New Herbage Plant Cultivars

B. Legumes

8. Lucerne

(a) *Medicago sativa* L. (lucerne) cv. Aquarius

Reg. No. B-8a-21. Registered 17 September 1992.

Originators: D.B. Waterhouse[1] and R.W. Williams[2].

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Released by NSW Agriculture.

Origin

Aquarius was bred by the New South Wales Department of Agriculture at Yanco Agricultural Institute. The breeding team comprised D.B. Waterhouse and R.W. Williams, with assistance from A.J. Milvain, T.M. O'Brien, C.M. Rose, G.F. Lonergan, and W.H. Jackson. The initial material was bred and selected by G.G. Drummond, J.A.G. Irwin, D.B. Waterhouse, M.E. Lattimore, A.J. Milvain, I.A. Cole, P.G.H. Nichols and M.M. Say. The name 'Aquarius' follows the naming system developed for lucernes bred by NSW Agriculture, and associates the variety with its primary use in wet areas such as under irrigation or in high rainfall situations.

Aquarius was developed by crossing a breeding population derived from the highly winter-active cultivar, CUF-101 (Nielson and Lehman 1976) with elite clones from an experimental line, NAPB 0310. Plants from CUF-101 were initially selected in the field at Windsor, NSW in 1979 for resistance to stem nematode [*Ditylenchus dipsaci* (Kuhn) Filipjev] and resistance to leaf diseases including stemphylium leaf spot (*Stemphylium botryosum* Wallr.) and pepper spot [*Leptosphaerulina trifolii* (Ros.) Petr.]. These selections were polycrossed by hand and the progeny screened for resistance to leaf disease in the field at Nowra, NSW and for resistance to blue-green aphids (*Acyrthosiphon kondoi* Shinji) and colletotrichum crown rot (*Colletotrichum trifolii* Bain et Essary) in the greenhouse at Yanco. Plants from this second cycle of selection were hand-crossed using pollen from clones of NAPB 0310 selected for major gene resistance to phytophthora root rot (Irwin *et al.* 1981). Progeny from this cross were further screened for resistance to blue-green aphid and to spotted alfalfa aphid (*Therioaphis trifolii* (Monell) f. *maculata*) in the greenhouse, and polycrossed to form Aquarius.

Selection for resistance in each of the last two generations was practised within and among half-sib families using large numbers of plants to avoid inbreeding depression. Aquarius is a synthetic cultivar, based on 97 plants in the final generation.

Aquarius was submitted for registration by NSW Agriculture, which will maintain breeder's seed. Recommended for registration by the New South Wales Herbage Plant Liaison Committee. An application for PVR protection of this cultivar will also be submitted.

Morphological description

The crowns of Aquarius plants are densely branched and are more spreading and less erect than CUF-101 and other highly winter-active lucernes. For example, after one year in an irrigated trial at Leeton, NSW, spaced plants of Aquarius had an average crown area of 39 cm^2, and this was 26% larger than CUF-101, 46% larger than WL605, and 31% larger than P577, P5929, and Sequel (S.P. Young and R.W. Williams unpublished data). Flower colour is predominantly purple to mauve (85.2%), with a low proportion of plants with lilac flowers (14.8%), and no variegated types.

Agronomic characters

Aquarius was bred to provide a persistent, highly winter-active lucerne for haymaking and/or grazing in irrigated or high rainfall environments. The major cause of the poor persistence and declining production of lucerne stands in these wet environments is phytophthora root rot (Irwin *et al.* 1977; Rogers *et al.* 1978). Aquarius is significantly more resistant to phytophthora root rot than all previous cultivars, including the resistant cultivar Aurora. For example, Aquarius had 65% survivors compared to Aurora with 20%, Sequel with 10%, Trifecta and CUF-101 with 9%, Siriver with 6%, and Hunter River with 2% following the exposure of seedlings to phytophthora root rot in a greenhouse (I.D. Kaehne, R.W. Williams, J.A. Horsnell, B.M. Martin and E.T. Kobelt unpublished data). In a severe test using different isolates of phytophthora, 44% of Aquarius seedlings survived exposure compared with only 7% for Aurora and 2% for Hunter River (T.M. O'Brien and R.W. Williams unpublished data). Aquarius is the first cultivar in Australia to be given a "High resistance" classification for resistance to phytophthora root rot.

Aquarius is also more resistant to colletotrichum crown rot than CUF-101 and Hunter River, but is less resistant than cultivars Aurora and Sequel. In a greenhouse test at Yanco, 21% of Aquarius seedlings survived inoculation with colletotrichum compared to 10% for CUF-101, 6% for Hunter River, 30% for Aurora, and 52% for Sequel (T.M. O'Brien and R.W. Williams unpublished data). A greenhouse test for resistance to stemphylium leaf spot (I.D. Kaehne, R.W. Williams, J.A. Horsnell, B.M. Martin and E.T. Kobelt unpublished data) suggested that Aquarius, with 47% survivors, was similar to CUF-101 and Sequel with 37% and 38% survivors respectively, but was inferior to Siriver with 58% survivors and Quadrella with 61%.

