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Serena and Circle Valley medic establishment

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By M. A. Ewing, Research Officer, Dryland Research Institute, Merredin

Since the commercial release of the burr medics Serena in 1983, and Circle Valley a year later, much has been learnt about the establishment and management of these pasture legumes. When sown on suitable soils and with the appropriate establishment and management techniques, these medics have the potential to dramatically change farm profitability. This results from both increased production from livestock and from improved cereal crops grown in rotation.

Burr medics (Medicago polymorpha) persist on soils and in situations where previously available pasture legumes have frequently failed. In their native Mediterranean environment burr medics are able to grow on a wide range of soil types, and this same characteristic is evident in Western Australia. They are particularly well suited to the grey sandy loam over clay soils prominent in the southern wheatbelt, and the brown sandy loams (usually mildly acidic) which are widespread in wheatbelt areas.

Characteristics of Serena and Circle Valley

Serena and Circle Valley are the two burr medics commercially available in this State. They are difficult to distinguish in the vegetative stage, although Circle Valley does have a darker green leaf and a more prominent dark fleck at the base of the leaf. The burrs of the two varieties are similar, both being spineless. The main difference is in their maturity.

Germinating in late May, Serena flowers after about 70 days, while Circle Valley takes 95 days. In comparison, Cyprus barrel medic (M. truncatula), the variety most commonly grown in the past, flowers after 80 days. Serena's early maturity makes it most suited to areas with less than 350 mm average annual rainfall, while Circle Valley suits areas receiving more than 450 mm. A mixture of the two cultivars is appropriate for areas receiving between 350 and 450 mm of rain a year.

Establishment philosophy

Establishing a legume pasture is an expensive procedure because of the high costs of seed, fertiliser, herbicide and sowing operations. In addition, there is usually a reduction in stock carrying capacity in the establishment year. However, increased returns in the form of improved livestock and crop performance
from medic pastures can be expected over many years. Once successfully established, burr medics persist without the need for resowing for extended periods, even when part of relatively intensive cropping rotations.

Given the high investment cost of new medic sowing, it is important to match the rate of their establishment to the financial capacity of the farm. A large medic establishment programme which stretches available economic resources often leads to short-term technical compromises in establishment procedure which can threaten the establishment operation. It is also sensible to fine tune establishment procedures on a small area to gain experience before undertaking a larger programme.

Medics persist and regenerate at a satisfactory plant density through poor seasons and frequent cropping because of their ‘hard’ seed characteristics. They produce a large quantity of seeds which germinate over many years (at least five years for Serena and Circle Valley). Once established, a seed reserve exists in the soil which can be run down during droughts or cropping years and replenished during favourable seasons.

However, this high level of hard seed can be a problem during establishment. In the year after first sowing when a medic pasture regenerates, as little as 20 per cent of the seeds have the potential to germinate. In later regenerations, seeds from several years seed set will contribute to the pool of germinating seeds. The first year of medic regeneration is a special case. To be successful a large seed set is needed the year before, hence the strong emphasis on management practices which result in high first year seed production. The suggested establishment procedures outlined in this article are based on this requirement.

Managing medic pastures in later seasons can be more flexible because maximum seed production is not necessary in every pasture phase to ensure a medic dominant pasture in the long term.

**Establishment procedures**

**Soil type choice**

Inoculation of medic seed with the current Group A strain of acid-tolerant rhizobia has enabled Serena and Circle Valley medics to be grown on mildly acidic soils ranging from pH 6 to 7 (1:5 in water). Many wheatbelt sandy loam soils and grey clays can now be sown to burr medics whereas, in the past, medics have been confined largely to heavy textured, neutral or alkaline soils. Serena and Circle Valley can also be grown successfully on these neutral or alkaline soils.

Most sandplain soils in the wheatbelt which may have grown subterranean clover at some time are below pH 6. Current research results indicate that medics will give successful long term nodulation on at least some of these soils. However, our experience of growing medics on such soils is limited. Research to identify further improvements in medics and medic rhizobia growing on acid soils is underway, and this is expected to widen further the soil type range on which medics can be grown (Figure 1).

