# 19. Sheep Production in Mediterranean Environments

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## Learning objectives

On completion of this topic you should be able to:

For Mediterranean climatic regions in Australia:

- Understand the distribution and characteristics
- Be aware of the pasture growth characteristics
- Whole-farm considerations of ley farming systems
- Feed sources for sheep other than pastures, in particular those associated with crop residues
- Wool growth

## Key terms and concepts

Winter dominant rainfall, cool wet winters, hot dry summers, annual pasture systems, ley farming, mixed farming enterprises, supplementary feeding

## Introduction to the topic

The separate description of sheep production in Mediterranean environments is more than warranted, as at least one third of sheep in Australia are supported in such climatic regions.

The 'classic' Mediterranean environment is one characterised by wet cool winters and dry hot summers. Autumn and spring are transitional between these extremes. Rainfall, although in many cases low by annual comparisons with others sheep producing regions, is relatively reliable and largely (of the order of 85%) confined to the cooler months. The net outcome of this, with lower evaporation, is the potential for a considerably more effective rainfall, and hence the growth of a range of adapted pasture grass and legume species.

The distinctive features of such an environment and the agricultural systems commonly practised are discussed here in some detail, and include:

Pasture composition

Pasture growing season

Pasture feed variations – quality and quantity

Farming systems, in particular cropping/livestock associations

Annual feed sources for livestock

Timing of livestock management and husbandry

Wool quality effects

Disease management and control

# 19.1 Distribution and features of Mediterranean regions

Within Australia, the most apt description for the location of Mediterranean climatic zones would be either side of the Great Australian Bight – i.e. the relevant regions of Western Australia and South Australia. Well over half would be in Western Australia. Smaller areas of Victoria and NSW may qualify for the definition. Such zones are found largely, but not exclusively, within the 'wheat-sheep zone', as classified within the Australian grazing industry survey zones.

Annual rainfall may range from 200 mm to 1000 mm, although more typically would be 300 to 600 mm. The characteristic and overriding feature is the concentration of rainfall in the cooler half of the year and the paucity of rainfall during the warmer months. A boundary of at least 65% of annual rainfall during the winter months has been described (Boyce et al 1991).

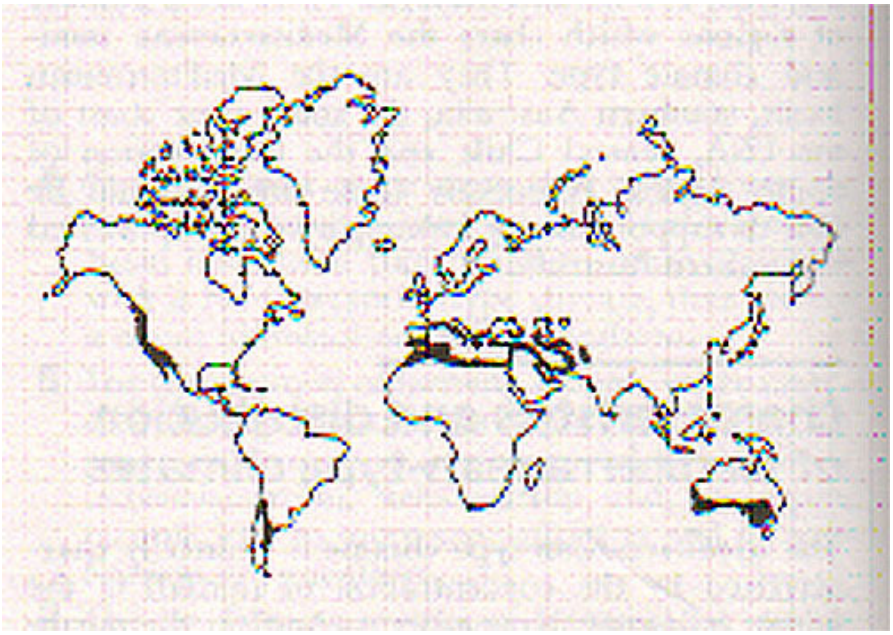
Further features of such climates and regions include:

- Cool and mild winters
- Hot and sunny summers, low humidity
- Frosts in winter not generalised nor severe
- The pasture species are nearly all annuals, perennials being found uncommonly and in confined niches favoured by soils of superior water-retaining characteristics
- Farming systems associated with cropping, in that at varying intervals pastures may be replaced by a crop monoculture for one or more years.

It is instructive to briefly note the distribution of Mediterranean regions elsewhere in the world – if or no other reason than the name obviously originated outside Australia! Interestingly enough, there are surprising differences in agricultural systems even though the climates are similar.

The regions surrounding the Mediterranean basin comprise perhaps the largest example of the climate type, although differing in being far more mountainous than the Australian regions. The other regions are the cape region of South Africa, central Chile and the south-west coast of North America (much of the state California).

**Figure 19.1 World distribution of regions with a Mediterranean-type climate.**
**Source: Boyce et al (1991)**



# 19.2 Pastures

Grazed pastures are by far the main source of nutrition for sheep, and some special mention is required. Other significant sources in Mediterranean regions are crop residues ('stubbles') and a range of supplementary feeds necessitated by the prolonged summer period without pasture growth; these will be discussed subsequently.

