

Goat Nutrition Guide





Nutrition is important for both the health and productivity of stock. Feeding is central to the relationship between owners and their animals so it's hugely rewarding when done well. This NRM guide has been written to give information to goat keepers who are looking to feed and care for their goats with renewed understanding. It is also aimed at people who might be considering keeping goats, to give confidence to get going. NRM is New Zealand's longest running feed brand and is committed to supporting goat owners at all levels. Your questions and comments are welcomed, so best practice can be discussed and shared.



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Introduction

Goats are of some economic value in every nation of the world and are of increasing commercial interest here in New Zealand as the benefits of goat milk, meat and fibre are being realised.

Small block owners looking for companion animals, paddock mates or an alternative to a house-cow and cow's milk are finding goats in one form or another appealing. Professional and lifestyle goat keepers alike report goats to be both alluring and productive and they are attracting passionate converts. Nutritionally they are a fascinating species that respond well to supplementary feeding provided it is tailored to their needs.



General Facts

- **Global goat population:**
Around 900million
- **Temperament:**
Intelligent and curious.
- **Mature weight:**
Males/Females 27kg/24kg to 140kg/100kg depending on breed (Pygmy through to Boer)
- **Life expectancy:**
10-18 years.
- **Gestation period:**
144-155 days (five months).
- **Birth rates:**
Most goats only have two teats but can have one to six kids per litter; over three is rare.
- **Oestrous (heat) cycle:**
Between 18-22 days. Oestrous period lasts for 12-36 hours.
- **Stockmanship skills required:**
Good for dairy; average for pets.
- **Livestock unit equivalent:**
Two.
- **Profitability/income streams:**
Good for goat milking, kid rearing, meat and potentially fibre.

Useful Terms

- **AB/AI:** Artificial breeding/insemination whereby sperm is artificially introduced into the reproductive tract of a female for the purpose of conception. Helps the spread of genetic progress and conservation of genetic resources because a male's genetics can be transported and delivered to more females than would be practical naturally.
- **Agronomist:** Seed expert who is well qualified to advise on seed mixes or crops for a specific region for both reliability and profitability.
- **Baleage:** Normally pasture or lucerne (alfalfa) silage conserved in individually wrapped bales for ease of movement rather than preserving in a clamp.
- **Buck:** Male goat.
- **Crude protein:** Indication of the protein content in a feed, determined by measuring the nitrogen in a feed and assuming that mostly it will be from protein containing about 16% nitrogen (crude protein = $N \times 6.25$).
- **Compound feed:** Formulated feed pressed into pellets which ensures good utilisation, convenience and normally enriched with essential minerals and trace elements which are bound into the pellets to prevent sorting by animals.
- **Deferred grazing:** Way of shutting up paddocks for grazing later in the season rather than conserving as hay or silage. Concerns some people as combustible material accumulates in paddocks which could fuel a paddock fire should ignition occur.
- **Doe:** Female goat.
- **Dry matter:** Portion of the diet that contains nutrients; important to consider when comparing the cost of moist feeds and dry feeds as moisture (water) is cheaper in the water trough than carted in with feeds.
- **Hay:** Traditional method of preserving grass which relies on sun drying to reduce the moisture content to about 15% or less which limits the action of plant and microbial enzymes. Hay can be made from grass-based pastures, clovers and lucerne. The quality of hay depends on the quality of the original crop and minimising harvesting and storage losses.
- **Kid:** Young goat.
- **Kidding:** Giving birth.
- **Maintenance:** Nutrient requirements to keep an animal at a particular body mass and condition.
- **Major (macro) minerals:** Minerals required in grams per head per day. Essential minerals are critical for normal health and production.
- **ME - (Metabolisable Energy):** Normally stated in MJ/kg Dry Matter; an estimate of the digestible energy available in a feed minus the energy lost in methane and urine. A good indication of feed quality.

Fun Fact

The first Heidi book was about a goat-loving girl in the Swiss Alps who spent her summers on the mountains with a goatherd Peter. The book was originally published in 1880.

Mohair: Fibre produced by Angora goats.

Useful Terms Cont.

- NE - (Net Energy): Estimate of the energy from the total diet actually used for maintenance, growth, pregnancy or production calculated as Metabolisable Energy, minus the heat produced by metabolism and fermentation. Microbes in the rumen generate a lot of heat which can be handy in the winter but is largely lost to the animal.
- Nanny: Female goat but more commonly called a doe.
- Pasture: Normally grass based such as ryegrass, cocksfoot, fescue species with some clover but increasingly contains broad-leaved species like chicory and plantain which may add variety to the grazing animals diet.
- Silage: Often made from pasture but can be made from clover, lucerne or whole crops (cereal and maize). Quality varies greatly depending on the crop ensiled and quality of the ensiling process. If baled at harvest called baleage which is typically more mature than pit silage.
- Strip grazing: Way of rationing grass intake by regularly moving an electric fence. Works well with cattle but less well with goats.
- Straights: Individual feeds that can be purchased in bulk or incorporated in compound feeds. Normally by-products from human food, such as soya bean meal from soy oil production or bio-fuel production, such as maize dark distillers grains from maize grain distilled to make ethanol. Some like tapioca are grown for the animal feed itself.
- Trace (minor) minerals: Minerals required in mg (thousands of a gram) per head per day. Essential trace minerals are catalysts which play a key role in the effectiveness of enzymes and hormones throughout the animal's body.
- Wether: Castrated male.

Fun Fact

Abraham Lincoln's sons had two goats that lived with them in the White House.



Housed goats eating a hay based diet.

Breed and Types Available

While goats belong to the family 'bovidae' and they are classed as ruminants along with the likes of cows and sheep, they also belong to the sub-group capra, which only includes goats.

There are over 300 distinct breeds of goat, grouped according to their main purpose (meat, milk or fibre), so the breed or mix of breeds selected may depend on what you want to get out of your goats. Goats were the first animals to be used for milk by humans. Breeds more suited for milk production include the Nubian, Saanen Sable, British Alpine and Toggenburgs. Different breeds have different milk production characteristics, with the Nubian often compared to a Jersey cow—producing less milk but with a higher milk solid percentage. The Saanen is compared to Friesian cows—producing more milk but with a lower milk solid percentage. If a good meat breed is required then the South African Boer or the New Zealand developed Kiko is a good choice, as they tend to put on weight quickly, instead of producing lots of milk. Some breeds are dual-purpose, meaning they produce plenty of milk as well as put on weight well and cross breeds can often be a good choice and easier to get your hands on.

The Angora and Cashmeres are well known for their high-quality fibre, which is sought after for use in luxury clothing items. If a pet is what you are after, looks and personality may be a priority and potentially any goat breed will fit the bill! One is never enough - goats are very social animals and are best kept in herds.

There is a myth out there that all goats smell—this is half true. Bucks have scent glands located just to the rear of their horns and in a few other locations. These emit an odour, with the smell becoming stronger during the breeding season, with the hope of attracting a mate. Does on the other hand do not smell any more than other livestock such as sheep or cattle. Bucks can be easily avoided on your farm, in order to evade their smell. Castrated bucks (wethers) do not smell.



South African Boer Goat

System Options

The product goats are most well-known for is their milk. Goat milk typically fetches a high price per kilogram of milk solid (fat and protein) and makes particularly tasty cheese.

Demand for goat's milk has encouraged many smaller farmers into larger scale commercial production. Goat milk is preferable to cow's milk for people with allergies, as it contains less allergenic proteins. The fat in goat milk is also easier on the digestive system due to its fat globules, which are naturally much smaller in size compared to cow's milk. Goat milk is also reported to alleviate the symptoms of eczema and other skin irritation, so is often included in skin products for sufferers of these skin conditions. Goat milk is actually used more regularly by people in the world as a whole compared to cow's milk, with goats being a popular stock choice in less developed countries due to their high efficiency to convert feed to milk and the fact that cows produce more milk daily than what a family can practically make good use of. An average dairy doe may produce over 2.5 litres per day over a 300-day lactation, whereas a dairy cow can produce ten times this amount. A goat or two may match a family's milk consumption more closely than a cow, plus goats are smaller and less dangerous to handle than dairy cows so are a good option for people relatively

new to handling stock. There is an added time commitment required when keeping milking goats as they require daily milking, or even twice daily milking if wanting to optimise milk production. If milking's are skipped this can cause health issues in does, such as uncomfortably full udders and even mastitis, so it does require some commitment. Hand milking can be time consuming, however more automated milking machines can increase ease of milking. The kids produced by does in order to stimulate the lactation will require hand rearing, which can be time consuming but personally rewarding.

Farming goats for fibre is a specialist operation and Angora/Cashmeres do have increased maintenance requirements (such as shearing) and can be more susceptible to animal health issues such as skin irritations, lice and fly strike. Their fibre however is much sought after for luxury clothing items and can fetch a high price, so they can generate some income.

Currently most of the goat meat produced in NZ is from feral goats but there is growing interest in farming meat breeds such as the Boer and NZ breed Kiconiu. Goats can handle steeper contours and consume more weeds than sheep and cattle so can complement traditional stock in hill blocks with little effect on existing stocking rates.

Top Tip

Goats are like little cows in some ways but not others, so it's best to understand what you are feeding them and what they need before making mistakes.

Goats can also of course be kept simply as pets and they can be just as entertaining and interactive as the family dog, as they are very intelligent and trainable animals. They can even be taught to do agility courses and tricks like dogs and at the time of writing they do not have to be registered with authorities like cattle and deer under the NAIT (National Animal Identification and Tracing) system.

Goats do have some special requirements, in order to keep them as healthy and productive as possible. They do require extra attention in terms of fencing and housing.



Commercial goat milk operations are becoming more popular in NZ.



Around the world goats will go the extra mile in search of feed.

Tips for Optimum Goat Health and Wellbeing

- Housing is important to consider when keeping goats. Goats do not withstand the wet and cold very well and are susceptible to pneumonia and may benefit from shade in the summer so robust weatherproof shelter of some kind is vital. Shelter should be light and airy but not too draughty.
- Adequate fencing is important when keeping goats, as they tend to be very good at escaping and can slip through openings and holes in fences you may think they wouldn't have a chance of getting through. Electrified fences are recommended.
- Hooves require regular trimming. Goats without access to rocks and concrete may require more frequent hoof trimming than those that do. Only the dead hoof should be trimmed, possibly every 2-3 months if necessary. Get some advice on the best way to do this and the best equipment to use. Over-trimming can cause bleeding, pain and subsequent infection.
- Goats are particularly susceptible to internal parasites (worms) and should be on an appropriate drenching programme based on faecal egg counts and the degree of cross grazing with cattle, horses and alpacas. It's best to talk to your vet around parasite control, in order to ensure you are using the correct drenches at appropriate times during the season.
- Shearing fibre goats requires special care by experienced shearers.
- Kid goats may need to be de-budded if the growth of horns is to be avoided. It is better to de-bud animals at a young age rather than de-horn at an older age (the dehorning procedure can be distressing for both the goat and human). Some goats are of the polled variety and horns will not grow due to their genetic makeup. Talk to your vet for more information.
- There are some health and welfare issues associated with tethered goats, as they can often not express their normal social behaviour and can sometimes not be given the care they require. It is recommended that goats are not tethered, however if they are, it is recommended that the MPI 'Code of Welfare for Goats' is consulted and adhered to.

