

Production from a breeding doe

Being aware of the critical stages in a doe's production cycle and being able to measure and then optimise the productivity of a breeding herd is critical to the success of commercial goat breeding enterprises. This factsheet will help goat breeders understand what to measure and when as well as the management strategies available to optimise reproductive performance.

Monitoring performance

The reproductive performance of a herd is critical to productivity and profitability. As such, it is important to measure performance at key times in the production cycle. This can be done by assessing several basic measurables which will help determine whether an enterprise is performing reasonably well or whether management actions are required to improve performance.

The number of kids sold per 100 does joined ('turn-off percentage') is a key profit driver in a goat production system. Other terminology may be used to measure enterprise performance, such as pregnancy scanning percentage, kidding percentage, marking percentage and weaning percentage, and while these are important intermediate measurables and may indicate where management can be improved, they relate to stages along the production continuum rather than the ultimate driver of profitability which is the number of saleable kids or number of kids sold.

Turn-off percentage is a key profit driver in a goat production system



Key points

- Many interrelated factors influence reproductive performance.
- The number of kids that are produced to saleable weight, or turn-off percentage, is a key profit driver in goat breeding enterprises.
- Measuring performance at each stage in the reproductive cycle allows management practices to be maintained or adopted to optimise turn-off percentage.

An example of how an intermediate measurable may be used would be where there is a significant drop in marking percentage compared with kidding percentage indicating that kids are lost between kidding and marking. This may be due to a number of factors including predation or perhaps because the doe's body condition was inadequate during pregnancy or lactation to allow her to raise the number of kids delivered. The likely cause can be further defined by maintaining records of other important elements impacting doe performance throughout the reproductive cycle.

Considering this example further and focussing on marking percentage, we can see that marking percentage only tells part of the story as this is influenced by:

- number of does which are pregnant (conception rate)
- percentage of does with multiple pregnancies
- whether the multiple pregnancies are twins or triplets
- number of does which carry their pregnancy full-term
- number of kids born alive
- number of kids surviving to weaning.

Understanding how an enterprise is performing at each of these stages is important to optimising turn-off percentage and ultimately, profitability.

The important stages within the reproductive cycle and the measurable elements thereof are discussed further.

Managing goats to maximise reproductive performance

Stage 1: Pre-joining management of breeding does, breeding bucks and maiden does

Pre-joining management influences fertility and fecundity. In this instance, fertility refers to the ability of the male and female goat to reproduce. Fecundity is similar but refers to the reproductive potential of the individual, particularly their ability to reproduce in great numbers.

Key factors

- **Seasonality**

Does are known to be seasonal breeders with a peak in oestrus occurring in autumn, triggered by shortening day length (photoperiod effect) and a natural reduction in oestrus in spring. This results in a peak in doe nutritional requirements due to kidding and lactation in spring, 150 days later, when there is typically an abundance of feed. The concentration in kidding also serves to reduce the potential impact of predators.

Despite being seasonal breeders, does will cycle out of season in response to external factors such as nutrition and the presence of sexually active bucks and it is common for does to have three kiddings over two years in a continuous joining herd.

- **Body weight and condition score at joining**

Body weight and condition score are important in maximising the reproductive potential of breeding does although it must be remembered that these are just two factors among many that influence reproduction. They are, however, significant and while their degree of influence will vary depending upon other environmental and physiological factors, a few general rules should be considered and managed when seeking to maximise a doe's reproductive potential.

Does become more fecund as they grow toward and realise their breed-dependent mature live weight. This is particularly so when they are on a rising, rather than static, plain of nutrition; that is, the feed they have access to is improving in quality rather than remaining constant.

Does also tend to be more fecund when they are gaining rather than losing weight and typically have a greater number of offspring than most sheep and cattle breeds. Rangeland goats on average kid three times in two years with an average of 1.59 embryos per pregnancy. Does will often produce single kids from their first pregnancy with this increasing to twins and triplets in subsequent pregnancies as they mature.

Goats of higher condition score weigh more than goats of the same age and physiology but of a lower condition score. As such, heavier does within an age group tend to be those in better condition.

Maintaining goats around condition score 3 throughout pregnancy and lactation will deliver significant benefits through increased fertility after pregnancy.

Goats maintaining or improving from about condition score 3 following pregnancy will generally begin cycling before goats in poorer condition or goats losing weight – such goats can demonstrate postpartum anoestrus which describes a delay in cycling after pregnancy.

