Pushing the profit drivers for pasture

M. Gout

Productive Pastures Pty Ltd, Gundagai NSW 2722
<mikegout@seedforce.com>

Abstract. *There are many things that livestock producers can do to improve their profitability. Like most agricultural enterprises, much of this will be reliant on favourable weather and prices. There are, however, some simple 'profit drivers' for livestock production from pasture and forage crops. Producers should get these into perspective and work on those with higher potential profits before or whilst focussing on more marginal options. Without feed, there will be no enterprise or higher-cost grain-feeding, so yield is important, but total feed availability is not usually the problem. Better utilisation of existing feed, better grazing management and nutrition to feed more of existing pasture at higher nutritive value will go a long way to increase profit for most producers. Once these are working well, the use of forages or pastures to fill feed-gaps and provide higher weight-gain potential should be considered as part of the farm feed-base. And finally, when looking to sow new pastures or forage, do your homework and find those options that can provide more feed at critical times, better forage quality and lower anti-nutritional factors. All these factors are well proven to drive livestock profitability from pastures. As well as breeding for higher nutritive value, care should be taken to avoid factors that have a negative impact on animal production.*

Introduction

Long term research and development into pasture production has led to steady genetic gains in many long-established pasture species, plus a broad range of new species. These developments have provided current livestock producers continued competitive advantage in their ability to drive productivity of their forage-based production systems. There has been a general premise that as one increases productivity, so will profitability increase. This may not be the case, and the aim of this paper (and the associated Excel session at the conference) is to examine a range of issues that may influence profit so that producers and advisors can focus on the simple 'big ticket' items as opposed to wasting time and resources on less important (profitability-wise) issues.

The other issue that I would like to address is the inclusion of capital costs into the profit equation so that we can clearly separate the real estate gains made by ownership of land for farming, from the returns to funds invested from attempts to profit from use of the land. The biggest complaint from livestock producers would be that they do not have enough pasture available for their stock – or for the stocking rate that they would like to run. What they are in fact saying is that they are faced with seasonal feed shortages due to either the 'normal' pasture supply curve deficits, or deviations from that curve caused by climatic factors such as lack of rainfall, too much rainfall, hotter or colder than normal temperatures or a combination of all of these, for typical season growth.

Another issue for producers is having adequate high quality feed suitable for high rates of live-weight gain or milk production. Feed on offer seems to be suffering from the two main problems, either:

- Low availability
- High availability but poor quality.

The aim of this paper is to identify the key drivers of profit from pastures, review some examples of this from research work, and then to use simple models to highlight the profitability of particular changes in pastures and their management.

Increasing pasture utilisation

In most cases, producers are faced with choices from seed marketers offering them more feed – eg. 10 per cent more feed will deliver extra meat, milk or wool. This may be the case, but may not be what is needed. Apart from well managed dairy farms and a handful of beef producers, lack of total feed is not the issue as pasture utilisation rates will vary from 25–40% for extensive sheep and beef grazing operations (largely set stocked) to 50–65% for intensive fattening (budgeted rotational grazing) operations, to 60–75% for dairy operations with daily rationing of available pasture combined with other feed sources.

So the first area to improve profit from pastures is to increase utilisation. This may require:

- Further subdivision or use of electric fencing

Table 1. The gross revenue from perennial ryegrass cultivars in the Canterbury lamb study (Source: Westwood and Norriss 2001). Year 3 contained data for winter, spring and summer seasons only

Cultivars	Year 1		Year 2		Year 3		Mean	
	Carcass weight (kg/ha)	Gross revenue ($/ha)	Carcass weight (kg/ha)	Gross revenue ($/ha)	Carcass weight (kg/ha)	Gross revenue ($/ha)	Carcass weight (kg/ha)	Gross revenue ($/ha)
Aries HD	510	1275	548	1318	359	896	542	1163
Bronsyn	323	806	374	935	231	577	309	772
Embassy	461	1153	450	1104	337	842	416	1033
G.Nui	313	781	341	813	261	651	305	748
Quartet	537	1343	550	1375	349	873	478	1197
Vedette	441	1101	456	1083	269	673	388	952

- Adjusting stocking rate and enterprise to maximise grazing of peak production periods
- Harvesting of surplus feed to be fed back later in periods of deficit.