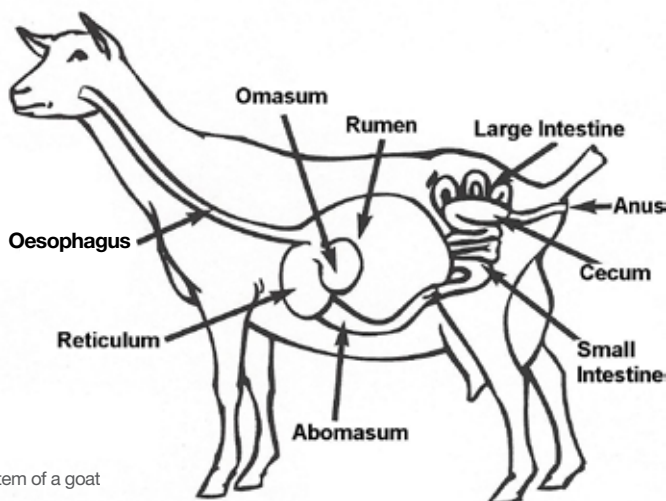
Goats have excellent co-ordination and love climbing things; owners suggest they benefit greatly from access to a 'playground' to reduce boredom.

Introduction to Goat Nutrition

Successful goat keeping requires many practical skills including animal husbandry, agronomy and nutrition.

While goats are resilient and adaptable, having some understanding of their needs can improve the outcome of a new venture or improve the performance of an existing enterprise. Goats are classed as ruminant animals, as are cattle and sheep. This means they can get nutritive value out of higher fibre plant matter due to their complex digestive system consisting of four stomach compartments. Mammals lack the enzyme to digest cellulose, so ruminants rely on a symbiotic relationship with microorganisms (bacteria, protozoa and fungi) to digest fibrous plants like grasses. Ruminants are great hosts who work hard to provide feed through the day into a nice warm chamber that is as free from oxygen as possible and clearing waste products like organic acids and

gases their symbiotic microorganisms generate in large quantities but would rather not be surrounded by. Ruminants also go to the added trouble of ruminating or 'chewing the cud', a process where they bring food previously consumed back into their mouth in order to break it down further by chewing and adding saliva, easing the access for microbes and buffering some of the acidity they create. Goats literally go the extra mile to harvest green feed, browsing on plants many species avoid. Although an amazing system, ruminants can struggle to cope with extreme diets. Too much hard fibre (especially lignified) can 'bung up' the rumen and limit dry matter intake, unlike horses they do not know how to cut their losses and pass material which is too fibrous. At the other extreme, very lush pasture in the spring or feeding too much rapidly fermentable carbohydrate (starch and sugar) may deliver insufficient fibre to support enough rumination which reduces the efficiency of the fibre digesting microbes.



Digestive system of a goat



Goats are natural browsers and love to seek out other sources of feed from their environment.

Herbivores around the world evolved to fill specific plant supply niches, like koala bears for example who are totally dependent on eucalyptus leaves. Although goats are in the same animal group as cattle and sheep, they do have a more flexible feeding behaviour which has seen them succeed in many different environments. They are classed as browsers rather than grazers, which means they actively seek out feed in trees, bushes and shrubs, rather than just grazing the pasture that is directly in front of them. They also like to eat weeds and woody parts of plants that other livestock would not eat, so they are very thrifty animals when they need to be. For this reason, goats tend to prefer a diet with more variety and simply offering them a typical ryegrass/ clover pasture may not be ideal. Access to good quality hay may provide

a higher fibre component and it may be worth exploring alternative forage mixes.

It is perhaps no coincidence that farming systems based on “cut-and-carry” fresh forage, conserved forages and concentrate feeding are well suited to the biology of the goat. Cut and carry systems often utilise broad-leaved species which survive longer in the sward without the pressure of hard grazing. Goats are possibly able to consume a more concentrated diet than cows and utilise grain-based starchy feeds well BUT are highly-suited to utilising high fibre feeds. Nature has uniquely equipped them with the biology to make good use of more mature conserved forages and grain based supplementary feeds. While sheep and cows are conditioned by their anatomy to retain fibre in their rumen to maximise fibre digestion, goats are able to allow higher passage rates out of their rumen.

Introduction to Goat Nutrition Cont.

Cattle can lose condition when fed as much low-quality hay as they can eat, goats have a bit more flexibility to increase throughput when forage quality drops. Although they have a smaller digestive capacity, they can eat up to six percent of their bodyweight in dry matter compared to nearer four percent for cows. A shorter retention time in the rumen may reduce how much energy is extracted per kg consumed but if more can be consumed per day overall energy intake can increase. With their greater flexibility, it is not surprising goats have become so popular in so many different countries despite producing a wide range of feedstuffs.

Goats do have a reputation for consuming things they shouldn't, which can be frustrating for owners and also not good for the goat if they consume something poisonous. For this reason, make sure that fencing is adequate and that goats are not given access to plant matter that could cause health issues. Do your own research into what may be available to goats in your paddocks and if safe to consume or not. Although goats are curious by nature and like to consume woody plants and weeds, if higher production is desired out of them, such as in the case of milking goats or growing kids, a better quality diet will be required in order to support the higher energy and protein requirements associated with a higher physiological state. For this reason, supplementation with a grain-based feed may be beneficial, particularly if pasture quality is not as good as it should be.

Although goats are known to eat things they shouldn't, they can also be fussy at times. Goats will decrease feed intake if offered spoiled feed. They don't even like to eat feed that other goats have nuzzled. Hygiene is therefore important and feed troughs should be cleaned out regularly and new feed should not be out on top of old feed.

Goats will aim to select a diet of better quality than what's on offer and at times will go to great lengths, such as climbing trees, to achieve their goal. A tendency to graze higher has exposed goats to less parasites than are found in the base of swards so over the millennia they have evolved less resistance to worms than sheep and cattle. Commercial systems based on "cut and carry" have become popular to avoid the problem of parasites but often incorporate conserved forages which are of lower nutritional quality than high quality grazed pasture. Highly digestible supplements are a good complement to conserved forages which typically lack protein and minerals in addition to being harder to digest. Fortunately, in studies goats appear to digest fibre more than might be expected. They chew their feed better and recycle nitrogen to the rumen more efficiently thanks partly to being equipped with big salivary glands. Goats grazing alongside cattle and horses will consume tannin rich vegetation such as woody plants, weeds and brush not consumed by the other species. This is due to their ability to more effectively neutralise tannins thanks to compounds in their saliva.

Top Tip

Don't take the risk of feeding mouldy feed – it may contain mycotoxins.



What factor is limiting the production of my goats?

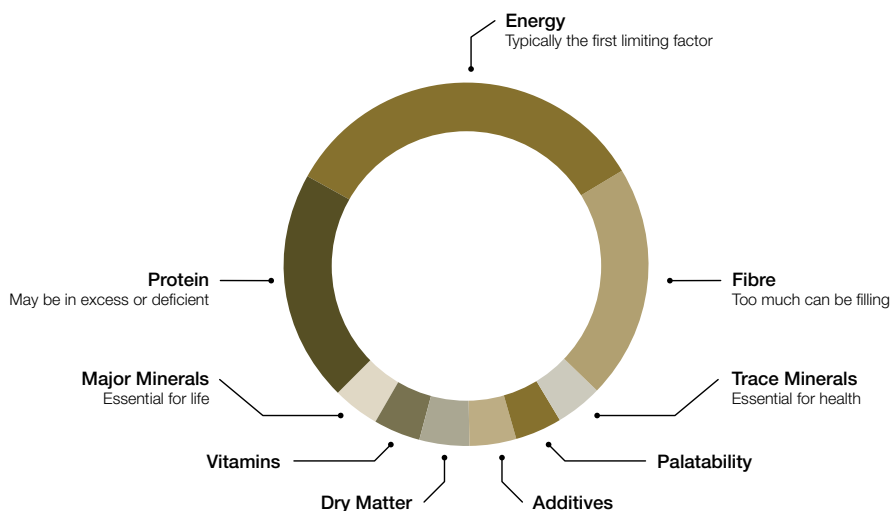
When considering diets for productive stock it is worthwhile considering what is the limiting factor.

Which nutrient, if supplied in greater or lesser quantity, will allow higher levels of production, health or fertility? If you have control over where your goats roam and what feed is available to them, it helps to understand what feeds contain in relation to the needs of different classes of stock.

In most circumstances, **energy is the first limiting factor for rapidly growing or lactating animals**. Energy intake is determined by the energy density of the diet. This is normally measured in megajoules metabolisable energy per kg dry matter (MJ ME/kg DM) multiplied by the dry matter intake. For forages, ME is

normally a reflection of the maturity of a crop when consumed. The typical ME of different forages and feeds is readily available online and in print. Forages and feeds can be sent to a laboratory for analyses and the ME will be reported.

Young, leafy material is easier to digest and contains less fibre than more mature plants. Pasture based milk production normally focuses on grazing pasture before the fourth leaf stage. Maintaining low residuals (i.e. grazing paddocks down low) may not be desirable for goats given their susceptibility to worms that live at the base of the sward and limited drench options. Grasses decline in feed value as the crop gets bulkier and especially at times of the year when they reproduce as the seed head is often held on a strong, fibrous stem to lift it above the leaves. This is so seeds



can eventually get blown far and wide provided goats haven't eaten them first. Whole crop silages (cereals and maize) have a lift in feed value as grain is produced but inevitably contain a bulk of fibrous mature material because at the time of ear initiation the crop is already bulky and relatively mature. Supplementing mature forages with grain-based supplements is a logical way to increase the energy density of a ration for lactating goats. Forages are generally bulky, relatively low nutrient dense feeds. For a more detailed explanation of how energy in feed is utilised by ruminants see Appendix 1.

The second limiting factor for milk production is generally protein.

When describing animal feed, we often use Crude Protein percentage (CP%) as an indication of the amount of protein they contain. Crude protein is calculated by multiplying the nitrogen content of the feed by 6.25 and assumes that the protein in the feed contains 16% nitrogen. The rumen microflora are so tiny they can't consume the protein molecule whole. Just like we can't swallow a whole piece of rhubarb without biting it into small pieces. Microbes have to digest proteins externally, absorb the chopped up amino acids they are made from and then rebuild them into their own microbial protein, which is well balanced to the needs of lactating ruminants. The actual protein available to a ruminant (Metabolisable Protein-MP) is the amount absorbed from the lower digestive tract in the form of amino acids arising from the digestion of microbial protein and undegraded

digestible dietary protein passing from the rumen. Rationing and choosing between feeds gets a little more complicated because an MP value cannot simply be ascribed to an individual feed because it depends how the total diet is digested.

Excess protein can be used for energy, but energy cannot be used for protein. Forage maturity goes hand-in-hand with lower crude protein percentage, so diets based on conserved forages are likely to lack protein relative to the needs of growing or lactating stock. Rumen microbes require a balanced diet if they are to multiply and ferment the diet efficiently, so the first priority in terms of protein supply is to ensure protein available in the rumen is not limiting fermentation. At higher levels of production, by-pass protein or digestible undegradable protein, can help to meet the needs of the animal over and above what can be supplied by rumen microbes. It is important that by-pass protein is also digestible, or it will by-pass the animal completely and end up in the dung. Protein associated with the fibrous part of seed kernels or burnt protein may be undegradable in the rumen but also undigestible after the rumen so will not deliver available protein to the animal. Protein is generally more expensive than energy and excess protein is excreted very concentrated patches in urine which is not always well utilised by pasture so it makes sense not to over-supply protein. Over-supply may be inevitable when high quality pasture dominates the diet because lush, leafy pasture typically contains more protein than stock require.

