MANAGEMENT OF THE PASTURE COMMUNITY:

SELECTING THE RIGHT PASTURES TO MEET THE MARKET

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SUMMARY: The more closely the feed supply is matched to the demands of livestock, the more likely the efficiency of the pasture/ livestock operation will improve and profits increase. Producers with irrigated pastures and the intensive dairy industry have progressed significantly towards closely matching pastures with the requirements of stock. In the more extensive enterprises, where production is more variable, this is not the case despite advances overseas. The feed supply on the Northern Tablelands is examined in relation to supplying large lean lambs and feeder steers. Growth rate and quality information on a range of pasture types are inadequate to closely match supply and demand. Developments in improving these factors are discussed as well as the role of decision support systems that are available to assist the producer close the feed gap as much as possible within the constraint of the available resources.

In the ideal production unit we would first identify the product most likely to increase profit, then identify the requirements of the product and subsequently work to satisfy these needs efficiently and economically.

In our extensive grazing enterprises this approach is not always followed. Many producers use the pasture base as the starting point and see what they can do with it in terms of maximising profit. This approach although understandable, tends to reduce opportunities, as the pasture base can be modified for both quality and quantity to fit the needs of a range of enterprises. As well, the efficiency of pasture utilisation is more likely to be greater, as the operator has looked closely at what is needed to meet a target and what feed is likely to be available.

Dairy farmers have shown the way by looking at the nutritional requirements of the dairy cow then matching supply and demand for optimal production. Collins (1986), in the first conference of this Society, demonstrated this approach by constructing a feed profile and a feed budget. He used a simple spreadsheet in which he based his feed supply estimates on pasture measurement data supplied by the local district agronomist. He matched this with the established requirements for milk production.

Jim Collins' system allowed for "What if's" to be tried and so provided a means of refining his pasture base over time so that a closer matching of supply and demand was possible. Currently, dairy farmers have access to electronic decision support systems(see later) that enable them to work through different combinations of pastures, forage crops and concentrates to arrive at the most likely and profitable feed supply system for their farm. An increasing number of dairy farmers now have tightened up their balance of supply and demand and are showing the results in additional profit.

Similarly, with feed lot cattle, the number of variables are relatively small and the producer has a good level of control over the process.

The dairy farmer has the advantage of being able to quickly gauge the effect of a change of feed through daily milk yield and quality. Also he is often operating in a relatively reliable rainfall area, often with a significant area of irrigation. The feed lot operator, has removed much of the variability from the immediate production system and can monitor feed quality, quantity and live weight gain.

In extensive dryland production systems quick feedback is limited, but we do have a lot of information that can direct us into fine tuning supply/demand. We can also increase our efforts in monitoring weight gain and hence increase the feedback enabling more rapid change to more efficient feeding.

Developments overseas in extensive grazing enterprises (*e.g.* New Zealand), have demonstrated the practicality of more closely matching feed supply and demand (Milligan *et al.* 1987). We may claim

that variability in climate and feed supply is greater over much of the country we manage, the exercise is not impossible, just more challenging.

Can we more accurately match our pastures to our product requirements than in the past?

Yes! In recent years there have been a number of developments that bring us closer to the dairy situation than ever before. Because of the great variability involved, we can not expect to reach the degree of efficiency over the production cycle that dairy farmers achieve, unless variability is reduced by irrigation.

The following factors have improved our ability to more closely match the supply with the requirements:

- More information is available on the specifications for livestock for specific market segments;
- More information is available on the feed requirements of stock to meet market targets;
- More information is available on the quantity and quality of pastures produced;
- Decision support systems are available that help identify stock requirements that enable fine tuning of matching supply with demand, and assisting with economic decisions, *i.e.* GrazFeed;
- Extension programs are availablewhicht will enable producers to learn to assess pastures and livestock, *i.e.* PROGRAZE;
- More reliable pasture species and management techniques have increased the reliability of production; and,
- Increased availability of climate risk analysis tools which help the producer to better understand the level of risk involved and make better informed decisions, *i.e.* Rainman, MetAccess.

To illustrate the approach of more closely matching pasture supply to the goals set for livestock, we have selected Northern Tablelands pastures as our feed base and 2 enterprises - large lean lamb and feeder steers. Although we have selected these particular combinations, the approach is applicable to other enterprises and geographic areas.

