Module 7 – Nutrition

What to do?

Nutrition is about understanding what and how much to feed your animals. In order to start planning your feeding program, you need know three key things:

1. Know what you want to achieve ie know your product.
2. Know the nutrient requirements of your stock. These will vary with:
    - Physiological state.
    - Age.
    - Performance level.
    - Class of animal.
    - Climatic conditions – temperature, windchill and frost.
3. Know your feed resource and how it grows:
    - Feed quality and quantity.
    - The regeneration time of specific plants (required rest periods).
    - The maximum and minimum heights/quantities of plant material to optimise plant and animal performance.

How to do it?

Know what you want to achieve.

As with all aspects of managing an enterprise, it is critical that you know the end point of the production cycle ie what is the product that you want to sell? If you can describe the type of goat that you are aiming to turn-off the property, this will help to guide your feeding decisions.

The sorts of things that you need to know are:

- Liveweight targets.
- Expected growth rates.
- Condition score targets.

Other profit drivers that can be influenced by nutrition include:

- Fertility ie the incidence of multiple births increases with liveweight of the doe; a rising plane of nutrition prior to the commencement of joining will increase ovulation rates.
- Maintenance of pregnancy, especially in the last 6 weeks. Goats can abort their kids to save themselves if put under stress from lack of feed.
- Birthweight ie the nutrition provided to a doe in late pregnancy will have a strong influence on the birthweight of her kid(s).
- Severe penalties for over-fat livestock. Feed on offer to animals destined for slaughter should be carefully managed to ensure that market specifications are met.
- Kid survival ie the mortality of newborn kids is directly affected by birthweight and milk supply, both of which are influenced by the nutrition of the doe.

Armed with this information you can then start to plan the annual feeding program.

The carcase on the left is emaciated and has been condemned by an AQIS inspector while the carcase on the right is in ideal condition.

For further assistance in describing your desired product, refer to the Market Specifications section in *Module 8 – Marketing*.

To learn more about condition score and liveweight targets, fertility and kid liveweight and mortality, refer to *Module 6 – Husbandry*.

Know the nutrient requirements of your stock

The minimum nutrient levels required to regulate basic bodily function, such as breathing, blood circulation, body temperature, digestion, etc is referred to as the maintenance requirement.

In addition to maintenance, nutrients are required for growth, activity, pregnancy, lactation and changes in body condition. In addition, extremes of weather can increase nutrient demand as the animal tries to deal with excessive heat or cold.

The basic dietary components are:

- Water.
- Energy.
- Protein.
- Fibre/roughage.
- Vitamins.
- Minerals.

Like all other livestock, goats need quality feed to perform well.

Water

Water is essential for goats to survive and thrive. Both quantity and quality of water have an impact on stock performance.

The amount of water a goat needs to drink depends on:

- Physiological state (eg lactating, dry).
- Production levels (eg for a dairy goat as milk production increases, so too does water requirement).
- Activity levels (eg amount of walking).
- Environmental conditions (eg temperature, humidity, rainfall).
- Diet (eg dry feeds and salty feeds increase water requirements).
- Water quality (eg as salt levels increase stock may require more water).
- Availability of shade and shelter (eg without shade on hot days, body temperature increases and, as a result, goats need more water).

Water requirements and salinity tolerances:[62]

Class of goat	*Water consumption per head per day (assuming dry feed diet)**	*Maximum salinity level (total salts ppm) (Scarlett 2002)***
Weaners	4-6litres	7,000ppm
Adult dry goat	5-7litres	14,000ppm
Doe with kid	5-10litres	10,000ppm

** The above requirements for water consumption could double if the temperature exceeds 40ºC.*

** * When fed diets with salty plant material such as saltbush (Atriplex spp), blue bush (Maireana spp) or copper burr (Scerolaena spp) the maximum salinity tolerances should be reduced by 30%.*

The figures in the table above are for goats on a dry feed diet (dry pasture, grain or hay). The reality of stock water intake is that as the moisture content of the pasture increases, stock get more of their daily water requirement simply from the food they eat, and hence require less actual drinking water.

[62] McGregor, B. (2003). Nutrition of goats during drought. Rural Industries Research and Development Corporation.

For example in winter, when conditions are damp and pasture is lush (often up to 85% moisture) stock can get a large proportion, if not all, of their water requirement from the pasture they eat. Whereas, in mid-summer when the atmosphere is dry and pastures are dry (35% or less moisture content), stock will need to drink more frequently and greater volumes of water to meet their needs.

Poor water quality can have a negative impact on water intake and stock performance. Physical, chemical and biological factors affect water quality.

- Physical – sediment/turbidity.
- Chemical – salinity, mineral content, acidity/alkalinity, chemical residue.
- Biological – algae and bacterial.

Poor water quality will often reduce water intake levels, which in turn reduces stock performance. Chemical imbalances can be toxic. Minor toxicities will reduce stock performance and, in the extreme, can lead to illness and even death. Similarly, biological agents can produce harmful toxins eg blue green algae. In some cases, diseases can also be carried in water and spread on consumption.

If unsure of the quality of your water supply, have the water tested. Many water authorities and government departments of agriculture have some capacity to test water quality. Alternatively there are private companies which specialise in the provision of water testing services.

Energy and protein

The items required in the largest quantities are energy and protein.

The energy component that ruminants use is referred to as metabolisable energy (ME), and is measured in terms of megajoules (MJ). You will often see this written as megajoules of metabolisable energy (MJME).

The main protein component that is of interest is crude protein. It is measured in grams, but is also often referred to in terms of a percentage (%CP).

One of the advantages of the Australian goat production system is that it is forage-based. Green pasture and shrubs are generally well-balanced in terms of their energy, protein, fibre, vitamin and mineral contents. The limiting factor is more likely to be the quantity available, rather than the nutrient balance.

Energy and protein requirement tables:[63]

Maintenance requirements:

Live weight (kg)	Energy requirement (MJME/day)	Protein (g/day)
10	2.27	33.00
20	3.82	55.00
30	5.18	74.00
40	6.43	93.00
50	7.60	110.00
60	8.71	126.00
70	9.78	141.00
80	10.81	156.00
90	11.80	170.00
100	12.78	184.00

Note: the above figures are for goats in confined areas ie minimal activity.

[63] Information for these tables was sourced from: McGregor, B. (2003). Nutrition of goats during drought. Rural Industries Research and Development Corporation.
Greenwood, P. (1992). Dairy Goats: Nutrition. Agfact 7.5.5. New South Wales Agriculture.

Activity requirements:

Type of grazing	Activity level	Extra requirements above maintenance
Block or strip grazing Intensive management	Low	Maintenance plus 25% (maintenance x 1.25)
Hilly pasture Semi-arid rangeland	Medium	Maintenance plus 50% (maintenance x 1.50)
Mountain pasture Arid rangeland	High	Maintenance plus 75% (maintenance x 1.75)

Pregnancy requirements:

Stage of pregnancy	Extra energy requirements above maintenance (MJME/day)	Extra protein requirements above maintenance (g/day)
First 3 months	No extra energy requirements	No extra protein requirements
Last 8 weeks	5.94	82.00

Milk production requirements:

	Extra energy requirements above maintenance (MJME/day)	Extra protein requirements above maintenance (g/day)
Lactating doe	9.00	180.00

Assuming an average lactation length of 12 weeks, with a doe producing an average of 1.5 kg milk/day with a milk solids test of 9.5%.

If you are a dairy producer, you may require figures for a range of production scenarios. *Module 7 - Nutrition Toolkit 7 page 2* lists some useful references that are dairy-specific.

Growth requirements:

Growth rate g/day	Extra energy requirements above maintenance (MJME/day)	Extra protein requirements above maintenance (g/day)
50	1.84	14.00
100	3.67	28.00
150	5.51	42.00

[63] Information for these tables was sourced from: McGregor, B. (2003). Nutrition of goats during drought. Rural Industries Research and Development Corporation.
Greenwood, P. (1992). Dairy Goats: Nutrition. Agfact 7.5.5. New South Wales Agriculture.

Severe weather requirements:

If conditions are cold, wet and windy, extra energy will be required by the goat to keep warm. Under such circumstances, energy allowances should be doubled.[64]

To match the energy and protein requirements with appropriate feeds refer to *Module 7 - Nutrition Toolkit 7 page 4*.

When formulating a ration it is important to consider how much a goat can physically consume. Maximum intake is related to body weight. A goat can physically only eat about 3.5% of its body weight each day. The actual amount largely depends on the quality of the feed offered.

For example: to provide the nutrients required to maximise the performance of young kids it is recommended that the quality of the feed ration be at least 10MJME/kg DM and 16% crude protein. If the feed is of lower quality, the kids physically cannot eat enough to meet their needs.

If you are more familiar with dry sheep equivalents (dse) figures, you may find the dse table which appears later in this module useful. Note: 1 dse requires 7.6MJME/day.

Fibre/roughage

Fibre is an important part of the goat's diet. It is particularly important in the diet of lactating does, does in late pregnancy and young kids (prior to and post weaning). It is also important to supply roughage if feeding a high starch diet eg grains.

In a lactating doe, one of the by-products of the fibre digestion, acetic acid, promotes the production of milk fat (butterfat). Fibre/roughage should make up at least 30% of the doe's diet during lactation.[65]

Does late in their pregnancy require roughage in the diet to promote the mobilisation of the body's reserves of calcium in preparation for lactation, when the demand for calcium often outweighs that which is able to be supplied in the diet.

For young kids approaching weaning and after weaning, fibre is essential to aid rumen development.

High grain diets, such as those fed during periods of feed shortage, can cause digestive upsets. When high-starch feeds such as grains are digested, acids are produced as a by-product. Excessive acidity in the rumen can cause problems such as acidosis or 'grain poisoning'. Chewing fibrous material stimulates the production of saliva which contains natural buffering agents, thus combating rising acidity levels. It is recommended that the ratio of concentrates (grain or pellets) to roughage should not exceed 2:1.[66]

In each of the above scenarios, you also need to consider that fibre is slow to break down in the rumen. The breakdown of fibre does supply some energy. However, too much fibre in the diet can actually restrict intake, which can be undesirable if the animal has high energy requirements, such as for growth, lactation or gaining condition. The key is to provide a balanced diet.