Increasing utilisation can have another side-benefit to increasing profitability. By harvesting more feed it will usually be harvested at levels of higher nutritive value offering better meat, milk or wool production per head at the same stocking rate. It will also enable higher stocking rates as more feed will be consumed, so this simple issue can have a multiplier effect on profitability.

Increasing pasture supply

As producers lift stocking rate to increase utilisation it follows that increased yield will provide a greater safety margin to prevent feed-deficits. While this may be the case, if those yield increases are produced at periods of peak pasture supply it may again lead to lower levels of utilisation. In this case, increases in pasture production should be focussed on increasing the production of feed in specific seasons of concern. This may be achieved by:

- Strategic use of nitrogen to boost feed at specific times
- More recently, the use of gibberrelic acid has shown promise on some species during the cool growing seasons
- Use of different cultivars that may provide more feed when you need it
- The use of specific forages or pasture types to change the pasture supply curve on the farm.

Improving nutritive value

Research undertaken by Westwood and Norriss (2000) in New Zealand compared milk production from two perennial ryegrasses (Aries HD and Yatsyn 1), with similar total and seasonal yield characteristics. Aries HD which was selected for higher digestibility, yielded 11.2 per cent and 15.6 per cent more milk solids (MS) per year over each of the two years – 228 vs. 202 kg MS/herd/day year 1 and 340 vs. 294 kg MS/herd/day year 2. This trial provided good evidence that improved nutritive value could improve profitability.

Further trials of perennial grasses by Westwood and Norriss (2001) under lamb grazing highlighted even greater differences between six cultivars. The data reported in Table 1 showed improved returns of up to $562 per hectare from the best compared to the worst performing cultivar and showed some differences between seasons for the various cultivars. Unfortunately, these differences were not able to be partitioned to the specific 'drivers' – tetraploidy increasing water soluble carbohydrates, and utilisation increased digestibility, reduced neutral detergent fibre (NDF) driving intake and lower endophyte levels enabling closer grazing and higher intake. What the trial did achieve, however, was to highlight that yield alone was not the only driver of profitability, despite most forages being marketed on yield data alone. The highest yielding variety from other replicated field trials was not the most profitable.

Further trial data from grazing forage brassicas highlighted the value of adding fibre (when NDF levels are too low for optimum rumen function) to provide increased live-weight gain (Table 2).

With the high costs of animal performance studies and often criticism of the results due to the management practices used, much of the development of forages in various parts of the world is now tested for yield and nutritional value and then evaluated for profitability under animal performance models. Much of USA lucerne breeding involves selection of lines using near infrared spectroscopy screening and then yield and wet chemistry, or *in vivo* testing of elite lines, before entering the data into dairy models to highlight predicted

Table 2. Lamb growth rate and live-weight gain (LWG) on brassica with different fibre sources

Treatment	Growth rate (g/hd/day)	Production (kg LWG/ha)
Pasja + straw	302	520
Pasja	281	484
Pasja + lucerne	244	420

profitability. The benefit of using modelling is that it allows advisors to alter the assumptions by individual enterprises and properties to reflect the varying levels of management.

Research in France by 'RAGT Semences' has developed diploid Italian ryegrass – with the same nutritive value as tetraploids during the cool season, and the summer density and persistence of diploid Italian ryegrass. RGI 542 has been tested under grazing in Australia over the past two years by Seed Force and these trials have confirmed the breeding benefits compared with Australian control varieties, and it has now been commercialised in Australasia as SF Indulgence DipQ. Under animal performance modelling, the higher metabolisable energy (ME), lower NDF (Table 3) and similar yield would deliver up to $500/ha greater returns for milk and up to $300/ha under beef based on various assumptions.

