Interim Final Report on Project DAQ.083

Backup Legumes for Stylos
(01.07.92 to 30.06.96)

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“Scotchy Pocket”, Gympie (R Bambling)
“Wadeleigh”, Miriam Vale (B and K Scott)
“Bethome”, Bororen (A and F Smallcombe)
“Surrell Hills”, Duaringa (C and C Dunne)
“Granite Vale”, St Lawrence (J Olive)
“Glensfield”, Sarina (J Cox)
“Willunga”, Nebo (G Bethell)
“Tedlands”, Koumala (L Bredden)
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Project DAQ.083 Backup legumes for stylos

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PROJECT ABSTRACT

The backup legumes for stylos project was developed to identify, evaluate and release well adapted non-stylo legumes in response to the north Australian beef industry's reliance on stylo legumes for sown pasture development.

Fifty-five legumes were sown over 3 years in large sward plots in 32 separate experiments from Gympie in the south up the Queensland coast to Mt Garnet in the north and Katherine and Daly Waters in the Northern Territory. Sites were on soils suitable for growing stylos and receiving 650 to 1000 mm average annual rainfall. Performance indicators included persistence and dry matter yield, response to phosphorus and contribution to liveweight gain. Soil seed reserves and legume quality were measured for selected legumes at selected sites.

Below average and poorly distributed rainfall across most sites in most years quickly "culled" those legumes not well adapted to low and variable rainfall. However many positive outcomes were achieved.

Two new legume cultivars (Reid and Kretschmer) have been developed and will increase the area sown to pastures in the southern spear grass area. Commercial seed and management packages will be available in 1997-98.

Results from this project have highlighted the beef industry's reliance on the stylo legumes but have also better characterised the performance of the various stylo and alternative legume cultivars and have improved knowledge of their current adaptation and value.

This updated adaptation and performance information on all current stylo and alternative legume cultivars will increase the area sown to improved pastures. These sown pastures and the updated management packages will be used by the beef industry to meet changing market requirements.

A wide network of sites and species is now established and will allow continued recording of performance data, promotion of the benefits of sown pastures and allow identification of further new legume cultivars.

Partnership activities between research, extension and producer collaborators have been strengthened and will be maintained to further develop best management practice and promote positive aspects of sown pastures.

EXECUTIVE SUMMARY

The **Aim** of this Project is to identify and release well adapted alternative legume cultivars to the stylos.

Background

The majority of northern Australia's beef production comes from native pastures. However to meet many of today's market requirements native pastures need to be augmented with supplements or higher quality sown pastures.

The stylo legumes have played an important role in the adoption and use of sown pasture technologies by the beef industry. The adaptation of stylos to a wide range of soil and climate variables, and their contribution to increasing animal liveweight gain, is well documented. The use of stylo pastures, particularly Seca, has raised both producer and industry confidence in sown pasture development as a proven method to better meet various market requirements.

Disease or insect attack is a potential threat to any legume at any time and an industry's reliance on one or two legumes is fraught with danger. Examples include rust in Siratro, Psyllids, Bruchid beetles and a root fungus in Leucaena and of course anthracnose in stylos. Undoubtedly the greatest threat to the continued use of stylos is the fungal disease anthracnose (*Colletotrichum gloeosporioides*) which first struck common Townsville stylo in 1974. Sections of the beef industry and many research and extension professionals are becoming concerned at the increasing reliance placed on the stylo legumes. Since the early 1960s when common Townsville stylo was the only stylo sown, 16 stylo cultivars have been released. However anthracnose has caused seven of these cultivars to be removed from commercial use and recently released cultivars have been selected for resistance or tolerance to anthracnose.

The backup legumes for stylos project was developed to identify, evaluate and release promising non-stylo legumes. Alternative legumes, with adaptation to a similar target area as the stylos, are good insurance against the threat of diseases and pests devastating current stylo cultivars. Such an event would also dent industry confidence in the use of sown pasture technologies.

Overview of Project:

A total of 55 legumes was sown in a network of 27 sites on soils suitable for growing stylos and in the 650 to 1000 mm average annual rainfall zone in Queensland and the Northern Territory. Sowings took place in 1992/93, 1993/94 and 1994/95 in large sward plots with two replications of each sowing. Another 5 sites were sown to selected legumes to record liveweight gain and 9 legumes were evaluated for response to phosphorus at 3 sites.

Below average and erratic rainfall across most sites in most years has adversely impacted on legume establishment and performance and quickly "culled" those legumes not well adapted to low and variable rainfall.

Success in achieving objectives:

Objective (i): By July 1995, to study and understand the general agronomy and ecology of three well adapted legume cultivars (particularly from *Aeschynomene* and *Chamaecrista* species) and develop commercial management practices to speed their integration into the commercial grazing industry.

Achievement: Two new legume cultivars were registered in September 1995 (*A. villosa* cvv. Reid and Kretschmer) with information on adaptation, response to phosphorus, palatability, tolerance to herbicides, commercial seed production and sowing recommendation. Updated management information for current cultivars Lee, Glenn and Bargoo jointvetch, Wynn cassia and the stylo cultivars is also being transferred to industry.

Objective (ii): By July 1995, to demonstrate the animal production potential of the new cultivars.

Achievement: Drought has severely restricted measurement of liveweight gain from *A. brasiliana* and *Chamaecrista rotundifolia* (at Mt Garnet) and *A. villosa* (at Gympie). However sites are now established and this objective will be pursued over the next two years.

Objective (iii): By October 1995, to produce a minimum of 100 kg of seed of the three new cultivars for time of release.

Achievement: Approximately 200 kg of seed of each of Reid and Kretschmer has gone to the licensee, Southedge Seeds, Mareeba, for commercial seed increase in 1996/97. The licensee is combining with QDPI and NSW Agriculture in using some of this seed for on farm demonstration areas in 1996/97.

Objective (iv): By October 1995, to determine field nutrition requirements and responses and develop appropriate seed technology packages for each new cultivar.

Achievement: The response of Glenn, Lee and Reid to six rates of phosphorus fertiliser has been documented and the information is being prepared for use in commercial management packages. Recording response patterns for *A. brasiliana* CPI 92519, *C. rotundifolia* CPI 86172, and Wynn at Mt Garnet has not been possible due to drought.

Objective (v): By June 1996, to release the three cultivars to complement and back up currently used legume cultivars (particularly for the stylosanthes species).

Achievement: Data from this project have expedited the release of two new cultivars (Reid and Kretschmer) which were registered by the QHPLC in September 1995 with commercial seed production commencing in 1996/97. Potential cultivar release of *A. brasiliana* CPI

92519, which has demonstrated similar adaptation to dry conditions as Seca, is on hold until LWG data are available. Insufficient data are currently available to justify release of *C. rotundifolia* CPI 85836 and 86172.

Objective (vi): By June 1996, to select 5 new legumes for pre-release.

Achievement: Three accessions of *A. histrix* (CPI 93599, 93636, 93638) were placed on QHPLC pre-release in August 1994 and *A. americana* CPI 93624 which flowers several weeks earlier than Glenn indicates better regeneration at several sites. Several *Desmanthus virgatus* accessions demonstrate variation in adaptation to lighter soils.

Industry impact and implications. This project is the most comprehensive and wide-ranging "on farm" evaluation of current and potential pasture legumes undertaken in north-eastern Australia. It has therefore focussed the attention of research and extension organisations and staff, funding bodies and the beef industry on the current state of resources and technology available for sown pasture development.

Positive industry impacts include:

- Two new legume cultivars (Reid and Kretschmer) have been developed. They will increase the area sown to pastures in the southern speargrass areas where stylos are less widely adapted. The new legumes have higher quality forage and better cold tolerance than stylos, are adapted to a wider range of soil types (including clays) than fine stem stylos and will grow in lower rainfall than Glenn and Lee jointvetch.

- Updated adaptation and production information on all current legume cultivars will result in better management packages for, and better production from, sown pastures.

- Potential new well adapted legumes have been further characterised and progressed towards registration for commercial use.

- A wide network of sites and species is now established for continued recording and observation on persistence and grass/legume stability under grazing.

- Partnership activities between research and extension professionals and producer co-operators have been strengthened and will be maintained to develop best management practice of, and benefit from, sown pastures.

- All these impacts are improving the ability of the northern Australian beef industry to meet changing market requirements.

Implications to industry:

- Results have highlighted the beef industry's reliance on the stylos for legume based sown pasture development, particularly in the below 1000 mm annual rainfall areas.

- Results also indicate the shrubby stylos, Seca and Siran, are well adapted to below 600 mm annual rainfall, which is normally used as the lower rainfall limit of adaptation.

- Continued monitoring of established sites will allow examination of concerns that shrubby stylos may be so well adapted to harsh conditions as to become a threat to some rangeland situations as environmental weeds, particularly in the area of native grass/sown legume balance.

- The increasing perception that introduced legumes have potential environmental weed status will influence future release of well adapted potential new legume cultivars, via implementation of the "precautionary principle". Two potential new cultivars, currently on pre-release, are in this position, namely *Aeschynomene brasiliana* CPI 92519 (adaptation next best to Seca) and *Chamaecrista rotundifolia* CPI 85836/86172 (higher yielding than Wynn cassia). In some soils both have low palatability to stock during the growing season.

- Management is a key component in successful sown pasture development, production and sustainability. Development and implementation of management packages to maximise all three segments is a priority issue for everyone involved in the beef industry.

Recommendations:

1. Continue to monitor sites for as long as possible for information on long term persistence and production, stability of grass/legume mixtures under grazing and to responsibly monitor "not-released" legumes established on producer properties.

2. Canvas opportunities for joint activities with other projects where the existing resources of the BULS project may be of mutual benefit. For example stability of native grass/sown legume mixtures under commercial grazing practice.

3. Document and canvas possible student project work where deficiencies in current knowledge still exist. For example plant nutrition, relationships between legume palatability and soil fertility and documenting quality and digestibility of new legumes.

4. Over the next two years further develop partnership activities with producer co-operators to ensure application of information gained into their property management. Such partnerships will be a link to industry future needs and support for sown pasture development. It will also develop management guidelines for on farm sites with "not to be released" legumes.

5. “Workshop” information currently collected, with R & D professionals and with producers to ensure recommendations are up to date and relevant to industry needs.

6. Utilise the resources of NAPPEC to review current pre-release legumes with doubts about palatability and “environmental weed” concerns. Request written report from NAPPEC by June 1998.

7. The positive aspects of introduced pasture plants need to be emphasised by R,D&E professionals and beef industry users, as a balance to the increasing perceptions and media emphasis on negative aspects.

2.0 MAIN PROJECT REPORT

2.1 INTRODUCTION

The majority of our beef production in northern Australia comes from native pastures but sown legumes are needed to augment these native pastures so current day market specifications can be met. These specifications include weight and age for consumption beef, growth rates for store and live export cattle and the starting point, breeder herd nutrition for high calving percentage and continued growth of weaners. Oversowing native pastures with introduced legumes is the most economical and therefore most widely used practice for improving animal performance. Replacement pastures, using introduced grass/legume mixtures, is a well used practice on higher fertility soils. Mineral and protein supplements are mainly fed for maintenance rations rather than for production, due to the higher labour and cost inputs involved.

Cultivars of *Stylosanthes* have increasingly dominated sown pasture development in northern Australia over the past 10 years. Estimated seed production of the most used stylos over the past 3 years is 150 to 200 tonne for Seca/Siran and 60 to 80 tonnes for Verano/Amiga. Ten years ago, in the mid 1980s, estimated production for Seca was 20 to 50 tonne while Verano has remained constant at around 60 to 80 tonnes (John Hopkinson, pers., com.). The use of Seca stylo has increased more than four-fold in the past 10 years. (Estimates of seed production of all current legume cultivars is shown in section 2.3.9.) This increase in use of Seca can be attributed to its adaptation to a wide range of climatic and soil conditions and its reliability of establishment. Its contribution to LWG of 40 to 60 kg/head/year when sown into grass pastures is also well documented.

There is still vast potential for sown pasture development in northern Australia. The total area of black spear grass in Queensland is 25 m ha (Burrows *et al* 1988) and Weston *et al* (1984) estimated 15.8 ha is classified as "well adapted" to stylos. Current estimates of the area sown to stylos vary from over 1 million ha (Partridge *et al* 1996) to 600,000 ha of effective stylo pastures in north-eastern Australia (Miller *et al* 1996). Even on the latter estimate, these stylo pastures result in an extra 10,000 tonne of carcass beef each year worth at least $20 million, with the area increasing by 32,000 ha and the beef value by $1 million each year.

In general terms the area to which stylos are well adapted equates with the black spear grass zone in Queensland and includes the lighter clay loams such as brigalow-blackbutt soils. The area receives a 650-1000 mm AAR. The current range of alternative legumes available for sowing in this area is Wynn cassia, Aztec atro and Glenn, Lee and Bargoo jointvetch. Most of these alternatives have only been evaluated in the wetter end of this rainfall range and none are as well adapted as the stylos to variable soil and rainfall conditions. Current annual seed production is Glenn/Lee 50 tonne, Wynn 10 tonne, Aztec atro 10 to 20 tonne and Bargoo nil.

Anthracnose is generally accepted as a major threat to the continued use of stylos. A large input of resources, costly in time and many millions of dollars in money, has gone into *Stylosanthes* research in the past two decades to collect, select and breed new stylo cultivars which are resistant to anthracnose. This work has involved CSIRO, University of Queensland

and QDPI. A full list of legume cultivars registered since 1961 is shown in Appendix 1 and includes 15 from *Stylosanthes.*

The backup legumes for stylos (BULS) project was developed to identify and evaluate promising non-stylo legumes emerging from early stage evaluation projects such as COPE (Staples and Pengelly 1996) and to release alternative and complementary back-up legumes to the stylos. Alternative legumes, with adaptation to a similar target area, are good insurance against the threat of disease or pests devastating current stylo cultivars. Such an event would also dent industry confidence in, and production from sown pastures. There is also a need for legumes which produce higher quality forage and respond to improved fertility.

Contracted Project Objectives:

(i) By July 1995, to study and understand the general agronomy and ecology of three well adapted legume cultivars (particularly from *Aeschynomene* and *Chamaecrista* (previously *Cassia*) species) and develop commercial management practices to speed their integration into the commercial grazing industry.

(ii) By July 1995, to demonstrate the animal production potential of the three new cultivars.

(iii) By October 1995, to produce a minimum of 100 kg of seed of the three new cultivars for time of release.

(iv) By October 1995, to determine field nutritional requirements and responses and develop appropriate seed technology packages for each new cultivar.

(v) By June 1996, to release the three cultivars to complement and back-up currently used legume cultivars (particularly for the *Stylosanthes* species).

(vi) By June 1996, to select five new legumes for pre-release.

2.2 METHODOLOGY

2.2.1 Adaptation sites under grazing

Objective: To study and understand the general agronomy and ecology of promising legume material relative to current cultivars

Sites: Lighter acid to neutral soils in the 650 to 1000 mm AAR zones suitable for growing stylos were selected. Fourteen sites ranged from Gympie in the south up the Queensland coast to Mt Garnet in the north and Daly Waters and Katherine in the Northern Territory. Characteristics of each site are summarised in table 2.2.1.1 and individual sites are detailed in the results section (2.3). Location of sites is shown in figure 1.

Species sown: A total of 55 legumes were sown at these sites with sowings occurring in 1992/93 (series 1), 1993/94 (series 2) and 1994/95 (series 3). Table 2.2.1.2 sets out details of these sowings across sites.

Methodologies used: A disturbed seedbed was prepared prior to sowing. Sowing rate was 3 to 5 kg/ha of seed broadcast onto the surface. A minimum seed germination percentage of around 30% was attempted and all legumes were inoculated with the appropriate rhizobium. Pasture presentation yield and composition were recorded towards the end of each growing season using "BOTANAL" (Tothill *et al* 1992). Legume population and other observations (palatability, disease, etc) were also recorded during the BOTANAL activity.

