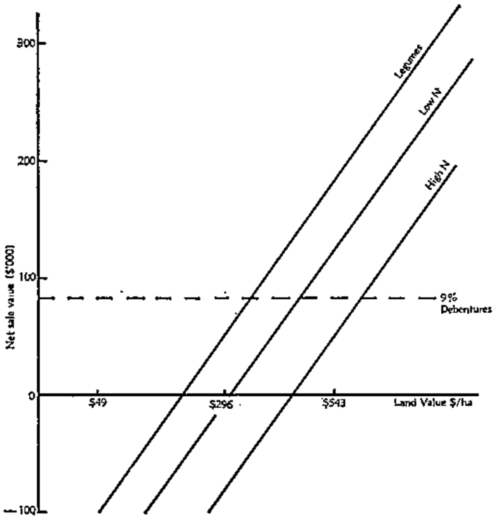
The non-farm investment is generally better than any of the land developments. The payoffs for legumes and low N are, however, greater at high levels of income and long horizons. The outcome of this comparison depends very much on the assumed market value of developed Wallum land. The figures in table 9 are based on a value of $296 a hectare for developed land. Selected sets from the above table have been graphed to illustrate break-even points in terms of land value. The first graph (figure 3), based on a starting capital of $50,000, $8,000 p.a. income for investment and a 10-year investment life, shows break-even land prices from $383 a hectare for legumes up to $605 for the high nitrogen system. At the other end of the scale in figure 4 the required land values per ha range from only $235 (legumes) to $432 (high N) with $100,000 starting capital, $35,000 a year income and a 20 year investment period.

TABLE 9

A comparison of investment payoffs after taxation

	Budget No. 1 Pangola/ Legumes	Budget No. 2 Pangola/ Low N	Budget No. 3 Pangola/ High N	Non-farm investment
	$	$	$	$
A. *Ten Year Investment Period*				
1. With $50,000 starting capital and:				
(i) $8,000 p.a.	37,073	—17,468	—85,830	79,845
(ii) $17,000 p.a.	66,197	12,547	—59,778	91,639
(iii) $35,000 p.a.	117,712*	59,499	—11,114	115,943
2. With $100,000 starting capital and:				
(i) $8,000 p.a.	108,748	45,203	—19,355	144,339
(ii) $17,000 p.a.	126,862	60,393	3,987	155,990
(iii) $35,000 p.a.	171,195	120,190	50,675	179,294
B. *Fifteen Year Investment Period*				
1. With $50,000 starting capital and:				
(i) $8,000 p.a.	75,500	12,207	—71,209	102,584
(ii) $17,000 p.a.	118,572	62,704	—14,114	126,740
(iii) $35,000 p.a.	199,856*	156,844	77,997	174,729
2. With $100,000 starting capital and:				
(i) $8,000 p.a.	142,898	88,933	12,660	175,698
(ii) $17,000 p.a.	185,860	136,616	62,679	199,692
(iii) $35,000 p.a.	257,913*	226,534	146,136	247,681
C. *Twenty Year Investment Period*				
1. With $50,000 starting capital and:				
(i) $8,000 p.a.	119,556	74,044	—41,650	128,063
(ii) $17,000 p.a.	178,725*	141,530	52,840	166,531
(iii) $35,000 p.a.	290,909*	268,590*	178,662	242,505
2. With $100,000 starting capital and:				
(i) $8,000 p.a.	194,145	159,334	55,929	211,247
(ii) $17,000 p.a.	252,084*	222,833	137,629	249,234
(iii) $35,000 p.a.	353,294*	343,789*	253,509	325,207

* = Equal to or better than non-farm investment.



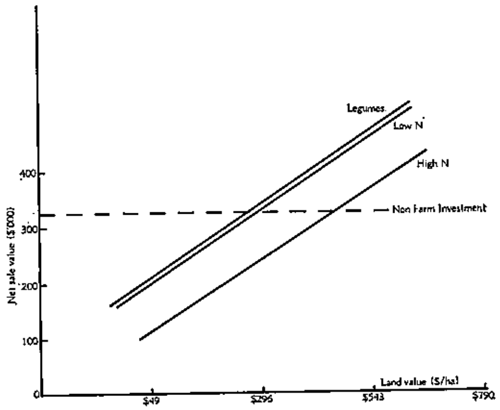


FIGURE 3 (left).
Effect of land value on net sale values ($50,000 *starting capital,* $8,000 *annual input of capital an* 10 *year horizon).*

FIGURE 4 (right).
Effect of land value on net sale values ($100,000 *starting capital,* $35,000 *annual input of capital an* 20 *year horizon).*

DISCUSSION

A common feature of the budgets is that although beef production is high, the investments lead to large peak deficits and long repayment periods. With a low beef price of $0.53/kg the deficit and payback period are infinite (Table 5). At this price initial owned capital of $250,000 is required before payback periods are substantially reduced (Table 7).

