DEPARTMENT OF
PRIMARY INDUSTRIES

Irrigated Winter Forages in Northern Victoria

Choosing an option

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Irrigated Winter Forages: Choosing an Option

Pastures can be the cheapest source of feed on dairy farms in northern Victoria, provided that they are grown and utilised well. One of the best ways of minimising the cost of milk production is to grow and consume as much pasture as possible. This requires effective management and a desirable species composition.

Effective management involves the use of best management practices in the areas of pasture establishment, grazing, water, and soils and fertilisers.

A desirable species composition requires selection of an appropriate species, effective pasture establishment and good management.

Forage options

The range of annual pasture and winter forage crop options available for irrigated farms in northern Victoria include:

- subterranean clover
- Persian clover
- balansa clover
- berseem clover
- short-lived ryegrass (annual, Italian and hybrids)
- winter cereals (oats, wheat, triticale, barley).

When selecting an appropriate option a range of factors need to be considered. These include:

- time of establishment
- time of spring finish
- water use
- annual yield
- management requirements
- soil type
- ability to self-regenerate the following season
- growing costs
- feed quality (energy, protein and fibre contents)
- tolerance of pests and diseases
- tolerance of salinity.

This brochure outlines the key differences between these options and aims to assist you in selecting the most appropriate option. Their management is outlined in other brochures in this series.

Time of establishment

Successfully starting an annual pasture or forage in late summer or early autumn will be affected by:

- water availability/soil moisture
- quantity of seed present
- temperature effects on germination
- growth habit (some cereals may become reproductive before winter if sown too early).

High early growth depends on:

- high establishment density
- good soil fertility
- minimal effect of pests and diseases.

Temperature effects on germination

- High temperatures limit the germination of many annual clovers even if soil water is available.
  - For annual clovers such as subterranean, balansa and berseem clover, the proportion of seeds that will germinate is greatly reduced at temperatures above 25˚C.
  - The germination of the Persian clover cultivar “Maral” is not affected by temperatures up to 35˚C.
  - The germination of other Persian clover cultivars at high temperatures is between that of subterranean and “Maral” Persian clover.
- The germination of ryegrass is also reduced at high temperatures. This limits the likelihood of successful ryegrass establishment from early starts.
- Good followup management is required to ensure successful establishment.

Time of spring finish

The length of the growing season in spring is dependant upon:

- maturity type of the forage
- the period for which soil moisture levels are adequate for plant growth.

The growing season of Persian clover in spring is longer than that of either subterranean or balansa clover. This means that there is more flexibility in time of spring finish with Persian clover than with other clovers.

Within each species of annual clover, cultivars are categorised into early, mid and late season types on their flowering times and length of growing season in spring. These categories are not comparable between species, for example, a late season subterranean clover will finish much earlier than a late season Persian clover.

For self-regenerating forages, eg subterranean clover, balansa clover and some Persian clover cultivars, it is essential that soil water supply is maintained for a sufficient period in spring to ensure adequate seed production. This ensures a potential for high seedling density and growth rates the following autumn.

Ryegrass cultivars have a range of maturity times in spring. When included in mixes with clovers it is important to match their maturity times.

Choosing a cultivar for spring production

- For dryland paddocks, early or mid season subterranean or balansa cultivars are most applicable as their early flowering time enables them to produce seed in most years before soil moisture runs out.
- For paddocks that receive some irrigation during spring, mid or late season subterranean or balansa cultivars are most suitable.
- For paddocks that may be irrigated into late November or December, late season Persian clover is the preferred option.
- When sowing ryegrass/clover mixes, it is important to match their maturity times in spring.

Water use

The quantity of water required largely depends on the number of irrigations required in autumn and spring.

Climatic conditions (amount and distribution of rainfall and evaporation), soil type and depth of water table will also influence water requirements.

The typical number of irrigations required for annual pastures and forages in autumn are:

- early February start-up, 7 irrigations
- early March start-up, 4 irrigations
- early April start-up, 2 irrigations.