Market requirements

Large Lean Lambs

There is potential for higher prices in the April to August period. To market then, lambing will need to occur about September, perhaps into early October, if the objective is to supply into the early part of that period.

The large lean lamb required by the trade is a 2-3 score principally a second-cross cryptorchid with a hot carcase weight of 20 kg or better at 5 - 8 months of age.

The target we have set ourselves for this example is for lambs to reach a live weight of 45 kg by April necessitating an average growth rate of 200 g/head/day, assuming a mid September lambing, a birth weight of 4.5 kg, and weaning at 12 weeks of age.

Table 1. Pasture benchmarks for sheep and cattle (Bell and Blackwood 1993).

Sheep	Minimum herbage mass kg green DM/ha	Cattle	Minimum herbage mass kg green DM/ha
Dry sheep	400 - 500	Dry cow	900 - 1100
Pregnant ewes - mid	500 - 600	Pregnant cow (7-8 months/not lactating)	1500 - 1600
- last month	800 - 1000	Lactating cow (calf 1-2 months old)	2300 - 2500
Lactating ewes - singles	1000 - 1200		
- twins	1400 - 1600		
Growing stock		Growing stock	
% of potential growth rate:		% of potential growth rate:	
30% (90 g/day)[1]	500 - 600	30% (0.41 kg/day)[2]	1000 - 1200
50% (150 g/day)	700 - 800	50% (0.78 kg/day)	1400 - 1600
70% (190 g/day)	900 - 1000	70% (1.03 kg/day)	1800 - 2000
90% (250 g/day)	1500 - 1600	90% (1.31 kg/day)	2800 - 3000

Note: [1]The growth rates in brackets for sheep are based on a weaned four monthold crossbred lamb of approximately 32 kg (standard reference weight 55 kg) on a pasture where the green component was 73% digestible, there was 500 kg DM/ha of dead herbage of 45% digestibility and 30% legume; [2] The growth rates in brackets for cattle are based on a weaned 13 month old steer of approximately 320 kg (standard reference weight 500 kg) on a pasture where the green component was 73% digestible, there was 500 kg DM/ha of dead herbage of 45% digestibility and 30% legume.

Feeder steers

The goal is to supply steers to the feedlot, ultimately destined for the Japanese grainfed market. Feedlot entry specifications being approximately 415 kg liveweight with a fat score of 2.

Due to price and availability, weaners are purchased at 250 kg live weight in mid to late May. The target is to turn them off by Christmas, necessitating an overall growth weight of 0.9 kg/head /day.

The feed requirements

Bell and Blackwood (1993) gave an indication of the quantity of feed needed to achieve certain outcomes (Table 1). For lambs to reach a good growth rate, say greater than 70% of potential, 1000 - 1500 kg of dry matter of green pasture of high digestibility (*i.e.* 73%) needs to be available to stock. For steers to achieve a comparable growth rate they require around 1800 - 3000 kg of dry matter of similar pasture quality.

Benchmarks (*e.g.* Table 1) can provide acceptable information on livestock requirements. However in reality, the amount of pasture available and its quality is going to vary. In the two examples discussed in this paper, *i.e.* large lean lamb and feeder steers, the winter pasture availability is likely to limit production and as we move towards summer and pastures mature, pasture quality or digestibility is likely to decline and so limit intake by stock and reduce animal growth rates.

Figure 1. Pasture requirements and production of large lean lamb.

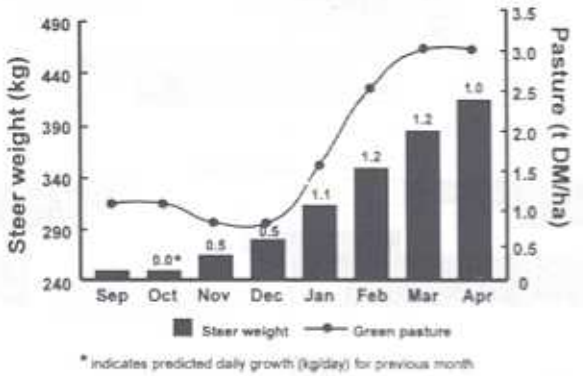

Figure 2. Pasture requirements and production of feeder steers.

