



Organic Farming: Perennial Pasture Establishment

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This Agnote provides information on the establishment of introduced perennial pasture species (phalaris and lucerne) within a dryland organic farming system in Victoria.

Introduction

Perennial pasture species are essential for the long term economic and environmental sustainability of dryland farming systems in Victoria. Perennial pasture species have deep roots that can make better use of soil water throughout the year than annual plant species. They can therefore assist in the management of dryland salinity and soil acidity. They can also provide critical ground cover to reduce the potential for erosion, as well as provide high quality livestock feed.

Perennial pasture species, such as phalaris and lucerne, are widely used by livestock and mixed farmers to provide high quality feed on a year round basis. Phalaris is grown for its winter feed production and lucerne for its summer feed production. This Agnote will provide information about establishment of these two species within an organic farming context. Establishment refers to the period from soil preparation for sowing to the first autumn after sowing.

Soil conditions and fertility

Both phalaris and lucerne establish best in well-drained, friable soils that have a pH (CaCl₂) between 4.6 and 7.0 (phalaris) and between 5.0 and 8.0 (lucerne). Both species do not tolerate low soil pH (acidic soil) and lime will be required if a soil test shows low soil pH. Well-drained soils are also required for establishment because poor drainage may result in surface crusting thereby preventing seedling emergence.

Good soil fertility is essential for phalaris and lucerne establishment. The essential nutrients required are phosphorus (P), sulphur (S), potassium (K) and nitrogen (N). Soil management in an organic system will rely on the regular addition of organic material either through green manure or compost to ensure nutrient availability however, allowable mineral inputs may be needed to ensure a successful pasture establishment.

A soil test that provides information on the pH, nutrient status, cation exchange capacity and organic matter levels is recommended prior to nutrient purchase and pasture establishment.

Allowable sources of S (elemental sulphur) and K (rock potash) can be applied prior to pasture establishment so that they are available to newly establishing seedlings. Both phalaris and lucerne should be sown with P (rock phosphate products or phosphatic guano). Phalaris can benefit from N *after* sowing but on a broad-acre scale, allowable N products such as blood and bone or Dynamic Lifter™ are unlikely to be economic. Adequate N fertility for phalaris establishment is best achieved by sowing subterranean clover in the pasture mix.

Annual rainfall requirements

Phalaris is suited to areas ranging from 450 to above 700 mm annual rainfall but soil pH (CaCl₂) must be above 4.6 and classified as moderately acid to alkaline. Below 4.6 the level of available aluminium becomes toxic to phalaris plants.

Lucerne has a broader annual rainfall range, being able to establish in areas with as little as 250 mm rainfall each year. Lucerne can also be highly productive in higher rainfall areas (600 mm and above) but does not tolerate water-logging or low soil pH (below 5.0 in CaCl₂).



Figure 1. Establishing lucerne is characterized by dark green oval cotyledons and serrated trifoliate leaves.



Figure 2. Establishing phalaris is characterized by blue-green leaves and is relatively uncompetitive in the seedling stage.

Weed management prior to sowing

As both phalaris and lucerne are relatively uncompetitive in the seedling stage it is critical to provide a seed-bed that is mostly weed free. In organic systems, herbicides are not allowed so weed management must begin at least two years before pasture establishment.

It is recommended that a program to reduce the annual grass [*Lolium rigidum* (Annual ryegrass), *Vulpia spp.* (Silver grass), *Hordeum leporinum* (Barley grass)] seed-bank is implemented as these species will compete vigorously in the seedling stage. Non-chemical grass weed management methods include strategic grazing, cutting silage or hay, green manuring or cultivation to prevent grass seed set. As much as 90% of the annual ryegrass seed-bank can be reduced in two years of strategic weed management. Another effective method of annual grass weed management is an ‘autumn tickle’ where the seed-bed is lightly scarified to stimulate ryegrass germination. These plants can then be killed with cultivation prior to pasture sowing. This method is suitable when there are early autumn break rains but should not be relied on as the sole weed management method.