A species perhaps universally associated with the region is the legume subterranean clover (*Trifolium subterraneum*). This is very well adapted to areas with acid soils. The other significant annual legume, associated with more alkaline soils, is Medic species (*Medicago*). The best-performing and most respected grass component is Annual Ryegrass (*Lolium rigidum*), although pastures inevitably contain a considerable range of other grasses. These may be less desirable on account of lower productivity and, particularly for sheep health and wool quality, destructive seed characteristics.

By the end of the dry period, most of the plant material originating the previous season is no longer present, having been eaten, trampled, leached or lost to microbial decomposition. If present, its nutritional attributes have been severely diminished. Following the 'opening' rains in autumn, plant germination occurs and pasture growth is initiated. The fate of pasture is in a precarious state at this time, as sufficient rain must fall with a distribution such that soil moisture is maintained to enable plant establishment and growth. A single large rainfall event is undesirable, the water being lost to soil due to runoff. "False" breaks are feared, as not only is the growing pasture lost, but the seed bank for the next germination may be severely depleted, with the outcome being sparse pastures for the remainder of the season.

With plant growth responding to moisture and temperature, there is a characteristic or typical pasture growth/supply curve (Figure 19.2). This is one of gradually increasing quantities of pasture during winter followed by a rapid increase in spring, reaching a maximum at plant maturity as rainfall finishes for the season. There are essentially four reasonably distinct feed situations confronting grazing ruminants:

| Season | Pasture Characteristic | Pasture Quality | Pasture Quantity |
|---|---|---|---|
| Winter | green | high | limiting |
| Spring | green | high | abundant |
| Summer | dry | low | non-limiting |
| Autumn | dry | low | limiting |

Perhaps one of the most distinctive features of Mediterranean pastures is the abruptness of change, in both quality and quantity. Combined with soils of relatively low water-retaining capacities, the temperature and rainfall effects on the predominantly annual pastures lead to rapid pasture establishment at the "break" of the season, and equally rapid senescence at the end.

With pastures germinating at the commencement of the cooler months, it is important that growth be rapid and that the components are accessible to sheep as soon as possible. In this regard pasture composition is critical, as can be appreciated from Table 19.1. The value of annual ryegrass is apparent.

**Figure 19.2 Example of pasture growth /availability in a Mediterranean climatic region. Source: Bell (2005).**

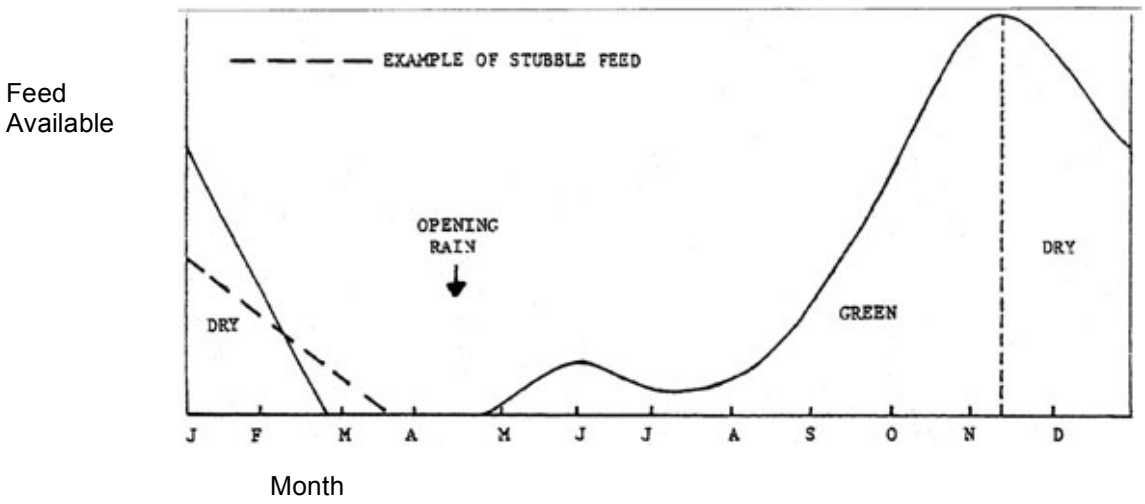



**Table 19.1 Pasture attributes associated with maintenance of sheep. Source: Adapted from Smith et al. (1972).**

| Pasture Species | Pasture Yield kg DM/ha providing maintenance | Days taken from germination |
|---|---|---|
| Annual Ryegrass | 130 | 28 |
| Capeweed/ Silvergrass | 380 | 56 |
| Sub-clover | 480 | 60 |
| Silver Grass | 450 | 103 |
| *Erodium* | 640 | 97 |

