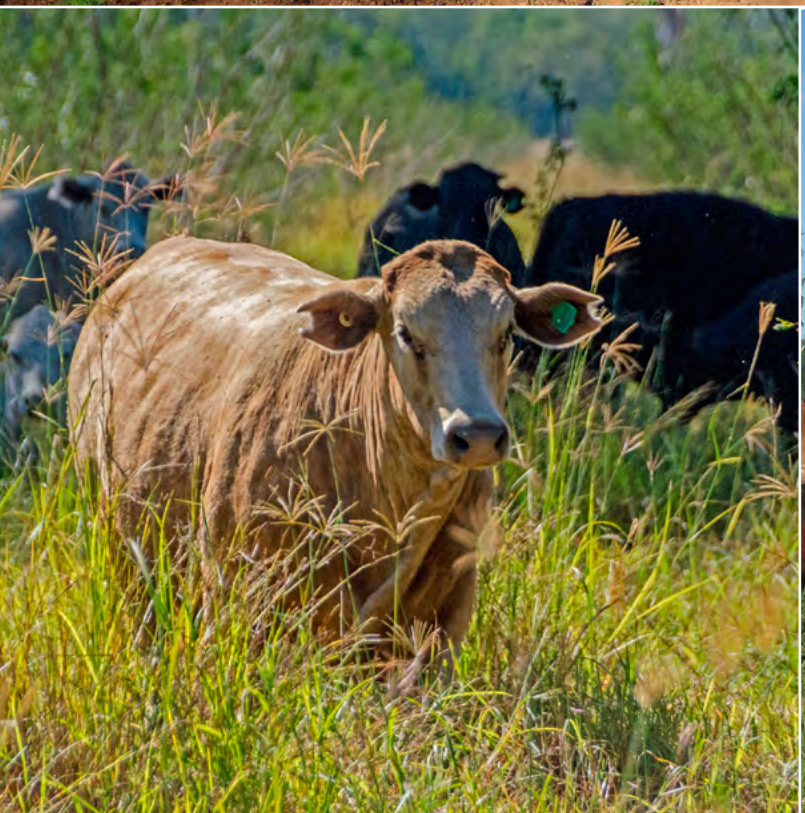
6. Costs and returns



Chapter 5. Costs and returns

6. Costs and returns

Leucaena is a perennial legume which has a potential life of over 30 years. Any investment in leucaena involves a high initial outlay of funds to develop the pasture, a period of lower returns as the pasture is establishing, followed by a long period of high production and relatively stable returns.

The value of a leucaena investment to a business depends upon:

- the costs of establishing the pasture
- how successfully it establishes (this affects future profitability)
- the length of productive life of the leucaena (reduces the long-term impact of the high initial investment)
- the level of long-term productivity (live weight gains, stocking rates)
- the alternative land use if leucaena was not planted (establishing a leucaena pasture may not necessarily be the most profitable option)

In this chapter, the value of an investment in leucaena is analysed taking these factors into account.

Gross margin analysis is used to illustrate the profitability of converting a paddock of perennial grass to a leucaena-grass pasture. The important factors that contribute to making leucaena a successful investment are highlighted. A whole farm economic analysis of investment in leucaena by an independent consultant is recommended for your own business.

6.1. Costs of establishment

Good establishment will depend on using the correct techniques to maximise eventual productivity and minimise time to full grazing. The combination of cost of establishment, low animal production during establishment and the income foregone from the activity that leucaena is replacing, can reduce short-term cash flow of the farm business.

Clearing or blade ploughing paddocks, deep ripping, fencing and water reticulation, if needed, will add to establishment costs.

The cost of establishment will depend on the previous land use and condition as this will affect the method of ground preparation, seeding rates and cost, and method of pre- and post-plant weed control.

Operational (labour) costs depend on whether a contract planter or property owner plants the leucaena.

Costs of establishment will depend on previous land use. Old cultivation land is associated with costs of weed control and establishing new grass.

Typically the cost of consumables for planting by an owner/operator is around $250–300/ha (Table 6.1). For property owners using their own equipment and time, the major consumable costs at planting are purchase of seed, diesel, pre and post planting herbicides, and starter fertilizer (Table 5.1).

If an owner operator costs out personal time at $75/hour, labour cost would be $150–$175/ha. This increases the cost of establishment to $400–475/ha.

Using contract planters for total establishment can add $300 /ha depending on hourly rates (Table 5.2). This increases the cost of establishment to $550–$600/ha.

Good establishment is critical to long-term profitability.

