



TE MĀTAURANGA AHUWHENUA, AHUONE  
**AGRICULTURE AND HORTICULTURE**



**AGS305K**  
**MANIPULATING THE PRODUCTION PROCESS**  
**– LAMB MEAT**  
**NCEA LEVEL 3**



# AGRICULTURE AND HORTICULTURE

## NCEA LEVEL 3

### Expected time to complete work

This work will take you about 22 hours.

### You will work towards the following standard:

Achievement Standard 90650 (Version 2) AHS 3.4

### Explain market requirements and the production process for a nationally significant primary product

Level 3, External

Credits 6

### In this booklet you will:

- describe the production process from establishment to harvest
- develop a calendar/schedule of opportunity for a nationally significant primary product
- explain and justify how manipulations of the production process achieve specific attributes for a specified market opportunity
- send in your project diary for your teachers to check your research project progress (if you have not sent it in with AGS305). Use the cover sheet AGS305C for this purpose.

### Assessment

Your teacher will look at how well you complete:

- your self-marking tasks
- the assessment tasks in sessions 6 and 7.

# CONTENTS

- 1 The production process
- 2 Establishment of an agricultural product: lamb meat
- 3 Lamb growth
- 4 Harvesting lamb
- 5 Applying your knowledge to goats
- 6 Teacher-marked activity
- 7 Answer guide

# HOW TO DO THE WORK

## When you see:



*Check the answer guide.*



*Your teacher will assess this work.*



*Watch the DVD.*

## You will need:

- lined refill
- video on *Lamb production AGS305DV*
- access to a computer
- the A3 insert (AGS305B).

## Resource overview

You can do this work either one session or several at a time.

Write your answers on lined refill or word-process your activities.

Make sure all loose sheets sent to your teacher are well labelled with your name, student ID number, and the activity and question number.

# 1 THE PRODUCTION PROCESS

There are three main stages in the production process:

- establishment
- growth
- harvest.

In these booklets (AGS305 and AGS305K) you will study the production process of two commercially-grown primary products – tomatoes and lamb meat.

Your research project for Achievement Standard AHS3.1 (AS90649), which began with AGS303, requires you to research the production process of a commercially-produced primary product from your local area.

Study of these primary products (lamb meat and tomatoes) will allow you to demonstrate knowledge and understanding of the production process. You will show your ability to apply this knowledge to resource-based questions on products that are unfamiliar to you.

## **ESTABLISHMENT**

Establishment is the starting point in a production cycle. For products such as tomatoes and lamb, the starting points are:

- tomato cultivar selection up to the point of transplanting seedlings
- breed selection up to the birth of a lamb.

The length of the cycle depends on the plant or animal type. With fruit tree production, it can take years to establish plants which crop annually. For apples, you could choose a full cycle from site selection, cultivar choice, and the production of a grafted seedling tree, or an annual cycle beginning with bud formation and ripening in spring.

## **GROWTH**

For tomatoes and lamb, growth is the stage from:

- transplanting tomato seedlings until the harvest of mature fruit
- birth of a lamb until its slaughter.

At all stages, but especially the growth stage, various inputs are added into the production process. These inputs help to achieve an end product that is acceptable for the market opportunity the product is grown for.

## THE PRODUCTION PROCESS

### INPUTS

These are all the conditions, activities, and materials necessary for the production of a product for a particular market opportunity.

Inputs can be divided into three types:

<b>Inputs</b>	<b>Examples</b>
environmental – physical factors	heat, light, water, nutrients, carbon dioxide, air flow and quality, soil type
biological – influences from other organisms	pests, diseases, genetic makeup, competition
husbandry (management) – activities involved in looking after the product	thinning, pruning, tailing, flushing

The management input involves making decisions on which inputs to use and/or manipulate. Management will also decide when each input will take place and/or when each input might be manipulated (changed or altered to the grower's advantage) during the production process.

### HARVEST

This includes all operations from picking tomatoes to post harvest treatment to grading or packing. For lambs, the harvest stage includes all operations in the slaughtering process and, sometimes, transportation to the slaughter house.

### CALENDAR OF OPERATIONS

A calendar of operations shows the stages in the production process, including the length of each stage. A calendar of operations for tomatoes is included in AGS303.

#### Possible calendar of operations for South Island Texel lamb meat at 300 metres above sea level

<b>Establishment preparations</b>	4 weeks before mating, crutching carried out
<b>Establishment flushing, better feed</b>	3 weeks before mating put onto high quality feed
<b>Establishment mating</b>	Two groups A and B Group A mated 25 April Group B mated 5 May
<b>Establishment lambing</b>	Group A lambing on 20 September Group B lambing 18 October
<b>Growth/weaning</b>	Weaning 3rd week in January, depending on weights of lambs and feed available
<b>Harvest/slaughter</b>	Lambs sold in 3–4 groups straight from mother to the processor or straight from the mother as stores. The remainder kept go to liveweight 38–42 kg, gives a 17 kg carcass. All excess stock must be off the property by March.

## SCHEDULE OF OPERATIONS

This is a management plan based on the calendar of operations. It shows the inputs into the production process and when they are applied.

The inputs and the timing of the inputs into the production process will affect the yield, quality, market opportunity and therefore the profitability of the product. For example, the timing of the planting of outdoor tomatoes to avoid late frosts will affect yield and the time of harvest. The timing of pest control will affect quality.

The schedule of operations for a particular product will depend on the specific market opportunity the product is grown for. For example, lambs grown for live export will not have tailing included on the schedule of operations because that market prefers fat long-tailed ram lambs.

For the purposes of NCEA assessment, a calendar of operations and a schedule of operations are both known as a **schedule of operations**, as described in this booklet.



Read about the possible inputs in the wheat production process then answer the following questions.

### Wheat production

Stage	Input
Establishment	Environmental – soil moist enough for germination Biological – paddock weed-free Husbandry – farmer drills appropriate amount of seed Managerial – made decision on cultivar to sow
Growth	Environmental – humid weather good for growth Biological – humid weather encourages diseases/pests Husbandry – pesticide sprayed on crop Managerial – decision on best time to apply pesticide
Harvest	Environmental – hot, dry weather Biological – grain mature and ripe Husbandry – harvested at correct moisture level Managerial – securing alternative market if quality problems

1. Name the three stages of the production process.
2. List the four types of inputs applicable to each stage of the production process.
3. Give one husbandry input for each production stage of the wheat growing process.

## THE PRODUCTION PROCESS

4. a. What is a schedule of operations?  
b. What effect does a schedule of operations have on outputs of a production process?
5. Read the following extract about the production process for potatoes, then answer the following questions.

### Potatoes

It's time to plant your potatoes. The cultivar chosen is the early maturing Ilam Hardy rather than main crop Ruas, which are normally grown. The change is a response to better early season prices and the trend to mild winters with reduced risk of late frosts.

The soil has been well cultivated and a general NPK fertiliser applied. The seed potatoes have been sprouted prior to planting to speed up the growing process. The seed is sown as soon as the soil temperature can support growth. Rows are 60 cm apart and formed with furrows 8–10 cm deep. Fertiliser with good nitrogen levels is added to the furrow and worked in to take advantage of the cultivar growth rate potential and avoid possible root damage. The seed potatoes are spaced 20–25 cm apart in the furrow and the covering soil is ridged up. This helps frost protection, checks weeds and maintains soil around the developing potatoes; potatoes may go green if too near the surface.

During the growing season, moisture levels can be maintained with irrigation, and side dressings of urea will boost growth and potato size. In humid weather, check for potato blight fungus attack and spray as a preventative measure or at first attack. Harvest will be approximately three months from planting. A trial dig can check progress, but when the plant is in full flower is a good indication of harvest time.

- a. Select an input to illustrate each of the following factors:
  - i. environmental
  - ii. biological
  - iii. husbandry.
- b. Describe a management decision which relates to:
  - i. a market opportunity and profit
  - ii. yield
  - iii. quality.



6. Read the following extract then answer the questions.

### Winter lettuce

Sowing and planting: February is the main month for sowing seed for greenhouse lettuce. Although seed is usually sown outside in rows, a better method is to sow the seed in boxes of a sterilised medium.

Depending on growing conditions and propagation method, allow 4–6 weeks between sowing and transplanting. April is the main month for transplanting lettuce in greenhouses. Some variation in planting dates is possible but if transported too early when conditions are too warm, too much soft growth is made before winter and either frost damage occurs, or the crop goes to seed. If transplanted too late, the crop will mature late in spring and returns will suffer because of competition with outdoor lettuce.

Harvest time for the first pick is variable but normally 7–8 weeks from transplanting.

- a. Construct a flow chart using sowing, transplanting and harvest stages and the time involved.



- b. What will be the effect on yield or profitability from:
- transplanting too early
  - transplanting too late.



Check the answer guide.

## MANIPULATIONS

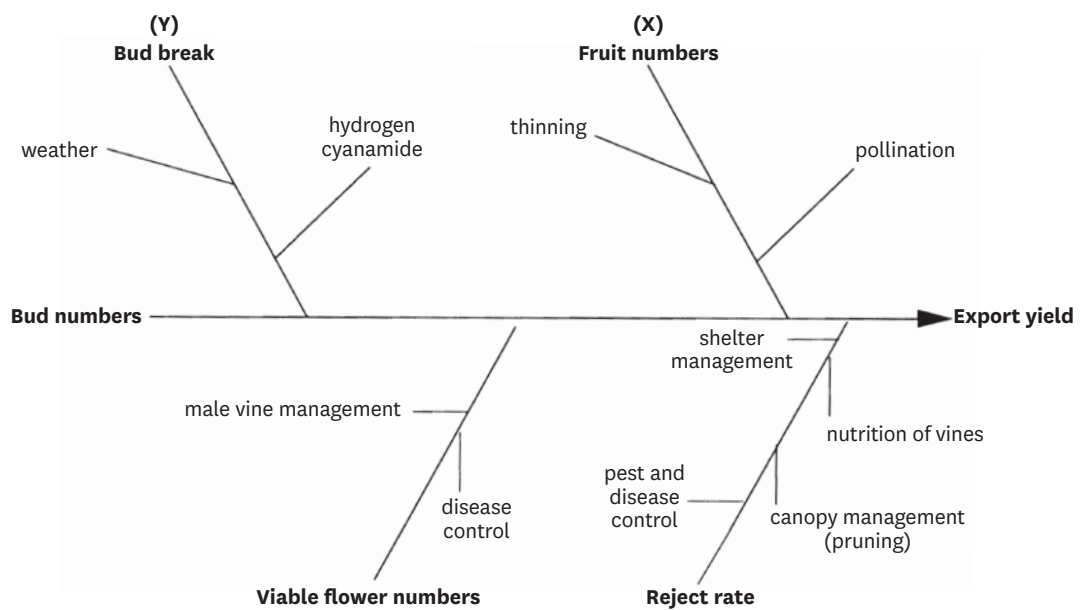
Decisions made by the grower on the timing and type of inputs can manipulate the production process. These decisions can affect the yield, attributes, and time of harvest of the final product. These manipulations are often done so the product meets the specification of a particular market opportunity.

## THE PRODUCTION PROCESS

### INTERACTION OF INPUTS IN KIWIFRUIT

This table shows some of the inputs in producing export kiwifruit and how they can be manipulated. It shows how interrelated these inputs are. Notice:

- Fruit numbers (X) are influenced by the pollination rate and the amount of thinning of small or imperfect fruit to give the best export yield.
- Bud break (Y) is the beginning of the annual production cycle. The more buds that break (develop) the greater the potential number of flowers and fruit. Buds need a specific amount of natural winter chilling or they can be artificially stimulated to develop by chemical application. This example shows how inputs cannot be regarded in isolation (more buds → more flowers → more pollination → more thinning → higher export yield) and can vary from year to year (warm winter → insufficient chilling → fewer buds).



In the next activity you'll see how flower numbers can be manipulated.

1B

Read the following article which shows how flowering can be increased artificially then answer the questions.

### Plant growth regulator to break kiwifruit dormancy

Hydrogen cyanamide, under the brand name Hi-Cane, is a patented plant growth regulator specifically aimed at breaking kiwifruit dormancy. It is beneficial in areas where inadequate winter chilling of vines results in poor bud break and low fruitfulness.

A single application in early/mid August, while vines are dormant, results in an even bud break 30–40 days later. This leads to more floral shoots and more flowers per cane. Increases in flowers per cane have been in the order of 30 per cent. It must be noted that in areas where there is sufficient winter chilling, the effect is greatly reduced because chilling is already sufficient to ensure an adequate bud break.

For the grower to achieve maximum yields, good consistent flower numbers are essential. Care must be taken not to overload vines or a reduction in fruit size can occur. In cases of heavy induced flowering, it is necessary to thin fruitlets to between 40 and 50 per m<sup>2</sup>. Growers must also ensure good plant nutrition and husbandry to enable the

fruit to reach the desired size, and the vine to carry the crop without stress. Treated vines undergo a compacted burst of flowering in mid-November lasting from four to seven days, as opposed to the normal one to two weeks. With flowering shortened and flower numbers increased, bee pollination alone may not always be enough, particularly if rain occurs over the flowering period. It is recommended that growers maximise numbers of pollinator bees and consider using artificial pollination as well. Hi-Cane treatment and artificial pollination are very compatible because the short even flowering normally allows good pollination to be obtained with one pass through the orchard.

Hi-Cane must be applied as a fine spray mist for full coverage. In no circumstances should Hi-Cane be applied to run-off, as this can lead to higher concentrations at the cane ends, where some buds may be damaged.

In areas of poor winter chilling, Hi-Cane will become an important management tool for kiwifruit growers of the future.

1. What does application of hydrogen cyanamide do and how is it helpful?
2.
  - a. When would you apply the chemical?
  - b. When would you expect to see a result?
  - c. What is the result?
3.
  - a. Where flowering is heavy, why would thinning be necessary?
  - b. In your own words, explain why reducing fruit numbers could affect profit and marketable yield.
4. In what way is the use of Hi-Cane and artificial pollination compatible?



Check the answer guide.