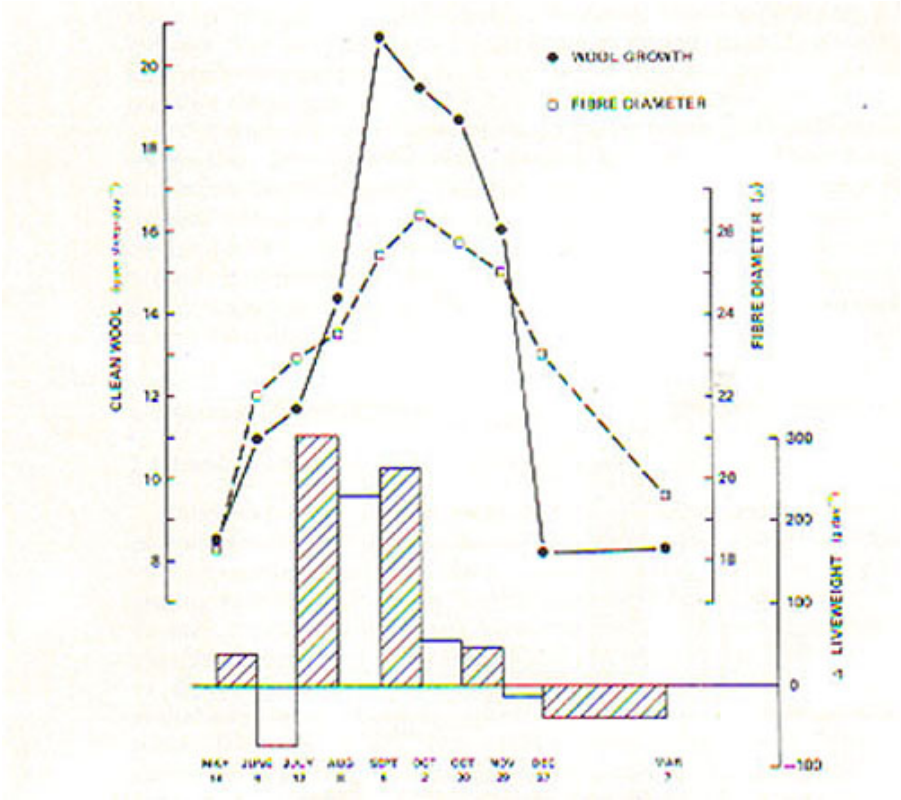
As a source of nutrition for sheep, the major attribute of pasture from germination in autumn or winter until spring is its accessibility. Both height and density of pasture combine to influence this attribute, aptly and typically quantified by the term “FOO” (Feed On Offer). The results of a simple trial in a Mediterranean region of South Australia elegantly demonstrate this (Table 19.2).

**Table 19.2 The influence of plant density on pasture yield and sheep performance. Source: Allden (1980)**

| | | | Liveweight change of sheep (kg) during | | | |
|---|---|---|---|---|---|---|
| Seeding rate (kg/ha) | Initial Plant Density (plants/m²) | Pasture Yield 7 weeks after sowing (kg/ha) | Winter 5/7 - 27/9 | Spring 27/9-21/12 | Whole Period | Cumulative yields of DM for whole experiment (kg/ha) |
| 4 | 165 | 43 | -18 | - | - | 3,197 |
| 8 | 243 | 83 | -18 | + 1 | - 17 | 5,032 |
| 16 | 495 | 113 | -16 | +18 | + 2 | 6,801 |
| 32 | 1,126 | 237 | 0 | +15 | +15 | 9,653 |
| 1,024 | 35,993 | 1,620 | +12 | + 4 | +16 | 9,851 |

From late spring until senescence, pasture composition and stage of growth become the major influences. Although biomass is usually then more than adequate, the rate of decline in pasture digestibility associated with plant maturity and eventual death has important effects for sheep. For example the rate of sheep body weight change can fall from 250 g/day to 50 g/day in a 3-week period (Purser, 1981). Similarly the rate of wool growth drops precipitously over the period, with clearly evident effects on fibre diameter (Figure 19.3).

**Figure 19.3 The seasonal pattern of wool growth, fibre diameter and sheep body weight change. Source: Purser and Southey (1984)**




# 19.3 Sheep management calendar

The most significant management decisions made by managers of sheep flocks are time of joining (and therefore time of lambing) and time of shearing. The former has far-reaching ramifications because the major physiological changes associated with reproduction carry with them equally major nutritional requirement changes, and the marrying of sheep feed requirements and feed availability, particularly from pasture, may present challenges. Inevitable interactions with cropping programs (see later) may further complicate the sheep management calendar, including time of joining.

As Mediterranean regions encompass low to quite high rainfall climates, management considerations for the range of these are discussed.

## 19.3.1 Lambing time – low rainfall locations

Typically pasture availability is low in low rainfall (e.g. 200 – 350 mm) regions. This is not only because of the low moisture availability but also because of low plant density associated with those paddocks cropped the previous year. Weeds in a cropping context include valuable pasture plants such as annual ryegrass. Therefore weed control, of necessity very effective, jeopardises the quality of pastures in the system.

Hard-seeded legumes are favoured as pasture components, due to their ability to regenerate after some years of continuous cropping. However the slow establishment of these legumes compared with grasses has the effect of considerably delaying adequate pasture for sheep following the autumn rains.

Traditional lambing time in these areas was in autumn, typically April and May. This was always a compromise, and the loss of pasture quantity in the last decade has meant a shift both earlier and later. The early choice aims to take advantage of what may be the major feed source on the farm – crop stubble, maintained ungrazed until ewes are introduced for lambing perhaps as early as March. Feed supplements must be provided through winter for the lactating ewe.

Delaying lambing until July and August is the other choice, waiting until pasture availability is adequate for the lambing ewe. With the shorter growing season experienced in drier regions, pastures could be expected to be finished by September – hence lambs, still small at weaning, need to be supplemented until recently-harvested crop residues become available.

As can be appreciated in both these decisions, considerations relating to the crop enterprise influence the sheep management calendar. This will be discussed further in a later section.

## 19.3.2 Lambing time – medium rainfall locations

In regions with annual rainfall in the range 350 – 550 mm, the pasture growing season is longer, and pastures have the potential to be much more productive. Although temperatures are colder than in the drier areas, they are still significantly warmer than temperate regions of eastern Australia, and good early pasture growth is expected. With less of the typical farm devoted to cropping, there are more pastures not recently recovering from the experience, and density and species are more easily maintained.

