Persistence of sown pasture legumes under grazing in north eastern New South Wales

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Graziers on the NSW north coast are looking for "low input" pasture legumes, plants that establish easily into mixed swards, persist and are reasonably productive with little fertiliser input. Eight subtropical legume species were screened for their ability to establish from oversowing into natural pasture areas in this region. The sites in which they were sown were often timbered and were primarily sandy, low fertility soils. The sites were colonised by native grass species and more aggressive introduced species such as carpet grass (*Axonopus affinis*).

Materials and methods

Eight pasture legumes were sown (Table 1). Safari, a cultivar of Kenya white clover (*Trifolium semipilosum*), was used as a reference species. Safari had been selected for both growth and persistence. It is relatively productive plant requiring fertiliser and management for survival. The other seven species, *Aeschynomene falcata* (Bargoo joint vetch), *Cassia rotundifolia* (Wynn cassia), *Desmodium canum, Stylosanthes guianensis* (CPI 18750a), *Glycine tabacina* (P7874, native legume), *Glycine microphylla* (P11819, native legume) and *Zornia curvata* (CPI 38221) are usually classified as low to moderately productive species.

The legume seed was always sown with the appropriate inoculum where possible and lime pelleted. Mo superphosphate was applied at sowing and none of the sites had a recent fertiliser history before sowing.The seed was broadcast at 2 to 3 kg/ha after minimal cultivation of the seedbed in late summer. The seed was sown as a mix, with a 50:50 combination of scarified to untreated seed used for each species. All the seed was of high viability and all the species had a hard seed content of between 50 and 70% except *Desmodium canum* which was 30% hard seed.

The sites were grazed as part of the whole paddock under normal farm management and were usually set stocked. The areas were generally heavily grazed but each had some periods where they were totally de-stocked. The annual average rainfall across the sites varied from 1125 mm at Kyogle (wettest site) down to 1025mm at Grafton

Table 1 Description of legume species sown at eight sites in northern eastern New South Wales.

Species/cultivar/accession	Description
Aeschynomene falcata cv. Bargoo	Drought tolerant, grazing tolerant, prostrate and fine stemmed perennial. Establishes slowly but seeds prolifically. Grows on moderate to well drained upland soils.
Cassia rotundifolia cv. Wynn	Herbaceous self-regenerating, short lived perennial. Pods shatter readily to shed seed. Suited to sandy soils and swards with little grass competition. Late summer sowings, as in this study, may disadvantage establishment.
Desmodium canum CPI 37346	Perennial with woody, upright stems. Suits sands to light clays. Spreads by creeping stems that root at nodes and by seed. Has a low hard seed content which may make it less suitable for broad-acre over-sowing.
Glycine tabacina P7874	Twining, weakly stoloniferous perennial. Suits soils derived from shales, sandstones, limestone or volcanic rock. Persists well in timbered areas suggesting it may be suitable for agro-forestry areas.
Glycine microphylla P11819	As above but finer than *G. tabacina*. Tolerates less well drained soils. Is worthy of further work as its seed production in a nursery situation is very good but little is known of its management requirements.
Stylosanthes guianensis CPI 18750a	Perennial, semi-prostrate. Has some low temperature tolerance. Suited to lighter textured soils where grass competition is minimal. Less suited to heavy grazing than Oxley stylo. Is susceptible to anthracnose in wetter areas.
Trifolium semipilosum cv. Safari	Adapted to a wide range of soils but will not tolerate poor drainage or low phosphate levels. Known to spread extremely well under constant grazing pressure.
Zornia curvata CPI 38221	Herbaceous perennial with long slender stems. Tolerates finer textured poor soils. There is a wide range of *Zornia* material which could be evaluated for types that are more adaptable and persitant than CPI 38221 (which is more succulent than most and could succumb to selective grazing).

(GARAS).

The presence of each species in a $0.25m^2$ quadrat on a transect of 150 quadrats across each sites was recorded in autumn (frequency of occurrence).

Results

Species Establishment. Bargoo joint vetch (*Aeschynomene falcata*) had consistently high establishment frequency (Table 2, frequency recordings ranging from 99-61%, except for 27% at Stony Station). The second highest establishment frequency was for *Zornia curvata* (97%) however there was a wide range of frequency counts for this species across the sites. Kenya white clover (*Trifolium semipilosum*) established in 85% of quadrats at Bald Hills and 69% at Lilydale, but usually was found in less than

Table 2. Frequency counts (% quadrats in which species recorded) for 8 species at 8 sites from 1982 to 1992.

