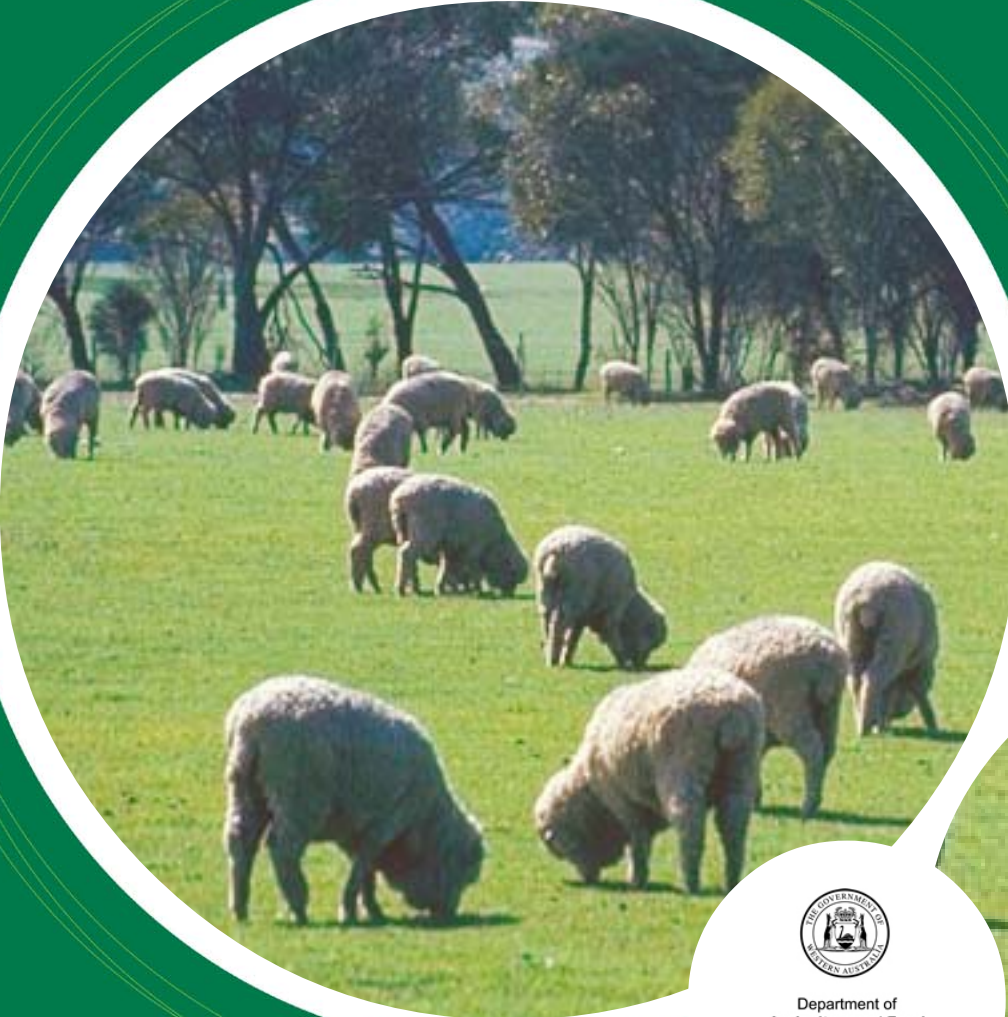


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# Getting into sheep

## An introductory guide to sheep management

By Keith Croker and Roy Butler  
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South Perth and Merredin  
Department of Agriculture and Food  
Western Australia



Department of  
Agriculture and Food



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# Getting into sheep

Sheep husbandry can be an interesting and rewarding activity but before starting to work with or buy sheep ask yourself if you are prepared to spend the time and effort to care for them.

First, talk to Department of Agriculture and Food (DAFWA) officers, consultants, stock agents and sheep owners in your district and ask the following questions:

- Should I go it alone with my sheep interest or should I join with my neighbours engaged in common areas of husbandry?
- How many sheep can my farm feed?
- Can I purchase extra feed locally?
- Where and by whom can the sheep be shorn?
- Is there a veterinarian in my district?
- Where can I buy the sheep?
- How can I sell the wool, lambs and sheep?

Enquire about the disease and parasite prevention and control programs in your area, and find out if there are any localised problems such as annual ryegrass toxicity, poison plants, fleece rot, flystrike and so on.

Sheep cannot be placed in a paddock and forgotten. The sheep, along with their water, feed and fences must be inspected regularly. If you do not live on the farm, or visit it only infrequently, make sure there is a responsible person available who is willing to inspect and manage the sheep on your behalf.

## BASIC ESSENTIALS

### *Pasture*

Pasture is the cheapest feed for sheep, so make full use of it.

Sheep eat a wide variety of pasture species, but prefer plants that are short and green. A grass-subterranean clover mix is an excellent sheep pasture. Sheep do not thrive on pasture taller than 8–10 cm, although adult sheep can be forced to eat rank grass by stocking them heavily on it. However, beware of overgrazing because it can lead to severe erosion problems and complaints from neighbours. Check on the suggested stocking rates for your area.

A top-dressing of superphosphate each year usually ensures good pasture growth, particularly if there is a good mixture of clover and grass.

One hectare of well established grass-clover pasture, properly managed and fertilised, is enough to graze 7 to 10 wethers in the high rainfall zone (over 500 mm). If the pasture is in the 300–500 mm rainfall zone, 1 hectare can carry only three to five wethers. Natural pasture, or relatively poor improved pasture, will have a much lower carrying capacity.

Breeding ewes need more feed and consequently the stocking rate for ewes must be lower than for wethers—one breeding ewe is equivalent to 1.5–2.0 wethers depending on their size.

## Hand feeding

The district in which your farm is located will probably receive very little rain during summer and early autumn. Hand feeding (supplementary feeding) can therefore be necessary during this time, at least for breeding ewes and weaners, and particularly if the stocking rate is relatively high or paddock feed runs short in late summer, autumn or winter. Seasonal conditions will of course influence pasture growth. The supplementary feed provided is usually one of, or a mixture of the common grains, such as oats, wheat, barley, lupins or occasionally peas or beans. Alternatively, you may prefer to feed commercially produced sheep pellets (also called cubes or nuts).

**Table 1 Suggested weekly grain rations (oats or 75 oat:25 lupin mixture) for sheep where some paddock feed is available**

Weaners (older than 6 months)	1.5 kg
Adult dry sheep	1.5 kg
Lactating ewes	2.5 kg

For feeding sheep, oat grain is often preferred because it is palatable and relatively safe to feed although better growth is obtained with oat and lupin grain mixes. Wheat or barley grain can be used but only if some pasture is available. Without care, feeding wheat and barley, or some sheep pellets can lead to digestive problems such as acidosis (grain poisoning).

The suggested rates of feeding rations in Table 1 are designed to hold sheep in a healthy lean condition when some paddock feed is available but they will not be enough to maintain sheep in good condition.

The rations suggested in Table 1 are for sheep that have been successfully introduced to the grain over a period of at least 14 days. Lupins are safer to feed to sheep than are



*Merino sheep being supplemented with grain.*

the cereal grains. In addition, smaller quantities of lupins can be fed less frequently because they have a higher nutritional value and are unlikely to cause acidosis.

Energy is the major nutrient required for the maintenance of sheep. Both cereal grain and legume seed are good sources of energy. Where total weekly grain rations are 2.5 kg or more for weaners and 3.5 kg or more for adults, then some roughage (hay or paddock feed) needs to be supplied.

Ideally, hand feeding of sheep should start before paddock feed runs out. Acidosis can occur when sheep are introduced too rapidly to wheat or barley grain in bare paddocks. Hay, oats and lupins are relatively safe and the likelihood of getting acidosis with these feeds is lower. However, it is still advisable to introduce sheep to oats reasonably slowly.

Introducing sheep to supplementary feeds with oats or lupins reduces the possibility of acidosis developing. Sheep should therefore first be introduced to oats and then

changed over to wheat or barley by progressively reducing the proportion of oats and increasing the proportion of wheat or barley in the supplement.

Because oats can be difficult to buy, wheat is often fed to sheep. Suitable introduction programs for wheat are given in Tables 2 and 3. Remember that if you provide large quantities of grain, or change to wheat more quickly than recommended, acidosis can result.

During the introduction program, sheep should be observed closely for signs of scouring or other disease symptoms. Seek advice immediately problems arise.

Sheep can be maintained in store condition when fed a good quality pasture or oaten hay, if it is available. If the sheep are fed a full ration of hay, the recommended weekly rates are:

Wethers	5 kg per head
Ewes in late pregnancy	8 kg per head
Lactating ewes	11 kg per head
Weaned lambs	4 kg per head

**Table 2 Maximum amounts of wheat or barley to feed to dry sheep in the early stages of hand feeding**

Day of feeding	Ration to be fed each feeding day	
	per sheep (g)	per 100 sheep (kg)
1	50	5
2	50	5
3	100	10
4	100	10
5	200	20
6	200	20
7	300	30
8	300	30
9	350*	35
10	350	35
11	350	35
12	430 <sup>†</sup>	43
13	430	43
14	430	43
15	860	86
17	860	86
19	1300	130
22	1300	130
Then twice weekly feeding at the rate of 430 g/hd/day		

\* This represents a full grain ration for weaned lambs greater than 14 kg and/or 6 months old which have access to the best paddock feed available. The amount of grain fed per day need not be increased after this time but the frequency of feeding outlined above should be followed.

<sup>†</sup> Represents a full ration to maintain an average dry Merino sheep in backward store condition.

**Table 3 Maximum amounts of wheat or barley to feed to lactating ewes in the early stages of hand feeding**

Day of feeding	Ration to be fed each feeding day	
	per sheep (g)	per 100 sheep (kg)
1	50	5
2	50	5
3	100	10
4	100	10
5	200	20
6	200	20
7	300	30
8	300	30
9	350	35
10	350	35
11	350	35
12	450	45
13	450	45
14	450	45
15	450	45
16	550*	55
17	550	55
18	550	55
19	550	55
20	700 <sup>†</sup>	70
21	700	70
22	700	70
23	700	70
24	1400	140
26	1400	140
Then twice weekly feeding at the rate of 700 g/hd/day		

\* Lactating ewes or any sheep fed more than 3.5 kg of wheat or barley per week (500 g/day) will also need some roughage (1 to 2 kg of hay or equivalent paddock feed per week).

<sup>†</sup> Represents a full ration for an average lactating Merino ewe.

## **Water**

It is vital for livestock to have access to a reliable source of suitable drinking water throughout the year. During hot weather a sheep drinks up to 9 litres of water a day.

If salty water is a problem in your district, have the drinking water analysed for its total salt content. This can be carried out for a cost by many DAFWA district offices or at local Landcare centres. Lambs, weaners and breeding ewes can tolerate, but not thrive, on up to 1100 millisiemens per metre (mS/m) of total salts while adult dry sheep can tolerate up to 1800 mS/m.

The salinity of a water source can change over the years and fluctuate with seasons. Often the water in dams, soaks and tanks becomes increasingly salty during the summer because of evaporation.

Stream salinity fluctuates from season to season because of the seasonal incidence of rainfall.

Sheep usually become accustomed to the variation over the year and suffer little effect. Sheep that are thirsty through travelling or being under extreme conditions can drink very saline water and thrive for a short period. However, if used continuously such water will cause ill effects and the worst affected sheep will stand apart from the flock and scour almost constantly. Often, the whole flock does poorly.

Special care should be taken not to pollute the water supply.

Cloudiness of water due to clay in suspension is not normally harmful to sheep. However, bacteria or algae in water can produce toxins that harm stock. There are problems if a brightly coloured scum is seen.

As with all such troubles, prevention is better than cure. Ideally, sheep should not be allowed to drink directly from the source of water. Troughs should be checked daily in summer. If you are going away get someone reliable to keep an eye on the water supply.

## **Fences**

Protect your investment. Do not even consider grazing sheep in a paddock that does not have sheep-proof fences because no matter how good the pasture in that paddock can be, they will undoubtedly wander. This will cause problems with sheep on roads, friction between neighbours, damage to crops and gardens and general sheep husbandry problems such as out-of-season lambing and spreading of diseases and external parasites.

It will also be necessary to separate different classes of sheep on your property, for example rams and ewes or sick from healthy sheep.

If new fences are required, make a careful assessment before deciding what to erect. The easiest and quickest fence to build is one of prefabricated wire that can be purchased with five to eight horizontal strands and separated with vertical wire at various spacings. Prefabricated end assemblies can be used and black star steel pickets that are driven into the ground will support the fence. Plain or barbed wire can be added to the top of the fence if required to keep out larger stock. Always install large gateways for easy movement of sheep and wide machinery such as that used in cropping a paddock.

Stock agents can supply and advise on materials for a variety of fences.

## **Sheep yards**

Generally, sheep yards are the basic unit for all sheep handling operations. Facilities need to cope with some or all of the following operations:

- shearing
- trucking
- crutching, jetting, dipping, drenching, inoculation, foot paring and foot bathing



- identification—ear tagging or branding
- selection—weighing, condition scoring, classing, mousing or drafting.

The size of the flock will influence the size and design of the yards. Allow 1 square metre per sheep in the holding yard.

A suitable yard design that allows easy handling of sheep is shown in Figure 1.