**Paddock choice and preparation**

Medics are best established in paddocks in which previous weed control has been excellent. In practice, this means sowing medics after one or more cereal crops. Stubble can be removed by burning, making sowing easier. Since soils on which medics are generally sown are not prone to wind erosion, stubble burning is usually a safe practice.

When Glean® is used for weed control in cereal crops, small amounts of residual chemical can seriously damage following newly sown or regenerating medics. The level of residual Glean® in the soil is influenced by soil pH, rate of Glean® applied, timing of application and the amount of rain after application.

The likelihood of Glean® damage will be highest on alkaline soils when applied at high rates, especially post-emergent applications and when rainfall following application is low. Alternative weed control measures should be used in cereal crops in the year before medic pastures are established on alkaline soils. Alternative strategies should be considered for mildly acid soils, although the chance of significant medic damage from residual Glean® is lower on such soils.

**Seed purchase and inoculation**

To attain satisfactory germination of 80 per cent or more, the medic seed coat must be scarified, usually at a seed cleaning shed. The germination percentage of purchased seed should be checked because ‘harvester’ samples of medic seed rarely have satisfactory germination levels.

Seed must be inoculated correctly before sowing to introduce the associated nitrogen-fixing rhizobia to the soil. The mildly acidic soils on which Serena and Circle Valley are often sown are not ideal environments for rhizobial growth, nodulation of roots and subsequent survival in the soil. Inoculation using the lime pelleting process is an essential element of successful establishment.

Rhizobia should be applied to the seed in a gum solution and the seed coated with lime. (See Farmnote No. 29/84 “Inoculation and lime pelleting”.)
Common causes of poor root nodulation are:
• Storing packets of rhizobia under hot conditions leading to a high bacterial death rate.
• Inoculating the seed too early and storing it for lengthy periods.
• Inoculating but not lime pelleting the seed, or applying inoculum by dusting or in a water solution.
• Producing poorly made pellets which crumble during handling, separating the bacteria from the seed.
• Excessive handling of pelleted seed before sowing, resulting in abrasion of the lime pellet from the seed. Abrasion has caused problems where pelleted seed has been pre-mixed with fertiliser in a field bin before being loaded into a seeder. In some air-seeders the lime coating has been stripped from the seed as it passes through the machine.

These problems mean that the bacteria which infect the early developing roots to give nitrogen fixing nodules are either absent or present in low numbers near those roots. The result is failure to nodulate or at best a delay in nodulation which takes place on later formed lateral roots. Without nodulation medic growth is generally poor, particularly on lighter textured soils where soil nitrogen levels are low.

Sowing
Two systems of pasture establishment are commonly practised. Medics can be sown on their own or they can be sown as a mixture with a cereal crop (under-sowing).

Table 1. Dry matter and seed yield of Circle Valley medic sown under a wheat crop, Katanning, 1985

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Dry matter (t/ha) at 7/10/85</th>
<th>Seed yield (kg/ha) at harvest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>4.5</td>
<td>1670</td>
</tr>
<tr>
<td>Wheat + Circle Valley at 2 kg/ha</td>
<td>3.8</td>
<td>2.3</td>
</tr>
<tr>
<td>Wheat + Circle Valley at 4 kg/ha</td>
<td>3.1</td>
<td>2.8</td>
</tr>
<tr>
<td>Wheat + Circle Valley at 8 kg/ha</td>
<td>2.3</td>
<td>3.7</td>
</tr>
<tr>
<td>Circle Valley (2 kg/ha)</td>
<td>—</td>
<td>3.3</td>
</tr>
<tr>
<td>Circle Valley (4 kg/ha)</td>
<td>—</td>
<td>4.3</td>
</tr>
<tr>
<td>Circle Valley (8 kg/ha)</td>
<td>—</td>
<td>5.2</td>
</tr>
</tbody>
</table>

Wheat sown at 50 kg/ha in late May, site sprayed for annual ryegrass control, no broad-leaf weed control.

Source: C. Revell and C. Thorn, Department of Agriculture, Katanning.