6.2. Gross margin analysis

Returns to establishment

This analysis of the costs of establishment does not include the opportunity cost of the land being unused during establishment of the leucaena. With good conditions and with correct planting technique, leucaena rows should reach a height

Table 6.1: Development cost calculator for consumables used when establishing leucaena-grass pasture

Consumables estimate	% paddock planted	Rate/ ha	$/L or $/kg	Estimated $/ha
Pre-planting and planting costs				
Leucaena seed - "Wondergraze"	100%	2	$50	$90.00
Insecticide seed dressing (Cosmos©[2])	100%	2.5	$1.05	$2.60
Beetle bait - including labour to mix	100%	5	$3.30	$16.50
Starter fertiliser (Starter Z) @ 25% area in row	25%	150	$0.90	$33.80
Spinnaker©[2] sprayed over 8m of row (generic brand)	100%	0.15	$140	$21.00
Glyphosate - fallow	100%	1.5	$5	$7.50
Glyphosate - pre-plant	100%	1.5	$5	$7.50
2,4-D - pre-plant	100%	1.5	$5	$7.50
Post-planting costs				
Glyphosate using shield spray	75%	1	$0	$0.00
2,4-D using shield spray	75%	1	$0	$0.00
Broad leaf weed control (Basagran©[2]) @ 20% (only if needed)	25%	0.4	$35	$14.00
Grass weed control (Verdict©[2]) (only if needed)	25%	0.25	$20	$5.00
Grass seed @ 75% (price dependent on variety and coating)	75%	10	$15.00	$112.50
Diesel - after rebate	100%	50	$1.10	$54.60

[1] Consumable costs may vary with source
[2] See Chapter 2 note on registration of chemicals

of 1.5–2m by the end of the first summer when the leucaena pasture can be lightly grazed.

Full grazing can be possible approximately 24 months after the leucaena is established, with stocking rates varying between 1 and 2 ha/AE.

Grass seed can be planted at the end of the first summer, or at the beginning of the second summer.

Variable seasonal conditions during the 12 months after leucaena planting can impact considerably on the estimated gross margin for the establishment year.

Typically, productivity and profitability of a leucaena-grass pasture over the whole establishment period is estimated at 20–25% of that of the fully established pasture.

Returns after establishment

Examples presented compare the profitability, using gross margin analysis, of converting to leucaena-grass pasture against a range of other high-input forage options for beef production at five sites in the Fitzroy River catchment.

This detailed gross margin analysis, conducted by the Queensland Department of Agriculture and Fisheries from 2011 to 2014, compared high-value pasture options in three regions:

- central Queensland open downs (Emerald – Capella area)
- central Queensland brigalow (Biloela – Rolleston area)
- southern Queensland brigalow (Taroom – Wandoan area).

The grazing options were:

- perennial pasture options (leucaena-grass pastures; butterfly pea-grass; buffel grass)
- annual forage crop options (oats, forage sorghum, lablab).

Although the commercial stock in the paddocks were of mixed size and class, assumptions used for the gross margin analysis were:

- an adjustment was made for interest on capital.
- stocking rate is expressed as ha/AE where an AE (adult equivalent) = 450kg steer, calculated for the duration of grazing for annual forage crops, and per annum for the perennial pastures.

Table 6.2: Development cost calculator for operational costs based on contract planter rates[1] for establishing leucaena-grass pasture

Operational estimate at contract rates (if $150/hour)	Estimated ha/ hour	$/hour	Estimated $/ ha
Pre-planting and planting			
Deep ripping (only if needed)	3	$150	$50.0
Primary discing	4	$150	$37.5
Second discing	5	$150	$30.0
Final seed bed prep (speed tiller or cultivator)	6	$150	$25.0
Fallow spray	10	$150	$15.0
Pre-emergent spray - glyphosate & Spinnaker©[2]	10	$150	$15.0
Planting/fertiliser/innoc/water inject/Spinnaker©[2]	3.4	$150	$44.1
Post-planting			
Crusting cultivation - yetter wheels (only if needed)	5	$150	$30.0
Beetle bait application	10	$150	$15.0
Inter-row cultivation (only If needed)	5	$150	$30.0
In crop grass weed spray - Verdict©[2] to control grasses	10	$150	$15.0
Inter-row shield spray (only if needed)	7	$150	$21.4
Pasture/cover crop inter-row planting (only if needed)	5	$150	$30.0

This table reflects costs of establishing leucaena into buffel grass pasture where there is no need for regrowth control or stick picking. If planting into recent cultivation there is no need for disc ploughing.
[1] Contract rates will vary with contractor
[2] See Chapter 2 for note on registration of chemicals

Animal productivity for five forage options

The most productive high-value forage option was leucaena-grass pasture with an average live weight gain of 192 kg/ha (Table 6.3). This was more than 2.5 times as productive as perennial grass alone, twice as productive as any annual forage crop, and 1.5 times the productivity of the other perennial legume-grass option of butterfly pea-grass.