With this as a background, it can be understood that not only is there potential for higher stocking rates on grazed pastures, but lambing ewe nutrition is substantially improved. Although lambing is observed to commence from April until August, the peak period is undoubtedly June-July. The conventional logic associated with choice of lambing time in Mediterranean regions is to enable lambs to reach a satisfactory weight, and be weaned, before pastures senesce. This is to do with both pasture nutritional quality and the very likely onset of damaging grass seeds with plant maturity. This weight is widely taken to be about 45% of mature bodyweight, and therefore around 25 kg or greater for the strains of sheep commonly found.

If anything there has been a trend to later lambing, earlier lambing flocks suffering too often from late or “false” breaks to the season (Autumn rains initiating pasture growing are expected in May, but their occurrence can range from late March until mid-June). Later lambing enables higher numbers of ewes to be carried with less winter supplementary feeding, better fitting their feed requirements to the expected pasture growth characteristics.

Although the later lambing times may on the surface not allow sufficient time for the conventionally desired lamb performance, the system is more and more associated with satisfactory and profitable sheep flocks on account of a number of features:

- better pastures
- the availability of cereal and legume crop residues and dedicated unharvested summer forage crops
- lupins for summer supplementation
- better awareness of and prophylaxis against trace element deficiencies
- informed worm control.

## 19.3.3 Lambing time – high rainfall locations

Higher rainfall Mediterranean regions are characterised by an earlier and more reliable autumn break to the season, cold winters and a longer spring growing period. Although there may be more summer rain, only in coastal areas are perennial pastures common. Lambing time is similar to the medium rainfall locations, for the same reasons. Specialist lamb production is more common in these higher rainfall areas, and lambing may in these cases be advanced to the earlier months, for example May, to enable marketing of sufficiently large lambs to meet modern premium market specifications before pasture senescence.

## 19.3.4 Time of shearing

The traditional shearing time for flocks has been in the spring; typically this was associated with autumn lambing with lambs being shorn at 4 – 5 months of age. An influential factor in this decision is the damage inflicted by uncontrolled grass seeds, both on wool quality (vegetable matter) and particularly on lamb health.

The nature of the seed heads of many of the annual grasses which flourish in Mediterranean regions is such that eye, skin and carcase damage can be severe especially in young sheep. Removal of the fleece prevents the awned grass seeds from gaining the initial purchase on the sheep.

Shearing time has changed somewhat in more recent times, being spread more evenly over the calendar (Table 19.3.).

Factors associated with the change include:

- Better pasture management (elimination of unwanted grasses by combinations of cropping, controlled grazing and selective herbicides)
- The emergence of wool price penalties for low staple strength created an awareness of the unfortunate wool fibre profile associated with spring shearing, and added to the impetus to change
- The move to later lambing is also a driving factor
- Declining numbers of shearers is another, undeniable reason to spread shearing more evenly.

**Table 19.3 Percentage of Wool Shorn by Season in Western Australia**
**Source: K. Curtis pers. comm.**

| | Percentage Wool Shorn | | |
|---|---|---|---|
| **Season** | **1992** | **1997** | **2004** |
| Spring | 40 | 36 | 26 |
| Summer | 19 | 25 | 24 |
| Autumn | 19 | 22 | 30 |
| Winter | 22 | 17 | 20 |

# 19.4 Crop residues (“stubbles”)

As has been noted, it is extremely common for farms in Mediterranean regions to have a cropping enterprise of varying magnitude in association with pastured sheep. Whilst details of the interaction will be discussed in a subsequent section, the specific attributes of crop residues are documented here, as they provide an increasingly important source of sheep nutrition more and more relied upon in summer and autumn months.

## 19.4.1 Crops grown

As a generalisation the crop occupying the greatest proportion of cultivated land would be wheat. Other cereals expected are barley and oats, and on occasions triticale. Canola is now very commonly found in rotation with the cereals, being associated with convenient and effective weed control, cereal root disease control and of high value itself.

The legumes lupins, peas and beans can be incorporated into the cropping rotation in some areas, as nitrogen sources as well as facilitating cereal disease and weed control. Bear in mind that in low and medium rainfall regions, this latter role is played by pasture, the sheep being carried to manage and utilise the pasture.

## 19.4.2 Factors affecting stubble value to sheep

After grain harvest typically in early summer, the standing residue is available for grazing by sheep.

The main value is the grain left behind, either shed by the crop before harvest or not retained by the harvesting machinery (in this regard stubbles have lost value in recent years as harvesting technology has continued to improve). The leaf fraction of the crop may provide some value, depending on a number of factors, and any weeds present are of value depending on their nature (legumes far superior to grasses).

The usual order of value of these stubbles as sheep feed is:

1. Lupin and pea stubble
2. Oat stubble
3. Barley stubble
4. Canola stubble
5. Wheat stubble.

The amount of grain, as well as its species, are both important influencers of value. Although there are formulae to estimate the time for which a stubble may be adequate for sheep, it is far better to inspect it for grain content than to rely on such a "formula". For example, if more than 5 or 6 oat grains are visible on approximately one square foot (900 $cm^2$) of ground under oat stubble, all classes of sheep should be able to maintain bodyweight. Older sheep, especially wethers, maintain at half this level. Higher levels are associated with weight gain, the magnitude of which depends upon the digestibility and protein content of the grain.