What factor is limiting the production of my goats? Cont.

Fibre can be a limiting factor if either under- or over-supplied. A diet low in effective fibre e.g. long fibre from forages rather than the short fibre in by-products, may not support sufficient rumination and if rich in soluble carbohydrates may increase the risk of sub-acute rumen acidosis which can limit health and production. Diets based on mature pasture or conserved forages may over-supply fibre for high producing dairy goats. Although goats can tolerate higher fibre diets by increasing rumen outflow, inevitably faster transit times will limit fermentation and the digestibility of the feed consumed.

Diets need to be balanced in terms of the key major essential minerals, especially calcium, magnesium, sodium and phosphorus. Major minerals can be associated with stock going down, metabolic issues linked especially to calcium and magnesium in particular. Simply adding loose minerals to blends can be problematic. Goats do not like to eat a lot of fine particles in their feeds so minerals can be avoided. Pelleting reduces the amount of fines and ensures essential minerals and expensive micro-nutrients like trace elements and vitamins won't be left in the trough. Phosphorus is often considered the forgotten mineral in New Zealand and can be lower in mature forages than young, leafy forages. Some dicalcium phosphate has been included in NRM Dairy Goat Pellets because it has a crucial role in so many processes throughout the body.

The effects of trace minerals are a little more subtle and health issues can be difficult to pinpoint as several trace

mineral deficiencies share the same symptoms. For example, both cobalt and iron deficiency can cause a loss of appetite. Poor fertility may be linked to a deficiency of copper, iodine, manganese, selenium and zinc. Iodine deficiency seems to be more common in goats compared to other livestock. Iodine deficiency is characterised by goitre (an enlarged thyroid gland), rough, brittle hair and reduced growth rate/condition loss. Kids from iodine deficient does may be born weak or dead – if born alive, they can often grow in a stunted manner with shortened leg bones. Ensuring that goats are kept topped up with iodine is important, particularly in New Zealand, as our soils are typically low in iodine. However, humans are not good at dealing with excess iodine so it's important however not to over-do iodine supplementation for milking animals or the iodine content in their milk may be excessive for the end user. A zinc deficiency can be associated with poor skin and hair condition. Other micronutrients may be deficient at times, including but not restricted to selenium, copper and cobalt. Mineralised compound feed or mineral blocks can be a good way of ensuring that goats are always topped up on the mineral side. There are some compound feeds available specifically for goats, however if these are not easily accessible, multi feed options can be a safe option too. Some trace minerals are also available in an organic form where the mineral is linked to an organic component such as an amino acid which increases the availability to the animal.

Mineral and Trace Elements for Goats

Where specific recommendations are not available, dairy cow and sheep recommendations have been included as an indication only.

Mineral	Function	Symptom if deficient	Supplementation (check with a vet or supplier)	NRC requirement in the diet/ kgDM g/kg or mg/kg	Toxicity g or mg/ kg	Comments
Magnesium (Mg)	In enzymes and nervous system (transmits nerve impulses) throughout the body.	Hypomagnesaemic tetany (staggers) – nervousness leading to convulsions and even death.	Magnesium oxide on pasture, blocks, infeed or magnesium chloride or magnesium sulphate in water. Magnesium phosphate and magnesium bullets.	0.5 – 1.4g/kg (NRC 2007)	6g/kg (NRC 2005)	Not stored so needed daily. Poor weather, very lush growth and potassium can reduce intake.
Calcium (Ca)	Found in bones and teeth but also enables nerves and muscles to function.	Milk fever pre- and post-kidding and also when mating if dry matter intake falls.	Limestone and dicalcium phosphate.	1.4 – 6g/kg (NRC 2007)	15g/kg (NRC 2005)	Milk fever more common in older dairy does at kidding than maiden does.
Sodium (Na)	Maintains fluid and ion balance in body.	Abnormal licking of wood, soil, & urine, reduced performance.	Salt in mineral supplements or rock salt. Salt both stimulates and regulates intake.	0.5 – 1.1g/kg (NRC 2007)	40g/kg (NRC 2005)	Always provide access to unlimited drinking water if supplementing animals with salt.
Phosphorus (P)	Essential in formation of bones and body structure. Concentrated in red blood cells, muscle and nerve tissue.	Weakness, poor appetite or depraved appetite, reproductive failure.	Dicalcium phosphate most commonly used.	1.3 – 3.3g/kg (NRC 2007)	6g/kg	P level drops as forages mature and in whole crops. Often linked with protein so low protein diets may be P deficient.
Cobalt (Co)	Required for vitamin B12 production in the rumen.	Poor appetite, harsh coat and muscle wasting known as pinning.	Cobalt sulphate in fertiliser, bullets, injection.	0.11mg/kg (NRC 2007)	25mg/kg (NRC 2005)	Cobalt levels in grass lowest in spring and summer.

Mineral and Trace Elements for Goats Cont.

Mineral	Function	Symptom if deficient	Supplementation (check with a vet or supplier)	NRC requirement in the diet/ kgDM g/kg or mg/kg	Toxicity g or mg/ kg	Comments
Copper (Cu)	Involved in many different enzyme systems as a catalyst.	Anemia, poor growth, scouring, 'spectacles' and poor coat condition, reduced fertility.	Copper sulphate fertiliser, injection, bullets and licks.	Lactating 15mg/kg Mature 20mg/kg Growing 25 mg/kg (NRC 2007)	40mg/kg	Interacts with sulphate, zinc, molybdenum and iron in the rumen which reduces availability.
Iodine (I)	Essential for thyroxin production which controls metabolism.	Goitre (thyroid gland becomes enlarged) and reproductive problems (irregular to suppressed oestrous, early embryonic death).	Iodised salt or injection.	Lactating 0.8mg/kg Growing 0.5mg/kg	50mg/kg EEC limit 10mg/kg feed to reduce risk to consumers	Requirement increased in presence of goitrogens (kale and other brassicas).
Manganese (Mn)	Essential for the functioning of the brain and nervous system.	Bone deformities in newborn/young. Low fertility and milk production.	Various manganese compounds including sulphates, oxides and chlorides.	7.7 – 23.9 mg/kg (NRC 2007)	2000mg/kg EEC limit 150 mg/kg	Forages normally rich in manganese.
Selenium (Se)	Anti-oxidant in all active body tissues.	Weak muscles disease (WMD), unthriftiness in young stock, poor conception rates and retained cleansings.	Sodium selenate orally or by injection, mineral supplements or as fertiliser.	Lactating 0.3mg/kg Growing 0.3mg/kg	5mg/kg EEC limit 0.5mg/kg in complete feed	Excess selenium is toxic so avoid supplementing by several routes at the same time.
Zinc (Zn)	Needed in enzyme systems throughout the body and keratinous tissues.	Dry skin, coarse hair, soft hooves.	Zinc oxide in drench or bolus, Zinc sulphate in mineral supplements.	5.4 – 63 mg/kg Lactating 39mg/kg	300 sheep 500 cattle Unknown goats	Helps good hoof, skin and hair growth and aids immunity.

NRC – National Research Council which issues internationally accepted nutrient requirements for different species and classes of stock.

Vitamins

Vitamins are essential organic compounds that are required by the body in minute amounts for metabolism, physiological function (maintenance, growth, reproduction etc.) and health.

The vitamins most likely to be deficient in the goat's diet are A, D and E. Vitamin A is essential for growth, reproduction, vision and plays a role in disease resistance. Plants contain the yellow pigment β -carotene which is converted to Vitamin A in the animal. The levels of β -carotene decreases as the plant

matures. Vitamin D is known as the 'sunshine' vitamin or the 'anti-rickets' vitamin and plays an essential role in calcium and phosphorus metabolism. Most animals do not have a nutritional requirement except housed animals when insufficient sunlight is available. Vitamin E works closely with selenium throughout the body as a biological antioxidant and plays an essential role in disease resistance and reproduction.

Fun Fact

Both male and female goats can have beards.



Housed goats may benefit from additional vitamin supplementation because of their diet and reduced exposure to sunshine.

Applying Nutrition Science to Practice

Does your goats' current diet meet their needs? If you are starting out from scratch what can you do to put the odds of a successful outcome in your favour?

Forages are relatively bulky feeds, so the first priority for higher levels of milk production or growth is to ensure stock are full i.e. can eat as much as they can. The second priority is to ensure the quality of the forage is appropriate to the needs of the class of animal being fed.

If the quality of the forages is not sufficient animals can be full but not fully fed i.e. they are eating as much as they can, but nutrient intake is still not sufficient to meet their potential growth rate or milk production. Higher quality forages are important for higher levels of production and are fundamental to successful pasture-based livestock farming.

Digestibility is a key indicator of the quality of a forage because it is correlated to both ME and intake potential. As digestibility rises each mouthful consumed delivers more energy to the animal and because it ferments faster they can eat more of it. Conversely, as digestibility drops each mouthful consumed delivers less energy to the animal and because it takes longer to ferment they eat less of it per day. High quality forages require less supplementation than poor quality forages but even high-quality forage will not meet the needs of the highest performing milking doe alone. Lower quality forages may be appropriate for animals at maintenance such as pets, wethers or 'dry' goats that are not growing or gaining weight

and indeed may be desirable to ensure animals are content but not gaining weight and in danger of becoming obese. Pasture quality drops as the plants get bigger and especially when seed heads are produced as the stems are strong and harder to digest than young leaves. Conservation (preserving forages as hay or silage) inevitably lowers the feed value of the crop being preserved and the aim of good preservation is to minimise the losses. To minimise conservation costs per kg the temptation is often to give the crop longer to bulk-up but high yield often comes at the cost of reduced feed value.



The milking goat gets the majority of her energy and protein from the end products of microbial fermentation or digestion of the dead microbes themselves (rumen bacteria are over 60% protein). Like any eco-system, the rumen microflora thrive best on a balanced diet. Feeding supplements only once or twice per day is not ideal but by including ingredients with a range of fermentation rates the delivery of nutrients can be spread over a longer period. A source of fermentable energy and protein, NRM Dairy Goat Pellets have been formulated to help maximise microbial protein production and then

help meet additional nutrient requirements over and above those met by the rumen microbes. Microbial protein production is maximised when energy and protein are available to the rumen microbes in a synchronised manner – NRM Dairy Goat Pellets contain a range of non-GM energy and protein sources which degrade at different rates after consumption and so are more likely to balance the forages eaten between milkings.

Attention to detail is a common theme amongst successful livestock farmers. Many profitable farmers pay fastidious attention to providing clean drinking water to their stock. Goats are prone to fouling their drinking water so equipment or practices that ensures access to clean water is important.

Grains are a good complement to forages because they are high in energy and low in fibre. After appropriate processing they are readily fermentable so can be used to increase energy intake in a relatively small volume which takes up less space in the rumen. By-products—often called straights—have a range of energy and protein levels so are useful for balancing a diet.



The softness of hay reflects its digestibility.

Top Tip

*If you can measure it you can manage it
— laboratory testing of feed is
worthwhile if trying to understand
production or health issues.*

It pays to have a close look at what your goats are eating.



Body Condition Scoring

The key goal of nutrition is to keep stock fit but not thin or fat so they can enjoy a long and productive life.

