What value do sub-tropical pastures offer in a southern farming system?

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Background

The value delivered by investing in sub-tropical pastures in the south of NSW depends on the context of the investment. To assess the return on investment it is necessary to understand:

- The livestock system including periods of peak demand
- The existing feedbase including timing of supply
- Feed utilisation
- The skills of the manager
- The level of supplementary feed necessary to support energy deficiencies

This analysis uses existing open source data in conjunction with non-replicated trial data generated by Holbrook Landcare Network and supported with MLA PDS funding, to investigate the benefits of inclusion of sub-tropical pastures into a southern NSW prime lamb production system (the case study farm located at Yerong Creek NSW).

The aim of this analysis was to investigate the value of changing a proportion of the feedbase (14% of effective area) from temperate annual pasture (grass and sub clover) to sub-tropical pasture (tropical grass with sub clover in a winter lambing prime lamb production system. Changes to the livestock production system were not investigated. Feedbase types by area on the case study farm have been used in this analysis.

A key assumption in this analysis is that the sowing of sub-tropical pastures would replace existing annual temperate pastures. This rule has been applied as it represents the changes made to the case study farm. Attempts by the manager to sow improved temperate perennial pastures on the granite soils with low water holding capacity now populated by sub-tropical grasses and annual temperate legumes were unsuccessful.

A key benefit of this case-study specific sub-tropical pasture based system is that the mid-winter feed supply is boosted by the oversowing of temperate, winter growing annual legume species such as sub clover and medic in the winter following the sowing of the sub-tropical grasses. This results in a sub-tropical pasture with little marginal cost of feed foregone in mid-winter and a high marginal benefit of feed grown over the summer and early autumn months.

The success of a system including sub-tropical grasses is dependent on the ability of the manager to ensure that livestock demands meet the additional high feed supply in the summer autumn months.

Assumptions

A range of assumptions have been used to derive the outputs of this analysis. Location-specific pasture growth rate data was largely unavailable, so existing pasture growth rate data has been adjusted to deliver best-estimates of pasture growth rates for the series of feed sources on the case study farm.

For example, daily pasture growth rates by month for the case study farm were estimated by multiplying the NSW south-west slopes pasture growth rates in the feed supply curves by 80%. The south-west slopes pasture growth curves do not include sub-tropical grass growth rates thus the growth rate data from the Upper Hunter region pasture growth curves was used. The frequency of receiving 40 millimetres of rainfall over 2 days between January and April is 50% in Yerong Creek relative to 75% in the Upper Hunter (Source:CliMate). The impact of lower relative growth rates from sub-tropical pastures than those projected in this analysis is dealt with in the sensitivity analysis of the investment analysis.

As sub-tropical pastures in the case-study farm system were oversown with sub-clover the assumption has been made that the winter growth between May and September is equivalent to that of the adjusted annual grass and clover pasture growth rate for the case study locality.

Figure 1 shows the assumed pasture growth rate for the sub-tropical pastures. Pasture growth rates by month were not collected as part of the trial thus imputed estimates have been made. The green dotted curve shows the estimated pasture growth rate of the tropical grass and sub clover pasture mix. The growth of the grass is complemented by the winter growth habit of the sub-clover because the clover is completing its annual life cycle during a period when the tropical grass starts to become active. The sub-clover also fixes nitrogen for use by the grass. The clover growth is highly dependent on managing the residue of the sub-tropical grass. This requires diligent and intensive grazing management with very high livestock numbers, particularly during periods of high summer rainfall.

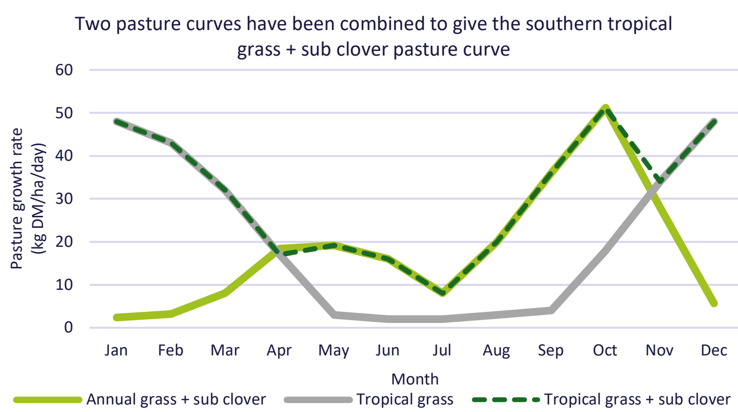

Figure 1. Two pasture curves contribute to the combined southern sub-tropical plus sub clover pasture curve

Figure 2 shows sub-tropical pasture growth supplies over 50% more pasture than the adjusted imputed growth of lucerne, temperate annuals (Annual) or temperate perennial pasture types (perennial).