For lupin stubbles, the lupin seed concentration to provide maintenance is about 3 per square foot for young and 2 per square foot, for older sheep.

- The lower the rainfall under which the crop is grown, the higher the stubble and grain digestibility (See Figure 19.4)
- Time since harvest also influences stubble quality (See Figure 19.5). Stubble digestibility declines approximately 4% per month as a result of weathering even without any grazing. Digestibility is considerably reduced after rain, particularly from March onwards.

Lupin stubbles are a special case; they generally provide high rates of weight gain in all classes of sheep, at least initially. However they do suffer from a tendency to become toxic to varying degrees to grazing sheep if receiving rainfall at any time from senescence onwards. Even without rain the sheep must be monitored at regular, frequent intervals for any signs of lupinosis.

If we consider the pasture growth and availability curve (Figure 19.2) then the quantity of feed provided by stubble can be added over the December – March period. This quantity will vary with the proportion of the farm in crop.

**Figure 19.4 Dry matter digestibility of leaf and stem fractions of stubble, as influenced by rainfall. Source: Purser and Southey (1984).**

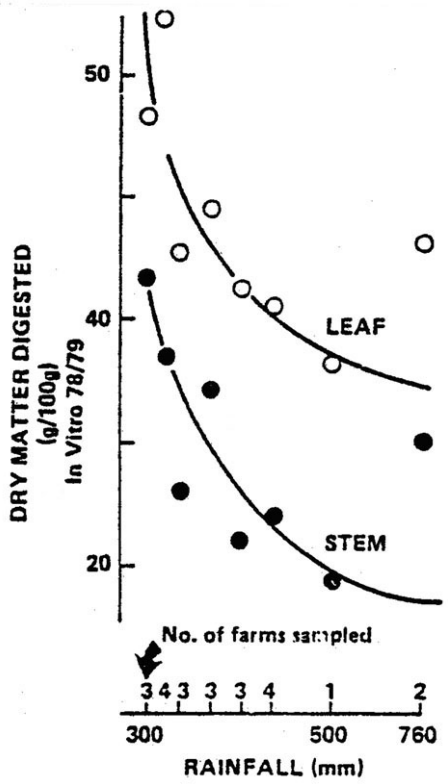
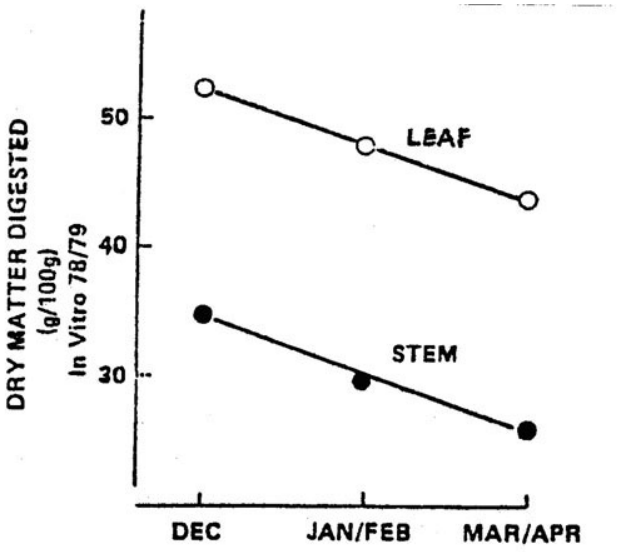



**Figure 19.5 Digestibility of stubble fractions at various times after harvest. Source: Purser and Southey (1984).**



# 19.5 Supplementary feeding

Perhaps the distinguishing feature of supplementary feeding of sheep in Mediterranean regions, like the rainfall and general climate, is its overall predictability. Having said this, many aspects are influenced by seasonal conditions and events as in all regions.

## 19.5.1 Supplementary feed composition

- Oats. It is not surprising that the most common supplements fed are those easily and cheaply grown in the regions – hence the popularity of oats. This is in spite of its sometimes less than ideal protein and energy values. Market price has in many seasons resulted in oats being the cheapest energy source
- Lupins are the grain of choice if available – as they are grown in many parts of the regions. Their use has dropped somewhat in recent years, due to continued inability to be a satisfactorily profitable part of cropping rotations. The advent of canola and use of fertiliser nitrogen have provided other options. Diseases have also had an influence in this. However many farmers will aim to have some lupins on hand at the start of every summer, for a variety of uses.

A good example of the relative values of oats and lupins fed to sheep on a typical Mediterranean climate pasture was provided by Thompson and Curtis (1990). Over 143 days 18 month old Merino wethers were supplied with one or the other of the two grains at rates ranging from 0 to 500 grams per day. A summary of the results (Table 19.4) shows that as little as 50 grams per day of lupins could change a liveweight loss of 28 grams per day to a small gain.

**Table 19.4 The effect of level and nature of grain supplement on live weight change of sheep. Source: Thompson and Curtis (1990).**

| Supplement Rate (g/hd/day) | Liveweight change (g/hd/day) | |
|---|---|---|
| | Lupins | Oats |
| 0 | -28 | -28 |
| 50 | + 5 | (not tested) |
| 100 | +24 | +1 |
| 200 | +33 | +17 |

- Barley and wheat are utilised, sometimes by preference and sometimes when no alternatives are available. Their higher energy and protein levels are valuable, but higher starch and lower fibre levels compared with oats means management must be more precise when feeding to avoid lactic acidosis
- Conserved forages – hay and silage – are not uncommon, the latter becoming more popular of late. The most likely source of hay is a cereal, usually an oat crop. Pasture hay is uncommon except in the higher rainfall regions.

