



Irrigated Winter Forages in Northern Victoria

Managing Subterranean Clover

Irrigated Winter Forages: Managing Subterranean Clover

Subterranean clover is the main legume species in many irrigated annual pastures in northern Victoria. It may be grown alone or in combination with short-lived ryegrass.

The key principles for the management of subterranean clover based pastures relate to:

- **achieving a high plant density at establishment**
- **optimising management of grazing, water, and soils and fertilisers**
- **ensuring adequate seed production.**

Subclover is a self regenerating species with a high proportion of “hard seeds”. This means that management for good establishment in the initial year will differ to that in subsequent years.

1. Initial establishment

1.1. Time of establishment

Subclover can be started any time from late February onwards. However, germination is limited by high temperatures so the first irrigation should be applied when maximum daily temperatures are less than 30°C.

1.2. Seedbed conditions

When establishing subclover pastures, a cultivated, weed-free seedbed is required. Subclover and short-lived ryegrass seed can either be broadcast onto the cultivated surface and lightly covered with a roller, or sown at a depth of 5-10 mm, and irrigated up. Seedling emergence will be delayed if subclover is sown deeper than 10 mm.

Subclover seed should always be inoculated prior to sowing, using an appropriate inoculum, to ensure that the appropriate rhizobium are present for nitrogen fixation.

Following the initial irrigation, subsequent irrigations should be at the same interval as for perennial pasture, ie. a cumulative evaporation less rainfall interval (E-R) of 50 mm.

Good surface drainage is essential for areas that are to be established early in order to avoid scalding.

1.3. Sowing rates

The recommended rate to sow subclover seed is 8-10 kg/ha.

The low subclover seed rates in the initial year compared to that in existing subclover pastures (200-400 kg/ha) will limit seedling density and early growth compared to that from existing subclover pastures. If early feed is required, other pastures, such as (well managed) existing subclover or Persian clover pastures or the inclusion of ryegrass in the mix, should be considered.

Sowing subclover alone:

- subclover seed @ 8-10 kg/ha.

Sowing subclover with annual or short-lived ryegrass:

- subclover seed @ 6-8 kg/ha
- short-lived ryegrass seed @ 10-15 kg/ha.

1.4. Management

It is essential that newly sown subclover pastures are well managed in the first spring in order to produce a large amount of seed for high seedling densities and early growth rates in the following autumn. The keys to high seed production in spring are:

- maintaining adequate soil water supply until late October (see section 2.4).
- reducing the amount of seed removal in hay or silage by not cutting when the majority of clover burrs are above cutting height.

In all other aspects, the management of newly sown and established subclover pastures are similar.

2. Establishment in subsequent years

2.1. Time of establishment

Subclover can be started from early February onwards, with start-ups from late February onwards being most reliable. The earlier the startup, the higher the autumn-winter DM production, but the harder it is to achieve due to high temperatures reducing germination rates and seedling densities.

When selecting paddocks for early irrigation, it is important to choose those with a large amount of subclover seed present. As a rough guide, 10 surface burrs/dm² (10 x 10 cm square) is approximately 400–500 kg seed/ha and provides the potential for a high seedling density.

With start-up times in late March and April, a high seedling density can be achieved from a smaller amount of seed due to higher germination rates (see Table 1).

With every month that start-up is delayed after early February, potential production in autumn-winter can decrease by between 0.5 and 1.5 t DM/ha, with a reduction of 0.9 t DM/ha being typical. Provided that the subclover is started before late April, there is no effect of start-up time on spring production.

The start-up time also affects the species composition of pastures, with pastures tending to be clover dominant if started early and grass dominant if started later.

2.2. Seedbed conditions and sowing rates

Residual pasture on a subclover paddock should be removed by late January by grazing and/or topping.

When oversowing short-lived ryegrass into established subclover pastures

- oversow prior to the second irrigation
- use ryegrass seed @ 10–15 kg/ha
- oversow at a depth of 5–10 mm.

2.3. Early season growth of subclover

The keys to early season growth of subclover pastures are:

- high establishment density (see section 2.4).
- use of best management practices (BMPs) for grazing, water, and soils and fertilisers (see sections 3, 4 and 5).
- control of pests and diseases (see section 8).

