A GUIDE TO

180

IMPROVED LAMBING PERCENTAGE

160

Edited by K.G.Geenty

meat NEW ZEALAND

WOOLPRO

A guide to **IMPROVED LAMBING PERCENTAGE** for Farmers and Advisors.

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INTRODUCTION

At high levels of animal performance, sheep farming can be very profitable. For example at 150% lambing in a ewe flock, with 80% of hoggets lambing, good lamb growth and wool production, over 10% return on capital can be achieved based on economic farm surplus.

Improved lambing percentage is one of the keys to achieving high sheep farm production and profit comparable with other livestock enterprises including dairying.

In 1996, in recognition of the importance of improving lambing percentage, the Meat and Wool Boards established a programme to provide relevant information to assist sheep farmers towards achieving this goal. Preliminary work in this programme, including a comprehensive review of the world literature, showed many potentially viable lambs conceived at mating time were lost by the time of lamb tailing.

Subsequently a workshop including farmers, scientists, veterinarians and consultants identified areas for more research on lamb survival. They concluded that considerable information was available but not currently being used by sheep farmers. It was decided effective use of this information on the average sized sheep farm with 2,000 ewes could result in 200 additional lambs by tailing time. This goal could realistically be achieved in two or three years or by the year 2000.

Hence the programme theme, ***200 by 2000***.

This booklet contains the information gathered as part of this programme. It is presented in the order of the reproductive cycle in sheep starting with the weaning to mating period and working progressively through to lambing. It is designed as a guide and reference to all aspects of feeding, management and husbandry associated with improving lambing percentage. There is information in the appendices on feed requirements of sheep, condition scoring and diagnosing causes of lamb death.

It is emphasised that this booklet is not intended as a recipe for improved lambing percentage but rather as stimulus to identify areas for improvement and provision of information for appropriate action. The booklet does not provide all the answers or information as research is continuing in some of the key areas, in particular prevention of bearings and regulation of lamb birth weight for better survival.

Dr Ken Geenty
Editor

200 by 2000

CONTENTS

SUMMARY

This summary covers the contents of Chapters 1-5 and the bullet points appear throughout the text as 'signposts' for ease of locating further detail.

Chapter 1:

LAMBING PERCENTAGE POTENTIAL ON FARMS

Improved lambing percentage makes the biggest contribution to higher profits on sheep farms. This chapter covers where potential lambs are lost, scanning and tailing percentage on farms and changes needed to the farm system with improved lambing percentage.

What happens to potential lambs? 18

- In a South Island farm survey the average number of eggs shed per 100 ewes mated was 161, average scanning equivalent was 134% and average tailing 121%.
- Of the total 40 'eggs' lost, 25 were between mating and scanning due to barren ewes and embryonic failures, a further two 'eggs' were accounted for by late pregnancy ewe deaths and 13 'eggs' perished as lambing deaths.
- There was large variation in potential lambing percentage between individual survey farms.

Farm scanning surveys 19

- In four farm production monitoring schemes, tailing percentage increased between farms by 5.6 to 7.8 for each 10% increase in scanning percentage.
- Lamb losses between scanning and tailing averaged 20% for Crossbreds at scanning levels between 120% and 180% while average lamb losses for Merinos were 26% at scanning levels between 90% and 150%.

Farm system changes 22

- At higher lambing percentages planning and management needs to be more finely tuned so feed supply and animal needs are closely matched.
- Changes to the farm system could include less ewes wintered, later lambing, and lambs drafted earlier.
- Key aspects to monitor are pasture cover, ewe weight and condition score, pregnancy scanning, lamb growth rates and animal health.
- There is no set recipe for the best farm system.

Chapter 2:

WEANING TO MATING

The period weaning to mating is important for preparation of ewes and rams for good reproductive performance and high wool production.

Ewe weight and condition for mating 25

- Preparation for a good lambing percentage is largely done between weaning and the next mating.
- Ewes need to be in good body weight and condition (CS3) for high ovulation rates at mating.
- Ewes should not lose weight between weaning and mating as that will reduce food conversion efficiency and penalise wool production.
- Ewes need to eat 1.0 to 1.3 kg of dry matter per day (average quality) to hold condition score 2.5 to 3.5 during summer.
- Progress can be measured by live weight and/or body condition score (CS).

Ram health and preparation 28

- Ram preparation is important for good mating performance and sperm production which begins eight weeks before mating.
- Rams should be veterinary tested and fed to reach good body condition.
- Rams should be checked 8-10 weeks before mating for general soundness, genital problems like epididymitis, scrotal mange or pizzle rot, and feet problems.
- Seek veterinary advice for treatment of genital problems or foot abscess.
- The rams should have been purchased from brucellosis accredited ram breeding flocks.

Sperm production 29

- Good testicle size, or scrotal circumference of 30 cm or greater, is important for high quality sperm and semen production.
- Testes must remain cool for best sperm production and survival and this is important in the last eight weeks before mating as well as the mating period.
- If rams are woolly shearing the crutch and scrotum can help and provision of shade in hot conditions is advisable.
- Semen quality can be tested using electro-ejaculation or an artificial vagina followed by inspection for sperm density and motility.
- Serving capacity or libido of rams can be tested in pens with ewes in oestrus.
- Neither of these above tests are recommended for commercial situations.

Vasectomised rams. 32

- Uses of vasectomised rams include stimulation of hoggets or ewes to cycle earlier, identifying ewes in oestrus for AI and identifying non pregnant ewes after mating.

Chapter 3:

MATING & EARLY PREGNANCY

The mating and early pregnancy period includes the 5-6 weeks the rams are out plus a week or two. During this period potential lambing percentage is determined by ewe and ram fertility, ewe ovulation and conception rates and successful embryo establishment.

Ewe oestrus 35

- Oestrus is the period, averaging 30 hours, when ewes will accept ram service.
- The average interval between oestrus periods is 17 days.
- Shearing may stop ewes cycling and should be avoided from two weeks before until two weeks after mating.
- Ewe hoggets which show oestrus have a higher lifetime reproductive performance than those which don't.