## 19.5.2 Use of supplementary feed

- Ewes. It is expected that reproducing ewes will benefit from supplementation in most years from February onwards. This coincides with joining, and aims to maintain a satisfactory level of condition throughout autumn until the newly germinated pasture provides adequate availability. This may be 3 to 6 weeks after pasture germination.
- Weaners on pasture commonly require supplementation at a low level as soon as pastures have senesced – from November onwards. For young sheep in particular lupins are valuable, whether on pastures or cereal stubbles
- Flock rams being prepared for joining on dry pastures are supplemented for periods of 6 weeks to optimise fertility
- Sheep being prepared for sale over the period of pasture deficit may need supplementing.

## 19.5.3 Dry standing fodder crops

The dry nature of regions with Mediterranean climates lends itself to the planting of a winter crop dedicated to be left unharvested and grazed by sheep over much of the summer and autumn. This practice is perhaps less common now on farms with an increased level of crop, and therefore more stubble for summer grazing: however it is very effective. The crop is generally oats with or without a legume such as peas or vetches (lupins carries with it the danger of lupinosis). The nature of the standing crop is such that it is self-rationing, and large numbers of young sheep can be carried successfully with minimal labour inputs.

Planting of such a crop after a phase of cropping provides an excellent vehicle by which to re-establish pastures. As little as 0.5 kg of annual ryegrass seed can be sown with the crop, translating into a seeding rate the following year of more than 100 kg per hectare. This provides a sound base for retaining stock carrying capacity. Clover can then be top-dressed or sown into the remaining stubble.

An example of a supplementary feed "budget" for a typical sheep flock in a Mediterranean region is shown in Table 19.5.

**Table 19.5 Example of a grain feeding budget for sheep associated with Mediterranean pastures. Source: Kevin Bell (2006).**

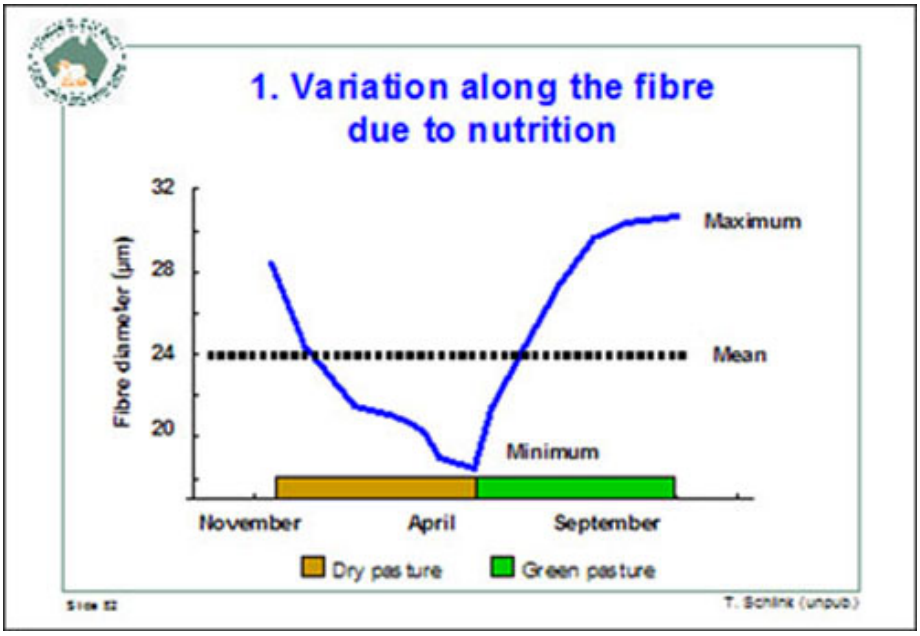
| | | | Kg Fed | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Stock** | **No. head** | **Grain** | **Feb.** | **Mar.** | **Apr.** | **May.** | **Jun.** | **Total (kg/head)** |
| **Maiden ewes** | 900 | Lupins<br>Oats | 100 | 100 | 100<br>100 | 100<br>100 | 100<br>100 | 15<br>9 |
| **Adult ewes** | 3100 | Oats | 100 | 150 | 200 | 200 | 200 | 25 |
| **Ewe weaners** | 1500 | Lupins<br>Oats | 50 | 80 | 100<br>100 | 100<br>100 | 100<br>100 | 13<br>9 |
| **Wether weaners** | 1500 | Lupins<br>Oats | 50 | 80 | 100<br>100 | 100<br>100 | 50<br>100 | 11<br>9 |
| **Wethers** | 1300 | Oats | | 100 | 100 | 100 | | 9 |

# 19.6 Wool growth

The pattern of pasture feed availability for grazing sheep in Mediterranean climatic regions has been referred to in Figure 19.2. The overabundance of high quality feed in spring and the paucity of feed in summer and autumn has an unavoidable effect on wool growth, the main variant being wool fibre diameter. This variation, increase as well as decrease, is the major contributor to lowering wool staple strength. The consequence is that tender wool, although an issue across all states of Australia, is more of a problem in such regions than elsewhere.

