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John Sylvester Gladstones

N. R. McKeown

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Serradella—a pasture legume for sandy soils

J. S. Gladstones, Senior Plant Breeder, and
N. R. McKeown, Research Officer

Serradella cultivation in Western Australia*

French serradella grows well on many of the sandy soils along the west coast where other species such as sub. clover often fail, and produces excellent feed both when green and in the dry state. Establishment is easy because of its soft-seededness. However the same characteristic, together with its erect growth habit, means that persistence under grazing has been poor. Also, because only a late-flowering type has been available, seed production is unreliable. Some stands have persisted satisfactorily for two or three years but after that have usually failed.

The origin of yellow serradella as a pasture plant in Western Australia is more recent. Unlike sub. clover it is not widely naturalised, which is surprising in view of its common occurrence through the whole natural range of sub. clover in the Mediterranean.

Credit for recognition of yellow serradella's possible value in Australia belongs to Mr W. M. Pitman, who found a few plants growing near his farm at Waroona, 130 km south of Perth, about 1950. Their origin is not known, but the plant type resembles that of the Spanish cultivated strains and some from southern Italy.

After preliminary trial and bulking on his farm, Mr Pitman released a small quantity of seed commercially in 1955. His cultivar has since become the main serradella cultivar grown in Western Australia. It was officially registered, and given the cultivar name “Pitman”, by the Western Australian Herbage Plant Liaison Committee in 1966.

Early evaluation of cv. Pitman was overshadowed by difficulties in its establishment due to poor germination of the seeds, which normally remain enclosed in pod segments and so do not get scarified in the normal harvesting and seed cleaning operations.

It was later demonstrated* that Pitman's hard-seededness can be broken down by alternating temperature treatment of the fully dry seeds for two months or more, such as by leaving them in a thin layer in the sun. Commercial methods were also devised to decoat and scarify the seeds mechanically. Although both methods have been used successfully, the costs have constituted a significant barrier to commercial seed production and use.

A second limitation to the use of cv. Pitman is its relatively late flowering and maturity, which confine successful cultivation in Western

Agronomic requirements of yellow serradella

Soil and nutritional requirements

The most important attribute of yellow serradella is its ability to thrive on some sandy soils where sub. clover does not persist. It is well suited to sandplain soils where the subsoil is some 40 to 100 cm below the surface, or to some deeper sands containing an appreciable clay fraction throughout. Except in special circumstances, there seems at present to be little point to growing serradella on soils which sustain good sub. clover pastures.

Unpublished experiments by students at the University of W.A. have shown that yellow serradella tolerates potassium deficiency better than sub. clover. However it is by no means immune. Some field plantings have failed because they have been on extremely deficient sands—the reason for trying serradella being, often, that everything else has failed.

Department of Agriculture trials by Mr. J. W. Gartrell (unpublished) have shown that serradella needs slightly less copper, zinc and molybdenum than subterranean clover. Comparative analyses of serradella and other pasture legumes grown on the same soil (Table 1) suggests that this is due to serradella’s greater ability to take up these elements from the soil.

No experiments have been reported which establish serradella’s phosphate requirement. Comparative analysis (Table 1) indicate that it takes up more than sub. clover and may therefore need less. However, until better information is available a requirement similar to that of sub. clover should be assumed.

One of the main reasons why serradella can grow well on quite deep sands is its deep root system. This enables it to draw both nutrients and moisture from greater depths than shallow rooted plants such as sub. clover. It can stay green and continue growing for several more weeks in the spring, especially if subsoil seepage water is available.

Capacity to take up nutrients from depth and recycle them to the surface could be expected to have beneficial effects on the total nutrient economy of the soil, especially for soluble mineral nutrients such as potassium, which are readily leached beyond the reach of shallow-rooted plants in sandy soils, and so become permanently lost.

Improving germination; seeding methods and inoculation

Hard-seededness breaks down in at least a fair proportion of seeds if they are left in a thin layer (2 to 3 cm) in the sun for two months or more. If placed in plastic bags or between plastic sheets they must first be thoroughly dried, otherwise the treatment is ineffective.

A simpler approach is to delay seed harvest until late summer, by which time capacity for immediate

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Table 2.—Compositions (whole tops) of different pasture legumes grown under the same conditions at Gidgegannup, Western Australia, and sampled a little before maturity (October 14-18).