Body types differ between meat and dairy breeds and weigh scales can be difficult to justify for small herds, so the ability to body condition score is a useful

skill to acquire. Search the internet or ask somebody who is experienced with goats how to body condition score (BCS) so that you can assess the condition of your animals against a recognised standard. Feeding to reach and maintain targets – especially fat cover over the spine – is both practical and achievable.

Body Condition Scoring (BCS) guide for dairy and meat goats

0 Emaciated		No internal or external fat reserves
1 Poor		Loin: No muscle on edges of transverse process, bones very sharp, thin skin. Vertebral angle has little muscle and is very concave. Spinous processes very prominent with no muscle in between. Rump: Sharp outline visible; no muscle between skin and bones. Pins: Very sharp, no padding.
2 Thin		Loin: Muscle extends to the edges of transverse process, spacing can be felt between the vertebral processes, thin skin. Rump: Outline slightly contoured; light padding but bones still somewhat prominent and very easy to feel. Pins: Sharp, little padding
3 Good		Loin: Muscle and subcutaneous fat covers edges of vertebral process; individual bones are somewhat distinct. Rump: Smooth, without signs of fat; pelvic bones and spine are distinct. Pins: Slight pressure needed to feel the pin bones.
4 Fat		Loin: Vertebral processes indistinct and firm pressure needed to feel them. Vertebral angle rounded but not yet bulging over spinous processes. Spinous process spacing difficult to detect; spine felt as a hard line. Rump: Heavily padded with fat; bones can only be felt with firm pressure. Pins: Heavily padded with fat, and firm pressure needed to feel them.
5 Obese		Loin: Edge of vertebral processes and spacing between too fat to feel bones. Vertebral angle bulges over the level of the spinous processes. Rump: Spine lies in the centre of a groove of fat. Pins: Buried in fat, bones very indistinct and hard to locate.

Feeding Lactating Goats

Surveys of commercial goat farmers in the North Island suggest lactation length from around 200 days in outdoor herds to closer to 320 days in indoor herds. Milk production of goats located in Waikato for the 2015 season (Scholtens, M., Lopez-Lozano, R., Smith, R. 2017¹)

revealed peak production in the herds surveyed was from 5th lactation does which averaged 3.7kg milk per day over a 246-day lactation. Interestingly, does in their 10th lactation were still producing well.

Milk production of goats located in Waikato for the 2015 season¹:

Milk Production of Goats in Each Parity For The 2015 Season

Variable	Parity									
	1	2	3	4	5	6	7	8	9	10
Lactation length (days)	192.1	217.0	223.6	216.0	246.2	237.5	230.4	208.0	190.3	232.0
Yields [^] (kg)										
Milk	581.5	801.6	883.6	846.1	917.5	856.7	837.5	664.2	625.8	699.7
Fat	19.5	26.8	28.3	27.6	30.0	27.2	26.4	21.7	19.9	27.4
Protein	18.3	25.4	27.9	26.6	28.6	26.7	25.7	20.3	19.0	24.9
Somatic cell score	8.8	8.9	9.1	9.1	9.4	9.6	9.6	9.9	9.9	9.9

[^]Yields are kg liquid milk, not kg milk solids

Pregnant goats need more energy and protein in late pregnancy. Their energy requirement may be double normal maintenance requirements, compared to three times maintenance requirements at peak milk production. Supplementary feeding may be necessary in late pregnancy if the condition of does is slipping, especially if the feed

value of winter pasture or conserved forages may be insufficient to meet the increasing demand from growing foetuses, especially if animals are grazing outside in cold, wet conditions when there is a wind chill factor. Goats are susceptible to ketosis/pregnancy toxemia if their needs are not met around this time.

However, as with dairy cows, expansion of rumen capacity takes time and dry matter intake is slow to rise after kidding compared to milk production so some weight loss is inevitable. Supplementary feeding can reduce the loss and help support and extend milk production. A long lactation length and shorter gestation fortunately takes the pressure off trying to get does pregnant whilst at peak milk production which challenges many spring calving dairy cows.

Does in early lactation will lose some body condition to provide more milk for their offspring. But at some point, depending on the genetic predisposition of the animal to produce milk, compared to holding condition, peak yield will be determined. This then sets the potential for the whole lactation provided nutrition continues to support that level of production. Meat breeds and crossbreeds are more likely to put a priority on body condition compared to dairy breeds and within dairy breeds some animals will have a greater inclination towards milk production.

Milk production is determined by:

- Size of the doe – bigger goats have the potential to produce more milk
- Genetic potential – dairy goats are by-and-large well-bred having been selected for milk production in excess of what 2 or 3 kids would naturally require for a very, very long time
- Demand – animals milked twice or three times per day will respond with more milk than animals milked once per day
- Ultimately the quality of the diet

A well-balanced diet will support does to produce to their genetic potential. High producing dairy goats in early lactation need more protein in their diet than dry or lower producing goats. Milk production is demanding, so to support higher levels of milk production the quality of the ration (in terms of energy and protein) and the ability to consume more needs to increase (i.e. is it available to be consumed and is the nutrient density sufficient).

Goats can recycle more protein than other ruminant species but high protein intake is still required to support higher liveweight gain or milk production. The examples below taken from the National Research Council recommendations (Nutrient requirement of small ruminants, NRC 2007) are for goats in confinement with no appreciable parasite burden. The recommendations show that the maintenance requirement of a dry doe is quite modest. Requirements in terms of both energy and protein increase through pregnancy, especially for does carrying triplets and more kids.

Fun Fact

Goats deposit less fat externally and more fat internally (around the organs) compared to sheep and cattle

Feeding Lactating Goats Cont.

Energy and protein requirements of a 70kg parlour milked doe

(taken from NRC 2007)

Animal	kg Milk	Body weight gain or loss g/day	Energy concentration in diet MJME/kg	Dry matter intake (DMI) kg (% of body weight)	ME MJ/d	Metabolisable Protein g/day	Crude protein g/day*	Crude protein % of the diet assuming DMI indicated
Mature doe (Dairy) Maintenance only	Zero	Zero	8	1.52 (2.2%)	12.1	68	94	6.2
Mature doe (Dairy) Early gestation, twins	Zero	40	8	1.83 (2.6%)	14.6	110	153	8.3
Mature doe (Dairy) late gestation, twins	Zero	97	10	1.87 (2.7%)	18.7	157	218	11.7
Mature doe (Dairy) late gestation, triplets	Zero	186	10	1.98 (2.8%)	19.8	174	242	12.2
Mature doe (Dairy) early lactation	5.6	-100	10	3.44 (4.9%)	34.4	415	576	16.8
Mature doe (Dairy) early lactation	7	-125	12	3.33 (4.9%)	39.9	487	676	20.3
Mature doe (Dairy) early lactation	8.4	-150	12	3.79 (5.4%)	45.5	573	796	21
Mature doe (Dairy) mid lactation	5	Zero	10	3.83 (5.47%)	38.3	420	583	15.2
Mature doe (Dairy) late lactation	3.6	120	8	4.35 (6.2%)	34.8	381	529	12.2

* MP is 72% of CP in the diet for indication only.

NRC have calculated the metabolisable protein (MP) requirement of different classes of stock. Feeds cannot be given a particular MP value because it depends on the how the total mix of feeds being consumed is fermented in the rumen and how quickly it leaves the rumen. It is not easy to convert MP to CP without knowing the degradability of the protein in the diet (Sahku et al 2004) so the figures in bold have been added as an indication only and assume MP averages 72% of the CP in the diet (ranges from 64-80% according to NRC 2000). They do not include the protein mobilised by weight loss and are included to highlight the increase in protein in the diet required to support higher levels of milk production. Heavily pregnant does also have increased pressure on rumen capacity caused by the growing size of their developing foetuses.

Lactating is a demanding physiological state that requires a good quality diet in order to support optimum production. Peak milk production occurs at around 6-9 weeks after kidding but feed intake does not peak until around 12 weeks after kidding. In dairy goats that are milking well (especially those with high milk production), this can mean that the herd is in a negative energy balance, as they are not physically able to consume enough energy until peak dry matter intake is reached. Negative energy balance means that the doe uses her body reserves to produce milk and this results in a loss of body condition. The lower the Body Condition Score at mating, the harder it will be for the doe to fall pregnant and the higher the chance the doe will not get pregnant. Feeding a high energy compound feed, particularly in early

lactation, can help to support the demands of milk production and minimise condition loss. Feeding a compound feed throughout the lactation can also help to increase peak milk production and lengthen the lactation. NRM Dairy Goat pellets are typically increased gradually to 0.5 to 1kg/head/day depending on the size, milk production and quality of the base diet. For higher levels of milk production high genetic merit dairy goats can be fed at up to 50% of the total dry matter intake – up to 1.5 to 2kg/head/day of NRM Dairy Goat Pellets for high performance animals during peak lactation for smaller and larger breeds respectively.

It is important to keep in mind that feeds designed for other animals may not contain all the nutrients goats need. For example, sheep feed generally contains very low levels of copper, as this trace element is only needed in very small amounts by this species. Goats on the other hand have a much higher requirement for copper, so if lactating goats are fed a sheep or multi-purpose feed, they will not be meeting all their nutritional requirements. Lactating animals require higher levels of macro minerals in the diet compared to dry animals (e.g. calcium and magnesium just to name a few). For this reason it is important that a mineral supplement of some sort is included in the diet as standard. Feeding a mineralised compound feed can be a great way of ensuring essential minerals, trace minerals and vitamins are delivered daily. The mineral content of forages varies greatly and antagonists – other minerals than can reduce the availability of essential minerals – can have a big effect on mineral supply to the animal. Where lower levels of

Feeding Lactating Goats Cont.

supplementary feed are being fed it may be necessary to feed additional mineral, but it is not always the case that more is better.

If wishing to supply specialist goat milk processors in New Zealand with your goat milk, there are sometimes nutritional guidelines that must be met in order to do so. For example, feeds containing genetically modified source ingredients (e.g. soy bean meal) or palm kernel expeller (PKE) meal may be prohibited by some milk processors. It is worth doing research into these guidelines to ensure they are followed.

For people with larger herds bought in conserved forages, straights or blends may be appropriate in addition to or as a complement to compound feeds. Some moist by-products like brewer's grains and kiwi fruit waste may be available in some locations. The cost of freight normally limits their use to close to the point of production. With purchased forages it is important to calculate the cost per kg consumed as wastage and other costs can add considerable to the purchase price. The dry matter and quality of forages, can also make a difference to their relative cost effectiveness, especially if more than just maintenance is sought.

Buying individual grains or straights may be useful if targeted nutrition is required to help balance a particular deficit in the diet. They are more of a DIY option and require more understanding of what they deliver and what is required than compound feeds or blends which carry a degree of nutritional complexity which means they will most likely meet more of the limiting factors more of the time. For larger herds, investment in storage, mixing and feeding systems may be required to make economic use of bulk feeds. Each season presents different challenges so it can be rewarding to adjust the supplementary portion of the ration as required. NRM has a team of Nutrition Specialists and Nutritionists that understand the forages and feed available in each region. NRM can supply straights and blends with options to contract forward to fix pricing and ensure supply which can be especially important when a drought hits and feed stocks in NZ rapidly diminish and take time to restock from overseas.

Top Tip

Read the label of any medicated feeds on-farm as they may require a long milk withholding period if accidentally fed to dairy goats.

