

## Section 8

# BREEDING

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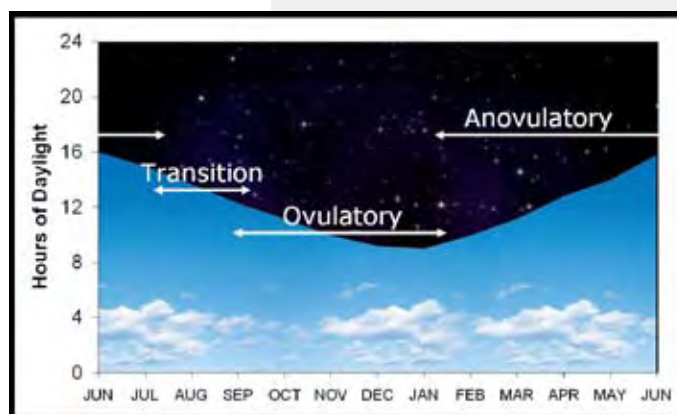
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## What is the natural breeding season for ewes?

- The breeding season for sheep is determined by day-length; specifically, the amount of light exposure.
- Sheep are 'short-day breeders,' which means their estrous cycle is triggered by shortening day-length that starts after the summer solstice so that they are fertile in the fall months. This is in contrast to horses which are 'long-day breeders' (i.e. cycle in the spring) and to cattle which cycle throughout the year.
- The hormonal activity of the sheep is divided into three periods.
  - The ovulatory period, in which the ewe cycles regularly and exhibits estrus (receptive to the ram) and is fertile.
  - The anovulatory period, in which the ewe does not cycle and is not fertile.
  - The transition period, which falls between the anovulatory and the ovulatory period, in which the ewe does not cycle but her hormonal system is being primed by the shortening day-length to start cycling.
- Ovulation refers to the release of an ovum (egg) from the ovary which may then be fertilized by the ram.
- There is tremendous variation in the duration of the ovulatory period between breeds, for example:
  - Short-breeding season breeds, which are naturally fertile from September to January, include:
    - Suffolk
    - Columbia
    - Cheviot
    - Leicester
    - Hampshire
    - Corriedale
    - Katahdin
    - Texel
  - Long-breeding season breeds, which are naturally fertile from July to March, include:
    - Rambouillet
    - Dorset
    - Romanov
    - Canadian Arcott
    - Rideau Arcott
    - Outaouais Arcott
    - Ile de France
  - Breeds originating further from the equator have shorter seasons; those from closer to the equator have longer seasons.



*There is tremendous variation in the duration of the ovulatory period between breeds.*



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## How long is the estrous cycle of a ewe during the ovulatory period?

- Typically, it is 17 days with the period of receptivity to the ram, also called 'estrus,' lasting approximately 30 hours.
- The length of the cycle can range from 14 to 19 days and may be influenced by the ewe's age and stage of the breeding season.
- The estrous cycle is divided into two sections: estrus, which coincides with ovulation; and diestrus, during which the ovary is secreting progesterone from a structure left-over from ovulation, called the corpus luteum (CL). During diestrus, which lasts approximately two weeks, the ewe is not receptive to the ram but the uterus is primed for receiving a fertilized ovum. If the ewe does not become pregnant, the CL regresses and by day 17 of the cycle, she returns to estrus and ovulates again.

## What are the signs of estrus?

- Estrus signs are very subtle.
- A ewe in heat will seek out the ram, allow him to sniff her, often swishing her tail to try to spread her scent.
- Shepherds may also notice slight swelling of the vulva.
- Ewes not in heat will move away from the ram.
- Because it is frequently the case that breeding is not observed by the shepherd, many producers employ a ram breeding harness which, when the ewe is mounted by the ram, will leave a crayon mark on her back.

## Does the cycle of a ewe lamb differ from that of a ewe?

- Ewe lambs have a shorter ovulatory period and begin cycling about three weeks after adult ewes and will cease approximately three weeks before the rest of the flock.
- They display estrus for a shorter time.
- The ovulation rate is highest in ewe lambs at the beginning of the breeding season.
- Ewe lambs are less likely to seek out a ram when in estrus.
- Ewe lambs are fertile by seven months of age and should lamb by one year. Exceptions are ewe lambs born out-of-season, which may not lamb until 15 to 18 months of age, or some slower-maturing breeds (e.g. Merino).