Portable yards should be considered because they give you the advantage of being able to take the yards to the sheep. Such yards can be located to minimise dust, mud and the build-up of harmful bacteria. Portable yards are ideal when choosing a site for marking lambs.

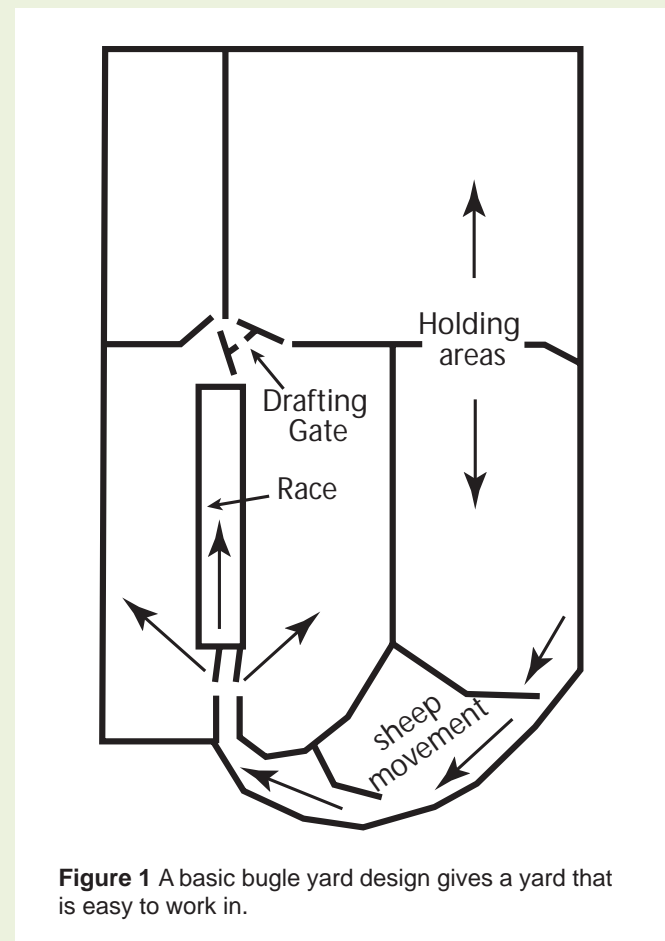
When designing sheep yards, an understanding of sheep behaviour will help the flow of sheep through the yards:

- The sheep must see treated sheep escaping—stationary sheep are motivated to move by witnessing running sheep.
- Oncoming sheep should not be able to see the operators and the noise of the operation should be minimised.
- The front of the race should be open so that the sheep do not approach a dead end.
- Strong contrasts in light should be avoided as these tend to balk the sheep.
- Sheep seem to move more readily around corners than in straight lines.

A drafting system should allow the operator to identify the sheep they want to separate and then help this separation with a minimum of error and effort. The drafting system should preferably be capable of drafting three ways and the sheep should move rapidly in single file through the system.

The drafting system can be aided by the following:

- tapered sides—narrowed at the bottom
- solid (light-proof) sides
- a slight upward slope
- solid drafting gates are preferred for horned sheep
- the direction of the drafting race should minimise the effect of the sun and shadows on operator and sheep. A south to north direction is preferable.



**Figure 1** A basic bugle yard design gives a yard that is easy to work in.

## Shearing shed

Is a shearing shed necessary?

For a small flock of sheep the expense of building a shed just for shearing is not warranted. Your farm may be near enough to a cooperative farmer who would allow the sheep to be shorn in his shed.

Sheep must be dry for shearing, so if a shearing shed is not available perhaps a car garage, machinery or feed shed could be used to provide cover before shearing. If you are contemplating building some form of shed, keep in mind that as well as the primary reason for building it you may want to hold and shear sheep in it. Ideas can be gained on constructing such a shed by inspecting the standard shearing shed designs that are available from several shed manufacturers and a number of publications.



*With portable yards it is easy to work sheep away from the main permanent yards.*

## Equipment

Equipment that will be required to manage a flock of sheep includes:

- ear tag applicators—for applying ear tags to identify age and/or ownership of sheep
- drenching gun (automatic or single dose)—used to control internal parasites
- earmarking pliers—by law each sheep owner must register an earmark (see ‘regulations’ below)
- hand shears—for removal of wool in the case of fly struck sheep, dags, etc.
- paring secateurs—necessary for trimming hooves
- raddle—either in crayon or pressure pack form used for identifying individual sheep. Raddle must be the type that will scour out of the wool
- tailing and castrating knife—for lamb marking
- vaccinating gun—used for administering vaccines and worm control drugs
- elastrator applicator—used for applying elastrator rubber rings that are used instead of a knife for tailing and castrating.

Depending on who does some of the work with your sheep, you may not need all this equipment.

## REGULATIONS

Before any sheep are delivered to your farm, it is important for you to understand the regulations concerning the ownership and movement of sheep.

### **Stock Act**

The purpose of the *Stock (Identification and Movement) Act (1970)* is to establish the ownership of stock, to help prevent theft and to ensure the identification of diseased stock at saleyards or abattoirs.

Every owner of stock is required to register a brand. The brand is registered for use on a specific property and can not be used elsewhere, except under the authority of a special permit. When you register a brand, you will also be allotted a registered earmark and a Property Identification Code.

*Registered brands* consist of two letters and one numeral and the same combination of symbols should be used on cattle, sheep, horses and goats. Pigs are tattooed with the number of the registered brand.

*Registered earmarks* for use on cattle and sheep are allotted with each application for brand registration. A registered earmark consists of two symbols that are placed in specific positions on the appropriate ear as allotted by the Brands Registrar and endorsed on the Certificate of Registration.

Flock sheep are required to be *earmarked* before:

- (a) being weaned
  - (b) attaining the age of six months
  - (c) being removed from the farm
- whichever occurs first.

The earmark symbols must be placed in the left ear of female sheep and in the right ear of male sheep.

Cull marks, age marks or ear tags can be placed in the ear opposite to that carrying the registered earmarks.

Registered earmark symbols are applied using a punch or pliers. They should not be less than 4 mm or more than 20 mm, in any dimension, by the time the animal is fully grown.

Sheep within the agricultural area are required to be *branded* when shorn for the first time or when removed from the farm, whichever occurs first.

A *registered brand* on sheep can be applied as:

- (a) a tattoo in the ear (opposite to the earmark)
- (b) an ear tag displaying the registered brand (the most common practice)
- (c) a firebrand on the horn, or
- (d) a wool brand.

If a wool brand is used it must be kept legible at all times.

Wool branding is no longer recommended (but currently is still legal) because new scouring processes do not easily remove the branding fluid. Wool buyers can discount wool-branded sheep.

Wool branding fluid must be scourable, of any colour except black and must be of SI-RO-MARK formulation. Paint should *never* be used. Should the branding fluid require thinning, then either heat slowly or add a small amount of turpentine but never petrol.

Each symbol of a wool brand must be 75 mm high (or wide) and be spaced 20 mm from the adjoining symbols.

The overall size must not be less than 175 by 75 mm.

## ***The National Livestock Identification System (NLIS)***

The National Livestock Identification System is a nationally agreed identification and tracing system for stock. It allows faster and more accurate tracing of individual animals back to their property of birth. Tracing of individuals or groups of animals is sometimes necessary for disease control or eradication purposes, or for investigating meat contamination issues.

Sheep farmers in Western Australia will comply with the requirements of the NLIS if their home-bred sheep are tagged as lambs with a tag of the correct colour (for year of birth) which has embossed on it, their registered brand. If the sheep were born elsewhere, they must have a **pink** ear tag with the owner's registered brand before they leave the owner's farm. The pink tag is put in the earmarked ear and any existing tags should not be removed.

### ***Movement***

You must have a valid Property Identification Code (PIC) in order to buy, sell or move sheep. The movement of sheep on to or off your farm must be accompanied by a livestock waybill. Plain waybill books can be purchased from DAFWA offices. Most purchasers however, will require a vendor declaration in addition to a waybill. Vendor declarations underpin an industry developed program of on-farm meat safety and hygiene; they document any animal health treatments the sheep have received and information on some feeding practices. Combined National Vendor Declaration and waybill books, pre-printed with your PIC, are obtainable only from Meat and Livestock Australia and can be ordered by phone (1800 683 111) or online <http://www.mla.com.au/lpa>.

## ***Administration***

All inquiries regarding earmarks and brands should be sent to:

The Registrar of Brands  
Department of Agriculture and Food  
PO Box 1231  
BUNBURY WA 6231

Phone (08) 9780 6207  
Fax (08) 9780 6136  
E-mail **brands@agric.wa.gov.au**

Registered brands can be checked at  
<http://www.agric.wa.gov.au/brands/index.asp>.

## **BUYING SHEEP**

For the prospective sheep owner who is inexperienced or interested only in growing wool, dry sheep (wethers or unmated ewes) are easier to look after than breeding stock. When purchasing sheep, use the services of a stock agent or someone with experience in buying sheep.

As a general principle, sheep that are locally bred are likely to do better than sheep from outside the district in which the farm is located.

Sheep in their first year after weaning are usually the most difficult to manage. Young adult animals between one- and two-years old are generally easier to care for and have plenty of productive years ahead of them.

The approximate age of sheep can be determined by checking the number of permanent incisor teeth. Sheep do not have incisor teeth in their upper gums. A lamb has a set of eight small incisor teeth that are termed '*milk*' teeth. Two milk teeth are replaced each year by larger, permanent incisor teeth until the sheep has eight such teeth at the age of four to four and a half years old.



*A weaner (about 4 months old), showing milk teeth with no permanent teeth yet.*



*A hogget (about 18 months old), showing the first two permanent teeth.*

When buying sheep select only sheep that appear to be healthy. Sheep can be down in condition but still remain alert and sound. Be wary of sheep that show signs of lameness or scouring. Check if Merino sheep have been mulesed as this minimises susceptibility to flystrike on the crutch area. Australian sheep industry representatives have agreed that surgical mulesing will cease from 2010. Therefore, in relation to risk of flystrike, select sheep with minimal skin wrinkle (plain bodied sheep) and breeches bare of wool.

Inspect the mouth for sound teeth and bite. Gums should be pink, as should the skin of the sheep when the wool is parted. Broken mouthed sheep, those that have started to lose teeth (normally at 5.5 to 6.0 years of age), can be considered for purchasing if plenty of good quality feed is available. Broken mouth sheep can be bought cheaply and can produce satisfactorily for another two or three years under good condition. Inspect any sheep with ragged pulled

fleeces. This can be due to rubbing against fences or nibbling their wool, but also can indicate external parasites such as lice, itch mite or blowfly maggots.

To minimise drench resistance in your sheep all incoming animals should be treated with a combination of broad-spectrum worm drenches before being released on the farm.

In addition to closely checking the sheep you intend to buy, ask the vendor to provide a National Sheep Health Statement, so that you have a record of their health status and any treatments they already have received.

### **Ewes**

If you wish to buy ewes for breeding, avoid those with hard lumps in the udder and missing or over-large teats.

There is no single 'best' breed of sheep. Your reasons for keeping sheep will probably determine the breed and type

of ewe chosen. If your main purpose is to produce lambs for sale or home consumption and you are not too concerned about wool, you could use virtually any ewes providing they have sound udders and reasonable body size. Merino ewes are most readily available and their wool is potentially the most valuable. Merino crossbred ewes ('first cross ewes') are generally more fertile and better mothers than straight Merinos but they produce less valuable wool. Alternatively you may prefer one of the British breeds, such as Poll Dorset or Suffolk, whose wool is of relatively low value.

If you want lambs for meat but the ewe's wool is of equal importance, you could consider using a dual purpose breed such as Corriedales or one of the South African Merinos such as the Dohne Merino or the Prime SAMM. If the fleece is to be used for home spinning of yarn then an English long wool crossbred sheep will be required (see section on coloured sheep).

If you want lambs for meat and don't care about wool at all you could prefer one of the fleece shedding, meat breeds such as the Dorper, Damara, Wiltshire Horn or Wiltipoll.

### **Rams**

It usually pays to buy rams from a reputable breeder. The testicles should be large, firm, springy and resilient, not small, hard or soft, flabby or uneven in size. Palpate the testes by standing behind the restrained ram and running your thumb and forefinger down the scrotal sac. By doing this, any odd-sized testes or lumps will become apparent when compared against the other.

The most common detectable abnormalities are enlarged or lumpy testes, particularly on the lower end where the epididymis is situated. It should be possible to feel between the epididymis and the body of the testicle. Any hard lump or undue swelling should be a warning against buying the ram. If there is any doubt about a ram, do not buy it.

In Western Australia some studs are accredited ovine brucellosis free. Ovine brucellosis reduces the fertility of rams and can cause ewes to abort. It cannot be treated. Buying rams from brucellosis-free studs avoids the risk of rams transmitting this disease to the ewes.

When managing a flock it is of utmost importance that every ram is fertile. There is no place for 'passengers' when the total number of rams is very small.

The weekly auction at the saleyards is fraught with risks for buying breeding stock because the sheep are likely to be culled from other farmers' flocks. Clearing sales and periodic breeding stock sales are normally advertised extensively in local and farming newspapers and are ideal for purchasing sheep.