Table 1. Subclover seedling establishment (seedlings/dm²)^A as affected by start-up time and spring irrigation

The late spring irrigation increases establishment density through more seed being present in autumn. The later the start-up time the higher the germination rate and hence seedling density.

Final irrigation (previous year)	Start-up time		
	early February	early March	early April
	Initial establishment year ^B (seedlings/dm ²)		
	0.9	1.0	1.0
	Subsequent years		
October	2.9	5.8	13.0
November	4.5	11.2	25.0

A a dm² is a 10 x 10 cm square

B following an initial sowing at a rate of 30 kg/ha (note this is 3–5 times the recommended rate)

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2.4. Achieving high establishment densities

A high establishment density is a key to the early season growth of subclover based pastures. High establishment density depends on:

- high seed production the previous spring
- low seed loss over summer
- rapid breakdown of impermeable seedcoats
- high germination of permeable seeds.

The target density for early subclover production is more than 15 seedlings per dm².

Seed production in spring

Maintaining soil water supply until late October (irrigate if necessary) is essential to enable high seed production. Table 2 shows that irrigating until November as opposed to October can double subclover seed production. However, the ideal time for the last irrigation will depend on the growing season length of the subclover cultivar (early, mid or late).

Autumn start-up time does not affect seed production in spring.

It is important to minimise the amount of seed removal in hay or silage by not cutting when the majority of clover burrs are above cutting height.

Seed loss over summer

There may be large losses of subclover seed over summer as a result of:

- summer rainfall resulting in false breaks (or early germination). However, a high proportion of hardseed means that only a proportion of the subclover seed is lost.
- grazing stock eating the clover burr. This is not likely to be a serious problem with cattle.

Breakdown of impermeable seedcoats

A large proportion of subclover seeds have an impermeable seed coat (commonly called “hard seeds”) which prevents water uptake and hence germination.

Breakdown of the impermeable seed coat over summer requires large temperature fluctuations which cause the seed to expand and contract, eventually cracking the seed coat sufficiently to allow water uptake. The progressive breakdown of “hard seed” as summer progresses results in an increasing proportion of “soft seed” (seeds with a permeable seedcoat that can germinate if soil water is adequate) (see Figure 1).

Removing most of the trash on the surface by late January helps the breakdown of the impermeable seed coat.

Table 2. Late spring irrigations increase subclover seed production, the amount of seed present prior to irrigation in autumn and seedling density following irrigation

Timing of final spring irrigation	Seed production in spring (kg/ha)	Seed present prior to irrigation (kg/ha)	Seedling density (number/dm ²) ^A
October	270	210	33
November	570	430	65

A a dm² is a 10 x 10 cm square

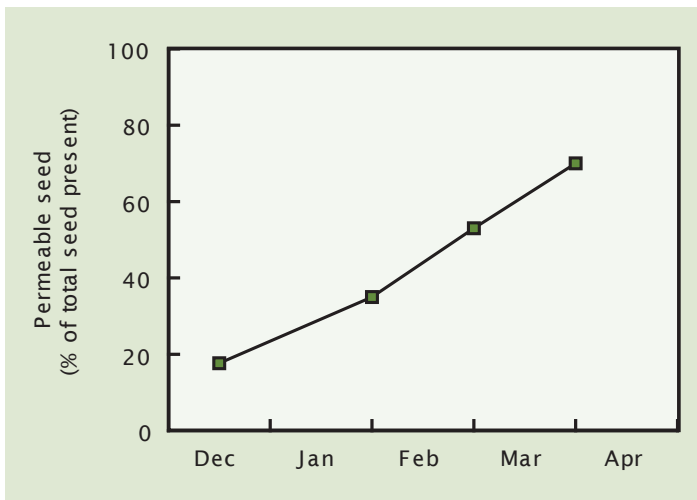


Figure 1. The proportion of subclover seed that is permeable (“soft”) increases over summer due to the breakdown of impermeable (“hard”) seedcoats

Germination of permeable seeds

Seeds with a permeable seedcoat (commonly called “soft seeds”) are capable of absorbing water and germinating.

The germination of “soft seeds” is limited by high temperatures (see Figure 2). Therefore, the first irrigation should be applied when maximum daily temperatures are less than 30°C.

