Hybrid Serradella - An Answer to the Hardseed Problem

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Serradella (*Ornithopus* spp.) refers to a group of fine serrated leaved, deep-rooted, winter-growing, non-bloating, hardseeded, annual legumes of Mediterranean origin. Yellow serradella (*O.compressus*) which appears to have been sown as a pasture on well drained sandy soils in southern Italy and central Spain is the source of most of the cultivars registered in Australia.

Although yellow serradella was first recorded in Sydney's Centennial Park around the turn of the century, it was the good performance of a naturalised strain noted by W.M.Pitman in Western Australia that sparked interest in serradella as a potential pasture legume for improvement of low phosphorus, sandy soils. In NSW, cv. Pitman did not perform well in initial evaluations except for trials in the Pilliga and Coonabarabran area. More recently, however, large areas of very acid soils have been sown to serradella in NSW, Victoria and South Australia. This expansion was aided by the selection of a number of new yellow serradellas (including: Avila, Elgara, Madeira, Tauro, and Paros) which cover a range of maturities and tolerances to aluminium and manganese toxicities.

However, while substantial progress has resulted from cultivar selection programs, the impact of serradella-based pastures has not be realised. In NSW, for example, there is less than 100,000 ha of serradella-based pastures even though there is more than 7 million hectares of acid or rapidly acidifying country which could be sown to serradella.

Poor germination - A consequence of hard seed

The hardseed characteristic has been identified as major problem in the establishment of serradella pastures. While it is desirable for annual legumes to have a percentage of hardseed to ensure a viable seed source for re-establishment in subsequent years, the levels in serradella are extreme with retention of pod segments reducing germination of seed pods to <10%. Consequently, it often takes three or more years before a reasonable pasture stand is achieved. The loss in production caused by slow establishment has hindered industry acceptance of serradella as a useful pasture legume (Drew, 1988). Despite good production, the high hardseed content restricted commercial use of yellow serradella as a green manure crop in Europe in the 1930's (Hueser and Pfrang, 1933).

The level of hard seed can be reduced using heat treatment, mechanical abrasion or chemical means. Of these, *mechanical dehulling* is the most effective method and several existing dehullers have been modified to remove the pod coat without causing significant damage to the seed. One machine which was specifically built to dehull serradella (Sanders, 1990) has recently been commercialised and at present the agronomy of the dehulled product in being evaluated in Western Australia.

However, while dehulling improves establishment of newly sown pastures, regeneration in subsequent years is determined by the degree of "softening" over the summer of seed reserves in the soil. In the true Mediterranean climate (hot dry summer, warm moist winter) of Western Australia, "softening" is sufficient to ensure regeneration, but in the acid soil areas of the tablelands and near slopes of NSW, insufficient softening may affect production of serradella pastures, especially in the second and third years after sowing. For these situations, cross breeding to reduce the level of hard seed to about 50% is an attractive alternative.

G20 - A Hybrid Serradella

Within the *Ornithopus* genus, French or pink ser-

radella (*O.sativus*) is the only soft-seeded species. In New Zealand, this species has been crossed with yellow serradella (cv. Pitman) to produce hybrids which retain the desirable features of both parents, *viz.* the productivity and hullability of pink serradella and the hard seed of yellow serradella (Williams *et al.*, 1987).

From this program, the G20 line which is currently being tested in Australia by Heritage Seeds in conjunction with co-operators, was produced. The yellow flowers with pinkish veins gives G20 a distinctive salmon-pink appearance in the field which contrasts with the solid yellow and pink flowers of its parents. The pod structure is similar to cv. Pitman with the beaked lomentum and moderate constriction between segments.

Testing to date suggests that G20 is suited to the later maturing, medium to high rainfall areas. However, it has exhibited good drought tolerance during very dry periods in areas where the soil type has a poor moisture holding ability (*eg.* iron bark ridge country at Parkes, NSW). G20 has also survived on heavier acid clay loam soils which experience periods of waterlogging during the winter months.

Production of G20 is comparable Avila and Tauro. Results from a trial conducted on the Panshanger sandy soils at Cressy (Tasmania) show that the yield (estimated by scores) for Tauro and G20 were similar at this late season site, but that both were superior to Avila at all assessment periods (Table 1). However, these results may be reversed when G20 is grown on more acid soils as Avila is more tolerant than Tauro to aluminium (Scott *et al.*, 1991). This is supported by preliminary results from Parkes where G20 was out yielded by Elgara in an environment with a shorter growing season and more acid ($pH_{[salt]}$<4.3) soils (D.Michalk and C.Revell, unpublished).

Like most serradellas, G20 is a small seedling and slow to establish (Table 1). This did not affect its yield potential as it quickly caught up the slight advantage gained by the greater seedling vigour of Tauro.

Table 1: Seedling vigour and yield of serradellas grown on Panshanger sandy soil at Cressy, Tasmania in 1992.

Cultivar	Seedling vigour[1] (July)	Yield			
		Sept	Nov	Jan	Mean
Avila	2.0	3.0	4.8	4.3	4.0
Tauro	3.0	5.3	7.3	7.3	6.6
G20	2.0	5.0	8.5	8.0	7.2
$LSD_{(P<0.05)}$		1.6	2.1	1.5	1.6

Notes: [1]Seedling vigour rated on 1 (poor) to 5 (excellent) scale; [2]Yield rated on 1 (poor) to 9 (excellent) scale.
Soil parameters: $pH_{(water)}$ = 5.6; Colwell P = 65 mg/kg.

Table 2: Comparison of rate of pod softening between Tauro and G20.

Cultivar	Softening period:		
	Freshly harvested	6 months	12 months
Tauro[1]	5:95[3]	10:90	25:75
G20[2]	50:50	60:40	80:20

Notes: [1]Measured in a diurnal range 15/60°C alternating temperature oven (after Bolland, 1985); [2]Softening under field conditions; [3]Soft to hard pod ratio.

The rate of pod softening for Tauro and G20 are compared in Table 2. In contrast to all yellow serradella cultivars, G20 has a high proportion of soft (50%), and after one year in the soil only about 20% of seed remains hard. This is equivalent to many subclover cultivars which have proved successful in the Tablelands and near slopes area of NSW.

Conclusion

Results from the initial testing of G20 are encouraging, but further research is needed to investigate fertiliser response, tolerance to aluminium and manganese, and persistence under grazing. However, on the evidence available, it is concluded that G20 could be a useful legume for medium to high rainfall areas that are not suitable for white or subterranean clovers.

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