Table 2. Performance of Serena medic sown alone or under a wheat crop, Newdegate, 1985

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Medic dry matter, spring (kg/ha)</th>
<th>Medic seed yield (kg/ha)</th>
<th>Wheat yield (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>7</td>
<td>3</td>
<td>1213</td>
</tr>
<tr>
<td>Wheat + Serena at 1 kg/ha</td>
<td>46</td>
<td>5</td>
<td>1226</td>
</tr>
<tr>
<td>Wheat + Serena at 2 kg/ha</td>
<td>57</td>
<td>18</td>
<td>1213</td>
</tr>
<tr>
<td>Wheat + Serena at 3 kg/ha</td>
<td>76</td>
<td>11</td>
<td>1200</td>
</tr>
<tr>
<td>Wheat + Serena at 4 kg/ha</td>
<td>103</td>
<td>45</td>
<td>1187</td>
</tr>
<tr>
<td>Serena at 5 kg/ha</td>
<td>2175</td>
<td>436</td>
<td>—</td>
</tr>
<tr>
<td>Serena at 10 kg/ha</td>
<td>2267</td>
<td>479</td>
<td>—</td>
</tr>
</tbody>
</table>

All wheat sowings at 40 kg/ha
over-ran the pasture, giving rise to little pasture seed set. Table 1 shows a contrasting situation where the pasture has competed strongly against the crop.

- Difficulties in the control of broad-leaved weeds in the cereal crop because of the presence of medics. Existing herbicides used for broad-leaf weed control will severely retard growth of the under-sown pasture. Failure to control these weeds will depress cereal yield and medic establishment.

- Sparse introduction of medic rhizobia to the soil through widely spaced, stressed medic plants under a crop. Low sowing rates used in under-sowing lead to poor distribution of rhizobia through the soil and can result in unsatisfactory nodulation when the pasture regenerates the following year.

Despite the apparent cheapness of the under-sowing system, it is not favoured because of its unreliability. Under-sowing also involves hidden costs such as reduced cereal crop yield and weed control difficulties.

The key elements of a specialist medic establishment system which result in maximum seed set are as follows.

- Control weeds before sowing. Sowing dry usually leads to significant competition from weeds. Weeds can be controlled by cultivation or knock-down herbicides. If weeds are to be controlled at sowing, knock-down herbicides generally will give best results because the medic seed must be sown shallow, thus restricting the effectiveness of cultivation (Table 3).

- Sow as early as possible. The optimum time for sowing medics will usually coincide with that for cereal crops. However, Serena, because of its early maturity, can be sown later (after cereals), especially in seasons with an early break.

- Sow shallow. On many soils sowing medic seed deeper than two centimetres will reduce seedling emergence. Sowing one to two centimetres deep gives best results. An alternative is to drop the seed on the cultivated surface and lightly harrow to give a shallow soil cover.

- Sow with an adequate seeding rate. Seeding rates between 5 and 10 kg/ha are usually satisfactory. A higher rate can be chosen if seed cost is low, weed competition high or substantial grazing is desired in the first year.

- Control weeds which emerge with the pasture. Grasses present at low levels can be grazed by sheep at low stocking rates to give selective removal. Heavy grass burdens can be controlled by the herbicides Hoegrass®, Fusilade® or Sertin®, depending on which grasses predominate.
Table 4. Seed yield of burr medic *M. polymorpha* N4980 grazed for various periods in 1985, Merredin

<table>
<thead>
<tr>
<th></th>
<th>Seed yield (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ungrazed</td>
<td>289</td>
</tr>
<tr>
<td>Grazed 3/7 to 13/8</td>
<td>200</td>
</tr>
<tr>
<td>Grazed 3/7 to 13/9</td>
<td>111</td>
</tr>
<tr>
<td>Grazed 3/7 to 24/10</td>
<td>106</td>
</tr>
</tbody>
</table>

Table 5. Dry matter and seed yield of burr medic *M. polymorpha* N4980 grazed for various periods in 1984, Pingrup

<table>
<thead>
<tr>
<th></th>
<th>Dry matter (kg/ha) when grazing stopped</th>
<th>Final dry matter (kg/ha)</th>
<th>Seed Yield (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ungrazed</td>
<td>—</td>
<td>7537</td>
<td>898</td>
</tr>
<tr>
<td>Grazed 15/7 to 8/8</td>
<td>717</td>
<td>8249</td>
<td>871</td>
</tr>
<tr>
<td>Grazed 15/7 to 12/9</td>
<td>1725</td>
<td>3747</td>
<td>892</td>
</tr>
<tr>
<td>Grazed 15/7 to 28/9</td>
<td>2766</td>
<td>5145</td>
<td>869</td>
</tr>
<tr>
<td>Grazed 15/7 to 9/10</td>
<td>2901</td>
<td>4389</td>
<td>713</td>
</tr>
</tbody>
</table>

A stand of Serena medic which produced a seed yield exceeding 1,200 kg/ha clean seed. The area was sprayed with Fusilade® and the effects of a missed patch are apparent.