All sites were grazed by cattle following the first winter, either in conjunction with an adjacent (small) paddock or with weaner steers locked on the site.

Table 2.2.1.1 Adaptation sites and their characteristics

Site	Lat.	Long.	AAR (mm)	Soil P_b (ppm)	Years* Sown	Fert. kg/ha P	Companion grass
"Narrabri" Gympie	26°01'	152°27'	991	9	1,2	20	Keppel Indian Bluegrass
"Brian Pastures" Gayndah	25°45'	151°46'	730	23	1,2,3	Nil	Black Spear
"Narayen" Mundubbera	25°41'	150°52'	716	6	2,3	10	Buffel
"Wadeleigh" Miriam Vale	24°15'	151°30'	1169	15	1	20	Signal grass
"Bethome" Bororen	24°10'	151°25'	1169	4	3	18	Bisset
"Sorrell Hills" Duaringa	23°43'	149°40'	727	12	1,2,3	Nil	Keppel Indian Bluegrass
"Granite Vale" St Lawrence	22°25'	149°32'	1040	12	1,2,3	Nil	Black Spear
"Willunga" Nebo	22°20'	148°37'	646	12	2	Nil	Buffel
"Glensfield" Sarina	21°28'	145°58'	969	16	1,2,3	Nil	Callide/Bisset
"Braceborough" Charters Towers	20°29'	145°50'	656	2	2,3	Nil	Black Spear
"Swans Lagoon", Ayr	20°05'	147°15'	852	2	1,2,3	12	Black Spear
"Sugarbag" Mt Garnet	17°56'	145°00'	810	4	2,3	10	Bowen Indian Bluegrass
"Stillwaters", Daly Waters	16°10'	133°06'	657	7	1,2,3	9	Black Spear
Katherine Res Stn Katherine	14°28'	132°19'	967	3	1,2,3	9	Buffel

* 1 = 1992-93, 2 = 1993-94, 3 = 1994-95

Figure 1

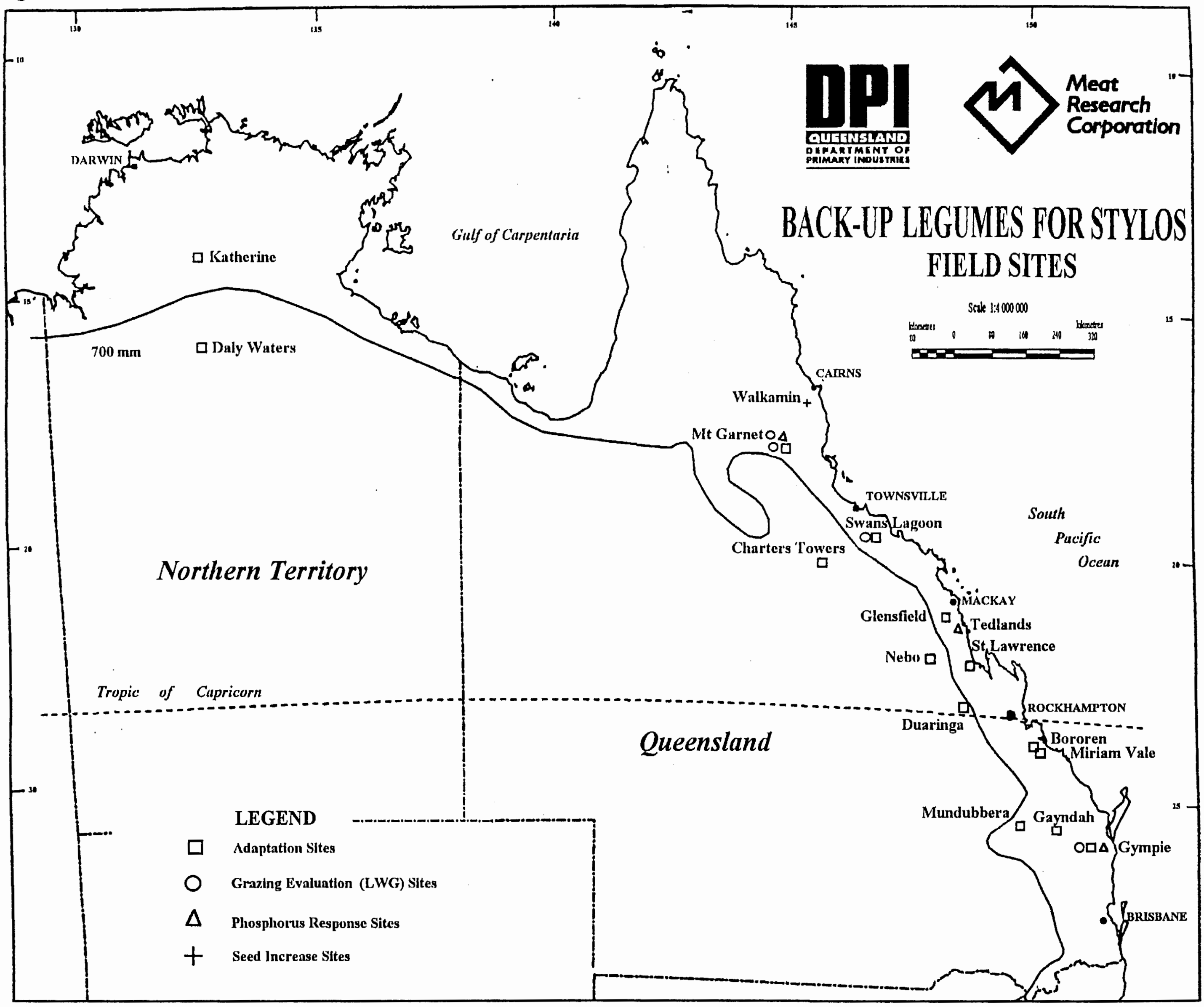
DPI
QUEENSLAND
DEPARTMENT OF PRIMARY INDUSTRIES
Meat Research Corporation
BACK-UP LEGUMES FOR STYLOS
FIELD SITES
DARWIN
Katherine
Daly Waters
700 mm
Gulf of Carpentaria
CAIRNS
Walkamin
Mt Garnet
TOWNSVILLE
Swans Lagoon
Charters Towers
South
Pacific
Ocean
Northern Territory
MACKAY
Glensfield
Tedlands
St Lawrence
Nebo
Tropic of Capricorn
ROCKHAMPTON
Duaringa
Queensland
Bororen
Miriam Vale
Mundubbera
Gayndah
Gympie
BRISBANE
LEGEND
Adaptation Sites
Grazing Evaluation (LWG) Sites
Phosphorus Response Sites
Seed Increase Sites

Table 2.2.1.2 List of accessions and cultivars sown in adaptation site network and year of sowing (1 = 1992/93, 2 = 1993/94, 3 = 1994/95)

	Species	Acc/Cv	Gayndah	M'bbera	Sexton	Miriam Vale	Bororen	Duaringa	St Lawrence	Sarina	Nebo	Ayr	Charters Towers	Mt Garnet	Katherine	Daly Waters
			'Brian Pas - Ridges'	'Narayen'	'Narrabri'	'Wadeleigh'	'Bethome'	'Sorrell Hills'	'Granite Vale'	'Glensfield'	'Wilunga'	'Swans Lagoon'	'Braceborough'	'Sugarbag'	Res Stn	"Stillwater"
1	*Aeschynomene americana*	56282			1				1							
2	*Aeschynomene americana*	91235	1		1	1		1	1	1		1			1	1
3	*Aeschynomene americana*	93624	1		1	1		1	1	1		1			1	1
4	*Aeschynomene americana*	93661			1				1							
5	*Aeschynomene americana*	Glenn	1		1	1		1	1	1		1			1	1
6	*Aeschynomene americana*	Lee	1,3	3	1	1	3	1,3	1,3	1,3		1,3	3	3	1,3	1,3
7	*Aeschynomene brasiliana*	92519	1,3	2,3	1	1		1,3	1,3	1,3	3	1,3	2,3	3	1,3	1,3
8	*Aeschynomene brasiliana*	93592	1	2	1	1			1	1		1	2		1	1
9	*Aeschynomene falcata*	Bargoo	2	2	2			2	2	2	2	2	2	2	2	2
10	*Aeshynomene histrix*	93599	3	3			3	3	3	2,3	3	3	2,3	3	2,3	3
11	*Aeshynomene histrix*	93636	1,3	3	1	1	3	1,3	1,3	1,2,3	3	1,3	2,3	3	1,2,3	1,3
12	*Aeshynomene histrix*	93638	3	3			3	3	3	2,3	3	3	2,3	3	2,3	3
13	*Aeschynomene paniculata*	93635													1	1
14	*Aeschynomene villosa*	37235	1	3	1	1	3	1	1	1		1		3	1	1
15	*Aeschynomene villosa*	91209	1	3	1	1	3	1	1	1		1		3	1	1
16	*Aeschynomene villosa*	93621	1	3	1	1	3	1	1	1		1			1	1
17	*Alysicarpus monilifer*	52343	3	3			3	3	3	3	3	3	3	3		
18	*Alysicarpus rogusus*	51655	3	3			3	3	3	3	3	3	3	3		
19	*Alysicarpus rogusus*	69487	3	3			3	3	3	3		3	3	3		
20	*Atylosia sericea*	30042	3	3				3	3	3		3	3			

Table 2.2.1.2 (cont)

Species	Acc/Cv	Gayndah	M'bbera	Sexton	Miriam Vale	Bororen	Duaringa	St Lawrence	Sarina	Nebo	Ayr	Charters Towers	Mt Garnet	Katherine	Daly Wts
		'Brian Pas - Ridges'	'Narayen'	'Narrabri'	'Wadeleigh'	'Bethome'	'Sorrell Hills'	'Granite Vale'	'Glensfield'	'Wilunga'	'Swans Lagoon'	'Braceborough'	'Sugarbag'	Res Stn	"Stillwater"
21 *Chamaecrista pilosa*	57503	2	2	2			2	2	2		2	2	2	2	2
22 *Chamaecrista rotundifolia*	85836	1	2	1	1		1	1	1		1	2		1	1
23 *Chamaecrista rotundifolia*	86172	1	2	1	1		1	1	1		1	2		1	1
24 *Chamaecrista rotundifolia*	93094	2	2	2			2	2	2		2	2	2	2	2
25 *Chamaecrista rotundifolia*	Wynn	1,2,3	2,3	1,2	1	3	1,2,3	1,2,3	1,2,3	3	1,2,3	2,3	2,3	1,2,3	1,2,3
26 *Desmanthus virgatus*	30205	2		2			2	2	2	2	2	2	2	2	2
27 *Desmanthus virgatus*	33201	2		2			2	2	2	2	2	2	2	2	2
28 *Desmanthus virgatus*	37143							2	2	2	2	2			
29 *Desmanthus virgatus*	37538	2		2			2	2	2	2	2	2	2	2	2
30 *Desmanthus virgatus*	38351	2	2	2			2	2	2	2	2	2	2	2	2
31 *Desmanthus virgatus*	40071	2		2			2	2	2	2	2	2	2	2	2
32 *Desmanthus virgatus*	49728	3				3	3	2,3	2	3		3			
33 *Desmanthus virgatus*	52401	3				3	2,3	2,3	2	2,3		2,3		2	
34 *Desmanthus virgatus*	55719	2	2	2			2	2	2	2	2	2	2	2	2
35 *Desmanthus virgatus*	67643	3					3	2	2	3					
36 *Desmanthus virgatus*	78372							2	2	2	2	2			
37 *Desmanthus virgatus*	79653	2	2	2			2	2	2	2	2	2	2	2	2
38 *Desmanthus virgatus*	85178	2		2			2	2	2	2	2	2	2	2	2
39 *Desmanthus virgatus*	90754	2	2	2			2	2	2	2	2	2	2	2	2
40 *Desmanthus virgatus*	TQ90	2		2			2	2	2	2	2	2	2	2	2
41 *Desmanthus virgatus*	AC10	2	2	2		3	2	2	2	2,3	2,3	2,3	2,3	2	2
42 *Desmanthus virgatus*	AC11	2	2	2		3	2	2	2	2,3	2,3	2,3	2,3	2	2
43 *Desmanthus virgatus*	Marc	2	2	2			2	2	2	2	2	2	2	2	2
44 *Desmanthus virgatus*	Bayamo	2		2			2	2	2	2	2	2	2	2	2
45 *Desmanthus virgatus*	Uman	2		2			2	2	2	2	2	2	2	2	2
46 *Desmanthus virgatus*	Mixture	3	3			3	3	3	3	3	3	3	3	3	3

Table 2.2.1.2 (cont)

Species	Acc/Cv	Gayndah	M'bbera	Sexton	Miriam Vale	Bororen	Duaringa	St Lawrence	Sarina	Nebo	Ayr	Charters Towers	Mt Garnet	Katherine	Daly Waters
		'Brian Pas - Ridges'	'Narayen'	'Narrabri'	'Wadeleigh'	'Bethome'	'Sorrell Hills'	'Granite Vale'	'Glensfield'	'Wilunga'	'Swans Lagoon'	'Braceborough'	'Sugarbag'	Res Stn	"Stillwater'
47 *Macroptilium atropurpureum*	84989		3			3	3	3	3			3		3	
48 *Macroptilium atropurpureum*	Aztec		3			3	3	3	3			3		3	
49 *Macrotyloma axillare*	52469	2	2	2				2	2		2	2	2	2	2
50 *Macrotyloma axillare*	Archer	2	2	2				2	2		2	2	2	2	2
51 *Stylosanthes hippocampoides*	Oxley	1		1											
52 *Stylosanthes hamata*	Amigo	1		1			1	1	1		1			1	
53 *Stylosanthes hamata*	Verano	3	3	1	1	3	1,3	1,3	1,3	3	1,3	3	3	1,3	1,3
54 *Stylosanthes scabra*	49834		2												
55 *Stylosanthes scabra*	Seca	2,3	2,3	1,2	1	3	1,2,3	1,2,3	1,2,3	2,3	1,2,3	2,3	2,3	1,2,3	1,2,3
56 *Stylosanthes scabra*	Siran			1			1	1	1					1	

2.2.2 Grazing evaluation sites

Objective: To demonstrate animal production potential of promising new legumes relative to current cultivars they will complement or replace.

Sites: Six sites are now sown with sites and species summarised in table 2.2.2.1. Details of sites used are in section 2.3.4. Location of sites is shown in figure 1.

Design: The aim was to compare LWG from grazable areas of a promising legume in one paddock with a similar area sown of a standard cultivar, or pasture already established. Seed was sown at 3 to 5 kg/ha into a prepared seedbed. Stocking and weighing cattle at several sites was delayed by drought. Pasture presentation yield and composition was recorded towards the end of the wet season (BOTANAL) with legume population also recorded.

2.2.3 Response to phosphorus

Objective: To determine field response to applied phosphorus and measure the efficiency of use of varying levels of soil phosphorus.

Sites: Three sites were sown with details summarised in table 2.2.3.1. Location of sites is shown in figure 1.

Design: Randomised block with four replications at Mt Garnet and Mackay and three at Gympie.

Methodology: Plot size was 5 m x 2.5 m. Dry matter yields were recorded by mowing a 3 m x 0.9 m strip, subsampling, separating into legumes and other species and oven drying. At "Sugarbag", Mt Garnet, a direct percentage yield estimate within the BOTANAL technique was used. Soil analysis was carried out for each plot using 10, 2.5 cm x 10 cm cores per plot, taken prior to each year's growth, and bulked across reps. A base dressing of nutrients (Ca and S (as gypsum 417 g/plot), K (as KCL 250 g/plot), Cu (as $CuSO_4.5H_2O$ 10 g/plot), Zn (as $ZnSO_4.7H_20$ 10 g/plot), and Mo (as $Na_2MoO_4.2H_2O$ 0.6 g/plot)) was mixed with the various rates of phosphorus and spread onto the soil surface. Inoculated legume seed was sown at 10 kg/ha.