The higher productivity of leucaena-grass pasture was due to:

- a longer period of grazing during the year (284 days)
- a relatively higher stocking rate (1.3 ha/AE) compared to the perennial pasture options
- a consistent high-quality diet (12% crude protein and 59% digestibility).

Profitability of five forage options

The most profitable high-value forage option was also leucaena-grass pasture at $184/ha (owner rates) (Table 6.4). This was twice the profitability of perennial grass alone, 300–400% more profitable than sorghum or lablab options, and 30–40% more profitable than butterfly pea-grass and oats options.

This higher profitability of leucaena-grass pasture was due to:

- Higher quality feed available for most of the year. This led to higher animal performance, although live weight gains varied with season. Among properties, live weight gains varied from 0 to 0.31 kg/hd/day in winter and spring to 1.23 to 1.52 kg/ hd/day in early summer.
- Long-term productivity (more than 30 years), with no requirement to replant, spreading the costs of planting over the long life of the pasture
- Greater tolerance of regular grazing at relatively higher stocking rates than other perennial pasture options
- Greater growth of associated grass, through return of nitrogen, compared with sole perennial grass pasture which suffered from pasture run-down.

Table 6.3: Average stocking rate, grazing days beef production for six forage types grazed by cattle on commercial properties in the Fitzroy River catchment. Results are means with variability. (Bowen et al. 2018)

Parameter	Annual forages			Perennial forages		
	Oats	Sorghum	Lablab	Leucaena -grass	Butterfly pea-grass	Perennial grass
% of grazing area planted to improved forage[A]	59±8	67±5	58±15	77±8	88±12	-
Stocking rate[B] (ha/AE total grazing area)	1.0	0.6	1.0	1.3	1.7	2.7
Grazing days per year	116±9	107±15	107±4	284±59	181±24	224±79
% of legume / oats in diet[C, D]	77±5	-	54±23	51±5	21±15	11±2
Dietary CP (%)[D]	12.3±0.7	8.8±0.8	11.5±1.6	12.0±0.7	9.7±1.6	6.6±0.3
Dietary digestibility (%)[D]	63±1.3	55±1.2	59±0.5	59±3.8	59±0.3	55±1.0
Live weight gain (kg/ha/yr total grazing area)	93±12.9	108±40.3	99±57.5	198±32.2	125±60.6	76±32.8

[A] The remainder of the area consisted of perennial grass-only and, in some cases, timbered areas and watercourses.

[B] Total grazing area includes both sown high quality forage and associated perennial grass areas present in the paddock. The stocking rate for annuals was expressed as the average over the grazing period. The stocking rate for perennials was the average over each 365-day period of monitoring.
AE (adult equivalent = 450 kg non-lactating animal calculated as live weight to the power of 0.75)

[C]This is an indication of the proportion of the diet that was sown C3 species (oats and the sown legume species), although any consumption of naturalised legumes and weeds in the grass component of the pasture would be included in this measurement.

[D] Values represent the average over the entire grazing period.

Table 6.4: Average forage growing costs and gross margins, calculated using both owner rates and contract rates, for six forage types grazed by cattle on commercial properties in the Fitzroy River catchment. Results are mean and variability. (Bowen et al. 2018)

	Annual forages			Perennial forages		
	Oats	Sorghum	Lablab	Leucaena -grass	Butterfly pea-grass	Perennial grass
Forage costs per sown area ($/ha/year)[A]						
Contract rates[C]	194 ±24	142 ±47	144 ±17	39 ±6	26 ±3	3 ±2
Owner rates[D]	136 ±14	96 ±32	99 ±14	34 ±5	21 ±0	2 ±1
Gross margin per total grazing area ($/ha/year)[B]						
Contract rates[C]	102 ±20	24 ±48	18 ±2.5	181 ±35	140 ±119	96 ±52
Owner rates[D]	131 ±17	54 ±49	44 ±6.0	184 ±36	143 ±118	98 ±52

[A] Forage costs were the costs of forage establishment and maintenance. For butterfly pea-grass and leucaena-grass pastures that have a productive life of more than one year, the establishment costs were amortised (expressed as an average annual cost over the expected life of the forage).

[B] Gross margins were calculated as the gross income received from the sale of cattle less the variable costs incurred, and were expressed after subtracting interest on livestock capital.

[C] Calculated using a contract rate to cost actual machinery operations used by the co-operator.

[D] Calculated as if plant and machinery are owned by the business.

What the best leucaena properties achieved

The gross margins of the properties with leucaena paddocks varied between $90 and $305/ha/year.