At $0.60/kg budgeted investment return is highest for the low N system (4.5% IRR) with legumes second (2.8% IRR) and the high N system marginally lower at 2.6% IRR (Table 5). Halving the experiment's input of KC1 increases these IRR's to 6.3, 5.4 and 4.2% respectively (Table 6). The IRR's for the mixed (legume) pasture compare reasonably with those of McCarthy et al (1970) of 5.9% and a V/C of 1.0 at a beef price of $0.58/kg. In both these cases no taxation concessions were considered.

The budgets are sensitive to the price received for fat stock (Tables 5, 6 and 7; Figure 1). With the lowest beef price used of $0.53/kg dw the IRR's are negative or near zero and interest on outstanding debt exceeds income (Table 5). Using a higher price of $0.67/kg the IRR's range from 5.9% for legumes to 7.3% for low N (Table 5) or, when less KC1 is applied (Table 6) the values are 8.1% for legumes and 9.0% for low N. Payback periods are still very long (19 to 28 years) and peak deficits high ($326,000 to $579,000) (Tables 5 and 6). The high N system is rather more sensitive to beef price than the other alternatives, as shown by the steeper slope of the curve in figure 1.

An investigation of primary producer taxation considerations for an investor with different levels of non-farm taxable income reveals that payoffs, determined by sale value of assets less outstanding debt, favour the legume alternative over the low N system, while the high N system is always a bad last (Table 9). When compared with the after tax payoff from a non-rural investment assuming a 9% p.a. return, these rural investments are inferior except with large non-farm taxable incomes and long time horizons.

These findings may be compared with those for two other pastoral proposals, one in the Northern Territory based on the use of Townsville stylo (McLintock 1970) and the other dealing with brigalow development (Holst and Robinson 1964). The latter authors estimated that, on the basis of 1250 head and a maximum estimated total deficit of $152,000 in year 8, the return to capital and management in the Fitzroy Basin was about 8%. McLintock used an equity of $125,000 and a total debt of $286,000 in year 8 for a breeding and fattening enterprise of 3000 head. The return was 6% before tax, or after tax 2.4% if there was no other source of income and 4.9% if paying the maximum rate of tax on another source of income.

REFERENCES

BRYAN, W. W. (1968)—Grazing trials on the Wallum of south-eastern Queensland. 1. A comparison of four pastures. *Australian Journal of experimental Agriculture and Animal Husbandry.* **8**: 512-20.

BRYAN, W. W., and EVANS, T. R. (1971)—A comparison of beef production from nitrogen fertilized pangola grass and from a pangola grass-legume pasture. *Tropical Grasslands.* **5**: 89-98.

COALDRAKE, J. E. (1961)—Ecosystem of the coastal lowlands of southern Queensland, Bulletin No. 283, C.S.I.R.O., Australia, 138 pp.

EDWARDS, G. W. (1968)—The effect of income tax provisions on returns to investment in agriculture. *Quarterly Review of agricultural Economics.* **21**: 22-36.

EVANS, T. R. (1969)—Beef production from nitrogen fertilized pangola grass (*Digitaria decumbens*) on the coastal lowlands of southern Queensland. *Australian Journal of experimental Agriculture and Animal Husbandry.* **9**: 282-86.

EVANS, T. R. (1970)—Some factors affecting beef production from subtropical pastures in the coastal lowlands of south-east Queensland. Proceedings 11th International Grassland Congress, Surfers Paradise, Queensland 1970. 803-07.

HOLST PELLEKAAN, J. W. VAN, and ROBINSON, VALERIE J. (1964)—Property development in the brigalow areas of the Fitzroy Basin, Queensland. *Quarterly Review of agricultural Economics.* **17**: 154-71.

MCCARTHY, W. O., NUTHALL, P. L., HIGHAM, C., and FERGUSON, D. (1970)—Economic evaluation of land use alternatives for the southern Wallum region, Queensland. *Tropical Grasslands.* **4**: 195-212.

MCGUIRE, K. (1968)—Land development for beef production in the Wallum. *Quarterly Review of agricultural Economics.* **21**: 140-157.

MCLINTOCK, G. T. (1970)—The economics of pasture improvement for beef production in the Northern Territory: a Summary. *Quarterly Review of agricultural Economics.* **23**: 82-96.

MOORE, W. L. (1967)—A preliminary study of some economic aspects of Wallum development. *Tropical Grasslands.* **1**: 21-36.

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