- **Managing maiden does - age of joining**

How maiden does are managed is generally a function of the production system. For example, in low-input extensive rangeland systems where continuous mating is the norm, there is often little or no management of maiden does with respect to mating with reproduction largely being determined by seasonal influences. In an intensive operation where one or two matings occur each year, the producer has far more control over when maiden does are mated. In this situation, does are often mated at six or 12 month intervals. If mated at six month intervals for a spring and autumn kidding, the maiden does may be seven, 13 or 19 months old.

If only one mating is planned each year, presumably in autumn when fertility peaks, maiden does may be mated at seven months of age or held over to the next year to be mated at 19 months of age. This decision should be made in consideration of live weight and the long-term fertility of the herd.

Does will generally reach puberty when they reach about 40% of their mature live weight (roughly at 5-9 months of age and as early as three months). This means it may be possible to mate them at seven months, however the implications of early mating should be carefully considered.

Mating does at a young age and light weight while they are actively growing can have long-term implications for their reproductive performance through limiting growth and mature body weight and reducing fecundity. This may also impact kid survival in the first year. The preferred practice is to allow maiden does to grow out for another 6-12 months in controlled mating enterprises.

Does will generally reach puberty when they reach about 40% of their mature live weight



One approach is to establish a joining weight; that is an average weight at which does will be joined. As mature live weight varies across and between breeds, it is important that the average mature live weight of a particular herd be understood when estimating when puberty will occur (e.g. 40% of mature live weight) and establishing a target joining weight. In growing toward a target joining weight, Boer goats are capable of growth rates around 200 grams per day whereas rangeland goats may grow at 100-200 grams per day.

In some situations where high growth rates are achieved prior to puberty and a high plane of nutrition can be sustained through pregnancy and lactation to the second mating the following year, early mating may be undertaken without affecting the long-term reproductive potential of the herd. The key consideration under such circumstances is to ensure adequate nutrition is maintained throughout pregnancy and lactation and through to the doe's second mating to meet the doe's requirements for growth as well as pregnancy and lactation.

- **Managing bucks for joining**

Bucks destined for breeding should have previously been selected based on their structural conformation and genetic potential. In extensive rangeland enterprises characterised by continuous joining, bucks should be inspected whenever there is cause to yard the goats. Any bucks showing signs of injury should be treated and possibly consigned to sale with other sale goats.

Bucks should be selected based on their structural conformation and genetic potential



In operations with a set joining period, a more deliberate and timely management plan is required.

First and foremost, only appropriate bucks should be used for breeding purposes. Bucks with conformational flaws or congenital defects should be avoided. This selection process is distinct from the pre-mating inspection.

The focus of the pre-mating conformation inspection should be on disease, injury or degenerative disorders which would not be selected against through the buck classing process. Common defects include foot abscess, damaged tendons or broken legs and laminitis. Older bucks with broken mouths should also be avoided as these are unlikely to cope with the demands of mating.

Inspection of bucks should consider health, conformation and indicators of fertility



Bucks with signs of infirmity should be treated and, if required, removed from the breeding group of bucks. Substitute bucks may be required to be brought in to maintain a buck to doe ratio of 5% bucks to does in extensive operations and 1.5-2% in intensive operations. Higher mating percentages are advisable when using young or inexperienced bucks.

It is not advisable to introduce a new buck to an unfamiliar herd of bucks or a new environment or ration immediately prior to breeding as this can result in stress which can impact the production of sperm (spermatogenesis) and therefore affect their reproductive performance. Spermatogenesis takes about seven weeks in goats and the initial inspection of bucks should take place at least seven weeks prior to mating so replacement goats can be brought in and acclimatise if required.

Along with general health and conformation, bucks should also be inspected for indicators of fertility. One indicator of fertility is scrotal circumference which should be greater than 25cm at 14 months of age.

The testes and epididymus should be palpated to detect signs of hardness which can be an indicator of fertility problems. If hardness or abnormalities are detected, further clinical examinations may be required. The penis should also be observed for obvious abnormalities. If there is doubt about the fertility of bucks, a vet fertility test should be considered.

Abnormalities can indicate fertility problems. Testing or culling should be considered.



In general, bucks should be managed carefully in the lead up to mating to minimise stress and optimise condition. They should be given adequate feed and water, maintained in about condition score 3 and provided with ample shade, particularly in hot conditions as heat stress can reduce sperm production and reduce fertility.