64 McGregor, B. (2003). Nutrition of goats during drought. Rural Industries Research and Development Corporation.
65 McGregor, B. (2003). Nutrition of goats during drought. Rural Industries Research and Development Corporation.
66 Greenwood, P. (1992). Dairy Goats: Nutrition. Agfact 7.5.5. New South Wales Agriculture.

Vitamins and minerals

In comparison to energy, protein and fibre, vitamins and minerals are usually only required in relatively small amounts. If goats are being fully fed on high-quality green pasture and browse, their requirements for vitamins and minerals are probably being sufficiently met. Given a choice of feeds, goats will seek out what they lack.

However, there are some circumstances where extra supplementation may be required, such as if quality forage is in short supply, large quantities of supplementary feeds are being used, or where there are deficiencies in the plant material being fed. In some cases, excessive levels of particular vitamins and minerals can cause toxicities.

How do you know if your enterprise is affected by vitamin and mineral deficiencies/toxicities?

- Familiarise yourself with the symptoms and monitor stock performance. Information about mineral deficiencies can be found in *Module 7 - Nutrition Toolkit 7 page 14*.
- Seek advice from a veterinarian or animal nutritionist. Blood tests may provide some indication of deficiencies and toxicities.
- Soil and/or plant tissue tests can provide additional information about mineral status of the feedbase. Seek an independent analysis of the results.
- Local knowledge can be very useful, as mineral deficiencies are often very specific to a particular location, related to soil type and particular types of plants.
- Goats attacking trees may be looking for a mineral that is lacking in the pasture at the time.

If vitamin and mineral supplements are required there are many forms in which they can be supplied eg licks, injection, drenches, rumen boluses and pellet or powder form. Seek further advice from a veterinarian or nutritionist on the most appropriate form for your circumstance.

Changing diets

When changing diets, there is often an adjustment period, during which time, some weight loss may occur. If managed correctly, this weight loss will be quickly recovered once the goat has fully adjusted to the new feed source.

It may take some time for the goats to become accustomed to the taste, smell and texture of new foods.

The rumen microbes also need time to adapt to dietary changes, because it is these microbes that facilitate the digestive process. Some microbes are quite specific in the type of foods that they break down eg some break down sugars, some use starches, others are cellulose-specific.[67] Different microbes also have different tolerances in terms of acidity levels in the rumen – acid is a by-product of the digestion of carbohydrates. Therefore, the make up of the microbial population fluctuates depending on the rumen conditions and the feed source. When the diet changes, there can be a reduction in the efficiency of digestion, whilst the relative numbers of the different types of microbes adjust to suit the feed source.

When introducing new feeds to the diet, it is recommended that the changes are made gradually to ease the adjustment process. This means starting with small quantities of the new feed and slowly building up the amounts toward the desired intake. This process can take 2-4 weeks depending on the types of feeds being used. The higher the starch content and the lower the fibre, the slower the introduction required.

[67] Department of Natural Resources and Environment. (1997). Feeding Dairy Cows. Victorian State Government, Melbourne.

With high-starch feeds, such as grains and pellets, you may also consider incorporating buffering agents into the diet. The by-products of starch digestion are acidic. Buffering agents act to balance the acid production and maintain appropriate pH levels in the rumen.

Your management of dietary change is critical. The costs of getting it wrong can be reduced intake, reduced production levels and/or health problems, such as acidosis or grain poisoning. For more information on nutritional disorders refer to *Module 7 - Nutrition Toolkit 7 page 14*. For information on introducing goats to feedlot diets, refer to *Module 7 - Nutrition Toolkit 7 page 20*.

Buying supplements

When buying supplements be clear about the type of nutrient(s) that you are trying to source. You need to know your most limiting factor. Are you sourcing either energy, protein, fibre or a combination of these ingredients?

The next step is to understand the feed quality of the product that you are buying ie what are the energy, protein and fibre contents of the feed? *Module 7 - Nutrition Toolkit 7 page 4* can provide you with some information about the average nutritive value of some of the more common goat feeds. However, within a particular type of feed there can be wide variation between different sources, so the only way to get an accurate figure is to request a feed analysis on the feed that you are purchasing. Many fodder suppliers are now routinely supplying this information with their products.

In terms of getting value for money, buy the product that supplies the nutrient you require at the lowest price. Products with differing nutrient levels and prices can be compared by calculating the price in cents per unit of the nutrient. For example, if you are buying an energy supplement, calculate price in cents per megajoule. If you want protein, calculate cents per gram of protein. All calculations should be done on a dry-matter basis. The table on the following page shows how to do this calculation for energy supplements.

It is advisable to request a Commodity Vendor Declaration or relevant documentation when buying feed to prevent chemical residue contamination. For more information on stockfeed declaration forms refer to the Quality Assurance section in *Module 3 – Industry obligations*.

Comparing the cost of energy supplements – calculating the cost in cents/MJ of various feeds[68]

Sample	Cost per unit of feed	÷	Weight of unit	_	100	÷	Dry matter content	_	100	÷	MJ ME/kg DM	=	Cents/ MJME
	$/tonne		eg 1000kg or 25kg/bale		To convert to cents/kg		Dry matter percentage		percentage		Energy content of feed		Cost per MJ of the feed
Pasture hay	$3.20/bale	÷	25kg/bale	_	100	÷	85	_	100	÷	8.5MJ	=	1.77c/MJME
Barley	$160/tonne	÷	1000	_	100	÷	88	_	100	÷	12.5MJ	=	1.45c/MJME

[68] MLA. (2003). ProGraze® Victoria

Know your feed resource and how it grows

Quality and quantity

Having established the feed requirements of your goats, you now need to determine the quality and quantity of forage and/or supplements required to fulfil those needs.

The standard unit of measurement for feed quantity is kilograms of dry matter (kg DM). Moisture content varies widely between different feed sources, and with time of year. Therefore, to allow comparison between feed sources, quantity figures are always quoted in terms of dry matter.

Feed quality refers to the nutrient content of the feed source and these figures are always related back to dry matter.

There are many ways to measure feed quality. Some of the most common units of measurement are listed below:

Feed component	Explanation	Unit of measurement
Dry matter (DM)	Amount of dry material in a feed	%
Moisture	Amount of moisture in a feed	%
Metabolisable energy (ME)	Amount useable energy in a feed	MJ/kg DM
Digestibility	Portion of a feed that is retained by the animal, the rest is passed out as faeces. Digestibility is directly related to the energy content of the feed.	% of DM
Crude protein (CP)	Total amount of protein in a feed	% of DM
Neutral detergent fibre (NDF)	Total amount of fibre in a feed	% of DM

This information can be obtained via laboratory analysis of a feed sample. Many commercial fodder suppliers will have this information readily available for each of their products.

The nutrient values of a range of common goat feeds are listed in *Module 7 - Nutrition Toolkit 7 page 4*.

Palatability is also something that will influence a goat's grazing habits and feed preferences. Refer to *Module 7 - Nutrition Toolkit 7 page 9* for further information.

Another issue to consider is plant toxicities. Some plants can be toxic to goats. Toxicity levels vary and the effect on the grazing animal may depend on how much of the plant material that they consume. Refer to *Module 7 - Nutrition Toolkit 7 page 18* for a more information on toxic plants.

Maintaining your feed base

The key to maintaining your feedbase is good grazing management.

Before you start to think about grazing strategies, you should first be aware of some of the grazing habits displayed by goats that are different from cattle and sheep:

- Goats are able to utilise the foliage of trees and shrubs, and will eat a wide variety of forage plants.
- Given the opportunity, goats are very selective in the way that they graze.
- Goats are inquisitive and will sample new things.
- They will select the most energy-dense parts of a plant eg seedheads.
- Goats show more of a preference for roughage than other domestic livestock.

Understanding the goat's requirements and its grazing preferences is only part of the story in terms of developing grazing strategies. The other critical element is understanding the growth habits of plants and how they respond to grazing.

To ensure plant persistence, you need to be aware of how hard a particular type of plant can be grazed and how long it will take to replenish its reserves and grow back to a suitable size for grazing. Constant heavy grazing will have a deleterious effect on most plants and can lead to palatable plants being grazed out of a pasture mix.

Plant growth is driven by photosynthesis: a process where sunlight is intercepted by the plant's leaves, converted into carbohydrates and used for the production of plant material.

The factors impacting on plant growth are:

- Moisture.
- Soil temperature.
- Nutrients.
- Soil conditions.
- Sunlight – leaf area.

The main ones that landholders can influence are nutrient availability, capture of sunlight and to some degree soil conditions (eg acidity, drainage and compaction).

Moisture (unless you have irrigation) and soil temperature are largely out of the farmer's control.

Nutrient availability can be influenced by fertiliser application and actions which promote a healthy environment for soil microbes eg improving soil conditions.

Soil conditions can be altered by drainage, soil ameliorants (eg lime, gypsum), tillage reduction, trash/ground cover conservation and careful management of stock to prevent pugging.

The amount of sunlight captured is related to the management of leaf area. Think of the leaves of plants as solar panels that produce energy. The more leaf area, the more sunlight is intercepted, the more carbohydrates are produced, and the more leaf material is generated. Grazing and cutting are the main methods of manipulating leaf area, and this is where management can have a significant impact.