## THE PRODUCTION PROCESS

### **KEY POINTS**

- The production process involves establishment, growth and harvest.
- Environmental, biological, managerial and husbandry inputs can all be part of the production process.
- A schedule of operations shows the:
  - production process along with the length of time involved with each stage
  - inputs and the timing of the inputs into the production process.
- The manipulation of inputs will help to determine the yield, time of harvest and attributes of the final product.

## 2 ESTABLISHMENT OF AN AGRICULTURAL PRODUCT: LAMB MEAT

### CHOOSING A MARKET

The choice of market will help to determine the schedule of operations for the production of prime lamb. Most lambs in New Zealand are produced for our summer killing season.

The two main export markets are driven by the demand of the European Union (EU), where the Christmas market and the Easter market are both times when early season lamb is traditionally in high demand.

### PRIME MARKET

Prime lambs are sold direct from the farm to meat processing/slaughter companies. Export lambs are paid according to a schedule of prices for export weights and grades set by the meat processors.

Local sales in main centres sell prime lamb by auction. The meat may be bought for export or local consumption but these sales help set market values. Weekly stock sale values are reported in the newspapers.

### STORE MARKET

Store stock are lambs not in prime killable condition which farmers or companies buy to finish or grow on to prime condition. More lamb supply is now contracted as well. Prices for store stock vary during the season and from district to district. The prices received are affected by supply, grass availability and market prospects but to give a profit margin they are lower than prime prices.

### OTHER MARKETS

- Live trade  
This involves shipment of live sheep to the Middle East. Contracts are let for autumn delivery for heavy long-tailed lambs. This is not a current trade now due to animal welfare concerns.
- Out-of-season markets  
With increasing use of meat and year-round markets wanting 52 weeks supply for chilled product, contracts are offered for out-of-season lambs. For example, premiums can be paid for lambs available from July–October before traditional killing begins.

To achieve this early lamb, hormone treatments can be used so that ewes can be mated outside their normal breeding season. Breeds like Dorset and Finn have a naturally extended breeding season that can be an advantage for growing lamb for this market. This early lambing can have advantages for areas with dry summers but good autumn/winter feed is essential.

Alternatively, to meet the out-of-season demand, late lambs are finished in the following winter/spring.

## **BREED SELECTION**

In order to produce quality prime lamb, a major decision is the choice of ram and ewe breed or crossbreed.

Farm location, type of country, farm policy (breeding own ewe replacements, for example) farmer preference and market signals all affect this decision.

The choice of ram will provide most of the genetic improvement for optimum lamb production.

The choice of ram breed will determine if the lambs:

- are faster growing
- are earlier maturing
- produce heavy carcass weights
- are lean
- have a low fat depth on the carcass.

Breeds such as Texel, Suffolk, Poll Dorset and Dorset Down produce large lean carcasses. The last three all have low carcass fat depth.

Ewes vary in their ability to have:

- twins or triplets (fecundity)
- high milk production
- lambs with high growth rates
- lambs with good carcass composition (weight, fat).

Selecting ewes with good lamb production characteristics and culling low producers results in increased flock performance.

Ewes with the Booroola and Inverdale genes have higher ovulation rates, as do Finns. Cross-breeding with Finns, which have a high lamb drop of 260 per cent, can introduce high fertility genes into a flock. This results in an increase in lambing by up to 20 per cent or more. Ovulation rate and reproductive performance are heritable.

**Characteristics of some sheep breeds**

<b>Breed</b>	<b>Characteristics</b>
Finn	high fecundity, newborn lamb hardiness and good lamb growth rate potential
East Friesian	high fecundity and high milk-producing ability, resulting in good lamb growth rates
Texel	newborn lamb hardiness and improved lamb carcass composition
Poll Dorset	good milk production and fertility, ability to lamb out of season, improved carcass composition

**GETTING THE EWES AND RAMS READY**

Two major factors that affect lamb production before mating occurs are:

- day-length (light) which influences ram and ewe fertility
- nutrition which influences ovulation in ewes and ram fertility.

**EFFECT OF LIGHT ON FERTILITY**

Natural mating is seasonal, mating in autumn and lambing in spring. In both ewes and rams there is a hormonal response to decreasing amounts of daylight.

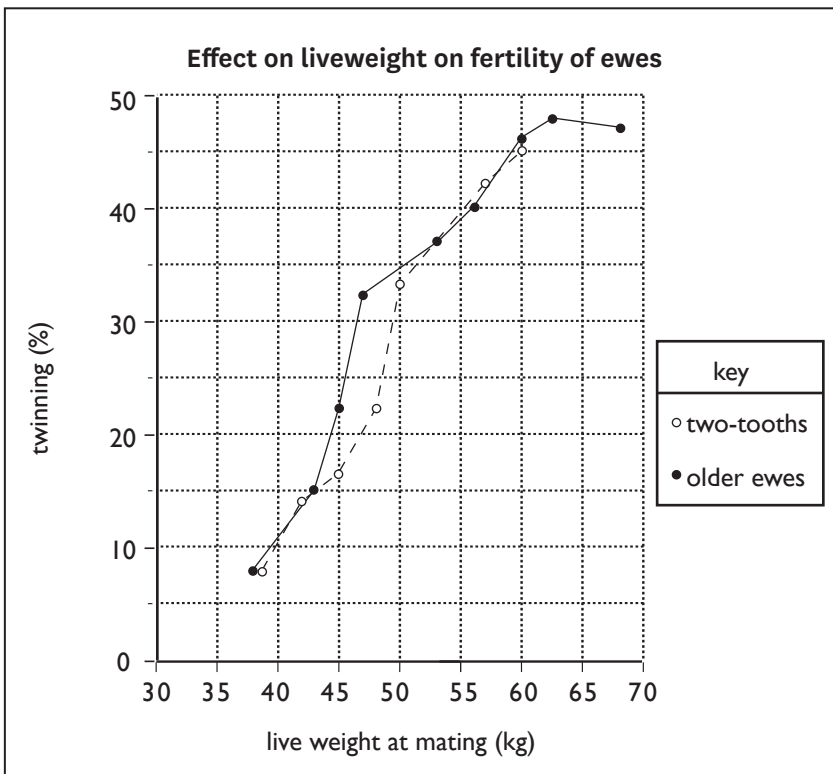
In rams, semen volume and quality increase and ewes begin ovulating or 'cycling'. Each cycle consists of a brief period of oestrus or 'heat' of 16–20 days (ovulation or egg release) when mating can occur. If the ewe does not become pregnant in this time, they will cycle again.

**NUTRITION**

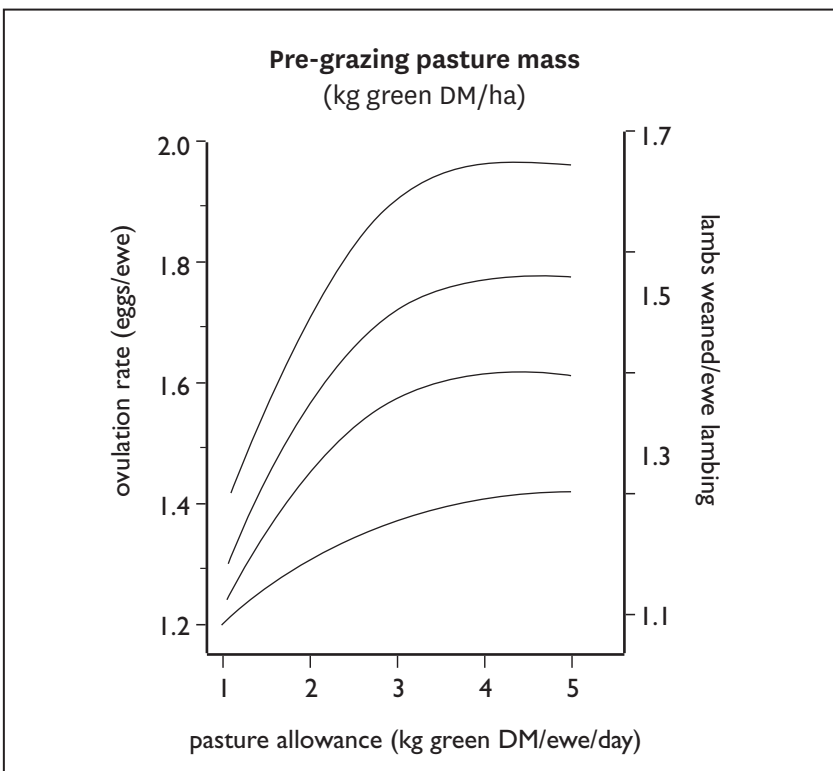
The amount and quality of feed are the end result of environmental inputs. Stock nutrition has a major influence on flock productivity and lambing percentage.

Well-fed rams perform better. It takes approximately 50 days for sperm to develop and mature. So, when preparing for mating, improved feeding should start about two months before mating (January/February).

Ovulation in ewes can be affected by long-term feeding levels and also changes in feeding levels. In general, higher ewe liveweight gives a higher rate of twinning.



The graph shows a similar response in sheep of different ages. Environmental conditions in autumn can be variable and, while ewe weights may be below optimum, an improving level of nutrition has a positive effect on ovulation and lambing percentage.



**GRAPH X**  
As available feed increases, ovulation rate increases as well.



**FLUSHING**

Increasing feed levels is called flushing. It is carried out for 2–3 weeks before mating and can continue for a month after the rams are running with the ewes, depending on feed availability. The type of feed affects ovulation too, as it can be depressed by grazing ewes on some legume cultivars.

2A

1. Which environmental factor triggers reproductive cycling in ewes?
2. What is ‘flushing’ and how does it affect the reproductive potential of ewes?
3. From graph X:
  - a. Describe the relationship between an ovulation rate and amount of pasture offered.
  - b. Give a possible reason why the number of eggs produced doesn’t equal the number of lambs weaned.
  - c. In your own words, describe the effect poor summer and autumn growing conditions for pasture would have on the national lambing figures in the following spring.



*Check the answer guide.*

**SYNCHRONISATION**

Synchronisation can be used to get ewes ovulating all together. This is done to make ewes breed out of season and get an early lamb crop. It also shortens the period of lambing. Introducing a ram, usually a vasectomised ram or teaser, early in the breeding season will encourage ewes to ovulate within 3–6 days but not get them pregnant. Hormones can also be used to achieve synchronisation.

**RAM AND EWE HEALTH**

In the establishment/pre-lambing stage there are inputs that can improve the chances of a large healthy lamb crop. These include improving and maintaining both ram and ewe health.

**RAMS**

Rams need to be fit, healthy and keen as tugging (mating) ewes is physically demanding work. Rams must be physically and reproductively sound.

Veterinarians can check ram fertility. Infertility can be temporary or permanent. Temporary infertility can be caused by stress from treatments like dipping and shearing or conditions like footrot. Ram testes must remain cool for the best sperm production and survival. Shearing the crutch before mating can help provide this. Shade should also be available for the animal in hot weather.

All treatments should be completed well before mating.

Shearing rams before mating increases their general mobility, although some wool helps to carry male pheromones, which help to bring the ewes into cycle.

All rams should be palpitated before selection for mating to make sure that they are healthy.

Permanent infertility can be caused by a bacterium *Brucella ovis*. The following extract is about the disease and its prevention.

**Epididymitis** is a common disease of rams caused mainly by the organism *Brucella ovis*, and resulting in a swelling of the epididymis, which is the structure lying alongside the testicle. Often 10 % of the ram flock may be affected and occasionally the proportion is much higher. The disease passes from ram to ram, either by their serving the same ewe or mounting each other. Rams may be infected and may shed the bacteria in their semen for some weeks before developing the hard swelling of the epididymis, or they may at no stage develop an apparent swelling. The fertility of affected rams is often reduced, and some become sterile. The same organism also affects ewes, causing abortions or the birth of dead or weakly lambs.

**Prevention:** In the first year of a control programme, cull all rams with epididymitis and vaccinate the remainder at least two months before mating. Subsequently vaccinate all ram lambs at four months of age and any bought-in rams. Keep young rams separated from older rams until at least three weeks after they have been vaccinated.

### HEALTHY EWES AND LAMBS

In ewes there is no infectious cause of infertility.

However, there may be lack of fertilisation due to:

- no tugging or mating at all
- ewes having extremely low liveweights
- rams being put out too early.

Other reasons for not producing a lamb may be due to the death of a fertilised egg or embryo.

This can happen:

- when multiple ovulations occur
- in very young or very old ewes
- due to disease like *Brucella*
- due to a nutrient deficiency, such as lack of selenium
- stress from factors such as high temperatures, poor nutrition and shearing.

Ewes that don't produce a lamb are called 'dry' or 'empty' ewes. Lamb losses from disease can be prevented by vaccination to protect both ewes and lambs from bacterial diseases like tetanus and blood poisoning.

**Blood poisoning** is a common disease of all ages of sheep, caused by the organisms *Clostridium chauvoei* and *Clostridium septicum*. These organisms enter the body either through wounds or by being swallowed. When they are swallowed, they can stay dormant until activated by injury or severe exercise. This creates suitable conditions for their growth, and the disease appears within one or two days. Outbreaks of blood poisoning in sheep may follow docking, shearing, dipping, vaccination and assistance at lambing.

**Prevention:** A single vaccination with a combined vaccine will give lifelong immunity, except when sheep are first vaccinated as hoggets, in which case a second vaccination is necessary when they are two-tooths. To protect lambs, the ewes must be re-vaccinated annually about three weeks before lambing to boost the antibodies. These are absorbed by the lamb in the colostrum from the vaccinated ewe.

2B

1. Rams must be physically and reproductively sound.
  - a. Why should preparations like shearing or dipping be done well before the mating season?
  - b. Why must they be physically fit?
  - c. What professional help can be used to test fertility?
2. Fertility can be greatly reduced by disease.
  - a. What bacterium can cause infertility and what is the disease called?
  - b. What effect could reduced fertility have on lambing percentage?
  - c. What effect can infection with this bacterium have on ewes?
3.
  - a. At what age would you vaccinate ram lambs you intended using as flock sires?
  - b. How long would you keep them separate from older rams?  
Provide possible reason(s) for this.
4. More lambs means more profit.
  - a. Give two reasons for non-fertilisation of ewes.
  - b. Give two possible reasons for a fertilised egg not developing.
5. Vaccination against blood poisoning protects the ewe. What needs to be done to protect her lambs and how is this protection obtained?



