EVALUATION OF ANNUAL PASTURE LEGUME SPECIES FOR ACIDIC, DEEP SANDY SOIL.

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Abstract

A test range of 180 accessions and cultivars from 14 species of the legume genera *Medicago*, *Trifolium* and *Ornithopus* were evaluated in single rows at two sites in 1991 in the northern wheatbelt of Western Australia. Both sites, Ogilvie and Tenindewa, were located on acidic earthy sands which received 442 mm and 248 mm of growing season rainfall respectively. Seed yields meaned across the two sites ranged from 0 to 55 g/row, with the top ten seed yielding lines consisting of 6 *O. compressus*, 3 *M. tornata* and 1 *M. littoralis*. Two of these were commercial cultivars, Paros (*O. compressus*) and Rivoli (*M. tornata*). Maturity, measured by days to first open flowers, varied over the test range from 63 to 123 days with the highest seed yields corresponding with flowering between 80 and 90 days. The lowest seed yields occurred with the *Trifolium* species, which is likely to be related to a shallower rooting pattern and the poor water holding capacity of the earthy sands.

Key words: Annual legumes, pastures, sand

Deep sandplain soils are a major soil type of the northern wheatbelt of Western Australia. They are moderately acid in reaction, have low water holding capacities and can have extremely low levels of potassium. While the advantages of legume based pastures in ley farming systems is well established, most sandplain pastures have little or no legume present. Attempts to introduce existing commercial cultivars generally fail either at the establishment phase or lack persistence in the medium term. This could be due to poor adaption of the commercial species and cultivars to the sandplain environment. To test the suitability of a range of annual pasture legumes for the deep sandplain soils, a study was established to examine the seed yielding potential of a wide range of species and ecotypes.

Materials and methods

A test range of 180 ecotypes and commercial cultivars from 14 annual pasture legume species were sourced from the Australian Genetic Resource Centres (Adelaide and Perth) and the national annual pasture legume improvement programs. These were sown in two replicate rows at two sites, Tenindewa and Ogilvie, 40 km east and north of Geradlton W.A., typical of the yellow sandplain soil (Table 1). Each row was 3 m in length, sown with 1.5 g of seed inoculated with an appropriate rhizobial strain and fertilised with 14 g of superphosphate. Both sites were sown in the last week of May 1991. Time taken to commence flowering was based on 10% of the row having open flowers. The pods or burrs were suction harvested from the entire rows, mechanically threshed and cleaned prior to the weighing of the seed yield.

Table 1: Soil characteristics of the two test sites.

	Soil depth	PH ($CaCl_2$)	P (mg/kg)	K(mg/kg)	Clay (%)	May to Oct rain (mm)
Tenindewa?	Surface	4.9	19	17	2	442
	10cm	4.2	14	10	4	

Ogilvie?	Surface	5.2	16	26	4	248
	10cm	4.7	22	16	4	

Results and discussion

The most successful species in terms of seed yield were *O. compressus*, *M. tornata* and *M. littoralis* (Tables 2 and 3). The seed yield of the *O. compressus* ecotypes tested was also maintained over a wide range of maturity. Seed yields averaged across the two sites ranged from 0 to 55 g/row, with the top ten seed yielding lines consisting of 6 *O. compressus*, 3 *M. tornata* and 1 *M. littoralis*. Most species were well represented by commercial cultivars except *M. littoralis* where both Harbinger AR and Harbinger yielded below the average for the species. Maturity, measured by days to first open flowers, varied over the test range from 63 to 123 days with the higher seed yields corresponding with flowering between 80 and 90 days.

Table 2: Average and maximum seed yield from the pasture legume species tested with the effect of maturity shown by grouping according to time taken to flower; early -less than 80 days, mid - between 80 and 100 days and late - greater than 100 days.

No.	Seed yield (g/3m row)			Mean for maturity groups		
?						
Species?	tested	Mean	Highest	Early	Mid	Late
O. compressus?	36	26.7	55.5	25.9	27.3	20.9
M. tornata?	53	18.4	41.1	10.1	23.6	11.9
O. pinnatus?	3	18.3	25.9	-	25.9	14.4
M. littoralis?	16	14.2	41.2	14.6	11.1	-
T. hirtum?	2	13.1	13.7	-	-	13.1
O. perpusillus?	2	12.4	21.3	-	-	12.4
T. cherleri?	9	11.7	19.9	4.3	12.6	-
M. polymorpha?	3	9.4	16.2	6.0	16.2	-
M. truncatula?	22	8.6	15.4	7.6	9.9	-

O. isthmocarpus?	3	8.1	11.9	-	9.1	7.8
M. aculeata?	9	6.5	14.5	8.0	1.2	-
M. murex?	6	6.3	9.0	5.7	6.8	-
T. subterraneum?	12	3.7	11.0	3.1	4.1	0.0
T. stellatum?	6	0.3	0.5	-	0.3	0.3

Table 3: Highest seed yielding commercial cultivars of the major species tested.

Cultivar/accession?	Species?	Days to flower	Seed yield? (g/3m row)
Paros?	O. compressus?	90	44.2
Rivoli?	M. tornata?	88	36.9
Mamora?	O. perpusillus?	104	21.3
Yamina?	T. cherleri?	91	20.0
Circle Valley?	M. polymorpha?	83	16.2
Hykon?	T. hirtum?	102	13.7
Harbinger AR?	M. littoralis?	82	11.3
Parabinga?	M. truncatula?	77	7.3
Dalkeith?	T. subterraneum?	84	4.7

The *Ornithopus* species appear to have a greater capacity for seed production on deep acidic sandy soils than the other genera tested. Although cultivars of *O. compressus* have been available since the 1950's, those with appropriate maturity have only been available since the late 1980's. Future pasture improvement on the low to medium rainfall acid sands should consider these cultivars. The medic species *M. littoralis* and *M. tornata* were also capable of high seed yields however their longer term performance may suffer in the acidic conditions.

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