Phosphorus rates were 0, 10, 20, 40, 60 and 80 kg P/ha as Triphos (20% P) at Mackay and Mt Garnet and as single superphosphate at Gympie

Table 2.2.2.1 Grazing evaluation sites

Site, Legume	Lat./Long.	AAR (mm)	Soil P_b (ppm)	Date Sown	Legume Sown	Fert kg/ha P	Companio n grass
"Narrabri" Gympie (*A. villosa*)	$26^0$01'S/ $152^0$27'E	900	7	18/11/92	CPI 37235 2 ha CPI 91209 2 ha CPI 93621 2 ha Miles Lotononis 6 ha	20	Keppel Pertusa
"Gympie" (*A. villosa*)	$26^0$09S/ $152^0$45'E	1000	40	6/1/95	Reid/ Kretschmer 3 ha Shaw 3 ha	Nil	Naturalised mat grass
"Sugarbag" Mt Garnet (*A. brasiliana*)	$17^0$56'/ 145^0	800	4	29/1/92	CPI 92519 20 ha	10	Bowen Indian Bluegrass
"Swans Lagoon" (*A. brasiliana*)	$20^0$05'/ $147^0$15'	750	8	10/12/94	CPI 92519 4 ha	Nil	Bisset
"Lamonds Lagoon" Mt Garnet (*C. rotundifolia*)	$18^0$22'/ $145^0$08'	700	4	1/12/91	CPI 85836/ 86172 Wynn 40 ha	10	Bowen Indian Bluegrass
"Tedlands"* Mackay (*A. americana*)	$21^0$36'/ $149^0$18'	1500	4	22/1/92	Glenn 10 ha Lee 10 ha	24 year 1 40 year 2	Callide and Tully

* Funded by MRC PDS Project rather than BULS Project.

Table 2.2.3.1 Response to applied phosphorus sites

Site	Lat./Long.	AAR (mm)	Soil P_b ppm	Legumes Sown	Date Sown
"Sugarbag" Mt Garnet	$17^0$56'S/ 145^0E	800	4	*A. bras.* 92519 *C. rot.* 85836 *C. rot.* Wynn *S. scab.* Seca	4/11/92
"Tedlands" Mackay	$21^0$36'S/$149^0$18 'E	1500	4	*A. amer.* Glenn *A. amer.* Lee *A. vill.* 91209 *S. scab.* Seca	27/10/92
"Scotchy Pocket" Gympie*	$26^0$01'S/$152^0$31 'E	900	7	*A. vill.* 91209 *A. vill.* 93621 *S. scab.* Seca *	30/10/93

* Three Arachis species/accessions were also sown in this experiment.

2.2.4 Seed production

All seed increase was undertaken at the DPI Walkamin Research Station on the Atherton Tableland in north Queensland.

Collaborators: JM Hopkinson, BH English, RW Walker

Location: 17^{0}13'S, 145^{0}43'E, 580 m ASL

Soil: Euchrozem, Gn 2.12, parent material basalt

Rainfall and Temperatures:

Climate	J	F	M	A	M	J	J	A	S	O	N	D	Tot/ Mean
Rainfall (mm)	230	220	219	53	29	20	9	9	9	20	82	118	1018
Mean Max (^{0}C)	30.0	28.9	28.1	26.4	25.0	23.5	23.3	24.9	26.9	29.2	30.6	30.4	27.2
Mean Min (^{0}C)	20.2	20.3	19.4	17.9	16.3	13.6	12.9	13.2	14.6	16.5	18.4	19.5	16.9
Frost incidence	Effectively frost free - only light frosts very occasionally												

2.3 RESULTS AND DISCUSSION

2.3.1 Rainfall

Below average and erratic summer rainfall, particularly in year 1 (1992/93), year 2 (1993/94) and year 3 (1994/95) has adversely impacted on legume establishment at many sites. The year 4 (1995/96) wet season started well but January, February and March were very dry at most sites.

All the Mt Garnet sites and the Charters Towers sites were droughted each year, receiving less than half average rainfall. Duaringa and St Lawrence sites had poor summer rainfall in years 1, 2 and 3. Nebo was very dry in year 3. Even those sites with better (near average) rainfall experienced dry periods and erratic summer rainfall in several years. Rainfall received at individual sites is shown in sections 2.3.2, 2.3.4 and 2.3.5 and is tabulated across all adaptation sites in table 2.3.1.1.

Legumes which have established, persisted and yielded well have done so under harsher than normally expected conditions at most sites. Also the failure rate at many sites may be higher than would have occurred in more average conditions. Only at the Northern Territory sites of Daly Waters and Katherine where rainfall was near average, could it be said that performance of legumes was a true indication of their adaptation to those environments. However as variability is a feature of rainfall in northern Australia this project has greatly advanced knowledge of current and potential pasture legume adaptation and has highlighted the superiority and dominance of *Stylosanthes* cultivars, particularly *S. scabra* cv Seca, for augmenting both native and sown pastures in harsh environments.

Table 2.3.1.1 Monthly rainfall recorded at Back Up Legumes for Stylo sites (shaded zones = month of sowing)

AAR	991	730	716	1169	727	1040	646	969	656	852	810	657	967
	Gympie	Gayndah	Mundubbera	Miriam Vale	Duaringa	St. Lawrence	Nebo	Sarina	Charters Towers	Ayr	Mt Garnet	Daly Waters	Katherine
	'Narrabri'	'Brian Pastures. - Ridges'	'Narayen'	'Wadeleigh'	'Sorrell Hills'	'Granite Vale'	'Wilunga'	'Glensfield'	'Braceborough'	'Swans Lagoon'	'Sugarbag'		
Jul-92													
Aug-92													
Sep-92													
Oct-92	58										0	4	35
Nov-92	96	85				44		11		16	35	25	94
Dec-92	73	108				94		120		93	74	108	137
Jan-93	183	135		88	56	172		344		121	26	110	371
Feb-93	84	68		78	36	36		125		55	115	253	240
Mar-93	28	32		96	3	77		19		0	64	23	39
Apr-93	3	0		4	0	0		44		0	0	0	0
May-93	18	8		37	15	0		24		0	0	0	0
Jun-93	21	27		5	9	11		24		0	0	0	0
Total	564	463		308	119	432		711		284	314	523	916
Jul-93	53	29		94	38	43		30		26	41	0	0
Aug-93	16	32		70	22	46		45		13	0	0	0
Sep-93	48	75	67	124	36	37	10	26		28	0	0	0
Oct-93	67	55	42	16	25	19	42	41		14	0	0	6
Nov-93	94	101	81	195	115	54	97	122		102	20	87	88
Dec-93	89	66	63	55	49	27	43	80		10	0	224	346
Jan-94	169	83	6	211	27	27	42	81	94	35	103	68	154
Feb-94	144	108	96	136	32	55	111	83	90	373	95	197	169
Mar-94	114	114	88	179	124	278	224	285	111	231	39	191	261
Apr-94	46	20	5	31	7	6	0	26	0	0	0	0	7
May-94	43	17	14	74	7	14	0	23	0	17	0	0	0
Jun-94	11	14	18	20	20	0	0	7	0	0	19	0	0
Total	893	715	480	1205	502	605	569	849	295	849	317	766	1032

Jul-94	21	22	7	17	5	7	0	19	0	0	21	0	0
Aug-94	9	0	0	0	0	0	0	5	0	0	0	0	0
Sep-94	9	3	12	11	14	0	0	3	0	5	0	0	0
Oct-94	24	65	67	63	16	48	59	36	0	10	0	20	18
Nov-94	18	49	19	32	0	45	26	13	0	0	0	26	141
Dec-94	52	29	27	87	46	52	19	96	17	51	67	123	141
Jan-95	28	68	58	159	44	36	45	151	30	48	60	122	389
Feb-95	293	117	113	107	44	82	66	219	167	184	163	213	140
Mar-95	47	137	17	17	67	56	47	27	0	43	79	182	135
Apr-95	24	70	24	30	0	40	4	19	6	0	0	5	42
May-95	39	47	57	60	41	48	70	52	29	10	36	13	0
Jun-95	0	12	18	20	0	10	0	26	0	0	12	0	0
Total	**565**	**619**	**419**	**603**	**277**	**424**	**336**	**666**	**249**	**351**	**437**	**704**	**1006**
Jul-95	0	4	4	11	8	0	0	3	0	0	0	0	0
Aug-95	11	10	4	58	65	78	59	142	52	92	76	0	0
Sep-95	12	27	25	29	0	0	2	0	0	0	0	12	20
Oct-95	56	82	165	85	93	80	105	69	20	77	21	5	51
Nov-95	139	153	171	155	44	194	51	112	55	67	85	101	55
Dec-95	125	178	107	139	88	105	29	119	21	86	85	109	147
Jan-96	356	178	106	391	214	339	81	236	117	401	218	152	199
Feb-96	52	47	5	12	19	0	0	53	0	0	83	33	57
Mar-96	7	34	10	11	0	0	0	42	0	29	75	186	92
Apr-96	53	19	19	188	106	241	50	171	13	27	56	42	121
May-96	153	136	123	114	8	0	22	9	0	13	0	0	0
Jun-96	21	10	5	11	42	29		48	29	37	11	0	0
Total	**986**	**878**	**744**	**1204**	**686**	**1066**	**399**	**1001**	**307**	**828**	**710**	**638**	**741**

2.3.2 Legume adaptation at individual sites (record of legume persistence and growth under grazing)

2.3.2.1 GYMPIE:

Collaborators: BG Cook and AG Salmon, DPI

Co-operator: CV (the late) and JR Cotter

Location: "Narrabri", Sexton. $26^0$01'S, $152^0$27'E, alt 50 m ASL

Soil description: Soloth, with sandy loam surface

Soil analysis (0-10 cm):

pH	EC	Cl^-	P_b	$SO_4^=/S$	Ca	Mg	Na	K	ECEC
	(mS/cm)	(ppm)			(me/100g)				
5.7	0.053	20	9	8	2.3	2.0	0.2	0.4	5

Dates sown: Series 1, 26 January 1993; Series 2, 24 February 1994, Series 3 not sown due to drought.

Companion Grass: Series 1 *Bothriochloa pertusa* cv Keppel
Series 2 *B. bladhii* spp *glabra* cvv Swann, B. Dahl

Rainfall (mm):

Year	J	A	S	O	N	D	J	F	M	A	M	J	Tot
1992/93				58	96	73	183	84	28	3	18	21	-
1993/94	51	16	48	67	94	89	169	144	114	46	43	11	893
1994/95	21	9	9	24	18	52	28	293	47	24	39	0	565
1995/96	0	11	12	56	139	125	356	52	7	53	153	21	986
Mean (Theebine)	46	32	40	69	71	127	152	144	127	71	59	53	991

Results and Discussion:

Conditions throughout the trial have not been ideal for plant growth, and although some of the monthly rainfall totals are equal to or greater than the average shown for the nearby recording station at Theebine, distribution was such as to cause stress through surfeit or shortage. However, in both series 1 and 2, rainfall was adequate for establishment, although delay between planting and rain in series 2 may have jeopardised survival of RNB on the seed.

Frosts have been experienced each year at the site, mostly late enough so as not to adversely affect seed set.

Series 1 (Table 2.3.2.1.1): Early populations varied from 4 to 84 plants/m^2, all but three producing counts above 20 plants/m^2. The companion grass, Keppel Indian bluegrass, established and grew well, provided an early ground cover in most plots. Early growth of some legumes, notably Seca, Siran and some of the *A. americana* accessions was sufficient to suppress the Keppel. High levels of nitrogen fixed by some of the *A. americana* at this stage produced a visual colour and yield response in the companion grass.

Although there are fairly clear trends in species adaptation at the site, these would have to be interpreted in relation to prevailing weather conditions. In establishing annuals, the ideal situation is for the plant to grow vigorously during the planting year and set large amounts of seed (anything up to 1 t/ha) which will then provide the persistence base over successive years, even without good seed set in those years. While all accessions established adequately, extremely poor rainfall during the normal flowering period for most lines (March-May), exacerbated by the poor moisture holding capacity of the soil, resulted in negligible seed set in the first year. This would have prejudiced the success of obligate annuals such as *A. americana* CPI 56282 and Glenn and *A. villosa* CPI 37235, and weak perennials such as the other *A. villosa* and *Chamaecrista* accessions. Strong perennials such as *S. scabra* and *A. falcata* would have been less affected. It is therefore inappropriate to say that poor performers are not adapted at this site, but reasonable to conclude that sound performance reflect adaptation. On this basis, Seca and Siran are undoubtedly the best adapted of those species with high yield potential. This is also demonstrated by the large seedling population under the parent plants. Bargoo is the other variety obviously well adapted at the site.

At this stage, it would appear that Amiga and Verano may also have a role. Past experience on this soil type suggests otherwise. While the initial population might persist for several years, poor recruitment leads to a decline in population, usually after 2 or 3 years. If seed prices are reasonable, they may still play a pioneer role in pasture plantings. It is tempting to conclude that the increase in population of *C. rotundifolia* CPI 85836 may demonstrate gradual improvement - it may also demonstrate differences in hardseededness between it and Wynn, with Wynn germinating well in the first season and CPI 85836 hardseededness breaking down somewhat by year 3. There is no reason to believe that either accession has any real superiority over the cultivar.

This is not the case with *A. americana* CPI 93624. At this site it is markedly superior to cv. Glenn, a result in accordance with performance at the Gympie COPE site where, in a different soil and vegetation type, CPI 93624 persisted and spread to a greater extent than any other line tested. There is good reason to believe that *A. villosa* may be of value in this environment, but not so *A. histrix* that flowers very late and is very palatable. *A. brasiliana* is definitely adapted, but was treated with herbicide due to concerns regarding its weediness. While this is the responsible approach, the concerns were probably ill-founded, since both lines were usually eaten as well as, or better than *S. scabra*. Even if *A. brasiliana* proved a useful forage, the difficulty in harvesting seed in the sticky canopy may diminish its commercial appeal.

Series 2 (Table 2.3.2.1.2): Populations rarely reached levels measured in series 1, although in most cases, sufficient plants established to assess adaptation at the site. Notable exceptions were some of the *Desmanthus* accessions. A less aggressive grass, *Bothriochloa bladhii* spp. *glabra* was used as the companion species, the two cultivars Swann and Keppel being very similar. In most cases, the sown grass would have provided little or no competition for the establishing legumes.

Once again, Bargoo and Seca populations are maintaining at desirable levels. There is little doubt that Bargoo stands will improve with time as seed is dropped or spread by cattle. Data to date show no advantage of *C. rotundifolia* CPI 57503 or 93094 over cv Wynn. At a nearby site on a similar soil type in a trial planted in 1988, CPI 93094 has performed much better than Wynn, spreading in quantity from the evaluation row. At that site, CPI 57503 has all but died out.

Although some of the *Desmanthus* accessions and cultivars established poorly, it is unlikely that they would have succeeded on this soil type, since most others showed a rapid decline in population over the years. While there are still healthy plants of Bayamo and CPI 38351 in the plots, the marked reduction in population gives little hope for long term persistence. The most notable exception is CPI 37538, an accession collected from sandy country near Córdoba in Argentina. It is probably more correctly *D. acuminatus*, a low growing type that contrasts with many of the *D. virgatus* types by virtue of growth habit and the short, densely clustered pods. A single plot of this accession planted in Series 1 is also maintaining well.

Macrotyloma axillaris has proven unsuited to this soil type and/or management. It is surprising that *M. psammmodes* CPI 39098 has not performed better at this site in view of its general performance on harder and drier sites.