Reducing anti-nutritional factors

Further improvements in animal production have been made possible through a better understanding of other factors having a negative impact on animal production. In the 1990s, two new forage rapes (Arran and Striker) failed to deliver positive animal performance results. They were subsequently found to contain high levels of two alkaloid types (glucosinolates and S-methyl cysteine sulfoxides) that adversely affect intake at low levels and can be toxic at high levels under certain soil nutrition levels.

Table 3. Nutritive value analysis of Italian ryegrass. Data are means of 4 replicates sampled prior to each grazing by beef steers, Gundagai NSW. Feed analysis undertaken by NSW Department of Primary Industries Feed Quality Service, Wagga Wagga

Cultivar	Ploidy	July	August	September	October	December	mean
			Metabolisable energy (MJ/kg DM)				
SF Emmerson	tetraploid	11.63	10.63	10.60	9.73	10.25	10.57
RGI 542	diploid	11.43	10.53	10.65	9.83	10.55	10.60
Feast II	tetraploid	11.48	10.70	10.48	9.65	10.15	10.49
SF Accelerate	diploid	11.33	10.43	10.45	9.73	10.13	10.41
Crusader	diploid	11.30	10.25	10.43	9.53	9.75	10.25
Hulk	diploid	11.40	10.40	10.35	9.28	9.80	10.25
Sonik	diploid	11.10	10.38	10.30	9.50	9.50	10.16
			Crude protein (%)				
SF Emmerson	tetraploid	22.00	21.50	24.1	21.40	24.30	22.66
RGI 542	diploid	23.70	21.20	24.3	23.00	24.10	23.26
Feast II	tetraploid	22.30	19.50	25.1	22.20	24.70	22.76
SF Accelerate	diploid	24.50	21.30	23.8	22.20	24.10	23.18
Crusader	diploid	24.0	23.10	24.5	21.20	22.40	23.04
Hulk	diploid	24.60	21.40	24.3	20.70	22.10	22.62
Sonik	diploid	23.50	21.70	24.5	21.00	22.10	22.56
			Neutral detergent fibre (%)				
Emmerson	tetraploid	32.5	36.3	40.5	48.3	45.0	40.5
RGI 542	diploid	31.0	36.8	41.3	49.3	43.8	40.4
Feast II	tetraploid	30.5	35.8	41.3	49.8	47.0	40.9
SF Accelerate	diploid	31.3	41.3	43.0	51.3	45.8	42.5
Crusader	diploid	34.3	41.8	45.3	54.0	48.5	44.8
Hulk	diploid	35.3	38.8	44.0	51.5	47.0	43.3
Sonik	diploid	34.5	39.5	43.0	52.0	49.8	43.8

The variety Bonar was released in the mid-1990s with lower levels of these compounds and performed better in animal performance trials. Further understanding of these compounds highlighted the ability to minimise their levels in forage brassicas by reducing supply of sulphate and available nitrogen to growing brassica crops.

Research by AgResearch New Zealand identified a number of compounds contained in the fungal endophytes which exist in tall fescue and perennial ryegrass. By identifying endophytes with low or nil levels of some of these alkaloids, they have been able to insert these into existing cultivars to improve animal safety and performance.

Trial work in New Zealand has shown an improvement of 9 per cent for ryegrass containing the AR1 endophyte compared to the same cultivar containing standard wild type endophyte (Table 4)– an increased benefit of $322/ha per year for an increased sowing cost of around $40/ha. Other novel endophytes in perennial ryegrass offer better persistence against pasture pests, but trial data supporting any animal benefits or improved profitability are not yet available.

Improving persistence

This is a difficult trait to prove as there have been few long term (greater than 3 years) trials reported which have measured production and profitability over time. The simple assumption is that if a pasture lasts longer or has a greater plant density at the end of a trial then it should be more profitable over the long-term.

This myth has been popularised by recent survey work highlighting the outstanding persistence of phalaris in long-term pastures. No-one would dispute this outcome, but to extrapolate profitability from persistence is an extremely dangerous exercise.