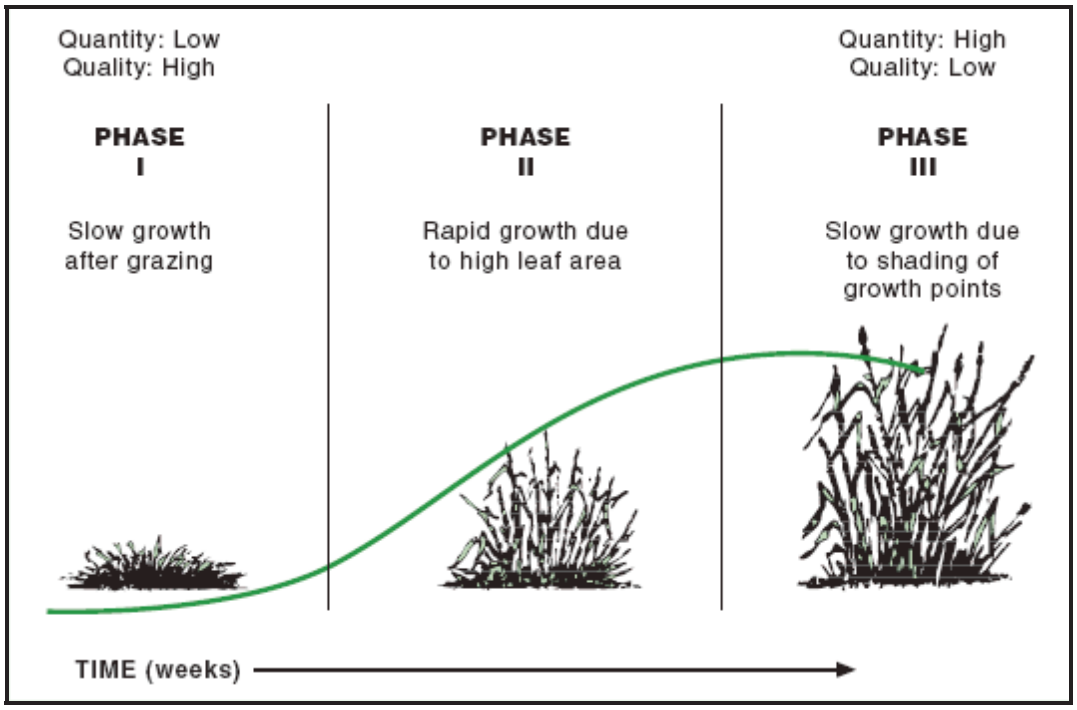
Grazing temperate pastures

In temperate grass-based pastures it is common to think about pasture growth in terms of the number of green leaves. Grass tillers are only able to maintain a certain number of green leaves before the oldest leaf starts to decay. Decaying leaves are of low feed quality and lower palatability, and thus represent wasted production. The aim is to graze as many green leaves as possible and minimise decay.

For example, perennial ryegrass has, at most, three active green leaves per tiller: the fourth leaf onward will be decaying. So the aim is to commence grazing when there is an average of three green leaves per tiller. Other common temperate grass species function similarly and hence a similar grazing strategy is appropriate: phalaris has a maximum of four active green leaves and cocksfoot and fescue have at most five active green leaves.

Having determined when to commence grazing, the next questions are when to take stock out and how long to spell the paddock before the next grazing. This is governed by the rate of plant recovery and growth.

The recovery of temperate pasture grasses after heavy grazing is initially quite slow the rate of growth rapidly increasing as more leaves appear, reaching a plateau, and then declining as decay begins to surpass new growth.



Sourced from the PROGRAZE® DPI Victoria, MLA 2005

Phase 1

- Very short pasture.
- Low leaf area, very little interception of sunlight.
- Initial regrowth is often driven from plant energy reserves.
- Slow pasture growth.
- High-quality feed, low quantity.

Phase 2

- Phase of greatest pasture growth.
- Increasing leaf area allows increased photosynthesis and thus increased biomass production and replenishment of plant energy reserves.
- Good quality and quantity.

Phase 3

- High leaf area, but shading of lower leaves and decay, reduces the growth rate.
- High quantity, low quality.

The aim of grazing management is to spend as much time in phase 2 as possible. This is where you get the greatest pasture growth, striking a good balance been feed quality and quantity.

As you can see in the previous diagram, the lower the level of leaf area remaining at the end of grazing, the slower the rate of plant recovery. It is advisable to retain some leaf area at the end of the grazing period.

If pastures are subject to frequent heavy grazing, and are continuously kept in phase 1, individual plants will begin to suffer, and some will be killed. Loss of desirable plant species opens up the pasture to weed invasion. Also with reduced plant cover, the soil surface is exposed, increasing the risk of erosion.

At the other end of the scale (phase 3), prolonged periods of infrequent or lax grazing lead to large quantities of very low quality feed. In tall pastures very little light gets down to the growing points at the base of the plants, and lower growing species may be completely shaded. As a consequence, low-growing plants often do not survive and the formation of new grass tillers is suppressed, and thus the pasture starts to thin out.

The rate at which each new leaf appears is governed by moisture and soil temperature. If one or both of these is limiting, the rate of appearance of new leaves will be slow. For example in summer, soil temperature is not a limiting factor, but there is often a deficit of moisture, hence summer growth rates are often slow. In spring, when soil temperature and moisture conditions are optimum, pasture growth is very rapid. The frequency of grazing needs to be adjusted accordingly, with long rest periods between grazings when growth rates are slow, and more frequent grazing when growth rates are high.

Managing rangelands

The key to successful rangeland management is to match goat numbers with feed supply. It is visual cues, such as plant numbers and species present, that indicate how the balance between feed supply and demand is working. This balance will change with the seasons, and hence may necessitate seasonal adjustments to stocking rate.

If you are unsure of the average carrying capacity of your area, seek advice from the Pastoral Lands Board or department of agriculture or primary industries in your area. Local knowledge is a valuable resource and local graziers may be helpful in determining carrying capacity.

If you have some idea of the dry sheep equivalent or dry stock equivalent rating for area (dse/ha) then you can estimate the number of goats that can be carried.

The table below gives some general guidance of the dse rating for goats.[69]

Class of goat	Dry sheep equivalent (dse)	Weight range
1 dry doe	0.75	30-40kg
1 breeding doe	1.5 (doe in a herd producing 150% kids)	40-60kg
1 weaner	0.7 (weaning to one year old)	20-40kg
1 buck	1.5	60-80kg

These figures are intended as a guide only. The ratings will be affected by production levels, physiological state of the animal and frame size.

Establishing an appropriate stocking rate and length of grazing period is about understanding the quantity of feed on the ground, sometimes referred to as food on offer (FOO). Feed quantity is estimated in kg DM/ha. The ability to accurately estimate feed quantity is a skill that develops with practice. There are a number of publications that provide sets of photo standards to help you with this task. The photos illustrate what different fodder quantities (kg DM/ha) look like in different rangeland environments. You can use these photos as a reference point to help you estimate the kg DM/ha in your paddocks. Such publications will be available through your local department of agriculture or primary industry. Training courses are also available that teach fodder assessment skills.

Knowing the amount of feed available and the feed requirements of your stock (refer to feed requirements tables displayed earlier in this Module), you can easily calculate the amount of stock that can be run in a given area, for a given period of time.

When making stocking rate decisions, it is important to consider weather trends, ie probability of average rainfall, below-average rainfall or above-average rainfall, and factor these into your stocking rate calculations.

You also need to take into account the impact of non-domestic animals that are grazing the area eg feral animals and native wildlife, as they will also be contributing to the demand for feed.

During the initial stages of enterprise change, from beef or sheep to goats, it is generally the case that the stocking rate can be lifted for the first 12-18 months. The reason that this is possible, is because of the build-up of browse previously untouched by sheep and cattle. Once a distinct browse line becomes apparent, the stocking rate must be reduced to avoid over-grazing.

Fodder utilisation will be strongly influenced by the presence or absence of available water. Goats will graze within range of water points, therefore water points should be located in the centre of grazing paddocks to encourage grazing across the entire area.[69] This becomes particularly important in summer when any surface water has dried up and stock is reliant on defined water points. During these periods, the grazing pressure around watering points will increase, and so monitoring of the feedbase and management of stock numbers is critical.[69]

Monitoring has both an animal and an environmental component:

- Is the stock being adequately fed? Assess weight, condition and behaviour (underfed does with kids at foot may appear staggery and will not stride out).
- Is the environment being maintained in a healthy state? Look at the soil condition and plant growth; look for signs of degradation.

[69] Blood, D. and Williams R. (2005). The Grazing of Goats in the Pastoral Areas of Western Australian. Best Management Practice – July 2005. Department of Planning and Infrastructure Western Australian Government; Pastoral Lands Board.

Signs of rangeland degradation:[70, 71]

- Increasing levels of bare ground. Reduced plant density and low levels of plant litter on the soil surface.
- Lack of feed bulk, even at times when there is usually high plant growth.
- Reduced numbers of perennial plants.
- Increased presence of unpalatable species.
- Increase in the proportion of annual plant species.
- Increase in the proportion of broadleaf weeds.
- Increase in presence of woody plants.
- Lack of regeneration of trees and shrubs.
- Browse line clearly visible at the highest extremes that goats can reach.

In rangelands, the dietary preference for goats is of the order: 30% grass, 40% non-woody broadleaf plants (forbs) and 30% browse (woody species).[72]

A recent Producer Initiated Research and Development project analysed faecal samples to determine the dietary preferences of goats grazing in rangeland conditions in southern Queensland during drought conditions. The results of the study showed that coming out of drought the goats tended to concentrate their diet selection on herbage and browse. This allowed the grass species to regenerate at a far greater rate than those paddocks grazed by sheep and cattle over the same period.[73]

It is important to be able to identify the different types of plants present on your land and understand the grazing preferences (what is palatable and what is not?). The species most at risk from overgrazing are the most palatable shrub and inter-shrub species.[74] *Module 7 - Nutrition Toolkit 7 page 9* provides details of the relative palatability of different plants.

Monitoring means getting off the track and observing the type and number of plants present, regeneration levels, ground cover, etc. Photo points can provide an excellent means of making comparisons over time. Select several reference points at different locations on your property, and take a photo from that point at the same time each year or each season. Observe the change over time and take action as required.