Comment:

Methodology was flawed to the extent that there should have been some guarantee of establishment -irrigation. It cannot be claimed that all species have been adequately evaluated if they were not given every opportunity for their potential to be demonstrated. As noted, this means one season of seed set in the case of annuals, and in the case of perennials, that they were nodulated with an effective strain of RNB. There is some doubt that the effective CB 3126 would have survived from planting to germination on seed of the highly specific *Desmanthus*. Those accessions still surviving may well be the more promiscuous of the set. Irrigation would overcome both problems. While it can be argued that to have irrigation supplied at all sites would be too expensive, it can equally be argued that to have a single planting of a particular set without irrigation is a "high-odds-against" gamble.

The project has confirmed the value of those cultivars already recognised in the area - Seca, Wynn and Bargoo. Miles lotononis is also recommended on these soils, but was not in the core sets. However, a single plot established with series 1 to compare Miles with 2 accessions of *L. heterophylla*, confirms its value and shows it to be as good or better than the comparators.

Of the non-cultivar material, *A. americana* CPI 93624 and *D. virgatus* (*acuminatus*) CPI 37538 are the only ones that warrant further assessment with a view to progression through to cultivar status.

However, with limited resources, it is probably more appropriate to maximise use of existing cultivars. There is always a resistance to pasture development when beef prices are low. This is understandable and probably insurmountable. At this stage we do not have a full extension package for cultivars such as Seca and Siran, particularly with regard to soil adaptation and compatibility with stoloniferous grasses such *as Bothriochloa pertusa* cv Keppel and *B. insculpta* cv Bisset. We now need to document statewide experience in this regard, incorporate that information in decision support packages, and , using a simple observation plot approach, try to fill the gaps in our knowledge. There is also a need to intensify efforts to get Bargoo jointvetch onto the market. There have been problems in seed production of this valuable plant, partly due to its pod shattering; partly to anthracnose, and partly to continuing drought in those areas where it theoretically could be successfully produced.

This project has also provided an opportunity to assess Swann and Keppel bluegrass, both new commercially, and both adapted to low fertility soils. This site will be maintained for as long as possible to monitor not only legume performance, but also that of companion grasses, together with grass/legume compatibility.

Table 2.3.2.1.1 Population dynamics and yield comparisons (Series 1)

Treatments		Population (plants/m^2)			Yield (kg/ha)	
		25.3.93	10.5.95	17.4.96	10.5.95	17.4.96
A. americana	CPI 56282	8.3	21.5(69)$^+$	1.9	49 (3)$^{++}$	48(2)$^{++}$
A. americana	CPI 91235	40.7	0.6(39)	0	2 (0)	0(0)
A. americana	CPI 93624	22.5	39.3(81)	10.1	57 (3)	170(6)
A. americana	CPI 93661	22.6	1.6(38)	0.5	0 (0)	15(0)
A. americana	cv Glenn	83.8	6.1(59)	0.1	6 (0)	3(0)
A. americana	cv Lee	77.8	1.2(45)	0	38 (1)	0(0)
A. brasiliana	CPI 92519	62.0	*	*	*	*
A. brasiliana	CPI 93592	47.9	*	*	*	*
A falcata	cv Bargoo	46.6	18.8(76)	13.2	38 (2)	114(5)
A histrix	CPI 93636	56.2	0.4(35)	0.8	5 (0)	21(1)
A. villosa	CPI 37235	44.6	19.7(83)	11.2	44 (3)	78(4)
A. villosa	cv Reid	28.7	14.5(69)	6.2	24 (1)	57(3)
A. villosa	cv Kretschmer	71.5	13.4(62)	2.2	30 (2)	18(1)
C. rotundifolia	CPI 85836	4.0	3.4(48)	8.6	13 (1)	174(6)
C. rotundifolia	CPI 86172	9.4	2.8(52)	4.4	0 (0)	76(3)
C. rotundifolia	cv Wynn	55.9	6.7(64)	5.6	20 (1)	59(3)
S. hippocampoides	cv Oxley	29.3	1.3(48)	0.9	0 (0)	2(0)
S. hamata	cv Amiga	39.0	9.9(86)	9.1	197 (12)	93(5)
S. hamata	cv Verano	50.1	7.6(76)	9.5	93 (5)	77(4)
S. scabra	cv Seca	35.3	15.6(98)	15.5	2220 (64)	3174(68)
S. scabra	cv Siran	48.5	9.8(91)	16.0	1702 (54)	3624(76)

* = sprayed out
$()^+$ = frequency % occurrence in quadrats
$()^{++}$ = legume % of total yield

Table 2.3.2.1.2 Population dynamics (Series 2)

Treatments		Population (plants/m^2)		
		27.5.94	**10.5.95**	**17.4.96**
A falcata	cv. Bargoo	15.0	23.0	11.6
C. pilosa	CPI 57503	7.8	11.7	7.4
C. rotundifolia	CPI 93094	10.8	5.9	10.9
C. rotundifolia	cv Wynn	6.4	7.1	10.7
D. virgatus	CPI 30205	18.8	3.2	0.0
D. virgatus	CPI 33201	4.8	4.5	0.4
D. virgatus	CPI 37538	36.8	18.3	9.6
D. virgatus	CPI 38351	16.6	2.9	1.7
D. virgatus	CPI 40071	15.8	2.6	1.8
D. virgatus	CPI 55719	2.0	0.3	0.1
D. virgatus	CPI 79653	6.0	0.0	0.0
D. virgatus	CPI 85178	0.8	0.0	0.0
D. virgatus	CPI 90754	1.0	0.3	0.1
D. virgatus	CPI 121840	nr	1.1	0.0
D. virgatus	TQ 90	2.6	0.1	0.0
D. virgatus	BB AC 10	5.8	0.8	0.2
D. virgatus	BB AC 11	9.6	0.7	0.1
D. virgatus	cv Bayamo	19.8	3.2	0.8
D. virgatus	cv Marc	4.6	0.6	0.6
D. virgatus	cv Uman	0.8	0.0	0.0
M. psammodes	CPI 39098	nr	0.8	0.6
Ma. axillare	CPI 52469	12.8	0.3	0.0
Ma. axillare	cv Archer	4.0	0.2	0.0
S scabra	cv Seca	16.2	3.7	5.1

nr = not recorded

2.3.2.2 GAYNDAH:

Collaborators: RL Clem, BM Darrow, DM Burrows, DPI

Co-operator: DPI (J Mullaly)

Location: The 'Ridges' block on Brian Pastures Research Station, 25 km SE Gayndah, 25°45'S, 151°46'E., alt 131 m ASL

Soil description: Rudimentary Podzoloc (Uc 2.22) with sandy loam surface (rep 2 of series 1 is on a solodic soil (Dd 1.43)

Soil analysis: (0-10 cm).

	pH	EC (ms/cm)	Cl^- (ppm)	P(bicarb) (ppm)	SO_4-s (ppm)	Ca (meq%)	Mg (meq%)	Na (meq%)	K (meq%)	CEC (meq%)
Rep 1	6.1	0.02	10	26.2	-	2.5	0.85	0.1	0.39	8
Rep 2	6.5	0.07	60	15.3	-	6.9	6.2	0.5	0.58	27

Dates sown: Series 1, 4 December 1992; Series 2, 2 December 1993; Series 3, 17 January 1995.

Rainfall (mm):

Rainfall at site (mm)	J	F	M	A	M	J	J	A	S	O	N	D	Total
1992											85	108	
1993	135	68	32	0	8	27	29	32	75	55	101	61	628
1994	83	108	114	20	17	14	22	0	3	65	49	29	524
1995	68	117	138	90	47	12	4	10	27	84	155	178	930
1996	204	47	34	19	136	10							
AAR	107	96	72	38	39	30	34	28	29	61	70	104	708

Results and Discussion:

The 1992/93 wet season was poor but in the remaining years conditions have been reasonable for establishment and growth although all years were below average. Plant counts and presentation drymatter yields are shown in tables 2.3.2.2.1 and 2.3.2.2.2 in series 1 (rep 1 and

2 shown separately), table 2.3.2.2.3 - series 2 and table 2.3.2.2.4 - series 3. (*A. brasiliana* CPI 93592 has performed well at this site but is not included in discussion of results as it has been decided not to proceed with evaluation due to potential environmental weed threat (precautionary principle).

Ungrazed yields in the fourth year in Series 1 was highest for *Chamaecrista rotundifolia* CPI 86172. It dominated yield in rep 1 (73%) and native companion grass yield was 27%. Wynn cassia had next highest yield, being 24% of the yield in rep 1. Oxley fine stem stylo outyielded Amiga stylo in year 3 and 4. *Aeschynomene brasiliana* CPI 92519 was the other legume to persist to year 4. *A. histrix* CPI 93636, *A. villosa* CPI 91209 and 93621 and Amiga had populations of <1 plant/m^2 in year 4. The two soil types (rep 1 and rep 2) in series 1 produced different legume performance with the sandy surfaced Rudimentary Podzol producing best establishment and subsequent persistence and yield.

In series 2, Wynn cassia (and other *Chamaecrista* lines) had highest population in the third year followed by Seca stylo and Bargoo jointvetch. A number of *Desmanthus* lines are persisting on this light textured soil with CPI 37538 best and CPI 38351 TQ90, AC10, AC11 and Bayamo with >1 plant/m^2.

In series 3 *A. histrix* CPI 93599, *A. brasiliana* CPI 92519 and *Alylosia sericea* had >1 plant/m^2 but none approached current cultivars of which Wynn and Seca had highest counts and yield.

Table 2.3.2.2.1 Plant Counts (Plants/m^2) Series 1, Gayndah

	Date Sown	4-Dec-92						
		Uc2.22 (R1)	Dd1.43(R2)	Uc2.22(R1)	Dd1.43(R2)	Rep Mean	Uc2.22(R1)	Dd1.43(R2)
		Year 1	Year 1	Year 2	Year 2	Year 3	Year 4	Year 4
Species	**Acc./Cv.**	12-May-93	12-May-93	21-Apr-94	21-Apr-94	11-May-95	18-Apr-96	18-Apr-96
A. americana	91235	0.0	0.0	0.0	0.0	na	0	0
A. americana	93624	0.4	0.0	0.5	0.2	na	0	0
A. americana	Glenn	0.4	0.0	0.2	0.3	na	0	0
A. americana	Lee	0.7	0.5	2.5	2.7	na	0	0
A. brasiliana	92519	2.0	6.8	4.7	4.7	1.7	4.8	0.6
A. brasiliana	93592	15.0	1.5	12.7	0.7	na	13.9	1.3
A. histrix	93636	0.8	0.7	5.5	2.2	na	1.1	0.8
A. villosa	37235	2.5	0.4	0.7	0.2	na	0	0
A. villosa	91209	1.3	0.7	0.0	2.2	na	1.1	0.2
A. villosa	93621	0.0	0.0	2.5	1.8	na	0.4	0
C. rotundifolia	85836	5.2	4.2	8.7	5.5	2.5	2.9	1.1
C. rotundifolia	86172	3.2	2.0	9.5	5.5	19.2	23	8.2
C. rotundifolia	Wynn	17.8	0.3	21.3	0.0	12.1	12.8	0.4
S. hippocampoides	Oxley	1.8	0.0	5.0	0.0	4.0	5.9	0.4
S. hamata	Amiga	1.0	2.0	4.0	4.7	2.3	0.6	1

Table 2.3.2.2.2 Legume Dry Matter Yield (kg/ha), Gaydndah Series 1

	Date Sown	4-Dec-92						
		Uc2.22(R1)	Dd1.43(R2)	Uc2.22(R1)	Dd1.43(R2)	Rep Mean	Uc2.22(R1)	Dd1.43(R2
		Year 1	Year 1	Year 2	Year 2	Year 3	Year 4	Year 4
Species	**Acc./Cv.**	12-May-93	12-May-93	21-Apr-94	21-Apr-94	11-May-95	18-Apr-96	18-Apr-96
A. americana	91235	0	0	0	0	na	0	0
A. americana	93624	4	0	0	0	na	0	0
A. americana	Glenn	5	0	0	18	na	0	0
A. americana	Lee	16	8	188	167	na	0	0
A. brasiliana	92519	17	69	353	518	99	424	0
A. brasiliana	93592	208	21	1648	65	na	1949	65
A. histrix	93636	15	4	913	376	na	87	53
A. villosa	37235	21	2	0	0	na	0	0
A. villosa	91209	12	6	0	33	na	28	0
A. villosa	93621	0	0	396	223	na	81	0
C. rotundifolia	85836	318	219	2167	1055	242	374	134
C. rotundifolia	86172	75	60	1383	836	488	4172	901
C. rotundifolia	Wynn	509	3	1265	0	170	1769	1
S. hippocampoides	Oxley	16	0	181	0	110	450	20
S. hamata	Amiga	10	8	438	47	28	53	0

Table 2.3.2.2.3 Plant Counts (plants/m^2) and Legume Dry Matter (kg/ha) Yield Gayndah, Series 2

Species	Date Sown / Sampling Date / Accession/ Acc./cv	Population 1 Jun 94 Year 1	Population 12 May 95 Year 2	Population [1]8 Apr 96 Year 3	Yield 1 Jun 94 Year 1	Yield 12 May 95 Year 2
	Date Sown 2-Dec-93					
Aeschynomene falcata	Bargoo	24.7	15.3	4.9	142	450
Chamaecrista pilosa	CPI57503	16.5	7.3	16.7	1776	1189
Chamaecrista rotundifolia	CPI93094	11.	12.3	24.2	1006	1401
Chamaecrista rotundifolia	Wynn	20.	10.6	29.7	2618	1996
Desmanthus virgatus	Bayamo	5.6	4.6	1.3	25	63
Desmanthus virgatus	BB AC 10	7.	2.6	1.2	69	88
Desmanthus virgatus	BB AC 11	7.5	3.1	1.2	68	102
Desmanthus virgatus	CPI30205	2.4	4.	0.5	23	41
Desmanthus virgatus	CPI33201	1.	1.3	0.4	6	11
Desmanthus virgatus	CPI37538	10.	11.9	8.6	49	135
Desmanthus virgatus	CPI38351	3.4	3.1	1.7	47	98
Desmanthus virgatus	CPI40071	3.2	1.1	0.5	11	5
Desmanthus virgatus	CPI55719	2.2	1.6	0.3	19	66
Desmanthus virgatus	CPI79653	3.6	3.1	0.8	16	6
Desmanthus virgatus	CPI85178	0.3	1.	0.	0	0
Desmanthus virgatus	CPI90754	1.4	1.	0.8	12	7
Desmanthus virgatus	Marc	3.8	7.9	0.8	59	150
Desmanthus virgatus	TQ90	5.4	4.4	1.8	34	161
Desmanthus virgatus	Uman	0.6	0.4	0.	4	6
Macrotyloma axillare	Archer	1.9	0.4	0.6	365	188
Macrotyloma axillare	CPI52469	5.5	0.3	0.2	344	112
Stylosanthes scabra	Seca	8.9	5.7	7.5	804	2158

Table 2.3.2.2.4 Plant Counts (plants/m^2) and Legume Dry Matter Yield (kg/ha), Gayndah Series 3

Species	Acc./Cv.	Population: 4 Apr 95 Plants /m^2 Year 1	Population: 18 Apr 96 Plants /m^2 Year 2	Yield: 18 Apr 96 kg/ha Year 2
	Date Sown	17-Jan-95		
Aeschynomene americana	Lee	28.3	2.7	261
Aeschynomene brasiliana	92519	14.3	1.0	60
Aeschynomene histrix	93599	4.3	1.4	49
Aeschynomene histrix	93636	7.3	0.3	3
Aeschynomene histrix	93638	4.7	0.7	48
Alysicarpus monilifer	52343	0.7	0.0	0
Alysicarpus rugosus	51655	2.7	0.0	0
Alysicarpus rugosus	69487	1.7	0.0	0
Atylosia sericea	30042	5.0	1.1	217
Chamaecrista rotundifolia	Wynn	7.7	14.6	2871
Desmanthus virgatus	49728	3.3	0.5	150
Desmanthus virgatus	52401	3.0	0.0	0
Desmanthus virgatus	67643	0.3	0.0	0
Desmanthus virgatus	Jaribu	9.0	0.0	0
Stylosanthes hamata	Verano	3.7	3.6	198
Stylosanthes scabra	Seca	17.0	7.5	1469

Comments:

Performance of accessions of *Chamaecrista* and *Aeschynomene* are of interest. Seca, fine stem stylo and Wynn are currently available but all have shortcomings both from a production and a conservation point of view. The perception is that producers in the Burnett are just discovering how good a plant Seca really is and plantings are increasing. RD & E concern is that it will soon become dominant. It may take a little longer in this region, however, with frosting in very cold winters and stiffer competition from grasses in wetter summers. Neither extreme has been experienced in recent years and it is difficult to know what is really desirable, a Seca type that is more readily eaten or a legume with less drought tolerance as seedlings?