Ewe ovulation rate 37

- A high ovulation rate (O/R) is the first step in achieving a high lambing percentage.
- High ewe live weight and live weight gain during mating causes high O/R - for each extra kg of ewe weight there will be 1.3% higher lambing rate.
- A 10% increase in O/R means 6.9% more lambs born and 5.7% more lambs tailed.
- Increases in lamb drop above 170% are mainly due to more triplets and less singles.
- Underfeeding just before and during mating will reduce O/R.
- Major genes affecting O/R include the Booroola and Inverdale. Ewes with these genes have higher O/R by 1-3 eggs (homozygous Inverdale ewes are infertile).
- There is breed variation in average O/R with Merinos at the lower end of the scale, crossbreds in the middle and Finns highest with potential lamb drops over 200%.
- There is large variation in O/R within breeds.
- Crossbreeding can be used to introduce high fertility genes and will give up to 20% increase in O/R in addition to the breed genetic gain.
- Vaccines (eg Androvax) which immunise ewes against some of their own hormones can increase O/R by up to 58%.
- Ewe breeding season is normally from early to late autumn (February to May) and starts with a 'silent' cycle (ovulation without oestrus).
- Each successive ewe oestrus during the breeding season has about 0.15 more eggs shed.
- Breeds such as Dorsets (polled or horned) and Merinos have a longer breeding season than crossbreds.

Synchronisation 43

- Synchronisation can be used to get ewes ovulating simultaneously by using hormones or rams.
- Rams introduced early in the breeding season, either vasectomised or entire, will stimulate ewes to ovulate within 3-6 days.
- Use of hormones involves CIDR sponges with progestagens inserted into the vagina so ewes will ovulate after withdrawl.
- Synchronisation for out of season breeding usually requires PMSG also to stimulate ovulation.
- The pituitary hormone melatonin can be used as an implant to regulate the breeding season.

Internal parasites and trace elements 45

- Worms are not normally a problem with ewes at mating time but checking faecal egg counts prior to mating, particularly with young ewes, may be warranted.
- Selenium should be routinely administered pre mating in deficient areas.
- Iodine deficiency can suppress lambing percentage so levels should be checked.

Toxins 47

- Facial eczema (FE) caused by a pasture fungus can suppress lambing percentage through increased barrenness and fewer multiples.
- Effects of FE can be minimised by preventive grazing management, zinc dosing or breeding for resistance.
- The toxin zearalenone from a pasture fungus can reduce ewe fertility and fecundity.
- Tests for zearalenone levels are best done using ewe urine samples.
- Phyto-oestrogens produced by plants such as red clover, subterranean clover and lucerne can decrease ovulation rate by up to 30%.
- Pure stands of oestrogenic plants should be avoided around mating time.
- High endophyte ryegrass pastures can suppress lambing percentage so should not be used around mating time.

The ram 50

- Ram harnesses can be used to identify the timing of ewes mated and expected spread of lambing.
- High protein feed supplements can be used for preparation of rams for mating if high quality pasture is limited.
- Ewe:ram ratios of 150+ can be used for well prepared rams with good body condition and testes tone.
- Ewe:ram ratios should be 100 or less for younger ewes and/or rams.

Artificial insemination 52

- Originally artificial insemination was used mainly in ram breeding flocks and more recently in commercial flocks for introduction of new breeds.
- Conception rates of 65-70% are regarded as good and are higher for intra-uterine (laparoscopic) than cervical inseminations.
- Either fresh or frozen semen can be used successfully by a skilled operator.

Conception failure 53

- Failure to mate can include up to 3% of ewes and can be minimised by high ewe live weight and condition, good ram preparation and appropriate ewe:ram ratios.
- Fertilisation failure can be due to poor ram preparation and/or stresses during mating such as excessive yarding, shearing or flystrike.

Embryonic and placental development 54

- Embryonic losses in early pregnancy commonly reach 20-30% of fertilised eggs and most losses are in multiple ovulations.
- Causes of embryonic loss include genetic abnormality, diseases such as Hairy Shaker, mineral deficiencies or hormonal imbalances.
- Little can be done by farmers to significantly reduce embryonic losses.
- Placental development between days 30 and 90 of pregnancy is linked to lamb birth weight.
- Loss of ewe live weight (5 kg or greater) during early-mid pregnancy will reduce placental development and lamb birth weight causing poorer survival of multiples.
- Ewes need 1.0-1.3 kg of pasture dry matter per day in early pregnancy to maintain body weight.

Chapter 4:

MID & LATE PREGNANCY

During the mid and late pregnancy period it is important to hold ewe body condition, minimise ewe health problems and prepare for good lamb survival and ewe lactation.

Pregnancy scanning 58

- Pregnancy scanning information, obtained between days 60 and 90 of pregnancy, allows farmers to identify empty ewes and those with single or multiple pregnancies.
- Scanning results give farmers a measure of their potential lambing percentage and losses between scanning and tailing.
- An important benefit from scanning is separation of ewes with multiples from those with singles for preferential feeding and lambing management.

Ewe feeding and lamb birth weight 60

- Feeding in mid pregnancy to maintain good body weight and condition will promote good placental growth and satisfactory lamb birth weights and survival with multiples.
- In both heavy and light ewes carrying twins a high level of feeding during mid pregnancy increases foetal weight, the effect being greatest in light ewes.
- Severe underfeeding in mid pregnancy can reduce the number of lambs born.
- Some evidence suggests shearing ewes in mid pregnancy (between days 50-100) significantly increases birth weight of multiples.
- During late pregnancy (days 100-150) foetal and udder growth is rapid with increased ewe energy requirements.
- Underfeeding of ewes in late pregnancy will cause loss of ewe body condition and possibly metabolic disorders and if severe will reduce lamb birth weight.
- Increased ewe feed requirements above maintenance during the final 60 days of pregnancy are 0.1-0.5 kg DM per day for singles and 0.2-0.9 kg DM for multiples. Feed must be of high quality i.e. leafy pasture 3-5 cm in length.
- Foetal growth in late pregnancy is largely unaffected by feeding levels.
- Lambs from ewes underfed during mid-late pregnancy will have lower body fat reserves when they are born with less chance of survival.
- Ewes supplemented with protein or concentrates in late pregnancy may produce more colostrum and improve lamb survival.
- Under feeding in mid-late pregnancy restricts udder development and subsequent milk production.
- Ewe lambs born to ewes well fed during pregnancy have better lifetime reproductive performance than those from ewes poorly fed.
- Autumn lambing requires a different feed profile which suits summer dry areas with good winter pasture growth like Northland.
- Shearing of ewes in mid pregnancy is more likely to increase lamb birth weight than pre lamb shearing.

- Pre lamb shearing of ewes can encourage them to seek out shelter with better lamb survival.

Abortion 67

- The most common causes of abortion in sheep are toxoplasmosis and campylobacter (also known as vibrio).
- Lamb losses due to abortion are generally greatest in younger ewes with less immunity.
- Lamb deaths due to toxoplasmosis can be at any stage during pregnancy or soon after lambing.
- A single vaccination for toxoplasmosis gives lifetime immunity and is highly effective.
- Infection and lamb deaths with campylobacter is in the last 6-8 weeks of pregnancy.
- Vaccination for campylobacter is effective with a sensitiser and booster required in the first year and a booster each year thereafter.

