Forage for Beef Production

Profitable livestock production is a challenge, involving practical experience and science.

The personal experience and intuition of cattle producer is built up over many years. The science of livestock production and animal nutrition is often not simple and is itself, an evolving science growing as new information is accumulated.

Practical experience and science combine well in this field, where no two seasons are the same and where circumstances change all too quickly.

Setting Goals

As with any business, the setting of goals in livestock production is beneficial. It may involve producing so many steers per year or producing a certain number of bullocks per month, of a particular weight range. Having a goal is a good first step. The following steps are then:

- Determine the feed requirements (quantity and quality) to meet these goals.
- Choose the feeds that can meet these needs.

Achieving these goals is about satisfying the nutritonal needs for the chosen level of productivity.

Predicating Voluntary Intake

One method of predicting the maximum dry matter intake (DMI) by stock of a particular feed is to use a calculation involving the Neutral Detergent Fibre (NDF) content. NDF is often listed in feed analysis reports. It is useful to note that DMI decreases as NDF increases.

The equation below can be used to provide a guide for dry matter intake for beef cattle.

$$\textbf{Maximum intake} = \frac{1.2\% \text{ of Animals Liveweight}}{\text{NDF}}$$

Example:
For a 200kg steer on a diet with NDF of 52%, the calculation becomes:

$$\textbf{Maximum intake} = \frac{0.12 \times 200}{0.52}$$

4.6kg of dry matter

What happens to intake if the feed is older and more fibrous? If the grazing was delayed, the NDF % will increase because the fibre content will be increasing. Continuing the previous example with the 200kg steer, but with the NDF increased to 60%, the calculation becomes:

$$\textbf{Maximum intake} = \frac{1.2\% \text{ of } 200}{0.60} = \frac{0.12 \times 200}{0.6}$$

4.0kg of dry matter

These calculations illustrate the effect that feed quality will have on voluntary feed intake. As forage gets older, it becomes more fibrous and the amount of forage that stock can physically eat and digest each day starts to decline.

Some further examples of voluntary intake are below in Table 1 which lists the dry matter intake of growing beef cattle.

TABLE 1: Guide to maximum dry matter intake of growing beef cattle

	Dry matter intake (kg/day) for beef cattle of liveweight (kg)					
Average energy value of feed (MJ/kg)*	100	200	300	400	500	600
92	3	5	6.7	8.4	10	11.3

Adapted from 'The Nutrient Requirements of Ruminant Livestock', (1988) Commonwealth Agricultural Bureau. Used with permission.

**Metabolisable energy value of 9.2 MJ/kg is representative of good quality forage.*

continued...

[Adapted from The Forage Book, 2nd edn by Peter Stuart, Published by Pacific Seeds, Toowoomba, 2002]

5. Forage for Beef Production

Protein Requirements

Protein supply is another important factor affecting livestock performance. Livestock protein requirements can be expressed in two way. Firstly, in percentage terms, for example 145 crude protein or secondly, in absolute terms such as 700 grams of crude protein per day. In general, young growing stock require a higher percentage of protein in their diet than older mature stock.

Trying to determine the precise protein requirement for particular stock can require a lot of calculations and involve making some assumption. Table 2 provides a guide to the protein requirements of some classes of beef cattle.

TABLE 2: Guide to the metabolizable energy and crude protein requirements for some classes of beef cattle.*

Class of beef cattle	Energy requirement (MJ/kg)	Crude protein requirement (%)
Young actively growing	10-11	13
Fattening older bullocks	10	12-13
Mature dry cows in calf	7	6

**This information has been adapted from Agriculture Victoria Agnote #AG0374 'Energy and Protein Requirements of Beef Cattle'. (1995). Their permission to use this is gratefully acknowledged.*

Energy Requirements

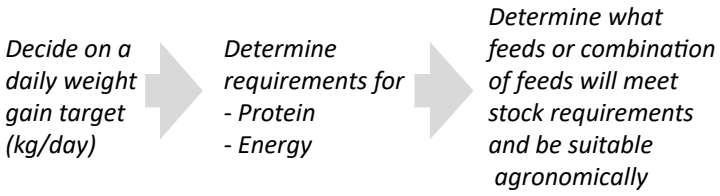
Energy requirements can be expressed in many terms, but the current most popular term is metabolizable energy (M.E.). It is expressed in megajoules per kilogram (MJ/kg) of dry matter. Throughout this book, where MJ/kg is used, it will be referring to the metabolisable energy content of the dry matter.

An animal's energy requirement can be expressed as an energy concentration e.g. 9.5 MJ/kg of feed, or in terms of total energy required per day e.g. 85 MJ/day.

Daily energy intake is therefore dependent on:

- The energy content of the feed
- How much of that feed will be eaten per day

The illustration below shows factors involved in achieving livestock productivity goals.



Determining the precise energy requirement for stock involves a series of calculations and assumptions. It is beyond the scope of this publication to explain this further. It is more appropriate to provide guideline figures for the energy requirements of some classes of stock as shown in Table 2.

Other Factors Affecting Liveweight Gain

Voluntary intake, feed protein and energy content have all be discussed as important factors affecting liveweight gain and performance. The following are additional factors, which can also affect liveweight gain:

1. Stage of animal's development. When animals are being fattened, more energy is required per kilogram of grain than when they are putting on muscle.

2. Breed. Comparing stock of similar age, cattle of early maturing breeds may have a lower daily fain than cattle of later maturing breeds. This is due to stock of early maturing breeds putting on more fat a younger age.

