

The profitability of dryland forage crops: a modelling analysis in Central Queensland.

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Abstract

Central Queensland graziers with arable land typically sow forage crops to either fatten cattle for feedlot entry or finish animals for slaughter. While the decision to sow dryland forage systems is highly dependent on seasonal conditions, the main motivation is for high weight gain over short time periods to meet a particular market specification. However, many graziers rarely calculate the full costs associated with forage production, nor compare the range of options available. Like other commodities, the input costs of forage crops are constantly increasing while the real price of beef (\$/kg) after inflation is removed has remained stagnant for the last 60 years. More than ever, producers need to analyse the returns obtained from an investment in forages.

When analysing the profitability of a range of forage crops in central Queensland, we discovered a paucity of robust production data across our target soil types. It was also apparent that overall profitability was not necessarily correlated to the amount of beef produced; rather, the input costs (forage and cattle) were the main determinant. Our analysis highlights the need for producers to assess their own operation with objective production and cost data, to fully understand the options available and make informed management decisions.

Key Words

Forage crops, profitability, central Queensland.

Introduction

In central Queensland, beef production from native or sown pastures is subject to seasonal rainfall variation. This variability results in difficulties for graziers in this region to maintain quality and quantity of forage to consistently maintain cattle production throughout the year, while meeting ever tightening market specifications. Together with these production vagaries, costs are constantly increasing while the real price of beef (\$/kg) after inflation is removed has remained stagnant for the last 60 years (Holmes 2009). Graziers in central Queensland are facing the same issues as the rest of the northern Australian beef industry, that is how to increase production (kg of beef/ha) while minimising costs of production to improve profitability (McCosker *et al* 2010).

While a range of forage options (eg native pastures, improved pastures and annual forages) are available to beef producers in central Queensland, the targeted use of high quality forages such as oats, forage sorghum, Lablab butterfly pea and *Leucaena* have the potential to improve the profitability of beef enterprises through increasing turnover and productivity. Graziers with arable land therefore typically sow forage crops to either fatten cattle for feedlot entry or finish animals for slaughter in the shortest period possible. However, experience of local extension officers indicate that few graziers routinely calculate the full costs associated with forage production, or compare the range of options available for fattening or finishing cattle (Hickey *et al* 2011). Monitoring is confined to a basic level, such as the number of head turned off, and income at the end of the grazing period are assessed. Increasingly, weight gain assessments are made to evaluate the production benefit of the forage. What is missing is an analysis of the full cost of production, which includes the variable costs of growing the forage and associated livestock costs of purchase (either bought in or breed), interest on livestock capital, transport, and animal health or other management costs. Undertaking this analysis requires knowledge, skills and effort but the return on this time investment is necessary to assess when and what forages could be grown, if at all. This paper outlines a modelling analysis of the economic performance from a range of forages in central Queensland.

Methods

Detailed economic analyses were conducted for three case study sites across the Fitzroy River catchment in central Queensland, representing the Southern Brigalow region (Taroom-Wandoan area; Site 1), the Central Brigalow region (Bauhinia-Theodore area; Site 2) and the Open Downs region (Capella area; Site 3). Six forage types were modelled at each of the sites, including:

- the annual forages: oats, sorghum and lablab,
- the perennial forage systems: butterfly pea-grass and leucaena-grass, and
- baseline pasture for comparison: buffel grass at Sites 1 and 2, and Queensland bluegrass pasture at Site 3.

To compare forages with different production cycles it was necessary to conduct analyses beyond a one year period. The most appropriate methodology is a discounted cash flow which calculates a Net Present Value (NPV = \$/ha.year). The discounted cashflow structure discounts future costs and benefits back to a present value which allows comparison between investment options which have costs and returns in different years. The NPV is the sum of discounted values of future income and costs associated with an investment. The highest NPV is the preferred option. Also calculated were the net cattle income (gross cattle income minus livestock costs), forage planting costs and, for the annual forages, a gross margin. The gross margin is the gross income minus variable costs. A GM could not be calculated simply for the perennial forages (butterfly pea and leucaena), as these incur large establishment costs at commencement and benefits that flow over a number of years.