A planned approach to grazing management, where the aim is for greater control over the grazing system, does require the producer to have an appreciation of feed quality and quantity measured in the terms expressed above. PROGRAZE is a program developed by NSW Agriculture, with support from the Meat Research Corporation and the International Wool Secretariat, to assist in improving the skills of producers in making these estimates.

We aim to achieve average growth rates in our lambs of 200 g/day and 0.9 kg/day in the steers. In reality, over their respective finishing periods, growth rates will vary considerably around these averages. An important objective for the grazing plan is to concentrate on making available sufficient quantity of pasture (kg DM/ha), while recognising the restrictions of seasonal pasture growth.

Figures 1 and 2 are simulations of the large lean lamb and feeder steer enterprises using predictions from GrazFeed. Digestibilities (Figure 3) used in these predictions are based on data generated over two years of recordings of an improved pasture at Glen Innes as part of the Pasture and Animal Assessment Project. These simulations indicate the amount of pasture required for our objective for both the large lean lamb and feeder steers. The predicted weight of stock at the middle of each month is indicated by the top of the bar while their growth rate over the previous month is indicated by the number over the top of the bar. Critical aspects of these simulations are as follows :

Large Lean Lamb

- The provision of 1000 kg green DM/ha for lambing and building to 1500-1600 kg by mid October. Lamb growth rates over the first 3 months are vital to achieving the target.
- Managing grass/legume pastures so that herbage does not exceed about 3000 kg green DM/ha ensures that optimum quality is maintained. Above this quantity, digestibility tends to decline especially with grass dominant pastures.
- Pasture quality (as measured by digestibility), in association with the amount of pasture available, largely determines success when high production levels are required. When a similar simulation was conducted using a native pasture dominated by summer growing

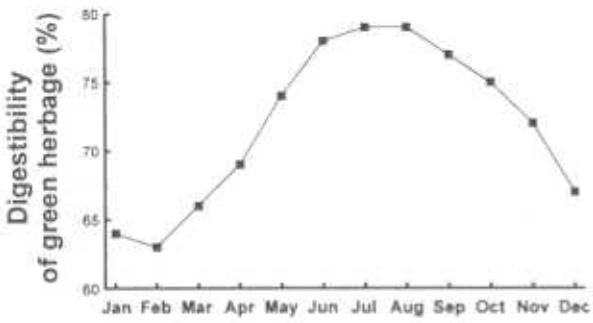

Figure 3. Mean digestibility of an improved pasture at Glen Innes 1988-91.

species where measured digestibilities ranged between 3 and 7 units of digestibility below that of the improved pasture depicted in Fig. 3, lambs had not reached 40 kg by mid May and this was assuming 1500-1600 kg green DM/ha was available from mid October.

- Lamb growth in February *i.e.* 115 g/day, is restricted by low digestibility (Figure 3). If the objective is for elite lamb (50 kg liveweight) to be produced prior to winter, this low period of digestibility needs to be addressed by an alternative pasture source *e.g.* lucerne or possibly chicory or supplementary feeding.
- The provision of about 1500 - 1600 kg DM/ha of green pasture from October to April. With planned management this should be possible, except possibly for late summer and autumn with the seasonal downturn in pasture production. A special purpose pasture such as lucerne or possibly chicory may be considered to fill this gap.

Feeder Steers

- Herbage mass requirements through winter range between 700-1000 kg green DM/ha. With planning this should be achievable.
- The critical period is likely to be in the early spring where there is a requirement in September of an average herbage mass of 1500 kg green DM/ha. The lift to around 3000 kg by the end of spring should be attainable in most years with planning.
- Rapid growth of pasture in late spring and early summer can result in high levels of herbage mass, early maturation of mixed pasture and so a lowering of digestibility. Attempt to manage pasture for steers so green herbage mass does not exceed about 3500 kg DM/ha. Where pastures are allowed to exceed this amount, quality may drop to unacceptable levels, especially with grass dominant pastures.