If persistence is an outcome of low palatability or high levels of anti-nutritional factors, then a long-term pasture based on these characteristics will soon be out-performed by pastures with better milk or meat production capacity even if they have to be re-sown more often. The impact of plant compounds toxic to animals such as endophyte clearly demonstrates this point.

Table 4. Impact of endophyte on milk production and returns

Endophyte	Milk production (kg MS/ha/year)	Milk returns ($NZ/ha)
Standard	847	3,642
AR1	942	3,965

However, if pastures of similar animal performance can offer longer term persistence then this would be a benefit. Consider the example of using highly winter active lucerne to drive yield in winter- rainfall dominant areas. Research has confirmed that the lower-crown, more dormant types will out-perform the more winter-active types in pasture phases in excess of five years. But by sowing a more dormant type with a Mediterranean grass can increase the winter and total production over a highly winter active lucerne alone, and still maintain better lucerne density and stand longevity.

Phalaris should be used as a major component of long-term (breeding) pastures under low management and low utilisation systems. But it can be even more profitable under heavier stocking rates especially during winter as trial work at Glenormiston, Victoria by Reed (1974) and at Cressy, Tasmania (Gout 2006).

However the Cressy data and pasture work in the New England (R. Eccles, personal communication) has highlighted the ability of well managed tall fescue-based pastures in reliable (and in particular summer-rainfall areas) to achieve high animal performance over a number of years that would clearly cover more frequent re-sowing costs. These results are backed up by University of Uruguay trials, that I inspected in 2005, that had achieved beef live-weight gains of 760 kg/ha under low fertility and management, and 1,100 kg/ha under high fertility and management.

In my experience, sowing phalaris with tall fescue can enable medium-term benefits over phalaris alone with phalaris being capable of persisting if tough years or overgrazing thin out the tall fescue. Phalaris will colonise spaces in the sward as will subterranean clover included in the pasture mix.

In general, if persistence gains are possible (but not at the expense of palatability, intake, pasture utilisation, feed quantity and quality), then it is a good benefit and should lead to improved profitability. But persistence gains alone may be at the expense of enterprise profitability.

Dilution of capital costs

Livestock farming has relatively little capital tied up compared to broad-acre farming operations. Operators typically use contracted labour and machinery for key operations, with operator labour, land, shed, yards and livestock as the main areas for investment. Typical economic thought has highlighted the potential to improve profitability by diluting overhead costs over greater stock numbers to reduce per unit costs.

While this is part of the story, focus should be on reducing production-costs by increasing the turn-off of meat, milk or wool from the property to reduce the cost of production of each kg of output.

I have memories of a visit to New Zealand dairy producers in the mid-1990s claiming 85% pasture utilisation, but peaking milk production at 14 L/cow off grass, and wasting energy on relatively high maintenance needs compared to production requirements. The production levels could have been achieved with 25 per cent less stock (and associated capital cost). I met one such producer who had figured it out and dropped from 1,200 to 900 cows to produce the same milk, with 300 cows x 90 MJ x 260 days or 7 million MJ ME saving – about 600 tonne of grain ($250,000) plus 300 cows x $1,700 ($500,000) less capital tied up. Who would not want to improve profit by $250,000 and reduce borrowings by $500,000? The point here is that the focus on pasture utilisation as the main driver of profit had seen the enterprise go over the profitability threshold, and negatively impacted costs of production and return on equity.

The difficulty for meat producers at the current time is that the changing market conditions have not yet signalled any rational reason to grow out stock to higher weights as an alternative to grain-finishing, now that grain costs have 'belted' lot feeders and taken buyers out of the market. Again there is no incentive to buy weaner stock at say $2.00/kg and grow them out at higher maintenance requirements to sell at $1.60/kg. It takes a lot of weight-gain to cover the price loss. The successful trading enterprises of a few years ago can no longer justify buying in stock to improve profitability by grazing the excess spring flush, when they could be sold at similar or higher prices per kg.