<table>
<thead>
<tr>
<th>Legume</th>
<th>Crude protein (per cent)</th>
<th>Calcium (per cent)</th>
<th>Magnesium (per cent)</th>
<th>Phosphorus (per cent)</th>
<th>Manganese (parts per million)</th>
<th>Zinc (parts per million)</th>
<th>Copper (parts per million)</th>
<th>Cobalt (parts per million)</th>
<th>Selenium (parts per million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ornthopus sativus</td>
<td>20-1</td>
<td>1.22</td>
<td>0.34</td>
<td>0.27</td>
<td>107</td>
<td>62</td>
<td>8.0</td>
<td>0.106</td>
<td>0.012</td>
</tr>
<tr>
<td>O. compressus (yellow serradella) cv. Pitman</td>
<td>20-1</td>
<td>1.31</td>
<td>0.38</td>
<td>0.25</td>
<td>106</td>
<td>58</td>
<td>7.5</td>
<td>0.087</td>
<td>0.030</td>
</tr>
<tr>
<td>Trifolium subterraneum (sub clover) cv. Bacchus Marsh</td>
<td>15-0</td>
<td>1.21</td>
<td>0.35</td>
<td>0.15</td>
<td>46</td>
<td>31</td>
<td>5.7</td>
<td>0.088</td>
<td>0.009</td>
</tr>
<tr>
<td>Trifolium subterraneum (sub clover) cv. Clare</td>
<td>12-9</td>
<td>0.88</td>
<td>0.24</td>
<td>0.13</td>
<td>30</td>
<td>24</td>
<td>5.4</td>
<td>0.082</td>
<td>0.017</td>
</tr>
<tr>
<td>Trifolium hirtum (rose clover) cv. Kondinin</td>
<td>16-0</td>
<td>1.23</td>
<td>0.30</td>
<td>0.14</td>
<td>34</td>
<td>33</td>
<td>5.4</td>
<td>0.056</td>
<td>0.011</td>
</tr>
<tr>
<td>Medicago truncatula (barrel medic) cv. Hannaford</td>
<td>14-4</td>
<td>1.06</td>
<td>0.33</td>
<td>0.14</td>
<td>28</td>
<td>20</td>
<td>5.3</td>
<td>0.061</td>
<td>0.018</td>
</tr>
</tbody>
</table>

Pods and pod segments of the three serradella species, left to right—yellow, pink and slender serradella.

Serradella seed sold consists of pod segments.

Inoculation is not needed on country which has carried well nodulated serradella or lupins within the past five or six years. Elsewhere it should be carried out, using a standard lupin/serradella culture.

If inoculating seed which has not been dehulled, pre-moisten with water at 0.75 litres per 12 kg of in-hull seed. The appropriate amount of peat-inoculum is mixed in an adhesive solution of strength 50 g methyl cellulose to 1 litre of water, for use at 1 litre per 12 kg of seed. Finally, pelleting lime is applied at the rate of 6 kg per 12 kg of seed.

If satisfactory nodulation is attained in the first year, it is most unlikely that there will be any further nodulation problems. Unlike those nodulating clovers, medics, peas and vetches, the bacteria nodulating serradella and lupins can colonise and persist well in sandy soils.*

Diseases and pests of yellow serradella

Yellow serradella in Western Australia has so far been fairly free from disease. Brown leaf spot (Pleiochaeta setosa), which also infects lupins, has been recorded on serradella but seems to be fairly rare. Occasional plants have been seen suffering from root rots and a virus disease (probably bean yellow mosaic virus), but again these have been rare and have not suggested a serious disease problem.

Serradella is also relatively free from insect attack, except for seed-eating grubs of which the most important is the native budworm, Heliothis punctigera. Using an early flowering variety and avoiding excessive grazing during seed development both help by allowing pods and seeds to mature before the grubs appear in number.

Serradella is little attacked by the red-legged earth mite, Halotydues destructor, and in this respect is superior to sub. clover. Although mites can often be seen on the plants, they do little damage.

Grazing of established yellow serradella stands

Yellow serradella can withstand continuous grazing in much the same way as sub. clover, but a different grazing strategy may be needed for it to perform to its fullest capability. Serradella paddocks are probably best grazed short early in the growing season, because the seedlings are prostrate and readily overgrown by grasses. This applies to Pitman more than to Uniserra, whose seedlings are a little more erect.