Time of sowing

The optimum time for sowing phalaris is in autumn. Maximum germination occurs when daily temperatures are between 15 and 25°C, and sowing in autumn gives the phalaris seedlings sufficient time to establish a root system prior to the onset of warmer drier weather in summer. If the autumn break rainfall is late then it is recommended to wait until the following autumn rather than risk a spring sowing where annual plant competition is high.

Lucerne can be sown in autumn or spring but autumn is preferred to allow time for the root system to establish. Spring sowing can be done if there is reliable spring rainfall. Sowing in winter is not recommended because lucerne growth is slow and the young plants are more susceptible to pest and disease problems.

Seed preparation

It is important to check the germination percentage of perennial species prior to sowing as this will affect the rate at which seed is sown. Certified pasture species are sold

with germination percentages stated, but germination often declines with age of the seed so a simple germination test conducted prior to sowing will verify the viability of the seed. Select 100 seeds at random and place these on a moist bed of cotton wool. Seed is viable when there is an emerged radicle.

Legume seed should be inoculated prior to sowing. Lucerne requires a bacterial inoculant so that the N fixing bacteria can commence the symbiotic relationship to fix atmospheric N. This is critical for long term persistence of the lucerne sward and for sustainable nitrogen fertility. Inoculation of legume seed is allowed in organic systems and is recommended for successful pasture establishment. Lime-coating of inoculated legume seed can provide a protective micro-environment for the germinating seed. Inoculated and lime-coated legume seed is commercially available but many producers perform this operation themselves just prior to sowing.

Sourcing certified organic pasture seed is difficult in Victoria as there are few producers who specialize in seed production. Whilst it is a requirement to use certified organic seed in an organic farming system, it is possible to obtain a derogation if suitable organic seed cannot be found.

Sowing methods

There are four sowing methods that can be used to establish either phalaris or lucerne. Effective seed-soil contact in a weed free seed-bed is essential to achieve the best possible germination of the perennial species.

1. Conventional cultivation

Conventional cultivation involves the preparation of a cultivated seed-bed that is free of other plant species and is prepared to a fine tilth where soil clods are no more than 1-2 cm in diameter. This method involves significant cultivation and may affect soil structure however it provides the best seed-bed for perennial pasture establishment. The phalaris or lucerne seed can then be sown in rows with fertiliser into a moist even seed-bed where accurate seeding depth control can be achieved. Rolling at the same time as seeding will ensure good seed-soil contact.

2. Surface sowing or broad-casting

Surface sowing or broad-casting involves dropping perennial pasture seed on a cultivated soil surface or an existing grazed pasture. Where seed is dropped on to a cultivated soil surface and then rolled afterwards, good seed-soil contact can be achieved. The disadvantage of this method is that the pasture seed has to compete with any germinating weed species for the available fertiliser, instead of having strategic access to it when sown in rows. Where seed is dropped on to an existing grazed pasture, such as might occur in non-arable hilly areas, the seeds may not achieve direct contact with the soil and it is likely that a poor germination will result.

3. Direct drill

Direct drilling is where pasture seed is drilled in rows into an existing grazed pasture. The advantages of this method are that seed has direct access to fertiliser and there is generally good seed-soil contact if rolling is used. The disadvantage of this method in an organic farming context is that the germinating seed must compete with the existing pasture sward, which may contain many vigorous annual species. This will affect germination and establishment as both phalaris and lucerne are relatively uncompetitive in the seedling stage. Hard grazing before sowing will increase the chance of a successful establishment.

4. Under-sowing

This method involves broadcasting perennial pasture seed at the same time as sowing a cereal crop. This method is often used by mixed farmers in the last cropping year of the rotation and typically, oats are sown at a lower rate (30 kg/ha) with pasture seed dropped on the surface. The advantages of this method include savings on time and fuel because pasture is being sown at the same time as the crop, and a paddock is kept in production whilst pasture is establishing resulting in continued income. The disadvantages of this method are that pasture seed doesn't have direct access to fertiliser, it has to compete for moisture and light with the establishing crop, and there is generally poor seed-soil contact.