Young bucks should receive special consideration at mating. While bucks will reach puberty at about 40% of mature live weight, it is generally advisable to defer mating until they are more mature at around 19 months of age. This allows the bucks to grow to a size where they will be able to more effectively serve does, more able to cope with dominance behaviour of older bucks and allows more time for selection and culling.

Young bucks are often best introduced to cycling does prior to general mating either by being turned out with the does a week or two in advance of the general mating or in a well fenced small yard with does known to be cycling to allow them to familiarise themselves with the mating process. It is generally advisable to mix young and old bucks during mating so the young bucks may learn from experienced bucks and the experienced bucks may cover for the young bucks in the event that they are having difficulty mating the number of does required.

Bucks in addition to the number normally required to mate with a given number of does (5% in extensive operations and 1.5-2% in intensive operations) may be required when young bucks are being used to ensure complete mating. All bucks, especially young bucks, should be observed during mating to ensure they are performing. Injured or disinterested bucks should be treated and if required replaced to prevent a poor conception rate.

Stage 2: Post joining

The gestation period for goats is around 150 days. It is important to minimise stress and optimise nutrition during this period as this can influence the viability and productivity of the neonate.

A useful tool which can assist with the management of joined does is pregnancy scanning.

Pregnancy scanning can help determine the success of the joining process and allows management strategies to be adopted which meet the requirements of the does to help ensure optimal kidding percentages. Does are generally scanned six weeks after the bucks are removed from the herd. Scanning can determine whether the goats are empty (not pregnant), carrying a single kid or carrying multiple kids. A mob may be drafted accordingly so appropriate management strategies relating to aspects such as nutrition and predation can be put in place for each mob.

Pregnancy scanning is a useful management tool



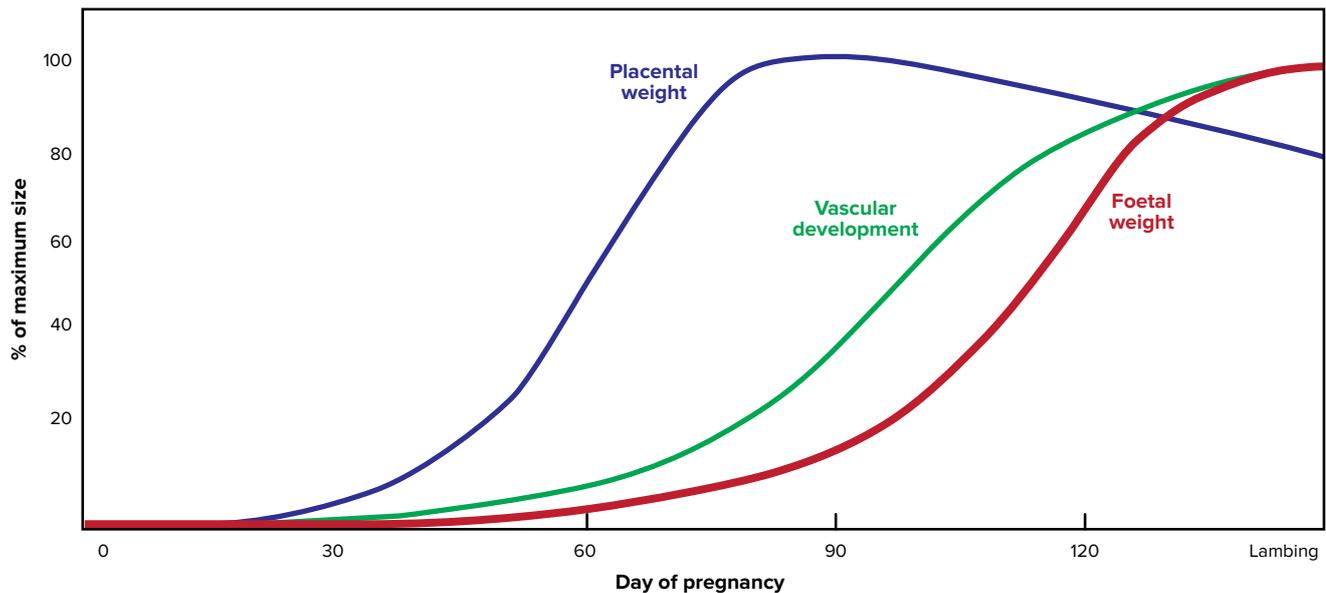
A low scanning percentage may identify issues elsewhere within the business which should be addressed prior to the next joining to improve reproductive performance.