Typical nutritional value of grains and common by-products

Feed	Energy (MJ ME/ kg DM)	Protein (% Dry Matter)	NDF (% Dry Matter)	Key Benefits	Key Limitations
Wheat	13.8	12.5	12	• Very high energy with average protein. • High in starch, low in fibre and tends to be low in vitamins. • Is useful for increasing milk protein yield and for growth.	• Best fed in a controlled feeding situations. • Major minerals, trace elements and vitamins may need to be supplemented when feeding wheat to support milk production or growth. • The readily fermentable carbohydrates present can cause acidosis when fed at high levels.
Barley	13.2	11	21	• High energy, low protein, palatable and digestible. • Best fed through an in-shed feed system or mixed in a ration on a feed pad.	• Readily available carbohydrate source Requires rumen adaptation for optimum and safe use. • A good complement to high quality pasture which often supplies more protein than lactating dairy cows require. • Can help to lift the Energy density of a diet containing Conserved forages or medium quality pasture. • High starch and risk of acidosis at high feeding rates and/or when quickly introduction into the diet.
Maize	14	8.5	10	• High energy and starch. • Slowly digestible.	• Compared to wheat and barley, more of the starch in maize is not fermented in the rumen, so maize tends to have more of an effect on cow condition compared to temperate grains. • Some level of acidosis risk but less than barley or wheat. • Low in protein, fibre, and minerals.
PKE	11.8	17	60–70	• Useful to fill a feed pinch when forage supply is limiting. • Non-GM.	• Less nutrient dense than grains and some other by-products. Oil content effects milk composition. Typically 18% of the NDF is in the form of indigestible lignin which may limit DMI. Pasture fed cows are often not protein deficient. High copper level even for some dairy breeds when fed at high levels for a long period.

Feeding Lactating Goats Cont.

Typical nutritional value of grains and common by-products

Feed	Energy (MJ ME/ kg DM)	Protein (% Dry Matter)	NDF (% Dry Matter)	Key Benefits	Key Limitations
Soy Hulls	11	11	65	Safe high fibre feed – but less than 5% of the NDF as lignin so works well in high performance rations. Swells and forms a three dimensional matrix in the rumen which may help rumen microbial function. Low protein level helps lower total CP% in pasture based diets.	Specifications undersell its virtues – should be used by more farmers, more of the time. Importers are struggling to predict demand so it sells out – best to contract forward. Value appreciated around the world so not available at bargain-basement prices like PKE.
DDGS (Maize)	13.5	30	30	High energy and protein can help increase the nutrient density of a total ration. Contains yeast extracts and a fermentation smell which is associated with good palatability. About 55% of protein is rumen by-pass which may support milk production.	Contains about 6% fat which is unsaturated residual cereal oil which limits recommended feeding rates – especially for young ruminants or when other unsaturated oils are present in the diet. Protein may already be over-supplied, excess rumen degradable protein will require energy to neutralize.
Tapioca	12.2	2.5	27	Typically contains about 55% starch and very low protein content.	- Typically available as a large nut which may cause problems with some auger systems. Palatability can vary. - Non-GM.
Soya Bean Meal	13.8	52	10	High content of high quality protein with good amino acid content can help support production across many species and animal types. Good palatability and digestibility, so ideal for calf feed. Huge supplies as long as deep fat frying is popular.	Looks expensive, but is often the best value protein supplier. Most soya is GM and demand for non-GM in New Zealand is not sufficient to justify specialist non-GM importation.
Canola Meal	12.2	36	25	A high protein, good energy feed used to partially replace soya bean meal.	The protein is less digestible than soya bean meal. Bitter taste can be unappealing – especially to younger animals who prefer sweet tasting feeds. GM free New Zealand and Australian canola meal may be available.

Compound feed relies on the feed mill to process and combine straights and minerals in appropriate amounts relative to the intended class of animal being fed and relies on adjustment of feeding rate to accommodate the difference in need between animals. Pelleting offers a number of advantages over blended feeds:

1. The heat and pressure associated with pelleting reduces the bacterial loading so that pellets stay fresher for longer
2. The hammer milling of grains ensures good utilisation compared to intact grains
3. Micro ingredients are evenly distributed through the pellets and cannot separate out during transport and storage
4. Pelleting prevents sorting and selection by the animal when presented with the feed.
5. Less fines are left behind in the trough or paddock when pellets are well formed and durable.



Some of the straights silos at the Rolleston feed mill.



NRM Dairy Goat Pellets

High protein, high energy pellets formulated from non-GMO* ingredients designed for dairy goats.

A high performance high protein mineralised compound feed formulated to meet the Dairy Goat Co-op requirements (January 2019) being formulated free from both GM ingredients and PKE. Designed to support milk production and health of lactating dairy goats. A good option for milking house-cows.

KEY BENEFITS AND FEATURES

NRM Dairy Goat Pellets contain:

- Non-GM legumes (peas or beans) and/or canola meal to provide both rumen degradable and rumen by-pass protein to complement lower protein forages and deliver protein to support milk production.
- Non-GM grains and molasses to deliver a high level of fermentable energy to support body condition and milk production.
- Macro minerals calcium, phosphorus, sodium and magnesium for health and production.
- A combination of organic copper for improved bioavailability and inorganic copper to counter antagonists to support health and performance.
- Added vitamins for health, growth and fertility.
- Durable pellets for feeding in the milking shed or mixing with forage.



PROTEIN



HIGH ENERGY



NON-GMO

FEEDING RECOMMENDATIONS

Introduce gradually over 10-14 days, especially if stock are not accustomed to supplementary feeding as aggressive feeders may eat more than shy feeders initially and rumen microbes take time to adjust to new feeds.

If feeding at the rates indicated below build levels gradually over 10 to 14 days. Optimum feeding rates depend on the quality and quantity of pasture on offer and the level of production of the livestock being fed but typically do not exceed the recommended rates below for more than a week.

Ensure adequate amounts of forage (grazing and/or conserved forages such as silage, baleage or hay) and clean drinking water are available.

Caution: Do not feed to sheep, young calves or kids as NRM Dairy Goat Pellets™ contains a high level of bio-available copper. Not recommended for camelids and equines. Additional minerals may be required in certain circumstances, professional advice should be sought if additional selenium or copper is being delivered simultaneously via other routes.

FEEDING RATES (expected live weight in brackets)

Animal Species & Type	Feeding Rate (kg/head/day)
GOATS	Ideal for growth in young stock and milk production in milking does
MILKING DOE (55KG)	Typically 0.5kg to 0.75 kg per head, per day but could be up to 50% of the total diet dietary dry matter intake (up to 1.5kg for smaller, high yielding breeds at peak yield)
MILKING DOE (70KG)	Typically 0.5-1kg per head, per day but could be up to 50% of the total dietary dry matter intake (up to 2kg per head, per day for large, high yielding breeds at peak yield)
GROWING KID OVER 3 MONTHS (30KG)	0.25kg up to 0.5kg per head, per day
MILKING COW (400-500KG)	Up to 3kg per head, per day

TYPICAL ANALYSIS[^] (APPROXIMATE ON AN A DRY MATTER BASIS)

Metabolisable Energy** MJ ME/kg	13
Crude Protein %	18
Dry Matter %	87

**Metabolisable Energy (ME) values are calculated by a registered laboratory from an equation and are not an actual measured value. Therefore they are only a guide for predicting the energy content of a feed.

[^]Variations in nutritional values may occur due to natural variability in feed ingredients. Our FeedSafe NZ certified sites have well developed systems to minimise any variation from the typical levels shown.

INGREDIENTS SELECTED FROM

Wheat, maize grain, barley, canola meal, legumes (peas or beans), grain by-products, grass fibre, molasses, limestone flour, linseed flakes, dicalcium phosphate, magnesium oxide, salt, NZ vegetable oil, trace mineral and vitamin premix including 0.75mg added selenium/kg and 22.5mg added copper/kg, flavour, mould inhibitor.

NRM Dairy Goat Pellets™ formulations do not contain soya bean meal, soya hulls, corn gluten meal, maize DDGS, tapioca, copra meal, Palm Kernel Expeller, or any Restricted Animal Material.

*Formulated from non-genetically modified crops and by-products. May contain traces of GM material used in the feed mill.

STORAGE

Store in a cool, dry and vermin free environment out of direct sunlight. Do not feed pellets which have become wet and moulded.

Kids

The gestation period in goats is 144–155 days (about 5 months). When a doe is approaching parturition she will have a swollen vulva with discharge, her udder may start bagging up and she will separate herself away from other animals to prepare for the birth. Kidding normally goes smoothly. The rule of thumb is 30:30:30 as in 30 minutes from first sign of placenta to presentation of kid to actual birth of kid. Any longer than that and an inexperienced person should get help. Soon after birth the kids should be standing and suckling from the doe's teat.

It is important that kids receive adequate colostrum soon after birth. Colostrum contains immunoglobulins, which are important for supporting the immune system of young animals while their own immunity develops in the months ahead. The amount of colostrum fed in the first 24 hours should be 10% of the kid's body weight. Kids that are suspected not to have received adequate colostrum should be fed colostrum via bottle or tube. Goat colostrum is best, however purchased cow colostrum can work as well. If the kids are to be taken away from the doe in order to milk the doe, this should be done as soon as possible following birth to minimise distress and the kid should be given its first drink of colostrum as soon as possible.

Raising dairy kids can be done in a similar way to calves in the dairy industry and much of their practices and tips can be translated to rearing kids. How dairy kids are raised can impact on how productive they will be in the years to come, so attention to detail is important. Caprine arthritis encephalitis (CAE), can be transmitted from the doe to the kid

through the colostrum. Transmission can be avoided by feeding kids colostrum from does shown to be CAE-free, using heat-treated colostrum or by feeding another species colostrum. If CAE is of concern to you, have a chat with your vet about the best ways to avoid transfer from doe to kids (more information about CAE on page 42).

Goat milk replacers can be used successfully as a fresh goat milk alternative and it is best to use purpose made bottles or feeders, which are more widely available for goats in recent times. Kids be can reared with milk replacer labelled as suitable for feeding to goats. Goats and lambs are more prone to abomasal bloat than calves so increasingly whey-based milk replacer is favoured for kids as they seem to create less bloating. Calf milk replacer is not typically recommended for kids but some whey milk replacers are suitable for kids. When feeding your kids milk, don't allow them to gorge on the milk. Follow instructions on the bag for feeding levels and don't be tempted to offer more. Kids can be aggressive eating and can over-consume milk which can cause bloating and/or scouring. Also make sure you mix up the milk according to the instructions and feed the milk at body temperature (38–39°C). Milk that is fed too hot can cause issues.

A doe tending to her two kids.





Kids respond well to bottle feeding.

A hard feed should be offered from an early age to kids whilst they are still drinking milk or milk replacer in order to aid in the development of the rumen and help maintain growth after weaning. Kids reared with products designed for lambs may need supplementary copper to ensure health and development proceeds normally. Goats have a similar requirement for copper as cattle so from a copper perspective hard calf feeds such as NRM Moozlee or GrowUp 20% are more appropriate for kids than products designed solely for lambs. They won't eat much for the first few weeks but if some is put out fresh each day, they will start to take an interest and intakes will increase from there. Once the kids are really getting into the Moozlee, they can be gradually moved over to NRM GrowUp 20% Pellets if desired, or they can be kept on the Moozlee for longer if that is preferred. It is best to make the change from Moozlee to pellets gradually by mixing them together before fully transitioning over to the pellets. It's also important to not make the change from Moozlee to pellets at a time when something else is changing for the kids (for example weaning off milk). It's a good idea to leave the hard feed in once the milk feed is taken away for some time, as it helps support kids during the stressful weaning period.