Sowing rates

Conventional sowing rates for phalaris are 2 kg/ha and most commercial seed has a germination percentage of about 70-80%. This means that about 2.7 kg/ha needs to be sown to account for the lower germination potential. In experiments conducted at the Department of Primary Industries, Rutherglen, in cultivated seed-beds, phalaris was sown at either 2.4 kg/ha or 4.8 kg/ha in a mix with subterranean clover. The higher seeding rate was used as a method to compete against annual weed species. The phalaris and clover was sown either in rows, broadcast on the surface or undersown. Germination results showed that row sown was significantly better than broadcast or undersown, and that the lower sowing rate was sufficient to provide for an optimal plant density of 30-50 plants/m².



Figure 3. Higher (left) and lower (right) seeding rates of row sown phalaris and subterranean clover sown in an organic system at Rutherglen.

Conventional sowing rates for lucerne are 2-4 kg/ha between 250-400 mm annual rainfall and 4+ kg/ha where annual rainfall is 400 mm or more. At Rutherglen, sowing lucerne in rows resulted in better establishment than when it was broadcast or undersown, and like phalaris, the

conventional sowing rate (4-5 kg/ha) was sufficient to achieve an optimal plant density of 20 plants/m². In areas with annual rainfall above 450 mm an established lucerne stand may have up to 20 plants/m² and in lower rainfall areas, this may reduce to 8-12 plants/m².



Figure 4. Higher (left) and lower (right) seeding rates of row sown lucerne and fescue in an organic system at Rutherglen.

Sowing depth

Soil moisture conditions are critical when sowing perennial pasture species and sowing seed deeper to place seed in moisture is generally not recommended. Phalaris should be sown at a depth of about 10-15 mm into firm moist soil. Lucerne can be sown deeper (up to 25 mm depth) if the soil type is sandy but no deeper than 15 mm if the soil type is clay or loam.

Pest management

Both lucerne and phalaris are susceptible to damage from red legged earthmite (*Halotydeus destructor*) in the cotyledon and early seedling stages. Organic management of this insect includes green manuring in the spring prior to lucerne establishment to disrupt the diapause egg laying process thereby reducing the potential population of earthmites for the following autumn. For more information about earthmite management, see www.timerite.com.au.

Phalaris cultivars

There are two main groups of phalaris cultivars. The older semi-winter dormant phalaris cultivars, such as Uneta or Australian, are characterized by prostrate growth habit, poorer seedling vigour and only moderate growth over winter.

The new phalaris cultivars, such as Siroso and Holdfast, are characterized by more erect growth, higher winter production and better seedling vigour.

Lucerne cultivars

Lucerne cultivars are categorized according to their level of winter growth activity. A winter activity scale is used where 1-3 means that the lucerne is winter dormant; 4-5 means that lucerne is semi-dormant; 6-7 is winter active; 8-9 is highly winter active and 10 is very highly winter active.

Grazing management in the establishment year

1. Phalaris

The primary objective in the establishment year is to ensure that the phalaris plants establish a sound root

system, and are provided with the opportunity to produce tillers and dormant buds to ensure their survival over the first summer.

Light grazing of phalaris in the establishment year can occur once the plants have reached a height of 15 cm. Young cattle can be used for grazing as they are less likely to pull out young phalaris plants. The phalaris should then be left so that seed heads can emerge. At this time dormant buds are produced by the plant and it is this mechanism that allows the phalaris to withstand many months of hot dry weather over summer. In January phalaris can be grazed to utilize the dry standing material and then in autumn, can be grazed to 5 cm in height to stimulate tiller production.



Figure 5. Establishing phalaris needs to produce dormant buds for summer survival.

2. Lucerne

Grazing management for lucerne in the establishment year is similar to phalaris in that the objective should be to produce healthy lucerne root systems and crowns that can respond to summer rainfall. In the first year lucerne should only be lightly grazed (a few days maximum) when flowering begins, or when plants begin to wilt and shed older leaves. Stock should be removed if they are grazing near the lucerne crowns.



Figure 6. Establishing lucerne should only be grazed lightly in the first year.

Further reading

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