Grazing plans

To develop grazing plans similar to our two examples requires knowledge of livestock requirements to achieve a specific outcome and pasture production. In respect to pasture production this refers to their growth potential and quality variation over time. Plans of this nature are often described as a fodder budget particularly when they include predictions of stocking rates.

Predictions of livestock requirements can be obtained from GrazFeed. Unfortunately, sufficiently detailed pasture production information is not yet

Table 2. Potential production of quality feed from Northern Tablelands pasture and crops (Based on District Agronomists' estimates of likely production in average years with good management).

Pastures	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
Native(summer grasses)																		
Microlaena/White Cl																		
Native/White Cl																		
Cocks/Fesc/White Cl																		
Phalaris/White Cl																		
Phalaris/Sub Cl																		
Lucerne																		
Chicory																		
Forage Crops																		
Jap Millet																		
Oats																		
Turnips																		
Forage Brassicas																		
S.T. Ryegrass/Red Cl																		
Short term ryegrass																		
Key																		
High quality cattle and sheep feed sufficient for high growth rates, mod stocking rate																		
High quality sheep feed sufficient for high growth rates, mod stocking rate																		
High quality feed insufficient for high growth , mod stocking rate																		

readily available for all districts. NSW Agriculture has plans to publish available information for the Tablelands and Slopes and eventually GrassGro (see later), a computerised pasture growth program being developed by CSIRO should be a ready source of this information.

Table 2 provides our prediction of expected production from the main pasture types on the Northern Tablelands in an average year based on estimates by district agronomists in the region. It is an attempt to provide a reasonable estimate for the producer given that more accurate information may not be available. For this exercise, we have chosen to use approximately 1500 and 2800 kg green DM/ha as indicators of quantity as they are the approximate amounts needed to be made available to sheep and cattle respectively to achieve high levels of production. The quality aspect is covered by assuming the feed is highly digestible (*e.g.* 70 -75%).

On an individual property in the Northern Tablelands, a producer will have to modify the predictions of likely feed supply in Table 2 to cater for his own soil types, fertility, management and local climate. As well, other species including new introductions may have a role.

Our estimates on chicory production are based on data from the Central Tablelands and still need validating in this environment.

Using Table 2 to match the needs of the **large lean lamb** enterprise (Figure 1) that is, approximately 1600 kg green DM/ha of high digestible pasture between September and April, there are a number of points that are apparent:

- Lucerne and possibly chicory will meet the requirements in the summer and autumn period, but will be slow in the earlier part of the production period (September/October) under tableland conditions.
- Native grass pastures are inadequate and even with super and white clover will probably be inadequate at the finishing period in April. If microlaena and white clover are the main species present then quality production should improve, however experience has shown that a good percentage of white clover is necessary and performance of white clover has been unimpressive in recent years.
- Of the temperate grasses, phalaris will provide quality feed throughout much of the required period. White clover is the preferred companion legume. Fescue and cocksfoot based pastures have an extended feed supply and so are more reliable than phalaris pastures for animals targeted for this market. Choice of grass may of course be dependant on factors such as soil type.
- None of the forage crops are adequate to carry lambs right through by themselves but they are useful to carry stock for much of the period and relieve pressure on perennial pastures. Forage brassicas such as forage rape and chou moellier offer the best possibilities but may be unreliable when finishing stock in April.

When matching our **feeder steer** requirements to the pasture supply we have a different situation as the scenario we have chosen allows for the low winter feed production on the tablelands.

This scenario does not push the growth rates of feeder steers and a large bulk of high quality feed (2000 - 2500 kg/ha) is not needed until November - December. However, reasonable quantities of highly digestible forage (1000 -1500 kg/ha) are needed in the September - October period. In the winter period, the producer may have to put up with low steer growth rates until feed improves. On this basis,

- Our main temperate grass/legume pastures will supply the requirements satisfactorily, with fescue/cocksfoot/white clover pastures generally providing more reliable late feed.
- Native pastures, by themselves, are incapable of reaching the target weights as they are too slow to meet the weight gains in early spring. *Microlaena* based pastures contribute earlier and have a role in this enterprise.
- Lucerne and possibly chicory have a role in the final months before sale but winter growth rates restrict their usefulness. Winter active lucerne varieties may contribute a little more than indicated, but mainly in the late autumn early spring period, and not winter.
- Of the forage crops, the role of oats is obvious over the winter/spring months but short term ryegrass has the advantage of later production and should take steers through close to finishing, especially if grown with red clover in the mix.