Top tips for hard feeding

- Offer hard feed from the first week of life so kids can get used to the flavour and texture.
- Make sure fresh feed is put out each day and old feed is removed. If left it can go stale and put kids off eating it.
- Make sure feed troughs are kept clean.
- Ensure troughs are at the correct height for kids to reach and eat comfortably from.
- Ensure there is adequate trough space so there is no competition for eating the hard feed.
- Don't use a hard feed that has palm kernel or other cheap by-products in it. This can decrease the palatability of the feed.
- Don't allow lactating goats producing milk for human consumption to eat calf feeds like NRM Moozlee which contain Bovatec® 20CC.

Fun fact

Goats deposit less fat externally and more fat internally (around the organs) compared to sheep and cattle

Coccidiosis

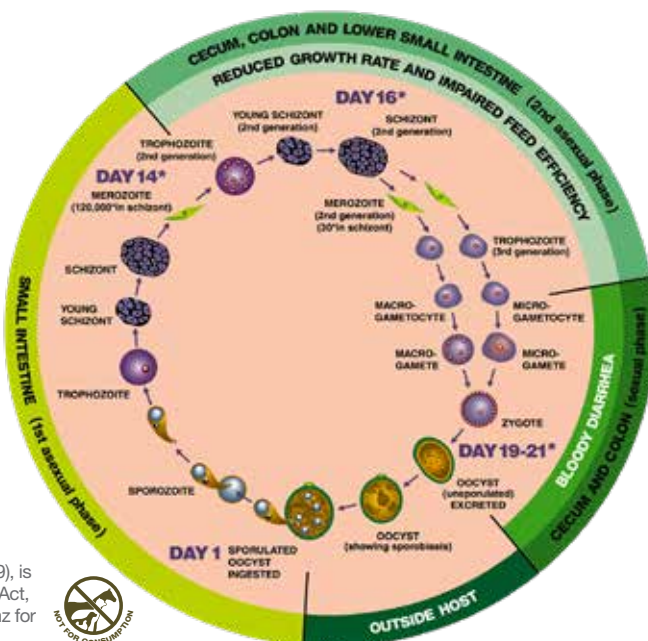
Coccidiosis is a debilitating disease caused by a protozoa parasite and is common in young goats. It is more commonly seen when large numbers of kids are reared in the same facilities year on year. The parasite affects the intestine of animals, laying eggs in the intestinal lining and when the eggs hatch some time later, the intestinal lining is damaged, causing a bloody scour. Immunity increases as the immune system develops; however young goats are susceptible. Coccidiosis can be difficult for animals to recover from after a severe case. If coccidiosis is suspected, contact your vet as soon as possible. Preventative measures can be taken if

the coccidiosis burden on a property is high due to more intense kid rearing over several years as the protozoa can survive between seasons and gradually increase. A calf feed like NRM Moozlee or NRM GrowUp 20% containing a coccidiostat (in this case lasalocid sodium as Bovatec® 20CC - see Appendix 2) may be a good option in this case but it is best to discuss this with your vet. The level of coccidiostat in calf feeds should be effective but not dangerous for kids provided the recommending feeding rate in terms of the coccidiostat per kg of live weight of the consuming animals is not exceeded.

Life Cycle of the Parasite Which Causes Coccidiosis

Feed that contains Bovatec® 20CC¹ cannot be fed to goats producing milk for human consumption. If this occurs then milk should be discarded for 35 days following the last time that goats consumed feed that contains Bovatec® 20CC. Beware – feeds containing a coccidiostat are poisonous if consumed by dogs, horses or alpaca, so it must be kept away from these animals. See Appendix 2.

¹Bovatec® 20CC (ACVM: A009679), is registered pursuant to the ACVM Act, 1997. See www.foodsafety.govt.nz for registration conditions.



Water

Goats must have drinking water available at all times.

This becomes even more important if they are pregnant or lactating, if it's very hot or if they are on dry feed. The water supply should allow for a minimum of 4 litres a goat each day and the supply system should be able to provide up to 15 litres a head daily in temperate climates. During periods of water loss (e.g. scours, hot or humid weather) or water restrictions (e.g. freezing conditions, inadequate supply) a reduction in body fluid quickly impacts negatively on metabolism

and feed intake. Water is important for the regulation of body temperature by heat loss by the lungs and urine.

Young goats and kids will often play on the rims of troughs and they can slip in and drown. It's a good idea to cover deep troughs or to place concrete blocks or bricks in them so that any animal that falls in can escape.

Troughs should be checked sufficiently often to ensure that daily water supplies are not contaminated and they should be cleaned regularly.

Stock water should be clean and easily accessible.



Reproduction

Replacements represent the future of a herd. To maximise the gain from genetic improvement it makes sense to grow animals so they reach their genetic potential. Does reach maturity as early as 3-4 months of age but mating should be held off until 5-6 months, to avoid adversely affecting growth and production.

Goats are classed as seasonal breeders, with oestrus cycles linked to day length. Does tend to come into heat as the day length shortens and autumn approaches. Does must be put to the buck when displaying signs of being on heat and it may only be on heat for 24 hours at a time. If an oestrus cycle is missed, or does not result in a pregnancy, the doe will come back onto heat in 17-20 days (this varies between goats). Signs of heat can be more difficult to detect if only a few goats are kept on the property but there are some tell-tale signs that a doe is on heat:

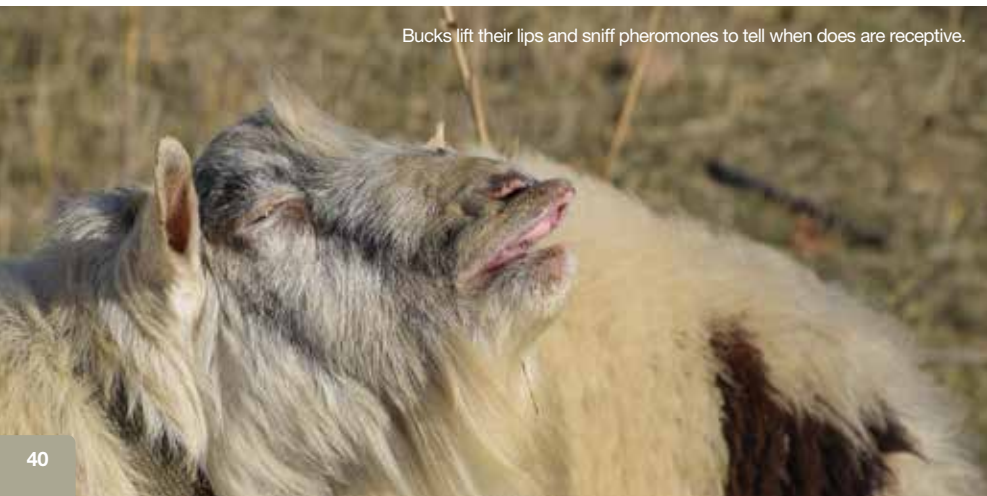
- Swollen vulva sometimes accompanied by a discharge.
- Riding other goats or being ridden by them.

- Increased tail-wagging.
- Bleating.
- Increased urination.

If a buck is present on the property, the signs will be more obvious. Once heat is detected the doe must be put up to the buck. This is more difficult if there is no buck on the property, however there are other options such as bringing the doe to an off-site buck or artificially inseminating the doe. Artificial insemination is growing in popularity and is a good way to avoid travelling to bucks and possible inbreeding issues. Increasingly responsible breeders request evidence that does are disease free before allowing services. If artificial insemination is preferred, it is best to do more research into how it can best work for your system.

Unlike other goats, Boer goats are polyestrous and can breed throughout the year.

Bucks lift their lips and sniff pheromones to tell when does are receptive.



Pet goats

The growing goat dairy industry needs replacement does but is inevitably producing male kids that can be grown for meat or available for forever homes as pets. Pets can be reared in the same way as replacements to ensure a strong, healthy start to life. Once fully-grown, feed requirements for mature, non-lactating animals are quite modest. NRM Multifeed Nuts are a good option for pet goats that need a supplement to maintain or lift condition without the extra minerals required for milking goats. They are a good option as a treat or to help recover or retain body condition – especially during the winter. NRM Alpaca pellets are a good option for pets if looking for a non-GMO option. A mineralised salt block with copper levels designed for cattle will help top-up trace minerals and stimulate water consumption as animals tend to drink after licking a salt block.

Meat Goats

In 2016 the commercial goat kill in NZ was 121,000 – less than 1% of the lamb kill of 19.5 million lambs. Meat goats may complement other livestock, especially on marginal land where they can help weed and pest control. Interest is growing in meat breeds like Boer to supply specialist markets that value goat meat with premiums available for wethers and females and avoidance of bucks because their meat can be tainted in terms of flavour. Goat meat, otherwise known as ‘chevon’, is a staple meat in many cultures around the world including Africa, Asia

and South America. Goat meat is very similar in characteristics and taste to beef and lamb but lower in fat and is often described as delicious, sweet and mild. Farming goats for meat can be viable commercially and goat meat is growing in popularity in the Western world due to its desirable taste. Goat meat is also a useful by-product of keeping goats for fibre or milk. Boers have been specifically bred for meat production but even they crossed with dairy goats to increase milkiness and Cashmere for thicker coat for cold regions. Goats can be slaughtered for the table at 3-6 months of age but can be taken to bigger weights and finished around 12 months of age. Boers under good management can reach carcass weights of 14-18kg at eight months of age. Unneeded bucks can also be slaughtered at a few days old for consumption and are very popular in some cultures. Meat goats are often reared on their mum but can be reared by hand if necessary and respond well to additional protein supplements when growing. If meat goats require extra energy during the finishing phase NRM Multifeed are a good option. Feeding rate will depend on the quality of the base diet, if animals are cold and/or wet and the rate of weight gain required.

Top tip

Read the label of any medicated feeds on-farm as they may require a long milk withholding period if accidentally fed to dairy goats.

Health and Wellbeing

Acidosis

Acidosis or grain poisoning can occur when goats eat large amounts of rapidly fermentable carbohydrate—sugar or starch—which can be found for example in fodder beet and grain respectively, especially if goats are not accustomed to eating them or even if they're suddenly eating them again after a short break. Sugar and processed grain is rapidly fermented in the rumen, if the microflora are not accustomed to the acids produced, the rumen can become too acidic for the fibre digesting microbes required to fully

utilise forages. Dry matter intake can be affected, in acute cases the gut wall fails to contract properly and gases can build up causing bloat. As the rumen swells it can constrict the heart and death may occur rapidly. Animals suffering from sub-acute rumen acidosis may have suppressed dry matter intake and performance. Grain is a valuable and useful way to deliver energy to ruminants but feeding instructions for products should be followed to reduce risk. High sugar feeds like apples, molasses and fodder beet also need to be fed with care.

Biosecurity

Animal Status Declaration

Ministry for Primary Industries
Mātauranga Ahu Matua



Declaration: I am the person in charge of these animals and I declare that I have read and understand the requirements for this ASD and that the information that follows is true and accurate.								TBfree herd no or LIC MINDA code (cattle and deer only)	
Signature (person in charge)				Address animals moved from (Rapid number, road and town/district)				NAIT number	
								Phone	
Name (person in charge)				Owner's postal address (if different from above)				Fax	
Owner/Trade name (if different from person in charge)								Email	
								Date / /	
Stock type	Steer	Heifer	Cow	Bull	Lamb	Sheep	Deer	Other	
Tallies									
Description (e.g. breed, age (e.g. R1, R2, R3), ID, etc)									
Destination (e.g. name and location of processor, saleyard or farm destination)									

Part of an ASD form

Biosecurity

Good biosecurity can help keep your stock free from pests and diseases in addition to helping to boost long term productivity. Animal contact is the main risk to stock so try to minimise the movement of stock in and out of your farm. A closed herd policy may not be possible but understanding the animal health status of the farm from where stock are to be purchased should be helpful. Animal Status Declarations (ASD's) must be completed when animals are moved between properties and apply to:

- Cattle, deer, sheep, pigs, goats, ostriches, emus, horses, alpacas and llamas.