The number of required irrigations can be 1 or 2 lower in a wet year and 1 or 2 higher in a dry year with high evaporation rates.

The number of irrigations required in spring depends on the climatic conditions in both winter and spring, with irrigations required in August in around 25% of years.

The typical number of irrigations required for annual pastures and forages in spring are:

- late September finish, 1 irrigation
- late October finish, 2 irrigations
- late November finish, 4 irrigations.

The number of required irrigations can be 1 or 2 lower in a wet year and up to 2 or 3 higher in a dry year with high evaporation rates.

The amount of water applied at the first irrigation in autumn on annual pastures or forages is typically 1–3 ML/ha. Subsequent irrigations typically require 0.5 ML/ha. The first irrigation in spring following a dry winter may require up to 1.0 ML/ha.

Irrigated Winter Forages: Choosing an Option

Annual yield

There is little comparative data on the annual yields of the various annual pastures and forages. The available information suggests that:

- annual dry matter (DM) production is closely related to the length of the growing season
- forage cereals and ryegrasses may have higher growth rates during winter than the annual clovers.

The time of establishment affects autumn-winter DM production. For every month that irrigation is delayed after early February, the potential autumn-winter DM production from annual clovers such as subterranean, balansa or Persian declines by 0.5 to 1.5 t DM/ha, with a decline of 0.9 t DM/ha being typical.

The DM production from these annual clover species is similar up to late June (given similar starting times), averaging 4.7 t DM/ha for an early February start-up, 3.8 t DM/ha for a late February start-up and 2.8 t DM/ha for a late March start-up.

With annual clover species there is little effect of autumn start-up time on DM production in spring.

Management requirements

Annual pastures and forage crops differ in their management requirements mainly due to differences in:

- establishment – self-regenerating versus annual resowing
- tolerance of pests and diseases
- use of nitrogen (N) fertilisers.

Subterranean clover based pastures generally require less management input than a Persian clover/short-lived ryegrass pasture grown with high N inputs.

In all cases, the use of best management practices is essential to optimise the performance of a forage crop.

Soil type

Soil issues that can influence the choice of pasture or forage crop grown include:

- soil texture
- ease of cultivation
- trafficability when wet
- salinity (more details are given later).

Heavy soils that are hard to cultivate and traffic when wet are generally better suited to subterranean clover than to Persian clover. In contrast, Persian clover is generally better suited to lighter soils that are easy to cultivate.

Ability to self-regenerate

Some annual forages have the ability to self-regenerate each autumn from seed produced the previous spring. These forages include:

- subterranean clover
- balansa clover
- some Persian clover cultivars
- some annual ryegrass cultivars.

The management of these forages to ensure adequate seed production is very important.

Other annual forages need to be resown each autumn for a reliable performance. These forages include:

- winter cereals
- most short-lived ryegrass cultivars
- berseem clover
- some Persian clover cultivars.

These forages typically have soft seeds that will germinate whenever there is sufficient soil water.

Forages that can reliably self-regenerate have features that prevent many of their seeds from germinating after summer or early autumn rainfall. In clovers these features are:

- hard-seed. These seeds have an impermeable seed coat that prevents water uptake and hence germination (see below for more details).
- temperature response. Many forages have limited germination at high temperatures (see “time of establishment”).

"Hard" and "soft" seed

- "Hard seeds" refer to seeds that have an impermeable seed coat which prevents water uptake and hence germination.
- "Soft seeds" are seeds with a permeable seed coat that allows water uptake and germination if moisture and temperature conditions are suitable
- 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 the "hard seed" results in an increasing proportion of seeds with permeable ("soft") seedcoats as summer progresses. This "soft seed" is capable of absorbing water and can germinate when temperature and soil water conditions are adequate.
- Clovers which produce a high proportion of "soft seeds" in spring usually need to be sown each year. This is because many seeds are lost with false breaks.