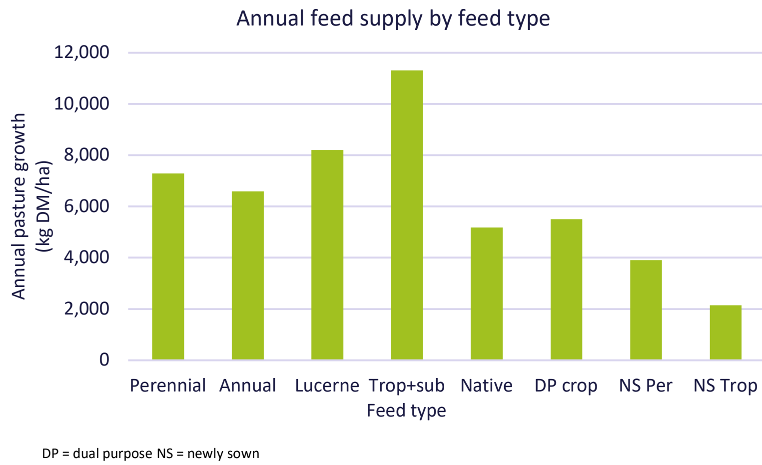

Figure 2. Annual feed supply by pasture/crop type

Figure 3 shows the proportional contribution of effective area changes with the inclusion and exclusion of sub-tropical pastures to the mix. Where sub-tropical pastures are included, annual pasture area declines and where they are excluded from the feed base the annual pasture area increases. Thus, the key difference driving the outcomes of the analysis are the differences in feed supply and feed quality between annual pastures and sub-tropical plus clover pastures. Figure 2 shows that the marginal difference between pasture growth of annual pastures and sub-tropical pastures is approximately 4.7 tonnes dry matter per hectare per year. The case study farm has now included 150 hectares of sub-tropical grass into the system resulting in an estimated 709 tonnes of additional feed across the farm per year.

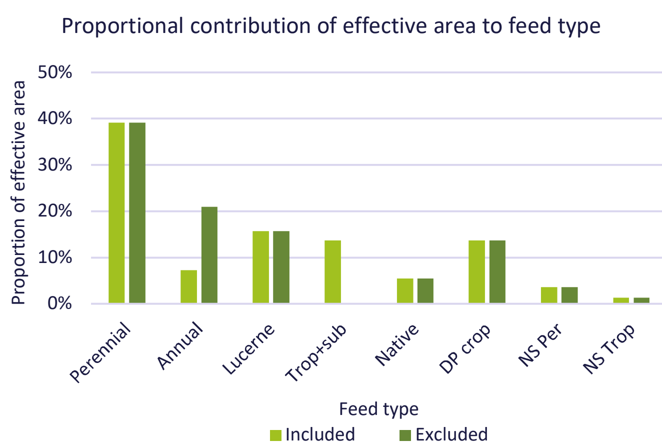

Figure 3. Proportional contribution of effective area to different feed type with and without sub-tropicals

Figure 4 shows the difference in average pasture growth by season between temperate annual grass and sub clover pastures and sub- tropical plus sub clover pastures. The data shows that most of the difference in growth occurs in summer with only minor differences between pasture types in Autumn, Winter and Spring.

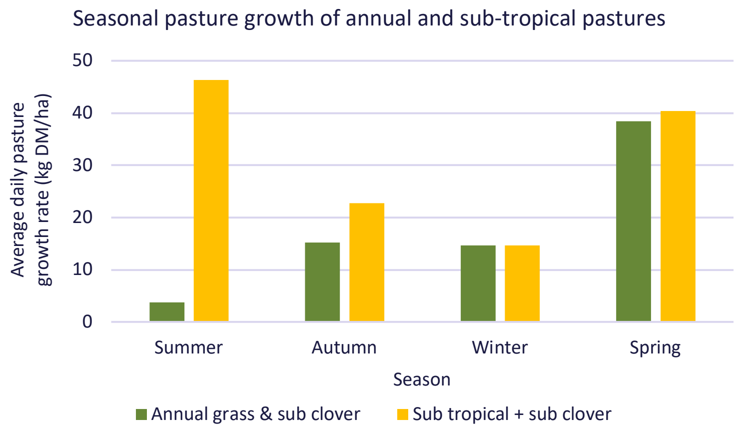

Figure 4. Seasonal pasture growth of temperate annuals and sub tropicals inclusive of sub clover