Development and growth of the placenta and the vascular system within the pregnant doe begin approximately 30 days after conception. The placenta and the vascular system support the developing kid or kids in the uterus.

Maximum foetal development occurs in the last trimester of pregnancy amounting to 70% of the kid's birth weight. This last trimester growth rate is largely dependent upon the placental and vascular development in the first third of pregnancy and is particularly important if the doe is carrying multiple off-spring which is often the case. As such, it is important that nutrition be managed carefully throughout the 150-day gestation period as restricting placental development in the first trimester will limit the development of kids in the last trimester and limiting intake in the last trimester may lead to abortion or metabolic disorders such as hypoglycaemia.

This relationship is similar to what occurs in sheep, and is demonstrated in Figure 1.

Figure 1: Foetal weight, placental growth and vascular development patterns in Merino ewes



(Source: http://www.agric.wa.gov.au/PC_91913.htm)

Most reproductive loss occurs in the first 30 days after conception due to abortion or foetal re-absorption. The key to minimising this loss is managing nutrition during the joining period and minimising other potential stressors such as heat. Most controlled mating programs are timed so that mating coincides with peak fertility which occurs in goats in autumn. In some goat production areas, autumn can be characterised by declining feed quality and availability, making nutritional management during joining even more important.

Maintaining doe condition score and live weight during joining is important. Pasture quality of less than eight megajoules per kilogram of dry matter (MJ/kg DM) or insufficient dry matter may result in body weight loss and affect conception rates.

Supplementary feeding and grazing management should aim to deliver a rising plain of nutrition so that goats are gradually gaining weight, for example at 50 grams per head per day, from condition score 3 during mating. Remember that a reduction in feed quality and feed quantity in the first 30 days following conception also impacts on foetal growth and birth weight in the last trimester of pregnancy due to a reduction in placental development. Kid birth weight correlates with kid survival. Low birth weight kids are far more likely to succumb to environmental challenges than average and above average birth weight kids.

Managing nutrition during the joining period and minimising other potential stressors helps minimise early reproductive losses



Stage 3: Pre kidding – foetal development and kid survival

Birth weight drives survival rates at kidding. Kids with birth weights of less than 2.5kg have a... 67%-85% survival rate, while kids with birth weights of greater than 2.5kg have 92%-98% survival rates.

Maintaining doe condition score at 3-3.5 throughout pregnancy and avoiding nutritional stress is the most effective way to ensure optimal birth weights and kid survival. It is advisable to assess the condition score of does at opportune times before and during pregnancy to ensure this is being maintained.

Condition scoring may occur when bucks are put in with the does, again when the bucks are removed and then whenever there is a need to handle the does such as when parasite control is undertaken. It is, however, important to remember that handling is a stressor and should be minimised throughout pregnancy, particularly in late pregnancy. Condition scoring is therefore best conducted when other necessary processes are being undertaken.

Maintaining doe condition score at 3-3.5 throughout pregnancy is one important factor in ensuring optimal birth weights and kid survival



Kids have low body fat reserves at birth compared to lambs and calves which makes them particularly vulnerable to adverse weather conditions. Multiple births increase the risk as twins and triplets typically have lower birth weights than singles and the multiples must compete for their mother's attention and milk.

There are a number of management options available to producers to help lay the foundation for a successful kidding. Autumn joining provides the best opportunity to manage pre kidding nutrition as the majority of does will be kidding in late winter or early spring on higher quality feed supply.

Available feed should be adequate to meet the needs of the does provided an appropriate stocking rate is maintained. The diet should include protein, energy and roughage as well as trace minerals to prevent the occurrence of metabolic disorders. A pasture quality test may be useful in determining the quality of the feed on offer. If supplementary feeding is required, it is important that the quality of the feed being fed is understood and meets the doe's requirements.

Does in late pregnancies require approximately 2.5 percent of their live weight in dry matter feed per day with about 10MJME/kg DM and 13.5 percent protein. Specific supplements such as calcium may be required if inadequate amounts are available in the pasture or supplementary feed, although such deficiencies are rare when goats have access to browse.

Parasite control is also critical during pregnancy and this should be managed to ensure does do not carry a significant internal worm burden into kidding which may compromise her ability to raise the kids.