If degradation is occurring, stocking rates in the area may need to be reduced or the area completely spelled for a period of time to allow for plant regeneration. To encourage regeneration of declining species, spelling will be necessary during the flowering period. The period of spelling should allow time for the plant to set seed, for seed to ripen and then fall to the ground; approximately 6-8 weeks for grasses.[75]

[70] Blood, D. and Williams R. (2005). The Grazing of Goats in the Pastoral Areas of Western Australian. Best Management Practice – July 2005. Department of Planning and Infrastructure Western Australian Government; Pastoral Lands Board.
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Case studies

Tool 7.1

Finding further information

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Pastoral Memo – Southern Rangelands. Government of Western Australia, Department of Agriculture, Meekatharra. P.O. Box 108, Meekatharra W.A. 6642 Tel: 08 9981 1105 Fax: 08 9981 1571 Mark Alchin (Editor) Email: malchin@agric.wa.gov.au

Western Division News Letter. NSW Department of Primary Industry. www.agric.nsw.gov.au/reader.wdn

Australian Goat Notes. Simmonds, A.J. 2001. Australian Cashmere Growers Association Limited. This is a published collection of papers and notes covering all aspects of goat production. Contributing papers and notes from many of the state departments of agriculture, Rural Industries Research and Development Corporation (RIRDC), breed societies and breed associations.

Arid Shrubland Plants of Western Australia. 1994. Mitchell, A.A. and Wilcox, D.C. University of Western Australia Press.

Water quality and provision for goats. McGregor, B. A. 2004. Rural Industries Research and Development Corporation.

Palatability and Potential Toxicity of Australian Weeds to Goats. Simmonds, H. Holst, P. and Bourke, C. 2000. Rural Industries Research and Development Corporation.

The Glove Box Guide to Growth, Flowering and Seeding of Plants of the NSW Rangelands. Milthorpe, P.L. and Wynne, M.J. 2001. New South Wales Department of Primary Industries.

The Glove Box Guide to Tactical Grazing Management for the Semi-Arid Woodlands. Campbell, T. and Hacker, R. 2002. New South Wales Department of Primary Industries.

Sustainable Meat Goat Management. Meat & Livestock Australia Producer Initiated Research and Development, G2001/Q14. South Queensland Goatmeat Producers' Group – an analysis of manure samples undertaken by members from the South Queensland Goatmeat Producers Group. The report outlines some interesting findings about what goats are actually selecting from the fodder on offer. This report is available from Meat & Livestock Australia. For a summary of the financial component of the report see *Tool 2.8 page 13* in Module 2 – Financial Analysis.

Dairy Goats: Nutrition. Greenwood, P. 1992. New South Wales Agriculture. Agfact 7.5.5. A useful reference specifically targeted toward dairy producers.

Managing Drought. Mackay, B. 2002. New South Wales Agriculture. Third edition.

Rearing Orphaned Kids. Clarke, J., Thomas, I.R., Couchman, R.C. and McGregor, B. 2001. B16. In: "Australian Goat Notes." P. 69. Australian Cashmere Growers Association.

Courses and workshops

EDGE*network*® courses are available nationally. **PROGRAZE®** is a pasture course for temperate pasture areas. To find your state contacts for EDGE*network*® contact Meat & Livestock Australia.

FOO project (Food On Offer) This is a simple tool for monitoring grazing days per hectare per 100 mm of rainfall. Contact the Department of Agriculture, Western Australia.

GrazingforProfit™ Training School – business school for grazing industry. Includes a nutrition and grazing management component. Resource Consulting Services (RCS), Sandgate Queensland. www.rcs.au.com

Stocktake – learning to better manage feed availability in rangeland areas. Contact the Queensland Department of Primary Industries and Fisheries for more information.

Grazing Land Management® – learning about grazing strategies for rangelands. Meat & Livestock Australia, EDGE*network*® education package. Contact the Queensland Department of Primary Industries and Fisheries for more information.

Websites

Refer to *Module 1 – Property planning Toolkit 1 page 5* for instructions on how to conduct an effective web search.

Australian Animal Health
www.aahc.com.au

NSW Department of Primary Industry
www.dpi.nsw.gov.au

Department of Primary Industries, Victoria
www.dpi.vic.gov.au

South Australia Research & Development Institute www.sardi.sa.gov.au

Primary Industries and Resources South Australia www.pir.sa.gov.au

Department Primary Industries, Water & Environment, Tasmania
www.dpiwe.tas.gov.au

Department of Agriculture Western Australia
www.agric.wa.gov.au

Queensland Department of Primary Industry and Fisheries www.dpi.qld.gov.au

Northern Territory Department of Business Industry and Resource Development
www.dpi.nt.gov.au

Rural Industries Research and Development Corporation www.rirdc.gov.au

Meat & Livestock Australia
www.mla.com.au

Tool 7.2

Nutritive value of common goat feeds (average values)[76]

Feed type	Energy MJ ME/kg DM	Crude protein % of DM
Pasture and fodder#		
Buffel grass	8.8	11.2
Curly windmill grass	8.9	12.5
Guinea grass*	9.8	16.2
Johnson grass	7.0	6.9
Kangaroo grass	7.5	5.4
Lucerne (early vegetative stage – 30cm)	10.0-11.0	22.0-28.0
Lucerne (late vegetative stage – 45cm)	9.0-10.0	18.0-24.0
Lucerne (early flowering – 50cm)	8.0-9.5	15.0-22.0
Lucerne hay	8.5	20.0
Mitchell grass	7.5	9.2
Pangola grass*	6.9	2.8
Paspalum	7.8	9.1
Purple pidgeon grass	7.4	7.7
Queensland bluegrass	6.0-6.8	1.9-3.9
Rhodes grass	7.6	7.3
Temperate pasture mix: lush, green pasture	10.0-12.0	15.0-22.0
Temperate pasture mix: early summer pasture	7.0	10
Temperate pasture mix: late summer pasture (dry)	5.0	5.0
Temperate pasture mix: hay	1-9	5-10
Woollybutt	8.3	8.5

The nutritive value of pasture and fodder species changes throughout the year. For example, the feed value during the vegetative stage of plant growth will be distinctly different to the reproductive (flowering) stage. Environmental conditions can also affect the nutritive value of feed eg frost. These factors need to be taken into account when assessing the value of pastures and crops as potential sources of goat feed. A feed analysis will be required to determine the exact feed quality.

* Results of a single test only.

[76] The data in these tables has been sourced from: McGregor, B. (2003). Nutrition of goats during drought. Rural Industries Research and Development Corporation.
NSW Department of Primary Industries. (2005). Website: www.agric.nsw.gov.au/tools/fes/index
Kaiser, A.C., Pilz, J.W., Burns, H.M. and Griffiths, N.W. (2003). Successful Silage Top Fodder. New South Wales Agriculture and Dairy Research and Development Coorporation.

Nutritive value of common goat feeds (average values) *continued*

Feed type	Energy MJ ME/kg DM	Crude protein % of DM
Concetrates		
Barley	12.0	10.0-14.0
Cottonseed – meal (mechanical protein extraction)	3.0	44.0
Cottonseed – meal (solvent protein extraction)	11.0	46.0
Cottonseed – whole	14.0	23.0
Molasses	12.9	6.2
Oats	12.0	5.0-12.0
Triticale	12.0	8.0-14.0
Wheat	12.0	9.0-13.0

Nutritive value of common goat feeds (average values) *continued*

Feed type	Energy MJ ME/kg DM	Crude protein % of DM
***Trees and shrubs*†**		
Golddust wattle leaves (*Acacia acinacea*)	7.2	14.7
Mulga leaves (*Acacia aneura*)	6.5	12.0
Silver wattle leaves (*Acacia dealbata*)	8.3	14.8
Mimosa bush leaves (*Acacia farnesiana*)	7.9	23.0
Myall spp. leaves (*Acacia species*)	8.5	13.0-16.0
Rosewood leaves (*Alectryon oleifolius*)	6.6-8.5	8.0-13.0
Boonery (*Alectryon oleifolius ssp. canescens*)	7-9	10.5-13.0
Kurrajong leaves (*Brachychiton rupestre*)	7.0	15.0
Scarlet bottlebrush leaves (*Callistemon macropunctatus*)	6.2	7.0
Wild orange leaves (*Capparis mitchelli*)	9.0-10.1	12.0-16.0
Belah leaves (*Casurina cristate*)	8.0	9.4
Swamp sheoak leaves (*Casuarina glauca*)	8.5	15.4
Tree lucerne (*tagasaste)* leaves (*Chamaecytisus proliferus*)	8.0	13.0
Sugar gum leaves (*green*) (*Eucalyptus cladocalyx*)	8.9	9.3
Sugar gum leaves (*dead*)	7.4	4.9
Sugar gum bark	6.8	1.8
Wilga leaves (*Geijera parviflora*)	9.0	15.0

† The nutritive value of fodder species changes throughout the year. For example, the feed value during the vegetative stage of plant growth will be distinctly different to the reproductive (flowering) stage. Environmental conditions can also affect the nutritive value of feed eg frost. These factors need to be taken into account when assessing the value of fodder species as potential sources of goat feed. A feed analysis will be required to determine the exact feed quality.

Nutritive value of common goat feeds (average values) *continued*

Feed type	Energy MJ ME/kg DM	Crude protein % of DM
Trees and shrubs†		
Manuka leaves (*Leptospermum juniperinum*)	8.6	6.4
Gruie / Emu apple leaves (*Owenia acidula*)	8.9-10.1	10.0-14.0
Pine tree leaves (*Pinus radiata*)	7.2	9.0
Peppercorn tree leaves (*Schinus molle*)	10.2	20.3
Tamarisk leaves (*Tamarisk parviflora*)	9.0	20.2

† The nutritive value of fodder species changes throughout the year. For example, the feed value during the vegetative stage of plant growth will be distinctly different to the reproductive (flowering) stage. Environmental conditions can also affect the nutritive value of feed eg frost. These factors need to be taken into account when assessing the value of fodder species as potential sources of goat feed. A feed analysis will be required to determine the exact feed quality.

Nutritive value of common goat feeds (average values) *continued*

Feed type	Energy MJ ME/kg DM	Crude protein % of DM
Weeds‡		
Saffron thistle leaves (Carthamus lanatus)	12.1	14.4
Spear thistle leaves (Cirsium vulgare)	11.3	20.2
Artichoke thistle leaves (Cynara cardunculus)	11.5	14.8
Boxthorn leaves (Lycium ferocissimum)	12.4	28.3
Boxthorn stems	9.2	11.6
Horehound leaves (Marrubium vulgare)	10.9	23.3
Sweet briar leaves (Rosa rubiginosa)	10.5	20.7
Blackberry leaves (Rubus fruticosus.)	10.5	21.0
Young blackberry stems	10.5	21.0
Old blackberry stems	7.4	6.1

‡ The nutritive value of weed species changes throughout the year. For example, the feed value during the vegetative stage of plant growth will be distinctly different to the reproductive (flowering) stage. Environmental conditions can also affect the nutritive value of feed eg frost. These factors need to be taken into account when assessing the value of weeds as potential sources of goat feed. A feed analysis will be required to determine the exact feed quality.