Ewe health disorders and deaths 69

- Ewe deaths are costly with 1% of ewes lost in a 2,000 ewe flock equivalent to 40 ewes wintered and 50 lambs tailed.
- Milk fever due to calcium deficiency can occur in late pregnancy, usually in ewes with multiples, due to sudden changes in feeding or disruptions such as shearing, crutching or vaccinating.
- Treatment for milk fever is by injection with calcium borogluconate.
- Pregnancy toxaemia (or "sleepy sickness") can occur in late pregnancy, again usually in ewes carrying multiples, and is due to underfeeding or stress such as prolonged bad weather.
- Treatment for pregnancy toxaemia is oral with a sugary solution or "ketol".
- Vaginal prolapse, or "bearings" can occur in late pregnancy and is most prevalent in ewes with multiples
- Bearings are caused by high intra-abdominal pressure and there is no scientific evidence on ways of avoiding the condition.
- Retention of bearings followed by successful lambing can be achieved with early detection and careful treatment (see recommendations page 72).
- Underfeeding ewes in late pregnancy is *not* recommended for prevention of bearings.

Pre-lamb health checks 73

- Ewe vaccination with "5-in-1" in late pregnancy protects lambs against deaths caused by clostridial diseases and blood poisoning.
- Ewes should have adequate levels of selenium and vitamin E at lambing to avoid lamb deaths due to white muscle disease.
- Iodine deficiency in ewes can hinder lamb development during pregnancy and cause lamb deaths soon after birth due to goitre.

Chapter 5:

LAMBING

Lambing is the time when all the work done up to mating and during pregnancy is realised with a good lambing percentage. The aim is to give all lambs 'on board' the best possible chance of surviving and thriving.

Choosing lambing paddocks 75

- Lamb survival is better on flat or gently sloping paddocks than on steep hills.
- Effective shelter will help lamb survival and should be used preferably for multiples.
- Types of shelter include hills or slopes, trees or shelter belts, bushy plants and lamb covers.

Lamb survival 78

- Average lamb deaths range from 5-26% between farms and are higher for multiples than singles.
- Major causes of lamb death are dystocia in singles and starvation/ exposure in multiples.
- Some 70% of lamb deaths can be prevented by better ewe and lamb nutrition and preventive measures.
- Optimum lamb birth weight for best survival is 3.5-5.5 kg for singles and multiples. Weight below this range increases the risk of starvation/exposure (mainly multiples) and above dystocia (mainly singles).
- Generally Merinos have lower lamb survival than crossbreds as do pure Finns with larger litter size and lower lamb birth weight.
- Lambs born in autumn or winter have lower birth weights than in spring.
- Lamb survival is often higher with crossbreeding due to positive heterosis for lamb birth weight and ewe milk production.
- Lamb survival is generally lower in hoggets or young ewes than older ewes.
- Significant differences in lamb survival have been shown between progeny of different sires.
- Selection for improved lamb survival can include components like ease of lambing, mothering ability, lamb vigour and cold resistance of lambs.

Shepherding & intervention 85

- Separating early and late lambers assists with differential feeding and allows more effective shepherding.
- Shepherding intensity varies and can decrease lamb losses by assisting difficult births, attending to cast ewes, treating bearings and fostering mis-mothered lambs.

- It is important not to disturb ewes from their lambing site so effective bonding can occur.
- Low pasture cover at lambing (less than 1000 kgDM/ha) is likely to cause increased mis-mothering and lamb deaths.
- Lamb swapping and stealing often occurs with ewes crowded around the same site and is not a big problem with commercial farms but causes inaccuracies for pedigree recording in ram breeding flocks.

Main causes of lamb deaths 87

- Dystocia is mainly caused by difficulty of passing large single lambs through the birth canal but can also occur with smaller weak lambs and poor ewe uterine contractions.
- Since dystocia is repeatable assisted ewes and their lambs should be identified for culling.
- Small weak lambs with little or no body fat reserves or subject to severe cold weather, mis- mothering or lack of colostrum or ewe milk may suffer starvation/exposure
- The chilling effects of wind and rain combined are more likely to cause lamb deaths from exposure than low temperature alone.
- Lambs vary in their ability to maintain body temperature in cold conditions but this is very difficult to select for.
- Ewes vary in mothering ability which is repeatable and can be assessed from their reaction to human presence.

Ewe nutrition 92

- Good ewe nutrition in late pregnancy and early lactation improves lamb survival and early growth.
- Pasture cover at lambing should be 1200 kg DM/ha or 2-3 cm long.
- During early lactation pasture cover should be 1400-1600 kg DM/ha or 4-5 cm length.

Ewe milk production 93

- Ewe milk production peaks 2-3 weeks after lambing then gradually declines.
- Ewes with twins produce 30-50% more milk then those with singles.
- There is a large variation in ewe milk production levels within flocks but this is hard to select for as lambs substitute good quality pasture for milk.

DEFINITIONS

Abortion The premature loss of a pregnancy, usually where the dead foetus is expelled, from 60 days of pregnancy on.

Difference Scanning percentage minus tailing percentage (number of lambs lost per 100 ewes scanned).

Egg Is the female reproduction cell produced by the ovary.

Embryo Is the stage of pregnancy between 11 and 34 days after fertilisation. After this time the organs and body systems develop and the body shape forms.

Fecundity/ prolificacy Ability of ewes to produce multiples.

Fertilisation The process by which the sperm unites with the egg to form a fertilised ovum. This occurs in a tube (the oviduct or fallopian tube) that links the uterus with the ovary.

Fertility Proportion of ewes that get in lamb or rams that fertilise eggs.

Foetus Stage of pregnancy from day 34 until full term. Over this time the organs and systems mature.

Lambing percentage $\frac{\text{number of lambs tailed}}{\text{number of ewes mated}} \times 100$

Mummified foetus A foetus that has died but has neither been reabsorbed nor expelled. Fluids are absorbed from the dead foetus leaving the dried up structures inside the uterus. This may be expelled at any time but very often is delivered at term when another surviving foetus may be born normally.

Ovary The sex gland of the female that produces eggs. There are two in each female. The process of releasing the eggs is called ovulation. More than one egg can ovulate from one ovary at the same time. Eggs can ovulate from both ovaries at the same time.

Ovum Refers to the unfertilised or fertilised egg up until 11 days after fertilisation. It is a cell mass that has no organs, major tissues or systems developed.