### ***Inherited defects***

When selecting rams and ewes it is important to reject sheep that have defects that can be passed on to their young:

- **Jaw defects**—when the teeth extend forward past the dental pad or when the teeth hit the back of the pad. This condition normally becomes more severe with age and reduces the animals' grazing efficiency.
- **Face cover**—becomes a problem when wool growth extends down the face and around the eyes, causing wool blindness. This trait is highly heritable and is related to low fertility in breeding ewes.
- **Hairiness**—in some breeds the wool tends to become hair or kemp, especially in the breech area. All kemp must be skirted from the fleece. Any sheep showing signs of kemp should be culled from the flock other than those breeds in which hair is normal such as Dorpers and Damaras.



*Select sheep that have an open face.*

- Wrinkles—body wrinkles are common in some breeds of sheep, particularly in the Merino. Wrinkles provide warm, moist pockets of skin under the wool where sheep blowfly larvae can proliferate and also cause problems for the shearer. It is therefore advisable to select plain-bodied sheep.

### ***Coloured sheep—a warning***

The popularity of naturally pigmented wool for home crafts has resulted in a premium being paid in private sales for certain types of coloured wool. On a small farm, owning a flock of coloured sheep can be quite profitable if the fleeces

are sold privately to home spinners. However, when coloured fleeces or fleeces containing only a small amount of coloured wool find their way to the wool auctions, they can contaminate an otherwise valuable clip.

The wool trade has become increasingly concerned about the rising risk of coloured fibre contamination of Australia's wool clip.

Complaints of dark fibre contamination from manufacturers of wool products have increased in recent years and have coincided with the increase in the number of coloured sheep and the introduction of new breeds of sheep to the agricultural area.

One-tenth of a gram of coloured fibre is enough to contaminate a 200 kg bale of wool and make it unacceptable for use in a pastel cloth. A black fibre cannot be dyed any other colour.

To protect the Australian wool industry, the following points must be adhered to if the wool is to be consigned to the wool auctions.

- Coloured sheep must never be run in white flocks.
- Do not shear coloured sheep in the same shed at the same time as white sheep. If there are coloured sheep on the farm, shear them last.
- The greatest care must be exercised in cleaning the shearing board and shed after shearing coloured sheep.
- Coloured fleeces along with locks and skirtings should be placed in plastic bags.
- Every wool producer has a responsibility to be vigilant in keeping coloured fibre contamination from the wool clip and in identifying coloured fibre contamination where it is unavoidable.

For those wool producers interested in coloured wools, join the Melanian Sheep Breeders' Society of Australia and gain

the advantage of the Society's expertise in managing coloured sheep. The Royal Agricultural Society of WA can advise the current contact address.

### **Breeds of sheep**

For new sheep farmers, one of the early and interesting decisions to make is, 'what breed of sheep should I have?'. There are plenty to choose from.

The Merino is by far the most common breed of sheep in Australia. For many years, all other sheep breeds were collectively termed British breeds, including some which had come to Australia via New Zealand. However, in Western Australia there are now sheep breeds originating from continental Europe, Scandinavia, North America, the Mediterranean and South Africa. As well as these breeds, Australian farmers are continuously developing new breeds and strains of sheep.

Sheep can also be described by the main purpose for which they are kept. This can be for wool, wool and meat (dual purpose), meat or in rare cases, milk. However these divisions are not absolute since wool sheep also produce meat (as lamb and mutton) and most meat sheep produce wool. Some meat sheep, however, shed their fleeces and do not produce a saleable fleece.

The following table provides a guide to the various sheep breeds and the primary purposes for which they are kept. There are breed societies for most, if not all, the breeds listed. The Royal Agricultural Society of WA will direct you to people knowledgeable about a particular breed.

Primary use	Merino	British breeds		Other breeds
		Short wool	Long wool	
<b>Wool production</b>	Strong, medium, fine and superfine strains		Drysdale Elliotdale Lincoln Tukidale	
<b>Dual purpose (wool and meat)</b>	Dohne Merino Prime SAMM #Corriedale #Polwarth		Border Leicester Cheviot Coopworth English Leicester Perendale Romney	
<b>Meat</b>		*Wiltipoll *Wiltshire Horn Dorset Horn Hampshire Down Poll Dorset Ryeland South Suffolk Southdown Suffolk White Suffolk		*Damara *Dorper American Suffolk Awassi Finnsheep Karakul Texel
<b>Milk</b>		Poll Dorset		Awassi East Friesian

\* These sheep shed their fleeces annually.  
# These are not Merinos but have been developed from Merino and British breeds.

### **Merino**

The Merino makes up more than 90 per cent of Western Australia's sheep flock. The rams are polled or horned, and the breed is medium framed but not as heavily muscled as other breeds. Rams customarily carry neck folds. Merinos are mainly wool producers. The Merino will produce a lamb that can be grown to heavy carcass weights without becoming over fat. The meat quality can be very good so long as the lambs are well fed and are handled with minimal stress.

Although lambing percentages may not be as good as in other sheep breeds, the Merino is better suited to our harsher conditions. Merinos have normally been mulesed as lambs to help control breech flystrike, but this practice is expected to cease in 2010. Selection of Merinos with



minimal skin wrinkle and bare breeches is therefore becoming much more important. Staple length of the wool grown over 12 months averages 10 cm with a fibre diameter range of 19 to 25 microns, with most being between 21 to 23 microns. There are many 'strains' of Merino and these vary in body size and degree of fineness of the wool fibres. Collinsville, Peppin and Saxon are examples.

For your farm the initial decision on what type of sheep to breed will depend on the intended use of the progeny. Will the progeny be sold to other farmers for breeding? Are they to be bred for wool, meat or both? Observe the type of sheep bred in your district before making the final decision.

An example of a type of breeding plan that could be put into practice by a small farmer is to mate a Merino ewe with a British breed ram such as the Poll Dorset. This would produce a good prime lamb for your own use or for sale. However, larger farmers could have quite different objectives for their sheep flocks.

Another benefit of having crossbreds is that their skins are the best and easiest for home or commercial tanning.



*Merino rams.*

## MANAGING THE BREEDING FLOCK

### *Mating*

Having decided to run a breeding flock you must then decide when to put the rams in with the ewes. This decision will be influenced by several factors.

The duration of the breeding season varies between breeds but generally extends from January to July, with autumn being the most fertile and sexually active period for ewes. The length of pregnancy is 147 to 150 days, about five months. Lambing can be timed to coincide with times of good feed availability. If you decide to use this strategy, ewes should begin lambing about six to eight weeks after the break of the season—perhaps even later in southern areas where low winter temperatures can depress pasture growth. Lambing before this time will necessitate supplementary feeding to prevent ewe and lamb losses.

### *The breeding ewe*

Maiden ewes usually will not rear as many lambs as mature ewes. If ewes are infected with internal or external parasites or suffer from other health problems, lambing will suffer. The udders of all ewes should be carefully inspected for abnormalities before mating starts, particularly for blind, large or damaged teats and ewes with these problems should be culled if possible.

The ewes should be in as good condition as possible at the start of mating. During pregnancy the ewe must provide for the developing lamb she is carrying, maintain her own body condition and produce wool.

The lamb develops quickly in the ewe's uterus during the last six weeks of pregnancy and the ewe must be adequately fed during this time. If ewes are undernourished during late pregnancy they are forced to draw upon their own body reserves and become vulnerable to pregnancy



*Merino ewes and lambs.*

toxaemia. Even if this disease does not occur, undernourished ewes are likely to produce small, weak lambs whose chances of survival will be further impaired by the lack of an adequate supply of milk. The nutritional requirement of a lactating ewe is about double that of a dry sheep.

Green pasture feed is the best and cheapest feed but might not always be available during pregnancy. If there isn't enough good quality feed available ewes should be supplemented throughout their pregnancy with an increasing amount fed during the final six weeks of pregnancy (see Table 4).

**Table 4. Weekly grain ration for pregnant and lactating ewes when some paddock feed is available**

Weeks before lambing	6-4	4-2	2-0	Lactating
Grain per head per week (kg)	0.75	1.0	1.75	2.5

Prolonged yarding, shedding, fast droving or other stresses should be avoided close to lambing as these activities can cause pregnancy toxaemia, hypocalcaemia and general lambing difficulties. Ewes should not be shorn during late pregnancy.

### **Ram fertility**

As with ewes, certain factors can reduce the fertility of rams. Temporary infertility can be caused by excessive heat and for this reason it is advisable that the ram holding paddock and the mating paddocks have plenty of shade and water.

Any disease condition that induces fever (such as foot abscesses) can also stop sperm production or lead to poor fertility. Flystrike, fast or long droving, fighting during hot weather and shearing can also lower the fertility of rams.

Recovery after these conditions does not immediately restore the quality of the semen and it can be two to three months before semen quality is satisfactory. Sperm take about seven to eight weeks to develop and reach maturity.

It is advisable to avoid shearing rams within six weeks of or during the early part of joining.

At mating time rams should be in good physical condition but not fat. If it is necessary to feed rams to improve their condition and potential sperm-producing capacity, feeding should begin at least eight weeks before the rams are joined and continue until joining begins. Cereal grains or other supplements can be used for this. Sweet lupin seed increases the size of the testes and is especially effective at improving condition and sperm production of rams.

At least six weeks before mating the hooves should be checked and, if necessary, clipped and the polls and breeches of the rams jetted to prevent flystrike. At the same time, the testicles should be inspected for size and abnormalities as was done when the rams were purchased.

## ***Lambing time***

By recording the date that the rams were put with the ewes, the day the first lamb can be expected is known. A paddock that is well watered and adequately sheltered should be reserved for lambing, making certain that the paddock is not overstocked.

If the ewes need to be shorn or crutched before lambing organise for these jobs to be done no closer than six weeks before lambing is due to start.

## ***Lambing surveillance***

From about a week before the first lamb is due the ewes should be carefully observed but disturbed as little as possible. If possible, use binoculars to observe the lambing ewes and only enter the paddock if a ewe or lamb needs help.

The vast majority of ewes lamb normally and need no assistance. Allow the ewe to produce her lamb unaided if she can and avoid disturbing her unless help is obviously needed.

The normal position of the lamb as it leaves the uterus is to have the forelegs extended with the head between them. Difficulties can arise if the lamb is delivered hind legs first, head turned back or one or both legs folded back. If this happens the ewe will need help. It is best to call an experienced sheep owner or a veterinarian until you feel qualified to do the job yourself. Some maiden ewes (those lambing for the first time) could need assistance even though the lamb is being presented normally.

A ewe should deliver the lamb within 15 minutes after the fluid sack that surrounds the lamb in the uterus has ruptured.

Most lamb deaths occur at or within a few days of birth. Losses due to difficult births have already been mentioned. The main causes of lamb losses in the days immediately after the birth are starvation associated with bad mothering and exposure to heat or cold.

Starvation can be caused by a lack of milk from the ewe or the lamb's inability to obtain the milk within a few hours of birth. Proper nourishment of ewes during pregnancy can minimise this problem.

Exposure to heat or cold can be avoided to some degree by careful choice of lambing dates. However, unseasonal hot or unusually cold, windy weather can occur during lambing and choosing paddocks with trees and low bushes or long tufty grasses will help to reduce the impact of such adverse weather. Generally a healthy lamb from a well-fed ewe can withstand bad weather better than a small, weak lamb from an undernourished ewe.

Predators that kill or maim lambs are foxes, wild and domestic dogs, crows, wedgetail eagles and feral cats. Flock guard animals, such as alpacas and dogs (especially bred and conditioned for the purpose), are sometimes used to reduce predation. Enquire about the best methods to control these predators in your district.

One way of increasing the size of your flock is to let it be known that you are prepared to spend the extra time necessary to rear orphan lambs. Some sheep farmers are not interested in rearing these lambs and are quite willing to give them away if they know they will be cared for in a satisfactory manner.

### A suggested calendar for a breeding flock

Month	Activity
January	Supplementary feeding of ewes and rams if necessary. Put ram with ewes. In southern areas, where low winter temperatures can depress pasture growth, consider mating in February.
February	Maintain a good level of feed during mating. Inspect rams for poll wounds due to fighting.
March	Remove rams from ewes after six weeks of mating. Shear all sheep.
April	Feed as required.
May	Ewes should be on a good quality feed during the last six weeks of pregnancy. Supplement paddock feed if necessary.
June	Drench and vaccinate ewes and move into spelled lambing paddocks. Feed as required.
July	First lamb marking—all lambs older than three days are tailed, castrated, ear marked and vaccinated.
August	Second lamb marking after finish of lambing.
September	Crutch and wig all sheep, ring wethers and rams late in the month.
October	Jet all sheep for protection against body strike. Wean lambs and sell prime lambs.
November	Watch for fly strike. Obtain ewes and rams for next breeding season, if required. Make fire breaks according to district regulations.
December	Rams on good quality feed in preparation for mating and supplement paddock feed if necessary. Physically inspect all rams and ewes selected for mating.

### Orphan lambs

Before deciding to rear a lamb artificially, recognise that a ewe can raise a lamb better than you can. Therefore, if the ewe can be identified it is worth attempting to re-mother the lamb if she is physically capable of rearing it. Alternatively, try to foster the lamb to another ewe by confining the ewe and lamb in a small, enclosed pen. 'Mothering-up' pens can be erected in the lambing paddock and built from four 1.25 metre mesh panels laced together at each corner. Old seed or fertiliser bags attached to the four panels and stabilised by steel pickets driven into the ground prevent the ewe from seeing out and being distracted. In most cases, the ewe will mother the lamb in 24 to 48 hours.