Although it will set adequate seed in the spring when grazed at moderate stocking rates, serradella benefits from a relaxation of grazing...
pressure at this time. Removing too much of the tops at this stage delays maturity and reduces seed production. In this respect serradella contrasts with sub. clover, whose seeds are well protected from grazing.

Serradella has an extremely high feed value, and contains no oestrogens.* It maintains its protein and mineral content during maturation to a greater extent than most other pasture plants.

Table 1 shows the contents, a little before maturity, of crude protein and of various major and trace elements in the two common serradella species, as compared with other pasture legumes of similar maturity, grown with the same fertiliser treatment on a light gravelly soil at Gidgiegannup. (For the five trace elements, the figures are means of the three application rates of each element.)

The data show serradella to be particularly rich in protein, phosphorus, manganese, zinc and copper.

**Long-term persistence**

Much remains to be learned about the long-term persistence of yellow serradella. A fairly common experience has been that re-establishment is poor in the second year, presumably due to excessive hard-seedness or physiological seed dormancy. If enough seed is present and conditions are suitable for growth, the stand usually builds up over the next year or two. Established serradella pastures have been known to change almost entirely to grass, only to revert to dominant serradella the following year.

Grazing trials have indicated that serradella does not react to seasonal variation in the same way as sub. clover. At Wongan Hills Research Station, when dry spring conditions critically reduced the amount of seed set by Geraldton sub. clover, Uniserra set adequate seed because of its greater capacity to respond to finishing rains. It also appeared better able to tolerate a following unfavourable start of season, when false breaks and red-legged earth mite attack further reduced the already sparse sub. clover stand. On the other hand good seasonal openings which have favoured sub. clover have tended to allow grasses to dominate the serradella, especially at low stocking rates.

Regeneration of serradella pasture after cropping has been good, at least in regions of favourable rainfall, but little is known of its regeneration in drier districts.

**Place of yellow serradella in the farming system**

The characteristics of yellow serradella appear to complement those of sub. clover, giving it a place on some sandy soils which are marginal or too poor for sub. clover but too good to be relegated to sandplain lupins.

On farms with mixed soil types, seasonal fluctuations in feed availability may be reduced by having some serradella paddocks and some sub. clover paddocks. Good serradella years can be bad sub. clover years, and vice versa. The need to reduce grazing pressure on serradella in spring dovetails well with the desirability of heavier grazing then on the sub. clover paddocks, and on paddocks being prepared for cropping. Serradella also provides non-oestrogenic paddocks for ewes.

Sowing a mixture of sub. clover and serradella in paddocks with mixed soil types has not been as successful as might be expected. At least when mixed with high-oestrogen sub. clover, the serradella tends to be eaten out preferentially because of its greater palatability. If the sub. clover is earlier maturing than the serradella (which would normally be the case), the green serradella remaining after sub. clover maturity is subject to intense grazing just when it is most vulnerable, resulting in a failure of seed production even at light stocking rates.

**Future possibilities**

Present experience with serradella in Western Australia is based on a very few strains, whose introduction has been largely a matter of accident. Better adapted types may exist, but it has not been possible to obtain much new genetic material by scientific exchange—other than a small number of French serradella lines from northern Europe and more recently a few yellow serradellas from Spain—because the species are more or less uncultivated and little is known about them.

To obtain new genetic material, research workers from the University of W.A. and the Department of Agriculture have recently collected and introduced a wide range of naturally-occurring serradellas, as well as of lupins and sub. clovers, in visits to various Mediterranean countries.

Preliminary sorting and screening of the collections has yielded some 200 distinct strains, mostly of yellow serradella, ranging in flowering time from about the same time as Uniserra (from North Africa) to much later than Pitman. Among the limited material of *O. pinnatus* and *O. perpusillus* are lines much earlier flowering than any which have previously been available. Several lines of *O. isthmocarpus* are also fairly early. The most promising lines from each species are being increased for more detailed evaluation in the field.

Serradella will undoubtedly remain of minor importance compared with sub. clover. Experience has nevertheless proved that it can be useful in Western Australia in medium and high rainfall districts which have a high proportion of sandy soils.

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*Francis, C. M., unpublished data.*