FSS is still highly regarded especially for the very coarse sands but plantings seem to have declined. Seed availability has also declined. A plant adapted to a wider range of soils and a little more productive may be useful. Verano and Amiga are not used commercially, maybe because it's too cold?

It appears Wynn is less favoured these days because of the poor palatability problem and the subsequent over-grazing of associated species. It is probably a bit marginal in the <700 mm zone anyway or at best unreliable; good in the wet years but less useful in drier times. It seems there is a case to test if the new *Chaemacrista* lines and *Aeschynomene brasiliana* CPI 92519 can be made more acceptable to stock (fertiliser, supplements) but also seems the decision may have been made via the precautionary principle.

2.3.2.3 MUNDUBBERA:

Collaborators: CK McDonald, RM Jones, CSIRO

Co-operator: CSIRO

Location: CSIRO Narayen Research Station. 25^{0}41'S, 150^{0}52'E, 60 km SW Mundubbera, 282 m ASL

Soil description: Yellow podzolic with a sandy surface supporting narrow leaf ironbark Duplex, 30-40 cm to hardpan

Soil analysis (0-10 cm):

pH	P_b	Ca	Mg	Na	k	ECEC
	ppm	me%				
6.2	7	3.9	1.8	0.09	0.54	9.9

Dates sown: Series 2, 10 December 1993; Series 3, 10 January 1995

Companion Grass: Molopo buffel (series 2)
Gayndah buffel (series 3)

Rainfall (mm):

Year	J	F	M	A	M	J	J	A	S	O	N	D	Total
1993											81	63	
1994	6	96	88	5	14	18	7	0	12	67	19	27	359
1995	58	113	17	24	57	18	4	4	25	165	171	107	763
1996	106	5	10	19	123	5							
AAR	106	96	72	37	39	37	36	27	34	56	77	100	716

Results and Discussion:

Legume counts and dry matter yields are shown in Table 2.3.2.3.1 for Series 2 and 2.3.2.3.2 for Series 3.

Chaemacrista rotundifolia cv Wynn and CPI 93094 have performed reasonably well in the series 2 sowing, and 93094 has a higher soil seed bank. However Wynn has performed much better in the series 3 sowing. Interestingly the animals are selectively grazing the grass in the Wynn plots, as opposed to the grass in other plots, suggesting that the good growth of Wynn last summer must have pumped some N into the system. *C. pilosa* grew well in the first year and set a lot of seed. Growth has not been as good since but there are still some plants and a good soil seed population.

Desmanthus virgatus lines all virtually failed in the series 2 but this was probably due to the hot dry weather after planting which led to the death of the *Rhizobium*. One plot of BBAC IO has built up to a reasonable stand, but the plot is a bit different to the norm. In the series 3 sowing, Jaribu and CPI 37538 each had a reasonable plant population at the start but very poor growth.

Although the stands of Seca stylo and *Stylosanthes scabra* CPI 49834 were sparse in the first year, each one has continued to increase in population. Verano looked quite reasonable in the series 3 sowing. CPI 49834 seems well adapted to the Burnett area and is sometimes referred to as "Burnett stylo" by graziers.

Aeschynomene brasiliana and *A. histrix* in the first sowing are almost non-existent but *A. brasiliana* is quite good in the series 3 sowing. *A. villosa* and Lee jointvetch lack vigour, while Bargoo continues to increase in the series 2 sowing.

Macroptilium atropurpureum lines all grew well but unfortunately were mostly dug out by rat kangaroos, so very few plants are left. *M. axillaris* cv Archer and CPI 52469 were less than 10% in the first year after sowing and then disappeared.

The *Alysicarpus* lines and *Atylosia sericea* have all but died out, and never looked promising.

Table 2.3.2.3.1 Plant Counts (plants/m^2) and Legume Dry Matter (kg/ha)Yield Mundubbera, Series 2

Date Sown 12-Dec-93							
		Population			Yield		
Species	Sampling Accession	11-May-94 Year 1	26-Apr-95 Year 2	17-Oct-95 Year 3	27-Apr-94 Year 1	26-Apr-95 Year 2	25-Mar-96 Year 3
Aeschynomene brasiliana	CPI92519	15.4	1.8	1.4	51	8	51
Aeschynomene brasiliana	CPI93592	12.	0.	0.	29	0	0
Aeschynomene falcata	Bargoo	26.2	10.2	16.	22	14	128
Aeschynomene histrix	CPI93638	2.6	0.	0.	11	0	0
Chamaecrista pilosa	CPI57503	5.8	0.8	1.4	960	8	238
Chamaecrista rotundifolia	CPI85836	9.4	0.8	0.2	225	trace	39
Chamaecrista rotundifolia	CPI86172	9.8	0.6	0.8	448	trace	48
Chamaecrista rotundifolia	CPI93094	18.4	7.	5.	493	9	525
Chamaecrista rotundifolia	Wynn	17.2	3.4	4.2	416	8	230
Desmanthus virgatus	BB AC 10	5.8	2.6	3.6	29	26	80
Desmanthus virgatus	BB AC 11	6.6	0.6	2.2	27	trace	0
Desmanthus virgatus	CPI38351	4.4	0.4	0.	trace	trace	0
Desmanthus virgatus	CPI55719	3.6	1.	1.	trace	trace	0
Desmanthus virgatus	CPI79653	1.2	1.	1.	trace	trace	0
Desmanthus virgatus	CPI90754	0.4	0.2	0.	trace	trace	0
Desmanthus virgatus	Marc	3.4	1.6	1.2	30	6	trace
Macrotyloma axillare	Archer	3.2	0.	trace	62	0	0
Macrotyloma axillare	CPI52469	6.8	0.	trace	240	0	trace
Stylosanthes scabra	CP49834	12	13.6	8.4	na	15	153
Stylosanthes scabra	Seca	9.6	5.	4.8	44	21	216

Table 2.3.2.3.2 Plant Counts (plants/m^2) and Legume Dry Matter (kg/ha)Yield Mundubbera, Series 3

	Date Sown	12-Jan-95			
		Population		Yield	
Species	Sampling **Acc./Cv.**	1-Mar-95 Year 1	17-Oct-95 Year 1	26-Apr-95 Year 1	25-Mar-96 Year 2
Aeschynomene americana	Lee	0.6 (13.2)	0.6	trace	66
Aeschynomene brasiliana	92519	26.8 (0.2)	16.8	304	240
Aeschynomene histrix	93599	16.6 (0.4)	9.4	65	15
Aeschynomene histrix	93636	31.8 (0.2)	11.6	76	25
Aeschynomene histrix	93638	18.6 (0.6)	6.2	114	trace
Aeschynomene villosa	37235	13.2 (0.4)	2.4	40	60
Aeschynomene villosa	91209	5.6 (15.6)	5.4	trace	96
Aeschynomene villosa	93621	3.6 (16)	2.2	trace	72
Alysicarpus monilifer	52343	0 (1)	0.0	trace	0
Alysicarpus rugosus	51655	0.8 (1.2)	0.0	trace	0
Alysicarpus rugosus	69487	0.4 (2.4)	0.0	trace	0
Atylosia sericea	30042	1 (0)	0.0	21	trace
Chamaecrista rotundifolia	Wynn	25.4 (0.4)	22.6	342	1120
Desmanthus virgatus	37538	4.6 (2)	4.8	trace	25
Desmanthus virgatus	Jaribu	20 (3)	14.8	19	trace
Macroptilium atropurpureum	84989	1 (0.2)	0.4	24	trace
Macroptilium atropurpureum	90748	0.8 (0.4)	trace	trace	trace
Macroptilium atropurpureum	90776	4 (0)	0.4	40	52
Macroptilium atropurpureum	Aztec	4.2 (0.4)	0.2	100	42
Stylosanthes hamata	Verano	18.4 (3.2)	2.4	129	124
Stylosanthes scabra	Seca	5.2 (31.6)	9.4	20	275

( ) seedlings

Comment:

At this site, no new line stands out ahead of current cultivars Wynn, Siratro, Seca or Bargoo. CPI 93094 may be marginally better than Wynn, but not sufficient to warrant any further investigation at this stage. *C. pilosa* has some promise as it seems to be a little more palatable than Wynn if grazed before it gets too stemmy. A few plants in a grazing trial have persisted and multiplied over 10 years to now cover an area of 5 x 2 m. Poor performance of *Desmanthus* may be attributed to poor survival of effective rhizobium nodulation bacteria. *S. scabra* CPI 49834 is already shooting from the base after frosting and so may have a role on sandy soils in areas where it is to cold for Seca. *A. brasiliana* CPI 92519 has shown that it will grow quite well, but was even less palatable than Wynn. This could limit its value due to environmental concerns.

2.3.2.4 MIRIAM VALE and BOROREN:

Collaborators: RC Cheffins, J Wright, DPI

Co-operators: B and K Scott; A and F Smallcombe

Location: "Wadeleigh". 24^{0}15'S, 151^{0}30'E. 5 km NE Miriam Vale
"Bethome". 24^{0}10'S, 151^{0}25'E. 15 km E Bororen

Soil description: Solodic (Dy 3.12) with sandy loam surface.

Soil analysis (0-10 cm): **"Wadeleigh" and "Bethome"** respectively.

pH	Cl (mg/kg)	P(bicarb) (mg/kg)	SO_4-S (mg/kg)	Ca (meq %)	Mg (meq %)	Na (meq %)	K (meq %)	EC (mS/cm)
6.1	13	15	5	3.6	2.2	0.08	0.21	0.03
6.1	9	4	6	3.4	2.3	0.11	0.08	0.03

Dates sown: Series 1, 25 January 1993 "Wadeleigh"
Series 3, 16 January 1995 "Bethome"

Rainfall (mm):

"Wadeleigh" and "Bethome" (recorded in Miriam Vale)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1993	88	78	96	4	37	5	94	70	124	16	195	55	862
1994	211	136	179	31	74	20	17	0	11	63	32	87	861
1995	159	107	17	30	60	20	11	58	29	85	155	139	870
1996	391	12	11	188	114	11							
AAR	212	207	144	77	62	56	49	31	35	67	85	140	1169

Results and Discussion:

The establishment period for Series 1 received well below average rainfall resulting in below expected legume growth and seed yield, which got legumes off to a slow start. The second summer November to March was better but rainfall finished early in the third and particularly in the fourth years, with virtually no rain from early January to mid April in 1996.

Series 1 (Tables 2.3.2.4.1 and 2.3.2.4.2): The *Chamaecrista* and *Stylosanthes* legumes performed best. Seca had by far the highest year 4 yield followed by *C. rotundifolia* CPI 86172. Verano and Wynn had similar performance. The early flowering, annual *A. americana* CPI 93624 was best of the *Aeschynomene* legumes and regenerated and yielded better than Glenn. However the *Aeschynomene* legumes did not recover from the dry establishment year and performed poorly in the dry January, February and March of year 4.

Series 3 (Table 2.3.2.4.3): All except the *Alysicarpus* lines established well with Wynn and Seca again having highest population and yields. *A. histrix* CPI 93599 and *A. villosa* CPI 93621 (Kretschmer) were best of the new material.

Table 2.3.2.4.1 Plant Counts (plants/sq m), Miriam Vale Series 1

	Date Sown	25-Jan-93			
Species	**Acc./Cv.**	Year 1 23-Mar-93	Year 2 9-Jun-94	Year 3 9-May-95	Year 4 16-Apr-96
A. americana	91235	10.4	4.4	0.2	0
A. americana	93624	6.2	19	6.6	5.4
A. americana	Glenn	8.8	29.6	6.5	1.6
A. americana	Lee	11.2	21.8	1.5	1.2
A. brasiliana	92519	20.6	*	*	*
A. brasiliana	93592	11.6	*	*	*
A. histrix	93636	13.2	6.8	3.5	0.7
A. villosa	37235	5.8	8.1	1.2	0.0
A. villosa	91209	15	20.9	4.7	0.5
A. villosa	93621	24.2	39.6	6.6	0.9
C. rotundifolia	85836	4.8	14.6	12.8	13.2
C. rotundifolia	86172	8.4	13.2	21.1	12.4
C. rotundifolia	Wynn	11.5	12.9	18.0	11.8
S. hamata	Verano	5	25	10.7	10.3
S. scabra	Seca	7.2	8.4	12.3	11.7

* sprayed

Table 2.3.2.4.2 Legume Dry Matter Yield (kg/ha), Miriam Vale Series 1

	Date Sown	25-Jan-93		
Species	**Acc./Cv.**	Year 2 9-Jun-94	Year 3 9-May-95	Year 4 16-Apr-96
A. americana	91235	52	0	0
A. americana	93624	170	9	184
A. americana	Glenn	234	13	80
A. americana	Lee	471	21	90
A. brasiliana	92519	*	*	*
A. brasiliana	93592	*	*	*
A. histrix	93636	116	70	32
A. villosa	37235	66	0	0
A. villosa	91209	134	27	0
A. villosa	93621	234	46	22
C. rotundifolia	85836	301	362	242
C. rotundifolia	86172	424	1106	634
C. rotundifolia	Wynn	333	467	479
S. hamata	Verano	217	398	359
S. scabra	Seca	208	1408	3042

* sprayed

Table 2.3.2.4.3 Plant Counts (plants/m2) and Dry Matter Yield (kg/ha), Bororen Series 3

	Date Sown	16-Jan-95		
		Population		Yield
	Sampling Date:	8-May-95	15-Apr-96	15-Apr-96
Species	**Acc./Cv.**	Year 1	Year 2	Year 2
Aeschynomene americana	Lee	17.7	7.6	285
Aeschynomene histrix	93599	37	10.9	259
Aeschynomene histrix	93636	55.6	7.8	127
Aeschynomene histrix	93638	29.9	5.6	185
Aeschynomene villosa	37235	40.5	2.2	6
Aeschynomene villosa	91209	23.7	5.9	33
Aeschynomene villosa	93621	38.6	11.6	148
Alysicarpus monilifer	52343	0.4	0.5	8
Alysicarpus rugosus	51655	0.6	0.8	0
Alysicarpus rugosus	69487	0.7	0.2	0
Chamaecrista rotundifolia	Wynn	28	33.3	1298
Desmanthus virgatus	49728	5.1	1.2	17
Desmanthus virgatus	52401	5.2	0.7	0
Desmanthus virgatus	BB AC 10	14.9	1.2	15
Desmanthus virgatus	BB AC 11	24.1	0.3	8
Desmanthus virgatus	Jaribu	34.9	0	0
Macroptilium atropurpureum	84989	2.5	1.3	54
Macroptilium atropurpureum	Aztec	8.3	3.9	490
Stylosanthes hamata	Verano	17.7	22	599
Stylosanthes scabra	Seca	19.7	16.1	2559

Comment:

A lot of sown pasture development has and is taking place in the Miriam Vale area with Seca, Verano/Amiga, Oxley and Wynn. Response to a survey of 12 producers at a pasture walk indicated mixed feelings about Wynn with the two main concerns being palatability and legume dominance. However eight producers classified it as a useful legume and two said it was not.

