SELECTION AND EVALUATION OF AUSTRALIAN LEGUMES FROM THE GENUS *CULLEN* FOR PERENNIAL PASTURE PHASES – NORTH EASTERN WHEATBELT TRIAL

Richard Bennett, postgraduate student, The University of Western Australia

THE UNIVERSITY OF WESTERN AUSTRALIA

AIM

To evaluate a group of Australian perennial legumes to select species useful for perennial pastures adapted to the northern wheatbelt's low rainfall and acidic soils.

BACKGROUND

Several species of *Cullen* have agronomic traits which are suitable for perennial pastures. For example, *Cullen australasicum* has good nutritional value and had similar productivity and persistence as lucerne when trialed in the medium rainfall belt of New South Wales. Also, studies from Queensland on *C. australasicum*, *C. discolor*, *C. pallidum* and *C. patens* revealed that they could have deep roots to 4.3 m, equivalent productivity to lucerne when cut at 3 or 6 month intervals and an ability to persist and regenerate after grazing by cattle. These results suggest that these species and potentially other *Cullen* species may have agronomic traits making them suitable perennial pasture plants in WA.

Unfortunately, there are no *Cullen* species naturally occurring in WA's wheatbelt. This makes the selection of species and populations adapted to WA's wheatbelt difficult. Herbarium records show that *Cullen* species naturally occur across many different soil types and a large range of climates. Ten perennial, herbaceous species are found naturally in areas with less than 650mm average annual rainfall. Seven of these sometimes occur on acidic or waterlogged soils. Many species have populations growing in areas with less than 250mm annual rainfall. So despite the lack of naturally occurring populations in WA, we expect that some of these seven *Cullen* species will be adapted to the climate and, possibly, soils of WA's wheatbelt. The results from NSW and QLD. also indicate that there may be species with suitable productivity to make them viable perennial pastures.

The study presented here tested this, by comparing the persistence and productivity of 120 germplasm collections from nine Australian *Cullen* species to two perennial *Lotus* species and to two lucerne cultivars between September 2006 and April 2008.

TRIAL DETAILS

Property	Liebe Group Long Term Research Site, West Buntine
Plot size & replication	25m x 45m x 3 replicates. Each replicate has three plants of 104 collections (945 plants in total)
Soil type	Loamy sand, pH in water ~ 5
Sowing date	Seedlings were established for 5 weeks in the glasshouse and then planted out on the 6th of September 2006
Seeding rate	Single plants spaced 1 metre apart
Fertiliser	None
Paddock rotation	Paddock has come out of wheat into lupins which were sprayed out a month before sowing
Herbicides	None

RESULTS

Persistence and productivity of native species

When the individual populations within a species are considered as a whole (table 1), the results show that *Cullen australasicum*, *C. lachnostachys* and *C. pustulatum* were the best adapted species. All three of these species had survival rates equal to or higher than lucerne and were also the most productive of the *Cullen* species. However, the use of *C. lachnostachys* and *C. pustulatum* in pastures will probably be limited by their poor seed production (personal observations) and, although we have not tested their palatability, we expect that they will be poorly palatable. *Cullen australasicum*, therefore, seems to hold the best potential for further development as a pasture. The very poor persistence of *C. patens*, in particular, was surprising, as this species originates from areas with very low rainfall. This result may indicate that *C. patens* is very poorly adapted to some soil constraint at this site, possibly acidity.

Table 1: Persistence (% survival), cumulative dry matter production (g/plant^{-1}) of leaf material and in total (leaf, stem and flowers), from two harvests of Australian *Cullen* species, two lotus species, and two lucerne cultivars. Multiple populations were tested of many of the *Cullen* species and have been averaged to provide an indication of the potential of the species for development.

Species or cultivar	Dry matter produced from two harvests (g/plant)		Persistence (% surviving)
	Leaf	Total	
C. australasicum	16.3	42.1	73
C. cinereum	2.8	8.0	19
C. discolor	8.0	17.6	67
C. lachnostachys	18.1	28.5	86
C. pallidum	8.4	19.1	58
C. parvum	0.3	0.3	21
C. patens	0.7	1.6	0
C. pustulatum	26.3	50.6	100
C. tenax	1.1	2.8	19
Lotus australis	5.7	7.2	38
Lotus corniculatus	2.5	5.3	11
Lucerne (Sardi10)	31.8	68.1	72
Lucerne (sceptre)	23.8	45.5	67

Persistence and productivity of individual populations

When the persistence and productivity of individual populations of the better performing species are compared to lucerne, the results are even more encouraging for the development of *Cullen* species as perennial pastures. Several populations of C. australasicum, and one population each of *C. pustulatum*, *C. lachnostachys* and *C. pallidum* show much better persistence than the best performing lucerne cultivar (dotted lines). In addition, there were some populations of *C. australasicum* that showed better production of leaf dry matter than one or both lucerne cultivars. The nutritional value of *C. australasicum* leaves has not yet been tested.