Tool 7.3

Palatability of plants commonly eaten by goats [77]

Trees and shrubs[§]

Scientific name	Common name	Highly palatable	Palatable	Moderately palatable	Eaten occasionally
Acacia aneura	mulga	mature	-	young	-
Acacia escelsa	ironwood	-	-	-	all stages
Acacia homalophylla	yarran	-	-	all stages	-
Acacia mearnsii	black wattle	-	flowering	-	-
Acacia parodoxa	kangaroo thorn	-	-	-	all stages
Acacia spp.(other)	various names	-	-	all stages	-
Apophyllum anomalum	warrior bush (broombush, currant bush)	all stages	-	-	-
Atalaya hemiglauca	whitewood	all stages	-	-	-
Atriplex spp.	saltbush	-	-	all stages	-
Brachychiton populneum	kurrajong	all stages	-	-	-
Callitris columellaris	white cyprus pine	-	-	-	all stages
Callitris endlicheri	black cyprus pine	-	-	all stages	-
Capparis mitchellii	white orange (orange bush)	-	all stages	-	-
Cassia artemisioides	silver cassia	-	-	-	all stages
Cassia eremophila	punty bush (desert cassia)	-	-	-	-
Cassinia spp.	dolly bush, chinese shrub (c.aculatua), sifton bush (c.aculatua), biddy bush, sticky cassinia	-	-	-	isolated plants
Casuarina cristata	belah	all stages	-	-	-
Chamaecytisus proliferus	lucerne tree (tagasaste)	all stages	-	-	-

§ Within some species, palatability may vary between cultivars/varieties.

[77] Allen, C., Holst, P. and Campbell, M. (1999). Weed Control Using Goats. 3rd Edition. New South Wales Agriculture.

Trees and shrubs[§] *continued*

Scientific name	Common name	Highly palatable	Palatable	Moderately palatable	Eaten occasionally
Chenopodium nitrariacem	nitre goosefoot (nitre bush)	all stages	-	-	-
Crataegus spp.	hawthorn	-	-	all stages	-
Cytisus scoparius	scotch broom	all stages	-	-	-
Dodonaea attenuata	narrowleaf hop bush	all stages	-	-	-
Dodonaea viscosa	hop bush	-	flowering	-	-
Eremophila longifolia	emu-bush	all stages	-	-	-
Eremophila mitchellii	budda	-	-	-	all stages
Eucalyptus albens	white box	-	flowering	-	-
Eucalyptus melliodora	yellow box	-	-	sucker regrowth	-
Eucalyptus polyanthemos	red box	-	flowering	-	-
Eucalyptus populnea	bimble box (poplar box)	-	-	-	all stages
Eucalyptus spp.	box, gum and mallee	sucker leaves	-	all stages	-
Geijera parviflora	wilga	-	-	-	all stages
Gomphocarpus fruticose	narrowleaf cotton bush	-	-	-	isolated mature plants
Heterodendrum oleifolium	rosewood	all stages	-	-	-

§ Within some species, palatability may vary between cultivars/varieties.

Herbs

Scientific name	Common name	Highly palatable	Palatable	Moderately palatable	Eaten occasionally
Brassica tournefortii	wild turnip	all stages	-	-	-
Carduus nutans	nodding thistle	-	flowering	-	-
Carduus pycnocephalus	slender thistle	-	-	all stages	-
Carthamus lanatus	saffron thistle	-	flowering	-	-
Chondrilla juncea	skeleton weed	-	flowering	-	-
Cirsium vulgare	spear thistle (black thistle)	-	flowering	-	-
Craspedia spp.	bellybuttons	-	flowering	-	-
Echium plantagineum	paterson's curse	-	flowering	-	-
Erodium spp.	crowfoot	-	flowering	-	-
Hypericum perforatum	St. John's wort	-	-	-	all stages
Lactuca serriola	prickly lettuce (milk thistle)	all stages	-	-	-
Lepidium spp.	peppercress	-	flowering	-	-
Maireana spp.	blue bush, cotton bush	-	-	all stages	-
Marrubium vulgare	horehound	-	flowering	-	-
Medicago falcate	yellow flower lucerne	all stages	-	-	-
Medicago sativa	lucerne	flowering	-	-	-
Muehlenbeckia cunninghamii	lignum	all stages	-	-	-
Onopordum spp.	scotch thistle (illyrian)	-	flowering	-	-
Owenia acidula	gruie (colane)	all stages	-	-	-
Phytolacca octandra	inkweed	-	flowering	-	-
Plantago spp.	plantain	-	flowering	-	-
Pteridium esculentum	common bracken	-	-	-	all stages (but mainly mechanical damaged)
Rosa rubiginosa	sweet briar	all stages	-	-	-
Rubus spp.	blackberry	all stages	-	-	-

Herbs *continued*

Scientific name	Common name	Highly palatable	Palatable	Moderately palatable	Eaten occasionally
Rumex crispus	curled dock	-	flowering	-	-
Sclerolaena birchii	galvanised burr	-	-	-	all stages
Silybum marianum	variegated thistle	-	all stages	-	-
Sisymbrium spp.	mustard weed	-	flowering	-	-
Solanum carolinense	Carolina horse nettle	-	all stages	-	-
Trifolium spp.	clovers	-	-	-	mature
Urtica incisa	scrub nettle, tall nettle	-	all stages	-	-
Ventilago viminalis	supplejack	all stages	-	-	-
Verbena bonariensis	purpletop	-	flowering	-	-

Grasses and rushes

Scientific name	Common name	Highly palatable	Palatable	Moderately palatable	Eaten occasionally
Aristida spp.	wire grass	-	-	all stages	-
Chloris spp.	windmill grass	-	flowering	-	-
Cyperus spp.	nutgrasses	all stages	-	-	-
Danthonia spp.	wallaby grass	-	flowering	-	-
Eragrostis australasica	canegrass	-	-	all stages	-
Hordeum leporinum	barley grass	-	-	all stages	-
Juncus spp.	rushes	-	-	flowering	-
Lolium spp.	ryegrass	all stages	-	-	-
Nassella trichotoma	serrated tussock	-	-	-	all stages
Poa labillardieri	poa tussock	-	-	all stages	-
Sporabolus caroli	yakka grass (fairy grass)	-	flowering	-	-
Stipa spp.	speargrass	-	-	all stages	-

Having read through these tables and identified plants from your area, you should check for any toxicity issues. Refer to *Module 7 - Nutrition Toolkit 7 page 18* for more information and references that provide listings of toxic plants.

Tool 7.4

Nutritional disorders[78]

This tool below will help you to identify and manage the following nutritional disorders that can occur in goats.

- Bloat
- Grain poisoning
- Copper deficiency
- Selenium deficiency
- Cobalt deficiency
- Iodine deficiency
- Thiamine (vitamin B1) deficiency

This summary provides details of the prevailing conditions under which each problem is likely to occur, explains how to diagnose the problem and lists preventative management strategies.

Bloat

Conditions when likely to occur:

- Consumption of large amounts of lush, green, leguminous feed or lucerne hay.

Diagnosis:

- Clinical signs: gases form in the rumen causing distension on the left upper side. Death can occur quickly as pressure builds on the diaphragm causing failure of heart and lungs.
- Pasture assessment: at-risk pastures are those with a high proportion of legume, lush and in vegetative growth.

Treatment:

- Cooking oil or a bloat oil product can be administered to break up the gaseous foam in the rumen.

Preventative management strategies:

- Avoid grazing high-risk pasture.
- Provide access to roughage in the form of hay or dry pasture.
- For producers adopting intensive rotational grazing, slow the rotation so that goats are grazing more mature pasture. This may reduce risk but will not eliminate it.
- In intensive grazing or strip grazing situations, daily spraying of bloat oil on high-risk pastures prior to grazing may be cost-effective. This strategy will not be cost-effective or practical in many situations. Bloat oil in water troughs may be considered if water availability is controlled. Bloat blocks are less reliable.
- During periods of lush pasture growth maintain regular routine and intake of food and water.

Grain poisoning

Conditions when likely to occur:

- Ingestion of large quantities of grain in a short period of time, resulting in an excessive build-up of lactic acid in the rumen.
- Changing from one type of grain to another too quickly.
- Rapid increase in the level of grain feeding.

Diagnosis:

- Kicking at the belly, obvious pain and discomfort, grinding of teeth, standing dejectedly, not moving, sometimes bloated and scouring.

Preventative management strategies:

- Change the diet slowly; any change in feed type or amount of ration should be gradual.

[78] The information presented in this tool has been sourced from a number of references:
Simmonds, J. (Editor). (2001). Australian Goat Notes. Australian Cashmere Growers Association.
Hungerford, T.G. (1990). Diseases of Livestock. Ninth edition. McGraw-Hill.
Vincent, B. (2005). Meat Goats Breeding, Production and Marketing. Land Links.

- Provide fibre in the diet.
- Use a buffer in the ration.

Copper deficiency

Conditions when likely to occur:

- Copper deficient regions such as coastal sandy soils, granite soils and peat swamps; exacerbated by excess molybdenum or lime application.
- Deficiency typically occurs after an extended period of green feed. Copper is more available in dry feed.
- Growing stock and breeding stock are more susceptible to copper deficiency than other stock classes.

Diagnosis:

- Biopsy: Liver copper levels are very low, eg 2.6-17.2mg/kg (normal levels are greater than 40mg/kg).
- Blood samples should be taken from healthy goats and compared with those from affected goats. Normal serum or plasma copper levels are 500-1100mcg/litre.
- Soil: copper levels in the soil are poorly correlated with animal status, so do not use soil test to assess animal copper status. Soil copper level of 5ppm is adequate, but 4ppm molybdenum reduces available copper by 50%. Sulphur levels of 2g/kg or above also reduce copper availability.
- Abattoir: collection of liver samples if field biopsy not possible.
- Clinical signs: rough dull coat, poor growth, scouring, anaemia and poor reproductive ability.
- Kids may have an erratic swaying gait (swayback), usually weak and in poor condition. This is followed by paralysis.
- Confirmation of copper deficiency should be through blood sampling a proportion of the herd. Having done this, the most appropriate level of copper supplement can be determined.