***A ewe in heat will seek out the ram, allow him to sniff her, often swishing her tail to try to spread her scent.***

## When do ewe lambs reach puberty?

- Most reach puberty by five to 10 months of age or 60% of their adult weight.
- Ewe lambs are ready to be bred when they reach 70% of their adult weight.
- Ewe lambs should be fed to reach this target weight by two to three weeks prior to the planned breeding exposure.
- Again, there is tremendous variation between breeds with respect to adult weight and age of puberty. It is important to know what is correct for your breed.
- Ewe lambs of more prolific breeds reach puberty earlier than range-type lambs.
- It is important not to over-feed lambs after puberty or this will decrease fertility and milk production as an adult. Replacement lambs should be separated from market lambs by four months. Ewe lambs should be separated from ram lambs by this age as well to prevent accidental mating.
- Female offspring sired by rams selected for large testicular size reach puberty at an earlier age and are more prolific.



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## When is the optimal time for breeding?

- Ovulation occurs at the very end of estrus.
- The optimal time for a single breeding would be approximately nine to 12 hours after the onset of estrus.
- In most natural breeding situations, rams serve ewes multiple times during estrus ensuring an ample supply of viable sperm for fertilization.



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## What is a silent heat?

- The first estrus of the breeding season is not behavioural (i.e. the ewe is not receptive to the ram). This is normal and she will return to estrus within 10 to 14 days and exhibit a normal estrus at that time.
- There are many reasons that a ewe will not conceive during the normal ovulatory season. It may be that she is truly not cycling (e.g. insufficient nutrition) or that she is cycling but is not being bred by the ram. This may be a ram issue (e.g. infertility, shyness, injury, exhaustion, disease) or a ewe issue. If ewes are not being marked by the ram, then it would be prudent to have a breeding soundness evaluation performed to make sure he is fertile.

## What is the 'ram effect'?

- During the transition period (usually July and August) the ewe is not cycling but the shortening day-length is triggering melatonin secretion from her brain which primes the hormonal pathway.
- During this period, if ewes are introduced to rams that are new to them (i.e. haven't seen, heard or smelled them in at least a month), within a few days this will trigger the 'silent heat,' which is not fertile.
- This heat is followed in about 10 to 14 days with a fertile heat.
- The advantage of the ram effect is that it does not require hormones, it advances the breeding season by a few weeks, and it synchronizes the ewes so that the lambing period is very tight.
- This ram effect is thought to be caused by pheromones (scent hormones) released from the ram and detected by the ewe.
- Vasectomized (teaser) rams can be used to induce the ram effect (one teaser ram to 40 ewes) which are replaced with fertile rams no longer than 14 days later (one fertile ram to 20 ewes).



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## How many lambs will a ewe have?

- Most ewes are capable of giving birth to one to three lambs.
- Profitability of the flock depends on the majority of the ewes giving birth to multiple offspring.
- Shepherds should aim to develop breeding strategies that ensure an optimal ovulation rate, which is directly linked to number of lambs per ewe.
- As age increases, so does the number of weaned lambs.
- Mature ewes are expected to be better mothers.
- Older ewes also tend to ovulate more eggs.
- The highest ovulation rates in mature ewes are achieved during the mid-breeding season while ewes bred out-of-season have the lowest ovulation rates.
- Ovulation rates are highest between three and six years of age and decline thereafter.



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## Does nutrition influence ovulation rates?

- Yes, animals must be well-fed if they are going to reproduce.
- Poorly fed animals will use nutrients for life preservation before life creation.
- Ewes with the greatest nutrient intake tend to have the highest ovulation rates, with the exception that over-conditioned ewes, particularly ewe lambs, have decreased fertility and ovulation rates. For more information about body condition score (BCS), see Appendix 1 of the Code of Practice: <http://nfacc.ca/pdf/english/Sheep1995.pdf>
- Lambs should be weaned prior to breeding to enable sufficient improvement in the nutrient status of the ewe.

## What is 'flushing'?

- Flushing is the term used to describe the management practice of feeding ewes a higher energy level, exceeding their daily requirements for maintenance.
- To be effective, it must begin two to three weeks before the onset of the breeding season and should continue two to three weeks after the rams are removed.
- Most beneficial for thin ewes is the addition of grain concentrate to the ration at a rate of 0.2 to 0.7 kg (0.5 to 1.5 lb) per head.
- There is less response if they are in good body condition (BCS of 3.0 to 3.5). Ewes in good BCS will already ovulate well.



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## What should my ram-to-ewe ratio be during the ovulatory season?

