The new phalaris varieties Holdfast, Landmaster, Atlas PG and Australian II: Where do they fit?

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Since the discovery of the new seed-holding mechanism in *Phalaris aquatica* L., four new seed-retaining varieties adapted to a wide range of southern Australian environments have been developed by crossing and selection. These cultivars have been registered in the Plant Breeders Rights system, and seed is being produced and marketed by Seedco in SA and Auswest Seeds in NSW. The following descriptions of the agronomic features of the cultivars are offered to assist graziers and their advisers in the choice of the most appropriate cultivar for each application.

Holdfast

This winter-active cultivar with vigorous seedlings is designed to replace Sirosa and Sirolan in well-fertilised, rotationally-grazed grass-legume pastures. Holdfast was developed over an 18-year period, firstly by backcrossing the original seed-retaining plant of Australian phalaris with the forerunners of Sirosa and Sirolan, and secondly, by selecting retaining families for yield and persistence over two generations in 3-year sward trials at Temora and Canberra. The plants selected from the best families in these two generations were then selected for tolerance to aluminium at 10 ppm in nutrient solutions at pH 4.1 (Oram and Schroeder 1992).

Holdfast is agronomically similar to Sirosa, but is 15% less vigorous as a seedling and during winter in later years. Holdfast has established better than Sirosa on a limed acid soil with 10-20 mg Al/kg in the 10-20 cm layer, but with less acid lower layers. However, the surviving Sirosa plants grew as well as Holdfast plants in later years after they had developed root channels through the hostile layer.

Wool production has been similar from Holdfast and Sirosa pastures in a replicated trial near Canberra over the past eight years (Culvenor *et al.* 1996; Culvenor unpublished data). The pastures carried 15 Merino weaners per ha in three-paddock systems with 2 or 3 weekly shifts. Sheep on these winter-active cultivars produced 7% more wool than those on the semi-winter dormant Australian cultivar, mainly because of the higher production of phalaris and annual grass herbage in the Holdfast and Sirosa pastures in years with good late summer or early autumn rainfall.

Landmaster

This 'LandCare' cultivar is designed to protect shallow, stony, moderately infertile and acid soils from erosion and further acidification. Landmaster is based on 18 genotypes which were selected from 60 genotypes on the performance of their half-sib progeny over three growing seasons on moderately acid, infertile sedimentary soils on upper slopes at Molyullah (near Benalla) and at Axe Creek (near Bendigo) (Oram 1996). The 60 parents of these families in turn had been selected at the end of the third winter from rows grown at Axe Creek. Landmaster and Holdfast have four parental genotypes in common and are similar in morphology, and in having 7% of plants which require cold-treatment to make them flower, whereas Sirosa and Sirolan have none and Australian has 85% (Oram 1996).

Phalaris cultivars such as Landmaster should reduce groundwater recharge better than annuals on mid-slope areas (Schroder *et al.* 1997), and so reduce salinisation of lower discharge areas in landscapes developed from sedimentary rocks. On such sites near Bendigo and Benalla, Landmaster yielded 17% more herbage than Holdfast and Sirosa in the autumns and winters of 1993-6. However, Porto cocksfoot was more productive than any phalaris cultivar, apparently because of its greater tolerance to soil acidity, and its better growth in wet summers. Landmaster maintained a higher sward density than other phalaris and cocksfoot cultivars and breeding lines over a four-year period on an acid soil at Lexton, Vic. (R. Hill *pers. comm.*). On a granite soil of pH 4.2 at Tumut, NSW, Porto usually out-yielded

Landmaster in 1996-8, with Holdfast and Australian usually in third and fourth positions (P. Simpson *pers. comm.*).

Atlas PG

This cultivar is designed for the drier, marginal areas adjacent to the main phalaris belt, including much of the higher rainfall wheatbelt of south-eastern Australia. It is like Sirocco in having a higher degree of dormancy in the underground buds in summer which, like hardseededness in annual legumes, protects the buds from destruction following false breaks in summer (Oram and Freebairn 1984). Atlas PG also is suited to marginal areas because of its fast winter growth and early flowering. In 1992-5, it was usually superior to Sirocco in vigour and plant density in swards at Wagga Wagga and Coolah, NSW, in the first two years, but inferior during the drought of 1994 and in 1995.

Atlas PG was developed by two backcrosses of seed-retaining plants to the US cultivar, Perla koleagrass, and to five other Moroccan accessions or the cultivars Sirocco and El Golea bred from them (Anon. 1998; Oram 1999). Then followed four generations of selection among first-year spaced plants for seedling vigour, higher tiller number, high herbage yield, high bud dormancy, large tuber size, moderate plant height, high seed retention, resistance to panicle shattering and resistance to stem rust and leaf-browning diseases. Selection appears to have been effective in all traits.

It is expected that Atlas PG will be useful for grazing and for drying out subsoils in mixtures with lucerne and annual legumes in the wheat belt of NSW, Vic. and SA, where these species can be established under cover crops of cereals or lupins (Hoen and Oram 1967). The seed-retention characteristic will allow farmers to harvest their own seed. Atlas PG should also be useful for reducing erosion and lowering water-tables in the drier and more Mediterranean parts of the southeastern states. However, its summer dormancy is a disadvantage in regions with mild, moderately wet summers, such as the Tablelands of NSW, where pastures based on a progenitor of Atlas PG gave lower sheep liveweight gain during a summer in which sufficient rain fell to break the dormancy of Sirosa and Holdfast (Culvenor 1997). Certified seed will be available in 1999.

Australian II

This cultivar is designed to replace Australian and Uneta, by equalling Australian in persistence, grazing tolerance, and in recovery from plant losses through lateral spread, and by having greater plant vigour and seed set than Uneta, which is inferior to Australian in these two respects because it has an inbreeding coefficient of about 30% (Oram 1994). Both Uneta and Australian II are derived entirely from the Australian cultivar, and Australian II was developed by crossing 12 Uneta plants to twelve Australian plants. Seed retaining plants were located in the F_2 generation and intercrossed at random to produce half-sib families.

These were sown in replicated sward trials at Orange, Canberra and Hamilton, and grazed heavily and continuously during the second (1994 drought), third and fourth growing seasons. Nine families were selected on ground cover and yield, particularly in the third year. In general, these families equalled the nine Australian controls in the first three years, and surpassed them in the fourth year (Oram 1999). Seed set was better than in Uneta, so harvestable seed yield should be higher than in Uneta, and of course very much higher than in Australian, which sheds its most of its seeds as soon as they ripen. Australian and Australian II should be similar in other respects.

Management of phalaris

The success of phalaris-based pastures depends heavily on the following:

- Good conditions for seedling establishment, especially little competition from annual grasses
- Addition of adequate nutrients and lime in later years
- Rotational grazing through autumn and winter, especially for winter-active cultivars, which are usually the most palatable sward component, and so are overgrazed and overgrown by competitors if set-stocked, especially at high rates
- Adequate, but not excessive, grazing pressure in spring and summer to avoid phalaris dominance on the one hand, and grazing damage to young, elongating tillers on the other. Aim for some bare ground in autumn.

All cultivars should be treated as potentially toxic, especially during autumn and early winter if the phalaris herbage is readily accessible. Some toxins have been removed from Holdfast, Landmaster and Atlas PG by selective breeding, but at least one class remains to be identified.

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