Check the answer guide.

## **TUPPING (MATING)**

### **RAMS AND MATING**

The age, number and genetics of the rams available all influence the optimum ewe to ram ratio. Using fewer quality rams with a proven production record can increase production. A ram:ewe ratio of 1:150 is used for well prepared rams but 1:100 is more common, especially for younger or older sheep. Ram hoggets are mated 1:50.

Mating groups should have several rams so that if one fails there is a chance the ewes will be covered by another ram. A ewe will take several rams.

### **CYCLING**

Ewes normally cycle every 16–20 days for about three months. The rams are left in for two cycles (5–6 weeks plus two weeks) so a ewe not tupped in the first cycle has a second opportunity. Leaving rams for three cycles results in an extended lambing period. To identify ewes that have mated, harnesses with coloured crayon are put on the rams. The crayon rubs off on the ewe showing whether it has been tupped or not and, by using different colours each cycle, in which cycle she was tupped. This is useful for identifying groups for lambing and dry (non-pregnant) ewes. Shearing may stress ewes and prevent cycling, so it should be avoided before mating.

### **SCANNING**

Some farmers use ultrasound to determine which ewes are:

- pregnant
- empty
- or carrying multiple lambs.

Empty ewes can be culled and those carrying twins can be separated from the rest of the flock and given appropriate feed.

The number and weight of lambs produced directly influence the gross income and profit potential. Heavy ewes have a higher percentage of multiple ovulations, and ewe weight and percentage of lambs weaned are directly linked. Individual lambs in multiple births may be lighter than single lambs, however, the total production will be higher per ewe with multiple births.

To achieve optimum ewe weight a farmer may need to:

- save feed especially for flushing
- irrigate pasture
- give ewes a larger grazing area
- speed up grazing rotation
- give ewes supplementary feed or crops, under difficult conditions.

## **FEEDING PREGNANT EWES**

After flushing, ewe weight and condition are maintained throughout mating. Ewes need to be in good condition and have a high liveweight for high ovulation rates to occur at mating. High ovulation rates lead to a higher lambing percentage.

After two cycles, a winter feed programme begins. There are many variables in a winter feed programme:

- seasonal growth
- weather
- supplementary feed
- farm practices like slowing down the speed of rotational grazing and break feeding.

Nutrient deficiencies, such as selenium and iodine, should be avoided to prevent lamb deaths after birth.

In early pregnancy, the energy requirements of the foetus are small and useful food or metabolisable energy (ME) requirements are similar to a non-pregnant ewe. Underfeeding can cause embryonic death, or more often a low birth weight where the lamb will not survive past birth. Ewes need 1–1.3 kg of pasture dry matter per day at this stage to maintain body weight.

In late pregnancy, energy demands of the foetus can increase by 50–100 per cent over the maintenance requirements of the ewe. It is important at this stage to allow the ewe to maintain condition, keep healthy and prepare for lactation. Ewes, especially those with more than one lamb, often cannot eat enough to meet their energy requirements, as their gut space is restricted. Their own body reserves are used up and pregnancy toxaemia or ‘sleepy sickness’ can result from sudden or severe under-nutrition. Lack of nutrients, such as magnesium and calcium, cause metabolic diseases such as milk fever.

Underfeeding in the last stage of pregnancy can result in poor udder development and low milk production after lambing. Lambs with low body fat have less chance of surviving.

Overfeeding in late pregnancy can cause problems too. Large lambs can have a difficult birth and sometimes ewes straining to empty out can force the vagina or uterus to the outside causing a ‘bearing’ or prolapsed uterus. Fat ewes can become cast (unable to get up) and will die if not found, because they asphyxiate due to the pressure on the diaphragm.

Protein supplements during the last stage of pregnancy can allow the ewe to produce more colostrum after lambing.

## LAMBING

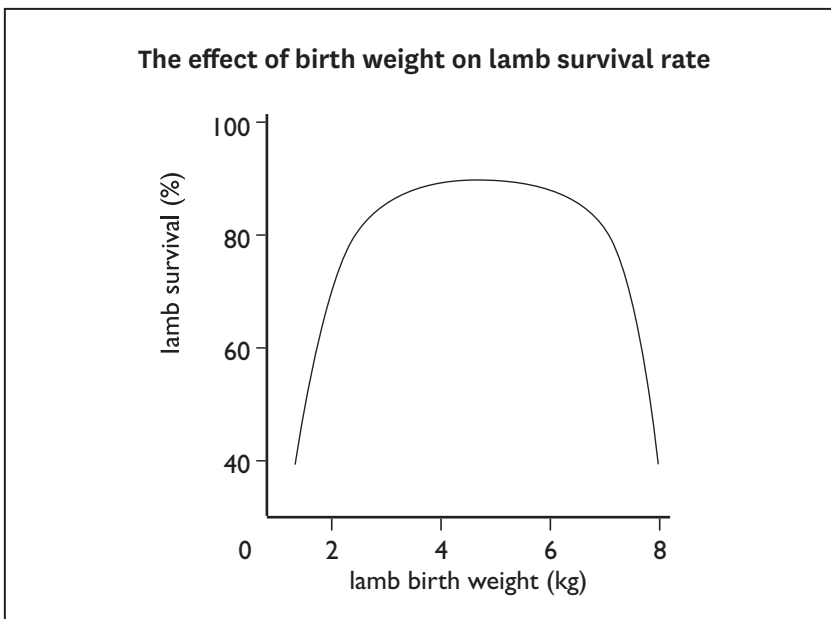
Sheep lamb 145–150 days after tupping. Lambing should be timed to begin at the same time as the increase in pasture growth in spring.

$$\text{Lambing \%} = \frac{\text{number of lambs tailed}}{\text{number of ewes mated}} \times \frac{100}{1}$$

Farmers growing a lamb crop for the early season chilled lamb market will need to lower the stocking rate or bring in extra feed so there is enough for ewes and lambs during the lambing period.

Husbandry inputs during lambing can range from intensive shepherding with ‘lambing beats’ twice daily to ‘easy or natural care’ where lambing ewes are left undisturbed. Over time, easy-care lambing eliminates stock prone to birthing difficulties and increases survival rates.

The optimum lamb birth weight is 3.5–5.5 kg. Lambs born in autumn and winter have lower birth weights. Low birth weight lambs grow at a slow rate until 20 kg.



## SHELTER AND WEATHER

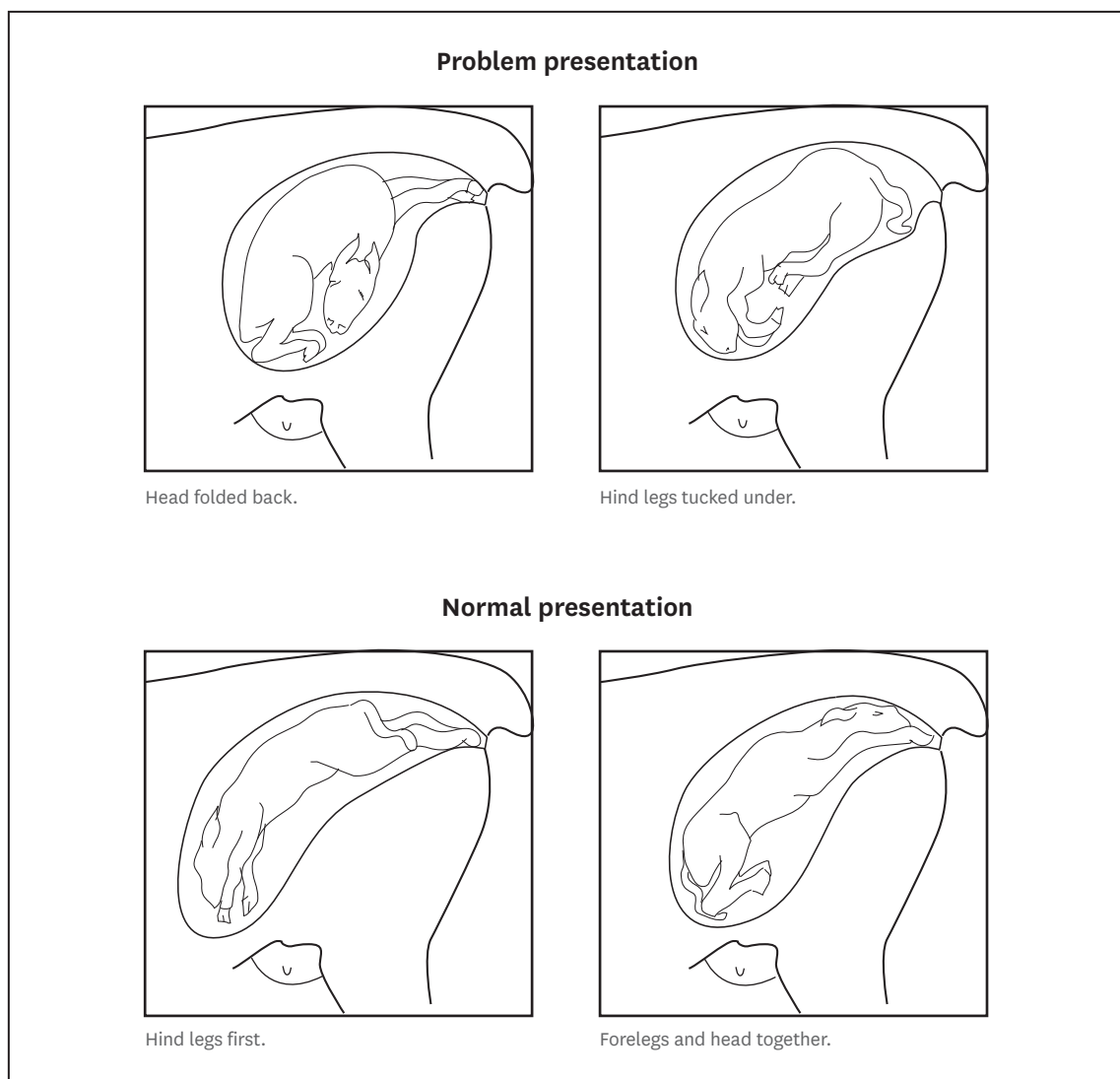
Where possible easier, more gently sloping land with shelter is used for lambing. In steep paddocks, twins can more easily get mismothered and bad weather can result in lambs losing body heat. This reduces the suckling drive. Suckling soon after birth is important as antibodies in the colostrum (milk formed in first few days that is rich in protein and antibodies) are absorbed in the first 12 hours.

Smaller lambs lose heat more rapidly and exposure deaths are more common in twins or where birth weights are low.

Ewes should not be disturbed from their lambing site so that bonding between the ewe and her lambs can take place. This results in less mismothering.

### DIFFICULT BIRTHS

Difficult births or 'dystocia' are caused by a pelvic opening too small for the size of the lamb (especially large single lambs), or the lamb being positioned incorrectly. The illustrations show how some problems can occur.



## ESTABLISHMENT OF AN AGRICULTURAL PRODUCT

2C

1.
  - a. Choose a common mature ram:ewe ratio for mating from 1:50, 1:100, 1:300.
  - b. Comment on the statement 'using quality rams can increase production'.
  
2.
  - a. For how many cycles are rams left with the ewes and why is this number appropriate?
  - b. What practice is useful in identifying when ewes have been tupped?  
In what other ways is this useful?
  
3. Levels of feeding are important throughout pregnancy.
  - a. In early pregnancy, how large are the demands of the foetus?
  - b. What effect could severe underfeeding in early pregnancy cause?
  - c. What condition could be brought on by underfeeding in late pregnancy?
  - d. In late pregnancy, what restricts adequate food intake (apart from feed shortage)?
  
4. Lamb deaths are most likely to occur at birth and up to three days old. In single lambs, dystocia is a common cause of death, as is starvation/exposure for twins. What is dystocia and why should it affect singles more than twins?



*Check the answer guide.*



### KEY POINTS

- Markets for lamb include: prime market, including export, store, contract.
- The market chosen will determine the schedule of operations.
- Breed selected will help determine the quantity and quality of lambs produced.
- Factors that affect lamb production before mating are nutrition, light levels and the health of both ewes and rams.
- High ewe liveweight gives a high ovulation rate and therefore a higher lambing percentage.
- Ewe:ram ratio at tupping depends on: breed, age of sheep, condition of both ewes and rams, and environmental conditions.
- Scanning is a useful tool to divide the flock into dry ewes, those carrying multiple lambs and those carrying singles.
- Nutritional requirements of ewes change throughout pregnancy.
- Lambing should be timed to coincide with spring pasture growth.
- Shelter for lambs and ewes in a quiet area improves chances of lamb survival.

## 3 LAMB GROWTH

After birth, lamb growth goes through two phases:

- birth to weaning
- weaning to point of sale, either for slaughter, or as stores (lambs not ready for killing that are sold to other farmers), or for the live meat trade (not a current market but under review).

### **BIRTH TO WEANING**

In the first three to five weeks, milk is the lamb's main diet.

Growth depends on two important factors:

- birth weight
- amount of milk it receives from the ewe.

Ewes do best on high quality legume pasture, as it is rich in protein which helps milk production and subsequent lamb growth. The breed of ewe also has an effect on the level of milk production.

Lambs start nibbling grass when they are two to three weeks old. When ewes reach their peak of lactation, at about three weeks after lamb birth, their lambs are eating increasing amounts of pasture. After this, milk production begins to drop off. By weaning time around 12 weeks, half the lamb's food intake can be grass. A good growth rate for lambs before weaning is 300 g per day but 500 g/day is possible.

Lambs eat more grass as they age and develop into a full ruminant. Twins will eat pasture earlier than single lambs.