Comments on Wynn cassia; summary responses to a survey of producers from 12 properties attending the Miriam Vale Rural Science and landcare field day in May 1996. Five questions were answered by "✓ " a YES/NO box with the option for comment.

Question	Response		
1. Area planted to Wynn?	6 >40 ha,	5 10-40 ha,	1 none
	YES	NO	UNCERTAIN
2. Has fertiliser been applied?	9	2	
3. A useful legume?	8	2	1
4. Will you plant more?	4	7	
5. Would you like a higher yielding type?	5	4	2

Comments from "NO voters" to Q4: too aggressive, unpalatable, invasive, pest risk, now spreading naturally, better alternatives available.

2.3.2.5 DUARINGA:

Collaborators: CH Middleton, JF Compton, DPI

Co-operator: Col and Cathy Dunne

Location: "Sorrell Hills", $23^0$43'S, $149^0$40'E, alt 95 m ASL

Soil description: sandy surface duplex in poplar box woodland

Soil analysis (0-10 cm):

pH	**Cl (mg/kg)**	**P_b (mg/kg)**	**Ca (meq%)**	**Mg (meq%)**	**Na (meq%)**	**K (meq%)**	**EC (mS/cm)**
6.4	10	16	1.90	0.84	0.03	0.21	0.02

Dates sown: Series 1, 10 February 1993 (resown 1 March 1994);
Series 2, 1 March 1994, Series 3,25 January 1995

Rainfall (mm):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1993	56	36	3	0	15	9	38	22	36	25	115	49	404
1994	27	32	124	7	7	20	5	0	14	16	0	46	298
1995	44	44	67	0	41	0	8	65	0	93	44	88	494
1996	214	19	0	106	8	42							
AAR Duar.	122	117	75	45	36	39	29	24	26	45	68	99	727

Results and Discussion:

The site has been characterised by severe drought in all years except 1995-96 when summer rainfall approached normal. 'Drought' effects were accentuated by the deep, sandy textured surface soil.

Establishment:

Series 1. The *Stylosanthes* group and *Chamaecrista rotundifolia* established the best. Of the *Aeschynomene* lines, only *A. brasiliana* CPI 92519 and cv Lee gave reasonable establishment populations.

Series 2. Fair to good establishment populations were recorded on all except some lines of *Desmanthus* (Bayamo, Uman, CPI 55719, Archer dolichos and Seca (poor seed quality?). *Desmanthus* CPI 30205 and cv Marc were best of the desmanthus to establish.

Series 3. There was generally poor establishment of all legumes except Stylo and *A. brasiliana* CPI 92519,

Performance:

Series 1. The commercial stylos, particularly Seca and Siran, showed best suitability to the soils (sandy surface) and climate conditions (drought). Of the new lines *A. brasiliana* CPI 92519 exhibited excellent persistence.

Series 2. *C. rotundifolia* CPI 93094 showed best performance. Of the *Desmanthus* lines, Marc, BBAC 11 and CPI 30205 were best.

Series 3. *A. brasiliana* CPI 92519 was the best of the new lines.

Summary:

In drought conditions on a relatively deep sandy surface soil the resilience and superiority of *S. scabra* was obvious. The best of the new material was *A. brasiliana* CPI 92519 which demonstrated remarkable drought tolerance.

Seca stylo is the legume sown by most properties in central Queensland. The most common method is flying or ground spreading into spear grass following a burn? Some Wynn is successfully sown but is not as popular due to less drought tolerance and low palatability? Siratro is used in some legume/grass mixtures on better soils.

Table 2.3.2.5.1. Plant Counts (plants/m2) and Legume Dry Matter Yield (kg/ha), Duaringa Series 1

Species	Acc./Cv.	Date Sown 10-Feb-93 (Resown 1-Mar-94) Population		Yield ve
		Year 1 25-May-94	Year 3 10-Oct-95	Year 3 10-Oct-95
A. americana	91235	0.1	0	0
A. americana	93624	0.0	0	0
A. americana	Glenn	0.2	0	0
A. americana	Lee	1.9	0	0
A. brasiliana	92519	2.6	4	293
A. histrix	93636	0.3	0.6	59
A. villosa	37235	1.6	0	0
A. villosa	91209	0.2	0	0
A. villosa	93621	0.2	0	0
C. rotundifolia	85836	5.3	0.8	12
C. rotundifolia	86172	3.9	0	0
C. rotundifolia	Wynn	7.3	4	216
S. hamata	Amiga	13.4	15.8	323
S. hamata	Verano	12.8	9.6	460
S. scabra	Seca	7.5	14	570
S. scabra	Siran	7.3	6.6	763

ve = visual estimation

Table 2.3.2.5.2 Plant Counts (plants/m^2) and Legume Dry Matter Yield (kg/ha), Duaringa Series 2

Date Sown 3-Mar-94		Population		Yield ve
Species	Sampling Date: Acc/Cv	25-May-94 Year 1	10-Oct-95 Year 2	10-Oct-95, ve Year 2
Aeschynomene falcata	Bargoo	13.8	0.6	15
Chamaecrista pilosa	CPI57503	10.	3.2	55
Chamaecrista pilosa (Col's)	57503	4.7	1	24
Chamaecrista rotundifolia	CPI93094	22.4	9.2	195
Chamaecrista rotundifolia	Wynn	5.2	3.2	100
Desmanthus virgatus	Bayamo	0.5	0.6	11
Desmanthus virgatus	BB AC 10	6.4	2.8	59
Desmanthus virgatus	BB AC 11	2.9	4.4	116
Desmanthus virgatus	CPI30205	11.5	7.6	61
Desmanthus virgatus	CPI33201	2.2	1.4	32
Desmanthus virgatus	CPI37538	2.	0	0
Desmanthus virgatus	CPI38351	1.2	0.25	5
Desmanthus virgatus	CPI40071	2.8	2.2	64
Desmanthus virgatus	CPI52401	6.	3.6	48
Desmanthus virgatus	CPI55719	0.5	0	0
Desmanthus virgatus	CPI79653	4.4	1.4	36
Desmanthus virgatus	CPI85178	7.	1.6	21
Desmanthus virgatus	CPI90754	3.9	0.6	36
Desmanthus virgatus	Marc	12.4	11.6	62
Desmanthus virgatus	TQ90	3.	0	0
Desmanthus virgatus	Uman	0.2	0	0
Macrotyloma axillare	Archer	0.5	0	0
Macrotyloma axillare	CPI52469	6.2	0	0
Stylosanthes scabra	Seca	0.8	1.6	37

v e = visual estimation

Table 2.3.2.5.3 Plant Counts (plants/m^2) and Legume Dry Matter Yield (kg/ha), Duaringa Series 3

Date Sown 20-Jan-95		Population		Yield ^{ve}
	Sampling Date:	21-Mar-95	10-Oct-95	10-Oct-95
Species	**Acc./Cv.**	Year 1	Year 2	Year 2
Aeschynomene americana	Lee	0.2	0	0
Aeschynomene brasiliana	92519	4.8	3.4	52
Aeschynomene histrix	93599	1.2	2	24
Aeschynomene histrix	93636	0.6	0.4	16
Aeschynomene histrix	93638	2.0	1.4	8
Alysicarpus monilifer	52343	2.8	0	0
Alysicarpus rugosus	51655	0	0	0
Alysicarpus rugosus	69487	0.4	0	0
Atylosia sericea	30042	0	0.2	0
Chamaecrista rotundifolia	Wynn	1.8	2.6	29
Desmanthus virgatus	49728	0.0	0.2	2
Desmanthus virgatus	52401	0.0	0	0
Desmanthus virgatus	67643	0.4	0.2	0
Desmanthus virgatus	Jaribu	2.4	0.8	19
Macroptilium atropurpureum	84989	0	0	0
Macroptilium atropurpureum	Aztec	0.2	0	0
Stylosanthes hamata	Verano	5.2	17	33
Stylosanthes scabra	Seca	3.4	4.6	18

v e = visual estimation

3.3.2.6 ST LAWRENCE:

Collaborators: HG Bishop, JJ Bushell, TB Hilder, DPI

Co-operator: J and V Olive

Location: "Granite Vale". 22^{0}25'S, 149^{0}32'E. 10 km S St Lawrence

Soil description: Solodic duplex with thin loamy surface; principal profile form Db 2.41

Soil Analysis:

Depth (cm)	pH	Cl (mg/kg)	P(bicarb) (mg/kg)	Ca (meq %)	Na (meq %)	K (meq %)	EC (mS/cm)
0-10 (bulk)	6.2	31	14	3.0	0.42	0.16	0.055
0-10	6.0	36	15			0.15	
10-20	6.4	62					
20-30	6.2	239					
30-50	6.9	663					
50-70	7.3	1200		1.7	9.8		
70-100	6.5	1316		1.1	8.7		

Soil Fractions (%):

Depth	c-sand	f-sand	silt	clay
0-10 (bulk)	16	42	21	25
0-10				
10-20				
20-30	10	25	17	50
30-50				
50-70	11	26	29	40
70-100	12	28	31	34

Dates sown: Series 1, 3 December 1992; Series 2, 1 December 1993; Series 3, 12 January 1995.

Rainfall (mm):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1992											44	94	
1993	172	36	77	0	0	11	43	46	37	19	54	27	522
1994	27	55	278	6	14	0	7	0	0	48	45	52	532
1995	36	82	56	40	48	10	0	78	0	80	194	105	729
1996	339	0	0	241	0	29							
AAR St Law	214	201	143	61	48	51	33	21	27	45	69	125	1040

Results and Discussion:

Rainfall has been well below average for each year. Although the 1995/96 summer started well no rain was received from early January till late April 1996.

Series 1 (Table 2.3.2.6.1). All legumes had reasonable establishment but by year 4 only the stylos, *A. brasiliana* CPI 92519 and *Desmanthus* registered a yield. A few of the other legumes had some seedling regeneration from the April 1996 rain. *Chamaecrista* lines have not grown well at this site.

Series 2 (Table 2.3.2.6.2). Bargoo, *Chamaecrista*, Seca and a number of the *Desmanthus* lines established best. *Chamaecrista* and Bargoo declined but many plants would have died out prior to the April 1996 rain. A number of *Desmanthus* lines have increased their population and have good seedling recruitment.

Series 3 (Table 2.3.2.6.3). All of the *Desmanthus* lines increased their population in year 2 as has *A. brasiliana* CPI 92519 and the stylos.

Comment:

Seca/Siran and Verano/Amiga are well adapted to this area and are the legumes sown in commercial pasture development. Glenn has been sown on this property in the past and has grown well in average rainfall years if good seed yields are produced in the first year. However persistence in the long term has not been achieved

Desmanthus material has consistently established and grown well in this soil, contrary to their performance in most sub-coastal duplex soils. A closer look at the profile soil analyses for this site and "Glensfield", Sarina, suggests the higher silt/clay content compared to "Glensfield" may be the most likely reason for better growth at St Lawrence. Soil surface P level is also higher.

The best non cultivar is *A. brasiliana* CPI 92519 which has persisted and been well grazed at this site.

Table 2.3.2.6.1 Plant Counts (plants/m ^{2}) and Dry Matter Yield (kg/ha), St Lawrence Series 1

Date Sown 3-Dec-92		Population				Yield ^{ve}		
		Year 1	Year 2	Year 3	Year 4	Year 2	Year 3	Year 4
Species	**Acc./Cv.**	18-Feb-93	26-May-94	5-Apr-95	12-Jun-96	26-May-94	5-Apr-95	12-Jun-96
A. americana	56282	10.1	0.3	0.9	0 (0)	18	6	0
A. americana	91235	6.4	0.0	0.0	1 (0)	0	28	0
A. americana	93624	3.8	1.4	0.2	0 (.6)	46	0	0
A. americana	93661	9.5	2.4	2.9	0.6 (9)	45	109	0
A. americana	Glenn	15.8	1.2	0.2	0 (0)	26	0	0
A. americana	Lee	13.2	3.6	0.8	0.2 (.7)	285	34	0
A. brasiliana	92519	18.1	8.9	16.4	6.4 (3.2)	876	457	300
A. brasiliana	93592	23.0	*	*	*	*	*	*
A. histrix	93636	13.1	4.0	1.5	0 (0)	127	38	0
A. villosa	37235	14.3	0.1	0.0	0 (0)	0	0	0
A. villosa	91209	4.8	0.0	0.0	1 (0)	0	5	0
A. villosa	93621	3.0	0.1	0.0	0 (4.6)	5	0	0
C. rotundifolia	85836	2.5	0.8	2.3	0.4 (4.4)	17	67	0
C. rotundifolia	86172	2.4	0.3	0.6	0 (0)	23	19	0
C. rotundifolia	Wynn	30.6	2.5	3.0	0 (1)	103	25	0
D. virgatus	Bayamo	9.4	4.2	8.5	3.8 (9.5)	239	281	200
D. virgatus	Uman							
S. hamata	Amiga	11.2	16.1	27.9	30.7 (23.5)	598	287	300
S. hamata	Verano	5.7	15.3	20.9	30.2 (13.3)	816	237	300
S. scabra	Seca	5.8	14.5	14.9	16.4 (13.3)	858	410	600
S. scabra	Siran	15.0	15.8	13.9	20.1 (13.7)	1031	523	600

* sprayed out ( ) seedlings ve = visual estimation

Table 2.3.2.6.2 Plant Counts (plants/m^2) and Dry Matter Yield (kg/ha), St Lawrence Series 2

Date Sown 1-Dec-93		Population			Yield
Species	Sampling Date: Acc/Cv	7-Feb-94 Year 1	6-Apr-95 Year 2	12-Jun-96 Year 3	6-Apr- 95 Year 2
Aeschynomene falcata	Bargoo	10.7	9.	0 (.5)	147
Chamaecrista pilosa	CPI57503	4.3	8.6	1.1 (3.7)	127
Chamaecrista rotundifolia	CPI93094	6.6	37.2	1.1 (12.9)	925
Chamaecrista rotundifolia	Wynn	7.9	32.3	0.2 (10.1)	525
Desmanthus virgatus	Bayamo	4.8	8.3	8.2 (18.3)	1048
Desmanthus virgatus	BB AC 10	2.3	5.6	4.9 (5.8)	378
Desmanthus virgatus	BB AC 11	3.2	6.3	5.4 (13.7)	587
Desmanthus virgatus	CPI30205	5.4	7.9	3.6 (2.9)	594
Desmanthus virgatus	CPI33201	0.8	1.	1.2 (1.9)	171
Desmanthus virgatus	CPI37143	1.2	3.8	4.5 (.1)	274
Desmanthus virgatus	CPI37538	4.	3.6	0.9 (.2)	35
Desmanthus virgatus	CPI38351	3.1	9.8	8.4 (19.7)	993
Desmanthus virgatus	CPI40071	2.9	5.1	2.6 (2.7)	485
Desmanthus virgatus	CPI49728	4.4	3.6	3.2 (1.6)	314
Desmanthus virgatus	CPI52401	5.3	8.1	6.2 (9.4)	557
Desmanthus virgatus	CPI55719	1.3	4.1	1.3 (1.8)	354
Desmanthus virgatus	CPI67643	3.6	5.5	2.2 (3.7)	755
Desmanthus virgatus	CPI78372	3.5	9.9	4.2 (6.8)	196
Desmanthus virgatus	CPI79653	3.9	6.9	1.9 (1.5)	60
Desmanthus virgatus	CPI85178	1.1	2.	0.9 (0)	41
Desmanthus virgatus	CPI90754	0.3	0.4	0.3 (.2)	21
Desmanthus virgatus	Marc	6.9	5.7	3.7 (.7)	213
Desmanthus virgatus	TQ90	2.2	3.8	5.8 (12.3)	279
Desmanthus virgatus	Uman	0.8	2.2	0.7 (.8)	298
Macrotyloma axillare	Archer	0.9	0.1	0 (0)	12
Macrotyloma axillare	CPI52469	0.5	0.2	1 (0)	1
Stylosanthes scabra	Seca	5.4	11.6	11.9 (9.9)	1332