Generally there are two types of orphan lambs—those that have been deserted at, or soon after, birth and those that have remained with the ewe for one or two days before being orphaned. Lambs that have suckled ewes during the first 18 hours or more of their life can be started immediately on milk or milk replacer when orphaned. However, if it is doubtful whether a lamb has received any colostrum, then colostrum or a substitute must be given for best results.



*An orphan lamb – its mother has died.*

### *Shelter*

Lambs born in severe weather can be in a critical condition during the first few hours of life due to excessive heat loss and an inability to maintain their body temperature. These lambs should be kept in warm conditions when they are brought in for artificial rearing. Even healthy lambs need supplementary heat for the first few weeks after birth if the outside temperature is low.

### *Hygiene*

It is extremely important to keep all feeding equipment and mixing utensils clean and hygienic. After each feeding all equipment should be dismantled, rinsed in cold water, scrubbed in hot water with a disinfectant and then finally rinsed in hot water and left to dry.

The use of equipment that has not been cleaned thoroughly can introduce infection and cause scouring in the lamb.

The shelter area used for lambs also should be regularly cleared of dung. All foodstuffs such as hay, pellets and water should be placed in receptacles that do not allow contamination.

### *Marking and tailing lambs*

Marking and tailing consist of earmarking and tail docking as well as castration of the males. One method of castrating a male lamb is to cut off the tip of the scrotum then, while supporting the internal tissues with one hand, withdraw the testicles with the hook or serrated grip on the handle end of a tailing knife. This allows good drainage of the wound, prevents ruptures and reduces internal bleeding.

An alternative method involves using a small, strong, rubber ring that is expanded by an elastrator designed for this purpose. The scrotum and testicles are drawn through

the rubber ring that is then released. The same rubber rings can be used on the tail instead of tailing with a knife.

The use of a registered earmark is compulsory. Special pliers with the owner's registered ear mark must be used. Males are marked on the right ear and females on the left. A quick, firm action is used to produce a clear mark with minimal discomfort to the lamb.

In accordance with the National Livestock Identification System, coloured tags with the owner's brand embossed on them must be used. The standardised eight-colour cycle that must be used is:

<b>Born 2008</b>	<b>Black</b>
<b>Born 2009</b>	<b>White</b>
<b>Born 2010</b>	<b>Orange</b>
<b>Born 2011</b>	<b>Light green</b>
<b>Born 2012</b>	<b>Purple</b>
<b>Born 2013</b>	<b>Yellow</b>
<b>Born 2014</b>	<b>Red</b>
<b>Born 2015</b>	<b>Sky blue</b>
<b>Born 2016</b>	<b>Black</b>

The age tag must be placed in the ear not containing the earmark. Because the owner's brand must be stamped on the tags, there is no need for wool branding.

Docking of tails to the tip of the vulva or slightly longer (third apparent joint) for ewes and a similar length for males aids in flystrike protection. It is not essential to dock tails of some sheep but if the tails are long and wool-covered, as they mostly are in Merino sheep, tail docking is advisable.

Tail docking is done with a knife, gas knife or elastrator ring. The best way to tail dock is to hold the knife with the palm of the hand upwards and the blade facing inwards, (with the edge towards the operator's body). Fold the tail around the knife-edge so the tail points towards the lamb's brisket. Then, with the elbow in contact with the hip, use a sideways body movement and exert enough pressure to sever the tail.

This method avoids injury to the operator and ensures a flap of loose bare skin is left on the underside of the tail stump to promote rapid healing and a clean wool-free tip of the stump.

At marking, lambs should be injected with a '3 in 1' vaccine, which will provide protection against pulpy kidney, tetanus and cheesy gland. Alternatively, a '6 in 1' vaccine can be used which also protects against blackleg, malignant oedema and black disease. If selenium or vitamin B<sub>12</sub> supplementation is required, vaccines can be used which include these.

Remember that a single vaccination provides only relatively short-term immunity of about eight weeks. For long lasting immunity a second vaccination should be given four to six weeks after the first and then repeated annually (this is especially important for protection against cheesy gland).

Injections should be given high on the neck under the skin behind the ear of the lambs to avoid carcass damage and possible down grading at slaughter.

Lambs may also be scratched with scabby mouth vaccine to reduce the chances of scabby mouth developing. If the sheep are destined for some live export markets, scabby mouth vaccination may be required.

The following points should be considered before lamb marking is performed:

- Marking is best carried out when the lambs are two to four weeks old. Strong lambs can be marked when only

a few days old and all lambs should be marked before six weeks of age. With extended lambings, more than one marking is advised—the first when the oldest lambs are six weeks old and later markings as required.

- Marking should be done on a mild day. Cold, wet days can cause losses due to shock while hot sultry weather can increase flystrike incidence. Extremes of weather can increase the possibility of infection.
- Allow time for lambs to mother up before nightfall, particularly in cold weather or when feed is scarce. Lambs should not be stressed by driving either before or after the operation. The safest plan is to arrange to have the mob close on the morning of the operation. Lambs that have been driven tend to suffer greater blood loss and shock. The need to drive sheep long distances before marking also usually means a later finish.
- Marking wounds provide an opportunity for the organisms that cause tetanus, arthritis and gangrene to infect lambs. These organisms can occur in the soil of sheep yards and camps. The use of temporary yards erected on a new site each year within the paddocks where the ewes and lambs are run will avoid this additional source of infection. The lambs can be released on to clean ground to mother up with no need for further driving.
- Boil the instruments for five minutes before starting work each day and keep them in disinfectant between lambs. Sharp instruments give clean wounds while blunt instruments bruise tissue and increase both the work and the healing time.
- If marking is done under clean conditions in temporary yards, away from dust and other sources of infection, no dressing is required. Severe fly activity at the time of marking can require the use of an anti-bacterial flystrike dressing.

- After each day's marking, collect all tails, testicles and pieces of skin for burning or burial to avoid a possible breeding site for bacteria in the soil. Clean and sterilise all instruments before storage.

## GENERAL SHEEP HUSBANDRY

No matter what type of flock you own, certain sheep husbandry activities will probably need to be carried out. Shearing, crutching, control of external and internal parasites and general health care of the sheep come into this category.

### *Handling sheep*

Whatever the job, for example, shearing, drenching, inoculation, jetting and so on, extreme care should be taken in handling the flock.

- When droving sheep, do not rush and hassle them. In hot weather, move sheep early in the morning or late in the afternoon.
- If you own a sheep dog, don't let it develop the habit of biting sheep. If the dog already has this habit, use a muzzle.
- If the sheep are being left in yards or a shed over night allow enough room for them to move around and lie down.
- If a sheep is to be sat on its rump, then tip it over by holding it under its jaw and lifting the head back. At the same time, place your other hand on the sheep's flank or rump, exerting pressure down and towards yourself.
- Sheep bruise easily. This can lead to downgrading of carcasses at the meat works. Lifting sheep by the wool, prodding, dog bites, overcrowding during transport and crushing sheep in gateways and races can cause bruising.

### *Shearing*

The traditional method of shearing is highly skilled, labour intensive and stressful for the sheep. In addition, skin cuts and second cuts of wool are virtually impossible to avoid. Therefore, for many years there have been attempts to develop better ways to harvest wool from sheep.

Most of these newer systems still require actual shearing of the sheep but instead of having one person shear one sheep they use robotic machinery or a type of assembly line with a number of people each shearing part of the sheep. Some of these systems are contained on a large trailer and brought to the sheep.

In another system the sheep are not physically shorn at all. Instead they are injected with a naturally occurring protein, an epidermal growth factor, which causes a temporary tapering in the wool fibre and hence a break in the wool. At the time of injection a net rug is put on the sheep. Three to four weeks later both the rug and fleece are removed. This product is currently used in lambs only.

However, most sheep producers find it still pays to get a professional shearer to remove the fleeces. If the shearer cannot come to the farm, the sheep could possibly be taken to a neighbouring farm for shearing.

The time of year that you shear the flock will depend on the availability of a shearer, your work program and any flock management problems on your farm. There is no ideal time for shearing. Spring shearing is more traditional, but wet, cold and windy weather in spring can cause shearing to be postponed and pose risks to freshly shorn sheep. Flystrike and grass seed problems can be minimised by shearing in spring. Autumn shorn fleeces are more prone to dust and vegetable matter contamination, and there is a greater risk of pregnancy toxæmia developing in autumn-shorn pregnant ewes.

In the week before shearing clean out the shed and remove anything not required for shearing. Thoroughly sweep and wash the shearing board and the area used for wool handling and storage. Check and repair pens and gates in the sheep yards and shed.

The flock should be drafted before shearing starts so that the rams can be shorn first, then the wethers, ewes, lambs and finally any hairy or coloured sheep.

Yard the sheep the evening before shearing to allow them to 'empty out'. If possible shed the sheep overnight so shearing will not be held up because of wet sheep. If the shed has a catching pen for the shearer leave it empty overnight. Urine and dung can make a floor very slippery and dangerous for the shearer. Sheep penned in a shed overnight can cause condensation to accumulate on the underside of the roof, resulting in wet sheep the next morning. To avoid this, allow adequate fresh air to circulate and pen up the sheep so that it is possible for them to lie down.

A good shearer will take all the wool from a sheep in one piece except for the wool on the belly. After the fleece has been shorn from the sheep, spread it out on a wool table or a clean dry surface with the shorn side down. Remove from the main fleece all short and sweat edges, skin pieces, heavy seeded clumps, short leg wool and stained wool. Put the skirtings, as these pieces of wool are called, aside into a bin, butt or a bag, keeping stained wool separate for drying if necessary. Then fold the fleece lengthwise, and roll it up. Put the fleece in a wool pack or a clean bag and store it in a clean, dry place until it is used or marketed.

Severe losses can occur in shorn flocks if the sheep are exposed to cold, wet, windy weather within about 14 days of being shorn.

Wool is a good insulator and sheep become accustomed to the protection given by the fleece. When the fleece is removed and the sheep are exposed to cold, wet and windy

weather some can be unable to adapt to the altered conditions. Cold weather requires sheep to generate more heat to keep them warm and sometimes the conditions can be so intensely cold that the sheep are unable to do so.

The most important precautions to take after shearing include:

1. Watch the weather and particularly the weather forecasts that often give special warnings for sheep farmers.
2. Try to reserve paddocks with plenty of natural shelter for sheep that have recently been shorn. If there is no natural shelter on your property it can be advisable to plant shelter belts.
3. If your sheep are losing condition at shearing time and the weather is likely to be unfavourable, consider feeding them a supplement to prevent them from losing more weight.
4. If the immediate weather forecast is unfavourable, do not let recently shorn sheep out of the shed and, if possible, muster the others that have been shorn in the preceding few days into a suitable building such as in or under the shearing shed or into an implements shed. Sheep being housed in this manner must be hand fed.

Recently shorn animals found prostrate on the morning after a bad storm can often be saved. Some farmers put these sheep in a sack tied loosely around the neck. When the sheep become warm they can be released. Hay is a good feed to offer these sheep.

### ***Crutching***

At least one crutching is needed between annual shearings otherwise the long wool around the crutch and tail becomes fouled with dung and urine, attracting blowflies when the skin becomes scalded (see section on blowfly strike).



If shearing is done in early autumn then the sheep should be crutched in late September. Crutching at this time should reduce the incidence of breech flystrike.

To crutch a sheep that is not to be sent for slaughter in the near future, shear or clip the wool around the breech, over the tail and down the back of the hind legs. Simply cutting away the dung-soiled wool below the tail (the dags) is not sufficient. It is much more important to prevent staining of the wool by shearing off the wool over the folds on each side of the breech along with their extensions to the crutch and down the legs.

It is often necessary to shear the wool around the prepuce of wethers and rams (ringing) to prevent fouling. Sometimes the wool around the face of sheep and horns of rams needs to be shorn (wiggling) to overcome 'wool blindness' or grass seed troubles.

### ***Selling wool—preparation of the clip***

Wool can be sold privately to a wool buying company or consigned to a wool auction. Australian Wool Innovation Ltd can advise on wool presentation.

Australian wool has the reputation for being well prepared, free of contamination and properly packaged and described. The standard of preparation is governed by the Code of Practice on the Preparation of Australian Wool Clip that is administered by the Australian Wool Exchange Ltd. The Code provides clear guidance on how to prepare a wool clip that is free of contamination, clearly described and well presented. You need to be aware of the general requirements under the Code.

The three key principles in the Code of Practice are:

- The need to present uniform lines of wool that meet the needs of wool processors and so attract maximum competition at sale time.

- The requirement to eliminate contamination from the wool clip.
- The proper documentation and identification of wool on-farm and at the time of sale.

Wool classers take on the primary responsibility for dealing with these issues and are registered by the Australian Wool Exchange Ltd so that their stencil/stamp is a sign of professional competence. If they are satisfied that a bale of wool meets the standards for the industry they will brand the bale before it leaves the shearing shed. This assists with the identification of bales during handling and storage.

If there isn't enough wool to fill a bale, the wool can be sent to a bulk-classing house where it will be amalgamated with other similar wools to give a saleable quantity. You will then be paid for the amount of your wool in the sale lot.