The seller should keep the ASD for one year after sale and the buyer for one year after the animals are kept. Informal trading makes it much harder to manage and control movement of animals if there is a disease outbreak. Dead stock should be disposed of appropriately.

Deter pests, rodents and birdlife by keeping the area around pens free of debris, spilled feed and standing water. Manage pests to control rodent and insect populations, especially in the milking shed, kid raising pens and feed storage area. Quarantining new stock for a least two weeks can help them recover from the transport stress and allow a proper health assessment to be made when they have settled. Diseases can spread through people, vehicles and equipment so minimise traffic and clean and disinfect vehicles or equipment carefully before sharing with other properties. Routinely and thoroughly clean and disinfect

anything that comes into contact with your goats. Restrict movement on and off your block if disease is suspected or identified. Don't become the source of a disease outbreak. Use bowls and troughs to prevent faecal contamination and clean and sanitise regularly.

NRM recommends the use of Virkon® S - a broad spectrum disinfectant that kills all viruses /bacteria/ fungi known to affect animals.

- Cleans and disinfects in one operation.
- Fast acting pathogen kill time
- Safe for humans and to spray in the presence of animals
- MPI approved against M Bovis
- MPI approved for exotic diseases.

Virkon® S

Virkon S has been independently proven against:

- Over 100 strains of viruses in 22 viral families
- Over 400 strains of bacteria
- Over 60 strains of fungi and yeasts

Anyone with farmed livestock or poultry should see themselves as part of the human food chain and having an important role to play in the safety of food and the sustainability of industries that are important for the NZ economy.

Health and Wellbeing Cont.

Bloat

Fortunately bloat is less common in goats than cattle and sheep. Bloat can be life threatening and can be frothy bloat (often linked to the consumption of lush legumes such as clover or Lucerne, especially when wet) or free gas bloat caused by a blockage in the oesophagus which can be caused by apples or carrots.

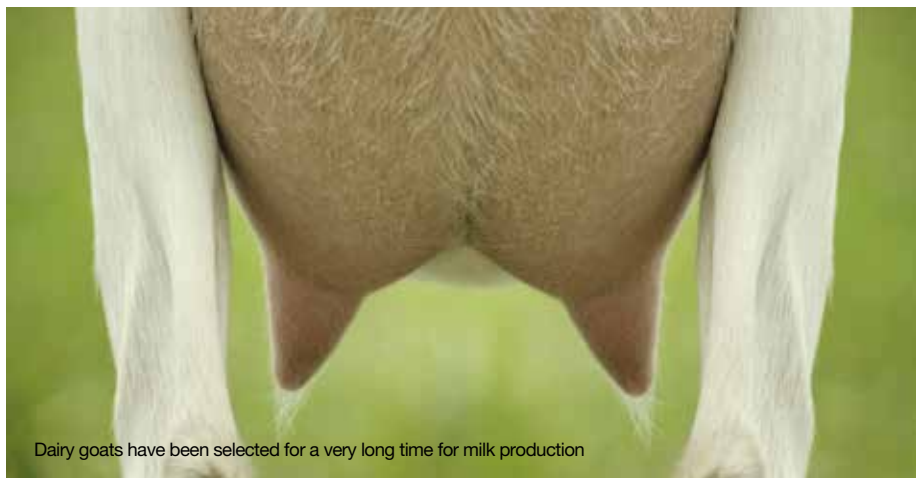
CAE (Caprine arthritis encephalitis)

CAE is a viral disease passed from does to their offspring through colostrum and milk. Symptoms are not apparent for some time following infection and symptoms can be set off when an animal goes through a period of stress. Some animals will never show signs but will continue to pass on the virus to offspring. CAE can take two forms in terms of symptoms. Inflammation of the brain in young kids can cause problems with walking, developing into paralysis of the back legs. In older goats CAE can cause chronic arthritis, with goats developing inflammation of joints, severe problems grazing due to the swelling and therefore condition loss due to decreased feed intake. There is no current cure for CAE. If an animal is suspected to have CAE, it should be tested and if found to be infected, should be culled. Prevention of the disease entering your herd is important, so goats introduced to your herd should be guaranteed CAE free by the seller, or tested for CAE before they join your animals. On the other hand, goats can live comfortably

for years infected with CAE if not put under stress, so CAE infected goats can make good pets. However, they should not be allowed to pass the disease onto other goats. Talk to your vet if you suspect CAE may be apparent in your goats.

Facial eczema

Facial eczema is caused by a toxin produced by the spores of the fungus *Pithomyces chartarum* which grows on pasture when the climate is warm and humid. The fungus grows especially in the base of the sward and in dead litter. If eaten the spores release toxins which can damage the liver and bile ducts. A breakdown product of chlorophyll then builds up in the blood causing sensitivity to sunlight, which causes inflammation of the skin when exposed to UV light. In severe cases the skin can peel off, leaving large burn wounds that can become infected and cause severe pain and discomfort. Reduced milk production and even death can result. Goats are more resistant to facial eczema than cattle and sheep. Goats will seek shade and may develop crusty lesions about their eyes and their ears may become thickened. Fungicide sprays can be useful provided they are applied before the spore count rises. Supplementation with zinc oxide at least 10 days before spore levels rise can help prevent facial eczema. Over-dosing with zinc can be dangerous and should be administered carefully but veterinary advice should be sought before using products registered for cattle and sheep for goats.



Dairy goats have been selected for a very long time for milk production

Grass tetany/ hypomagnesaemia

Hypomagnesaemia is defined as low blood magnesium and is a serious metabolic condition in goats. Magnesium plays a key role in the function of nerve fibres around the body. If blood magnesium levels are low animals become excitable which can develop to convulsions before they pass into a coma and die. Animals in milk, especially older ones, are at most risk because they are losing magnesium in milk every day, but mobile magnesium stores in the body are limited so if intake drops even for a short period blood magnesium levels can fall dangerously low. High levels of potassium or nitrogen and low levels of sodium or fibre in the diet can reduce magnesium supply from the diet.

Mastitis

Mastitis is an inflammation of the udder and can be caused by physical injury, stress, viruses, fungi or bacteria. The early signs of mastitis are a drop in milk yield, modified milk texture, colour and taste and misshapen udders. Mastitis can be either clinical (clots or serum can be seen in the milk) or sub-clinical (detectable by culturing the milk in a laboratory). Goat milk typically contains a much higher total bacterial count than cow's milk. This increases through lactation and with parity and high cell counts may not always indicate mastitis. Clean housing and milking practices are helpful for the prevention of mastitis in goats. Several trace minerals are important for disease resistance and fighting infection—especially zinc and selenium—so the prevention of deficiencies may help.



Love me, love my goat

Health and Wellbeing Cont.

Milk Fever

Milk fever or hypocalcaemia is a serious metabolic condition defined by a low level of calcium in the blood. People most probably associate calcium with strong bones and teeth but it's also essential for muscles to function properly. Moderate milk fever may cause poor appetite and milk production, goats may seem lethargic and a little depressed. If blood calcium levels drop too low animals are unable to stand and can slip into a coma if not treated quickly by administering calcium into the blood system. Clinical symptoms in goats tend to be less severe than those seen in cattle. Milk fever is most common around the time of giving birth when calcium is required for the rapid growth of multiple kids and colostrum and then milk production at a time of falling dry matter intake.

Multiple bearing does are at most risk before kidding whilst higher yielding dairy goats are at most risk post-kidding. Older animals are at increased risk because they produce more milk faster than young animals and because their ability to mobilise calcium from bones takes a little longer to get going. The mineral content of the diet in the weeks before kidding can increase the risk of milk fever. A very high calcium diet, such as one rich in lucerne, may increase the risk but a high potassium diet, such as one based on high quality pasture, may be a bigger risk factor. After kidding a higher calcium diet, especially in the first 3 to 4 days, will help increase calcium uptake until hormones kick-in to increase calcium mobilisation so it can be helpful to be generous with limestone flour to does in the colostrum mob.

Johne's Disease (pronounced 'yo-kness')

Goats seem to be more susceptible to Johne's disease than other livestock. Johne's disease is an incurable disease that infects young animals via interuterine transmission, colostrum/milk, or by mouth (via contaminated feed or water). Animals may not show signs of the disease until 1-2 years old. Symptoms include significant condition loss, scouring and eventually death. If Johne's Disease is suspected, contact your vet as soon as possible.

Mycotoxins

When moulds are stressed, they produce mycotoxins – poisons to kill other moulds. The presence of moulds does not mean mycotoxins will be present and if conditions get so bad the mould disappears the mycotoxins can be left behind. Mycotoxins are not evenly distributed through feeds so should be considered an invisible enemy that is hard to detect. Mycotoxins can have significant effects on animal health, production and fertility ranging from feed refusal, immune suppression, infertility and even death. Many types of feed from pasture through to conserved forages, grains and by-products can be a source of mycotoxins. Mould on feeds and conserved forages should be treated suspiciously and risk is related to the level of contamination, so the effects are reduced if the contaminated feed is diluted. Deciding not to throw away all suspect feed may prove a false economy. If mouldy feed has to be fed, a registered mycotoxin binder may

Health and Wellbeing Cont.

lessen the risk to the animal. Different binders work on different mycotoxins with the more elaborate binders generally having a wider spread of activity.

Poisonous plants

Goats seek a varied diet so it is important to be aware of the plants on your property and recognise what is poisonous to stock. Many garden plants are poisonous to stock. Some common poisonous plants are rhododendron, yew, azaleas, hydrangeas, bay trees and all flowers and bulbs.

Ryegrass staggers

Ryegrass staggers is a nervous disorder caused by a fungal toxin found in perennial ryegrass. It is common in the summer and autumn when conditions are ideal for the growth of the endophyte fungus *Neotyphodium lolii*. This fungus produces toxins which affect the brain and cause nervous signs. The fungus is beneficial to the plant as it provides protection from insects. Modern “endophyte-safe” ryegrass seed contains an endophyte strain which does not cause staggers but still protects the plant.

Clinical signs develop gradually over a few days and are most obvious when animals are disturbed or forced to move. Mild cases show fine tremors of the head and nodding movements while more severe cases have a stiff-legged gait, short prancing steps and ultimately collapse with rigid spasms that can last a few minutes. The disease itself does not cause death but there is a risk of injury or death as a result of accidents.

Affected animals may not do as well due to less time eating and may get dehydrated due to drinking less water. Dairy goats may produce less milk, become distressed when herded and go down in the shed.

If possible, remove animals from affected pasture. If safe pasture is not available, consider locking in yards and feeding a good quality conserved forage with fresh clean water available. Be aware that infected ryegrass will produce toxic hay. If ryegrass staggers is an annual occurrence consider planting safe crops or renewing pasture with an endophyte-safe variety. There are registered toxin binding products on the market in NZ which can help block the toxin before it is absorbed by the animal.