Preventative management strategies:

- Treat stock with a copper injection prior to the high risk periods of winter and spring. Alternatively, copper capsules can be used to provide longer-term (12 months) prevention.
- If copper levels in the herbage are low, top dress pasture periodically with copper (usually 5–7 years).
- When applying molybdenum to a pasture, also add copper, if copper levels are marginal in the herbage.
- Discuss dosage and management options with your veterinarian and agronomist. Be aware that toxicity can be induced by overdosing with copper supplements.

Selenium deficiency

Conditions when likely to occur:

- Selenium-deficient regions, such as coastal sandy soils, New South Wales tablelands, acidic soils, sedimentary and granite soils, usually in high rainfall regions, exacerbated by high-superphosphate application and clover dominance. Refer to *Module 6 – Husbandry*, *Toolkit 6 page 10* for more detail on selenium deficient regions.
- Typically deficiencies are greatest when feed is lush.
- Young growing stock are most at risk.

Diagnosis:

- Blood biochemistry: precise information on goats is not available. New Zealand work suggests that

goats have a higher requirement for vitamin E than sheep and this may also be true for selenium.

- Clinical signs: stiff-legged gait, arched back and death.

Preventative management strategies:

- Both selenium and vitamin E are necessary.
- Selenium can be administered as oral doses, injection or slow-release pellets lodged in the rumen.
- Selenium is potentially an extremely toxic substance and must be administered with care. Note that selenium supplements are commonly found in clostridial vaccines and anthelmintic drenches, so take care not to oversupply.
- Selenium should be administered to does prior to joining and again one month before kidding.
- Treat kids at marking. Repeat dose for kids at weaning, with further doses at 3, 6, 9 and 12 weeks up to joining.
- Slow selenium pellets or long-acting injections can be used for longer-term protection.
- Top-dress pasture – the decision to topdress should be made on the basis of cost/benefit analysis. It is usually too expensive to treat pastures, except in high stocking rate situations. Selchip™ at 300gms/ha is a cost effective product.
- Vitamin E is administered by injection. It can also be mixed with a grain ration and fed immediately.
- Discuss dosage and management options with your veterinarian and agronomist.

Cobalt deficiency

Conditions when likely to occur:

- Cobalt deficient regions such as coastal calcareous sands, high-rainfall granite soils and krasnozem soils, exacerbated by liming and high superphosphate application, especially in lush seasons. Refer to *Module 6 - Husbandry Toolkit 6 page 10* for more information.
- It has not been diagnosed in goats.

Diagnosis:

- Blood biochemistry: vitamin B12 deficient plasma, with levels less than 0.2mcg/ml indicate deficiency. A normal liver contains 0.32-2.0mcg/gram of cobalt.
- Pasture cobalt levels can be assessed, but are rarely tested. Levels below 0.8 parts per million indicate deficiency.
- Clinical signs: ill-thrift, weepy eyes, severe wasting and eventually death.
- Clinical response to deficiency treatment can be tested by comparing a treated mob with control (untreated) mob. Treatment group would receive either a vitamin B12 injection or cobalt pellets.

Preventative management strategies:

- Vitamin B12 injection will provide prevention for about 8–12 weeks. Slow release cobalt pellets can be used for longer term prevention.
- Top-dressing pastures with cobalt gives variable responses. Cobalt levels in pasture can be tested – below 0.8 parts per million indicates a deficiency.
- Discuss dosage and management options with your veterinarian and agronomist.

Iodine deficiency

Conditions when likely to occur:

- Iodine deficiency occurs especially in mountainous areas such as on the Great Dividing Range in Victoria and coastal New South Wales.
- Iodine levels tend to be low in lush clover-dominant pastures with a history of high superphosphate application.

Diagnosis:

- Clinical signs: thyroid gland swells producing a goitre; this is only a problem in new born kids. Adults appear to tolerate seasonal deficits.

Preventative management strategies:

- Drenching is recommended. Avoid feeding iodine as a lick as it is important to accurately control intake by the doe.
- Pregnant does grazing in high rainfall areas should receive a drench of iodine once or, in some cases, twice during the last two months of their pregnancy.
- Feed seaweed.

Thiamine (vitamin B1) deficiency

Conditions when likely to occur:

- Goats eating plants that are rich in the enzyme "thiaminase", such as bracken fern, mulga fern, rock fern and nardoo.
- After a dry period, the plants listed above will get away more quickly than other pasture species. Stock eating the fresh growth of these plants are at risk.
- Feeding large quantity of molasses, or a sudden increase in concentrates.
- Sudden changes of diet may predispose to thiamine deficiency, especially in young stock.

Diagnosis:

- Clinical signs include:
  - stargazing – head up and tilted back,
  - disorientation and aimless wandering,
  - apparent blindness, oscillating eyes, may appear cross-eyed,
  - lying down, head thrown back and stiff legs, convulsions and coma.

Preventative management strategies:

- Graze goats on fern-free paddocks until there is sufficient pasture or other grazing opportunities.
- Make available alternative feed ie good-quality hay so that stock are less likely to eat fern.
- Reduce the amount of fern on the property.

Tool 7.5

Toxic plants

It is important that you are able to recognise those plants in your area that are toxic, particularly those which are toxic to goats.

In terms of managing the threat posed by toxic plants there are a number of factors that you need to consider:

- Poisonous plants may include pasture species at certain growth stages, native species and garden plants.
- When animals are hungry they may gorge themselves on things that they would otherwise avoid. Therefore, do not introduce hungry goats to areas where toxic plants are known to be growing. If in doubt, let a few tasters in for a short period of time to check that the area is safe.
- Goats are curious animals and they will readily try something new. Be aware that goats may start eating poisonous plants when moved to a new area.
- Goats grazing in a particular area for extended periods may become accustomed to eating small amounts of toxic plant material, but new mobs introduced to the area will not have the same tolerance and can be adversely affected by eating the same plants.
- Herbicide treatments tend to increase the palatability of plants, including toxic plants.
- The relative toxicity of plants may vary according to the season and the stage of plant growth.
- Wilting in dry conditions and rapid growth after rain can increase the toxicity of a plant.
- Nitrite poisoning can be a problem when grazing green oat crops and other specific plants, such as variegated thistle, nitrogen-fertilised ryegrass, capeweed and mintweed.
- Some plants may only be toxic when growing in a particular soil type.
- Some plant toxins can be cumulative: the damage to internal organs may not be noticed immediately, but may develop over time.
- Applying fertiliser to promote lush growth may increase toxicity eg applications of urea can increase the risk of nitrate poisoning.
- Stressful growth conditions, such as drought and insect attack, may cause toxins to concentrate in the plant.
- Small amounts of toxic plants fed in a well mixed feed or as part of a pasture diet may be tolerated.
- Animals suffering from mineral deficiencies may develop cravings which cause them to eat plants that they would normally reject.
- Plant parts can vary in their relative toxicity. In some plants it may only be the seeds or the bark that is toxic.

There are a many good references that can help you to understand which plants are toxic, the level of toxicity, the impact of consumption by stock and the environmental factors that promote toxicity. Some useful titles include:

- Everist, S.L. (1981) *'Poisonous Plants of Australia'* Angus & Robertson
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Tool 7.6

Feedlotting goats

The information presented in this tool has been generously provided by the University of Queensland. We would like to thank to the authors, Mark Flint and Peter Murray, for their cooperation. The document was originally produced by the University of Queensland and published by the Queensland Department of Primary Industries.

DPI notes

Management guide for lot feeding goats

Mark Flint[A] and Peter Murray[B]

Introduction

This guide discusses what you need to know to operate a commercial goat feedlot.

Animal welfare in commercial goat feedlots can be found in *Code of Practice concerning the welfare provisions for lotfeeding goats* (in preparation, to be published by the Department of Primary Industries, Queensland).

What is lotfeeding?

Lotfeeding is the confining of grazing animals (in this case goats) for intensive management, primarily for optimal growth necessary for the economic preparation of animals for slaughter.

What problems may occur?

The key problems associated with managing goats in a feedlot include:

- The high occurrence of malnourishment and exhaustion, aggression and disease induced by stress.
- The difficulty of containing agile animals, particularly individual goats that have little respect for normal stock fences or have had little or minimal handling prior to pre-feedlot habituation.
- Specific handling techniques required to move and care for goats.
- The unique nutritional requirements of these animals.

Critical to planning a lotfeeding facility is defining specific outcomes. These include determining access of lotfed goats to markets, the potential profitability of lotfeeding under the given conditions, and contingency plans in case lotfeeding is determined to be unprofitable.

If lotfeeding is not likely to be profitable or advantageous, then it may be better to:

- Sell goats without lotfeeding them.
- Maintain these animals on poor quality pastures until quality fodder crops and/ or pastures become available.
- Agist goats.

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Costs of lotfeeding goats

The purchase of stock and the cost of feeding will be the major economic outlays once the feedlot itself is established. Feed can cost over $200 per tonne, and even between September and March when goats grow best, it will take between 7kg and 14kg of feed to produce 1kg of carcase. Naturally, such estimates vary seasonally and with locality. Costs of vaccinations and drenching, running the feedlot (including the employment of staff, transport of goats to the abattoir), slaughter and processing costs, and risk assessments (mortality and market guarantees) should be considered before proceeding.

Selecting goats for the feedlot

Suitable animals must be selected. Loss of stock due to poor pre-feedlot selection may result in significant economic losses.