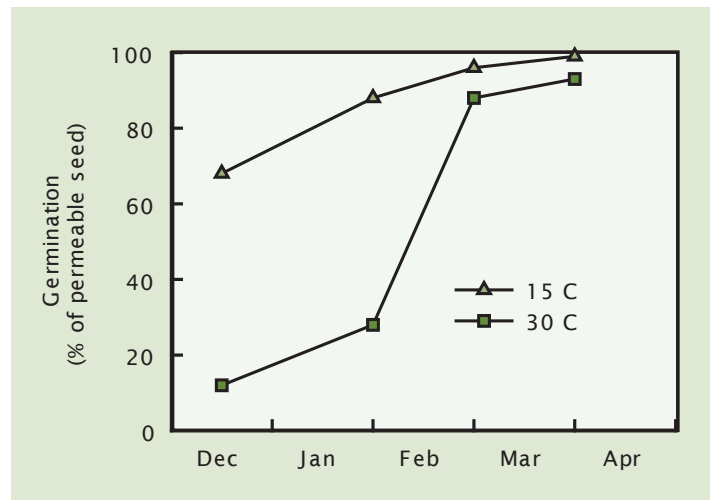


Figure 2. Germination of permeable (“soft”) subclover seed is affected by time since seed production and temperature. Germination is lower at 30°C than at 15°C.

Is extra subclover seed required in existing paddocks?

Extra seed should not be required in existing subclover pastures if seed production has been good in either of the previous 2 springs.

Situations where adding seed may be considered include:

- When attempting to introduce a new cultivar. This is risky as you will only be adding about 10 kg seed/ha compared to 200–400 kg/ha that may already be present. It is necessary in this situation to reduce the seedbank of the existing cultivar first.
- Following smoothing of pugged subclover paddocks prior to irrigation. Adding extra seed to badly pugged areas may be a worthwhile insurance policy.
- If a paddock is very patchy. However, as 1 surface burr/dm² is equivalent to 40–50 kg seed/ha, the burr density needs to be very low before it becomes worthwhile adding extra seed.

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3. BMPs - grazing

The first grazing of a subclover pasture is often associated with controlling summer weeds.

When annual or short-lived ryegrasses are included in the mix, subsequent grazings should be when the ryegrass is at the 2½-3 leaf stage.

When there is little ryegrass in the mix, subsequent grazings should occur when there is sufficient pasture present to graze. As a guide, this corresponds to minimum rotation lengths of 25 days in April, 35 days in May and 50-60 days in June and July.

The pasture should be grazed to a residual height of 4-5 cm. Lower residual heights will reduce regrowth rates, annual production (see Table 3) and long term regeneration of the subclover pasture.

Do not graze new regrowth (ie. a maximum of 3 days on the one area) as this will reduce regrowth rates.

Note that bloat can potentially be a problem when stock are grazing pastures with a high clover content.

Table 3. Effects of grazing management on subterranean clover yield (t DM/ha.year)

	Post grazing height (cm)		
	Hard (3 cm)	Medium (5 cm)	Lax (7 cm)
Year 1	9.1	10.7	10.1
Year 2	8.5	10.0	10.4

4. BMPs - water

The keys to good water management are to irrigate the pasture before it is moisture stressed and to minimise waterlogging. This is particularly important for areas established early and involves attention to:

- **irrigation frequency.** Following the initial irrigation, subsequent irrigations should be at the same interval as for perennial pasture, ie. a cumulative evaporation less rainfall interval (E-R) of 50 mm.
- **speed of irrigation.** Water should flow onto bays for a maximum of 4 to 6 hours. This requires good channel structure, good flow rates and well laid out bays. (The first irrigation is usually slower than this due to the large volume of water required).
- **quick drainage.** Surface water needs to drain off the bays quickly to minimise the period of water logging (ie. no standing water 18 hours after starting to irrigate). This requires well laid out bays with good slope for water flow over the pasture, well sealed channel plugs to avoid seepage, the use of spinner cuts (except on very short bays) to enhance surface drainage, clean drains so that water is able to drain off the end of the bays, and drains that run into a reuse system.
- **water quality.**
 - ◆ Subclover is *sensitive* to salt. Therefore, its growth will decline through the use of irrigation water with a salinity content of over 750 µS/cm (500 ppm). This is provided there is deep drainage of approximately 10% of applied water (irrigation plus rainfall) and no saline water table.
 - ◆ The quality of the water can be tested with an EC meter. Water from alternative water sources such as a drain, bore or spear should be tested regularly.