### **WEANING**

As ewe milk production declines and pasture becomes the major food intake for lambs, there is grazing competition between ewes and lambs. Pasture quality can also begin to decline at this stage and lambs require high quality for growth. To reduce competition lambs are weaned, that is, they are removed from the ewes and no longer have milk as part of their diet. The lambs and ewes then feed on different pastures.

Weaning lambs allows the grower to reduce the feed for the ewes and increase the feed volume and quality for the growing lambs.

If ewes are in poor condition, lambs can be weaned earlier to remove the competition between the ewes and lambs. This allows the ewes to gain weight and get back into condition before any adverse summer feed conditions caused by drought.

The time of weaning can vary from 8–16 weeks after birth, but actual timing is dependent on:

- amount of feed available
- ewe weight (condition)
- lamb condition
- competition between lambs and ewes for feed
- desired growth rate of the lambs (they may still grow faster on the ewe).

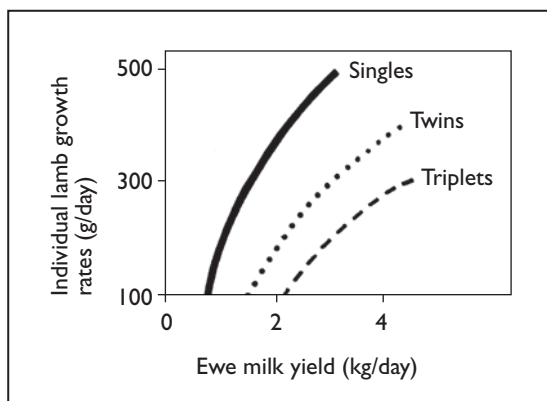
Lambs can be weaned early, if a high quality legume pasture or forage crop is available and lambs have reached a liveweight of about 16 kg. However this is to be avoided, unless heading into a drought. Target weights are about 25 kg.

Weaning can cause a check in lamb growth rates. When growth rates are high, lambs can achieve killable weights before weaning.

The timing of weaning should be aimed at slaughtering as many as possible as milk lambs (just off the ewe). Once weaned, their yield (carcass weight in proportion to liveweight) drops and they are less likely than an unweaned lamb to achieve a liveweight gain of 200 g per day. Costs, such as drenching and dipping, are also kept low if lambs are slaughtered early as milk lambs.

3A

1. In the three to five weeks after birth, what are the two factors that affect lamb growth?
2. What sort of pasture should ewes feed on and why?
3. When do lambs start nibbling pasture and at what stage is their diet approximately half milk and half grass?
4. What is a good growth rate for lambs before weaning?
5. Study the graph below to answer questions a and b.



Milk yield and lamb growth relationship.

- a. What effect do number of births per ewe have on ewe milk yield?
- b. How are individual lamb growth rates affected by the number of lambs born and surviving to each ewe?

## LAMB GROWTH

6. a. What is weaning?
- b. Why is it necessary?
- c. When does weaning take place?
- d. Weaning can cause a check in growth rates. Use the table to answer the question below it.

### Early and late weaning effects on lamb weight on hill country lambs

Date of weaning	Lamb weight (kg)		
	Nov	Dec	Jan
November (10 weeks)	19.3	23.8	26.9
December (14 weeks)	19.3	24.6	27.9

Which time of weaning (10 weeks or 14 weeks) most affects lamb growth rates? Support your answer with figures from the table.



*Check the answer guide.*

## PASTURE AND LAMB GROWTH

After weaning, lambs are dependent on pasture as their main food source.

### LAMB FEED REQUIREMENTS

The amount of food energy an animal needs, so that it is neither gaining nor losing weight, is called maintenance. Food energy above maintenance is changed into fat or protein for growth.

As their liveweight increases, lambs become less efficient at growing. In other words, they need more food energy to gain the same amount of weight each day because they require more energy for maintenance as body size increases.

The sex of the lamb also affects growth rates. Ram lambs, on average, have a 15 per cent higher growth rate than ewes and they grow differently as they lay down less fat, and more protein and water than ewes.

### PASTURE FOR LAMB GROWTH

For growth, lambs need to get energy and protein from pasture. The ideal pasture is one that provides high energy (from the grasses in the pasture) and high protein (from the legumes, usually clover, in the pasture). The higher the protein value in the pasture, the more muscle (meat) a lamb will develop.

The more dry matter (DM) energy (metabolisable energy/ME) that can be used by the lambs, the faster the growth rate.

Here are some examples:

- In summer, dry stalky pasture contains a high percentage of DM (28 per cent) but its ME concentration value is only 8. This pasture contains only 10 per cent crude protein so its quality is very low and, overall, is poor feed for growing lambs on. Lambs/sheep can eat about 4.5 per cent–5.5 per cent of body weight a day. They couldn't eat enough of this pasture to grow.
- 'Mixed length leafy' is a good quality pasture as it has a very high protein value (25 per cent) and the DM (15 per cent) has a high ME concentration (11 per cent).

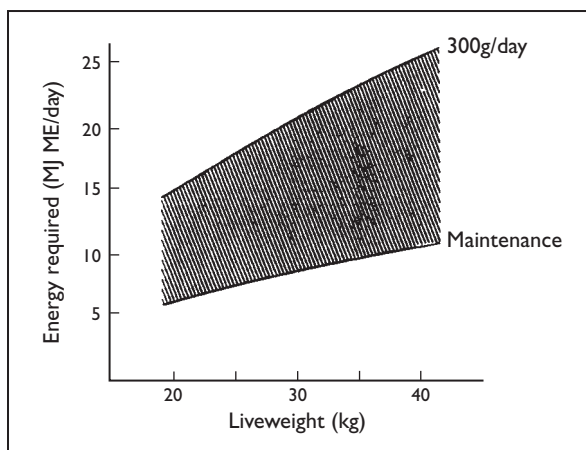
### PASTURE MANAGEMENT

Short, leafy pastures are best for raising lambs on. To achieve this:

- the lambs graze with other stock, such as cattle, that will eat the longer, poorer quality feed
- or the lambs graze by themselves, then other classes of stock (such as cattle or older sheep) are moved in to graze off any longer grass. When the paddock recovers to the short leafy stage, it is ready for the next rotation of lambs.

3B

1. What does the term 'maintenance' mean?
2. How does the sex of the lamb affect its growth?



3. Use the graph below to answer questions a to g.
  - a For a lamb at 20 kg liveweight, what is the energy requirement for maintenance? Give your answer in MJ ME/day (MJ measures the energy in megajoules).
  - b For a lamb at 20 kg liveweight, what is the energy requirement for a growth rate of 300 g/day excluding maintenance? (Give your answer in MJ ME/day.)
  - c For a lamb at 20 kg liveweight, what is its total energy requirement, including maintenance, if it is to achieve a growth rate of 300 g/day?

## LAMB GROWTH

- d. For a lamb at 35 kg liveweight, what is the energy requirement for maintenance? (Give your answer in MJ ME/day.)
- e. For a lamb at 35 kg liveweight, what is the energy requirement for a growth rate of 300 g/day excluding maintenance? (Give your answer in MJ ME/day.)
- f. For a lamb at 35 kg liveweight, what is its total energy requirement, including maintenance, if it is to achieve a growth rate of 300 g/day?
- g. From your answers to the above questions, what effect does increasing liveweight have on the energy requirements of a lamb?

4. Use the following table to answer questions a and b.

<b>Feed</b>	<b>% DM</b>	<b>% ME concentration</b>	<b>% Crude protein</b>
Pasture: Ryegrass/White clover			
mixed length leafy	15	11	25
spring, short leafy	15	11.8	24
spring, mixed	15	11.2	20
spring, rank	18	10.3	15
summer, leafy	18–20	10.5	15
summer, dry stalky	28	8	10
autumn, leafy	15	10.8	25
winter, autumn saved	17	10	20
winter, leafy	14	11.2	26

- a. Which of the spring pastures would be the best for feeding lambs on? Explain why.
- b. Which of the spring pastures would be the worst for feeding lambs on? Explain why.

5. How do farmers keep pastures short and leafy?



Check the answer guide.

## ALTERNATIVE FEEDS FOR LAMBS

When there are feed shortages, farmers can use forage crops to increase lamb growth. Brassicas such as kale, turnips, and swede can be used when grass pasture yield and quality are low. They are often used to finish lambs in summer because the quality is higher than that of many summer pastures.

The brassicas should be mature before they are fed to stock to prevent nitrate toxicity. They also need to be added to the diet gradually so the rumen has time to adjust to the new food. This helps to achieve high growth rates more quickly. Mixed feeding of hay and brassicas can also give high growth rates, as can other alternatives such as chicory and sulla.

## LAMB HEALTH

Lambs need quality feed and good health to grow quickly from birth to harvest. The main inputs to keep lambs healthy are:

- some aspects of docking
- parasite control
- disease control
- providing safe/clean pasture.

## DOCKING



Watch the DVD on Lamb production, AGS305DV.

‘Docking’ describes four operations on lambs. These are:

- removing tails or tailing
- marking their ears to identify them
- castrating male lambs so that they cannot breed
- vaccinating.

Docking should be done when lambs are small, about three weeks old, because the stress of docking on bigger lambs is more severe and the check on growth is greater.

Lambs are docked in paddocks because the ground is cleaner than dusty or muddy yards. The risk of infection through wounds made on the lambs is higher in yards. At three weeks old, they are also difficult to muster so the job is easier done in the paddock.

Each lamb is caught and either positioned on a board mounted on a fence post, or placed in a docking cradle.

## LAMB GROWTH

### TAILING

The tail is removed to:

- prevent build-up of dags (droppings) that make the wool dirty
- prevent flystrike (where flies lay eggs that develop into maggots which feed on the lamb's flesh)
- make the animals easier to manage at shearing.

By putting a rubber ring around the tail, the circulation of blood is stopped. This causes the tail to drop off later. Some farmers prefer to cut off the tail with a knife, or burn it off with a hot iron that seals the wound.



Tailing by rubber ring method.

### MARKING

Marking is where a piece of the lamb's ear is removed with a cutting punch. The ear marks can identify lamb ownership, sex and age. Left or right ear usually defines sex. Ear tags can be used too.

### CASTRATING

Castrating is removing or destroying the testicles of male lambs. It is important when ram lambs may be on the farm at tupping time and could cause unwanted matings. The testicles can be cut out with a knife, or dealt with by putting a rubber ring around them – they will fall off later. Castrated male lambs are called wethers.

### NON-CASTRATION

Most male lambs are tailed and castrated to make management easier, but leaving ram lambs entire can have advantages such as:

- faster growth than either wethers or ewe lambs
- carcasses that have more meat and less fat.

Cryptorchids are ram lambs who have had their testes moved back into the body cavity or held against the body wall by shortening the scrotum with a rubber ring. Body heat prevents testicle development so that the body growth and conformation of cryptorchids are part way between wethers and rams.

Raising cryptorchids has several advantages.

- With 25 per cent less fat than wethers, cryptorchid lambs can be grown to higher weights without excess fat.
- Castration can be avoided and this opens up the market opportunity of the live sheep trade. For this market, heavy weight, entire (non-castrated) sheep with tails are exported for Middle Eastern festivals.
- They grow like ram lambs, are infertile, and stay clean around the breech because they don't have a purse for the dung to stick to.



**VACCINATING**

Lambs get antibodies from ewes' milk for the diseases ewes have been vaccinated against, such as blood poisoning.

At docking, lambs are given an injection containing several antibodies to give them active immunity to a number of diseases. The most common of these diseases are blood poisoning, tetanus, pulpy kidney and black leg. All of these diseases can be fatal to lambs. The injection is given in a part of the lamb that will not blemish the carcass. Alternatively, the ewe can be vaccinated for these diseases late in pregnancy and this allows the lamb to gain protection as it drinks the colostrum.

3C

1. What are four things usually done at docking time?
2. What is the advantage of docking lambs when they are small?
3. Give one reason why it is better to carry out docking in a paddock rather than in yards.
4.
  - a. Give two reasons why tailing is done.
  - b. Briefly explain two ways that tailing can be done.
5. What is ear marking and why is it done?
6.
  - a. What is castrating?
  - b. Why is castrating done?
  - c. Briefly explain two ways of castrating male lambs.
  - d. What are castrated male lambs called?
7.
  - a. Name three diseases that lambs are often vaccinated against.
  - b. Where in the lamb should the injection containing the vaccines be given?

## LAMB GROWTH

8. a. What are two advantages of leaving ram lambs entire (non-castrated)?  
b. What are cryptorchids?  
c. Use the table below to answer this question:  
How does the GR (fat) measurement of cryptorchids compare with the GR of rams (entire) and ewes/wethers?

### GR measurement adjusted for carcass weight for ewe, wether, cryptorchid and ram lambs

Ewes/wethers	Cryptorchids	Rams
<b>GR (mm) adjusted to 16 kg CCW (cold carcass weight)</b>		
11.0	8.7	8.4
11.0	8.7	8.4
10.5	8.3	8.0
9.6	7.6	7.3
11.0	8.7	8.4

- d. What is one advantage of raising cryptorchids?



*Check the answer guide.*

## IMPROVING HEALTH

Apart from feed, the main manipulation to achieve suitable killable weights and grades is to improve lamb health. This will increase growth rates and carcass quality. Lamb health can be improved through:

- drenching
- external parasite control
- facial eczema control
- ryegrass staggers control
- preventing mineral deficiencies.