When matching the feed requirements with the potential supply for production of feeder steers, there is a temptation to push the growth rates further. The use of fodder crops (oats, ryegrass) could be used effectively, in combination with fescue/cocksfoot/white clover based pasture to turn off steers much faster. This is of course a decision that needs to be based on economics and whole farm management issues.

These two examples show the complexity of the pasture animal system and the need to appreciate the variables involved. The use of GrazFeed will be of value to producers who are attempting a closer matching of feed supply to market opportunities.

Stocking rates

Table 2 does not give a great insight into the potential stocking rates on these pastures or forage crops. It is designed to indicate when feed of adequate quality and quantity is available to reach target growth rates.

Attempts have been made in the past to indicate production deficiencies (Ayres *et al.* 1994) and carrying capacities/stocking rates on various pastures and forage crops for northern districts (O'Sullivan 1985; Lowien *et al.* 1991; Collett 1994; Ayres *et al.* 1994). At least these are good approximations and you will need to establish what is possible on your country under your management. Decision support systems such as Feed Plan can also be used to advantage in estimation of likely stocking rates. Figure 4 indicates production estimates (in livestock months) of five categories of pastures on a seasonal basis for the Northern Tablelands used in Feed Plan.

Managing the pasture community

The task in both these enterprises is to concentrate on feed quality especially in the case of large lean lambs. In practical terms this means increasing the proportion of highly digestible feed to low quality feed wherever it is practical and economical to do so.

As a general rule, in Northern Tablelands pastures, this involves increasing the percentage of legume in the pasture as opposed to grass (especially of summer growing grasses) and increasing the reliability of supply of quality feed. Soil fertility plays a major role in determining pasture quality.

Species

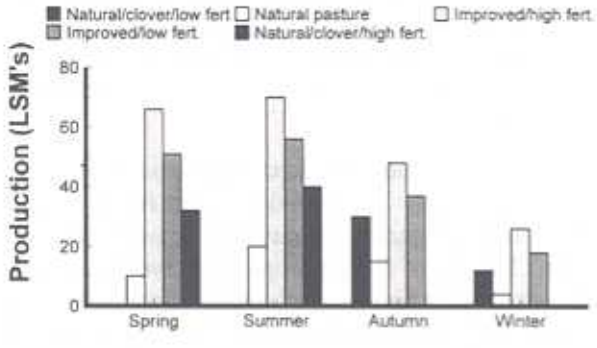

Figure 4. Pasture production - Northern Tablelands (S. O'Sullivan, Complan Handbook 6).

The greater the legume content in the pasture the better, provided long term botanical stability is not threatened and factors such as bloat are not increased to unmanageable levels. Herbaceous pastures such as chicory can be regarded as productive as legumes (Michalk *et al.* 1994) however, their use must take into account that they do not fix nitrogen. If the nitrogen supply is inadequate, quality may not be high. If chicory is used as a long term pasture ensure that the legume component or fertiliser nitrogen is maintained.

In mixed pastures , ensure that the content of legume in the main growing season is around 30 % or better. If the content falls below 20% you need to investigate the reason and work towards a solution as far as practical.

Fortunately, clover is easily and inexpensively added to most country on the tablelands or slopes. It is more risky however on the plains.

The consistency of pasture supply, while very much under the influence of the climate, can be assisted by careful selection of species. The role of perennial species, especially grasses is obvious.

The case for cool season grasses (phalaris, fescue etc) is very evident (Table 2). Recent interest in tropical grasses especially on the slopes does not help as these grasses tend to be lower in digestibility and more difficult to manage.

Grazing management

This is the area where the producer can have considerable effect on what feed is available to animals.

The maintenance of grass based pastures in the vegetative stage for much of the production period will keep their digestibility up and enhance the probability of maintaining legume percentage in the pasture.

In Northern NSW the management of the grass component is possibly more important than in the south as summer rainfall and a predominance of summer growing grasses make grazing management to maintain feed quality more challenging. This is particularly important in maintaining the legume component by grazing reasonably hard in the late summer-autumn period to stimulate sub clover establishment (Leigh and Halsall, 1994).