The keys for successful establishment of self-regenerating pastures are:

- ensuring adequate seed production the previous spring.
- minimising seed loss. Seed loss can occur as a result of removal in hay or silage, by grazing, or through germination at false breaks.
- ensuring that a high proportion of seed present at start-up is able to germinate. This requires aiding the breakdown of hard seed (through trash removal over summer) and the selection of an appropriate start-up time.

Growing costs

The growing costs of annual forages vary widely as a result of differences in the cost of:

- establishment
- seed
- fertiliser
- water.

Forages that self-regenerate tend to be cheaper to grow than those requiring annual sowing (Table 1).

Table 1. Typical growing costs for annual forages

Item	Self-regenerating[A]	Annual sowing
Establishment		
Cultivate	–	✓
Sow	–	✓
Seed		
Grass / cereal	–	✓
Clover	–	✓
Fertiliser[B]		
Phosphorus	✓	✓
Nitrogen	–	✓[C]
Other		
Water	✓	✓
Maintenance	✓	✓
Pests / diseases	✓	✓

A assumes that short-lived ryegrass is not oversown into the annual clover
B other nutrients may also be required
C nitrogen responses are best when grass dominant

Irrigated Winter Forages: Choosing an Option

Feed quality

The metabolisable energy content (ME) of annual clovers and short-lived ryegrass is higher than that of winter cereals.

The ME of annual clovers such as balansa, Persian and subterranean tends to be lower in autumn than it is in late winter and much of spring (Figure 1).

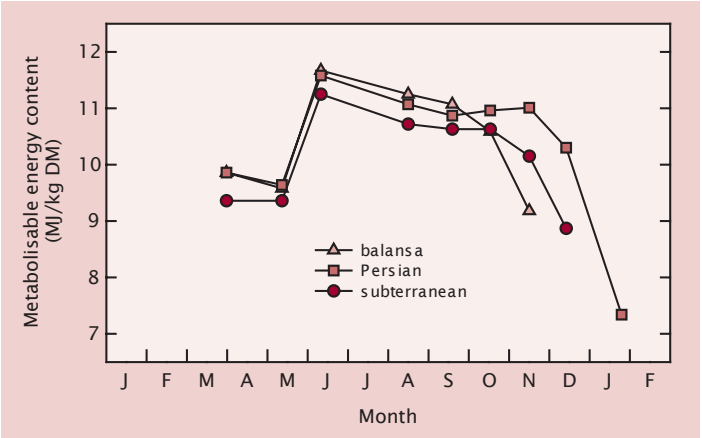

Figure 1. Metabolisable energy content of balansa, Persian and subterranean clovers

In late spring, the ME of the annual clovers decline as they mature (Figure 1). Therefore, the later maturity of Persian clover results in it maintaining its ME in spring for longer than either balansa or subterranean clover.

During their vegetative stages, the ME of ryegrass and clovers are similar. During their reproductive stages, however, the ME of grasses and cereals declines more than that of clovers.

The crude protein (CP) content of clover dominant pastures is greater than that of ryegrass dominant pastures or forage cereals. Annual clovers also maintain their CP content better at plant maturity than either ryegrass or forage cereals.

Species composition and plant maturity are therefore the main factors determining the ME and CP content of forages which are to be conserved.

The fibre content of grasses and cereals is higher than that of clovers. For grasses and cereals, the fibre content is higher for reproductive than for vegetative swards.

Pests and diseases

Forage species differ in their tolerance of pests and diseases. The cultivars (or varieties) within a species may also vary in their tolerance of individual pests and diseases.

While some pests or diseases, such as red legged earthmite and lucerne flea, can damage a wide range of forages, other pests or diseases, such as subterranean clover root rot, may attack only a limited number of forages.

When a paddock has a known history of a pest or disease problem, it may be necessary to choose a tolerant forage, or impose management practices that will control or limit the potential loss.

Early identification of pest or disease problems is crucial to the effective management or control of them.

