Coolamon is a mid-season to late-season flowering F$_4$-derived crossbred subterranean clover of var. subterraneum, developed by the collaborating organisations of the National Annual Pasture Legume Improvement Program. It is a replacement for Junee and has been selected for release on the basis of its greater herbage production and persistence, and its resistance to both known races of clover scorch. Coolamon is recommended for sowing in Western Australia, New South Wales, Victoria, South Australia and Queensland. It is best suited to well-drained, moderately acidic soils in areas with a growing season of 6.5–8 months that extends into November. Coolamon is best suited to phase farming and permanent pasture systems. It can also be used in cropping rotations, but at least 2 years of pasture are required between crops. Coolamon has been granted Plant Breeders Rights in Australia.

**Origin**

Coolamon subterranean clover [Trifolium subterraneum var. subterraneum (Katz. et Morley) Zohary and Heller] was bred by P. G. H. Nichols at the University of Western Australia Field Station (UFS), Shenton Park, Western Australia. It is derived from the cross 84S20 made by J. S. Gladstones in 1984. The seed parent was the F1 hybrid Junee/CPI 89881E and the pollen parent was the F1 hybrid 75S13–2/69S37–3 (Dinninup/Daliak/Toodyay C///Midland B/Northam C). Plant 84S20.14 was selected in 1986 at UFS as 1 of 14 F$_2$ single plants from cross 84S20. It was sown and harvested in 1987 as a bulk F$_3$ population in a clover scorch [Kabatiella caulivora (Kirchn.) Karak] disease screening plot at Denmark, Western Australia and was selected for further development on the basis of its resistance. In 1988, 84S20.14.7 was selected at UFS as 1 of 9 F$_4$ spaced plants from 84S20.14 to form the basis of Coolamon. Further between-line selection was conducted from 1989 to 1991 in 1-m rows at UFS and 1-m$^2$ clover scorch screening plots at Denmark. Selection criteria were as follows: (i) midseason maturity, (ii) low formononetin content (less than 0.2% of dry matter) using the procedure of Francis and Millington (1965), (iii) moderate hardseededness, using the laboratory procedure of Quinlivan (1961), (iv) moderate-strong burr burial, (v) strong winter and spring vigour, (vi) resistance to Races 1 and 2 of clover scorch and (vii) the leaf mark of CPI 89881E.

In 1992, Coolamon was selected as 1 of 62 midseason breeding lines of var. subterraneum for Stage I field evaluation in Western Australia, New South Wales, South Australia, Victoria and Queensland. In 1996, Coolamon was selected as 1 of 19 breeding lines to enter Stage II field evaluation trials in Western Australia, New South Wales, South Australia, Victoria and Queensland. Field evaluation was conducted as part of the National Annual Pasture Legume Improvement Program (NAPLIP). Stage I field evaluation was conducted under the code name 84S20–13, while Stage II evaluation was conducted under the code name SM012. The following collaborators of NAPLIP conducted field evaluation and final
selection of Coolamon: P. G. H. Nichols and P. Si (Department of Agriculture and Food Western Australia), G. A. Sandral and H. S. Dear (New South Wales Department of Primary Industries), J. C. Craig and C. T. de Koning (South Australian Research and Development Institute), P. M. Evans (Department of Primary Industries Victoria) and D. L. Lloyd (Department of Primary Industries and Fisheries, Queensland). M. J. Barbetti, D. J. Gillespie and M. P. You (Department of Agriculture and Food Western Australia) conducted screening for disease resistance. D. J. Gillespie conducted screening for red-legged earth mite [Hodoterus destructor (Fletcher)] resistance. P. G. H. Nichols and P. F. Smith (Centre for Legumes in Mediterranean Agriculture) conducted hardseed screening. The University of Western Australia conducted isoflavone analyses.

Coolamon was selected for release as a new cultivar in 2000. Selection was based on resistance to Races 1 and 2 of clover scorch, strong regeneration capacity, high winter and spring herbage production and high production and maintenance of seed reserves. The population for cultivar release was derived from 30 uniform plants selected in 2001. Coolamon is recommended for registration by the collaborating organisations of NAPLIP. It has been granted Plant Breeders Rights in Australia and is described in Nichols (2005). The Department of Agriculture and Food Western Australian will maintain breeders’ seed.

Coolamon is named after the town of the same name in southern New South Wales.

Morphological description

Coolamon has a distinctive leaf mark inherited from its CPI 89881E parent. Leaves produced early in the season have broad, pale green A3 arms (Nichols et al. 1996) with no central crescent. However, a pale green central C2 crescent (Nichols et al. 1996) extending halfway to the leaf margins, is also present in leaves produced later in the season. Leaves have no anthocyanin flush but have occasional flecks. Indentation of the distal margin is moderately strong. Stipules commonly have red veins under closed canopies, while calyx tubes have no pigmentation. Petioles, peduncles and stems (runners) are all glabrous, while leaflet upper surfaces are weakly pubescent. Seed colour is black, with about 130,000 seeds per kg when grown under ideal conditions. Further descriptions and photographs of distinguishing features are given in Nichols (2005) and Nichols and Barbetti (2005).