- Typical breeding scenarios involve one mature ram for 30 to 50 ewes.
- It is recommended to have more than one ram with a group of ewes to ensure adequate coverage.
- Competition between rams significantly increases the ram's ability to detect estrus although the producer should watch for fighting.
- Ram lambs can potentially breed as early as five to six months of age but should be limited to 15 to 25 ewes for their first season. Ram lambs should not be used to solely breed ewe lambs as both are not experienced.
- Ram psychology can play an important role in reproductive success; rams may fight and injure each other; they may 'fall in love' with a particular ewe; and they may ignore other ewes. The producer should watch for this and cycle rams so that all ewes are bred.
- If ewes are synchronized, then more ram power is required.

## How long should breeding exposure to the ram be?

- In season, it is expected that 70 to 75% of ewes conceive in the first cycle and close to 100% should be pregnant by the third cycle.
- There is no reason to have the ewes exposed to the ram for more than 42 days as ewes that are still not pregnant should be culled. A 42-day breeding period will mean a lambing period of almost two months.
- Thirty-five days (two cycles) is generally an optimal goal in-season and should result in excellent pregnancy rates.
- The ram should not be housed with the ewes when not breeding.



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## How long are ewes pregnant?

- The average duration of pregnancy in sheep is 147 days; the range is 144 to 151 days.
- Animals with twins or triplets will give birth sooner than those carrying singletons bred on the same day.
- The date the first lambs are expected can be calculated from the date the ram was introduced.
- Birth facilities should be ready at least two weeks before the expected arrival of the first lamb.
- One month prior to lambing, bred females should receive a booster vaccination with a multivalent clostridial vaccine that is protective against *Clostridium perfringens* type C and D, and *Clostridium tetani*. This is to ensure the ewes have adequate protection against clostridial diseases (e.g. pulpy kidney, enterotoxaemia and tetanus) and that they pass this protection to their offspring via the colostrum.



*The average duration of pregnancy in sheep is 147 days; the range is 144 to 151 days.*

## Can sheep be bred outside an established breeding season?

- Yes, one of the easiest ways to have ewes breed outside of the normal breeding season is to use breeds with a longer-breeding season or to cross-breed with these breeds and select replacement females from ewes that breed naturally out-of-season.

## Can the ewe's photoperiod be adjusted to breed out-of-season (i.e. in the spring)?

- Yes, this is done by fooling the ewe into thinking it is after June 21st, the summer solstice (i.e. shortening day-length), when it is actually after Dec 21st, the winter solstice (i.e. lengthening day-length).
- In late December, when it is dark most of the day, the ewes are exposed to light for the next 60 days. They need continual exposure to light for 16 hours per day to 'prime' them for the coming 'autumn.'
- After this priming, ewes are then restricted to only eight hours of light (minimum 500 lux) and 16 hours of darkness (less than 10 lux). This is to mimic shortening day-length and will cause melatonin secretion, which stimulates the hormonal glands to trigger ovulation usually six to eight weeks later.
- Light can be supplied by releasing animals outside into the sunlight during the day and bringing them inside in the late afternoon; however, it may be necessary to restrict light in the barn by covering windows after the end of March by which time the natural day length is 12 hours.
- The difference between the long and short-day light exposure should be at least six to eight hours.

- If successful, ewes will cycle every 17 days as they do in the ovulatory season. Estrus will not be synchronized.
- It is recommended that rams are also included in light treatments as they exhibit greater testicular size, improved libido and better semen quality when exposed to short days.

## Can hormones be used to stimulate ewes to breed out-of-season?

- During the anovulatory and transition season, the ovaries do not produce progesterone.
- There are a few products available that can supply this progesterone, either as a natural or synthetic version of this drug. Use of these drugs will cause the ewes to ovulate.
- At this time, these drugs are not licensed for use in sheep. One drug – Controlled Intravaginal Drug-Releasing Device for sheep and goats (CIDR-S or CIDR-G, Pfizer Animal Health) – is available only through an Emergency Drug Release, which can be obtained from the Veterinary Drug Directorate, Health Canada and must be prescribed by your flock veterinarian.
- Another drug commonly used, but not licensed for sheep, is a synthetic progestagen feed additive called megestrol acetate (MGA). Again, it can only be prescribed by your flock veterinarian.
- Generally, it takes exposure to the exogenous progesterone for 12 to 14 days to mimic the effect of the CL-secreting progesterone. Once the progesterone is removed, the drop will trigger the brain and pituitary gland to release hormones that will cause development of a follicle on the ovary, which contains the ovum, and then ovulation once the ovum is mature. The follicle secretes a hormone called estrogen. It is this hormone that is responsible for the behaviour signs of estrus.
- During the ovulatory season, once progesterone is removed most animals will display estrus and ovulate within 2 to 2.5 days.
- During the anovulatory or transition season, ewes will not come into estrus unless an additional drug is used at the same time as removal of the progesterone. This drug is called equine chorionic gonadotrophin (eCG), also called PMSG (pregnant mare serum gonadotrophin), and it mimics the effect of the hormones that cause the follicle to grow and ovulate.
- Since several animals are often treated at once, the use of these products has the added benefit of synchronizing estrus and thus tightening the lambing season.
- To increase success, ewes should be in good body condition and their offspring should be weaned.