Pregnancy scanning can allow does carrying multiple kids to be drafted off and managed to meet their higher nutritional requirements in comparison to does carrying single kids. Supplementary feeding should be undertaken in the event that spring pasture production is less than what was expected

or stocking rates are maintained at higher levels than can be supported by the pasture. It is normal for does to lose some weight during lactation; however, they should not be allowed to fall below condition score 2.

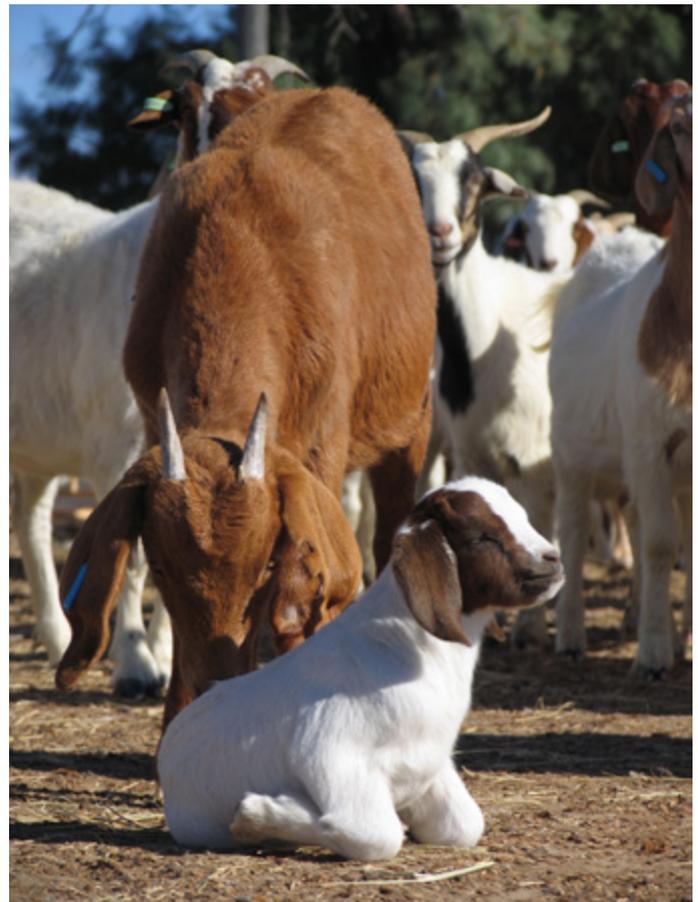
As does tend to 'plant' (hide) their kids and graze away, the identification and spelling of appropriate kidding paddocks with adequate cover is important. This is particularly the case for multiple births as the does' attention must be shared. Does should be moved into these paddocks prior to kidding and maintained at a stocking rate that will minimise the need for kidding goats to be moved. Small kidding paddocks with ample cover can also be useful to minimise mismothering and the opportunity for predation.

In some circumstances, a condition known as 'winter stasis' may impede growth rates during winter. Ensuring adequate nutrition and that does are parasite-free during pregnancy will assist in minimising the impact of winter stasis.

Stage 4: Kidding to weaning

Mortality rates in kids tend to be approximately 10% lower than for lambs under similar circumstances – kids are marginally more resilient than lambs. Critical to minimising kid mortality is ensuring adequate feed, water and cover are provided to the kidding does.

Feed, water and cover is critical for kidding does



Does will plant their kids following birth. This makes kids vulnerable to predation so there should be suitable protection in the paddock for kids to be safely planted. Keeping kidding paddocks small with ample feed and water will minimise the time the doe spends away from the kids, further reducing the risk of predation.

Does will plant their kids and graze



The nutritional requirements of pregnant does increase from about day 30 of gestation to peak at about three times the requirements of a dry doe during lactation. The greatest nutritional demand is experienced by does bearing multiple kids.

Does can be expected to lose condition during lactation although they should not be allowed to fall below condition score 2 as this could have negative impacts on milk production and impact the next reproductive cycle as fertility and fecundity are linked to body condition. If a doe loses too much condition, she may struggle to return to optimal condition prior to joining. Supplementary feeding and early weaning should be considered if feed conditions cause weight loss and condition scores fall below 2.

Early weaning can be useful in reducing the demand on the doe and allowing her to regain condition. This can be done when the kids reach about 10 kilograms live weight or from six weeks of age provided a high energy and protein diet is provided. As a general guide, a minimum of 11 megajoules of metabolic energy and about 180 grams of crude protein (18%) per kilogram of dry matter is required along with minerals, vitamins and fresh water.