Percent lambs lost $\frac{\text{difference}}{\text{scanning percentage}} \times 100$

Placenta Is an organ of pregnancy inside the uterus that links the dam with the foetus. It provides nutrients to the foetus and removes wastes.

Reabsorption This refers to the process that occurs when an ovum, embryo or young foetus dies and is absorbed back into the ewe. This usually occurs in the first 60 days of pregnancy.

Scanning percentage Number of lambs counted per 100 ewes scanned.

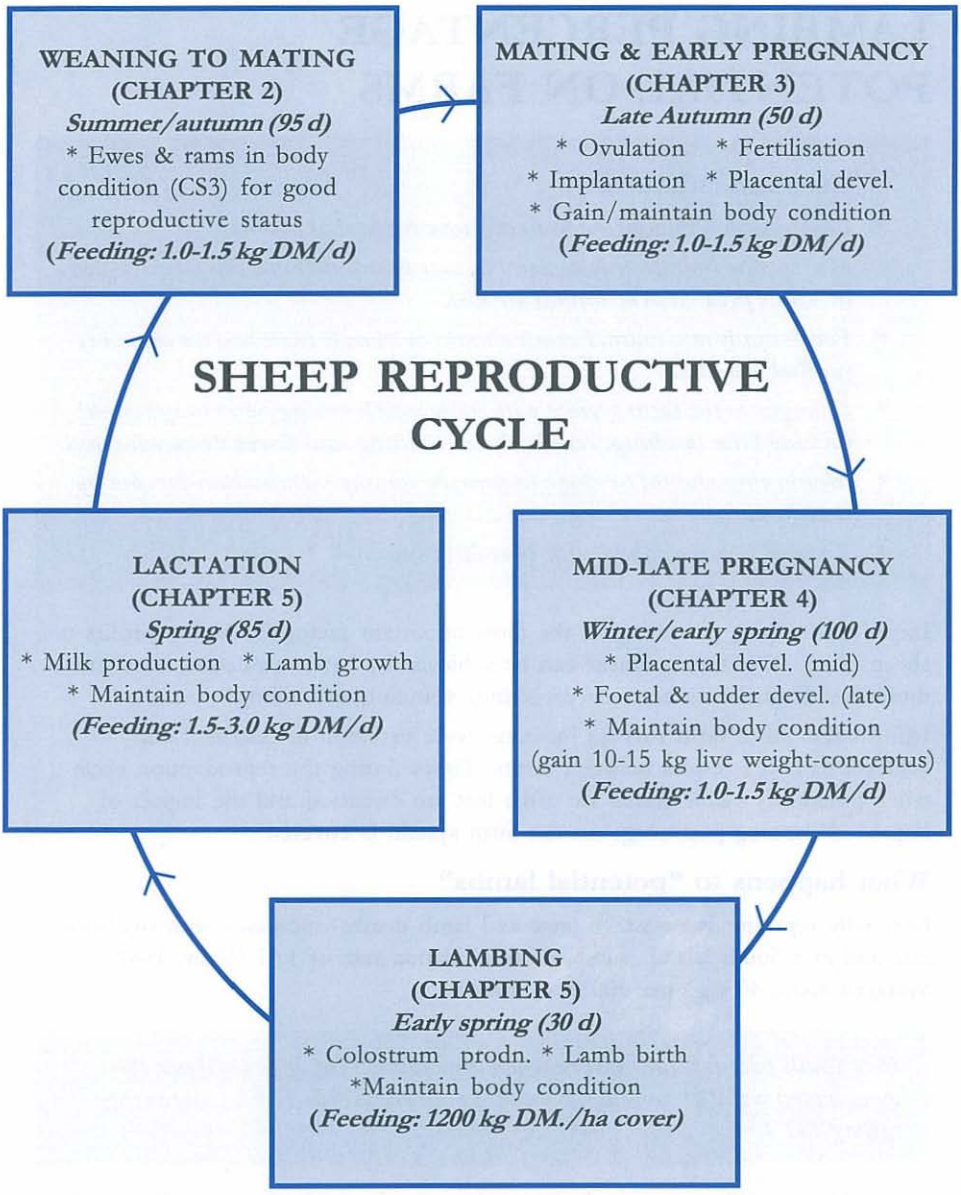
Semen Fluid produced by the male containing sperm and nutrients. It comes from the testes and the accessory sex glands.

Sperm (or spermatozoon)Is the male reproductive cell produced by the testes. It takes over 50 days for a sperm to form and mature inside the testes. The sperm fertilises the egg in the oviduct at the end of the uterus in the ewe.

Tailing percentage Number of lambs tailed per 100 ewes scanned.

Testes The sex gland of the male that produces sperm. There are two testes in each male. Attached to the testes is the epididymis which stores sperm.

Uterus The organ in the female in which the fertilised ovum embeds and in which the embryo and foetus develop.


WEANING TO MATING
(CHAPTER 2)
Summer/autumn (95 d)
* Ewes & rams in body condition (CS3) for good reproductive status
(Feeding: 1.0-1.5 kg DM/d)
MATING & EARLY PREGNANCY
(CHAPTER 3)
Late Autumn (50 d)
* Ovulation * Fertilisation
* Implantation * Placental devel.
* Gain/maintain body condition
(Feeding: 1.0-1.5 kg DM/d)
SHEEP REPRODUCTIVE CYCLE
LACTATION
(CHAPTER 5)
Spring (85 d)
* Milk production * Lamb growth
* Maintain body condition
(Feeding: 1.5-3.0 kg DM/d)
MID-LATE PREGNANCY
(CHAPTER 4)
Winter/early spring (100 d)
* Placental devel. (mid)
* Foetal & udder devel. (late)
* Maintain body condition
(gain 10-15 kg live weight-conceptus)
(Feeding: 1.0-1.5 kg DM/d)
LAMBING
(CHAPTER 5)
Early spring (30 d)
* Colostrum prodn. * Lamb birth
*Maintain body condition
(Feeding: 1200 kg DM./ha cover)

Chapter 1

LAMBING PERCENTAGE POTENTIAL ON FARMS

Recommendations

* *Lambing percentage needs to improve for higher profits.*
* *Most scope for minimising lamb losses is around lambing when 18-25% of lambs present at scanning are lost.*
* *Feed supply and animal needs should be closely matched for the most profitable system.*
* *Changes to the farm system with increased lambing percentage could include later lambing, regular lamb drafting and fewer ewes wintered.*
* *Monitoring should be done to provide quality information for quality decisions.*
* *There is no set recipe for the best farm system.*

Improved lambing percentage is the most important factor for higher profits on sheep farms. This improvement can be achieved by better ovulation rates and minimised lamb losses between pregnancy scanning and tailing.