## PARASITES

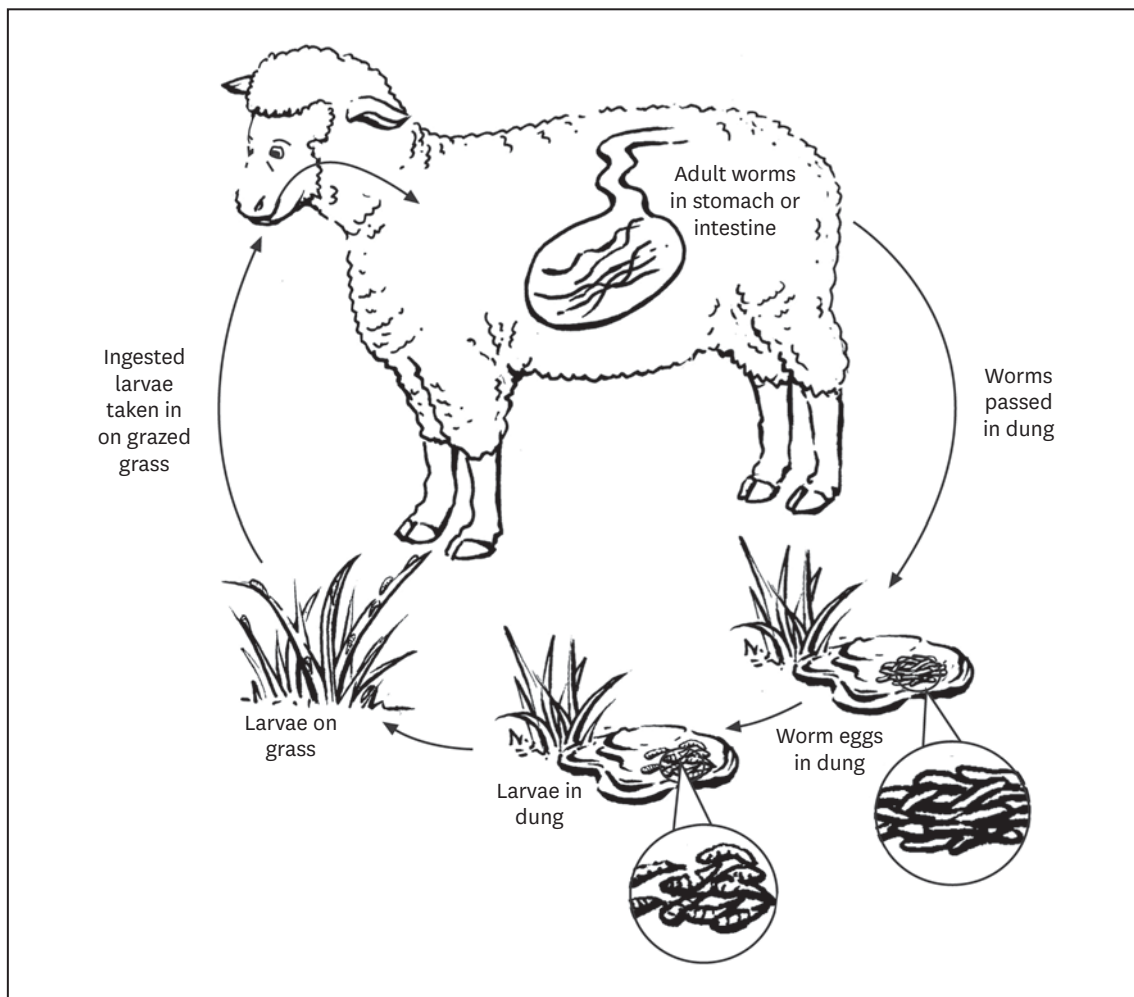
Some kinds of parasites live inside lambs (internal parasites), other kinds of parasites live on the outside of the skin (external parasites). Parasites, both internal and external, reduce productivity on sheep farms.

### INTERNAL PARASITES

There are several types of internal parasites but the most economically important are roundworms. Roundworms are found in the abomasum (stomach) and small intestine of lambs. The host (lamb) reacts to the presence of the parasite in the gut. This causes the disease and reduces the lamb's growth. Signs of infection include reduced growth, reduced appetite, weight loss and diarrhoea/scouring. Scouring is a symptom of an allergic reaction caused by the presence of the parasite.

### HOW LAMBS GET INFECTED

Worm larvae are picked up during grazing. In the gut, the larvae develop into adults. The adults lay eggs, which pass out in the faeces (dung). These stages are shown in the following diagram.



## LAMB GROWTH

The percentage of eggs that develop into infective larvae depends on weather conditions. In dry conditions, less than 1 per cent of eggs develop but in the moist, warm conditions of spring and autumn, more than 10 per cent of eggs may develop.

### **ROUNDWORM CONTROL**

Controlling roundworm parasites involves drenching, pasture/grazing control and checking drench effectiveness.

Drenching (giving a chemical through the mouth to kill worms in the gut) begins at weaning and is done at 21–28 day intervals. The number of eggs in faeces and larvae in pasture are reduced.

To provide lambs with pasture that is relatively free of eggs and infective larvae they can be put on:

- pasture that has been grazed by cattle
- forage crops.

In the past, regular drenching gave production gains. However, some worm populations are now showing resistance to one or more of the drench types commonly used. Drench types need to be used correctly and withholding periods observed. Lambs should be removed onto clean pasture after drenching. This includes pasture that has not been grazed for some time, new pasture or a forage crop.

How often adult sheep are drenched depends on faecal egg counts. Drenching is done once egg counts get to 300 eggs/g.

### **EXTERNAL PARASITES**

Dipping is carried out to control sucking and biting lice and other pests which reduce wool quantity and quality, and damage skins.

Blowflies are a pest as they ‘blow’ (lay their eggs) on sheep. The blowflies are attracted by the smell of wet urine and faeces-stained wool. When the eggs hatch, the maggots feed on skin and flesh. This is called ‘flystrike’.

Production losses occur because flystrike can:

- cause animals to lose weight rapidly
- cause wool wastage
- cause pelt damage
- kill a sheep within three to four days.

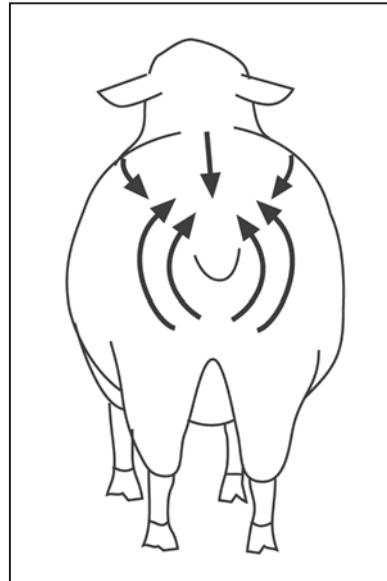
It is a debilitating disease and a serious animal welfare issue.

### EXTERNAL PARASITE CONTROL

These are controlled by applying insecticides as:

- dips and showers
- pour-ons and sprayers
- jetting or spraying with hand guns onto selected parts of the body.

In all systems, the shorter the wool, the easier it is to wet the sheep. Where sheep are flystruck, the wool around the affected area is clipped or shorn and the insecticide liberally applied. The picture shows the main sites to spray for blowfly.



Blowfly control application sites.

### FUNGAL DISEASES

Two other important diseases found in pasture, other than worm larvae, are facial eczema and ryegrass staggers.

#### FACIAL ECZEMA

In late summer and autumn, dead litter (leaves and stalks) builds up in the base of the pasture. In warm (days over 20 °C and nights over 14 °C), humid conditions, a fungus grows rapidly on the litter. The fungus produces a toxin called sporidesmin, which causes liver injury and photosensitivity in sheep. The common name for this condition in sheep is facial eczema.

#### FACIAL ECZEMA CONTROL

Warm, humid conditions favour spore production and this can be followed by an outbreak of facial eczema. Farmers can identify danger areas by spore counting. To reduce the amount of spores that lambs take in with their diet and prevent the disease, farmers can:

- change grazing management and use safe paddocks
- spray pasture with fungicides
- dose lambs with zinc salts
- add zinc salts to troughs or feed.

The ultimate control of facial eczema will be to breed animals with genetic resistance to the disease. Resistance is highly heritable and there is wide variation in breeds and individual sheep.

### RYEGRASS STAGGERS

In late summer, an endophyte fungus that grows inside ryegrass produces toxins. These toxins cause a nervous disease in sheep called ryegrass staggers. The staggers not only cause reduced growth rates but, with the resulting lack of coordination, may make farm activities such as stock movement, drenching and drafting impossible.

### RYEGRASS STAGGERS CONTROL

Farmers can reduce ryegrass endophyte on their farm through pasture management. In summer and autumn, animals should not graze the bottom two centimetres of pasture, seed heads and stem.

New pastures species now have an endophyte that gives pest resistance but does not cause staggers, for example ARI.

Grazing clean pastures allows animals to metabolise fungal toxins and recover.

Other pasture types can be used, such as Italian and hybrid ryegrasses, or tall fescue, chicory or any non-ryegrass species that don't have endophyte problems. Having these types of pastures on a part of the farm allows farmers to graze susceptible animals on clean pasture at critical times.



1. a. How do lambs get infected with roundworms?
- b. Use information from the session and from the table below to answer this question.

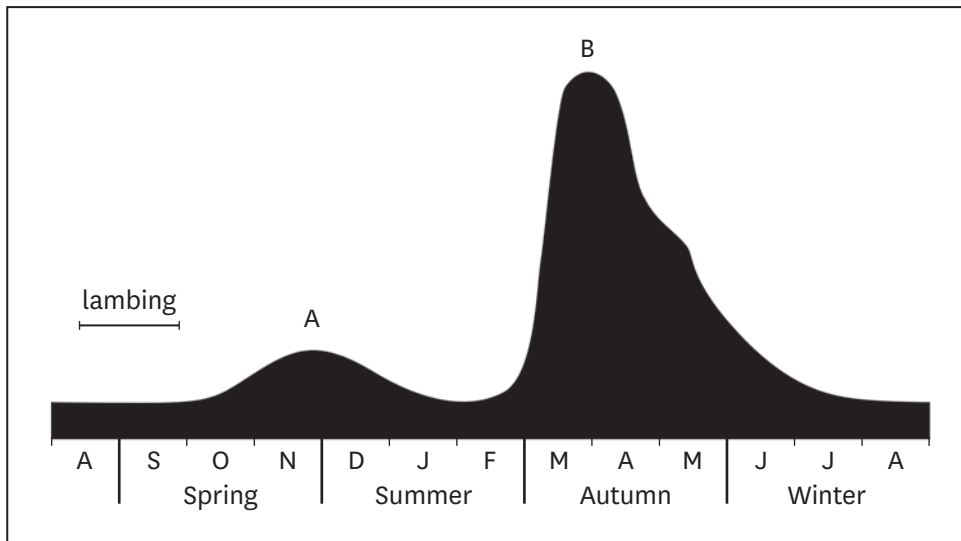
This table shows the effect of roundworm infection on lambs. Both groups of lambs were fully fed. Protein deposition is a measure of the amount of muscle development in the lambs.

Physical attribute	Worm-free lambs	Infected lambs
Liveweight gain (%)	100	48
Fat deposition (%)	100	58
Protein deposition (%)	100	49

What effects do roundworms have on lamb growth?

- c. How do you know if lambs are infected with roundworms?

2. Look at the graph below which shows the seasonal pattern of infective larvae on pasture. Explain the reason for the two peaks (A and B) in the graph.

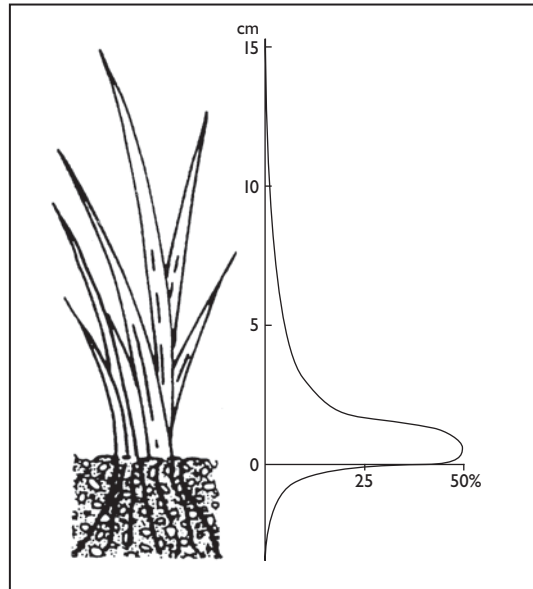


3. Roundworm control is often a combination of drenching and pasture/grazing management.
- How does drenching control roundworms?
  - Why is the correct use of drench types needed?
4. How can you provide fresh pasture with low levels of infective larvae?

## LAMB GROWTH

5. Study the graph below.

**The vertical distribution of infective larvae on herbage**



From the information in the graph, what sort of grazing management would you recommend? Choose from either **A** – close grazing below 4 cm or **B** – leafy grazing between 4 and 8 cm. Explain your choice.

6. a. What is 'flystrike'?  
b. List four production losses that can be caused by flystrike.
7. What is safe pasture?
8. a. What causes facial eczema?  
b. When is facial eczema most prevalent?
9. What causes ryegrass staggers?



*Check the answer guide.*

## MONITORING GROWTH RATES

Growth rates can be monitored by regularly weighing samples of the lamb crop. This is usually done at drenching time (about every three weeks). Their weight grade as a carcass can then be estimated. To increase growth rates, factors such as stock health and feed management can be manipulated. Planning for ways to increase the growth rates of next season's lambs, such as choice of breed, pasture composition and leaving rams entire, can also begin.



## USING DIFFERENT PLANT SPECIES FOR FEED

It is not only the amount and quality of feed that affects growth rates. The species present also has an effect.

For example:

- Hybrid ryegrass such as 'Galaxy' and 'Maverick Gold' are produced by plant breeders by crossing annual or short-rotation ryegrass with perennial ryegrass. These varieties are used in summer wet areas where Argentine stem weevil is not a problem. These grasses are long-lasting and give good winter feed production. 'Maverick Gold' does not contain endophyte and 'Galaxy' has good disease resistance.
- Impact ryegrass with Plus AR1 endophyte is ideal for finishing lambs in the autumn. This combination provides fast growing pasture with good winter growth and feed quality.

The trialling and use of new cultivars continue to be developed, not only of grasses and clovers but of other plants, such as chicory.

Chicory is a leafy tap-rooted herb which produces high quality summer feed. It also has a high mineral content compared to ryegrass and clover.

Other supplementary feeds that can increase lamb growth rates include lucerne, turnips, rape, chou moullier and non-endophyte ryegrass. All of these improve lamb quality through better health because ryegrass staggers are avoided. (The endophyte fungus causing the disease is absent in the plants listed here.)