Many stages throughout the reproductive cycle influences overall performance



Putting it together

In the final analysis, there are many stages throughout the reproductive cycle that can influence performance. Understanding and measuring these allows producers to manage production and their expectations.

Table 1 considers fecundity and what effect an increased proportion of multiple births can have on productivity assuming all other variables remain the same. Similar analysis can be done to consider the effect of changes in other variables can have, such as pregnancy rate, loss at birth or loss between birth and weaning.

The example in Table 1 allows producers to consider the potential benefit of increasing fecundity and cost strategies to achieve this, such as supplementary feeding to optimise condition score at joining to maximise fecundity or ensuring the correct buck-to-doe ratio is maintained and fertility is optimised. This may also help demonstrate the cost associated with out-of-season joining; fecundity would likely be reduced and fewer kids weaned – is the increased price on offer for out-of-season product sufficient to offset the reduced number of saleable animals?

Table 1: Example analysis

| Breeding herd | A | B | Explanation |
|-------------------------|-----------|-----------|--------------------------------------|
| | 40% twins | 60% twins | |
| Total joined | 500 | 500 | |
| Scan dry | 50 | 50 | |
| Dry percentage | 10% | 10% | Does dry per 100 does joined |
| Pregnancy rate | 450 | 450 | |
| Pregnancy rate | 90% | 90% | Does pregnant per 100 does joined |
| Singles | 270 | 180 | |
| Twins | 360 | 540 | |
| Total kids scanned | 630 | 720 | |
| DAB | 63 | 72 | Loss at birth - average industry 10% |
| Kids born alive | 567 | 648 | |
| Kidding percentage | 126% | 144% | Kids born per 100 does joined |
| Loss - birth to weaning | 57 | 65 | Loss birth to weaning 10% |
| Kids weaned | 510 | 583 | |
| Weaning percentage | 113% | 130% | Kids weaned per 100 does joined |

Acknowledgements

- Parkes J, Henzell R and Pickles G (1996). *Managing Vertebrate Pests: Feral Goats*. Australian Government Publishing Service, Canberra. ISBN 0 644 35846 7
- McGregor B (2007). *Reproduction Management of Fibre and Meat Goats*. ISSN 1329-8062 Agriculture Victoria. Access online: agriculture.vic.gov.au/agriculture/livestock/goats/management/reproduction-management-of-fibre-and-meat-goats
- Kimball, NP and Chuk, M (2011). *Feral Goat Ecology and Management in the Western NSW Rangelands: A review*. Western Catchment Management Authority. ISBN 978-0-7313-3588-6
- Van Saun R (nd). *Feeding the Pregnant Doe: Understanding the Need for Supplements, Minerals and Vitamins*. Penn State University Access online: goatdocs.ansci.cornell.edu/Resources/GoatArticles/GoatFeeding/FeedingPregnantDoes1.pdf
- Food and Agriculture Organization of the United Nations (1995). *ILCA working document - Reproductive losses in small ruminants in Sub-Saharan Africa: A review*. Access online: www.fao.org/Wairdocs/ILRI/x5460E/x5460e00.htm#Contents
- Stewart J, Shipley C. *Merck Veterinary Manual - Breeding Soundness Examination in Goats*. Access online: www.merckvetmanual.com/management-and-nutrition/management-of-reproduction-goats/breeding-soundness-examination-in-goats
- Aldridge MN, Brown DJ and Pitchford WS. *Genetic and phenotypic relationships between kid survival and birth weight in Australian meat goats*. Proc. Assoc. Advmt. Breed. Genet. 21: 350-353. Access online: www.aaabg.org/aaabghome/AAABG21papers/Aldridge21350.pdf
- NSW Government, Department of Primary Industries. *Artificial methods of rearing goats*. Access online: www.dpi.nsw.gov.au/animals-and-livestock/goats/mgt/rearing

More information

- *Going into Goats: Profitable producers' best practice guide:*
 - Module 6 - Husbandry
 - Module 7 - Nutrition
- McGregor B (2007). *Reproduction Management of Fibre and Meat Goats*. ISSN 1329-8062. Agriculture Victoria. Access online: agriculture.vic.gov.au/agriculture/livestock/goats/management/reproduction-management-of-fibre-and-meat-goats



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