Whoever classes the wool shorn on your property should prevent contamination of white wool with stained, black, pigmented or medullated wools and non-wool articles (i.e. foreign objects). If different breeds of sheep are to be shorn in the same shed, then the order of shearing should be:

1. White wool sheep at low risk of pigmented or heavily medullated fibres (e.g. Merino).
2. White wool sheep joined to pigmented, partly pigmented or heavily pigmented rams.
3. White wool sheep that have reared, or been run together with pigmented, partly pigmented or heavily medullated lambs/sheep.
4. White sheep marked as culls because of pigmented or medullated fibres.
5. Sheep with obvious pigmented or medullated wool.

Thus, the sheep with the lowest contamination risk are shorn first, followed by those that have been joined to or reared a pigmented sheep, crossbred pigmented lambs and finally pure bred pigmented sheep.

## ***Selling sheep***

Sheep can be offered for sale by auction and either you or a stock agent can organise a sale to another person or company. Lambs can also be consigned direct to abattoirs.

When selling sheep, whether on the farm or in saleyards, present them in the most attractive way possible. Daggy sheep look unattractive and will soil the flanks of other sheep while being held in confined spaces. Carefully clip dags off leaving as much clean wool as possible on the sheep. This method leaves the sheep with an evenly covered rump and breech.

Should a sheep lose a horn or be wounded close to sale time, remove it immediately before blood is rubbed on to the other sheep. Do not work sheep in muddy yards before the sale and keep them as dry as possible.

Any sheep that shows signs of ill health, limps or is conspicuous in any other way should be drafted from the flock and not sent for sale.

Bruising and physical injury are caused by rough and careless handling, especially in yards and trucks, when sheep are being despatched. To reduce this damage when sheep are being moved through yards, dogs should be muzzled to prevent biting and rattles should replace prodders to persuade sheep to move. When directing sheep in yards the body should be used as a visual block rather than slamming gates on the sheep. Pulling the wool and kicking or pulling by the leg are serious causes of bruising and should be avoided. Lambs should be lifted by gathering them up around the legs and sheep should be directed with a hand on the shoulder.

Should it be necessary to truck sheep to the sale, yard them a few hours before loading commences to allow them to empty out.

A lot of the damage suffered during transportation takes place while loading and unloading. These operations should be carried out as quietly as possible, remembering that attempts to hurry sheep usually slow the operation. Also ensure that loading ramps and trucks are properly positioned for smooth loading.

Stock vehicles should be well maintained and driven smoothly. Partitions should always be closed when sheep are on board, making sure to avoid too many or too few animals in each section. Sheep from mobs of different sex or size should be penned separately and horned sheep should not be mixed with polled sheep. Vehicles should be clean and provide a good footing and sheep should not be packed too loosely. Loosely packed sheep can fall over, become soiled and bruised and soil other sheep when they rise.



*Sheep being sold by auction.*

## DISEASES AND PARASITES

Your flock's health can determine whether or not you succeed with sheep. Disease prevention is the most effective and economical approach to ensure a healthy flock. Complete prevention or absence of all diseases can not be possible but following the best prevention practices makes good sense.

Disease control for sheep includes the usual health and sanitary measures. These are matters of good management.

- Protect against the introduction of diseases and parasites to your flock. Ensure that boundary fences are secure, that introductions of sheep are minimised, and that sheep brought onto your property are at least as healthy as your own, based on careful inspection and inquiry and provision of a National Sheep Health Statement by the vendor.
- Prevent spread of disease within the flock by removing sick sheep from the flock.
- Control, or eliminate diseases that are present by following recommended practices. Seek veterinary help if necessary.

Veterinarians, advisers and stock inspectors are available at DAFWA offices to discuss, advise, identify and help in eradication of any health problems you can have with sheep.

Veterinary assistance might not be immediately available and it will sometimes be necessary to communicate with a veterinarian by telephone about some conditions affecting the sheep. In doing so the following should be stated:

- Describe the breed, age, sex, breeding history, recent changes in body condition, and any recent treatments such as vaccination, drenching, shearing, lamb marking or mules operation.

- The pasture the sheep are grazing, giving the names of the dominant grasses and legumes, the quantity and quality of the feed available and the occurrence or otherwise of known poison plants.
- The seriousness of the situation in terms of the number of sheep in the flock; the number affected, the number that have died or recovered; the date of the first mortality; the daily death rate; whether the losses occurred suddenly or if the animals lingered for some time before dying and if a similar condition has occurred on the property or in the district previously.
- The main symptoms that have been noticed such as discharges; colour of the skin, eyes and mouth; scouring; any irregularities in the gait (lameness or staggers); standing apart from the flock; type of breathing; if lying on the ground then what position and anything else that is different compared with the healthy sheep.

If you should have the slightest doubt that an 'exotic' disease such as foot and mouth disease or bluetongue could have infected your flock, do not attempt to move the animal, but immediately contact your private veterinarian, a government veterinarian or a stock inspector, and do not leave the farm if possible. The Emergency Animal Disease Hotline (freecall) is 1800 675 888.

## Internal parasites

### *Introduction*

Parasitic worms in sheep can cause severe problems and even death but can be controlled with good management practices, including good nutrition, regular checking and judicious use of effective chemicals (drenches). For small flocks, sustainable worm control might not be possible due to constraints on spelling paddocks to minimise pasture contamination with worm larvae. Consequently there could

be a greater reliance on drenches to minimise the effects of worms and some worm species might develop resistance to particular drenches. If the same drench is used repeatedly a severe worm problem can result as the drench becomes less and less effective.

Individual sheep vary in their natural resistance to worms and this resistance is moderately heritable. In a small flock it might not be worthwhile to embark on a program of breeding for worm resistance but it may be possible to buy rams from studs that do practise selection for worm resistance.

### ***Important worms***

There are two main groups of gastro-intestinal worms that affect sheep in Western Australia.

#### ***Scour worms***

These worms (e.g. black scour worm (*Trichostrongylus*) and brown stomach worm (*Teladorsagia*, formerly *Ostertagia*)) are common in most areas and the immature stages (larvae) are abundant on pastures in winter and spring. Signs of infection include ill-thrift, diarrhoea (scouring) and in severe cases death.

#### ***Barber's pole worm (Haemonchus contortus)***

This worm occurs mainly in areas that have significant rain during warm weather and in pastures that remain green over summer. The larvae are most abundant on pasture in autumn and spring and after significant summer rainfall. Barber's pole worm sucks blood from the sheep and can cause anaemia (visible as pale mucous membranes of the gums and around the eyes), subcutaneous oedema (bottle jaw) and sheep deaths with little warning if environmental conditions are favourable. Sheep affected by barber's pole worm usually do not have diarrhoea (scouring).

### ***The worm life cycle***

Adult worms of each of the species are found in a specific location within the sheep (for instance, black scour worm in the small intestine and barber's pole and brown stomach worms in the abomasum (fourth stomach)). Male and female adult worms at this location mate and the females lay their eggs which then pass out of the sheep's gut and onto the paddock in the sheep's faeces.

To complete the life cycle, the eggs in the faeces hatch to release first-stage larvae. These develop through two stages over several days to become infective third-stage larvae. These third-stage larvae move from the faecal pellets to pasture plants with most located up to a height of about 25 mm above the ground. If grazing sheep ingest the larvae they will develop through further stages inside the sheep to become adult worms within about three weeks.

The development of the parasites on the paddock depends on the environmental conditions and the type of worm. For example, barber's pole worm thrives in warm, wet conditions and therefore occurs in areas where there is some summer rainfall or irrigation. Black scour worms and brown stomach worms are generally present in largest numbers in the autumn, winter and spring in a typical Mediterranean climate and occur throughout Western Australia.

Larvae will survive on pasture for long periods when temperature and moisture conditions are at an optimum. In winter some larvae can survive upwards of six months while in summer, with hot and dry conditions, most larvae are destroyed within a couple of months. However in areas with relatively mild summers, small numbers of larvae will survive over summer because they are protected in the dung pellets. These emerge later to infect grazing sheep when conditions become favourable again, such as after autumn rains.

## ***Diagnosing worms***

Diarrhoea (scouring) is usually the first noticeable sign of worms, except when the main worm involved is barber's pole worm. However, scouring might not only be due to worms. Sometimes scouring can be caused by a change in feed or other parasitic or bacterial gut infections. Loss of condition is also a common sign of worm infection. Young sheep are the most susceptible to worm problems because it takes a few months for them to develop immunity. Stocking a large number of animals in a small paddock will generally increase the rate of pick-up of worm larvae and lead to an increased worm burden in individual animals.

Scouring alone should not be relied on to indicate that worms may be causing trouble. Moderate worm burdens, sufficient to cause reduced growth rates, may be present without causing scouring, especially when the sheep are on dry feed.

The best way to diagnose the presence and significance of worms, other than autopsies, is to collect faecal samples from 10 to 20 randomly selected sheep to be checked for worm eggs. Most veterinary practitioners in rural and semi-rural areas are able to do a faecal worm egg count and offer advice on the best course of action, including the best drench to use.

## ***Treatment for sheep worms***

Depending on the number and relative importance of worms, a drench (anti-parasitic compound) might be recommended to remove them. There are many different types of drenches which differ in their effects against different parasites and in the likely status of resistance by worms. A veterinarian can advise on the most appropriate treatment, which might be recommended only for affected animals. It is important to avoid excessive frequency of treatments to avoid favouring worms that are resistant to drenches.



*Drenching a sheep. Note the position of the drenching gun.*

When animals are drenched they should ideally be moved to a less contaminated paddock. It is also important to ensure that good quality feed is provided, as worms have less impact on well-nourished sheep.

## ***General drenching tips***

Correct administration is essential to ensure drenches are effective. The following guidelines will improve the drenching technique:

- Under-dosing is a major cause of drench resistance so it is critical that sheep get the correct dose. A few of the larger animals should be weighed so that the dose for the heaviest sheep in the flock can be calculated. If there is a wide variation in size and condition of animals in the mob, then they should be drafted into even lines and drenched according to the maximum weight in each group.

- Drench guns should be checked regularly to ensure they deliver the correct dose.
- During treatment the drench gun should be placed over the sheep's tongue rather than in the front of the mouth. This helps to ensure that all of the drench is delivered to the rumen for maximum effect.
- When drenching, raise the sheep's head a little and do not turn it sharply to the side.

A local livestock contractor might be available to drench your sheep and undertake other husbandry practices.

## External parasites

### *Sheep blowfly*

The most common external parasite is the sheep blowfly larva or maggot. The main blowfly is the Australian sheep blowfly (*Lucilia cuprina*).



*A fly struck sheep. Note the dags on some of the other sheep.*

Blowfly strike occurs when flies of various species lay eggs in the wool of sheep, usually in spring or summer or following rain during warmer weather. When the eggs hatch the larvae or maggots burrow into the sheep's skin and live on its flesh causing severe damage.

Adult female flies are particularly attracted to scalded skin and wet wool such as around the pizzle, vulva, and breech and other wrinkled areas where wetness caused by rain, sweat or urine persists. Worms that cause scouring lead to soiled wool around the breech area, forming dags that are very attractive to egg laying females.

Crutching, shearing and jetting with chemicals are used to control blowflies. The danger periods for blowfly strike are when the weather is hot and humid. During such weather inspect the flock regularly. Treat affected animals immediately because flystrike is a painful and potentially fatal condition.

Flystruck sheep become fidgety, stamping the hind legs and even chewing their wool or rubbing against a post. Later, affected sheep show areas of dark green, discoloured wool and varying degrees of illness and lameness and can die. Although some sheep do recover spontaneously from flystrike, it is still critical to check and treat flystrike for animal welfare reasons.

**Note:** Property owners who have neglected their sheep have been prosecuted by the RSPCA.

### *Preventing flystrike*

During periods when flystrike is expected (spring/early summer) or when flies are seen, sheep should be treated to prevent them being struck or ideally shearing should be timed to occur just before the predicted fly season. If sheep are shorn and shearing cuts heal before flies become active, then a preventative chemical treatment might not be necessary.

If sheep are not shorn and require a treatment, the most convenient method is to use a spray-on chemical. The other method is to hand-jet which involves using a special applicator to apply the chemical through the fleece down onto the skin. For those who are inexperienced in handling sheep, hand-jetting can be very difficult and exhausting. A good race and yards are essential if sheep are to be hand-jetted. The other option is to contact a sheep contractor to apply the chemical.

### *Treating struck sheep*

Sheep that have maggots should be treated immediately. Catch and restrain the sheep and clip the wool away from the affected area (including a 5 cm-band of clean wool adjacent to the strike wound) to expose the maggots in the flesh. Also clip any narrow tracks of strike that lead away from the main strike. This is necessary particularly with coloured sheep when it is more difficult to see a strike and to where it has spread.

All wool and maggots should be collected and placed in an airtight plastic bag and left in the sun for a couple of days to ensure all the maggots have been killed. The struck area and adjoining clean area should be liberally dosed with a solution of jetting fluid at the recommended concentration or with a proprietary blowfly preparation available from stock agents.

Before sheep are treated with any chemical check the label for wool and meat withholding periods. Export slaughter intervals might also need to be considered. A current list of Export Slaughter Intervals and Withholding Periods for veterinary chemicals used on sheep can be found at the Australian Pesticides and Veterinary Medicines website, <http://www.apvma.gov.au>

### **Sheep lice**

The sheep body louse (*Bovicola ovis*) is an insect only 2 mm long with a brown body with several dark bands. The lice spend their whole life cycle on sheep, rarely infest other species of animals and never infest humans.

Lice have mouth-parts that are specifically adapted for feeding on the skin surface. During feeding the lice bite the sheep and cause intense irritation.