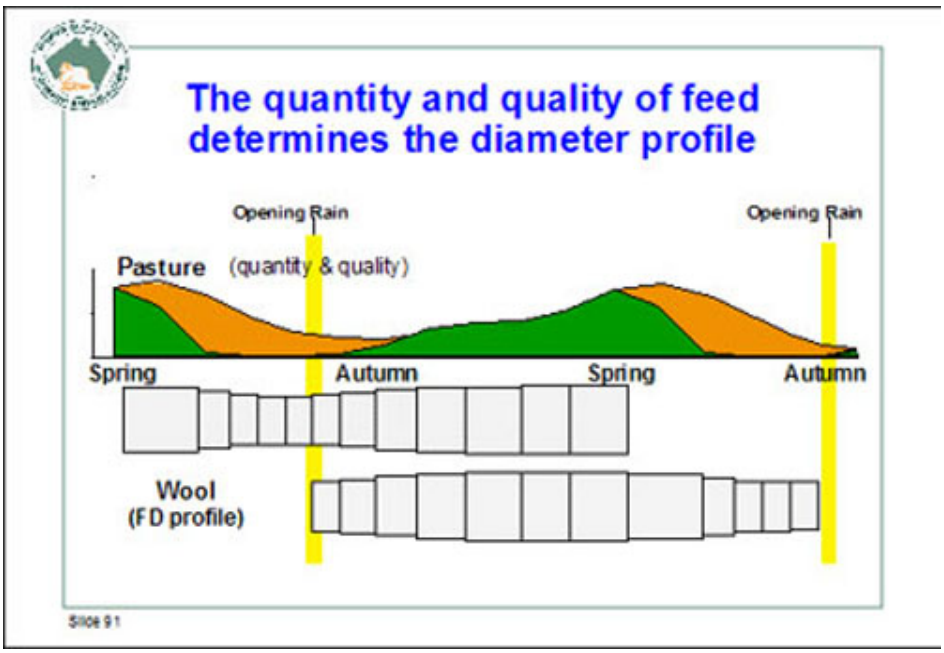
Wool fibres in Western Australia, for example, can vary by up to 10µm along their length. A typical fibre profile is shown (Figure 19.6).

**Figure 19.6 Example of wool fibre diameter variation over a growing season. Source: CRC for Premium Quality Wool, (2000).**




The diameter profile of a staple of wool grown in these regions can be dramatically and profitably modified by shearing time; autumn shearing being associated with improvement for obvious reasons (Figure 19.7). As described earlier, shearing times have been thus modified, in Western Australia at least.

**Figure 19.7 Influence of quality and quantity of feed, and time of shearing, on wool fibre diameter profile. Source: CRC for Premium Quality Wool (2000).**



# 19.7 Crop - sheep interactions; whole-farm considerations

It is pertinent to note a number of consequences of the association between pasture (and therefore in this case sheep) and land cultivation for crop production, as this is perhaps a very common feature of farming systems in Mediterranean climatic zones in Australia. This land management practice is often referred to as ley farming.

- Firstly, the importance of the sheep/pasture enterprise may, on many occasions, be minor relative to a cropping enterprise, in both area and profitability. As a result, management decisions and timing of operations may be such that the efficiency and profitability of the sheep operation is reduced. This needs to be understood, as in spite of this the whole farm operation is optimised. As long as the sheep are healthy there is nothing untoward about this
- Pasture may occupy anything from 10 to 90 percent of the managed land unit; no prescriptive guides can be given for optimum management, which highlights the need for an appreciation of each unique combined system. At the lower end the sheep are merely scavengers of crop residues, and are commonly purchased at the time of use and sold when the feed source has been eaten
- Bearing this in mind, the availability of stubbles in varying amounts provides a definite summer feed source, and has at least two benefits for farms maintaining a sheep flock over the whole year:

  (a) not so much pasture is required for the dry period, and therefore stocking rates on winter/spring pastures can be higher. This means better pasture utilisation

  (b) less grain or forage supplement needs to be provided throughout the summer/autumn – a significant saving in financial and labour terms
- The legume-containing pastures are a source of nitrogen for subsequent crops. The net increment to soil nitrogen as a consequence of legume root rhizobial activity varies with pasture productivity but under southern Australian conditions is usually a very impressive 40 to 100 kg of nitrogen per hectare per year (Reeves 1987). The choice of legume species is governed by two factors: persistence and productivity. Consequently a mixture of species is chosen which includes a balance of these attributes. This is necessary as pastures are eliminated in the cropping phase, and a legume seed bank which has the ability to persist for a number of years is of great importance
- For the cropping enterprise, the advantageous role of sheep stems from their ability to closely graze plants, and hence to control what for a crop will be weeds. This aspect of grazing management is implemented at various times throughout the pasture growing season, some examples of which are:

  - At the start of the season, to suppress newly germinated pasture until sprayed with herbicide or cultivated

  - In mid-winter, generally combined with herbicide, to influence the composition of pastures that they may better advantage the subsequent crop. This usually means the reduction of grasses and broad leaf weeds

  - In spring to control seed set of plants, especially grasses
- The physical reduction of crop residues by sheep as they graze is of value to subsequent paddock usage:

  - If the paddock is to return to crop, the reduction in material to be removed to enable/facilitate cultivation is a useful procedure

  - If a return to pasture is planned, the reduction in material greatly assists pasture seed germination; residues from high yielding cereal crops may completely blanket the soil, totally inhibiting new pasture germination.

This task may not be physically possible in all circumstances, but can certainly be valuable. Remember that such material is of very little nutritional worth, and considerable supplementation is usually required.