Water work issues can be a problem with older castrated males.

Urinary calculi

Castrated males and to lesser extent intact billies, are vulnerable to urinary calculi or 'water belly'. It is generally recommended that lambs and kids are castrated between 1 and 7 days of age, especially if rubber bands are used. Early castration removes the hormonal influence necessary for the urethra (the pipe from the bladder) reaching full size and increase the risk of problems later in life. The disease occurs when calculi (stones), usually comprising of phosphate salts, lodge in the urinary tract and prevent urination. Phosphorous is normally recycled through saliva and lost in faeces but with a low roughage diet less saliva is produced and more phosphorus is excreted in the urine which increases the risk of stones developing. A lack of

water and water sources that are high in minerals may also add to the risk. Access to salt can help stimulate water intake.

The ratio of Ca:P in the total diet can be important because if the ratio is less than 1:1 calcium absorption will be affected and excess P will cause bone malfunctions. A ratio of 2:1 is often quoted as ideal but for cattle a ratio of 7:1 may be safe and sheep 4:1 provided P level is adequate so it seems likely that more calcium above 2:1 is safer for goats. Cereal grains have a low calcium to phosphorous ratio so compound feeds normally contain added limestone flour to help maintain the proper ratio of calcium to phosphorus. Some people are unnecessarily focused on the Ca:P ratio in supplementary feed which generally only comprises a small part of the daily diet when actually the levels and ratios in the total diet are more important. Legume hays (Lucerne and clover hay) are good sources of calcium and increase salivation and rumination compared to leafy pasture so may be beneficial in terms of reducing the risk of urinary calculi. Feeds specifically designed for milking animals with added phosphorus and magnesium may increase the risk of males developing urinary calculi.



Health and Wellbeing Cont.

Temperature

The normal body temperature for goats is between 38.9 and 39.4 degrees centigrade (101.7 and 104.5 degrees F). Checking the body temperature of kids with diarrhoea is a good way to tell if they have a nutritional scour (body temperature normal) or an infectious scour (typically associated with increased body temperature but may be associated with low body temperature).

Worms

Goats are more susceptible to worms (internal parasites) than sheep and cattle when grazing pasture alone and tend to develop less innate immunity in adulthood. This may be because they naturally eat above the lower layer in pasture where worm larvae mostly live so have not developed the immunity to worms over the millennia. Some goats will accumulate large worm burdens with minimal outward signs until the infection is very severe and then 'crash' and can be difficult to turn around. Many dairy goat operations operate a 'cut and carry' system because of the challenges of managing worms in pasture-based goat grazing systems. Adult goats which are well fed and are not stressed are better able to resist and tolerate parasite challenge. Drench resistance is a particular problem on goat farms, possibly because the standard sheep dose rates appear to be only partially effective in goats and because more goats seem to retain the 'oesophageal groove reflex'. This diverts drench into the abomasum rather than the rumen, where it is required to be effective. Worms

are mentioned here because drench resistance and a lack of new drenches being developed means that better nutrition is likely to be central to reducing drench dependency going forward.

There are some steps you can take to decrease parasite burden in your animals (along with a drenching programme).

- Have a low stocking rate to decrease parasite load in the pasture
- Add more variety into the diet to decrease the amount of pasture consumed (pasture is the main source of parasites). In more extreme situations, limit access to pasture to reduce parasite exposure.
- Practise good pasture management practices such as not grazing too low (parasites reside in higher proportions in the base of the sward).
- Goats share some parasites with sheep, so sheep cannot be used to reduce parasite burden in pasture for goats. Cattle however can be used for controlling parasite burden in pastures by either co-grazing (grazing together at the same time) or if this is not preferred, cattle and goats can be grazing alternately on the same pastures.
- Take a cutting of hay from the pasture every so often – this reduces parasite load in the pasture for the next time it is grazed. Ensure animals are well fed. When feed is restricted, immunity can become compromised and parasite burden can increase. For animals under more pressure, such as pregnant and lactating goats, high quality supplements may help to support immunity.

- Make hygiene a priority and ensure housing, troughs and water sources are kept clean.
- Gut parasite levels can be checked by doing a faecal egg count (FEC) test on faecal samples which can help identify if a worming treatment is indicated.

For more information about drench resistance and worming strategies readers

are advised to read the NZ Beef and Lamb Wormwise for Goats booklet.

Salmonella

Salmonella has to be multiplied through an animal or bird. The rumen provides some protection against salmonella but high intakes can overwhelm the system.

Appendix 1

Understanding the energy in feeds

This section has been included to explain that although ME is the best estimate of the energy in a feed for ruminants it is not the complete picture and the difference is in the detail.

Anybody with a wood burner knows that organic matter contains energy which is given off as heat if burnt. The Gross Energy (GE) of plant material is fairly constant and normally about 19.5MJ/kg DM.

When a feed is consumed some energy is lost in faeces, in many countries dung is collected, sun dried and then used as a fuel so obviously contains energy. Wood contains similar GE as hay but if sawdust was pelleted and fed to ruminants it was pass through undigested because it is so heavily lignified that even rumen microbes can't digest wood.

The difference between the GE of the feed and the energy in the faeces being the digestible energy available to the animal:

Gross energy minus faecal energy
= Digestible energy (DE)

Feed for pigs and horses is normally described in terms of DE.

For ruminants some energy is lost in gases so feed is normally considered in terms of metabolisable energy (ME) rather than DE:

Digestible energy minus the energy in gas (methane = about 6-15% of energy consumed) and urine = ME (MJ ME/kg DM).

All warm-blooded mammals create some heat but the microbes living in the rumen generate more heat - which is good in the winter but bad in the summer because dry matter intake is suppressed during hot days. The amount of energy actually available to a

Appendix 1 Cont.

ruminant is the Net Energy (NE) which takes into account the heat generated by the animal's normal metabolism and fermentation in the case of ruminants:

ME minus Heat Energy (produced by metabolism and heat of fermentation) = NE actually used for maintenance, growth, pregnancy or production. Energy is used at different efficiencies for growth, pregnancy and lactation so the NE value of a feed can only be determined in relation to how it is being used by the animal.

Wow! Don't be put off at this stage, it all makes sense at the end!

Unfortunately then, not all ME is created equal. The ME delivered in fibrous forages will create more heat than the same ME delivered in say grains. The take-home message is that in pasture-based systems we want to make good use of high-quality forages but for higher levels of production it may be necessary to top-up diets with more concentrated feeds. Mature animals at maintenance i.e. not growing, not in the later stages of pregnancy, walking long distances and not milking may do fine if allowed to eat as much forage as they need even if the quality is not great. Some supplementary feeding may be necessary during the winter or if older stock need to regain some condition. For animals growing, pulling a goat cart, heavily in kid or milking, the quality of the forage has to be higher quality to sustain body weight, growth rates and/or higher levels of milk production. High quality pasture can support high weight gains and milk production but given the increased worm challenge when grazing pastures it may not be desirable in the

long term to rely exclusively on grazing. Grains and straights (normally by-products from the human food industry) can be used to complement forages, either individually, in blends or compound feeds. Manufactured feeds offer the advantage that ingredients have been balanced to help meet the specification required and may include minerals and trace elements that can be difficult to deliver individually.

Unless somebody is paying you to keep their animals e.g. over the winter, or the price of an animal changes due to seasonal demand, there is generally no profit in simply maintaining an animal i.e. feeding it just enough to maintain its current weight and condition. Low input, low output systems based on high quality pastures and forages can be profitable for breeding and finishing systems and supplementary feed needs may be quite modest and seasonal. High quality dairy animals can often outperform what grazing only will support and the value of their milk can justify supplementary feeding to increase the level of milk production or extend the lactation.

Appendix 2

Bovatec® 20CC

Contains Lasalocid sodium as an aid in the control of coccidiosis caused by *Eimeria* species in goats and cattle.

DIRECTIONS FOR USE

This product must not be used for growth promotion in ruminants intended for human consumption. By law the user must take due care, obtaining expert advice if necessary, to avoid unnecessary pain and distress when using the product other than as directed on the label.

Aid in Coccidiosis Control in Goats and Cattle:

- a. Mix 5mg Bovatec® 20CC (1mg Lasalocid) per kg liveweight per day to a plateau of 225mg Bovatec® 20CC per day (45mg Lasalocid) for goats and 2,000mg Bovatec® 20CC per day (400mg Lasalocid) for cattle into crushed grain, milk replacer, liquid supplement or other suitable food vehicle that will ensure adequate intake.
- b. Up to twice the above dose rate (i.e. 2mg Lasalocid/kg/LW) is indicated where severe coccidia challenge is expected or a wide range of individual liveweights occur within a group. (Do not feed more than 400mg Lasalocid/head/day to lactating dairy cattle).
- c. Reduced daily gain may result at 5 times and mortality from 15 times maximum recommended dose. Ensure you animals are adapted to medicated feed for 2 to 3 weeks prior to weaning, as coccidia challenge is most likely in the 8 weeks after weaning. In any case, initiate treatment at least 2 days prior to expected coccidial challenge.

CONTRAINDICATIONS

- Care must be exercised when feeding concurrently with other antimicrobials.
- Do not feed with other ionophores, e.g. monensin capsules, liquid or premix.
- Do not exceed recommended dose rates.
- Do not feed more than a total of 400mg Lasalocid/head/day to lactating cattle.
- Not to be used for single dose treatment.

CAUTION: Do not allow dogs, horses or other equids access to feeds containing Bovatec® 20CC, as ingestion by these species may be fatal.

WITHHOLDING PERIODS

It is an offence for users of this product to cause residues exceeding the relevant MRL in the Food Notice: Maximum Residue Levels for Agricultural Compounds.

Appendix 2 Cont.

Goats: **Meat:** Nil
Milk: **Milk intended for human consumption must be discarded during the treatment and for not less than 35 days following the last treatment.**

Registered pursuant to the ACVM Act 1997, No. A009679.

See www.foodsafety.govt.nz for registration conditions.

Approved pursuant to the HSNO Act 1996, No. HSR002037.

See www.epa.govt.nz for approval conditions.

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All information is provided in good faith and without prejudice

Recycle Me

Our bags are now recyclable and you can drop off your product bags for recycling at over 200 sites across New Zealand.

Being part of Agrecovery's Small Bags Product Stewardship Scheme provides farmers and growers with a sustainable solution for recycling plastic bags commonly used for products like seed, feed and fertiliser (25kg and under in size).

By providing sustainable solutions for used soft plastics – LDPE (#4) and woven PP (#5) – we can help towards a more circular economy and more sustainable ways of operating.

Across the sheep range our new NRM packaging has 25% less plastic per bag than our previous range, but are still strong enough to be transported and used on farms.

By returning them to a recycling site you can help reduce your bags going into landfill across Aotearoa.

RECYCLE ME



This bag is made from Woven PP#5.

Recycle at an AgRecovery Site.

Scan the QR code for acceptance criteria.



AGRECOVERY



Nobody is closer to your animals than you – and nobody understands their unique nutritional needs more than our qualified NRM nutritionists. It's their expertise that make our range of feeds some of the most scientifically advanced in the market. Plus having nationwide access to their in-depth knowledge will support your understanding of animal nutrition to improve the productivity and profitability of your farming operation.



MARKETED AND DISTRIBUTED BY NRM
We guarantee the quality of our products.
For more product information and animal
care advice please check out www.nrm.co.nz

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RECYCLE ME



AGRECOVERY