Cattle production from each of the forage types was modelled in terms of finishing steers to the same target weight (596 kg liveweight; 310 kg carcass weight). Cattle were assumed to enter the system at a weight sufficient to reach the target turn-off weight within the specified grazing period of each forage, and were valued at this entry weight. The grazing days, stocking rate and daily liveweight gain for each forage at each site were based on an assessment of measured values in both published and unpublished reports and the considered judgement of DAFF beef research and extension staff. These values are based on the assumption that forages have been grown and grazed using best-practice agronomic management and represent the expected long-term average performance across all seasons.

The GRASP pasture model (Rickert *et al.* 2000) was used to model the baseline pastures and the Agricultural Production Systems Simulator (APSIM; Keating *et al.* 2003) was used for annual forage crops. The annual forage crops were sown each year using a variable sowing rule which required 20 mm of rainfall over 3 days and 60 mm of plant available soil moisture. Growth of summer forage crops was assumed to end on the first day of frost and growth of oats assumed to end on 1 December each year. For the annual forage crops, each time the crop was removed, the soil nitrogen was re-set to the assumed base nitrogen level for that site. The forage paddocks remained in fallow during the non-growing season. The APSIM forage modules had been calibrated using physical cutting to mimic grazing. Oats and lablab were cut to a height of 10 cm at floral initiation, or when more than 3000 kg/ha of dry matter had grown. Forage sorghum was cut to a height of 15 cm at flowering or when height was greater than 80 cm. In the modelling of baseline pasture production, an annual utilisation rate of 20% was assumed to account for the effects of grazing. Because the perennial legume-grass pastures, butterfly pea-grass and leucaena-grass, cannot currently be modelled with sufficient reliability, estimates of biomass production were based on expert opinion and assessment of measured values extracted from both published and unpublished reports.

The economic analyses were conducted using an assumption that the same market conditions occur across all forages in each region. The results compare the economic performance of the forages based on the defined set of market assumptions over a 30-year period. Livestock purchase prices were taken from long-term averages at the Roma (Site 1) or Gracemere (Sites 2 and 3) saleyards. The prices used reflect the value of animals (based on weight and age) at the point of entry onto the forage. Livestock sale prices were taken from the long-term averages at the Dinmore meat processing plant. Freight costs were based on 2010 rates from major carriers in each of the relevant regions. Animal health costs were based on 2010 prices, and were based on treatments required immediately prior to, or during, forage grazing. For simplicity, and to allow valid comparison to the baseline scenarios, forage preparation and planting costs were based on estimated contract rates.

Results

Southern Brigalow region

Oats produced the highest liveweight gain and net cattle income but this option delivered a negative gross margin and a negative NPV due to high annual planting costs. The baseline pasture provided the lowest liveweight gain and net cattle income, but the second highest NPV after Leucaena-grass. Of the improved forages, butterfly pea-grass pasture produced the lowest liveweight gain and net cattle income but delivered the second highest NPV, after Leucaena-grass (Table 1).

Table 1. Comparison of forage options over a 30-year period in the Southern Brigalow region.

	Forage					
	Baseline pasture (buffel)	Oats	Forage sorghum	Lablab	Butterfly pea-grass	Leucaena- grass
Liveweight gain (kg/ha.yr)	54	202	153	139	99	110
Net cattle income (\$/ha.yr)	\$43	\$288	\$191	\$190	\$139	\$159
Planting costs (\$/ha.sowing)	N/A	\$307	\$275	\$323	\$384	\$343
Gross margin (\$/ha.yr)	\$43	-\$18	-\$84	-\$133	N/A	N/A
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NPV (\$/ha)	\$568	\$168	-\$1,110	-\$1,768	\$410	\$1,301
NPV (\$/ha.year)	\$19	-\$6	-\$37	-\$59	\$14	\$43

Central Brigalow region

Lablab produced the second highest liveweight gain and net cattle income, but delivered a negative gross margin and NPV due to high annual planting costs. Leucaena-grass ranked in the middle of the sown forages for liveweight gain and net cattle income but this option delivered the highest NPV (Table 2).

Table 2. Comparison of forage options over a 30-year period in the Central Brigalow region.