## How should the rams be managed for out-of-season and synchronized breeding?

- Ram management is critical for the success of out-of-season breeding. As rams have decreased fertility out-of-season, the ram:ewe ratio should be no higher than 1:5-7 ewes.



- If synchronized during the ovulatory season, the ram:ewe ratio can be increased to 1:10 ewes.
- Keep the rams physically away from the ewes (i.e. out of sight) until 24 hours after the CIDR-S or MGA has been removed. Failure to do this will result in low fertility and prolificacy (lambs born).
- Some producers find it helpful to move rams from group to group during the 24 to 36 hours that the rams are breeding the ewes – to ensure that all ewes are bred and to avoid issues with ‘ram psychology.’



***Ram management is critical for the success of out-of-season breeding. As rams have decreased fertility out-of-season, the ram:ewe ratio should be no higher than 1:5-7 ewes.***

## Does weather impact breeding?

- Temperature and humidity must be considered when breeding outside the normal breeding season.
- High temperature and humidity during the breeding season can reduce embryo survival and sperm quality, resulting in fewer offspring. It may also cause a decrease in behavioural estrus (i.e. the ewes are cycling but not displaying estrus).

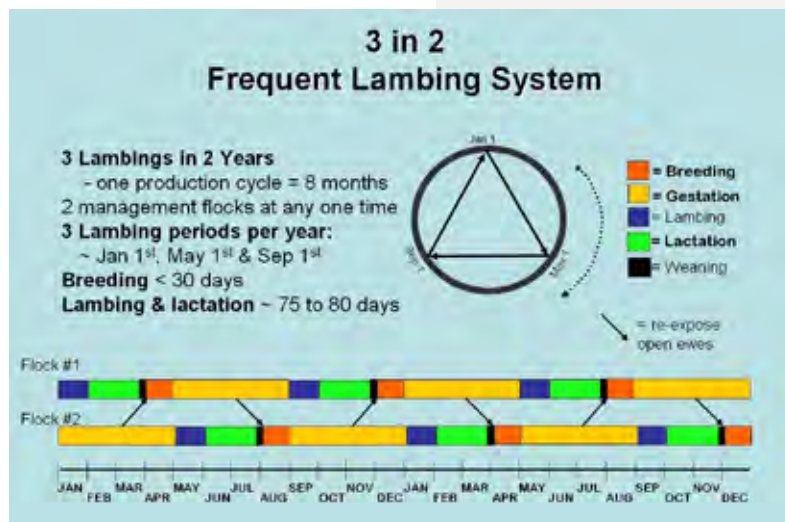
## What is an ‘accelerated lambing system,’ also called a ‘frequent lambing system’?

- If one adds up the days that a ewe is productive in a flock, there is a considerable amount time when she is ‘doing nothing.’ For example, if the breeding exposure is 35 days, pregnancy is 150 days, lactation is 60 days – then the ewe is not pregnant and not nursing a lamb for over 60 days of the year (i.e. she is a ‘freeloader’).
- This means it is possible to accelerate the ewe’s production so that she can produce more than one lamb crop per year – over her lifetime.
- Advantages to this system is that it increases lambs marketed per ewe per year, making each ewe more profitable, and it allows production and marketing of lambs year round – allowing access to the more lucrative out-of-season lamb markets and year-round cash flow.
- There are several systems being used by producers but the most popular and easiest to use is the ‘3 Lambings in 2 Years’ (also called the ‘3 in 2’), in which a ewe is asked to lamb every eight months. Another, more challenging, system is the Cornell Star System, which requires a ewe to lamb five times in three years or every 7.2 months.