From many of the above points, it can be appreciated that the use of sheep in the role of pasture manipulator may be counterproductive for the sheep enterprise itself. For example, grass-containing pastures, demonstrably better for early winter growth and therefore sheep nutrition, do not provide a break for cereal root diseases. Thus crop requirements may override optimum pasture composition.

Similarly, the timing of sheep husbandry operations and key management may be varied to better suit crop operations. This may even include key events such as times of lambing and shearing; the reason may simply be one of labour availability.

## 19.8 Sheep breeds, flock structures

The nature of pasture growth and availability in regions with a Mediterranean climate (large and abrupt changes in quality and quantity) tends to have an influence on sheep flock structure. As a generalisation, flocks are more ewe dominant, that is, there are less wethers maintained as is traditional throughout much of Australia, (although this has changed significantly nationally as a consequence of wool prices becoming lower compared with sheep and meat prices).

The Merino is by far the most common breed of sheep. It is associated with the traditional self-replacing flock as well as with first-cross lamb production. It is quite common for farmers to join a proportion of Merino ewes to terminal breeds for specialist lamb production. The proportion varies, but in order to maintain a self-replacing flock and introducing other sheep, this is usually less than 30 percent of ewe numbers.

In eastern state regions Border Leicester-Merino ewes are more common in specialist lamb enterprises.

Perhaps because sheep may not be the dominant or exclusive enterprise, or because tradition is not so pervasive, newly-introduced sheep breeds are more common in Mediterranean climatic regions than elsewhere in Australia. These include the Dohne, Dorper and South African Mutton Merino (SAMM). It is noteworthy that these breeds originated in parts of another country (South Africa) with similar climatic extremes (not necessarily Mediterranean).

## 19.9 Disease management and control

Sheep in Mediterranean regions are subject to most of the conditions found elsewhere associated with grazing environments. As a generalisation, the more distinct and predictable climate is an advantage in that preventive measures are more reliably instituted. Also, the dry summer and autumn is advantageous for blowfly and internal parasite control, the two most damaging afflictions of the Australian sheep flock.

The association with grain production means that supplements for sheep are readily and relatively cheaply available; nutritional diseases are therefore in the most part controlled.

## Readings

The following readings are available on CD


1. Purser, D.B. and Southey, I.N. 1984, 'Fluctuations in nutrient supply in the south-west of Western Australia', in *Proceedings of a Seminar on Wool Production in Western Australia*, (eds. S.K. Baker, D.G. Masters and I.H. Williams), Australian Society of Animal Production, pp. 99-111.
2. Bell, K.J. and Ralph, I.G. 1993, 'Current sheep management: Western Australia', in *Proceedings of a National Workshop on "Management for Wool Quality in Mediterranean Environments",* Perth, WA, Nov 4-5, 1992, pp. 60-66.
3. Foot, J.Z. and Vizard, A.L. 1993, 'Current sheep management: South Australia and Victoria', in *Proceedings of a National Workshop on "Management for Wool Quality in Mediterranean Environments".* Perth, WA, Nov 4-5, 1992, pp. 67-79.
4. Purser, D.B. 1980, 'Nutritional Value of Mediterranean Pastures', in *Grazing Animals* (ed. Morley, F.H.W.), Elsevier Scientific Publishing Co. Amsterdam, pp. 159-180.

**Activities**
**Multi-Choice Questions**

@ Available on WebCT

**Useful Web Links**

@ Submit answers via WebCT

**Assignment Questions**

@ Available on WebCT

@ Choose ONE question from ONE of the topics as your assignment. Short answer questions appear on WebCT. Submit your answer via WebCT

## Summary

Summary Slides are available on CD
Mediterranean environments support about one third of the Australian sheep population, commonly in mixed farming enterprises. These regions are characterised by cool wet winters and hot dry summers with mostly annual pasture species and a necessity for supplementary feeding. Sheep management in these areas is dependent on rainfall and feed availability but as sheep are commonly juggled with cropping enterprises, lambing and shearing times are not always the most suitable for the profitability of the actual sheep enterprise. The typical growing season in Mediterranean environments has implications for wool growth particularly fibre diameter and as a result shearing and lambing times may be adjusted to reduce problems such as tender wool.

## References

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McFarland, I.J. and Shaw, S.J. 1998, 'Sustainable wool production – a Western Australian perspective', *Proceedings Australian Society of Animal Production*, vol. 22, pp. 400.

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Purser, D.B. and Southey, I.N. 1984, 'Fluctuations in nutrient supply in the south-west of Western Australia', in *Proceedings of a Seminar on Wool Production in Western Australia*, (eds. S.K. Baker, D.G. Masters and I.H. Williams), *Proceedings Australian Society of Animal Production*, vol. 15, pp. 99-111.

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## Glossary of terms

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| Ley farming | Integration of land cultivation with varying periods of pasture growth, during which the pasture is generally used by grazing ruminants |
| FOO | "Feed On Offer". A quantitative measure of pasture mass at any stage of the growth cycle. It is used as a guide to ease of access by grazing animals, and is increasingly being used to predict accurately animal responses. It is becoming the standard national unit of measurement.<br>The unit is kilograms of dry matter per hectare (at all stages of the pasture growth cycle)<br>It is well to be aware that different states may calibrate differently |
| Stubble | The residue of crops remaining after grain harvest. It comprises grain, leaf and stem fractions, together with weeds growing through the cropping period |