Sheep body lice do not suck blood. There are two other uncommon and rarely important species of sheep lice that do suck blood. These are commonly known as face lice and foot lice.

By parting the wool on the shoulder, mid-side and flank of infested sheep lice can be found clinging to wool fibres usually within 10 mm of the skin surface.



*A lousy sheep.*

The number of lice on an infested sheep is difficult to estimate but if the average seen at each 10 cm parting of the fleece is one, there will be 2000–3000 lice on the sheep.

To relieve the intense irritation caused by biting lice the sheep rub against fences, posts and trees and if heavily infested they can scratch and bite at the wool. The wool becomes matted and discoloured, presenting a ragged, torn appearance.

A couple of weeks before shearing is the best time to look for lice as they will be in the greatest numbers and arrangements can be made for treatment at or shortly after shearing.

Select at least 10 sheep that have a ragged appearance of the wool. Up-end the sheep and part the wool down to the skin in areas that you would normally inspect for wool quality such as the shoulder and mid-side. At least 10 wool partings should be done on every sheep. Adult lice will be seen clinging to wool fibres and moving when exposed to light. Young lice are usually on the skin and difficult to see. If you are unsure that what you see is a louse, use a magnifying glass.

### *Treating lousy sheep*

The best time to treat sheep for lice is at shearing with an off-shears backline treatment or two to three weeks after shearing with a short wool plunge or shower dip. All sheep must be treated correctly. If using an off-shears backline treatment, the chemical must be applied according to label instructions and using the recommended applicator. Synthetic pyrethroid products are not recommended because lice resistance to this group was discovered over 10 years ago and it is likely that treatment will fail. Before using any chemical the label should be read carefully.

If lice are found in long wool (six months or more after shearing), contact your rural merchandiser or DAFWA for advice. Treatment options depend on the severity of the

infestation and the length of wool. It is unlikely that lice will be eradicated using a long wool treatment and any treatment done at this time should be followed up with a treatment after the next shearing.

## **Foot diseases**

Foot abscess, virulent footrot and benign footrot all occur in Western Australia and can be confused by people inexperienced in their identification.

### ***Foot abscess***

Foot abscess causes acute lameness, usually in one foot, and is caused by germs entering the foot through injury or bruising, resulting in the foot becoming hot to touch and possibly inflamed and swollen. If the abscess bursts or is opened by surgery a thick, greenish-yellow pus exudes. The abscess usually clears up without further treatment after the release of the pus. In some animals antibiotic treatment is necessary.

### ***Footrot***

Virulent footrot is a notifiable disease and the nearest stock inspector must be informed if the disease is suspected on a property. Contact the local DAFWA office for confirmation of the presence of footrot and sampling of interdigital skin. Virulent and benign strains are easily differentiated by laboratory tests, which take about 14 days.

### ***Virulent footrot***

Virulent footrot (VFR) starts to show mostly during spring as reddening, slight moisture and loss of hair between the toes. There can be separation or under-running of horny material at the junction of the skin and horn of the foot. Usually more than one foot on an animal is affected and there can be a distinctive offensive smell in affected feet.



The feet may become flystruck. Animals can become lame, lose weight and reduce wool production. The best defence against VFR is to prevent the entry of diseased animals to the property through good fencing to ensure stray sheep do not enter and buying only clean sheep or maintaining a 'closed' flock. In September 2008, there were fewer than 20 flocks quarantined for virulent footrot in WA. The Footrot Control Program is jointly funded by sheep producers and DAFWA.

### *Benign footrot*

The early signs of benign footrot (BFR) are similar to VFR but the development of lameness and under-running is less common. Because cattle in the south-west of Western Australia carry BFR strains and the disease is prevalent in about 15 per cent of sheep flocks and goat herds, BFR is not targeted for eradication.

It is important to report any suspect footrot to DAFWA. Laboratory tests can then confirm whether or not VFR is present.

## **Clostridial diseases**

Clostridial diseases include black disease, black leg, malignant oedema and the two most widely known diseases of this group—tetanus and pulpy kidney—and are caused by a closely related family of bacteria. Pulpy kidney is the most common clostridial disease occurring in sheep in Western Australia.

### *Tetanus*

A wound that appears to be healing could in fact be infected with the tetanus bacterium that produces a powerful poison affecting the nervous system. Tailing and marking wounds of lambs are a common source of infection.

A sheep suffering from tetanus lies flat on its side with legs stretched out and head back, the limbs become stiff, the jaw locks closed and the whole animal can be lifted like a board.

### *Pulpy kidney (Enterotoxaemia)*

The bacterium that causes pulpy kidney is a normal inhabitant of the intestines of sheep and in small numbers does not upset the animal. However, under certain conditions large numbers of the bacterium build up and produce a toxin that causes pulpy kidney and poisons the sheep.

Pulpy kidney usually occurs when sheep are grazing lush, rapidly growing pasture or young cereal crops or when they are being fed grain. The most dangerous time for older sheep is just after they are introduced to good feed from poorer feed. The disease can also occur in lambs suckling ewes with an abundant milk supply.

Sheep stricken with the disease are normally found dead as affected sheep die very quickly. If seen before death, affected sheep show a staggering gait with the head held low, before they then go down with the head held to the side. There can be some struggling and some animals can scour and affected lambs can have convulsions.

### *Cheesy gland (Caseous lymphadenitis or CLA)*

Cheesy gland is a bacterial infection of sheep that causes the development of abscesses ('boils') in superficial and internal lymph nodes and organs, particularly the lungs. It is a common infection in Western Australian sheep flocks. Infected sheep grow less wool and some may die of the disease, but the greatest losses occur at slaughter when entire carcasses may be condemned or require trimming.

Loss of meat and the cost of inspection for CLA are the major costs of this disease.

Unless infected sheep have visibly enlarged lymph nodes, such as those in front of the shoulder, in the flank or under the jaw, it is unlikely that you will recognise the disease in sheep on the farm. Abattoir feedback is the best way to know whether CLA exists and its severity on your farm. There is no effective treatment for CLA.

Most sheep become infected at shearing when bacteria coughed out by infected sheep contact fresh shearing cuts. Plunge or shower dipping also spreads infection.

Vaccination is the most effective way to control cheesy gland.

## Scabby mouth

Scabby mouth is a non-fatal viral disease of sheep. It is a common infection in Western Australia but, because an outbreak may often go unnoticed, some farmers may mistakenly believe that it does not occur on their farm. Most commonly it causes scabs and pustules on the lips and nose, but they may also occur on the lower legs, just above the hoof, and the udders and teats of ewes. Humans are susceptible to the infection. Sheep recover without the need for treatment. The disease is important because infected animals will be rejected for live export, slaughter or public sale and because it may infect humans. It is also important because it resembles two sheep diseases exotic to Australia, sheep pox and foot and mouth disease.

The virus that causes scabby mouth can survive in the environment, in scabs, for a long time, possibly years. Sheep become infected when the virus contacts abraded or unusually softened (persistently wet) skin.

Vaccination is the most effective way to control scabby mouth.

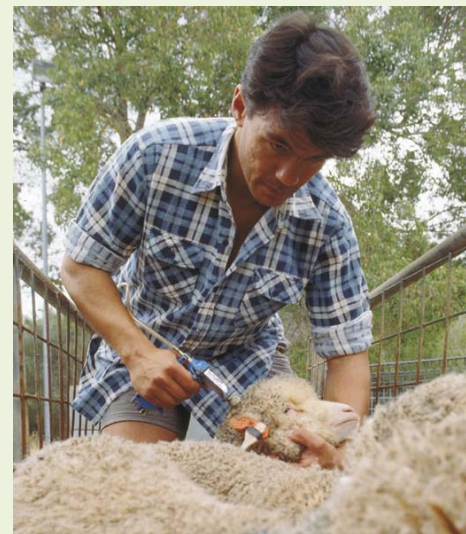
## Vaccines

Safe and effective vaccines for sheep are available against clostridial diseases, cheesy gland, scabby mouth and erysipelas arthritis. If the recommended vaccination programs are followed, vaccinated sheep will gain a very high degree of protection against the target infections. All vaccines should be handled and administered as directed by the manufacturer. All the vaccines, with the exception of scabby mouth vaccine, should be administered under the skin at the base of the ear.

All lambs should be vaccinated with a '3 in 1' or '6 in 1' vaccine at marking with a booster given four to six weeks later and an annual booster thereafter. The 3 in 1 vaccine protects against pulpy kidney, tetanus and cheesy gland. The '6-in-1' vaccine protects the lamb against all the clostridial diseases mentioned above as well as cheesy gland.

With pregnant ewes it is best to give the annual booster about six weeks before lambing to raise resistance and help protect the lamb during its early days of life.

Scabby mouth vaccine, if used, is administered by scratching the live virus solution onto the bare skin on the side of the brisket or the inside of the foreleg. The purpose-designed applicator must be used and all instructions carefully followed, remembering that the virus is communicable to humans.



*Vaccinating sheep at the base of the ear.*

If arthritis of lambs is a problem and the cause is identified as Erysipelas bacterial infection, then ewes may be immunised before lambing to protect their lambs from contracting the infection at marking. Ewes require two initial vaccinations, usually at joining and about four weeks prior to the start of lambing. Thereafter the ewes should receive an annual booster about four weeks before lambing begins.

## **Pregnancy toxaemia**

Pregnancy toxaemia is a nutritional disease affecting ewes late in pregnancy and mainly those carrying twins or triplets. Hence the common name 'twin lamb disease'.

Pregnancy toxaemia is caused by an inadequate energy intake during the last four to six weeks of pregnancy during which two-thirds of the growth of the foetus occurs. The rapid growth of the foetus makes heavy demands on the ewe and if feed is inadequate, normal metabolism cannot be maintained. This causes glucose deficiency and the characteristic symptoms of the disease.

Prolonged or sudden under-nutrition during the last month of pregnancy is the main cause of pregnancy toxaemia. This can be brought about by lack of paddock feed or stress such as transportation over long distances as well as prolonged yarding.

The affected ewe stops eating and drinking and develops a stiff, unsteady gait when driven and can collapse after a short distance. When approached the ewe shows little or no response. Grinding of teeth, frequent urination and a sickly sweet odour on the ewe's breath are further clinical signs.

Treatment is seldom successful so prevention is the best safeguard. Choose a lambing time when ewes will have sufficient paddock feed or be prepared to hand feed them. Avoid sudden starvation or stress such as yarding and trucking late in pregnancy.

## **Pink eye**

Pink eye is a common disease of sheep, particularly during summer. One or both eyes may be affected. If pink eye is suspected, first check that a grass seed has not lodged behind one of the eyelids as seeds can produce signs similar to those of pink eye.

Droplets from eye discharges that are carried by flies can spread the germ so avoid yarding infected sheep with unaffected animals if at all possible.

In affected animals signs may range from a watery eye to a cloudy cornea with pus discharge from the eye. In severe cases the eye can become completely white, causing temporary blindness. In most cases recovery is complete in 10 to 14 days but severe cases can take six weeks. Very few animals fail to recover completely.

Complete recovery will occur without treatment although treatment may be given under some circumstances. To treat pink eye place the affected sheep in a small yard with feed and water and apply eye treatment according to label instructions.

## **White muscle disease**

White muscle disease (WMD) is associated with deficiencies of vitamin E and/or selenium in the diet. The disease affects weaner sheep during summer and autumn when vitamin E and/or selenium can be deficient or in two- to ten-week old lambs during winter and spring when selenium can be deficient.

White muscle disease often becomes evident when sheep are stressed from shearing, driving, worm infestation, water deprivation or lamb marking. The disease affects both heart and skeletal muscles. In some cases only a portion of the muscle is affected and there can be a sharp contrast between the diseased and normal muscle tissue.

The heart is usually more frequently and severely affected when the cause is selenium deficiency and death rates from the disease can therefore be higher when selenium deficiency is the cause.

Usually more than one animal is found dead while others remain down, unable to get to their feet and die within a few hours. Some apparently healthy lambs brought in for marking can die or are unable to walk before leaving the yards. Some of the lambs that cannot walk can recover if left alone while others will die over the following two days.

When vitamin E deficiency causes WMD in weaner sheep many of the sheep may walk with a stiff gait and hunched back. If these animals are driven some will collapse and be unable to rise for a considerable time or can even die.

If WMD occurs it is necessary to determine if the cause is selenium or vitamin E deficiency and this can be done relatively cheaply and quickly by testing a blood sample. Handling of affected sheep to treat WMD is stressful and can result in deaths. If treatment is necessary, move and handle the sheep as quietly as possible. Prevention is preferable to treatment of the disease.

To prevent WMD caused by selenium deficiency in lambs, drench or inject pregnant ewes one month before lambing with selenium and then treat the lambs at marking. To prevent the disease in weaners, all sheep should be given a selenium pellet at weaning. Selenium pellets are lodged into the lamb's rumen using a specially designed applicator and will provide sufficient selenium for one to two years.

If pellets are not given weaners should be drenched or injected twice during the summer/autumn, first in January and again in six to eight weeks. Selenium can be administered with worm drenches and pulpy kidney vaccine. Selenium can also be provided via pasture topdressing, which negates the need to treat sheep

directly. The economics of topdressing versus sheep treatment need to be assessed to determine what is best for your situation.

Selenium toxicity has been recorded in sheep, so read and follow all dosage instructions carefully.