## What are the requirements of a ‘3 in 2’ system?

- Two management flocks are maintained on the farm and each is expected to lamb every eight months.
- For example, Flock 1 lambs in January 2009, September 2009 and May 2010, while Flock 2 lambs in May 2009, January 2010 and finally again September 2010.
- The breeding exposure is very short, and thus so is lambing. Lambs are weaned between 50 and 60 days and ewes are bred back about one week after weaning.

- Two of the three annual breeding exposures are out-of-season (e.g. spring for the September breeding and late summer for the January breeding), so the successful use of reproductive technologies is critical.
- While the '3 in 2' system makes much better use of labour, equipment and ram power, it does require a much higher level of management than annual in-season lamb production – for example, winter lambing and highly tuned nutrition so that ewes are weaned in good body condition and are ready for a successful breeding.
- Ewes that fail to conceive can be moved or 'slipped' to the other flock and re-exposed.
- Breeds that are maternal (i.e. are fecund, heavy milkers, excellent mothers and have extended natural breeding seasons) are preferred for frequent lambing systems, although the rams can be carcass types so that the lambs better meet market demands for superior carcasses.
- It is a more expensive management system than in-season annual lambing and is not for every producer, so the pros and cons must be weighed carefully.



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## What is the 'Cornell five-star breeding system'?

- In this system, three of five breedings occur out-of-season and ewes bred out-of-season tend to have fewer lambs born per ewe per lambing.
- This means a long breeding season and maternal breeds will need to be used for the best results.
- Rams are capable of breeding year round, but fertility and libido decline out-of-season so light treatment may need to be considered, especially when terminal breeds are used.
- With ewes lambing during the fall and winter months and lambs being weaned early, their feed requirements will be greater.
- Producers must carefully weigh the additional costs against the expected revenue.



**While the '3 in 2' system makes much better use of labour, equipment and ram power, it does require a much higher level of management than annual in-season lamb production.**

## How can you tell if a ewe is pregnant?

- Pregnancy diagnosis can be an important management tool.
- The maintenance cost of a single open ewe can consume the profits of several other productive ewes.
- Pregnancy diagnosis techniques:
  - Use of a ram with a marking harness:
    - Place a ram with a crayon-marking harness in with the ewes towards the end of the breeding season.

- This is useful for determining the fertility of another possibly questionable ram and for gaining an idea of the pregnancy rates for the season.
- This method is sometimes unreliable because some open ewes may not be detected in estrus and because aggressive rams may mark pregnant ewes.
- B- mode (real-time) ultrasonography:
  - Good facilities and careful handlers are the keys to a successful outcome.
  - Pregnancy diagnosis is a veterinary procedure and can only be performed by a licensed veterinarian or a qualified technician under the direct supervision of a licensed veterinarian. Consult provincial regulations.
  - Ultrasound operator must have easy access to the right side of the abdomen just ahead of the udder.
  - Ultrasound operators should be contacted well in advance of their arrival at the farm to determine what will be needed. Ewes should be clean and dry. Holding off feed from the night before is helpful as it shrinks the rumen allowing better visualization of the uterus.
  - Despite the visualization of positive signs of pregnancy, not all ewes will lamb.
  - Represents the best overall method of pregnancy diagnosis in sheep and goats.
  - Intrarectal scans can be useful for diagnosing pregnancy from approximately day 19 or 20 to approximately 100 days of gestation (best between 35 and 55 days post-breeding) but these can only be performed by a licensed veterinarian.
  - After 100 days, the uterus has often descended too far into the abdomen, beyond the depth of penetration of the sound waves, and a flank scan will be necessary.
  - Flank scans are best performed with a sector scanner.
  - Enables visualization of nearly the entire uterus, providing an accurate assessment of pregnancy status and fetal numbers.
  - Flank scans can be performed from 45 to 50 days of pregnancy onward, with the most accurate fetal counts occurring with scans performed between 45 and 90 days.
  - Loss of a pregnancy or a twin, especially before 40 to 50 days of gestation, can and does occur frequently.
  - Losses occurring around the time of pregnancy diagnosis can be reduced by minimizing stress on the animals.
- Abdominal palpation (ballottement):
  - This procedure requires experience.
  - Fetuses can usually be palpated after about 120 days of gestation.
  - Abdominal palpation is difficult to perform on fat animals or animals with very full abdomens.
  - Ewes are placed in the sitting position and the lower abdomen is palpated for the presence of fetuses.
- Blood tests:
  - All of these tests require a blood sample to be drawn from the jugular vein, and as such, are often not practical or affordable.