Fewer stem nematodes were extracted from plants of Aquarius than from plants of other cultivars at Singleton, NSW (D.B. Waterhouse and C.M. Rose unpublished data). Aquarius plants contained 2 170 nematodes per 100 g and this was 34% of the number of nematodes extracted from Trifecta plants, 28% of CUF-101, and only 3% of the number from Sequel. Aquarius is therefore classed as moderately resistant to stem nematodes. Aquarius is also moderately resistant to damage from blue-green aphids and had a survival index in a greenhouse test of 103. This was similar to Aurora with a survival index of 113, Siriver with 100, and CUF-101 with 99, but was significantly greater than Hunter River with 97, Trifecta with 94, and P577 with 86 (A.J. Milvain and R.W. Williams unpublished data). The resistance of Aquarius to spotted alfalfa aphids is comparable to that of other resistant cultivars. For example, both Aquarius and CUF-101 had 83% seedlings survivors, and this was similar to Aurora and Siriver with 92%, and Sequel with 80%, but was significantly greater than Trifecta with 67% and Hunter River with 1% survivors (I.D. Kaehne, R.W. Williams, J.A. Horsnell, B.M. Martin and E.T. Kobelt unpublished data).

This combination of resistances to pests and diseases confers on Aquarius the potential to persist, and therefore maintain production, in irrigated and/or high rainfall conditions. Aquarius averaged 163% of the site mean frequency of plants remaining after at least four years across four irrigated trials in NSW compared to 51% for CUF-101 and 64% for Baron. Furthermore, Aquarius yielded an average 111% of the site mean for the first two years of these trials, and was superior to its more winter-active parent, CUF-101 at 99% of the site mean and to all other cultivars in these trials. This initial yield advantage for Aquarius increased during the duration of these trials as herbage production became more dependent on plant persistence.

Aquarius has also shown greater than average yield and persistence in dryland trials at both Yanco (A.J. Milvain and R.W. Williams unpublished data) and Tamworth (D.B. Waterhouse, C.M. Rose and G.F. Lonergan unpublished data). Nevertheless, the advantages of Aquarius over other highly winter-active cultivars are best expressed where phytophthora root rot is the major limitation to lucerne growth and development. Therefore, the primary use of Aquarius will be as a general-purpose, highly winter-active lucerne for sustainable production under irrigated and/or high rainfall conditions.

Acknowledgements

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References

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Awards of the Tropical Grassland Society

The Society awards Fellowships to those within its membership who have made significant contributions to the understanding, use and improvement of tropical and subtropical pastures.

An annual award, The Tropical Grassland Society-ANZ Bank Award, is made to a commercial operator who has been an innovator in some aspect of tropical grassland development.

Fellow of the Tropical Grassland Society 1992

RAYMOND JOHN (Ray) JONES

Ray Jones obtained his B.Sc. from the University College of Wales at Aberystwyth in 1952, followed by four post-graduate diplomas over the next four years, including a DTA (Trinidad). He then worked in Kenya from 1956 to 1960, when he was appointed to the CSIRO Division of Tropical Pastures in Brisbane.

Ray's early work with CSIRO was at Samford and Gympie in the coastal areas of southern Queensland. It is a reflection of Ray's long involvement with the Society that some of the work was reported in Proceedings 6 and 7 of the Society, the Proceedings series being the forerunner to *Tropical Grasslands*. His work covered a wide range of interests from use of insecticides to control of bean fly when sowing siratro, establishing that setaria could pose problems with oxalate poisoning, to the effect of legume pastures on subsequent crop yield. He also had a flair with gadgetry. He was involved in the development of the capacitance meter for measuring pasture yield, and in the development of a "munch meter" to measure the number of bites made by grazing cattle. However, probably his greatest contribution was in measuring the effect of pastures on animals and vice-versa. He was the first person to clearly show the susceptibility of twining legumes to regular and close defoliation. His first paper on this topic was published in 1967 and later work formed the basis for his Ph.D. study.

Ray has shown how it is possible to use grazing trials to investigate a wider range of questions than those relating to routine comparison of the treatments imposed. From his grazing study at Samford he documented the slower rate of decomposition of litter from *Desmodium intortum* than from siratro. On the same trial he showed that it was possible to estimate the percentage of siratro in the diet of grazing animals by counting the number of siratro hairs that were passed in faeces. However, his outstanding contribution that flowed from the Samford grazing study related to the development of the "Jones and Sandland" method for relating stocking rate to liveweight gain. This relationship has been used throughout the world and found to be a very useful tool in pasture research, with the obvious proviso that it is not extrapolated with excessive enthusiasm outside a reasonable range of stocking rates! Ray was also involved with the leucaena toxicity saga and in developing the understanding of the mimosine-DHP degradation story. This interest was carried over into the next phase of Ray's career when he accepted the post of Officer-in-charge of the Davies Laboratory in 1975.

After he moved to Townsville, the flow of interesting and lateral thinking continued. Two good examples are worth quoting. Firstly, the finding about the mortality of cattle ticks that suffer an unpleasant death (for them) when they become stuck on the sticky exudate that occurs on stems of some *Stylosanthes* species. A second example relates to the use of carbon isotope analyses to measure the content of legumes in the