3E

1. List four manipulations that may increase yield, quality and market opportunities.
2. Suppose you want all your lambs drafted off the farm in the next two months (60 days). Weighing has shown that liveweight (LW) is increasing at 180 g/day.
  - a. When is this weighing usually done?
  - b. If their average LW is 30 kg at the present time, what will their LW be in 60 days time?
  - c. If carcass weight is 40 per cent of LW, what would their carcass weight be in 60 days?
  - d. If the growth rate had been increasing at 200 g/day, what would the LW be in 60 days?
  - e. If the growth rate had been increasing at 200 g/day, what would the carcass weight be in 60 days?
3. If you wanted to increase your lamb growth rates what might you be able to do:
  - a. This season?
  - b. Next season?
4. a. Read the article below, which shows how manipulation of feed composition can affect carrying capacity, growth rates and returns. Then draw up a table with the headings as shown and complete it using information from the article. The first pasture type is done for you as an example.

**More grass = more cash!**

THE HIGH costs of recovery support new species of pasture being trialled by AgResearch at Gore. These trials have shown pasture renewal is a big plus for the New Zealand farmer.

Returns from extra lamb growth between \$250 and \$770 have made it possible to recover the renewal costs in the first season. This is a spectacular cost recovery of between \$350 and \$600 per hectare and makes the exercise well worthwhile.

AgResearch Gore has undertaken research into liveweight gains over the last two seasons on a wide range of pasture types. Among these were old pastures which had a high level of browntop and dogstail. Research was also conducted into traditional ryegrass/white clover mixes with new grass such as tall fescue, and new type pastures with 20 per cent chicory mix with white and red clover.

According to David Stevens of AgResearch Gore, the trials at Riversdale and Gore Station revealed the lamb weight gains per animal and per hectare over a period of 100 days.

The trials also calculated the return per hectare over the same period.

Pastures of browntop/dogstail had a stocking rate of 20 lambs per hectare. The daily liveweight gain per lamb was 100 g. This was a total carcass per hectare increase of 75 kg. At \$2 per kg this pasture returned \$150.

With the improvement of pasture quality, stocking rates increased. This was most notable with the new species which were very summer active. The stocking rate with the ryegrass/white clover pastures was 25 lambs per hectare, achieving a daily liveweight gain of 185 g.

Over the 100 day period of the trial there was a carcass weight gain of 200 kg per hectare and a return of \$400 per hectare.

David Stevens says pastures were managed during the trial to ensure the best possible results. Browntop pastures were topped more than once to hold condition. The ryegrass/white clover needed only one topping.

Tall fescue, which is a new grass species, had been introduced into pastures and had brought a lift in daily liveweight gain of 215 g. The stocking rate with this species was 25 lambs per hectare. Total carcass gains were 230 kg per hectare and the 100 day return per hectare was \$460.

There were significant gains when chicory was mixed in as 20 % of the pasture mix. In those cases the daily weight gain was 260 g with a stocking rate of 30 lambs per hectare. Total carcass gain was 330 kg per hectare, returning \$660 per hectare for 100 days.

A specialist pasture made up of red and white clover mixed with 40 per cent chicory saw daily lamb weights of 280 g being recorded. This trial was conducted with 35 lambs per hectare giving a total carcass gain of 460 kg per hectare. The return over the 100 day period of the trial was \$920 per hectare.

David Stevens warned that the farming industry must realise, however, that chicory was of a short duration. Where a pasture mix was used with grass, the clover often took over from the chicory and promoted a good perennial pasture.

There has been vigorous growth of chicory in Southland over the last seven years but in other places, such as South Otago, it had lasted only one or two years.

The trials also revealed the fertiliser costs were about the same for all pastures. Superphosphate fed the clovers, which fed the grasses. It was also demonstrated that topping retarded the browntop and allowed the clovers to advance.

Table showing effect of different pasture species

Pasture type	Stocking rate (lambs per hectare)	Daily LW gain (g/lamb)	Carcass weight gain (kg/hectare)	Return (\$/hectare)
Browntop/ dogstail	20	100	75	150

- b. In addition to the favourable features of chicory shown in the table you have just completed, describe some of the other features of this plant.
5. a. Name some other plants or crops that can be used as supplementary feed for lambs.  
b. What advantage do other feeds have over endophyte ryegrass?



Check the answer guide.

## PREVENTING MINERAL DEFICIENCIES

Lambs get their minerals from the pasture they eat. However, there are four minerals or elements that lambs need in tiny amounts that plants do not need for healthy growth. These are the trace elements of cobalt, copper, molybdenum and selenium. These may not be present in some New Zealand soils.

Selenium is particularly important to lambs as it:

- prevents white muscle disease (which damages body and heart muscle)
- maintains disease resistance
- increases growth rates on soils like pumice.

It can be added to the soil as selenium prills.

The amount of selenium that is available in pasture plants can be reduced by:

- high rainfall, especially in spring
- acid pH of soil
- legume dominant pastures, which are lower in selenium than grasses.

Cobalt, copper and molybdenum are usually added to fertilisers before they are put onto the soil. Selenium is needed in very small amounts (for instance 1–2 mg for one-month-old lambs) and in excess it is toxic, so it is usually supplied as a drench or as an additive to a worm drench.

## LAMB GROWTH

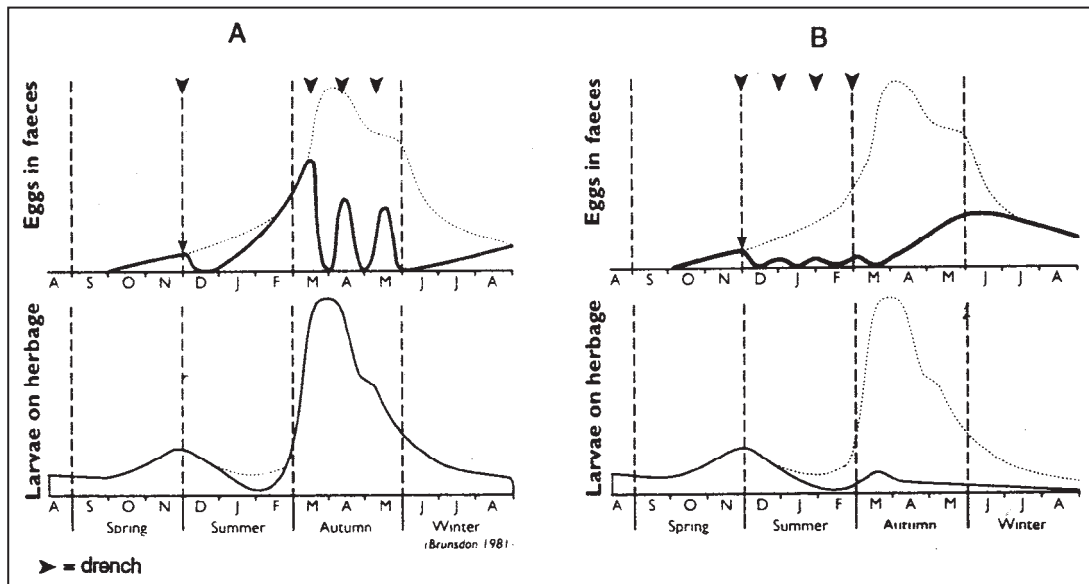
3F

1. Drenching can reduce the worm burden in lambs and it also kills eggs so that fewer larvae contaminate pasture. However, a correct drenching programme is important.

The two graphs on the left below show the effect of one drench at weaning and three drenches given monthly in the autumn (programme A).

The two graphs on the right show the effect of one drench at weaning and regular drenching at monthly intervals after weaning (programme B).

On all four graphs the dotted graph lines show egg and larvae numbers if no drenching was carried out.



Which drenching programme, A or B, is more effective? Explain why.

2. List three ways of applying insecticides to control external parasites.
3. a. When facial eczema spore counts are high, what can farmers do to reduce the effects of the spore toxin called sporidesmin?  
b. How likely is it that facial eczema could be controlled by breeding animals with genetic resistance to the disease? Explain your answer.

## 4. Read the extract below on ryegrass staggers.

Farmers can however reduce the impact of ryegrass endophyte on their farm. Pastures can be managed in summer and autumn to avoid grazing the bottom two centimetres of pasture, and seed heads and stem.

New pastures can be sown in perennial ryegrasses with no endophyte, but these will not persist well where Argentine stem weevil is a problem. Other pasture types that can be used include Italian and

hybrid ryegrasses, or tall fescue, chicory or any non-ryegrass species. Having these pastures on a part of the farm enables farmers to graze susceptible animals on safe pasture at critical times.

There is a lot more to learn about endophytes, and ongoing research at AgResearch is developing better solutions for the future.

*Animal Health*, September 22, 1993

- a. Many farmers have endophyte ryegrass pastures. What management practices can they use to reduce the incidence of ryegrass staggers?
  - b. If farmers are sowing new pastures, what species could they use and under what conditions to provide safe pasture at critical times?
5. a. What are the four trace elements, not always present in New Zealand soils and plants, that lambs need in their diet? How are they added to the lamb's diet?
- b. Why is selenium particularly important to lambs and what are two conditions that may reduce its availability in pasture plants?



Check the answer guide.

Refer to insert AGS305B, *An example of a schedule of operations for the production of lamb meat.*

### KEY POINTS

#### Lamb growth

- First diet is colostrum and then milk.
- Begin to eat pasture at 2–3 weeks.
- At weaning, move onto an all pasture diet.
- Weaning time depends on: feed available, ewe and lamb condition.
- Weaning can slow down lamb growth.
- Lambs can be slaughtered as milk lambs.
- Need a feed level above maintenance to maintain growth.
- Growth rate depends on age, sex and nutrition of the lamb.
- Pasture should be high in protein – contain legumes.
- Growth can be increased by forage crops, such as brassicas.
- Have increased growth rates when healthy. This involves pest and disease control, safe pasture and docking.
- Docking includes: tailing, marking, castrating and vaccinating.
- Growth rates can be manipulated by: not docking, monitoring growth rates to help with feed management decisions, using different pasture species, maintaining good health.

## 4 HARVESTING LAMB

As lambs grow, farmers need to decide when to sell and to which market, and then prepare them ready for sale.

### WHEN TO SELL

This will depend on:

- availability of feed
- condition of the lambs
- what the market returns are.

These factors will determine whether to sell the lambs early at lighter weights, to the freezing works or to other growers as stores, or later at heavier weights.

### CHOICE OF MARKET

Decisions made during the establishment and growth stages in the production of lambs affect the harvest of lambs. For example, timing of lambing and docking.

Rearing lambs is a financial risk, because market prices can change during the production process. Farmers need to constantly re-evaluate possible market opportunities during production. Part of this process involves keeping up-to-date with movement of market prices. Most farmers time lambing and rate of growth to hit a target weight on a particular date for a particular market.

Choosing a market is usually done well before mating. However, farmers do have alternatives if the market returns shift during production. Some examples are:

1. If there is good pasture growth in an area near where the lambs are grown, then the decision may be made to sell the lambs on the store market. However, if there is good pasture growth where they are being raised, they may be kept to gain weight before being sold.
2. If the lambs were kept entire at docking to sell as Hajj lambs, but the Hajj lamb price falls in the meantime to become unprofitable, they may then be sold for processing. In this case, the farmer gets less money because the lambs are entire.

Note: Live lamb exports (Hajj market) to the Middle East are not happening at present, due to animal welfare concerns.

## HARVESTING LAMB

4A

- Identify the three main factors that determine when lambs will be sold.
- Name the two market opportunities available if lambs are sold early at a lighter weight.
- By harvest time, your choice of markets will be limited by some of the decisions taken in the establishment and growth stages. Give one example.
- What is the relationship between ewe weight at mating and the percentage of lambs weaned?
- If the summer/autumn was very dry, why might you decide to delay flushing?
- There is wide variability in production both within and between breeds. What biological phenomenon gives cross-breeding a possible advantage?
- From the following Table A use figures to do the following.
  - Show the most productive breed in this trial.
  - Does this breed show superiority as sire, dam or both?

**Table A**

Ewe breeds: mean figures for weaning weight, pre-slaughter weight and carcass weight				
Dam breed (sire-dam)	Number of animals	WW (kg)	PSLW (kg)	CSSW (kg)
RR	81	25.8	32.7	14.7
RC	192	24.5	33.2	15.0
RD	130	26.1	34.7	16.0
CC	137	24.4	32.8	14.7
CR	236	24.4	32.9	14.9
CD	154	26.8	35.4	16.4
DD	96	28.9	36.7	17.4
DR	182	26.4	34.5	15.9
DC	247	26.3	34.7	16.1

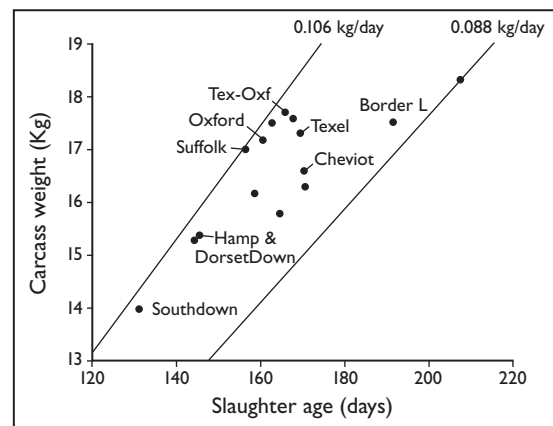
Note: R = Romney; C = Corriedale; D = Dorset

Note: WW = weaning weight

CSSW = carcass weight

PSLW = pre-slaughter weaning weight

**Figure B**



- The relationship between size, weight and fat levels is important for classifying carcasses.
  - Which breed sire would you choose from Figure B for earliest maturity?
  - Approximately how many days longer did the Oxford take to reach the same fat measurement?
  - How much heavier was the Oxford carcass than the Southdown?
- Which are the two most common ways to sell prime lamb?



10. Lambs sold on the store market may be in demand. What market or other forces could affect price?
11. If mating normally begins in March, how would you go about supplying out-of-season lamb? Give a major factor(s) you would need to consider.