Resting pastures following the seasonal break will encourage legumes (FitzGerald 1989), while resting mixed pastures in the spring will favour white clover composition (FitzGerald and Clark 1993).

A research program supported by the Meat Research Corporation is investigating optimum grazing management strategies for perennial pastures. This work should provide more precise management guidelines and a better understanding of seasonal resting on botanical composition.

Fertiliser use

The role of fertiliser in encouraging the legume component in a pasture is well known. What is less well known is the effect of fertiliser in increasing the quality of the pasture. Crocker (1994) working with fertiliser on pastures on the northern slopes demonstrated the effect of P and S on a mixed pasture and the effect on clover and protein content, an indicator of pasture quality. Saul (1994) showed the effect of increasing rates of phosphorus on pasture growth, botanical composition, digestibility, liveweight gain and stocking rate in Victoria.

Useful tools to assist matching supply to demand

Some useful decision support systems to aid matching feed demand with supply are listed below. Many are available through district officers of NSW Agriculture.

Dairy industry

Milkanomics Feed Plan - Matches the supply of pasture and forage crops to meet the needs of milking cows (NSW Agriculture).

Milkanomics Higro - enables the feed supply for the growth of heifers to be optimised. (NSW Agriculture)

Camdairy - Takes the base pasture and crop supply and optimises the most cost effective ration concentrates needed to reach production targets (University of Sydney).

Beef and sheep industry

Feed Plan - A program based on Complan and its estimates for seasonal feed supply for the Northern Tablelands, Slopes, and Plains. The seasonal feed supply accounts for 2 qualities of pasture. This can be matched against the feed requirement calculated for a particular enterprise. It is useful for approximate matching of supply and demand. Feed supply estimates from Figure 4 are used in this program (available through District Agronomists in northern districts).

Stockman - A program similar to Feed Plan but is less detailed. Feed supply is based on Complan estimates and is presented on a monthly basis. Useful for rapid "what if" effects of changing pastures and crop areas. Feed supply estimates from Figure 4 are used in this program (NSW Agriculture Tamworth).

SheepO - this is a whole farm program based on the farm's pasture production and examines the physical and financial outcomes of management alternatives for the sheep enterprise. (NSW Agriculture)

Beef-N-Omics - An economic analysis of alternatives for beef production systems utilising the pasture/forage crop base (NSW Agriculture).

GrazFeed - Predicts livestock production (liveweight, wool and milk production) on pasture and the effect of feeding supplements CSIRO).

Climatic Risk

Rainman (Qld DPI) and MetAccess (CSIRO) - These tools can develop a better understanding of risk associated with climate. We can use them to our advantage by looking at the probabilities of receiving rain during a particular period.

Further developments

Perhaps the most important development is AusFarm by CSIRO. AusFarm is an overall decision support system of which GrazFeed is one component. The development of GrassGro (another component) is well advanced.

GrassGro will enable producers to examine the feed production on their farms in terms of quantity and quality by entering the many components that make pastures grow, *i.e.* soil type, moisture, fertility, species *etc.* This development promises to overcome many of the problems highlighted above. It is likely to have it's initial application in temperate pasture areas.

Grasp, a growth model being developed by Qld DPI, can predict grass production based on agronomic inputs , and may have application on the NW plains of NSW.

MetAccess is a further module of the AusFarm and is a meteorological data base that can be used in conjunction with GrassGro.

Research in recent years has also demonstrated the possibility of using computers and modelling to construct feed profiles (based on growth indices) to assist in farm planning (Dick 1994). In a recent study on the eastern fall of the tablelands, a range of feed plans were established to estimate potential relative pasture production and livestock growth from a range of pasture types on different country.

GrassGro has the potential to provide us with meaningful pasture growth curves in the future however, in the meantime we are investigating the use of growth indices to provide growth curves for a range of pasture types for slopes and tablelands regions of NSW. This should provide producers with a ready approximation of production levels from common pasture types to match with enterprise requirements, but fine tuning will always be needed for your own property. The need for continued monitoring of your pastures and livestock is essential if you wish to closely match feed supply with demand.

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