Domesticating Australian Native Legumes for Pastures: A Case Study in *Cullen*

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Domesticating Australian native legumes for pastures : a case study in *Cullen*

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Introduction Perennial pastures have been advocated as an effective way to combat environmental degradation caused by dryland salinity and improve productivity in southern Australia's wheatbelt . However , there are currently few perennial legume cultivars that can be widely used in Western Australia (WA) , with lucerne (*Medicago sativa*) not adapted to drought conditions , acid soils and waterlogging , conditions common in WA's wheatbelt . *Cullen* spp . have been shown to have some potential for pastures in Queensland (Britten and De Lacy 1979) and in South Australia (Dear *et al* . 2007) but to date , use in WA had not been evaluated . Our approach included ecogeography to select native *Cullen* species potentially adapted to WA's wheatbelt , field trials of selected species to test adaptation , productivity and persistence , and a common garden experiment (CGE) to identify useful variation in agronomic characters in lines from germplasm collections of wild populations .

Materials & methods Eight perennial , herbaceous , drought tolerant (median average annual precipitation (AAP) less than 650 mm) , non-tropical (< 25% of AAP falling in January) *Cullen* species were selected for field trials (Bennett *et al* . 2006) . A total of 123 accessions were sourced from genetic resource centres in Australia for evaluation in the field and a CGE (Table 1) . For the field evaluation , nine seedlings from each accession and 18 seedlings each of two commercial lucerne cultivars were planted in September 2006 over three replicates at 1 m spacing at Buntine , in the northern region of WA's wheatbelt . The site had 320 mm average p .a . precipitation and deep , sandy soils with $pH_{(H2O)} < 5$. 5 . Plants were monitored monthly over 12 months for productivity (visual rating) and survival . The CGE was planted in irrigated plots during December 2006 with the same design and containing mostly the same accessions . The CGE plants were monitored for agronomic traits such as time to flowering from germination , leaf to stem ratio and height to width ratio .

Results & discussion The germplasm of some species encompassed a large amount of variation in agronomic traits (Table 1) . In the field trial , seven species of *Cullen* survived better or were more productive during summer than Sardi10 , the best performing lucerne cultivar (Table 1) . 13 accessions of *C . australasicum* and three accessions of *C . cinereum* both survived better and were more productive over summer compared with Sardi10 .

Table 1 *Cullen spp . attributes from CGE and field trials . ([a]-number of collections , compared with Sardi10) .*

Species	Accessions trialled	Time to flowering(d)		Leaf to Stem ratio		Height to Width ratio		Better survival[a]	More productive[a]
		max	min	max	min	max	min		
C . australasicum	48	<56	>185	2 .51	0 .41	1 .30	0 .38	22	29
C . cinereum	29	<56	<79	1 .90	0 .45	1 .41	0 .21	4	4
C . discolor	2	<99	*	2 .13	*	0 .03	*	1	0
C . leucanthum	2	<149	*	2 .44	*	0 .62	*	*	*
C . pallidum	4	<56	<99	2 .45	1 .02	0 .46	0 .19	1	0
C . parvum	3	<99	>185	3 .90	1 .84	0 .42	0 .25	1	0
C . patens	11	<56	<99	2 .37	1 .05	0 .11	0 .05	0	1
C . tenax	24	<56	>185	3 .08	0 .41	0 .06	0 .05	3	0

Conclusions The *Cullen* genus has potential to yield new perennial pasture varieties for WA's wheatbelt . *C . australasicum* seems to be particularly suitable , as this species is persistent and productive in the target environment , and the collection available has a large amount of diversity in key agronomic traits that could be exploited in future selection and breeding efforts . This paper presents an ecogeographic study , followed by a field trial and CGE which proved a useful and efficient way to identify and screen new germplasm with potential for the target area .

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