Salinity

Differences exist between plants in their tolerance of salt in irrigation water and/or soil.

Table 2 indicates general differences in salt tolerance between some forage species. Cultivars of species such as subterranean clover may also differ in salt tolerance. However, these differences are much smaller than differences between species.

The salt tolerance of plants also varies with:

- water management (irrigation method, frequency, intensity and waterlogging).
- stage of plant growth (germination, emergence, early seedling growth, flowering).
- climatic conditions (temperature, humidity, light).
- soil type.

Table 2. Salt tolerance of several forage species to applied irrigation water

The relative tolerance of species to soil salinity is similar to that of irrigation water.

Salinity of irrigation water	Comments	Forage species
0–750 µS/cm (0–500 ppm)	Suitable for use with all crops. Above 750 µS/cm sensitive plants will suffer some yield loss as soil salinity increases.	*Sensitive plants:* Subterranean clover, white clover
750–1,500 µS/cm (500–1,000 ppm)	Sensitive plants have increasingly reduced growth. Moderately-sensitive plants suffer little or no yield decline.	*Moderately-sensitive plants:* Balansa clover, Persian clover, strawberry clover, lucerne
1,500–3,000 µS/cm (1,000–2,000 ppm)	Moderately-sensitive plants will suffer increasing yield loss. Moderately tolerant plants should suffer little yield loss with good management at the lower end of this range. At the upper end some yield loss will occur.	*Moderately-tolerant plants:* Berseem clover, paspalum, perennial ryegrass, tall fescue, barley (hay), oats, wheat
3,000–5,000 µS/cm (2,000–3,300 ppm)	Moderately-tolerant plants will suffer increasing yield decline. Only tolerant plants should be grown with very good irrigation/soil management. Toward the top end of this range some yield loss will occur for some of the tolerant plants.	*Tolerant plants:* Couch grass, saltwater couch, tall wheatgrass, barley (grain)

Notes:

- Plants within each group are not arranged in any order of salt tolerance
- Salt tolerance values are generic guides and assume free drainage with at least 10% of the water applied (irrigation plus rainfall) passing through to the soil below the root zone and the absence of a saline watertable.
- Measurements of salinity do not indicate the type of salt present and so measurements must also be made of specific salts such as chloride.

Irrigated Winter Forages: Choosing an Option

Selecting an appropriate forage

The key features to considered when choosing an annual pasture or winter forage crop, are shown in Table 3. Taking the time to match crop features with your farm goals and resources will ensure that the best choice is made.

Table 3. Key features of annual pastures and winter forage crops.

Feature	Subterranean clover	Persian clover	Balansa clover	Berseem clover	Short-lived ryegrass	Forage cereal
Suitability for early start-up	✓✓	✓✓✓	✓✓	✓	✓	✓
Suitability for late finish	✓✓	✓✓✓	✓	✓	✓✓✓	✓✓
Water use	✓✓	✓✓✓	✓✓	✓	✓✓	✓✓
Annual yield[A]	✓✓	✓✓✓	✓✓	✓	✓✓✓	✓✓✓
Ease of management	✓✓✓	✓	✓✓✓	✓✓	✓✓	✓✓
Ability to self-regenerate	✓✓✓	✓–✓✓[B]	✓✓	✓	✓–✓✓	✓
Growing costs	✓	✓✓✓	✓	✓✓	✓✓✓	✓✓✓
Feed quality	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓	✓
Tolerance of salinity	✓	✓✓	✓✓	✓✓✓	✓✓✓	✓✓✓
Tolerance of pests / diseases	Need to consider on a cultivar basis					

Notes:
A assumes they are grown to their full potential
B the longer season Persian clover cultivars generally require sowing each year.
- the cultivars within a species can vary for each of the listed features.
- When sowing ryegrass/clover mixes there, is a need to match their maturity times in spring.

Key: ✓ low, ✓✓ medium, ✓✓✓ high.

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