Information from farm surveys indicates wide variation in potential and achieved lambing results between farms. Times during the reproduction cycle when potentially viable lambs are often lost are discussed and the impact of improved lambing percentage on the farm system is covered.

What happens to "potential lambs"

Generally reproductive wastage (ewe and lamb deaths) increases with ovulation rate and in a South Island survey at an ovulation rate of 1.61 (Kelly, 1982) averaged about 40 eggs per 100 ewes mated.

In a South Island farm survey the average number of eggs shed per 100 ewes mated was 161, average scanning equivalent was 134% and average tailing 121%.

Some 15% of viable eggs were lost as embryos and ewe deaths in the first 30 days of pregnancy. Another 11% died between pregnancy scanning (day 60–90 of pregnancy) and tailing at four to five weeks after lambing.

The diagram below shows where the losses occured with the numbers in brackets indicating the range of results from individual survey farms.

161 *(112–231)* eggs shed per 100 ewes mated

4% *(1–14%)* barren ewes = 6 eggs ↓

155 eggs

Partial failure of multiple ovulations, mostly in first 30 days of pregnancy = 19 eggs *(2–42)* ↓

136 embryos

1% *(0–9%)* ewe deaths (usually in late pregnancy) = 2 eggs ↓

134 foetuses

10% *(2–23%)* lamb deaths = 13 eggs ↓

121 *(82–163)* lambs tailed

Note that while 40 potential lambs were lost for every 100 ewes mated, some farms' performance was outstanding while others had huge losses.

Of the total 40 'eggs' lost 25 were between mating and scanning due to barren ewes and embryonic failures, a further two 'eggs' were accounted for by late pregnancy ewe deaths and 13 'eggs' perished as lambing deaths.

The average difference in the above survey between embryos which would have shown up as scanned (136%) and lambs tailed (121%) indicates a very low lamb loss of 11% during late pregnancy and lambing.

There was large variation in potential lambing percentage between individual survey farms.

Farm Scanning Surveys.

The widespread use of pregnancy scanning by ultrasound in New Zealand sheep flocks has provided a lot of information on lambing potential in flocks and lamb losses between scanning and tailing 4-5 weeks after lambing.

Information from four farm production monitoring schemes in New Zealand is summarised for the 1996 lambing as follows:

Table 1: Farm production monitoring schemes (1996 lambing season)

Scheme	Location	Breed(s)	Number of flocks	Average flock size	Total no. sheep
Landcorp	NI	Romney	35	6,800	240,000
Merino 100%	NZ	Merino	35	4,000	140,000
CF2000	Otago	Crossbred	35	2,500	88,000
LambMAX	Lower NI	Crossbred	21	2,600	55,000

Average scanning and tailing percentage for each flock in the above schemes is presented in Fig. 1.

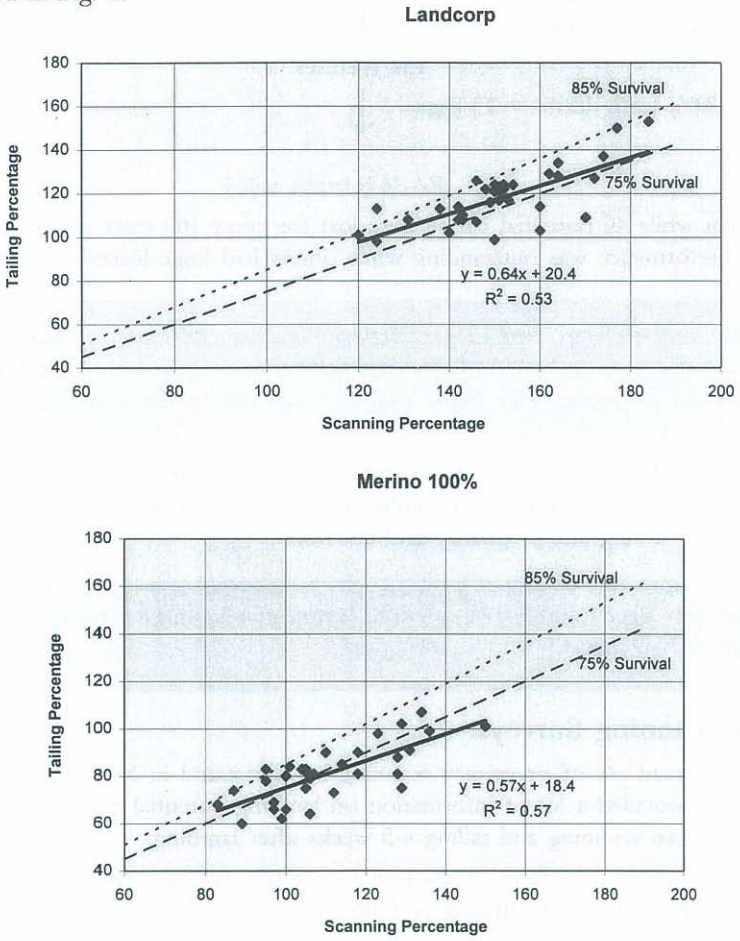
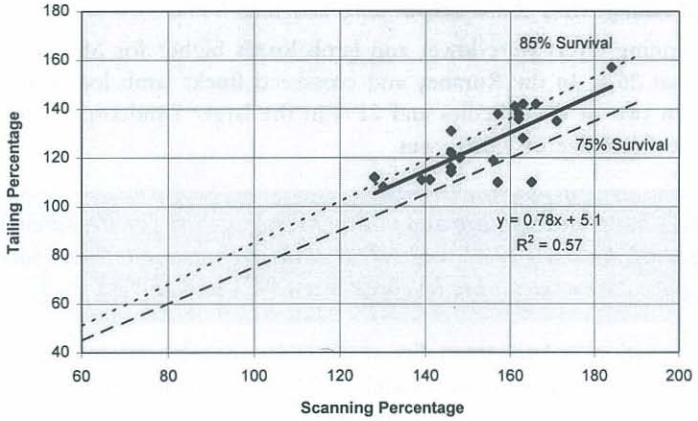


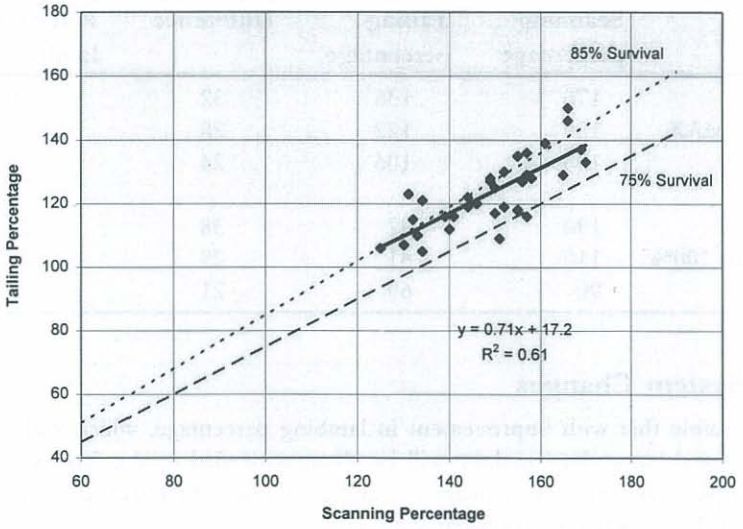
Fig. 1: Relationship between scanning and tailing percentage for individual flocks in four farm monitoring schemes.