	Forage					
	Baseline pasture (buffel)	Oats	Forage sorghum	Lablab	Butterfly pea-grass	Leucaena- grass
Liveweight gain (kg/ha.yr)	58	147	185	157	104	138
Net cattle income (\$/ha.yr)	\$51	\$297	\$357	\$310	\$181	\$221
Planting costs (\$/ha.sowing)	N/A	\$278	\$246	\$323	\$384	\$343
Gross margin (\$/ha.yr)	\$51	\$19	\$111	-\$13	N/A	N/A
NPV (\$/ha)	\$679	\$172	\$1,478	-\$167	\$964	\$2,017
NPV (\$/ha.year)	\$23	\$6	\$49	-\$6	\$32	\$67

Open Downs region

Of the improved forages, butterfly pea-grass produced the lowest liveweight gain and net cattle income, but came a close second to Leucaena-grass with NPV. Lablab produced the second highest liveweight gain and net cattle income, but delivered a negative gross margin and NPV due to high annual planting costs (Table 3).

Table 3. Comparison of forage options over a 30-year period in the Open Downs region.

	Forage					
	Baseline pasture (native)	Oats	Forage sorghum	Lablab	Butterfly pea-grass	Leucaena- grass
Liveweight gain (kg/ha.yr)	26	145	203	157	124	138
Net cattle income (\$/ha.yr)	\$21	\$263	\$343	\$282	\$195	\$214
Planting costs (\$/ha.sowing)	N/A	\$345	\$313	\$323	\$384	\$343
Gross margin (\$/ha.yr)	\$21	-\$82	\$30	-\$41	N/A	N/A
NPV (\$/ha)	\$285	-\$683	\$397	-\$509	\$1,282	\$1,417
NPV (\$/ha.year)	\$9	-\$23	\$13	-\$17	\$43	\$47

Discussion

A considerable amount of past research and development has been undertaken into the range of forages investigated in this analysis. However a smaller amount of information was available for butterfly pea-grass pastures, due to the more recent release of this forage. Obtaining regionally specific robust animal liveweight gain data from published and non-published sources was difficult, as there were inconsistent data collection methodologies or entire gaps with parameters such as weighing protocols, stocking rate, animal class, duration on the forage, percentage of other forages in the paddock. The value of conducting and

publishing liveweight gain comparisons from forages under the same seasonal and controlled management conditions on research stations cannot be underestimated.

Liveweight gain and net cattle income for all forages was higher than the baseline in each of the 3 case studies, indicating the range of forages tested here provide the opportunity for graziers to increase productivity and net income. This finding does not mean a grazier shouldn't utilise existing baseline pastures; rather the use of annual or perennial forages to fatten or finish stock provides production advantages. The annual forages produced higher liveweight gain and net cattle income over the perennial forage options. While the grazing period for the annuals is shorter than the perennials, the higher liveweight gain is due to higher availability of quality forage and consequently a higher stocking rate can be used.

Planting costs for the sown forages were generally similar in the open downs and southern brigalow regions, but the annual cereal crops were significantly lower than the others in the central brigalow region due to the absence of applied fertiliser. Overall, all annual forage crops are disadvantaged by their need to be sown every year, and over a 30 year investment period the liveweight gain and net income advantages are suppressed by the higher costs incurred.

Net present value (NPV) analysis indicates the perennial forages are generally more profitable across central Qld in the longer term. This is especially the case for Leucaena-grass, where this forage provided the highest NPV in all 3 case studies. The best overall performer of the annuals was forage sorghum; in the central brigalow case study, it ranked a close second to Leucaena-grass and delivered a higher NPV than butterfly pea-grass. In the open downs case study, forage sorghum produced the only positive NPV of the annual forages, whereas all annual forages delivered negative NPV in the southern brigalow case study. The results showed the importance of considering all costs and production values when considering alternative forages, as greater production (measured in kilograms of liveweight gain per hectare) do not necessarily equate to higher profitability if the costs of establishing the pasture are high.

Conclusion

The costs of a beef business, including the direct costs associated with livestock and forages, are constantly increasing while the real return of beef has remained stagnant for the last 60 years. Our analysis highlights that management decisions of when and what forage to sow should not be based solely on liveweight gain or cattle income; rather the costs associated with growing and sourcing cattle for the forage need to be included so overall profitability can be assessed. Graziers need to assess their own operation with objective production and cost data, to fully understand the options available and make informed management decisions.

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