Broad-leaf weeds are difficult to control in medic pastures and are best controlled before seeding. Large numbers of doublegee or capeweed can be sprayed with Tribunil® or Diuron®, both mixed with 2, 4-DB. Alternatively, 2, 4-DB can be sprayed alone as part of a 'spray-graze' system. All the chemicals are unpredictable in their selectivity between the weed and the medic and some medic damage is common.

• Control insect pests. The main threats are lucerne flea, red-legged earth mite and blue-green aphid. Red-legged earth mite and lucerne flea are most damaging to newly emerged seedlings and prompt control is vital to avoid a major set-back to the plants. This threat usually coincides with the end of seeding operations so it is a sensible precaution to have insecticide on hand and application equipment ready before sowing. Blue-green aphids are generally active in spring, and if conditions favour their early build-up they can reduce seed production potential. Several insecticides are effective in controlling aphids at moderate cost.

Grazing management

Grazing management strategies consistent with the objective of maximising medic seed yield will vary from season to season and depend on the amount of weeds present, particularly grasses. In a poor season characterised by a late start and a short growing season, seed yield will be maximised with little or no grazing of the stand. Table 4 shows how grazing in 1985, a poor season, has reduced seed yield of a burr medic N4980, a close relative of Serena and Circle Valley. When seasonal conditions were good at Pingrup in 1984, heavy grazing during most of the growing season only slightly depressed seed yield (Table 5).
As a practical guide, medic pastures can be grazed during establishment at an intensity so that sheep mainly remove the upright grass weeds. This level of grazing should be maintained until ground cover is almost complete. If this is achieved early in the season stock numbers can be increased, but not to a level where sheep are consuming pasture more rapidly than it is growing. If the weather is likely to induce moisture stress in the pasture, sheep should be removed until the pasture matures.

These grazing strategies apply to the establishment year only when medic plants are at a relatively low density. In later years when plant regeneration density is much higher and overall seed yield less important, continuous grazing from the break of the season is feasible. However, the relatively upright growth habit of burr medic makes it more susceptible to overgrazing than subterranean clover.

**Post-establishment rotation**

Medic seed germination is most reliable when the burrs are covered by some soil. This was evident in 1985 when light initial rains lead to poor seedling establishment on stands sown the previous year. The same situation did not arise in 1986 where there was a decisive break to the season. Cropping in the year following a successful establishment operation avoids this problem. Medic seed will be incorporated into the soil surface during the sowing operation and germination in the year after the crop will be reliable.

Another factor supporting this strategy arises from the seed germination patterns of medic. More seeds from the initial seed set usually germinate in the second regeneration year than in the first. If a longer initial pasture phase is needed, light cultivation in late autumn will give the burrs better contact with the soil and increase the reliability of germination. Delaying the light cultivation until late in autumn avoids the possibility of seed loss through false breaks of the season.

**Establishment summary**

- Control weeds in the year before sowing and again in the sowing year.
- Use inoculated and lime pelleted seed which has been scarified to give high germination percentage.
- Sow medics on their own for best establishment rather than sowing them under a cereal crop.
- Sow only one to two centimetres deep, and at a seeding rate between 5 and 10 kg/ha.
- Control weeds which emerge with the pasture by grazing or with herbicides.
- Control insects, red-legged earth mite and lucerne flea in the seedling stage and blue-green aphids in spring.
- Graze medic pasture carefully in the establishment year.

**Further reading**


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**Acknowledgement**

The Australian Wool Corporation and the Wheat Industry Research Committee of W.A. have contributed funds to this research area.

![A first-year stand of Serena medic in winter, showing the emphasis required on weed control.](image)