Figure 5 shows the feed supply curve in tonnes dry matter per month for the system. Of the 709 extra tonnes of feed supplied by including sub-tropical pastures over 150 hectares, 80 percent is supplied in Summer, 15 percent is supplied in Autumn and the remaining 4 percent occurs in Spring.

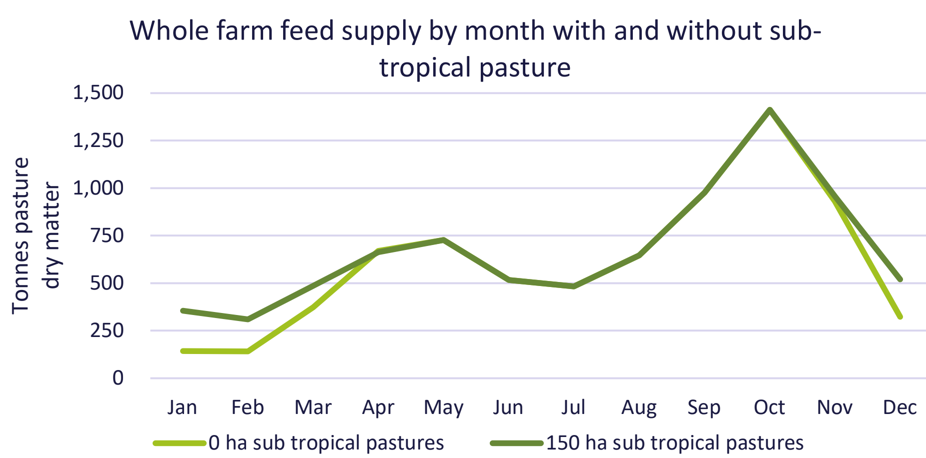

Figure 5. Adding sub-tropical pastures delivers extra feed primarily through the summer months.

The livestock system

The livestock system managed is a July lambing, self-replacing, composite prime lamb system. Lambs are sold between November and July with a small proportion of sale lambs being carried over to the point of lambing. Ewe maidens are lambed at 12 months of age approximately 1 month later than the main ewe lambing.

Figure 6 shows that the whole farm stocking rate of 14,300 average annual DSE is only achieved by supplementary feeding around 8,000 DSE per month for five months where the feed base is devoid of sub-tropical pastures or 5,000 DSE per month for four months where sub-tropical pastures are included in the feed base. Table 1 shows that this equates to the supporting of 13 percent and 24 percent of total farm stocking rate for the system with and without sub-tropical pastures respectively. The cost of supplementary feeding equates to $115,000 and $220,000 equivalent to $8.00 and $15.30 per DSE for the system with and without sub-tropical pastures respectively.

Table 1. Differences in the features of the feed base between systems with and without sub-tropical pastures

Feed differences between feedbase with & without sub tropical pastures			
Sub tropical pasture	**+ Sub trops**	**- Sub trops**	**+ vs -**
Supplement fed (T)	327	628	-300
Cost of supplement ($)	$114,566	$219,720	-$105,154
Tonnes pasture growth	8,057	7,348	709
Farm area sown to sub tropicals (ha)	150	0	150
Propotion area sown to sub trops	14%	0%	14%
Proportion total DSE fed	13%	24%	-12%
Cost of supplement ($/DSE)	$8.00	$15.34	-$7