Agronomic characters

Coolamon is a summer-season to late-season flowering variety, according to the terminology of Nichols et al. (1996). In Perth, it flowers about 131 days after sowing in early May, a few days later than both Junee and Woogenellup and about 9 days earlier than Urana (Barbetti and Nichols 2005). Coolamon has a distinctive leaf mark inherited from its CPI 89881E parent. Leaves produced early in the season have broad, pale green A3 arms (Nichols et al. 1996) with no central crescent. However, a pale green central C2 crescent (Nichols et al. 1996) extending halfway to the leaf margins, is also present in leaves produced later in the season. Leaves have no anthocyanin flush but have occasional flecks. Indentation of the distal margin is moderately strong. Stipules commonly have red veins under closed canopies, while calyx tubes have no pigmentation. Petioles, peduncles and stems (runners) are all glabrous, while leaflet upper surfaces are weakly pubescent. Seed colour is black, with about 130,000 seeds per kg when grown under ideal conditions. Further descriptions and photographs of distinguishing features are given in Nichols (2005) and Nichols and Barbetti (2005).

Coolamon is moderately resistant to root rots caused by Pythium irregularire (Buismann) and Fusarium avenaceum (Fr.) Sacc. You et al. (2005c) showed Coolamon suffered similar Pythium tap root rot damage to Dalkeith, Woogenellup and Trikkala but more damage than York, Riverina, Seaton Park, Junee, Goulburn, Denmark and Urana. Lateral root rot damage comparisons were generally similar. You et al. (2005c) also showed Coolamon suffered similar Fusarium tap and lateral root rot damage to all cultivars tested. For both diseases,
However, seedling survival rate for Coolamon was no different from uninoculated controls, although mean shoot dry weight was significantly less than uninoculated controls following *F. axruncum* inoculation.

Coolamon has similar susceptibility to other cultivars to red-leg earth mite, *H. destructor*, particularly at the cotyledon stage. In growth room tests on 2-week-old seedlings, mean cotyledon damage ratings were 5.8 for Coolamon, 4.1 for Junee, 5.2 for Junee, 5.7 for Seaton Park, 5.8 for Goulburn, 5.9 for York and 6.4 for Dalkeith, (on an increasing damage severity rating of 0–10).

Field performance data of Coolamon in 15 replicated Stage II trials across southern Australia under grazing management of typical of each district, is shown in Table I. Comparisons are made with Junee, a common treatment at each site. The most outstanding features of Coolamon are its high herbage production over the first four seasons from sowing. In one trial at Wundowie, Western Australia, persistence was measured into the sixth season. At this site, Coolamon had 58% more seedlings than Junee and 7.6-times persistence was measured into the sixth season. At this site, Coolamon had 58% more seedlings than Junee and 7.6-times persistence was measured into the sixth season. At this site, Coolamon had 58% more seedlings than Junee and 7.6-times persistence was measured into the sixth season.

Table 1. Mean field performance data of Coolamon (as a percentage of Junee) in 15 field trials across southern Australia

<table>
<thead>
<tr>
<th>Variety</th>
<th>Winter herbage (Yrs 1-3)</th>
<th>Spring herbage (Yrs 1-3)</th>
<th>Seed bank Yrs 1-3</th>
<th>Seedling regeneration density Yrs 2-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coolamon</td>
<td>110</td>
<td>114</td>
<td>104</td>
<td>112</td>
</tr>
<tr>
<td>Junee</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Potential use

Coolamon can be regarded as a direct replacement for Junee (and to Woogenellup in areas where it is still grown), with improved field performance and resistance to Diseases 1 and 2 of clover scorch. It is recommended for sowing in Western Australia, New South Wales, Victoria, South Australia and Queensland. Coolamon is best suited to areas where the disease is prevalent. Coolamon is adapted to permanent pasture and phase farming systems and also to cropping rotations, but at least 2 years are required between crops for reliable persistence.

Coolamon is well suited to mixtures with Junee, Seaton Park or York in the drier part of its target zone, while in the higher rainfall parts, it is suited to mixtures with Goulburn or Denmark. In paddocks with areas prone to waterlogging, Coolamon can be mixed with Riverina, or with Trikala in drier regions and with Gosse or Naper in higher rainfall regions.

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Seed licenced to: Premier Seeds, PO Box 40, Forth, NSW 2871, Australia.

References


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