The best gross margin of $305/ha/year was associated with:

- High yield of leucaena which occurred on deepest soils with highest soil phosphorus, or where P fertiliser was applied. This in turn led to highest % leucaena in diet (61%) and high crude protein in diet (12.9%). The protein content of diet increased with percentage of leucaena in diet. Around 50% leucaena in diet delivered a dietary protein intake of 12% which was needed to maximise live weight gain.
- Greater number of grazing days on the leucaena-grass pastures (318 days) leading to higher average stocking rate over 365 days of 1.2 ha/AE.
- High yield of companion grasses leading to higher stocking rates.
- Good grazing management (rotation plus strategic cutting to maximise productivity) which resulted in achieving higher stocking rates and higher beef production per ha.
- The above factors contributed to achieving the highest animal performance (kg/ha/year).
- A cattle weight gain monitoring program allowing managers to optimise timing of sales.

In summary, profitability was strongly influenced by higher beef productivity (kg/ha/year), lower forage planting costs and better cattle price margins.

Note that while calculation of paddock gross margins is the first step, a more complex whole farm economic analysis is recommended.

6.3. Economics of irrigated leucaena

Widespread dryland plantings of leucaena have been shown to be a productive and profitable investment in central Queensland.

Uncertainty

Some landholders have access to irrigation water and are applying it to leucaena to improve establishment and production and to reduce the uncertainty of animal output.

There is some level of uncertainty in the profitability of irrigated leucaena because it is a relatively new but highly intensive production system – especially if using overhead irrigation.

The significant capital investment in overhead irrigation equipment must be considered in the economic analysis of pivot irrigating leucaena.

To be profitable the investment must be able to cover all costs and provide a return on the capital invested.

The value of irrigated leucaena as an investment is sensitive to:

- development and infrastructure costs
- operational costs (e.g. water allocation, pumping and application costs, other costs)
- productivity of the pasture (kg of beef/ha/yr) over the life of the pasture
- trading margins and value per kg of weight gain
- returns from alternative production systems that may be available for investment.

To accurately assess the economics of irrigated leucaena, it is important to have good data on:

- water requirements, availability, reliability and pricing
- development costs for pumps, furrow irrigation, ring tanks or spray systems
- pasture production during the year
- animal growth rates and stocking rates.

This data is being generated through the efforts and records of some innovative producers but is not yet good enough for any broader recommendations. All prospective irrigators need to critically assess their own circumstances.

6.4. Producer experience – central Queensland

Scott and Judy Smith, 'Glenlivet', Thangool, central Queensland

Scott and Judy Smith run more than a thousand head of cattle on their property 'Glenlivet' near Thangool. The 2,660ha property is made up of 1,850ha of forest country and 810ha of scrub country. In March 2001, they planted 40ha of leucaena at a cost of just over $210/ha and found that the leucaena greatly increased its carrying capacity. By 2019, they had 210ha of leucaena across Glenlivet.

Seedbed preparation and planting. Scott and Judy have changed their seed bed preparation from total cultivation to strip planting, preparing the strips with cattle still grazing the paddock.

Leucaena planted in strips ploughed in an existing pasture

The strips are 4m wide with the first pass being deep-ripped to a depth of 500mm, followed by cultivation with offset discs and a scarifier until a good seedbed is achieved. When rain is predicted, the cattle are removed while the soil profile fills. They apply Spinnaker® and Roundup® at planting, and have found it best to plant in February to April.

Their first planting was cv. Cunningham with a row spacing of 6m, but they now plant cv. Wondergraze at 7m.

Control of unwanted plants. Weeds and grasses (especially buffel and green panic) in the strips are controlled mechanically as they can rob moisture from the seedbed. After the leucaena germinates the strips are scuffled if weeds emerge, and the inter-row grass is disc ploughed to control vigorous growth until the leucaena reaches 1m in height.

Grazing management. Scott and Judy have 21 paddocks of leucaena each averaging 10ha and they stock at 1 beast to 1–1.5ha. After a 2–3 day graze, each paddock gets 40 days of rest during the growing season. During the non-growing session, they will increase the rest period and reduce cattle numbers, or destock the leucaena. This ensures recovery of the whole system. Cattle are initially purchased at around 230kg LW, and are grown out on the forest country, before being finished on the leucaena for 60–70 days, often grain assisted.

Height control. Even with the high stocking rate the leucaena can still become tall and this reduces the amount of grass between the rows. They now use a tractor-mounted mulcher to cut all paddocks every year in spring to about 150mm.

Slashing leucaena down to 150mm to encourage bushy growth.

General comment. Good management for grazing and height control is paramount to achieve the maximum production from rain. They mulch any seedlings between the rows and then apply Grazon® and Ally® herbicides to the young regrowth. This practice gives very effective control.

The cost of establishment is currently approximately $380/ha; their payback period depends on rain but is generally two to three years.

The next level of management of the leucaena system is to improve soil health so that the leucaena system produces even higher quality feed and is even more sustainable into the future.

Leucaena and grass pasture at 'Glenlivet'