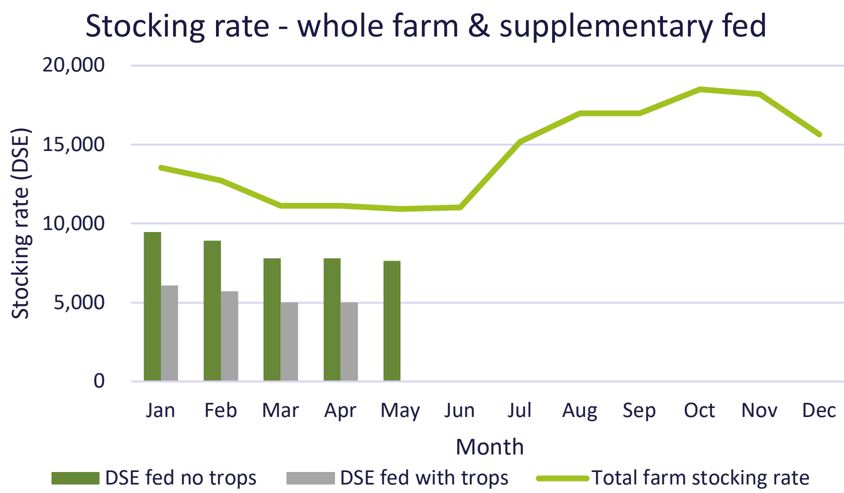

Figure 6. Whole farm stocking rate is 14,300 dry sheep equivalents

The livestock system in this analysis including ewe numbers, joining numbers, time of sale and lamb sale numbers were held constant between feedbase scenarios. The amount of supplementary feed was determined by adding a rule that closing biomass across the farm needed to equate to 2,000 kilograms of dry matter. This equated to the same amount of assumed feed at opening to ensure that feed inventory was in balance at opening and closing.

Figure 7 shows that while there are differences in closing feed amounts between systems with and without sub-tropicals both systems exceed 1,800 kilograms dry matter during lactation (a critical period for high levels of minimum biomass).

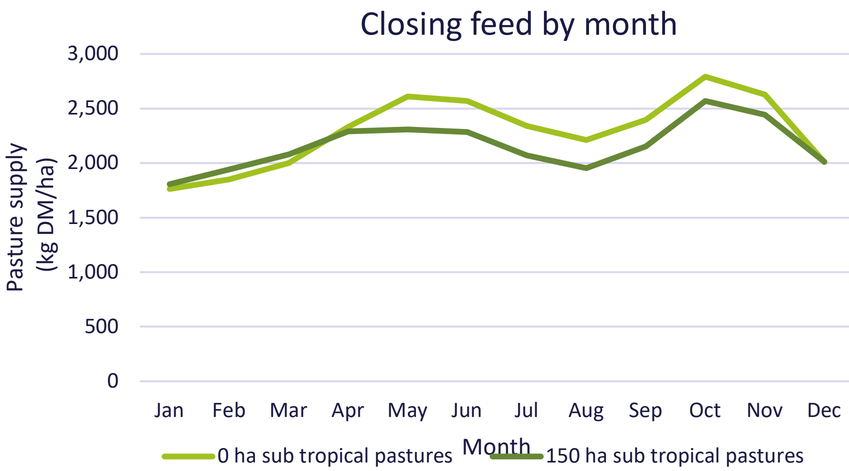

Figure 7. Closing feed supply by month for the systems with and without sub-tropical pastures

Cost benefit analysis

While the manager of the case study farm considers there are multiple benefits of sub-tropical pastures this analysis only considers the benefit of the value of the additional feed supplied relative to annual pastures. As the ewes in the prime lamb system only require minimal energy requirements over this period (other than during the pre-joining period) it has been assumed that the pasture quality supplied by the sub-tropical pastures adequately meets the livestock needs.

Feed test data from a Holbrook Landcare Network pasture assessment in 2024 in a pasture located close to the case study farm showed the following pasture quality for sub-tropical pastures. The February assessment was of poor quality as the stocking rate was inadequate for maintenance of pasture quality (Table 2). The quality of this feed however was still adequate to maintain condition of the ewes in the case study system.

Table 2. The quality of the sub-tropical pasture, despite being low, was adequate to maintain condition of the prime lamb ewes.

Grazing quality data		
Sub tropical pasture assessment		
Date:	**9-Feb-24**	**17-Apr-24**
NDF	68%	53%
Protein	7.5%	21.3%
DMD	51.8%	73.6%
MJME/kg DM	7.8	10.8

Source: Holbrook Landcare Network

The other key benefit valued highly by the case study farm manager is the lower incidence of summer growing weeds including Hairy Panic or Witchgrass, stinking goosefoot, Blackgrass due primarily to the competitive nature of the sub-tropical grasses.