As is seen by the trends in Fig.1, tailing percentage improved with scanning percentage between flocks but at a different rate in each scheme. For each 10% improvement in scanning there was a 5.6% (Merino 100%), 6.4% (Landcorp), 7.1% (CF2000) and 7.8% (LambMAX) increase in tailing.

Lamb MAX



CF2000



Shown for each is the regression line and equation between flocks with the 85% (dotted upper line) and 75% (broken lower line) lamb survival lines drawn on each.

In four farm production monitoring schemes tailing percentage increased between farms by 5.6 to 7.8 for each 10% increase in scanning percentage.

The area between the broken and dotted lines in Fig.1 includes flocks in the 75% to 85% band for lamb survival, or 25% to 15% lamb losses. This means that flocks above this band on the graphs had better than 85% lamb survival between scanning and tailing while those below were less than 75%.

Generally scanning levels were lower and lamb losses higher for Merinos, averaging about 26%. In the Romney and crossbred flocks lamb losses averaged around 18% in two of the schemes and 22% in the larger Landcorp scheme with higher average flock size of 6,800 ewes.

Lamb losses between scanning and tailing averaged 20% for Crossbreds at scanning levels between 120% and 180% while average lamb losses for Merinos were 26% at scanning levels between 90% and 150%.

The greater variation in lamb mortality at different scanning percentages in Merino 100% flocks compared with Lamb MAX is shown in Table 2.

Table 2: Relationships between scanning and tailing percentages and lamb losses for Merino 100% and Lamb MAX schemes

	Scanning percentage	Tailing percentage	Difference	Percentage lamb loss
Lamb MAX	170	138	32	19
	150	122	28	19
	130	106	24	18
Merino 100%	130	92	38	29
	110	81	29	26
	90	69	21	23

Farm System Changes

It is inevitable that with improvement in lambing percentage, which will mean proportionately more lambs, there will be changes needed to the farm system. For example very different management and production practises are required farming at 150% lambing compared with 110%.

The main aspects of management and production which will need reviewing with higher lambing percentage include:

- planning and prioritising activities

- mating and lambing date
- number of ewes carried through the winter
- lamb selling and breeding replacement policies
- sheep to cattle ratio
- feed planning
- breeding policy
- pasture production and fertiliser needs

Increased lambing percentage may require small changes or 'fine tuning' such as decreasing breeding ewe numbers or sheep:cattle ratio or reducing stocking rate through the winter to ensure better matching of pasture feed supply and animal needs.

At higher lambing percentages planning and management needs to be more finely tuned so feed supply and animal needs are closely matched.

For example with 20% more ewes having twins, good ewe body condition and adequate feed at lambing will be more important otherwise lamb mortality will increase markedly. This may require that some15% fewer ewes be carried through the winter (i.e. fewer ewes producing the same number or more lambs than previously) and a slightly later lambing date. Also with a greater proportion of lambs in the spring-summer period, lamb selling and drafting may need to be earlier to ensure enough feed for good ewe weights at mating.

Changes to the farm system could include less ewes wintered, later lambing, and lambs drafted earlier.

In addition to stock policy decisions like those above, other components of the system will need consideration to support a higher lambing percentage. Included will be factors like fertiliser application and pasture varieties for better feed production, provision of stock shelter, adequate sub-division for effective feed planning and allocation and reviewing lambing date.

Monitoring.

A critical part of effective planning and management for higher lambing percentage is monitoring to provide 'quality information for quality decisions'. For example a significant improvement in lambing percentage may simply come from vaccinating against contagious abortion (toxoplasmosis or campylobacter) if it is known this is a spasmodic or regular problem.

Key aspects to monitor are pasture cover, ewe weight and condition score, pregnancy scanning, lamb growth rates and animal health.

Key aspects which need to be monitored include the following:

- pasture cover for sheep feeding levels
- ewe mating and weaning weight and condition score
- pregnancy scanning for preferential management
- growth rates of lambs for drafting and replacements
- genetic merit of rams
- animal health status

Monitoring should not be perceived as a cost but rather as a necessary investment.

There is no set recipe for the best farm system.

In conclusion it should be noted that there is no set recipe for the best farm system. Factors such as the knowledge, attitudes and skills of the farmer, production and profit goals and many other aspects of each individual farm will need to be considered in developing the best system for that farm.

The realisation of lambing potential on farms requires consideration of the many events and activities throughout the farming year from lamb weaning right through until the following lambing. The next four chapters progressively run through the weaning to mating, mating and early pregnancy, mid to late pregnancy and lambing periods.

Chapter 2
WEANING TO MATING

Recommendations

- *High ewe liveweight and condition score (CS3 or higher) are required at mating for good ovulation rate and potential lamb drop.*
- *It is more efficient and productive to hold good ewe liveweight and condition score over summer than to lose and regain.*
- *Ewes need 1.0 to 1.3 kg of dry matter per day (average to good quality) to hold body condition score at 3 over summer.*
- *Rams should be checked before ram buying time and again 8-10 weeks before mating and good feeding and exercise commenced.*
- *Buy rams from brucellosis accredited flocks and check all rams for testicle abnormalities and mange at least 8 weeks before mating.*
- *Use lower ewe:ram ratios with younger ewes and/or rams*

The period between weaning and next mating is important for good reproductive efficiency in the coming season and for good wool production. Performance will be penalised if ewes are "screwed down" or worked hard to maintain summer pasture quality to the extent that the ewes lose weight. Ewes which are light at weaning must be well fed to regain weight by mating time.

Preparation for a good lambing percentage is largely done between weaning and the next mating.

The ewe

Recovery of weight to next mating

The main determinant of the coming season's lambing percentage is ovulation rate at mating. Ewes must reach good mating weight and condition which may be difficult if they lost a considerable amount of weight during winter and have not made this up by weaning. Condition score ("CS", see Appendix 6) should be 3 or better at mating. Ewes need to gain about 5 kg live weight to improve by one condition score.