( ) seedlings

Table 2.3.2.6.3 Plant Counts (plants/m^2), St Lawrence Series 3

	Date Sown	12-Jan-95	
Species	Sampling Date: **Acc./Cv.**	6-Apr-95 Year 1	12-Jun-96 Year 2
Aeschynomene americana	Lee	1.4	1 (25)
Aeschynomene brasiliana	92519	3.1	7 (4)
Aeschynomene histrix	93599	0.0	0 (0)
Aeschynomene histrix	93636	1.9	0 (0)
Aeschynomene histrix	93638	3.0	1 (0)
Alysicarpus monilifer	52343	0.3	0 (0)
Alysicarpus rugosus	51655	0.0	1 (0)
Alysicarpus rugosus	69487	0.1	2 (0)
Atylosia sericea	30042	0.9	3 (0)
Chamaecrista rotundifolia	Wynn	3.2	0 (34)
Desmanthus virgatus	49728	1.1	5 (2)
Desmanthus virgatus	52401	0.4	2 (2)
Desmanthus virgatus	BB AC 10	1.7	12 (12)
Desmanthus virgatus	BB AC 11	1.6	32 (31)
Desmanthus virgatus	Jaribu	2.9	8 (4)
Macroptilium atropurpureum	84989	0.5	2 (1)
Macroptilium atropurpureum	Aztec	2.3	2 (14)
Stylosanthes hamata	Verano	3.5	49 (62)
Stylosanthes scabra	Seca	2.9	16 (14)

( ) seedlings

2.3.2.7 NEBO:

Collaborators: HG Bishop, JJ Bushell, TB Hilder, DPI

Co-operator: Geoff and Ruth Bethel

Location: "Willunga". 22^{0}20'S, 148^{0}37'E, alt 160 m ASL

Soil description: Solodic (Dy 2.33) with sandy clay loam surface

Soil analysis:

pH	Cl (mg/kg)	P(bicarb) (mg/kg)	SO_4-S (mg/kg)	Ca (meq %)	Mg (meq %)	Na (meq %)	K (meq %)	EC (mS/cm)
7.2	6.0	21	4.0	8.9	1.8	0.08	0.54	0.08

Dates sown: Series 2, 7 December 1993; Series 3, 11 January 1995

Rainfall (mm):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1993									10	42	97	43	
1994	42	111	224	0	0	0	0	0	0	59	26	19	481
1995	45	66	47	4	70	0	0	59	2	105	51	29	478
1996	81	0	0	50	22	0							
AAR	124	114	73	32	28	34	24	16	19	33	64	85	646

Results and Discussion:

Rainfall has been well below average and erratic offering harsh conditions for establishment. In Series 2 many of the *Desmanthus* lines have persisted as well as Seca but only at levels of around one plant/m^2 (Table 2.3.2.7.1). Virtually no establishment occurred with the Series 3 sowing.

Table 2.3.2.7.1 Plant Counts (plants/m²), Nebo Series 2

		Planted: 7 Dec 1993	
Species	Sampling Date: Acc/Cv	1-Jun-94 Year 1	14-May-96 Year 3
Aeschynomene falcata	Bargoo	1.1	0.
Desmanthus virgatus	Bayamo	0.5	0.4
Desmanthus virgatus	BB AC 10	2.	0.7
Desmanthus virgatus	BB AC 11	1.8	1.5
Desmanthus virgatus	CPI30205	1.4	0.3
Desmanthus virgatus	CPI33201	0.4	0.6
Desmanthus virgatus	CPI37143	0.5	0.4
Desmanthus virgatus	CPI37538	1.3	0.
Desmanthus virgatus	CPI38351	1.2	0.6
Desmanthus virgatus	CPI40071	1.8	0.6
Desmanthus virgatus	CPI52401	1.2	0.2
Desmanthus virgatus	CPI55719	0.2	0.
Desmanthus virgatus	CPI78372	1.2	0.9
Desmanthus virgatus	CPI79653	1.5	0.4
Desmanthus virgatus	CPI85178	0.	0.1
Desmanthus virgatus	CPI90754	0.5	0.
Desmanthus virgatus	Marc	2.6	0.2
Desmanthus virgatus	TQ90	1.5	1.2
Desmanthus virgatus	Uman	0.	0.
Stylosanthes scabra	Seca	1.5	0.8

2.3.2.8 SARINA:

Collaborators: HG Bishop, JJ Bushell, TB Hilder, DPI

Co-operator: J and R Cox

Location: "Glensfield", Blue Mountain. $21^0$28'S, $145^0$58'E

Soil description: Solodic (Dy 3.43) with loamy sand surface

Soil analysis:

Depth (cm)	pH	Cl (mg/kg)	P(bicarb) (mg/kg)	Ca (meq %)	Na (meq %)	K (meq %)	ECEC (meq % OD)
0-10 (bulk)	6.2	10	9	2.9	0.10	0.09	5
0-10	5.8	13	8	3.2	0.11	0.08	5
10-20	6.1	10		2.6	0.09		4
20-30	6.4	10		3.0	0.11		4
30-50	6.7	10		4.6	0.38		8
50-70	6.8	34		6.3	0.65		11
70-100	7.4	114		8.1	1.6		16

Soil Fractions (%):

Depth	c-sand	f-sand	silt	clay
0-10 (bulk)	36	43	12	9
0-10	40	40	12	9
10-20	44	38	7	11
20-30	44	32	5	19
30-50	34	21	5	41
50-70	23	20	9	49
70-100	21	21	9	49

Dates sown: Series 1, 26 November 1992; Series 2, 16 November 1993; Series 3, 10 January 1995

Rainfall (mm):

	J	F	M	A	M	J	J	A	S	O	N	D	Total
1992											11	120	
1993	344	125	19	44	24	24	30	45	26	41	122	80	924
1994	81	83	285	26	23	7	19	5	3	36	13	96	677
1995	151	219	27	19	52	26	3	142	0	69	112	119	939
1996	236	53	42	171	9	48							
AAR	221	192	157	68	40	37	27	20	20	33	49	105	969

Results and Discussion:

Establishment conditions for Series 1 planting was adequate but dry conditions set in after February 1993, restricting seed set in many legumes. Rainfall in the second growing season was well below average except for March. The third growing season was again very short, starting late and finishing in February. The fourth summer was above average for November, December and January but February and March were well below average with April again above average. This site has received several frosts during each winter sufficient to "cut" top growth of all legumes.

Series 1 (Tables 2.3.2.8.1 and 2.3.2.8.2): On persistence (counts) and yields the high performing legumes are the *Chamaecrista* group, the stylos and *A. brasiliana* CPI 92519. Wynn and CPI 86172 are similar and both ahead of CPI 85836. The higher populations in Amiga over Verano was related to seed quality although Verano has closed the gap by year 4. In the past commercial seed of Amiga and Siran was sold as naked seed while Verano and Seca was sold "in pod". One has to be careful in evaluation work that equivalent amounts of viable seed is sown and this point needs to be considered when interpreting initial legume populations.

Of the other *Aeschynomene* material, *A. histrix* and *A. villosa* CPI 91209 (Reid) and CPI 93621 (Kretschmer) have performed creditably given the low and variable rainfall conditions. Lee has performed best of the *A. americana* material but all have failed to handle the variable conditions. All three *Desmanthus* cultivars failed to persist. The results of soil seed reserves and legume quality studies at this site are shown in sections 2.3.7 and 2.3.8.

Series 2 (Table 2.3.2.8.3): *Chamaecrista* again had highest populations and yield at the end of year 3. *Macrotyloma axillare* CPI 52469 outperformed cultivar Archer, but both appeared unpalatable to cattle and ungrazed at time of recording. CPI 93599 is the best of the *A. histrix* accessions and Bargoo jointvetch is persisting well. None of the *Desmanthus* material appears to be adapted to soil conditions at this site.

Series 3. Legume population in the second summer was best for Wynn (14 m^2), *A. brasiliana* 92519 (9 m^2), *A. histrix* 93599 (5 m^2), Aztec (4 m^2) and Verano (8 m^2). *Alysicarpus*, *Atylosia* and Jaribu desmanthus have failed while Lee and Seca have 2 and 1 plant/m^2 respectively.

Comment:

Seca is the main commercial legume sown in this sub-coastal area of the Mackay hinterland with Verano/Amiga and Wynn also adapted but less reliable. This area receives quite heavy frosts in July and experiences a dry spring and early summer. It appears Reid and Kretschmer will be better adapted than Glenn and Lee. *A. brasiliana* CPI 92519 has persisted well and is quite well grazed, as is Wynn at this site.

Table 2.3.2.8.1 Plant Counts (plants/m²), Sarina Series 1

Species	Date Sown Acc./Cv.	26-Nov-92 Year 1 15-Jan-93	 Year 2 16-May-94	 Year 3 27-Apr-95	 Year 4 19-Mar-96
A. americana	91235	2.1	9	1.9	0.0
A. americana	93624	17.8	0.1	0.0	0.0
A. americana	Glenn	23.1	12.9	1.0	0.2
A. americana	Lee	21.8	18.5	1.2	1.1
A. brasiliana	92519	47.8	13.7	22.3	22.6
A. brasiliana	93592	46.5	*	*	*
A. histrix	93636	53.4	11.7	5.3	8.0
A. villosa	37235	28.7	5.9	7.2	1.0
A. villosa	91209	28.8	9.9	7.7	4.5
A. villosa	93621	23.3	12.9	9.4	4.3
C. rotundifolia	85836	6.2	11.5	9.8	18.6
C. rotundifolia	86172	8.3	13.1	22.0	25.3
C. rotundifolia	Wynn	35.1	18.4	29.7	51.7
D. virgatus	Marc	13.1	0.2	0.1	0.0
D. virgatus	Bayamo	19.8	0.7	1.0	0.0
D. virgatus	Uman	8.4	0.3	0.0	0.0
S. hamata	Amiga	34.2	32.2	23.7	34.8
S. hamata	Verano	14.8	19	14.1	29.6
S. scabra	Seca	21.6	21.3	18.8	17.6
S. scabra	Siran	51.3	24.3	18.6	21.2

( ) sprayed out

Table 2.3.2.8.2 Legume Dry Matter Yield (kg/ha), Sarina Series 1

	Date Sown 26-Nov-92				
Species	**Acc./Cv.**	Year 1 16-Jun-93	Year 2 16-May-94	Year 3 27-Apr-95	Year 4 19-Mar-96
A. americana	91235	244	191	99	0
A. americana	93624	1	0	0	0
A. americana	Glenn	690	183	0	13
A. americana	Lee	1005	1281	45	38
A. brasiliana	92519	899	1534	1641	1144
A. brasiliana	93592	1837	*	*	*
A. histrix	93636	1455	611	455	225
A. villosa	37235	34	79	41	0
A. villosa	91209	220	595	256	71
A. villosa	93621	284	562	305	72
C. rotundifolia	85836	161	661	378	1191
C. rotundifolia	86172	360	760	1126	2297
C. rotundifolia	Wynn	734	761	1053	2147
D. virgatus	Marc	75	0	0	0
D. virgatus	Bayamo	22	6	0	0
D. virgatus	Uman	99	0	0	0
S. hamata	Amiga	1342	1504	592	662
S. hamata	Verano	271	682	327	381
S. scabra	Seca	577	1059	1264	1511
S. scabra	Siran	461	1320	1528	1951

( ) sprayed out

Table 2.3.2.8.3 **Plant Counts (plants/m^2) and Dry Matter Yield (kg/ha), Sarina Series 2**

Date Sown 16-Nov-93		Population			Yield	
Species	Acc/Cv	5-Jan-94 Year 1	4-May-95 Year 2	19-Mar-96 Year 3	4-May-95 Year 2	19-Mar-96 Year 3
Aeschynomene falcata	Bargoo	10.	20.3	10.2	423	64
Aeschynomene histrix	CPI93599	19.3	11.1	13.3	1046	360
Aeschynomene histrix	CPI93636	5.3	7.5	5.3	570	311
Aeschynomene histrix	CPI93638	9.5	6.	2.4	444	150
Chamaecrista pilosa	CPI57503	18.8	16.5	21.6	1483	1418
Chamaecrista rotundifolia	CPI93094	17.3	26.4	34.7	1988	3453
Chamaecrista rotundifolia	Wynn	21.5	20.3	39.4	2005	3530
Desmanthus virgatus	Bayamo	18.	3.9	0.	25	0
Desmanthus virgatus	BB AC 10	5.8	2.7	0.	8	0
Desmanthus virgatus	BB AC 11	4.5	2.2	0.6	44	19
Desmanthus virgatus	CPI30205	7.8	1.	0.	73	0
Desmanthus virgatus	CPI33201	3.	0.6	1.	0	52
Desmanthus virgatus	CPI37143	2.8	0.6	0.	0	0
Desmanthus virgatus	CPI37538	3.5	0.3	0.	4	0
Desmanthus virgatus	CPI38351	5.8	1.4	0.	7	0
Desmanthus virgatus	CPI40071	4.8	2.	0.	6	0
Desmanthus virgatus	CPI49728	11.	3.1	0.	31	0
Desmanthus virgatus	CPI52401	5.5	2.6	0.6	57	19
Desmanthus virgatus	CPI55719	1.	0.7	0.	7	0
Desmanthus virgatus	CPI67643	3.	1.4	0.	50	0
Desmanthus virgatus	CPI78372	3.8	1.4	0.2	16	0
Desmanthus virgatus	CPI79653	1.	0.3	0.	4	0
Desmanthus virgatus	CPI85178	0.	0.2	0.2	9	18
Desmanthus virgatus	CPI90754	2.	1.	0.	3	0
Desmanthus virgatus	Marc	3.5	0.9	0.	0	0
Desmanthus virgatus	TQ90	2.8	1.7	0.4	28	0
Desmanthus virgatus	Uman	0.3	0.5	0.	0	0
Macrotyloma axillare	Archer	8.3	1.3	1.4	203	410
Macrotyloma axillare	CPI52469	8.	2.4	2.2	401	1480
Stylosanthes scabra	Seca	7.	9.9	9.7	714	1299

2.3.2.9 CHARTERS TOWERS:

Collaborators: D Cowan, TA James, R Ford, DPI; CP Gardiner, James Cook Uni, Townsville

Co-operator: M Andison

Location: "Braceborough". $20^0$29'S, $145^0$50'E, 50 km south-west of Charters Towers

Soil description: low fertility massive yellow earth with sandy surface, supporting silver-leafed ironbark

Dates sown: Series 2, 20 January 1994; Series 3, 8 February 1995.

Rainfall (mm):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1994	94	90	111	0	0	0	0	0	0	0	0	17	312
1995	30	167	0	6	29	0	0	52	0	20	55	21	380
1996	117	0	0	13	0	29							
AAR Chart T.	135	129	103	43	24	26	17	13	15	22	42	86	656

Results and Discussion:

Series 2 (table 2.3.2.9.1) had adequate rainfall to establish and at the end of winter all *Aeschynomene, Chamaecrista* lines and Seca stylo had good plant numbers. Several *Desmanthus* lines were present but plants small and weak. No rain fell between March and Christmas and the only legume with a reasonable population by May 1995 was *A. brasiliana* CPI 92519. Following another very short wet season by April 1996 only Seca, Marc, Wynn and CPI 93094 had surviving plants. *A. brasiliana* 92519 was sprayed out as it was not being grazed on this low P soil.

Series 3 (table 2.3.2.9.2) germinated well, receiving 100 mm over 2 days with 67 mm follow-up 2 weeks later. *A. brasiliana* CPI 92519 and Wynn were best but the wet season then stopped and native grasses competed strongly with the sown legumes. Only Verano, Seca and Wynn had reasonable populations with *A. histrix* lines having some plants surviving. *A. histrix* was heavily grazed by kangaroos.