The manager acknowledges that these weeds still provide grazing value to non-lactating ewes in his system as they deliver green feed during summer. These species however tend to have a survival mechanism requiring a short duration period to reproduction which means that they provide quality feed for a shorter period when compared to the sub-tropical grasses.

The costs of establishment are the key costs incurred to sow the pasture. Included are herbicide costs, spraying application costs, seed costs, starter fertiliser costs, and costs of the seeding operation. These are shown in Table 3.

Table 3. The cost of establishment of sub-tropical grasses oversown with temperate legumes.

Cost of establishment of sub-tropical grass plus oversowing legumes				
Line item	**$/unit**	**Units/ha**	**Applicn nº**	**$/ha**
Herbicide	$13	1.5	4	$78
Spray application	$15	1	4	$60
Digit	$25	9	1	$225
Kikuyu	$75	1	1	$75
MAP (starter fertiliser)	$0.80	50	2	$80
Urea (not applied)			0	$0
Arrowleaf	$5.50	4	1	$22
Sub	$10	4	1	$40
Cavalier medic	$10	1	1	$10
Sowing application	$40	1	2	$80
Total establishment cost ($/ha)				**$670**
Sub tropicals area (ha)	150	Total investment		$100,500

The key benefit of the addition of sub-tropical pasture in the feed base to the case study farm quantified in this analysis is the reduction in the amount and cost of supplementary feed (Table 1). The system prior to inclusion of sub-tropical grasses required approximately 24 percent of total energy demands to be supported with supplementary feed, assuming the same stocking rate with and without sub-tropical grasses. This declined to 13 percent of total energy requirements after inclusion of the sub-tropical grasses.

An investment analysis has been undertaken to establish the return on investment in sub-tropical pastures for the existing livestock system on the case study farm. The initial costs of the investment include multiple pre sow knockdown spray applications for weed control prior to pasture establishment, seed costs, sowing costs and fertiliser costs. While the oversowing of temperate pasture legumes, including sub-clover, occurred 6 months after establishment of the sub-tropical grasses, the cost in this analysis has been included with the costs in the startup phase (Year 0). The cost of pre-sow weed control, sub clover seed, additional fertiliser and an additional pass of the seeder has been added to the costs of establishment of the sub-tropical grasses in year zero.

The analysis assumes only half of the benefit of reduced cost of supplementary feeding is achieved in year 1 of the cashflow due to half the pasture biomass being produced in the establishment year.

The analysis (Table 4) shows an internal rate of return of 81% with a net present value of $381,500 where the cashflows have been discounted at 15%. The investment analysis assumes that the pasture returns will continue for a period of 10 years with no value at the end of this time period.

Table 4. Investment in sub-tropical pastures generates estremely high rates of return

Partial budget investment analysis - sub tropical & legume pasture				
Year	**Cashflow**	**Cumulative cashflow**	**Discounted cashflow**	**Discounted cumulative cashflow**
0	-$100,500	-$100,500	-$100,500	-$100,500
1	$52,577	-$47,923	$45,719	-$54,781
2	$105,154	$57,231	$79,512	$24,731
3	$105,154	$162,385	$69,141	$93,871
4	$105,154	$267,540	$60,122	$153,994
5	$105,154	$372,694	$52,280	$206,274
6	$105,154	$477,848	$45,461	$251,735
7	$105,154	$583,002	$39,531	$291,266
8	$105,154	$688,156	$34,375	$325,641
9	$105,154	$793,310	$29,891	$355,533
10	$105,154	$898,465	$25,993	$381,525
Net present value			**$381,525**	
Internal rate of return			**81%**	
Discount rate			**15%**	

Sensitivity

A key driver of the outcome of this analysis is the sensitivity of the outcome to the marginal difference in feed supply between temperate annual and sub-tropical pastures. Given the sensitivity a sensitivity analysis was conducted to establish the extent to which returns on investment decline when there is less feed produced by the sub-tropicals.