Here are some essential factors:

- *Identification* – by law, goats cannot be sold or held without appropriate identification. This may take the form of earmarking, tattooing or a plastic ear tag.
- *Body condition* – goats in a feedlot must be in good physical condition. Feedlots are used to finish goats for slaughter, not to revive goats in poor condition. Reviving goats is unprofitable and poses a risk that disease may spread if the animals are in poor condition on entry to the feedlot.
- *Temperament* – do not choose 'wild' or skittish goats for a feedlot. Even with pre-feedlot habituation, a goat that does not respect fences or will not tolerate interaction with humans will not perform well in a feedlot.
- *Conformation* – choose goats with good conformation. This includes a natural shaped back (not too flat and not too curved) and good feet. In a feedlot, animals undergo a rapid increase in liveweight which places more pressure on their limbs and therefore the goat must not show signs of lameness from weight bearing. If a goat is limping, check between the hooves for abscesses, foot rot or soft-tissue damage. If the hoof is healthy, then check the leg for muscle, tendon or skeletal damage.
- *Age* – lotfeeding is designed to maximise the growth of young goats during their rapid growth phase of development (around 6 months of age, or the first summer after birth). Lotfeeding is of little benefit to older goats and although they will respond well to high-quality feed and intensive management, their liveweight gains are less. Two good indicators of age are;
    - o horn size (the larger the horns, the older the goat; naturally this is breed-dependent) and
    - o the number of adult teeth. This is similar to sheep where each additional adult tooth approximately equals an extra six months of age up to maturity.
- *Mouth* — check the mouths of goats for overshot or undershot jaws, and look for 'broken-down' teeth because these may impede feed intake.
- *Entry liveweight* – markets determine the entry liveweight (carcase weight) of goats being finished in the feedlot. Market requirements should be known before the start of lotfeeding.
- *Castration status* – in a feedlot, entire males are likely to have higher liveweight gains than castrated males.

Pre-feedlot habituation

Lot feeding of goats includes both a pre-feedlot habituation phase and a feedlot phase.

Pre-feedlot habituation is a necessary process if animals are to be accustomed to feedlot facilities prior to lot feeding. It is particularly important when using goats of feral origin or goats from large extensive husbandry systems due to their 'flighty' nature when introduced to intensive management systems. Pre-feedlot habituation reduces stress and encourages animals to eat the maximum amount of feed from their first day in the feedlot. Stressors may include a new ration, high stocking densities compared to extensive grazing, and new facilities and management practices.

1. Pre-feedlot drenching and vaccinating

Prior to entry to the habituation yards, each animal should be drenched and vaccinated to control internal parasites and reduce the risk of disease transmission between animals. Do this as the goats are being weighed into the pre-feedlot facility. These handling procedures should accustom goats to the human interactions they will experience in the feedlot.

2. Stocking density and duration in pre-feedlot habituation

Goats should be held at about 64 goats per hectare for a period of five days.

3. Pre-feedlot weighing and identification of shy feeders

Records of each goat's performance should be recorded. Weigh the goats at the start of pre-feedlot habituation and periodically to identify the change in liveweight for each goat during the habituation period. If a goat looses weight during this pre-feedlot habituation period, it may indicate the animal's future performance in the feedlot, poor health status and/or poor adaptation to the ration. If a goat loses excessive weight during the pre-feedlot habituation period (for example, greater than 200g/day) then it should not be entered into the feedlot.

4. Pre-feedlot water and feed ration

Goats need access to a minimum of 4L of cool, clean water per head per day. This requirement may be greater than 4L of water per day during summer and lower during winter.

During the pre-feedlot habituation goats are to be grazed on pastures similar to those they have been recently grazing and fed chaff or hay on the first day to provide a safe gut fill (about 2% of liveweight per head), then fed their feedlot ration (see Section 7.2 below).

Feedlot

1. General hygiene provisions

Feed troughs should be covered to prevent goats from standing in and contaminating the feed. Contaminated or uneaten feed should be removed daily to allow continuous access of fresh feed.

Hay, if fed, should be provided in elevated hay racks. Spilled residues must be removed daily to avoid contamination. Constructing a cement pad under the troughs and racks will allow for easier cleaning of spilled feed.

Water troughs should be cleaned every second day. Constructing a cement pad under the troughs will minimise mud (and contamination) from overflowing water.

2. Feedlot drenching and vaccinating

Goats should be treated with the following veterinary chemicals:

- 7ml of Virbac First MectinDrench™ or any similar drench registered for use on goats to control internal parasites including lung and intestinal worms.

- 1ml of Ultravac 6 in 1® vaccine at the start of the pre-feedlot habituation period to control the following bacterial diseases.
- Caseous lymphadenitis (caused by *Corynebacterium pseudotuberculosis*), enterotoxemia (caused by *Clostridium perfringens* type D).
- Veterinary tetanus (caused by *Clostridium tetani*).
- Black disease (a non-enteric, clostridial infection caused by sporulated organisms within Kupffer's cells in the animal's blood and liver).
- Malignant oedema (caused by *Clostridium septicum*).
- Blackleg (caused by *Clostridium chauvoei*).
- Use selected chemicals for control of external parasites such as lice and ticks if necessary.

Treatments may incur withholding periods so carefully read labels before use. Withholding periods vary significantly between treatments and should be known before application. **Follow safety precautions. Always read the label.**

3. Weighing goats

Each goat should be weighed on entry into the feedlot and again each week with the minimum of disturbance. If weekly weighing is likely to cause disturbance, then it may be necessary to weigh less frequently. Disturbances may result in decreased feed intake and decreased performance. Weighing should occur at the same time after the same practices have occurred; that is, if goats are fed before weighing on one week, then they should be fed before weighing every week for the duration of the lotfeeding period. This is to ensure that gut fill is approximately the same at each weighing, and no change in regime occurs that may induce stress among the goats. Records of liveweight change should be kept for each goat.

4. Monitoring the health of the goats in the feedlot

Signs of illness and stress-induced starvation in the goats should be checked daily. If any goat is sick or not eating, it should be removed from the pen and placed in an isolation pen where it is not stressed by competition from many goats and is not able to infect the rest of the feedlot flock.

Sick goats or shy-eaters may be subject to aggressive dominance by other goats. This can be disastrous in a feedlot situation. If in doubt as to the health status of a goat, consult a veterinarian.

5. Feedlot pen stocking density and pen size

In a feedlot, goats can be stocked at the equivalent of 1667 goats per hectare as long as a pre-feedlot habituation stage has been undertaken. This stocking density is the equivalent of 5.9m^2 per head and is approximately the same as the recommended density for lambs in a feedlot. Pens should be rectangular and approximately 42m by 60m to create manageable groups and to mimic 'natural' flock sizes of around 400 goats per pen.

6. Lotfeeding duration

Goats should not be lotfed for a period exceeding 35 to 42 days, as goats easily get bored and stressed in feedlots. Novel environmental stimulation (toys) helps to reduce boredom and stress. Toys may take the form of a pile of stacked railway sleepers and old car tyres or mounds of soil to climb on, or suspended plastic milk bottles and pipes to mouth and butt. After 35 to 42 days the relative increase in feed costs are likely to exceed any additional liveweight gains and may even make the process unprofitable.

This period may be longer if cheaper feed can be obtained and/or goats are introduced to the feedlot at a lower starting liveweight but be aware that additional novel environmental stimulation will be required for such animals to combat boredom and stress. Liveweight gains may not be as great after 35 to 42 days.

Currently, premium prices are not paid for big goats; premium prices are paid for goats that can be sent to specific export markets (that is for the majority of the year, goats around 35kg liveweight).

7. Water and feed ration/formulation

7.1 Water

Lot-fed goats may require up to 4L water/day. Goats will accept a level of up to 1.5% (5000mg NaCl/L) salt in their drinking water if the amount of salt is slowly increased up to this maximum salt concentration. This will allow the use of water from bores in feedlots. However, clean cool water (with a salt content of less than 2000mg NaCl/L) is preferred as it aids digestion and reduces the risk of introducing water-borne diseases.

7.2 Feed combinations to maximise growth

Because rapid growth is required, it is usually an advantage to feed a mixture of hay and grain ad libitum. A cereal grain and legume hay is suggested at a ratio of 70:30 cereal grain:hay.

Take precautions when starting to grainfeed to minimise the risks of lactic acidosis, liver damage and urinary calculi.

A mash containing a mixture of chaff and grains may provide a complete diet, available in a constant ratio without allowing animals to select components of the diet. This may also ensure that the goats eat the desired energy and protein levels required for rapid growth.

A young, rapidly growing goat can eat over 1.3kg of high quality ration per day and grow at over 200g per day. It is vital that animals are provided with more than this amount of ration if growth is not to be limited. Rations should consist of 90% dry matter (DM), 30 to 35% Neutral Digestible Fibre with a crude protein content between 15% and 17% and a metabolisable energy (ME) content of 9-12 mega joules ME/kg ration (DM). Additives to the ration such as minerals, salt, sodium bentonite, vitamins, urea and a coccidiostat may be required. Before lot feeding goats, consult an experienced small ruminant nutritionist.

In the confines of a feedlot, goats should not have access to toxic shrubs, trees or plants that may poison them.

Further reading

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- DPI's web site: www.dpi.qld.gov.au

DPI Notes

Guide for lot feeding goats: – facilities

Mark Flint[AB] and Peter Murray[A]

This guide discusses what you need to know to operate a commercial goat feedlot.

Animal welfare in commercial goat feedlots can be found in *Code of Practice concerning the welfare provisions for lotfeeding goats* (in preparation, to be published by the Department of Primary Industries, Queensland).

What is lotfeeding?

Lotfeeding is the confining of grazing animals (in this case goats) for intensive management, primarily for optimal growth necessary for the economic preparation of animals for slaughter.

Pre-feedlot habituation yard construction and facilities

Prior to lotfeeding, goats should be habituated to the facilities they will encounter on introduction to the feedlot.

1. Fences

Goats should be held in a habituation education yard with 7 or 9 strand plain wire electric fences during the pre-feedlot habituation process to teach them to respect (keep away from) fences. The fence should be constructed with alternating live and earth wires (top wire earth), with the gaps between each wire decreasing down the fence (wires 1-2, at the top, have a gap of 20cm, whereas wires 8-9, at the bottom, have a gap of 5cm). The bottom wire (which is an earth) touches the ground. The fence should be electrified to 9000V. The goats should be stocked at 64 goats per hectare.