Vitamin E is provided by green feed and in most years summer weeds and pasture that germinate after summer storms supply sufficient vitamin E to sheep. White muscle disease caused by vitamin E deficiency is only seen after extended periods without access to some green feed. Provide such sheep with vitamin E through drenching or mixing with feed. Injectable products (usually containing vitamins A, D and E) will probably not contain sufficient, therapeutic levels of vitamin E when given at label dose rates. Vitamin E powder can be mixed with water to make a drench.



*A sheep suffering from white muscle disease (JG Allen).*

## Lupinosis

Lupinosis occurs when sheep ingest toxins produced by a fungus (*Diaporthe toxica*) that colonises lupins. The disease only occurs when lupins have dried off and when conditions suit the fungal production of the toxins (phomopsins). These conditions are not precisely known but there is a requirement for moisture (rain or dew) and moderate temperatures (20–25°C).

In the absence of toxin production, dry lupin plants or stubbles provide excellent summer feed for cattle and sheep. Both the Western Australian blue lupin (sandplain lupin) and the cultivated sweet lupin can be infected by the fungus.

Affected sheep characteristically show a variable loss of appetite, depending on the toxicity of the lupins eaten. With very toxic material the sheep can suffer complete and immediate loss of appetite and many are likely to die during the following weeks with signs of lupinosis. Lesser toxicity can cause a fluctuation in appetite and so body weight decreases. Affected sheep appear dejected, depressed and will form the 'tail' in the flock if being driven. The detection of stragglers when sheep are moved within a paddock is an early indication of lupinosis.

On close examination, jaundice (yellow colouration) will be noticed in the mucous membranes of the eyes and mouth. In the milder form of lupinosis these membranes can have a muddy appearance. Should the liver of acutely affected sheep be examined soon after death it will be greatly swollen, bright yellow or orange and greasy when cut with a knife. The gall bladder will be enlarged five to six times its normal size.

Since the early 1990s all newly released lupin cultivars have been *Phomopsis*-resistant, resulting in an enormous reduction in the incidence of lupinosis. If lupins are to be planted and the stubbles subsequently grazed by sheep or

cattle, only plant *Phomopsis*-resistant lupins. However, the risk of lupinosis is not completely eliminated with these new lupin cultivars especially in cool, wet summers.

To prevent lupinosis developing, sheep grazing dry lupin plants or stubbles should be inspected daily for the first week then at least three times a week. Following summer rain, daily inspections should again start and continue for seven days. As soon as the earliest signs of lupinosis are recognised the sheep should be removed from the paddock.

Lupinosis interferes with normal selenium metabolism and this, combined with the stress of the disease, can result in sheep developing a form of WMD. It is therefore recommended that all weaner sheep in known selenium deficient areas be given selenium before grazing lupins.

By cutting green lupin plants soon after pod formation has started, the lupinosis fungus can be controlled. The cut lupins can be left on the ground but preferably conserved in bales or fodder rolls that are left in the paddock. Sudden drying of the lupins results in much of the fungus dying and reduces the potential for toxin production during summer. The more rapid the drying, the greater the beneficial effect.

## Annual ryegrass toxicity (ARGT)

ARGT is the poisoning of livestock that eat annual ryegrass seeds infected by a bacterium, *Clavibacter toxicus*. This bacterium is carried into the seed by a nematode, *Anguina funesta*. The poison produced by the bacterium mainly affects the brain and affected animals show nervous signs such as convulsions, hypersensitivity and incoordination.

ARGT can occur in stock grazing pastures or crop stubbles throughout large areas of the south-west. Most cases of ARGT occur from mid October to mid December. Hay and grain can contain toxic ryegrass so ARGT can also occur in stock eating these feeds at any time of year. Poisoned

animals can simply be found dead or collapsed, paddling or convulsing or, when driven, they can attempt to run, stagger, develop a rocking horse gait and fall.

There is no antidote for ARGV and eradication of annual ryegrass is very difficult. So the best way to minimise disease risk is to use a combination of control methods.

Options for control include:

- Spread twist fungus in late autumn. The fungus attaches to the invading nematode, hindering its movement, growth and reproduction as well as growth of the toxic bacterium.
- Establish a strain of ryegrass that is resistant to the nematode. This ryegrass will cross breed with existing ryegrass populations, gradually raising the overall genetic resistance of ryegrass on the farm to the nematode.
- Apply herbicides, such as paraquat/diquat or glyphosate, in early spring, before flowering of the ryegrass ends.
- Stock ryegrass pastures very heavily in winter and spring to prevent flowering.
- Cut ryegrass pasture for silage or early cut hay or plough it in for green manure.
- A vaccine could be available for livestock in the future.

## Fleece disorders

*Lumpy wool* (dermatophilosis or 'Dermo') results from inflammation caused by a bacterial infection of the skin. The disease causes horny projections to form along a tuft of wool and feels rough and lumpy to the touch. The sheep most affected on the wool area are Merinos from birth through to the hogget shearing. Older sheep are less affected on the wool area but commonly have face and ear lesions and are carriers of the disease.

The disease is most common in sheep in high rainfall areas, especially along the south coast. British breeds and crossbreds are rarely affected. Yarding wet sheep and sheep dipping increase the incidence of the disease.

Most sheep recover naturally from lumpy wool but if the infection is still active eight weeks before shearing is due to start an antibiotic injection, obtainable from a veterinarian, can be required. This will aid healing and cause the scabs to lift. Be aware of the antibiotic's withholding period if the sheep are to be slaughtered.

Lumpy wool lesions also predispose sheep to blowfly strike and fleece rot.

*Fleece rot* is a skin and fleece disorder that affects mainly Merino sheep in high rainfall areas. Fleece rot starts as a skin scald when the skin is kept wet for at least five days. As the disease progresses, a green discoloration of the wool appears and an odour is produced that attracts blowflies.

Direct selection of breeding sheep free from fleece rot is the best method of prevention as there is no treatment for this disorder

## Trace element deficiencies

Sheep need a continuous and balanced supply of trace elements to remain healthy. Sufficient trace elements are usually obtained from grazed pasture but in some areas of Western Australia deficiencies can develop and additional trace elements may need to be provided.

Areas of Western Australia deficient in trace elements are known so enquire if your area has a history of any deficiency. Two trace elements that are known to be deficient in some sheep farming areas are cobalt and selenium.

**Cobalt:** A deficiency of cobalt in sheep results in a loss of appetite and reduced liveweight and wool growth. Generally, sheep show a lack of thrift so that they appear starved even though there can be a good supply of feed.

Cobalt deficiency in sheep can be cured or prevented by inserting a cobalt pellet into the rumen of lambs at weaning. This is a simple operation using a specially designed applicator, the same used to administer selenium pellets.

For short term supplementation only—over a few weeks—vitamin B<sub>12</sub> can be given by injection

**Selenium:** This trace element is necessary for the growth of sheep and to prevent the development of certain diseases. The condition most often associated with selenium deficiency is white muscle disease which was discussed previously.

Further advice on animal health problems can be obtained from private veterinarians or advisers and veterinarians at your Department of Agriculture and Food district office.

## WORKING AND PET DOGS

On farms close to towns marauding dogs can be a major problem. Notify your local shire office at the first sign of killer dogs. Pet dogs should be kept as pets and not encouraged to become working dogs.

Family pets, friendly dogs and other well-mannered canines frequently turn out to be sheep-killers. Unsuspecting owners of such pets can hardly believe this until presented with proof. Unfortunately, once a dog or a pack of dogs start attacking sheep it is practically impossible to break the habit. Sheep killers will teach other dogs to do the same thing. Do not think your dog is innocent just because it is lying at the back door when you retire and when you get up. Tie the dog up or put it in a pen or shed at night.



*A good sheep dog can be a great help.*

A good sheep dog is a great help when working sheep. It is said that a top sheep dog is worth four men so it is worth protecting this valuable asset.

Below are some common parasites and disease that can affect your dog's working ability and health. Bear in mind when giving periodical treatment to the working dog that any pet dogs that live on or regularly visit the farm should receive the same treatment.

Sheep measles (*Cysticercus ovis*) are caused by the intermediate stage in the life cycle of a large tapeworm, called *Taenia ovis*, of the dog and fox. Sheep measles (seen as cysts in sheep muscle) have led to condemnation of carcasses and considerable economic loss in the export of sheep meats.

Cysts occurring in sheep and goats are commonest in the heart and diaphragm and in heavy infestations they can occur throughout the muscles.

Hydatid disease (*Echinococcus granulosus*). Infected dogs, foxes and dingoes carry the adult form of this parasitic tapeworm. The immature, bladder-like cysts of the larvae develop, particularly in the liver and lungs, of sheep, cattle and humans.

While they rarely cause any signs of ill-health in dogs, it is important to keep your dogs free of these tapeworms in the interests of meat quality and human health. Dose all dogs monthly with a drug recommended by a veterinarian. Sheep meat should be thoroughly cooked by boiling before being fed to dogs. If sheep are slaughtered on the farm, all scraps and offal should be buried deeply.

*Distemper* is caused by a virus and is one of the most common infectious diseases of dogs. The early signs of the disease are loss of appetite, fever, thick eye and nasal discharges, coughing and diarrhoea. Nervous symptoms, such as twitching or fits, are sometimes seen. Mortality is very high. All pups should receive a vaccination for temporary protection at two weeks of age and then at three months. Long lasting immunity can be given with another injection. All dogs should receive a booster vaccination every two years.

*Flea and tick* control in the past relied mainly on the use of relatively toxic organophosphate and organochlorine compounds. While these products are still used, there is now available a range of much safer and more effective treatments, including synthetic pyrethroids and insect growth regulators. Similarly, the products available for mange treatment are now both safer and more effective than those used in the past. When treating dogs don't forget to clean out and treat their kennels and surrounds.

Dogs should not be treated for external parasites with sheep lice or fly treatments unless the label states that this is permissible.

## POISON PLANTS

In general, poisoning of some type is to be suspected when a number of animals simultaneously become ill or are found dead. Should sheep wander from their paddock into natural bushland and deaths follow, then poisonous plants could well be the cause of death.

The most important group of native toxic plants belong to the genus *Gastrolobium* in the pea-flowered family. This genus includes some species once regarded as belonging to the genus *Oxylobium*.



*Prickly poison (Gastrolobium spinosum) is one of many poison plants in Western Australia.*

(Western Australian Herbarium, Department of Environment and Conservation)





Not all species of *Gastrolobium* are toxic. However, the toxic species of *Gastrolobium* have caused considerable economic loss to producers in Western Australia since the early days of settlement. Various species are widely distributed over the south-west agricultural areas and still cause sporadic and sometimes considerable losses of stock.

The poisonous principle has evolved to prevent grazing by native animals and is mostly present when the plants are producing new shoots, flowering or developing seed. The common names of some of these plants include: York Road poison, heart-leaf poison, prickly poison, thick-leaf poison, rock poison, box poison, and crinkle-leaf poison.

### **Recognition and identification**

Because the pea family has nearly 1000 native species in Western Australia, there are many look-alikes that resemble the toxic species of *Gastrolobium*. However, all of the 22 or so toxic species of *Gastrolobium* have three characteristics. One, or even two, of these characters are common in a single species of non-toxic pea-flowered plants but not all three on the one species.

The three characteristics of poisonous pea-flowered plants are:

1. Leaves are arranged in pairs or in threes or even more, forming a whorl, arising from one narrow zone on the branch.
2. Stipules present. These are short, usually brown or dark-coloured bristle or spine-like organs, a few millimetres long, borne in pairs at the base of each leaf stalk. Where there is only a short leaf stalk the bristles are at the base of the leaf where it joins the stem. Stipules can fall off early so only young branches should be examined closely. Stipules are common on pea-flowered plants including those possessing leaves that are arranged in pairs or in whorls.

3. Flowers are borne in open bunches above the uppermost leaves of the branches so that the flowers are held above the plant. These flower arrangements are called a raceme when the individual flowers have a stalk and the whole flower bunch itself has a stalk or a spike when the individual flowers are stalkless on a leafless extension of the branch.

### **Toxicity**

The toxic principle in the species of *Gastrolobium* is fluoroacetic acid. The sodium salt of this compound is the well-known '1080' poison used extensively for the control of rabbits and the clinical signs and post-mortem findings are identical with 1080 poisoning.

Both growing and dried plants of these native poison plants are toxic but the new growth after a period of dormancy and at flowering and fruiting is most toxic.

### **Garden plants**

Numerous garden and indoor plants are poisonous or irritants, the best known being the oleander and dieffenbachia. You will need the correct botanical name of the plant before you can look it up in a reference book to see if it is toxic. If unsure, ask your local plant nursery.

Sheep, including the pet lamb, should not have access to the home garden, abandoned gardens or rubbish heaps. Do not throw clippings of shrubs and hedges into paddocks where sheep are, or could be, grazing. Some information on garden plants that are toxic to pets is available on the website <http://www.petnet.com.au>.

What can be done?

- Learn which native poison plants occur in your district.
- Learn to recognise the plants.
- Avoid exposing stock to the hazards of the plants.

- Fence areas that contain the plants and keep sheep out of those areas.
- Keep grazing animals away from the garden and don't give garden weeds or pruned material to sheep.

For native plants and naturalised weeds you can check the FloraBase (<http://florabase.calm.wa.gov.au>), a source of information on the Western Australian flora maintained by the Department of Environment and Conservation (formerly CALM). This will give you details of the distribution and other features of the various species of *Gastrolobium* and other native poison plants.