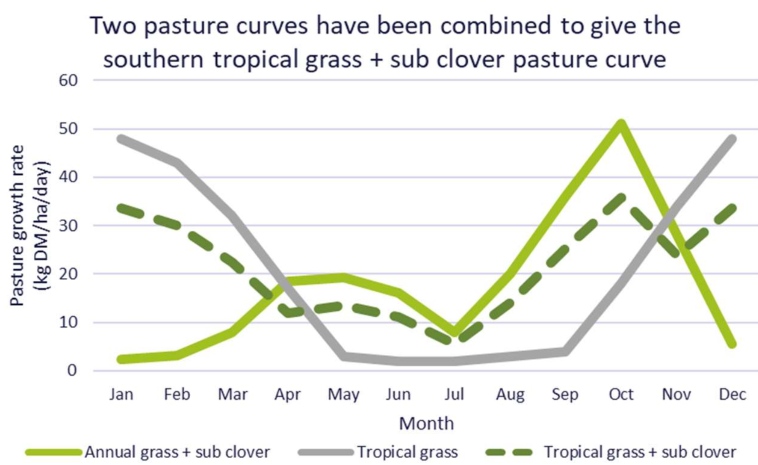

Figure 8. A 30% reduction in sub-tropical pasture growth relative to the base case results in lower feed across all months.

A decline in production of 30 percent relative to the base case has been used to assess the relative financial performance of the same investment in sub-tropical pastures. This moves total annual pasture growth in the sub-tropical pastures from 11.3 to 7.9 tonnes per hectare per year dry matter. The revised pasture supply curve can be seen in Figure 8. This results in a far lower difference in the marginal cost of supplementary feeding between a feedbase with and without sub-tropical pastures (

Table 5).

Table 5. The reduction in growth of sub-tropicals by 30% relative to base case results in less supplementary feed cost saved.

Feed differences between feedbase with & without sub tropical pastures			
Sub tropical pasture	**+ Sub trops**	**- Sub trops**	**Difference**
Supplement fed (T)	546	628	-82
Cost of supplement ($)	$190,943	$219,720	-$28,777
Tonnes pasture growth	7,548	7,348	200
Farm area sown to sub tropicals (ha)	150	0	-150
Propotion area sown to sub trops	14%	0%	14%
Proportion total DSE fed	21%	24%	-3%
Cost of supplement ($/DSE)	$13.33	$15.34	-$2

Table 6 shows the outcome of the investment analysis over a ten year time horizon. The internal rate of return is the compounded rate of return on investment into the pasture. The total investment into the pasture equates to $100,500 while the stream of returns comes from the $28,800 saved annually from spending less on supplementary feeding to supply energy to the ewes. This analysis assumes the same stocking rate between feedbase scenarios.

While the investment return from the sub-tropicals with 30% less growth is lower than the base case it is still a reasonable level of return given the risk and return profile.

Table 6. The reduction in the growth of sub-tropicals by 30% relative to the base case results in a lower return on investment but it is still reasonable at 22%.

Partial budget investment analysis - sub tropical & legume pasture				
Year	**Cashflow**	**Cumulative cashflow**	**Discounted cashflow**	**Discounted cumulative cashflow**
0	-$100,500	-$100,500	-$100,500	-$100,500
1	$14,389	-$86,111	$12,512	-$87,988
2	$28,777	-$57,334	$21,760	-$66,229
3	$28,777	-$28,557	$18,921	-$47,307
4	$28,777	$220	$16,453	-$30,854
5	$28,777	$28,997	$14,307	-$16,546
6	$28,777	$57,774	$12,441	-$4,105
7	$28,777	$86,552	$10,818	$6,713
8	$28,777	$115,329	$9,407	$16,121
9	$28,777	$144,106	$8,180	$24,301
10	$28,777	$172,883	$7,113	$31,414
Net present value			**$31,414**	
Internal rate of return			**22%**	
Discount rate			**15%**	

What this means to you

This analysis has shown that investment in sub-tropical pastures and oversown with temperate legume pastures can deliver good returns on investment. The extent to which they deliver solid returns on investment depends on:

- the skill of the manager,
- the existing livestock system and the timing of feed demand,

- the existing feedbase and the timing of supply,
- the quantity of feed supplied by the pasture being replaced and
- the requirement for feed supply over the summer period when sub-tropical pastures deliver more feed.

The outcome of this analysis is specific to the circumstances of the case study farm. The benefit derived in this business will be different in other businesses depending on the livestock system that they operate and the extent of the difference in feed supply and timing of feed supply between sub-tropical pastures and the existing pasture base.

Much of the benefit in this system is derived from additional feed supplied during a period of shortage in feed quality and feed quantity. It is possible that the same or superior benefits could be achieved from changes to the livestock system given the existing feed base however the scope of this project did not allow for the investigation of this as an alternative investment option.