A. Grasses
3. Phalaris
Phalaris aquatica L. (phalaris) cv. Australian II

Reg. No. A-3a-11
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Origin

In 1989, pairwise crosses were made between 12 plants of cv. Australian and 12 plants of cv. Uneta. Half of the Australian phalaris plants came from a paddock which had been continuously grazed at 20–30 sheep/ha for 10 years, and half from another old pasture grazed at 12 sheep/ha on Ginninderra Experiment Station, ACT. Uneta was developed from a single seed-retaining plant found by H. E. Schroeder in a population raised from a certified seed lot of cv. Australian (McWilliam 1980). This plant was outcrossed to cv. Australian plants grown from 30 certified seed lots (McWilliam *et al*. 1971). The F_1 plants were intercrossed, 4 seed-retaining F_2 plants were found, and these, together with the original retaining plant, founded the Uneta cultivar (McWilliam and Gibbon 1981; Oram 1990). This pedigree implies that Uneta has an inbreeding coefficient of about 0.3, assuming no inbreeding in Australian, and measurements in 8 experiments showed that this inbreeding reduced vegetative and reproductive performance by 7.5 and 25% respectively (Oram 1994).

The outcrossing of 12 Uneta plants to a similar number of unrelated Australian plants would approximately halve the level of inbreeding, while ensuring that all genes are derived from the original Australian cultivar. The F_1 plants were intercrossed and 6600 F_2 plants were grown in the field. Forty-five seed-retaining individuals were found, cloned and intercrossed in isolation. Three of these half-sib families were discarded because of low seed quantities and the remaining 42 families were sown at the Agricultural Research and Veterinary Centre, Orange, at the Pastoral Research Institute, Hamilton, and at the Ginninderra Experiment Station, Canberra, in 8-row, 7.5 m^2 plots together with 9 separate accessions of certified seed of cv. Australian and 2 entries of 1 accession of cv. Uneta. These entries were compared over 3 years (1993–95), primarily for maintenance of stand density under continuous close grazing, because the most important agronomic features of cv. Australian are its ability to maintain a high ground cover, even under heavy, continuous grazing, and to re-colonise any gaps in the stand caused by unfavourable conditions, such as drought or soil acidity. Fortuitously, a severe drought was experienced in the second year, 1994, so the performance of the entries was monitored through that year and the following autumn, winter and spring before selecting the best 9 families. The parents of these families were clonally propagated to produce pre-basic seed of the new cultivar, for which Plant Breeders Rights protection has been obtained (Anon. 1998).

Morphological description

Australian II is very similar morphologically to Australian and Uneta, which are described in Oram (1990). However, the seedlings of Australian II and Australian are larger than those of Uneta, Australian flowers 1–2 days earlier than Australian II and Uneta, and the proportion of flowers producing a seed in Australian II is higher than in Uneta, but lower than in Australian (Anon. 1998).

Agronomic characteristics

In the selection trials at Orange, Canberra and Hamilton, mean plant density of the selected families was generally similar to that of Australian in the first 3 years, but became higher than that of Australian and Uneta by the fourth year of the trial. Although tiller basal area declined considerably at Canberra and Orange during the 1994 drought, ground cover was still sufficient to enable the stands to recover with better rainfall. The tiller basal area of the 3 winter-active cultivars in the trials, Holdfast, Sirosa and Sirolan, declined more than that of the semi-winter dormant entries (Australian and its derivatives) by the fourth year, especially at Orange. Nevertheless, Holdfast outyielded Australian, Uneta and the selected families at Canberra in early spring of the third year, after a 6-week cessation of grazing. However, at Orange in the fourth year, the stand density of the winter-active cultivars remained low, because of their lesser capacity to spread rhizomatously (Conroy 1995; Culvenor 1997).

It is expected that Australian II will perform similarly to the mean of the selected families, because breeders' seed of the cultivar was produced by random inter-mating of the parents of the selected families. Thus, with respect to persistence under continuous grazing, the inbreeding depression observed in Uneta relative to Australian appears to have been corrected in Australian II. The same conclusion holds for the shoot length of seedlings grown in the dark until all seed reserves are

exhausted — Australian II had slightly longer shoots than Australian and both had significantly longer shoots than Uneta (Anon. 1998). However, the floret fertility of Australian II, although significantly better than that of Uneta, was significantly worse that that of Australian (Anon. 1998), suggesting that some inbreeding depression remains uncorrected in that trait. Seed yield should be higher in Australian II than in Uneta, and seed retention will be much higher than in Australian. Therefore, the release of Australian II should correct the scarcity and consequent high price of seed of the Australian type which prevailed in the late 1990s.

No selection was applied for lower concentrations of the toxic tryptamine and tyramine alkaloids known to occur in the herbage of phalaris cultivars, because, first, little genetic variation exists within cv. Australian for the dimethyltryptamines (Oram 1970), which are thought to cause 'phalaris staggers', and second, at least one of the toxins causing 'sudden death' remains to be chemically identified (Bourke 1992). Therefore, pastures based on Australian II should be grazed cautiously in districts where toxicity occurs on Australian phalaris pastures. On soils derived from limestone or sandstone, which have a low cobalt content, and on soils with low cobalt availability because of high available manganese, or high pH, or microbial activity under cold, wet conditions, additional cobalt should be supplied by administering ruminal pellets containing cobalt, by providing lick blocks containing cobalt and/or by spraying pastures with cobalt (Bourke 1998). Also, seedling size and competitiveness remain low in Australian II, so careful weed management remains essential before and during the pasture establishment phase.

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