There are also many regional herbaria in Western Australia where you can check the identity of plants and your local library will have copies of *Poison plants of Western Australia* by CA Gardner and HW Bennetts or *Poisonous Plants of Australia* by S Everist.

## WEEDS AND PESTS

Some plants and animals are declared under the *Agriculture and Related Resources Protection Act 1976* in a range of categories from eradication to management and containment, depending on the feasibility or even desirability of eradication. Some declared animals and plants do not currently exist in Western Australia but have been shown to have potential for detrimental effects in similar environments elsewhere.

The eradication of declared weeds and pests from your property will increase its value and make life easier for your neighbours because they will not be concerned about the potential spread of these problems. It is the legal responsibility of landholders to control declared species on their land. In addition, it is the responsibility of everyone in the community to prevent new pests from becoming established in Western Australia.



*Paterson's curse is a declared plant in Western Australia.*

DAFWA officers welcome the opportunity to advise and help property owners, both large and small, with weed and pest control issues. Your local department office should be contacted to clarify questions on weeds and pests. DAFWA office locations can be found in the phone directories or on the department's website (<http://www.agric.wa.gov.au>).

The lists of Declared Plants and Declared Pests with the relevant strategies for their control can be found on the DAFWA website (<http://www.agric.wa.gov.au>). If you have an infestation of a Declared Plant or Declared Pest on your property you are required to report it to your Biosecurity Officer at the local DAFWA office and also to carry out control measures.

With respect to weeds it is important to realise that some are toxic to animals and when eaten can cause death. Examples of these include cape tulip, Paterson's curse, heliotrope and slender ice plant.

Animals that cause damage to sheep include foxes and dogs. The best option is to control foxes before they become a problem. In small farm areas, the options for control can be limited due to the presence of other animals that can be adversely affected. Suitable options can include increased supervision of stock, particularly during lambing to deter foxes, use of fencing to exclude foxes from lambing paddocks, fumigating fox dens, trapping 'problem' foxes or shooting (if appropriate and legal in your area).



*Foxes can cause problems in lambing flocks.*

For further information see the following Farmnotes:

- *Options for fox control* (Farmnote 91/2001)
- *Fox baiting* (Farmnote 61/2003)
- *Are foxes killing your lambs?* (Farmnote 62/2001)

Domestic dogs of any breed, singly or in packs, can wreak havoc on sheep flocks, usually at night. The local police or shire ranger should be notified if such attacks occur. The farmer's own pet dog or working sheep dog can become a sheep killer. Alpacas, llamas, donkeys and some breeds of dogs can be used as guard animals for sheep flocks although they are not always effective.

## USE OF AGRICULTURAL CHEMICALS

Agricultural chemicals provide great benefits to agriculture by controlling weeds, pests and diseases. However, if misused they also have the potential to cause harm to the user, the general public, the environment and to trade. For these reasons, effective controls over all aspects of the production, supply and use of these chemicals are essential. Both Commonwealth and state legislation impose the controls.

To avoid being in breach of the laws, users of chemicals should:

- read the label
- only use chemicals as indicated on the labels of the containers unless another use is supported by a Permit issued by the Australian Pesticide and Veterinary Medicine Authority in Canberra
- not exceed the maximum rate and frequency of application for the use, as stated on the label
- observe all precautions/constraints and warnings on the label, especially the Withholding Period, and
- not allow foodstuffs to be contaminated by agricultural chemicals.

## SHEEP WELFARE

The owners and handlers of sheep are responsible for the health and wellbeing of the animals in their control.

The application of sound animal husbandry principles will fulfil the welfare requirements of animals. The Code of Practice dealing with the welfare of sheep outlines sound husbandry practices but is not prescriptive.

The important factors in determining welfare in a flock are the behaviour, attitude and consistency of the stockman. Important skills of the competent stockman include the ability to anticipate situations in which welfare can be at risk and to recognise early signs of distress or ill health in animals so that the appropriate preventative or remedial action can be taken.

The basic requirements for the welfare of grazing sheep are:

- an adequate level of nutrition to sustain health and wellbeing
- access to sufficient water of suitable quality to meet physiological needs
- arrangements, in advance, to ensure that food and water can be made available to them in emergencies
- social contact
- protection from predation
- protection from unnecessary pain and injury
- protection from and treatment of diseases, particularly those that are exacerbated by domestication and management
- protection from extremes of climate that can be threatening
- handling facilities that, under normal usage, cause neither injury nor distress
- ensuring someone responsible checks on the sheep daily when you are not at the property.

The *Animal Welfare Act 2002*, administered by the Department of Local Government and Regional Development, governs the treatment and welfare of animals in Western Australia. It has the power to enforce some of Australia's harshest penalties for animal cruelty offences. For more information on this Act and animal welfare Codes of Practice including Codes relating to sheep, see <http://www.dlgrd.wa.gov.au> and follow the links to animal welfare.

## ODD JOBS AROUND THE FARM

Numerous jobs that have to be carried out on any sheep farm can directly or indirectly affect the wellbeing of sheep.

- Collect and dispose of tins and packets that contained chemicals, paints, etc. so the sheep cannot be poisoned after licking or eating the residues.
- Collect any baling twine or wire that can be left on fences, in the paddock, or around the yards and buildings. Sheep can choke on twine and it is quite common for sheep to get twine or wire tangled around their legs or body.
- Collect any carcasses in the paddocks; sheep can suffer botulism caused by chewing old bones.
- Eradicate rabbits and declared plants along with plants that are poisonous to stock.
- Check with your local shire council on the requirements of fire breaks around the boundary, buildings and other improvements to your property.
- Clean water troughs regularly, check dams for debris, service windmills or pumps.
- Temporarily fence off dry muddy dams so sheep do not become bogged and die.

## RESPONSIBILITIES OF OWNERS OF LANDHOLDINGS

Whether a property is 2 or 2000 hectares, the landholder has many responsibilities. The way you manage your own land can have a major impact on the people, properties and environment beyond your fence line.

You need to treat your property with care—just as you would any residence. A patch of eroded soil, a mild weed infestation or insects in the fruit tree may not seem very serious, but these problems can be insidious. If left unchecked they can devalue your property, spread to adjacent smallholdings and commercial properties and even leave you in breach of the law.

On the other hand, a well maintained property could be more productive and more pleasurable to own and occupy. The most inexpensive and effective way to ensure this is to develop a property plan, using an aerial photograph of your property. Further information about doing this can be found at <http://www.agric.wa.gov.au> and follow the links to the Small Landholder Information Service.

### *Your legal responsibilities*

As in urban areas, some activities need prior approval by various authorities. This ensures the activities of some landholders do not adversely affect others and it helps everyone who lives in the area to enjoy their chosen lifestyle. It is your responsibility to find out if approvals are needed and substantial penalties can apply if approvals are not obtained. You should make initial inquiries with the local shire or relevant government department before purchasing land to ensure you meet their requirements regarding:

- clearing bush
- draining saline land (or any land in the Peel–Harvey catchment)

- controlling declared plants or animals
- running stock on a property
- establishing horticultural enterprises
- impacts on wetlands
- building or altering a house or shed
- starting up a business
- building a dam
- licensing a bore or drawing water from a stream
- any activities that can cause pollution on or off site
- whether your proposed activities are compatible with the zoning of the land and so on.

### *Weeds*

Weed control is more than a discretionary activity for landholders. There are legal requirements governing the control of 'declared' weeds. Your responsibilities in this regard are stated in the *Agricultural and Related Resources Protection Act*.

### *Plant diseases, insect pests*

The *Plant Diseases Act* was enacted to prevent the introduction into Western Australia of diseases affecting plants, to provide for the eradication of such diseases and to prevent their spread. You are obliged as a landholder to take measures to eradicate or prevent the spread of a disease and are required to abide by the relevant laws.

### *Plant and animal pests*

The *Agricultural and Related Resources Protection Act* deals with the control of declared plants and declared animals. The Act covers the prevention of the introduction and spread of declared plants and declared animals. As a landholder, it is wise to become familiar with your responsibilities under the Act.

## ***Livestock***

The *Stock (Identification and Movement) Act* provides for the registration and use of brands and earmarks for stock, and regulates the movement of stock.

The *Exotic Diseases of Animals Act* and the *Enzootic Diseases Regulations* specify notifiable diseases and the conditions to control and prevent the introduction of diseases to properties.

## GLOSSARY

<i>Ad libitum</i>	– offering food, or a ration, in unlimited quantities.	Ewe	– female sheep.
Blowfly strike	– an attack on sheep by blowflies that are attracted by the odour from wet, scalded skin.	Gare	– the long hairs that protrude through the fleece of some broad-wool sheep. Concentration is greatest near the breech.
Body condition of stock	– the degree of fatness indicating health status.	Hoggets	– sheep that have cut one or two of their first permanent incisor teeth.
Continuous grazing	– leaving stock in the same paddock to graze continuously.	Jetting	– spraying insecticide into the fleece to wet it to the skin as a protection against flystrike.
Crutching	– shearing or clipping the wool around the breech, over the tail and down the back of the hind legs. It is a preventative measure against blowfly strike.	Maiden ewe	– a young ewe that has not lambed.
Dagging	– removal of dags.	Marking	– the routine practice of ear-marking and tail docking of lambs, at about four- to eight-weeks of age. Other procedures commonly done at the same time include castration, mulesing, ear-tagging, vaccination and scratching with scabby mouth vaccine.
Dags	– staples of wool matted together with sweat, mud or dung, usually at the rear of sheep. They will wash out but can leave a stain.	Melanin	– the naturally occurring pigment in coloured wool.
Doggy wool	– wool that becomes straight and glossy and appears much coarser than it is. Grease tends to accumulate near the tip of such fleeces that become more common with age. Doggy wool can be confused with steely wool that is caused by copper deficiency in the initial stages.	Micron	– one thousandth of a millimetre. Used in the measurement of the diameter of wool.
Drench	– a dose of anthelmintic to control internal parasites.	Oestrus or heat	– the period when ewes will accept a ram (hormone controlled).
Dry sheep	– non-breeding sheep. Usually refers to adult sheep.		

Pieces	– the sweaty edges and short wool around the edge of a fleece. These are usually skirted off because of lower yield, shorter length and more vegetable fault.	Staple	– portion of wool.
Polled	– sheep with no horns.	Supplementary feed	– feed offered to animals in addition to the available paddock feed, usually when the latter is inadequate in quantity or quality.
Ram	– male sheep.	Tailing	– the tail is removed with a knife, rubber ring or gas-heated knife, at the third joint.
Ration	– a feed or mixture of feeds given to animals to last for a predetermined period.	Weaners	– lambs that have been weaned from their mothers, usually at 10 to 12 weeks of age.
Ringing	– removal of wool around the pizzle of rams and wethers.	Wether	– castrated male sheep.
Scouring	– diarrhoea.	Wigging	– removal of wool around the poll and eyes.
Set stocking	– a term used to describe sheep management where animals (usually ewes and lambs or ewes and weaners) are left on a particular pasture during, for example, lambing or lactation, or both.		



## FURTHER INFORMATION

The following websites and publications provide more information on various management issues discussed earlier and other aspects of having sheep on farms in Western Australia.

### Websites

<http://www.agric.wa.gov.au>

*click link* 'Farm Systems', *click link* 'Small Landholder'. The Small Landholder Information Service within DAFWA has set up this website specifically to provide information for small landholders on a wide range of topics. From the DAFWA website you can download the DVD and booklet *Sheep and goats: what you need to know*.

<http://www.awex.com.au>

Australian Wool Exchange Ltd. *Code of practice for the preparation of the Australian Wool Clip*

<http://www.wormboss.com.au>

Worm Boss

<http://www.liceboss.com.au>

Lice Boss

<http://www.apvma.gov.au>

Australian Pesticides and Veterinary Medicines Authority

<http://www.wool.com.au>

Australian Wool Innovations

<http://www.mla.com.au>

Meat and Livestock Australia

### DVD

*Sheep and goats: what you need to know*

This DVD, with accompanying booklet, is available at no cost from Suzy Norton, Communications Officer, Animal Biosecurity, DAFWA, South Perth.

### Books

*Australian Sheep and Wool Handbook* (Third reprint 1998)  
Edited by DJ Cottle. Published by D Joester, Gordon, NSW.

*Sheep Management and Wool Technology* (1986)  
JB D'Arcy. New South Wales University Press.

*Design of shearing sheds and sheep yards* (1986)  
AA Barker and RB Freeman. Inkata Press, Melbourne.

### Bulletins

*Good food guide for sheep*  
Department of Agriculture and Food Bulletin No. 4473.

*Code of practice for the use of agricultural and veterinary chemicals in Western Australia*  
Department of Agriculture and Food Bulletin No. 4648.

*Biosecurity for small landholders*  
Department of Agriculture and Food Bulletin No. 4573.

*The land is in your hands*  
Department of Agriculture and Food Bulletin No. 4686.

### Farmnotes and Factsheets

*Livestock on Small Landholdings*  
Department of Agriculture and Food Farmnote 3/2003  
(reviewed 2005).

*Livestock identification and movement: sheep and goats*  
Department of Agriculture and Food Farmnote No. 223.

*Sheep worm control in Western Australia*  
Department of Agriculture and Food Farmnote 51/2002.

*Sheep worms—quarantine drench to combat resistance*  
Department of Agriculture and Food Factsheet 3/2002.

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