But we should examine the impact of land prices and associated pasture options and production possibilities

Table 5. Impact of land values and pasture costs on costs of beef production

	Low value perennial	High value perennial	High value lucerne	High value annual rye	High value rape
Land value ($)	3,000	5,000	5,000	5,000	5,000
Sward life (years)	20	10	6	0.75	0.5–0.67
Capital cost ($)	300	500	500	500	500
Sowing cost ($)	300	350	300	300	240
Annualised ($)	15	18	50	300	240
Maintenance ($)	75	120	120	150	75
Yield (kg/ha)	5,000	8,000	8,000	10,000	8,000
Utilisation (%)	40	60	60	65	70
Feed availability (kg/ha)	2,000	4,800	4,800	6,500	5,600
Capital costs (c/kg)	15	10.4	10.4	7.7	8.9
Annual costs (c/kg)	4.5	2.9	3.5	6.9	5.6
Total costs	19.5	13.3	13.9	14.6	14.5
NDF (%)	50	45	40	40	35[A] with fibre
ME (MJ/kg DM)	9	9.5	10	10.5	12
Daily intake (kg)	7.2	8	9	9	10.3
Daily intake (MJ ME)	64.8	76	90	94.5	123.4
MJ ME for growth	20.8	32	46	50.5	79.4
LWG (g/hd/day)	462	711	1,022	1,122	1,765
Grazing days	365	365	365	210	150
LWG (kg/hd)	168	260	373	236	265
Stocking rate (DSE)	1.5	2.5	2	4	4
LWG (kg/ha)	252	650	746	944	1,060
Estimated FCE	20:1	12:1	10.7:1	8.5:1	7.5:1
Cost of LWG ($)	3.90	1.60	1.49	1.24	1.09

[A]Based on cost of money at 10% pa; Intake based on 1.2 x live-weight/NDF% for an average 300 kg steer; ME for growth based on 44 MJ for maintenance and 45 MJ per kg live-weight gain to see how our costs of production stand up. In general, the production output will determine the contribution of overhead costs to overall costs and it may not be the long term persistent pastures that are the most cost effective – it will depend on the operator and his cost structures. Perennial pastures may have a more significant role for breeding stock and other land health issues.

An analysis of some potential scenarios facing producers on a 'typical' farm with different soil types (and values) and forage options is used as a way of looking at the impact of land values and production systems on the costs of beef production. Table 5 sets up five possible outcomes from a continuum of possibilities to see how some of the factors discussed above might look in terms of setting the feed-base cost for a livestock property.

References

Bluett SJ, Thom ER, Clark DA, Mac Donald KA, Minnee EMK (2003) Milksolids production from cows grazing perennial ryegrass containing AR1 or wild endophyte. *Proceedings of the New Zealand Grassland Association* **65**, 83–90.

Garrett BC, Westwood CT, Nichol WW (2000) Optimising animal production from forage brassicas. In 'Proceedings of the New Zealand Institute of Primary Industry Management Conference.' pp. 61–73.

Gout MJ (2006) Progress with pasture plant breeding. In 'Proceedings of 15th Annual Conference Tasmanian branch of Grasslands Society of Southern Australia.' pp. 62–74.

Nichol WW, Garret BC (2001) Optimising prime lamb production on summer brassica crops. In 'Proceedings of the 6th World Sheep and Wool Congress', CD-ROM, 2001.

Reed KFM (1974) The productivity of pastures sown with *Phalaris tuberosa* or *Lolium perenne*. 1. Pasture growth and composition. *Australian Journal of Experimental Agriculture and Animal Husbandry* **14**, 640–648.

Westwood CT, Norriss MG (2000) Performance by dairy cows grazing two perennial ryegrass cultivars. *Proceedings of New Zealand Society of Animal Production* **60**, 247–252.

Westwood CT, Norriss MG (2001) Liveweight changes in lambs grazing six perennial ryegrass cultivars. *Primary Industry Management* **4**, 31–35.