*Check the answer guide.*

### **GETTING LAMBS READY FOR SALE**

There are manipulations at the harvest stage that can affect the yield, quality and profit of the lamb harvest. These can include:

- whether to shear or not
- skill at drafting
- practices that increase carcass quality.

Coordinating the sale or harvest of lambs at the best possible price determines the profitability of an enterprise. Preparing stock for sale is the last time the grower has an input into the lamb production.

### **SHEARING**

Lambswool is a by-product of the lamb meat trade. It can be profitable to shear lambs with longer wool, if the value of the wool is greater than the costs of shearing.

If shearing is profitable, then there are other advantages because shearing:

- stimulates the appetite so that lamb growth is increased
- reduces the risk of dags, stained wool and carcass contamination
- reduces flystrike
- meets the specification for live shipping.

### INCREASING CARCASS QUALITY

Practices that increase carcass quality include:

- keeping lambs clean and healthy
- observing withholding periods for drenches and dips
- allowing time after shearing for wool regrowth and healing of all cuts and bruises
- careful handling of lambs to avoid injury in yards or from dogs
- keeping lambs stress-free; chemical changes due to stress can reduce meat quality by affecting colour, texture or tenderness and keeping ability
- allowing lambs to empty out in yards before going to the works helps to keep the carcasses clean. Some processors pay additional money per head if the lambs are crutched and clean around the belly and breech.

### SKILFUL DRAFTING

Drafting is selecting lambs suitable for slaughter. Using the skill of the person drafting and possibly weighing scales, lines of lambs at target weights and grades can be accurately selected. The person drafting needs to be able to predict the carcass weight and fat cover from the live lambs.

The time the lambs spend being drafted needs to be as short as possible, within 24 hours. Lambs can't feed during drafting so growth can be affected. In the first 12 hours, most weight is lost is due to passing urine and faeces but, after 12 hours weight is lost from the carcass.

### LAMB CARCASS GRADING

Producers are paid according to schedules based on the grading criteria shown below. Prices can change from week to week and from one processor to the next. Premiums are often paid – especially early in the season (spring).

Lambs are graded according to two criteria:

- carcass weight
- fat content – assessed by measuring the fat depth at a specific point on the carcass (GR measurement).

#### Carcass weight range classification

A	≤ 9.0 kg
L	9.0–13.2 kg
M	13.3–17.0 kg
X	17.1–21.2 kg
H	> 21.2 kg

#### Carcass fat depth classification

A	almost no fat cover (light weight)
Y	≤ 7.0 mm fat (low fat content)
P	7.0–12.0 mm fat (medium fat content)
T	12.1–15.0 mm fat (high fat) cut and trimmed prior to export
F	> 15.0 mm fat (excessive fat) cut and trimmed prior to export.

**KEY POINTS**

- When to sell depends on availability of feed, condition of lambs, market returns.
- Lambs can be shorn before they are sold.
- Lambs should be free from injury, stress, dags and dirt, and withholding periods should be observed.
- Lambs should be drafted into groups of similar body weight and condition.

## 5 APPLYING YOUR KNOWLEDGE TO GOATS

In the external examination for Achievement Standard 90652 (Version 2) AHS3.4 you will show your ability to apply your general knowledge of the production process to manipulating a primary product that is unfamiliar to you.

### GOATS

Goats are farmed for their fibre, meat, and pasture improvement and weed control role.

### GRAZING MANAGEMENT

Goats are often grazed with cattle but only graze sheep pastures if they have been spelled for three weeks. Mixed-aged does and wethers (castrated males) are wintered with cattle.

Goats are browsing animals and, therefore, prefer a varied diet containing roughage. This makes them effective at controlling weeds in pastures. Their need for minerals is greater than other ruminants, so their preference for a wide range of plants helps to satisfy this demand.

Goats require taller pasture than sheep to achieve the feed intake needed for high quality fibre and liveweight growth. Goats grazing taller pasture eat fewer internal parasite larvae than when grazing shorter pastures. Once they have eaten 35–50 per cent of available pasture they will be ready for shifting.

Weather conditions can influence goat feeding with both high humidity, high temperature weather and cold wet weather depressing their appetites. Goats, unlike sheep and cattle, don't graze at night.

Goats need plenty of feed in winter to offset their slow rate of fibre growth and lower body fat levels compared with sheep. Low levels of feed intake at kidding and during lactation (milk production) result in increased kid losses through abandonment, doe weight loss and reduced kid weight gain. Large goats, young growing goats, pregnant and lactating goats need greater feed intakes.

### INTERNAL PARASITES

Sheep and goats are infected by most of the same internal parasites, but cattle are infected by different species. Adult sheep develop immunity to internal parasites but goats do not. Immunity in goats is also reduced by stress.

When drenches are given to goats, the level of active ingredient in their blood decreases more rapidly than in sheep, reducing the effectiveness of the treatment. Drench resistance is widespread but can be avoided by correct management of the drenches, such as by weighing animals before drenching to get the correct dosage, or using only when necessary. A quarantine system when introducing new goats into the flock can also be effective in preventing the introduction of drench-resistant strains of parasites.

Drench resistance is the ability of parasites to survive a lethal dose of drench. If less than 95 per cent of parasites are killed by drenching, resistance is said to be present.

Long-term control of internal parasites can be achieved with sound stock management, correct usage of drenches and by monitoring parasite egg numbers in the goat faeces by periodically conducting faecal egg counts.

As a minimum all goats should be drenched and moved to safe pasture:

- just before kidding
- at weaning
- at mating.

Extra drenching may be necessary during autumn if weather conditions are warm and wet.

### **FEET PROBLEMS**

Goats are susceptible to footrot – a smelly, painful bacterial infection between the toes of the foot – and scald, a less severe, non-smelly infection.

Use of footrot-resistant bucks in breeding programmes reduces the amount of footrot in a flock.

## **GOAT MANAGEMENT**

### **MOHAIR GOATS**

On a property in Southland, bucks join the does in early April for mating and remain for six weeks. Kidding begins in early September.

Bucks and does are shorn pre-kidding in July and again in January. They have access to covered yards during the three weeks after shearing. The kids are shorn in mid-February and again as hoggets in August. Surplus does are culled following the summer shearing and prior to mating.

Does receive two Avermectin drenches per year, before mating and after kidding. One lice treatment is also required each autumn. Kids receive a vitamin B12 injection at weaning and drenching at three-week intervals up to May. Goats are brought into the shed at regular intervals, including at shearing, to have their feet checked for scald. Those in need are treated with formalin or zinc sulphate solution. Misshapen hooves are trimmed if necessary.

### **CASHMERE GOATS**

Bucks join the doe flock in early May for six weeks. Kidding starts in early October. Kids begin to eat grass from three weeks old. Kids are weaned in early January, with culled animals slaughtered or sold in May. All goats are shorn six weeks before kidding and then moved onto sheltered areas of the farm or have access to sheds.

Does and kids receive two drenches in January and March, kids have a third drench just before Christmas. Drenches are rotated, or combination drenches are used, to reduce the chance of drench resistance developing. Feet are checked at shearing and at three-month intervals throughout the year as goats are prone to foot problems. Animals prone to footrot or scald are treated and, ultimately, culled from the flock.

## APPLYING YOUR KNOWLEDGE TO GOATS

Breeding programmes have been set up to develop better genetics and improve feet problems such as scald.



- Describe three ways in which goats graze pasture differently to sheep.
- Not all goats in a flock require the same level of feeding. List four factors to take into account when determining a goat's level of feeding.
- Shearing is a time when goats require extra shelter (compared with sheep). Explain why.
- Scald and footrot can be two common problems in a goat flock. Describe how they would affect a goat's normal grazing pattern.
- Outline the strategies a farmer can adopt to treat the occurrence of scald and footrot, and prevent them from recurring.
- Describe one other problem goats often have with their feet.
- Internal parasites are a greater problem in goats than in cattle or sheep. Explain why.
- List four strategies farmers can implement to manage the problem of internal parasites.
- For both mohair and cashmere-producing flocks, identify on a table like the one below when the husbandry operations listed take place.

(Drenching has been completed for you as an example.)

Husbandry operations	Mohair												Cashmere												
	Months																								
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J
Shearing																									
Mating																									
Kidding																									
Drenching of does			X							X			X	X											
Culling low-producing does																									
Checking feet for footrot and scald																									



Your teacher will assess this work.

## 6 TEACHER-MARKED ACTIVITY

### LAMB PRODUCTION

1. What two factors can cross-breeding rapidly effect?
2. Single lambs are more valuable individually than multiple-birth lambs, however, what is the relationship between lambs per ewe and total earnings?
3. On a timeline show the order of events, how long they each take and predict when lambing would occur from the following information.

Ram preparation two months prior to mating, mating occurs in March, ewes flushed one month before mating. Use a timeline like this:



4. In a season lacking feed, you could delay mating but, in normal circumstances, why wouldn't you bring it forward?
5. What is the relationship between ewe weight at mating and the percentage of lambs weaned?
6. List four possible operations carried out at docking and give a reason why each operation is carried out.
7. If a lamb is not castrated, how does this affect each of the following: growth rate, carcass composition and market opportunities?

TEACHER-MARKED ACTIVITY

How AgResearch rates pasture species

1 = poor, 3 = good	Perennial ryegrass	Tall fescue	Chicory	Cocksfoot	Phalaris	White clover	Red clover	Lucerne
Drought survival	1.5	3	3	3	3	2	2	3
Drought growth	1	3	3	3	1	0	1.5	3
Low soil fertility tolerance	1	1	1	3	3	1	1.5	1
Heavy soil tolerance	3	3	2	1	2	3	2	1
Ease of grazing management	3	2	1	3	3	3	2	2
Grass grub tolerance	1	3	3	3	3	1	2	3
Feed value	2	2.5	3	1.5	2.5	3	3	3
Summer growth	1	3	3	3	1	2	2.5	3
Autumn growth	2	2.5	3	3	3	2	2.5	3
Winter growth	2	2	0	1.5	3	1.5	1	0
Spring growth	3	2	3	2.5	2.5	3	2	3
Persistence	3	3	1	3	3	3	1	1
Potential lamb growth (grams/head/day liveweight)	225	260	300	220	220	320	310	310

Ryegrass/white clover pastures are widely used in New Zealand.

8. Choose two positive features of ryegrass for producing prime lambs and explain each choice.
9. Choose two positive features of white clover for producing prime lambs and explain your choice.
10. Give two reasons why a grower would shear lambs three weeks before slaughter.
11. What criteria are used to select lambs for slaughter during drafting?
12. Why is a short drafting time desirable?

Send your diary for Achievement Standard 90649 (AHS 3.1) back to your teacher for checking. Attach the cover sheet AGS305C to your diary.



Your teacher will assess this work.



# 7 ANSWER GUIDE

1A

## 1. THE PRODUCTION PROCESS

1. Establishment, growth, harvest.
2. Environmental, biological, husbandry, management.
3. Examples could be:  
establishment – drilling (sowing) appropriate amount of seed  
growth – applying pesticide spray  
harvest – harvesting at correct moisture level.
4. a. A schedule of operations is the management decision of when to apply husbandry techniques.  
b. A schedule of operations affects yield, quality profitability and market opportunities.
5. a. i. Well-cultivated soil, NPK fertiliser present, soil temperatures suitable, irrigation are examples.  
ii. Seed potatoes sprouted, early maturing cultivar  
iii. Ensure potatoes sprouted before planting, rows spaced, furrows formed, apply fertilisers, ridge soil up, irrigate, apply side dressings, control disease, harvest.  
b. i. Choosing Ilam Hardy. An early crop and better price.  
ii. Choosing to irrigate and apply side dressings.  
iii. Applying preventative spray against fungus attack.
6. a. Sowing  $\xrightarrow{4-6 \text{ weeks}}$  transplanting  $\xrightarrow{7-8 \text{ weeks}}$  harvest.  
b. i. Soft growth can be frost damaged or the crop goes to seed.  
ii. Late maturing reduces returns due to competition with outdoor lettuce.

1B

1. It breaks kiwifruit bud dormancy and replaces winter chilling essential for fruit numbers.
2. a. Early to mid-August.  
b. Results show 30 to 40 days after application.  
c. More floral shoots and flowers are produced.
3. a. To reduce overloading the vine and producing small fruit.  
b. Reducing fruit numbers can let the selected fruit reach the desired size. Smaller fruit are less marketable.
4. Because of the compact flowering period, pollen can be sprayed on to supplement bee pollination.

2A

## 2. ESTABLISHMENT OF AN AGRICULTURAL PRODUCT: LAMB MEAT

1. Reducing light levels.
2. Flushing is increasing feed intake of ewes prior to mating. It increases rate of ovulation.
3.
  - a. There is a direct relationship between feed offered and ovulation rate. More feed – more eggs/ewe.
  - b. Eggs may not be fertilised, embryos may abort, lamb deaths pre and post birth.
  - c. Poor feed conditions affecting ewe weights and reduced flushing effect would be reflected in lower lambing percentage.

2B

1.
  - a. Stress from handling may cause temporary infertility.
  - b. Topping is physically demanding.
  - c. Veterinary checks can test fertility.
2.
  - a. *Brucella ovis* causes epididymitis.
  - b. Reduced lambing percentage.
  - c. Infected ewes abort, or lambs are born dead or weak.
3.
  - a. Four months of age.
  - b. For at least three weeks for immunity to develop from the vaccination.
4.
  - a. No ovulation, topping, non-fertilisation of egg, or death of egg or embryo.
  - b. Stress due to things like shearing, poor nutrition.
5. Lamb protection comes from pre-lamb vaccination of the ewe and protection is transferred by colostrum (first milk) to the lamb.

2C

1.
  - a. 1:100
  - b. A quality ram can contribute to a large number of offspring.
2.
  - a. Two cycles give a reasonable lambing spread.
  - b. Rams wearing harnesses with coloured crayon mark the ewe if tupped. This shows when tupping occurred or if it occurred at all, which helps to identify groups of ewes for lambing, and dry ewes.
3.
  - a. Demand is low in early pregnancy.
  - b. Severe underfeeding could cause embryo death or subsequent low birth weights.
  - c. Pregnancy toxemia or sleepy sickness.
  - d. Gut size is restricted by the expanded uterus.
4. Dystocia is a difficult birth due to the lamb being too large for the pelvic opening.