Ewes need to be in good body weight and condition (CS3) for high ovulation rates at mating.

If ewes cannot reach a suitable pre-mating weight over summer, flushing becomes extremely important in achieving good ovulation rates and a high lambing percentage next season. Controlling feed quality over summer with breeding ewes may restrict their ability to regain weight before mating.

Although responses to flushing appear greater in thin ewes than fat ewes (Rattray *et al.*, 1980), deliberately reducing ewe weights over summer before flushing is not recommended. Ewes in good condition either pre-flushing or at mating have lower barrenness than those in poor condition.

It is much more efficient to hold ewe liveweight and condition score between weaning and mating as it takes a lot of extra feed to regain weight. For example, each kg of ewe liveweight lost is equivalent to 17 MJ ME while it takes 65 MJ ME to gain one kg of liveweight.

Ewes should not lose weight between weaning and mating as that will reduce food conversion efficiency and penalise wool production.

Experiments at Templeton Research Station (Thompson *et al.*, 1990) showed that ewes ate less feed if liveweight was held between weaning and mating and also had similar ovulation rates to ewes which had lost then regained to the same liveweight. In addition, ewes well fed over summer in these experiments produced 11% more wool than those underfed.

Results from the Templeton experiments are summarised in Table 3.

Table 3: Average ewe weight (kg) at weaning and subsequent mating in relation to different summer feeding levels and average ovulation rate (adapted fromThompson *et al.*, 1990).

Ewe Weaning weight (kg)	Summer feeding level	Average ewe mating weight (kg)	Average ovulation rate
54.8	low	47.0	1.52
54.8	low-high	50.0	1.73
54.8	medium	57.2	1.93
45.0	low	41.8	1.28
45.0	low-high	45.8	1.51
45.0	medium	46.5	1.53
45.0	high	56.9	2.17

Feeding level over summer

Ewe feed demand over summer is determined by the amount needed to maintain or gain weight for condition score of 3 or greater at mating. Tables 3 and 4 show the feed requirements of mature ewes maintaining or gaining liveweight. Use these to calculate the feed demand for ewes to reach their desired pre-mating weight (pasture length guidelines can be obtained from the Appendix 4.2).

Feeding recommendations

Table 4: Maintenance feed requirements of grazing adult sheep (kg of dry matter per day) (adapted from Geenty and Rattray, 1987)

	Feed quality		
Liveweight (kg)	**Poor** (25+% dead material) 8 MJ ME/kg DM	**Average** (green-leafy) 10 MJ ME/kg DM	**Good** (legume dominant) 12 MJ ME/kg DM
40	1.13	0.85	0.67
50	1.31	1.00	0.79
60	1.50	1.15	0.92
70	1.69	1.30	1.00

Extra feed required for liveweight gain, assuming average quality feed (10 MJ ME/kg DM):

50 g/day gain: Add approximately 30% to the maintenance amount above.
100 g/day gain: Add approximately 60% to the maintenance amount above.
150 g/day gain: Add approximately 100% to the maintenance amount above.

Ewes need to eat 1.0 to 1.3 kg of dry matter per day (average quality) to hold condition score 2.5 to 3.5 during summer.

Condition scoring

Weighing is a good tool for assessing summer weight change (from ewe weaning weight) and to monitor progress up to mating. Condition scoring can be useful for frequent checks on progress over summer and is quicker than yarding and weighing. This can be by condition scoring a few ewes in the corner of a paddock or when they are in the yards for some other job.

Progress can be monitored by measuring ewe live weight and/or body condition score (CS).

For more detail about condition scoring, see Appendix 6.

The ram

Health inspections

Active healthy rams are essential for good fertilisation rates, especially for high ewe:ram ratios (100+:1). Inspect your present rams before ram buying (to check the number of replacements needed) and again ten weeks before mating. A quick examination the day before putting the rams out leaves no time to cure health problems or find replacements.

Ram preparation is important for good mating performance and sperm production which begins eight weeks before mating.

Ram preparation

Ten weeks before mating, check for:

- wounds and flystrike
- genital health problems such as epididymitis, scrotal mange, pizzle rot and penis abnormalities. Isolate any rams with genital problems immediately to reduce the risk of infecting healthy rams. Get your veterinarian to inspect and blood test these rams.
- foot problems. Footrot and other lameness may reduce feed intake and hence sperm production, as well as reducing ram mobility during mating. Foot abscess will elevate body temperature and cause infertility for up to two months.

Seek veterinary advice for treatment of genital problems or foot abscess.

Sperm development takes eight weeks, so all sperm present at mating have developed prior to the mating period. Begin good feeding and exercise at least eight weeks pre-mating. Avoid shearing within eight weeks of mating.

A. Brucellosis

Brucellosis is caused by *Brucella ovis* and may be seen as epididymitis in rams. Often undetected, brucellosis reduces ram fertility and hence lambing percentage if enough rams are affected. Brucellosis is mainly considered a ram problem but occasionally causes aborted or small weak lambs if ewes are infected (Bruere, 1986).

Rams should be checked 8-10 weeks before mating for general soundness, genital problems like epididymitis, scrotal mange or pizzle rot, and feet problems.

Brucellosis is spread through sexual activity between rams and by ewes acting as passive carriers at mating, passing it on when mated by more than one ram.

Vaccination is no longer practised. Buy rams from accredited brucellosis-free flocks and beware of infection introduced by males other than breeding rams — e.g. a neighbour's cryptorchid lambs run with the rams while waiting to be collected. Isolate rams with epididymitis or testicular abnormalities (e.g. hardness or odd sizes) and blood test as soon as possible.

B. Scrotal mange

Scrotal (chorioptic) mange is a disease which may render rams infertile by raising testicle temperatures. Mange is associated with infestation by the *Chorioptes bovis* mite. Dried exudate appears on the skin, revealing damaged weeping skin when scraped from an active lesion. Many rams carry mites but have no lesions and there is no correlation between mite numbers and the extent of lesions on individual rams (Quinlivan, 1970).

Rams with small inactive lesions may produce normal semen but rams with extensive lesions have poor quality semen. Check rams carefully and reject any with active or extensive lesions — consider them temporarily unsound, treat and re-examine. Rams with severe active or inactive lesions may be permanently unsound and should be replaced (Quinlivan, 1970).

The mite may be carried by other animals (e.g. horses, cattle and goats). Consult your veterinarian about a treatment programme if rams have problems with scrotal mange.