***Loss of a pregnancy or a twin, especially before 40 to 50 days of gestation, can and does occur frequently.***

- Measurements of progesterone would be most useful between days 20 to 25 following estrus.
- Specificity of the progesterone test for pregnancy range from 70 to 80% in that absence of progesterone means that the ewe is not pregnant.
- However, elevated progesterone levels may not be associated with pregnancy as there are many reasons why a ewe might still have a functioning corpus luteum (CL) and not be pregnant.
- Estrone sulphate test is most accurate from 70 days of gestation onward. It cannot predict the number of fetuses, but is considered quite accurate with respect to both sensitivity (declaring a pregnant ewe, pregnant) and specificity (declaring an open ewe, not pregnant). Not all laboratories offer this test.
- Pregnancy-specific protein B (PSPB) is produced by the fetus of all ruminant species and is detected 18 to 19 days after breeding. While presence is highly associated with pregnancy, it may also be present in ewes that are open. This test has not proven to be commercially viable and may not be offered routinely.

## References

### ***Sheep and Goat Management in Alberta; Reproduction Chapter***

Alberta Lamb Producers and Alberta Goat Breeders Association, 2009

[http://www.ablamb.ca/producer\\_mgmt/sheep\\_goat\\_mgmt.html](http://www.ablamb.ca/producer_mgmt/sheep_goat_mgmt.html)

### ***Breeding Programs for Sheep Production***

W.E Howell, University of Saskatchewan, 1984

[http://www.agf.gov.bc.ca/sheep/publications/documents/pgm\\_sheep\\_production.pdf](http://www.agf.gov.bc.ca/sheep/publications/documents/pgm_sheep_production.pdf)

### ***Breeding Options for a Commercial Sheep Flock***

Delma Kennedy, Ontario Ministry of Agriculture, Food and Rural Affairs, 2000

<http://www.omafr.gov.on.ca/english/livestock/sheep/facts/00-081.htm>

### ***Glossary of Sheep Breeding Terminology***

Delma Kennedy, Ontario Ministry of Agriculture, Food and Rural Affairs, 2000

<http://www.omafr.gov.on.ca/english/livestock/sheep/facts/00-079.htm>

### ***Explanation of Flock Productivity***

Ontario Sheep Health Program

[http://www.uoguelph.ca/~pmenzies/PDF/Explanation\\_of\\_Flock\\_Productivity\\_OSHP.pdf](http://www.uoguelph.ca/~pmenzies/PDF/Explanation_of_Flock_Productivity_OSHP.pdf)

### ***Introduction to Sheep Production Manual***

Ontario Sheep Marketing Agency

<http://www.ontariosheep.org/Intro%20to%20Sheep%20Production/6.%20Reproduction%20and%20Lambing.pdf>

## Additional resources

### Planning a Breeding Program

Information on maternal traits, terminal sires, crossbreeding, inbreeding, linebreeding, etc.

[http://www.cansheep.ca/User/Docs/PDF/T2-8\\_Breeding\\_Plan.pdf](http://www.cansheep.ca/User/Docs/PDF/T2-8_Breeding_Plan.pdf)

### Selecting Breeding Stock

Information on economic and performance traits, health and confirmation, etc.

[http://www.cansheep.ca/User/Docs/PDF/T2-8\\_Breeding\\_Stock.pdf](http://www.cansheep.ca/User/Docs/PDF/T2-8_Breeding_Stock.pdf)

### Selecting Rams for Breeding

Information on breeding soundness examination, pasture hierarchy, etc.

[http://www.cansheep.ca/User/Docs/PDF/T2-8\\_Rams.pdf](http://www.cansheep.ca/User/Docs/PDF/T2-8_Rams.pdf)

### When to Cull Sheep

Information on culling criteria for ewes and rams.

[http://www.cansheep.ca/User/Docs/PDF/T2-8\\_Culling.pdf](http://www.cansheep.ca/User/Docs/PDF/T2-8_Culling.pdf)

### Health Problems Related to Breeding

Information on abortion, vaginal prolapse, pregnancy toxaemia, hypocalcaemia, ram health issues, etc.

[http://www.cansheep.ca/User/Docs/PDF/T2-8\\_Health\\_Problems.pdf](http://www.cansheep.ca/User/Docs/PDF/T2-8_Health_Problems.pdf)

### Lambing

Information on signs of imminent lambing, preparation, colostrum feeding, birthing problems, producer intervention, foster lambs, etc.

[http://www.cansheep.ca/User/Docs/PDF/T2-8\\_Lambing.pdf](http://www.cansheep.ca/User/Docs/PDF/T2-8_Lambing.pdf)