3A

**3. LAMB GROWTH**

1. In the three to five weeks after birth the two factors that affect lamb growth are the lamb's birth weight and the amount of milk it receives from the ewe.
2. Ewes should feed on high quality legume pasture as it is rich in protein, which helps ewe milk production, and this in turn increases lamb growth.
3. Lambs start nibbling pasture when they are two to three weeks old and by weaning time their diet is about half milk and half grass.
4. A good growth rate for lambs before weaning is 300 g per day.
5.
  - a. The greater the number of births, the higher the ewe's milk yield.
  - b. The more lambs that a ewe suckles, the lower the growth rates of individual lambs. That is, single lambs have the highest growth rates, next are twins and triplets have the lowest growth rates.
6.
  - a. Weaning is removing lambs from their ewes so that they no longer have milk as part of their diet.
  - b. It is necessary because there is grazing competition between ewes and lambs.
  - c. Weaning usually takes place between 10 and 16 weeks after birth because it is dependent on the amount of feed available.
  - d. Weaning at 10 weeks has a greater effect on lamb growth rates than weaning at 14 weeks. This is shown in the table; lambs weaned at 10 weeks weighed 26.9 kg in January whereas lambs weaned at 14 weeks were a kilogram heavier (27.9 kg) in January.

3B

1. Maintenance means the amount of food energy an animal needs so that it is neither gaining nor losing weight.
2. The sex of the lamb affects growth in the following way:
  - Ram lambs on average have a 15 per cent higher growth rate than ewes.
  - Ram lambs grow rather differently in that they lay down less fat and more protein and water than ewes.
3.
  - a. About 6 MJ ME/day
  - b. About 8 MJ ME/day
  - c. About 14 MJ ME/day
  - d. About 9 MJ ME/day
  - e. About 14 MJ ME/day
  - f. About 23 MJ ME/day
  - g. As the liveweight of a lamb increases, its energy requirements also increase.

## ANSWER GUIDE

4. a. The spring pasture that would be best for feeding lambs on is the 'spring, short leafy' because:
  - it has a high protein value (24 per cent) and protein is needed by lambs for muscle (meat) development
  - the dry matter (DM) has a high metabolisable energy (ME) concentration (11.8 per cent) which means that much of the energy in the feed can be used by the lambs.
- b. The spring pasture that would be the worst for feeding lambs on is the 'spring, rank' because:
  - it has a low protein value (15 per cent)
  - the % ME concentration is lower than that of the 'spring, short leafy'.
5. Farmers can keep pastures short and leafy by (any two of):
  - grazing the lambs with other stock, like cattle, that will eat the longer, poorer quality feed
  - grazing the lambs by themselves, then removing them from the paddock and putting in other classes of stock (such as cattle or older sheep) to graze off any longer grass; when the paddock recovers to the short leafy stage it is ready for the next rotation of lambs
  - mechanical topping.

3C

1. Four things usually done at docking time are removing tails, marking lambs' ears to identify them, castrating male lambs so that they cannot breed and vaccinating.
2. The advantage of docking lambs when they are small is that the stress of docking is less severe than on older animals and so the check on their growth rate is less.
3. It is better to carry out docking in a paddock because the ground in a paddock is cleaner than dusty or muddy yards.
4. a. Tailing is done to prevent:
  - build-up of dags (droppings) that make the wool dirty
  - flystrike (where flies lay eggs that develop into maggots which feed on the lamb's flesh).
- b. Tailing can be done by (any two of):
  - putting a rubber ring around it to cut off the circulation of blood
  - cutting it off with a knife
  - burning it off with a hot iron that seals the wound.
5. Ear marking is removing 'bits' of a lamb's ear with a punch. It is done to show things like lamb ownership, sex and age.

6.
  - a. Castrating is removing or destroying the testicles of male lambs.
  - b. Castrating is done on farms where ram lambs may be on the farm at tupping time and could cause unwanted matings.
  - c. Two ways of castrating male lambs are cutting the testicles out with a knife or putting a rubber ring around them.
  - d. Castrated male lambs are called wethers.
7.
  - a. Lambs are often vaccinated against blood poisoning, tetanus, pulpy kidney and black leg.
  - b. The injection should be given in a part of the lamb's body that will not be sold as a quality part of the carcass.
8.
  - a. Advantages of leaving ram lambs entire (non-castrated) are that, compared to wethers and ewes, they grow faster and their carcasses have more meat and less fat.
  - b. Cryptorchids are ram lambs that have had their testes either moved back into the body cavity or held against the body wall (by shortening the scrotum with a rubber ring). (Body heat prevents testicle development so that the body growth and conformation of cryptorchids are part way between wethers and rams.)
  - c. The table shows that the GR (fat) measurement of cryptorchids is considerably lower than that of ewes and wethers and only slightly higher than that of rams.
  - d. One advantages of raising cryptorchids is:
    - Cryptorchid lambs have 25 per cent less fat than wethers so they can be grown to higher weights without excess fat.

3D

1.
  - a. Lambs get infected with roundworms when they eat pasture which has infective larvae on it.
  - b. Roundworms live on food in the lamb's gut and this reduces the lamb's growth. The table shows that liveweight gain is only about half that of worm-free lambs. The worms also lower the amount of fat and protein laid down (deposited) in the lamb's body.
  - c. Signs of infection include: reduced growth, reduced appetite, weight loss and diarrhoea (scouring).
2. Peak A is in late spring and peak B is in the autumn. Both these seasons have the warm, moist weather conditions that favour the development of eggs into infective larvae.

## ANSWER GUIDE

3.
  - a. Drenching is giving a chemical through the mouth to kill worms in the gut.
  - b. Correct use of drench types is needed because some worm populations are showing resistance to one or more of the drench types commonly used.
4. To provide lambs with fresh pasture with low levels of infective larvae you can either put them on pasture that has been grazed by cattle or put them on forage crops.
5. B. Leafy grazing between 4 and 8 cm is recommended because most infective larvae are in the bottom 4 cm of the pasture.
6.
  - a. The eggs of blowflies hatch into maggots. Flystrike is when these maggots feed on the skin and flesh of sheep.
  - b. Four production losses that can be caused by flystrike are:
    - the animals lose weight rapidly
    - wool is wasted
    - pelts are damaged
    - sheep can be killed within three to four days.
7. Safe pasture is pasture that is relatively free from diseases that can affect lamb growth.
8.
  - a. Facial eczema is caused by a fungal toxin called sporidesmin.
  - b. Facial eczema is most prevalent in late summer and autumn in warm, humid conditions.
9. Ryegrass staggers is caused by the toxin of a fungus that grows inside ryegrass.

3E

1. Four manipulations that may increase yield, quality and market opportunities for lamb are:
  - not docking
  - monitoring growth rates
  - using different plant species for feed
  - improving health.
2.
  - a. Weighing samples of lambs is usually done at drenching time (about every three weeks).
  - b. Weighing has shown that liveweight is increasing at 180 g/day, so in 60 days the average lamb weight will increase by  $180 \times 60$  which equals 10,800 g or 10.8 kg. If their average LW at the present time was 30 kg, then in 60 days they will have an average LW of 40.80 kg.
  - c. Carcass weight is 40 per cent of LW, so 40 per cent of 40.80 kg = 16.32 kg.

- d. If the LW had been increasing at 200 g/day, then in 60 days the average lamb weight will increase by  $200 \times 60$ , which equals 12,000 g or 12 kg. If their average LW at the present time was 30 kg, then in 60 days they will have an average LW of 42 kg.
- e. Carcass weight is 40 per cent of LW, so 40 per cent of 42 kg = 16.80 kg.
3. a. If you wanted to increase lamb growth rates this season you might be able to manipulate factors such as stock health and feed management.
- b. If you wanted to increase your lamb growth rates next season you could consider things like a different choice of breed, changing the pasture composition, leaving rams entire.
- 4.

**Table showing effect of different pasture species**

Pasture type	Stocking rate (lambs per hectare)	Daily LW gain (g/lamb)	Carcass weight gain (kg/hectare)	Return (\$/hectare)
Browntop/ dogstail	20	100	75	150
Ryegrass/ white clover	25	185	200	400
Tall fescue	25	215	230	460
Red and white clover and 40 per cent chicory	30	280	460	920

- b. Chicory is a leafy tap-rooted herb which produces high quality summer feed. It also has a high mineral content compared to ryegrass and clover. The article 'More grass = more cash' mentions that chicory lasts longer in some pastures than others.
5. a. Other plants/crops that can be used as supplementary feed include lucerne, turnips, rape, chou moulrier and non-endophyte ryegrass. You may have thought of other plants.
- b. The advantage of other feeds over endophyte ryegrass is that ryegrass staggers are avoided so lambs can have better health and improved meat quality.

3F

1. The more effective programme is B because:
- the number of eggs in the faeces over the months of January to April is much lower than in programme A
  - the number of larvae on the herbage is greatly reduced (in programme A the number of larvae on the herbage is the same as if no drenching had been carried out).

## ANSWER GUIDE

2. Three ways of applying insecticides to control external parasites are:
  - dips and sprays
  - pour ons and sprayer
  - jetting or spraying with hand guns onto selected parts of the body.
3. a. When facial eczema spore counts are high farmers can reduce the effects of the toxin sporidesmin by:
  - changing grazing management and using safe paddocks
  - spraying pasture with fungicides
  - dosing lambs with zinc salts
  - adding zinc salts to troughs or feed.b. It is highly likely that facial eczema can be controlled by breeding animals with genetic resistance to the disease because the resistance is highly heritable and there is wide variation in breeds and individual sheep.
4. a. Farmers can reduce the incidence of ryegrass staggers on their endophyte ryegrass pastures by avoiding grazing (in summer and autumn) the bottom 2 cm of pasture and the seed heads and stems.  
b. If farmers are sowing new pastures they could use perennial ryegrass with no endophyte (non-endophyte ryegrass) as long as they do not have the problem of Argentine stem weevil on their farm. Other pasture types include Italian and hybrid ryegrasses or tall fescue, chicory or any other non-ryegrass species.
5. a. Cobalt, copper, molybdenum, and selenium. The first three are usually added to fertilisers before they are put onto the soil, selenium is needed in very small amounts and in excess it is toxic so it is usually supplied as a drench or as an additive to a worm drench.  
b. Selenium is particularly important to lambs as it:
  - prevents white muscle disease (which damages body and heart muscle)
  - maintains disease resistance
  - increases growth rates on soils like pumice.Two conditions that may reduce the availability of selenium in pasture plants are (any two of):
  - high rainfall, especially in spring
  - acid pH of soil
  - legume dominant pastures which are lower in selenium than grasses.



4A

#### 4. HARVESTING LAMB

1. Three factors that determine when lambs will be sold are the following.
  - Amount of feed. This often depends on the climate during rearing. For example, drought reduces feed quantity and quality.
  - Condition of the lambs.
  - What the market is doing.
2. Two market opportunities for early light weight lambs are the processor or stores.
3. The choice of markets will be limited by some of the decisions taken in the establishment and growth stages. For example, the breed used, time of lambing and docking decisions.
4. The higher the ewe weight at mating, the higher the percentage weaned.
5. Reducing flushing effect reduces lambing percentage.
6. Heterosis or hybrid vigour.
7.
  - a. Dorset.
  - b. Both.
8.
  - a. Southdown.
  - b. Approximately 30 days.
  - c. 3 kg.
9. Most are sold direct to meat works from the farm or at local stock auctions.
10. Demand could come from shortage of stock numbers, prospect of higher prices, plentiful supply of feed.
11. Out-of-season lamb could be supplied by using breeds with longer breeding seasons or using hormone technology. Cost of providing winter feed would need to be offset by price incentive.

# ACKNOWLEDGEMENTS

Every effort has been made to acknowledge and contact copyright holders. Te Aho o Te Kura Pounamu apologises for any omissions and welcomes more accurate information.

## **Information adapted from**

Grazing and feed management, Internal parasites, Goat management, from Goat Meat Industry Council and Meat New Zealand; and Goat farming not so silly, from 'The Star', *Rural News* 21, 19 February 2001.

Questions and marking schedule: Feeding and shelter, Animal health, Internal parasites, Table of schedule of operations; from 'University Entrance, Bursaries and Scholarships Examination: Agriculture and Horticulture: 2001', and 'Marking Schedule', © New Zealand Qualifications Authority 2001, Wellington, NZ.

## **Table**

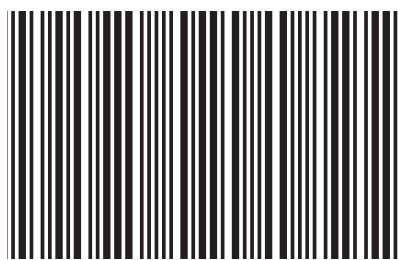
Characteristics of some alternative sheep breeds, from '400 Plus: A guide to increased lamb growth rates', Meat New Zealand; Lamb carcass grading, from AFFCO New Zealand; from 'University Entrance, Bursaries and Scholarships Examination: Agriculture and Horticulture: 2002', and 'Marking Schedule', © New Zealand Qualifications Authority 2002, Wellington, NZ. Used in any medium for education and its promotion by permission.

*How AgResearch rates pasture species*, © AgResearch, source unknown. Extract only.

## **Photo**

Photo: iStockphoto, Livestock farm herd of sheep, 8812244

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# SELF ASSESSMENT

## ARO MATAWAI

# AGS305K

Tick the box that's best for you.

	Very well	Quite well	With difficulty
I understand the production of lamb.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I understand how a lamb crop can be manipulated to meet market requirements and I can justify those manipulations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I can apply my knowledge on manipulating a product to an unfamiliar primary product – goats.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have completed the teacher-marked activity.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have included my project diary for AHS3.1 (AS90649) in this posting to my teacher.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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