5. BMPs – soils and fertilisers

A program to ensure adequate soil fertility includes:

- soil testing representative areas
- setting nutrient targets
- developing a fertiliser plan which takes into account nutrient imports and exports.
- implementing BMPs for fertiliser applications.

Phosphorus (P) targets for perennial pastures used for dairy production are in the range of 18–22 ppm of Olsen P. However, P targets for irrigated annual pastures are not known, but are likely to be at the lower end of this range. Typically, maintenance applications of P for subclover pastures are in the order of 20–25 kg P/ha.year.

Nitrogen fertilisers can be used to increase pasture growth when short-lived ryegrasses are included in the mix. The best responses to nitrogen are achieved when the pasture is ryegrass dominant and during winter and spring. Nitrogen fertilisers should be applied as soon as possible after grazing to allow the pasture sufficient time to respond before the next grazing. Urea needs to be washed into the soil within 24 hours of application to minimise losses.

Surface crusting is a common problem on sodic and newly land-graded soils and can be a major concern when establishing a new pasture as it can prevent seedling emergence. In this situation, the use of gypsum can be beneficial.

Soil salinity can affect pasture growth with the effect more pronounced in some species than others. Approaches to reduce impacts include ensuring use of low EC water, applications of gypsum or lime (containing calcium) to displace sodium, using salt tolerant species or lowering the water table.

6. Fodder conservation

The supply of pasture during spring is usually at a peak and may exceed herd requirements. To maximise the benefits of the surplus pasture, feed surpluses need to be identified and conserved.

During spring when there is a feed surplus, the first priority for conservation are annual pastures. (Note that BMPs are required to maintain the density of perennial pastures and hence the priority for conserving annual pastures.)

With subclover pastures, it is important to minimise seed burr removal during conservation. Avoid cutting when the majority of the clover burrs are above cutting height. This may compromise forage quality but ensures high seed production.

7. Cultivars

A range of subclover cultivars are available.

When choosing a cultivar consider:

- time to seed production or maturity. This will affect potential DM production and water use during spring. Early or mid spring cultivars are suitable for dryland situations while mid or late season cultivars are suitable for irrigated areas.
- soil type.
- disease tolerance.
- likelihood of waterlogging.

When sowing short-lived ryegrass into an existing subclover pasture the maturity of the short-lived ryegrass should be matched to that of the subclover ie. both clover and ryegrass grow until a similar time.

Finding information on cultivars

Grassland Society of Victoria – Pasture species database. Go to www.grasslands.org.au, and click on the link to the pasture species database.

Sales brochures – pay attention to where trials were located.

Seed merchants – should be more tailored to the local region than sales brochures.

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8. Pests and Diseases

The major pests of subclover pastures are red-legged earth mites, aphids, field crickets and lucerne flea. A close look at paddocks on a regular basis for these pests is important.

Redlegged earth mites (RLEM) can cause large losses in DM production, particularly when plants are stressed. There can also be severe impacts on the establishment of subclover. Effective management relies upon early identification of the problem and spraying if required.

Field crickets are a problem after false autumn breaks as their eggs hatch and they increase sharply in number (flood irrigation can drown a large proportion of the population). They can remove large amounts of seed and affect seedling emergence. Monitoring populations through laying hessian bags flat on the ground can give an idea of population levels and whether control is worthwhile.

Diseases may affect the establishment and growth of subclover. The most common problems are root rots caused by a range of fungi.

The most important root rot, particularly in irrigated pastures, is **subclover root rot** (or *Phytophthora clandestina*) which attacks the taproot of subclover seedlings in autumn. Infection usually occurs following the second autumn irrigation and results in debarking of the taproot about 10 mm below the crown. There are 4 known races of phytophthora root rot and subclover cultivars differ in their resistance to each of these races.

Where a susceptible subclover cultivar is grown in a paddock prone to root rot, the use of a fungicide may need to be considered. Fungicides are usually applied prior to the second irrigation: this is a preventative spray (ie it protects the seedling root from infection) and is not a cure for infected plants. Fungicides should always be applied according to the label.

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