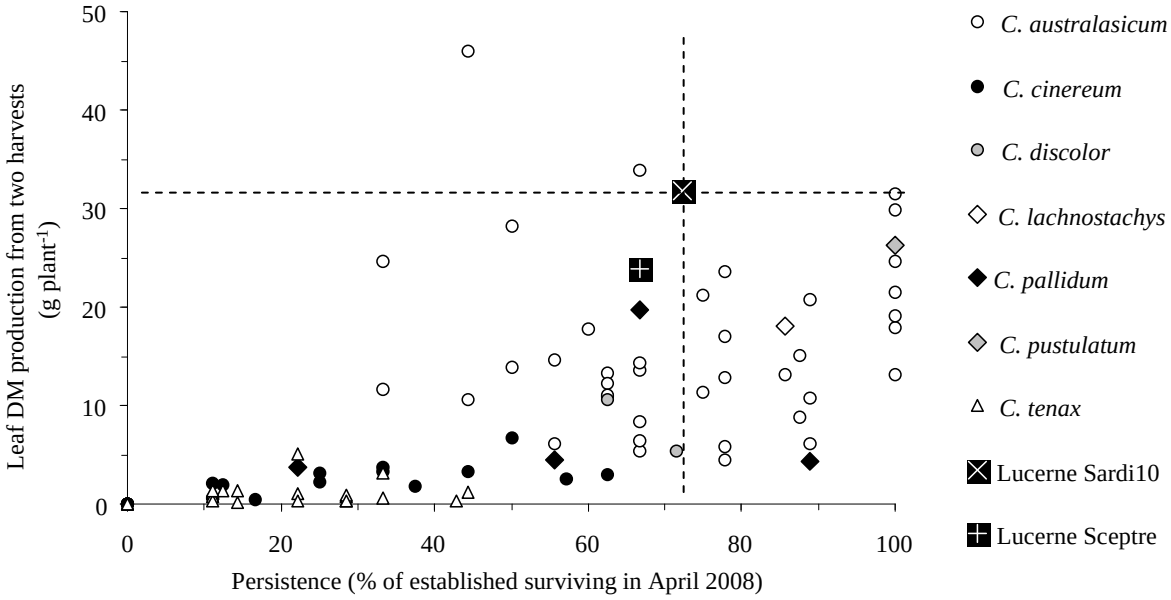

Figure 1: Persistence (% survival) and cumulative leaf dry matter production (grams of leaf per plant from two harvests) from multiple populations of seven Australian *Cullen* species compared with two lucerne cultivars. Six week old seedlings were established in September 2006, cut to 5cm from the ground once in January 2007, once in September 2007 and finally in April 2008 with dry matter measured on the final two cuts only. The dotted lines are centered over the result for the highest performing lucerne cultivar, Sardi 10.

COMMENTS

- The most important findings of this study are that populations from some undomesticated, native *Cullen* species persisted better or were more productive than lucerne under the trial conditions. This is the first study of the pasture potential of these novel perennial species in WA's north-east wheatbelt and the comparisons to highly bred lucerne cultivars are promising. These results also provide strong support for our expectation that some populations from *Cullen* species will have both adaptations and agronomic traits that make them suitable for use as perennial pastures in the low rainfall, Mediterranean climate of WA's wheatbelt. *Cullen* australasicum appears to hold particular promise in this respect.

ACKNOWLEDGEMENTS

- I would first like to thank the Liebe Group for their cooperation and for hosting the trial site.
- My postgraduate studies are supported by an Australian Postgraduate Award, Meat and Livestock Australia, The University of Western Australia and The AW Howard Memorial Trust. I would like to thank these funding sources and my supervisors: Dr Daniel Real, Dr Megan Ryan and Dr Tim Colmer.

PAPER REVIEWED BY: TAMMY EDMONDS-TIBBETT.

CONTACT:

Richard Bennett
Email: bennettr@cyllene.uwa.edu.au
Ph: (08) 6488 1936