2. Feed and water troughs

Facilities used during this period (water and feed troughs) should be the same as (or at least very similar to) those to be encountered in the feedlot to help familiarise animals with the eating and drinking facilities in the feedlot. Both feed and water troughs should be designed to be easily cleaned. Water troughs should supply a minimum of 4L of water per goat per day. Feed troughs should be designed to provide 5cm of trough space per goat with ad libitum feed.

3. Pre-feedlot habituation pen shelter

Goats need access to shelter from adverse weather conditions. Shelter from the wind, rain, direct sun and cold should be sufficient to cover all goats in the yard at the same time.

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Feedlot pen construction and facilities

A goat feedlot requires several basic facilities including individual rectangular yards (42 x 60m) each with feed troughs, water troughs, suitable environmental enrichment and a central shelter (running North-South to provide continual protection from the East-West track of the sun), access to laneways leading to handling yards and loading ramps. A feedlot should include at least one, and preferably several, isolation pens with separate water and feed sources, loading ramp and drainage system to avoid any contamination of healthy goats in other pens by sick goats (figure 1). In many cases, lamb feedlots will be modified to accommodate goats, and this may result in significant savings in establishment costs.

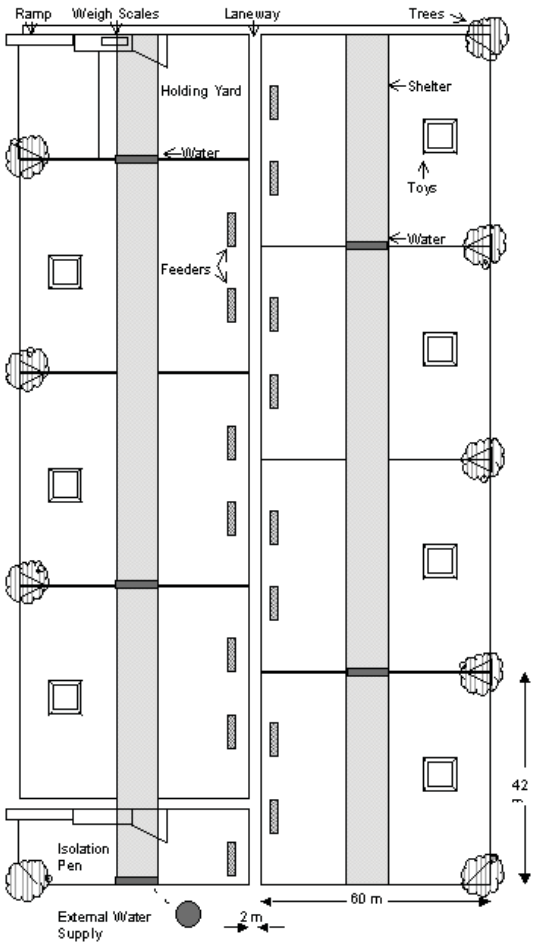

Figure 1. A potential goat feedlot design.

1. Fences

Feedlots should be fenced with at least 1100mm high (100 x 50mm mesh) weld mesh topped with fabricated wire netting to create a 1500mm high goat-proof fence. Weld mesh fences need to be checked daily to ensure that no goats have their head caught. No gaps should be left under the weld mesh or other escape routes left available to the goats. Any gap large enough for a goat to put its head through, is large enough to become a potential escape route, or goats may get their heads caught. Angled strainer posts can be climbed by goats, so posts should be external to the weld mesh. Plain wire electric fences of 9 strands are usable in a feedlot, but are not advised. Do not electrify weld mesh. If goats get their heads caught in an electrified weld mesh fence, it is likely to be fatal.

2. Feed and water troughs

Feed troughs (either as open troughs or self-feeders, Plates 1 and 2) should be fixed 400mm above the ground with a cover to prevent goats from standing in and contaminating the feed. A minimum feed trough length of 5 cm per head is recommended. Hay racks should be elevated to goat head height. The base of the rack should be approximately 800mm above the ground. Designs and dimensions for home-made self-feeders and hay racks are given by Bell et al. (1998).

Feed troughs do not have to be complicated or expensive. They may be open-style feeders with a cover to prevent goats from jumping into the trough.

Water troughs should be fixed at 400mm above the ground and supply clean water at a minimum rate of 4L of water per goat per day.

3. Shelter in a feedlot

Goats do not like rain, extreme heat or extreme cold. The feedlot should provide shelter for goats that protects them from these types of adverse weather conditions.

Shelter should be an open awning design that allows for unimpeded ventilation while still providing sufficient space so that each goat may have shelter during adverse weather without overcrowding occurring.

Shelter should provide 1.0 square metre of space per goat.

The awning of the shelter should extend North-South to provide goats with maximum coverage from the midday sun and also so that the pad can dry out.

For sheltering from cold, the awning should provide a wind break by having walls that prevent the unimpeded flow of air while still facilitating ventilation – for example, wooden barriers (short walls) and corrugated iron sheeting, such as the types used in cattle feedlots.

For sheltering from heat, enough space per goat should be provided so that body heat radiation from surrounding goats does not adversely affect the individual.

For protection from wet conditions, adequate floor drainage should be made available and the feedlot should be constructed with a ground slope of 3° to aid drainage.

4. Feedlot pen enrichment

All pens should be enriched with 'toys' to help alleviate boredom and disruptive behaviours in the goats. Toys do not have to be expensive or complex. Toys may take the form of a pile of stacked railway sleepers and old car tyres or mounds of soil to climb on, or suspended plastic milk bottles and pipes to mouth and butt. The addition of a new toy each week should continue to stimulate further interest and prevent boredom.

Before constructing a goat feedlot, access to markets should be assessed to determine if the enterprise will be economically viable.

Licences for the feedlot

In Australia, Government agriculture departments and local shire councils have specific requirements for environmental aspects of lotfeeding. These include effluent management, site location and water derivation. Before lotfeeding, consult the appropriate local authorities for approval.

The predisposition of a site to environmental and community problems, particularly those caused by groundwater contamination, soil erosion and dust pollution is a vital consideration in assessing its suitability for lotfeeding.

Further reading

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Case study

PASTURE MANAGEMENT

NAME:	Helen Darlington
PROPERTY NAME:	Yarrabee
PROPERTY LOCATION:	Goombungee, Queensland
PROPERTY SIZE:	250ha
NUMBER OF GOATS:	300-600
MAIN GOAT ENTERPRISE:	Boer goat stud
TARGET MARKET:	Export breeding-stock markets – stud Boer does and bucks
	Domestic breeding-stock markets – stud and commercial Boer bucks
SECOND GOAT ENTERPRISE:	Boer cross goat enterprises
TARGET MARKET:	Export breeding-stock markets – Boer cross does
	Domestic prime goatmeat market wethers
	Export meat market – cull stock
OTHER FARM ENTERPRISES:	Bacon pigs, beef cattle

Although Helen's enterprise is focused on stud breeding, it is run as commercially as possible, under intensive grazing conditions. The property is a mix of natural and improved pastures, supported by an average annual rainfall of 580mm, falling predominantly in summer.

When asked to outline her philosophy on grazing management, Helen explained that her intent is to supply adequate nutrition for her goats from clean pastures, whilst grazing in a manner which does not degrade the land – avoiding overgrazing or physical damage. To achieve this, Helen finds it necessary to spell paddocks from goat grazing for an average of four to six months each year. If there is evidence of overgrazing, Helen's strategy is to move the stock on and/or feed supplements

Aside from overgrazing, Helen cautions of the need be aware of the physical damage which goats can do as a result of camping and playing behaviour. The examples that Helen gave relate to erosion issues. She explains that "goats have the ability to damage fragile hilly areas due to their resting habits (they usually congregate to rest in the same area on the side of a hill and have a tendency to scrape a "nest" in the ground and therefore loosen up the soil). Young goats enjoy playing and rolling down slopes and so have the potential to erode soil over time." In these circumstances, fencing may be required to control access, or the paddock rested to allow time for groundcover to re-establish.

Internal parasites are another issue influencing Helen's grazing strategy. Parasite burdens are monitored and if problems arise, goats are moved to a cleaner paddock. On this property, cattle provide a valuable break in the grazing routine.

Fodder crops are also an integral part of the system. If rainfall permits, forage crops are grown as an alternative feed source, taking the pressure off when pasture growth is limited.

Helen describes grazing management "as a balancing act to constantly monitor the influences (rainfall, drought, stocking rate, goat behaviour and worm burden) that affect the pasture quality and/or land stability. Similarly, there is a continual need to juggle the number of goats and length of time that they remain in a paddock. This is important goat husbandry and is affected by nutritional requirements, worm burden status and markets. (Markets affect this due to the number of surplus goats being retained on the property at one time, in preparation for the next outlet)."

Case study

RANGELAND GRAZING

NAME:	Will Scott
PROPERTY NAME:	Wynyangoo Station and Narndee Station
PROPERTY LOCATION:	Mount Magnet, Western Australia
PROPERTY SIZE:	387,200ha
NUMBER OF GOATS:	25,000 – 45,000
MAIN GOAT ENTERPRISE:	Meat
TARGET MARKET:	Export trade – live goats and carcases

Will operates a free-range grazing system. The herd is dominated by females, with the exception of kids and 5% breeding males.

Internal fencing is a thing of the past. Stock are now controlled by the strategic establishment of watering points, with trap yards located at water. The watering points have been located to encourage even grazing across the property. Over the course of a year, goats will usually travel within a radius of 5km of water, and it was with this in mind that Will planned the layout of his water supply.

Will has found that the grazing behaviour of female goats has facilitated the regeneration of many rangeland plants. He explains that with the removal of bucks, females become more territorial and less inclined to mob together, reducing the grazing pressure on a given area. Females are much less destructive than male goats and tend to graze more at ground level. They are gentle grazers, sampling from a wide range of plants, without stripping individual plants. This allows plants to set some seed, thus facilitating the renewal process. Will contrasts this with his experience in running a sheep enterprise on this land, where the sheep ran in mobs and tended to overgraze particular species.

Will believes that the key to sustainable management of the rangeland environment is monitoring and balancing fodder availability and stock numbers. If the system is in balance, the enterprise can function profitably and sustainably.