Site	Species	Year										
		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Kyogle	*A. falcata*							83	22	26		
	C. rotundifolia							21	15	9		
	D. canum							21	6	2		
	G. microphylla							39	37	27		
	T. semipilosum							29	20	19		
	Z. curvata							23	7	6		
Coutts Cross	*A. falcata*					61	83	88	75	75		
	C. rotundifolia					0						
	D. canum					11	2	5	1	2		
	T. semipilosum					25	38	80	94	74		
	Z. curvata					32	41	2	17	19		
Stony Station	*A. falcata*					29		67				
	C. rotundifolia					14		82				
	S. guianensis					7		36				
	T. semipilosum					0		1				
	Z. curvata					11		26				
Fineflower	*A. falcata*	73		77	62	51	49	74		16		31
	C. rotundifolia	0		1	2	1	1	0		0		0
	D. canum	67		15	9	12	7	5		5		3
	G. tabacina	93		86	83	73	56	66		25		27
	S. guianensis	7		3	1	0	5	1		0		0
	Z. curvata	43		43	21	15	19	25		0		8
Lilydale	*A. falcata*		58	35	78	64	83	85	45	75	83	79
	C. rotundifolia		6	1	5	2	7	14	12	17	0	8
	D. canum		2	1	0	1	0	2	2	2	1	11
	S. guianensis		27	2	22	33	27	51	47	63	21	24
	T. semipilosum		69	41	80	75	23	64	62	65	10	46
	Z. curvata		20	5	10	4	8	10	1	7	1	12
Bald Hills	*A. falcata*				62		8	7				
	C. rotundifolia				14		5	1				
	D. canum				41		2	2				
	G. tabacina				50		18	15				
	G. microphylla				80		9	8				
	S. guianensis				5		0	0				
	T. semipilosum				85		7	6				
	Z. curvata				67		23	9				
Garas poor soil area	*A. falcata*			99	94	98	94	94		85	49	85
	C. rotundifolia			39	17	6	7	19		10	4	15
	D. canum			75	66	38	33	34		33	3	9
	G. tabacina			20	23	0	1	1		0	0	0
	S. guianensis			7	14	2	0	1		0	0	0
	Z. curvata			97	85	289	49	27		65	19	45
Garas Bahia area	*A. falcata*					82	65	71	64	75	25	
	C. rotundifolia					4	1	3	2	1	1	
	D. canum					3	4	6	5	8	1	
	G. tabacina					2	1	1	0	0	0	
	G. microphylla					1	0	0	0	3	0	
	S. guianensis					35	2	15	21	21	0	
	T. semipilosum					33	2	7	27	13	0	
	Z. curvata					9	2	12	17	21	0	

35% of quadrats at other sites.

Low establishment frequencies were recorded for *Desmodium canum* (around 30%) except at Bald Hills (75%). *Glycine tabacina* and *Glycine microphylla* had similar establishment frequencies. They were high at some sites (80-50%) but both low at the GARAS poor soil site. *Stylosanthes guianensis* had establishment frequencies of less than 10% at most sites. *Cassia rotundifolia* was recorded in 39% of quadrats at the GARAS poor soil site and 21% at Kyogle but established in less than 15% of quadrats at all other sites.

Species Persistence. Bargoo joint vetch had the greatest persistence. It was always recorded in more than 15% of quadrats in any year (Table 2). Where establishment of *Zornia curvata* was high, persistence was also good. However by the last measurement at most sites it had declined to less than half the frequncy recorded in the first year. The persistence of *Cassia rotundifolia* varied and at one site (Stony Station) there was a much greater frequency of *Cassia rotundifolia* in the third year than the first. At Lilydale it varied from 6% at establishment to 17% eight years later and back to 8% two years after that. These counts suggest new plants continued to regenerate from seed set in the earlier years at these sites. However at the rest of the sites establishment and persistence were poor.

The persistence of *Trifolium semipilosum* was good at the moister sites of Kyogle, Lilydale and Coutts Crossing. On the dry GARAS poor soil and Bald Hills sites it was poor. *Desmodium canum* had very poor persistence at all sites except Lilydale where it slowly increased from 2% to to be found in 11% of quadrats after 10 years. *Stylosanthes guianensis* increased from 7% to 36% in three years at Stony Station and persisted at Lilydale (27% at establishment and 24% 10 years later) however at sites where establishment was poor it virtually disappeared. *Glycine microphylla* persisted for three years at Kyogle but decreased rapidly from 80% to 8% in four years at Bald Hills. *Glycine tabacina* had greater persistence, remaining in 27% of quadrats at Fineflower after eleven years and 15% of quadrats at Bald Hills after four years.

Discussion

The most persistent and widely adapted species was *Aeschynomene falcata* cv. Bargoo, which is in accordance with previous small plot evaluation studies (Cameron *et al.* 1989, Wilson *et al.* 1981). It had high establishment frequencies and was persistent at all eight sites. *Zornia curvata* CPI 38221 showed promise with high establishment and good persistence at some sites. It is likely that Wynn cassia (*Cassia rotundifolia*) behaved as an annual, with plant numbers increasing at particular sites through seedling recruitment. The native glycines (*Glycine microphylla* P11819 and *Glycine tabacina* P7874) and *Stylosanthes guianensis* CPI 18750a were very site specific. *Desmodium canum* CPI 37346 was not impressive in either establishment or persistence. *Trifolium semipilosum* was included as a reference plant as it is known to require higher levels of fertility and management for production and persistence. It persisted well at the moister sites in this study.

On the basis of these results, commercialisation of the *Glycine* species, *Desmodium canum* or *Stylosanthes guianensis* cannot be justified. However it is encourgaing theat the widespread adaptation of *Aeschynomene falcata* measured in earlier small plot work is reflected in the results of larger scale sowings grazed under normal management conditions.

Acknowledgments

The authors would like to thank Mr Frank Biddle and Mr Warren Harrison with their assistance in sowing of field trials and data collection. Thanks go also to the owners of each of the properties on which the sites were established.

References

Cameron, D.G., Jones, R.M., Wilson, G.P.M., Bishop, H.G., Cook, B.G., Lee, the late G.R. and Lowe, K.F. (1989) *Tropical Grasslands*, **23**, 153-161.

Wilson, G.P.M., Jones, R.M. and Cook, B.G. (1981) *Tropical Grasslands*, **15**, 155-156.