Sperm production

A. Testicle size

Sperm production is proportional to the amount of testicular tissue — i.e. rams with larger testes generally produce more sperm. Large testes and high sperm production allow sperm numbers to remain high when rams serve many ewes per day. Testicle size may thus indicate a ram's potential ability to serve large numbers of ewes although sperm quality, ram mobility and libido are also important.

Simple practical measurements such as scrotal circumference can be used to estimate testicle weight and hence sperm production to compare rams for likely serving capacity (Knight, 1977). Generally a scrotal circumference of 30 cm or greater is adequate.

Good testicle size, or scrotal circumference of 30 cm or greater, is important for high quality sperm and semen production.

B. Scrotal temperature

The testes must remain cool for best sperm production and survival. This is especially important in the last eight weeks before mating, as fever or stress (from any cause) may reduce sperm quality and/or quantity. If rams are in full wool it is advisable to shear the scrotum and crutch and in hot areas shade should be available for rams.

Testes must remain cool for best sperm production and survival and this is important in the last eight weeks before mating as well as the mating period.

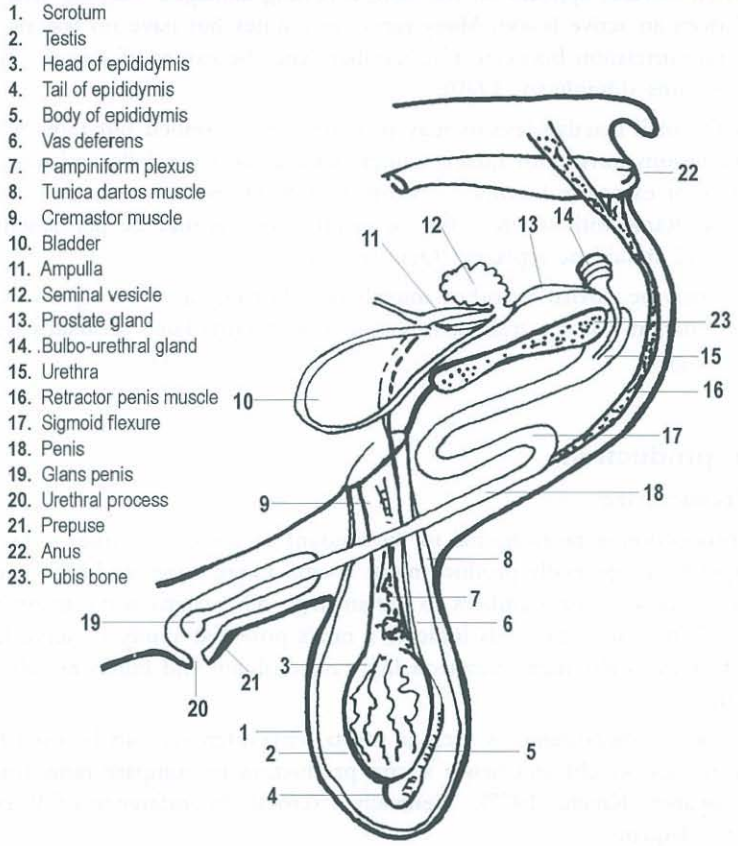


Fig.2: Reproductive system of the ram. Sperm are produced by the testes and acquire fertilising capacity in the body of the epididymis after which they reside in the tail of the epididymis. For effective sperm production (spermatogenesis) the testes must be two to three degrees C lower than body temperature.

C. Seasonality

Decreases in semen volume, sperm density and motility have been noted during late spring and early summer (i.e. when seasonal sheep breeds are sexually inactive) with peak values during autumn. In practice these changes are not usually important.

D. Semen quality

Semen quality tests are not warranted with commercial rams. Quality is most likely to be checked with expensive rams used in single sire group mating. Semen collected using electro-ejaculation is suitable for checking sperm motility and morphology but sperm numbers are variable and this is not a good check for density (Quinlivan, 1970). Samples collected with an artificial vagina are generally more consistent and sperm density tends to be higher (Mattner and Voglmayr, 1962).

Semen quality can be tested using electro-ejaculation or an artificial vagina followed by inspection for sperm density and motility.

Two or three tests at five day intervals are a better predictor of fertility than a single test (Quinlivan, 1970). If any factor is unsatisfactory at the first test, repeat test before rejecting the ram. Sperm volume and density also decline after frequent ejaculation so testing after high levels of sexual activity may give misleading results (Salamon, 1964).

E. High serving capacity rams

Identification of high serving capacity rams is best done with a serving capacity test which measures the number of successful services within a given period of time (e.g. two or more ejaculations when confined in a pen with four oestrus ewes for 20 minutes; Fitzgerald *et al.*, 1993). Testicle size, as mentioned above, indicates likely sperm production and possible serving capacity.

Serving capacity or libido of rams can be tested in pens with ewes in oestrus.

Rams born to prolific ewes, and preferably born as twins or triplets themselves, are more likely to have a high serving capacity than rams born to low fecundity ewes. Rams born as co-twin to another ram are more likely to have a high serving capacity than rams born as co-twin to a ewe lamb (Fitzgerald *et al.*, 1993).

Behaviour and sexual experience

Ram libido and sexual activity vary considerably. Across a range of studies, 27% of the rams used were found to be inactive when first exposed to ewes in oestrus (Fowler, 1983). While most rams improved with further exposure to ewes, some still showed poor performance — e.g. low libido and low ejaculation rates.

Older, experienced rams usually seek out ewes in oestrus whereas inexperienced rams, especially lambs, may not be as efficient at detecting oestrus ewes and may have lower fertility (Clarke *et al.*, 1966). Use ram lambs at reduced ratios (e.g. 50 ewes per ram lamb) and mate to older ewes which will seek out the ram. Harnesses can be useful to show ram lamb activity (especially for single-sire mating).

With ewe:ram ratios of 150+:1 use experienced rams if possible. Ram libido may outlast sperm production so rams may appear to continue mating but prove infertile.

Vasectomised rams

Vasectomies must be done by a veterinarian at least six weeks before use. Vasectomised rams can be used to:

- stimulate ewes to cycle earlier (see "Ram effect" page 43)
- identify ewes in oestrus for AI (see page 52)
- identify non-pregnant ewes after mating, using harnessed vasectomised rams (e.g. 500 ewes to one ram) after breeding rams are removed (This method identifies non-pregnant ewes for early sale well ahead of pregnancy scanning)
- stimulate hoggets to cycle earlier
- introduce non-breeding hoggets to the ram and get them used to ram behaviour

Uses of vasectomised rams include stimulation of hoggets or ewes to cycle earlier, identifying ewes in oestrus for AI and identifying non pregnant ewes after mating.