3. Quality of stock (genetic background)

4. Sex. Heifers require higher energy intake to achieve the same weight gain as steers, of similar weight. This is largely due to heifers putting on more fat.

continued...

5. Forage for Beef Production

5. Distances stock need to walk for grazing and watering.

6. Stock health, internal parasite load etc.

7. Environmental factors, such as extreme heat or cold.

Predicting Liveweight Gain

The best, and most accurate, method is to use past experience! Unfortunately, this information is not always available and other alternatives may have to be used.

It is possible to use a series of calculations to predict liveweight gain for beef cattle. When a precise prediction is required, many factors have to be taken into account, including the breed, sex, weight and age of the cattle. The protein and energy content of the feed are two other very important factors used in calculating potential liveweight gain.

Another alternative is to look up tables in books that provide predicted liveweight gain for a limited set of cattle weights and feed qualities.

The third alternative is to use a livestock computer-modelling program. Modelling programs allow individuals to enter known information into a computer and allow the program to calculate further information.

Two such programs are:

- Feedman 3.0. Published by Department of Primary Industries, Queensland (2000). Developed to assist cattle and deer producers evaluate a wide range of management options in Northern Australia, specifically regions in Central and South East Queensland.
- GrazFeed. Developed by CSIRO Plant Industry, Australia (1999). GrazFeed is a nutritonal management system suitable for any breed of sheep and cattle.

How does forage sorghum perform in meeting nutritonal requirements?

Forage sorghum has a reputation of producing large quantities of feed quickly. Under reasonable conditions it can produce 4t/ha of dry matter within 50 days after sowing. However, its reputation for feed quality is not as impressive.

When forage is not used at the ideal stage, continued raid growth can result in large amounts of lower quality feed. Feed quality can be surprisingly high when good varieties are chosen and used at an ideal stage of growth.

For crops under favourable conditions, this may be when the crop is only 80-100cm high. Table 3 illustrates what level of liveweight gain can be achieved with such a crop.

continued...

Table 3: Guide to protein and energy available for forage sorghum, grazed at an early growth stage. Numbers are based on an average crop of Jumbo being grazed by bullocks of a later maturing breed, when the crop is approximately 0.8m high (based on NDF of 53). Crops grown under poor conditions may have lower feed quality, which will lead to lower liveweight gain values.

Forage can supply						
Liveweight (kg)	**Dry matter intake (kg)**	**Crude protein (%)**	**Protein (g)**	**Metabolisable energy (MG/kg)**	**Total ME/day (MJ)**	**Potential liveweight gain (kg/day)**
250	5.8	18	1040	9.4	54	0.7
350	8.1	18	1458	9.4	76	1.0
450	10.4	18	1872	9.4	98	1.1

[Adapted from The Forage Book, 2nd edn by Peter Stuart, Published by Pacific Seeds, Toowoomba, 2002]

5. Forage for Beef Production

As a crop grows taller, there will be more tonnes of feed per factor, but that feed will be of lower feed quality and individual animal performance will be reduced. This is illustrated in Table 4 with a crop of Jumbo being grazed at a later stage when 1.5 meters tall.

Even with the best grazing management, there may be times when crops are being grazed after the ideal stage. This would normally mean reduced liveweight gains. But there is an alternative. It may be cost effective to provide a grain-based supplement to allow stock to make good use of forage, but still achieve the higher rate of gain. Table 5 provides a guide to what can be achieved using this method and the amount of grain required.

Table 4: Guide to protein and energy available from forage sorghum, grazer later than deal height. These values are based on an average crop of Jumbo, being grazer by bullocks of a later muting breed when the crop is approximately 1.5m high (based on NDF of 58%). Crops grown under poor conditions may have lower feed quality, which will lead to lower liveweight gain values.

Forage supplies						
Liveweight (kg)	**Dry matter intake (kg)**	**Crude protein (%)**	**Protein (g)**	**Metabolisable energy (MG/kg)**	**Total ME/day (MJ)**	**Potential liveweight gain (kg/day)**
250	5.1	16	816	8.6	44	0.5
350	7.2	16	1152	8.6	62	0.7
450	9.3	16	1488	8.6	80	0.8

Table 5: Guide to liveweight gain for cattle grazing forage sorghum and receiving a grain-based supplement. Based on grazing an average crop of Jumbo, 1.5m high with bullocks of a later maturing breed.

	Forage can supply**			**Grain can supply***		**Total of forage & grain**		
Liveweight (kg)	**Crude protein (g/day)**	**Energy (ME) (MJ/day)**	**Amount of grain fed (kg/day)**	**Crude protein (g/day)**	**Energy (ME) (MJ/day)**	**Crude protein (g/day)**	**Energy (ME) (MJ/day)**	**Potential liveweight gain (kg/day)**
250	632	34	2.1	336	26	968	60	0.8
350	950	51	2.3	368	29	1318	80	1
450	1190	64	3.7	592	46	1782	110	1.1

Table 5 notes:

**It is assumed for this table that the grain has an ME of 12.5 MJ/kg and based protein of 10%, but with a protein additive to lift crude protein to 16%. However, with the 450kg bullock, there should be sufficient protein in the forage and grain and no protein additive would be required.*

*** The bullocks' intake of forage will reduce when they are consuming grain, and so the values for the contribution of protein and energy from the forage have been reduced.*

For more information, please contact Pacific Seeds on (07) 4690 2666 or visit the website www.pacificseeds.com.au

Pacific Seeds

Growing possibilities

[Adapted from The Forage Book, 2nd edn by Peter Stuart, Published by Pacific Seeds, Toowoomba, 2002]