The best non-cultivar was *A. brasiliana* CPI 92519 which established well and persisted under the very dry conditions. In Series 2 plots were continuously grazed from July of establishment year. The native grasses were heavily grazed but CPI 92519 only lightly grazed. Kangaroos heavily grazed *A. histrix* lines in both sowings (preventing seeding in Series 2) but they did not graze *A. brasiliana* CPI 92519. Seca, Verano and Wynn cassia were best of the commercial legumes but it's too early to say Wynn is well adapted.

Table 2.3.2.9.1 Plant Counts (plants/m^2), Charters Towers Series 2

	Date Sown	20-Jan-94		
Species	: Acc/Cv	2-Aug-94 Plants/m2 Year 1	9-May-95 Plants/m2 Year 2	10-Apr-96 Plants/m2 Year 3
Aeschynomene brasiliana	CPI92519	37.4	11.6	*
Aeschynomene brasiliana	CPI93592	56.2	0.	*
Aeschynomene falcata	Bargoo	33.4	1.4	0.
Aeschynomene histrix	CPI93599	67.8	0.2	0.
Aeschynomene histrix	CPI93636	17.4	0.6	0.
Aeschynomene histrix	CPI93638	31.8	0.2	0.
Chamaecrista pilosa	CPI57503	6.2	0.2	0.
Chamaecrista rotundifolia	CPI85836	27.	0.4	0.
Chamaecrista rotundifolia	CPI86172	33.6	0.	0.
Chamaecrista rotundifolia	CPI93094	24.4	2.2	1.
Chamaecrista rotundifolia	Wynn	30.6	1.	1.
Desmanthus virgatus	Bayamo	0.	0.	0.
Desmanthus virgatus	BB AC 10	0.	0.	0.
Desmanthus virgatus	BB AC 11	0.	0.	0.
Desmanthus virgatus	CPI30205	5.2	0.	0.
Desmanthus virgatus	CPI33201	0.	0.	0.
Desmanthus virgatus	CPI37143	0.4	0.	0.
Desmanthus virgatus	CPI37538	1.4	0.	0.
Desmanthus virgatus	CPI38351	0.4	0.	0.
Desmanthus virgatus	CPI40071	0.	0.	0.
Desmanthus virgatus	CPI52401	0.8	0.	0.
Desmanthus virgatus	CPI55719	6.	0.	0.
Desmanthus virgatus	CPI78372	0.	0.4	0.
Desmanthus virgatus	CPI79653	0.	0.	0.
Desmanthus virgatus	CPI85178	0.	0.	0.
Desmanthus virgatus	CPI90754	0.	0.	0.
Desmanthus virgatus	Marc	6.6	1.	4.
Desmanthus virgatus	TQ90	0.	0.	0.
Desmanthus virgatus	Uman	0.	0.	0.
Macrotyloma axillare	Archer	0.8	0.	0.
Macrotyloma axillare	CPI52469	1.6	0.	0.
Stylosanthes scabra	Seca	10.4	0.8	5.

* sprayed out

Table 2.3.2.9.2 Plant Counts (plants/m²), Charters Towers Series 3

	Date Sown 8-Feb-95		
Species	Sampling Date: **Acc./Cv.**	9-May-95 Year 1	10-Apr-96 Year 2
Aeschynomene americana	Lee	0.2	0.0
Aeschynomene brasiliana	92519	34.0	*
Aeschynomene histrix	93599	1.8	1.1
Aeschynomene histrix	93636	6.0	2.7
Aeschynomene histrix	93638	20.4	1.5
Alysicarpus monilifer	52343	0.0	0.0
Alysicarpus rugosus	51655	14.0	0.0
Alysicarpus rugosus	69487	25.2	0.0
Atylosia sericea	30042	0.6	0.0
Centrosema brasilianum	55698	0.4	0.0
Centrosema pascuorium	Cavalcade	10.4	0.0
Chamaecrista rotundifolia	Wynn	31.6	14.9
Desmanthus virgatus	49728	9.8	0.0
Desmanthus virgatus	52401	1.4	0.0
Desmanthus virgatus	BB AC 10	7.4	0.0
Desmanthus virgatus	BB AC 11	0.0	0.0
Desmanthus virgatus	Jaribu	4.6	0.0
Macroptilium atropurpureum	61232	0.0	0.0
Macroptilium atropurpureum	67647	0.8	0.0
Macroptilium atropurpureum	84989	1.0	0.0
Macroptilium atropurpureum	Aztec	5.8	0.0
Macroptilium bracteatum	53770	2.4	0.0
Macroptilium martii	55782	0.2	0.0
Stylosanthes hamata	Verano	17.0	30.4
Stylosanthes scabra	Seca	6.8	17.0

* sprayed out

2.3.2.10 AYR:

Collaborators: HG Bishop, JJ Bushell, TB Hilder, DPI

Co-operator: DPI (K Jeppesen)

Location: Swans Lagoon Research Station, Millaroo. 20°05'S, 147°15'E

Soil description: Solodic (Dy 3.33). hard setting surface.

Soil analysis:

pH	Cl (mg/kg)	P(bicarb) (mg/kg)	Ca (meq %)	Mg (meq %)	Na (meq %)	K (meq %)	ECEC (meq % OD)
6.1	10	3	1.8	0.74	0.06	0.22	3.0

Dates sown: Series 1, 7 January 1993, Series 2, 9 December 1993, Series 3, 21 February 1995

Rainfall (mm):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1992											16	93	
1993	121	55	0	0	0	0	26	13	28	14	102	10	369
1994	35	373	231	0	17	0	0	0	5	10	0	51	722
1995	48	184	43	0	10	0	0	92	0	77	67	78	599
1996	401	0	29	27	13	37	4						
AAR Clare	238	189	141	46	31	21	15	10	11	16	36	96	852

Results and Discussion:

For Series 1 rainfall was low and erratic and conditions for establishment and growth severe. The Series 2 planting was swamped with weeds (*Indigofera* and *Sida*) following heavy February/March rain in 1994 and plots were slashed. Little follow up rain occurred. Series 3 received little follow-up rain, after sowing in late February 1995.

Series 1 (Table 2.3.2.10.1). By year 4 only stylo, *Chamaecrista* and *A. brasiliana* CPI 92519 plants were surviving. Seca had the highest drymatter yield followed by *A. brasiliana* CPI 92519, Wynn cassia and *C. rotundifolia* CPI 86172. CPI 85836 which is 2 weeks later flowering than CPI 86172 did not re-establish in the second year. Verano and Amiga have a high population of small plants which are heavily grazed. Seca is developing a dense stand with plants to 60 cm being top grazed while *Chamaecrista* and *A. brasiliana* CPI 92519 are moderately grazed.

Series 2 and Series 3 have few legumes established other than *Chamaecrista* lines, *A. brasiliana* CPI 92519 and Seca. Over the next two years all three plantings will be monitored for persistence and yield, competition with native companion grasses and amount of legume eaten (by use of exclosure cages).

The commercial cultivars Wynn and Seca are very well adapted to this environment. Seca is widely sown by producers but there is a need for well adapted, less aggressive alternative legumes of higher forage quality. *A. brasiliana* CPI 92519 is well adapted but its "stickiness" has raised some doubts on general palatability, LWG data is required before release is contemplated. As is noted in section 2.3.4 the Mt Garnet site to obtain LWG data has been droughted since commencement in 1991/92.

Table 2.3.2.10.1 Plant Counts (plants/m^2) and Legume Dry Matter Yield (kg/ha), Ayr Series 1

Date Sown 7-Jan-93		Population				Yield	
		Year 1	Year 2	Year 3+	Year 4	Year 2	Year 3^{ve}
Species	**Acc./Cv.**	10-Feb-93	11-May-94	20-Apr-95	9-Feb-96	11-May-94	20-Apr-95
A. americana	91235	3.9	0	0	0	8	0
A. americana	93624	5.6	0.1	0	0	5	0
A. americana	Glenn	4.9	0.4	0	0	63	0
A. americana	Lee	1.2	0.8	0	0	13	0
A. brasiliana	92519	10.2	11.6	95	11.2	4669	2000
A. brasiliana	93592	11.9	*	*	*	*	*
A. histrix	93636	0.3	0.6	0	0	54	0
A. villosa	37235	7	0.3	0	0	4	0
A. villosa	91209	2.7	1.7	0	0	10	0
A. villosa	93621	5.6	0.3	0	0	0	0
C. rotundifolia	85836	0.9	2.5	0	0	584	0
C. rotundifolia	86172	0.7	6.5	83	18.4	3135	1500
C. rotundifolia	Wynn	5.5	6.2	83	38.4	1731	1600
S. hamata	Amiga	6.4	8.1	68	58.8	2960	800
S. hamata	Verano	8.2	8	95	88.9	2124	1000
S. scabra	Seca	4	8.3	93	30	3168	4000

* plots sprayed out + frequency % v e = visual estimation

2.3.2.11 MT GARNET:

Collaborators: Kev Shaw, Col Webb, DPI

Co-operator: Robert and Lorraine Henry

Location: Sugarbag Station, 32 km SW of Mt Garnet, $17^0$40'S, $144^0$55'E

Soil description: Yellow duplex with sandy loam surface.

Soil analysis (0-10 cm):

pH (1:5 H_2O)	**EC** dS/m	**P_b** mg/kg	**K** me/100 g	**Ca** me/100 g	**Mg** me/100 g	**Zn** mg/kg
6.6	0.01	3	0.1	1.10	0.18	0.2

Dates sown: Series 2, 17 February 1994; Series 3, 2 February 1995.

Companion grass: Native pasture

Rainfall:

	J	A	S	O	N	D	J	F	M	A	M	J	Total
91/92	0	0	0	0	41	31	53	380	0	0	18	0	523
92/93	0	0	54	0	35	74	26	115	64	0	0	0	368
93/94	41	0	0	0	20	0	103	95	39	0	0	19	317
94/95	21	0	0	0	0	67	60	163	79	0	36	12	438
95/96	0	76	0	21	85	85	218	83	75	56	0	11	710
AAR Mt Garnet	180	192	138	39	23	21	11	7	7	19	57	115	810

Results and discussion:

Establishment of Series 2 lines generally failed with the exceptions *C. pilosa* CPI 57503 and *C. rotundifolia* CPI 93094 and Seca which, in 1996, produced 263, 525 and 188 kg DM/ha respectively of a total pasture yield of approximately 750 kg/ha. Of the series 3 lines, only *A. brasiliana* CPI 92519, Wynn, Verano and Seca were present but yields were all less than 100 kg/ha and plant numbers were low.

There is no doubt as to the ability of CPI 92519 to cope with drought. Of more concern is its lack of acceptability to stock and its capacity to shed leaf in the dry season. Cattle do eat this legume but it is certainly not sought out.

General comments:

To date, the main outcome of the BULS project in the far northern dry tropics has been confirmation that *A. brasiliana* CPI 92519 is able to establish and grow under conditions of extreme drought. An unfortunate attribute of the plant is its propensity to drop its leaf even in the early dry season. In this respect it appears to shed leaf even earlier than Wynn and certainly much earlier than Seca.

Whether or not the new *Chamaecrista* lines see the light of day depends to some extent on their relative performance with respect to Wynn as well as a resolution of the question of both the acceptability and digestibility of the new *rotundifolias.* In the far north at least there is still much to learn about the limits to the adaptation of Wynn. Certainly its acceptance by stock is unquestioned.

Both Wynn cassia and Siran stylo (particularly the latter) have now been available for some years but their use has been restricted. A possible reason is a recognition that pasture workers have over-reacted to the anthracnose threat given the genetic diversity already available.

Considering the potential value of anthracnose resistance in Siran stylo and its muted reception by both industry and agencies, it is reasonable to suggest the disease threat is less than first projected.

There are a few areas in the far north where the current suite of legumes do not meet identified needs. The major need is for an adapted legume for the upland basalts in the Mount Surprise region. Wynn currently most closely meets that need but still falls some way short of the ideal, if it exists. Other areas are, perhaps, more ones of potential in as much as there is likely to be an emerging need for legumes and grasses for intensive pastures in the 650 mm to 1200 mm rainfall areas to service demand for quality pastures in the live export trade. The area in question is one with a radius of perhaps 200 to 300 km from Karumba and Weipa.

We also need to think about pasture needs in the future. It is possible that we may not be allowed to introduce and release species with the weedy features we desire for our pastures. Future needs may well be plants for intensive development under managed conditions, i.e., in smaller cleared areas rather than oversown into the rangelands as at present.

2.3.2.12 DALY WATERS, Northern Territory:

Collaborators: RT Andison, J Morrison, DPI & F

Co-operator: Ted Hart

Location: "Stillwater". $16^0$10'S, $133^0$06'E, 30 km east of Daly Waters

Soil description: Red Earth (Gn 2.11) with clay loam surface

Soil analysis (0-10 mm):

Depth	pH	P_b (ppm)	K (meq %)	SO_4S (mg/ kg)	Ca (meq %)	Na (meq %)	Cl (mg/ kg)	C/S (%)	f/s (%)	Silt (%)	Clay (%)
0-10	6.1	7	0.74	7	5.2	0.01	10	8	35	22	40
10-20	5.8						8				
20-30	5.9			10	4.0	0.01	8	7	27	16	56
30-50	6.1						7				
50-70	6.4			16	3.9	0.01	8	5	22	14	62
70-100	6.5			9	3.8	0.01	107	4	21	17	63

Dates sown: Series 1, 22 December 1992 (resown 18 January 1994); Series 2, 18 January 1994; Series 3, 24 January 1995.

Rainfall (mm):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1992										4	25	108	
1993	110	253	23	0	0	0	0	0	0	0	87	224	697
1994	68	197	191	0	0	0	0	0	0	20	26	123	625
1995	122	213	182	5	13	0	0	0	12	5	101	109	747
1996	152	33	186	42	0	0							
AAR D.W.	159	159	120	23	6	5	2	2	5	20	55	102	657

Results and Discussion:

Rainfall was close to or above average although finishing in February of year 1 and March in remaining years. Series 1 was replanted on 18 January 1994 after the first planting failed to persist (Table 2.3.2.12.1). The replanted Series 1 has also shown poor persistence (Table 2.3.2.12.2). Only Seca and Verano of Series 1 could be called adapted to this site with the Seca plots visible from 100 m away. All legumes in Series 2 performed poorly with even Seca and Bargoo declining severely in year 3. All legumes in Series 3 had some plants established in year 1 but *A. brasiliana* 92519 had highest year 2 counts with 1 plant and 6 seedlings/m^2 (Table 2.3.2.12.4).

Table 2.3.2.12.1 First Year Plant Counts (plants/m^2) and Legume Dry Matter Yield (kg/ha), Daly Waters Series 1

	Date Sown	22-Dec-92		
		Population		Yield
		Year 1	Year 2	Year 1
Species	**Acc./Cv.**	2-Feb-93	17-Jan-94	21-May-93
A. americana	91235	15.1	0	85
A. americana	93624	2.4	0	61
A. americana	Glenn	3.8	0	73
A. americana	Lee	3.2	0	0
A. brasiliana	92519	1.7	0.1	13
A. brasiliana	93592	0.6	0.0	0
A. histrix	93636	6.4	0	54
A. paniculata	93635	39.3	0	30
A. villosa	37235	1.9	0	28
A. villosa	91209	19.3	0	67
A. villosa	93621	27.9	0	50
C. rotundifolia	85836	2.4	0	132
C. rotundifolia	86172	4.8	0	237
C. rotundifolia	Wynn	2.4	0	83
Cen.brasilianum	40067	3.3	0	82
Cen.brasilianum	55696	2.8	0	263
Cli. ternatea	mix	3.6	0.1	58
S. hamata	Verano	1.9	0.8	104
S. scabra	Seca	36.9	1.2	307

Table 2.3.2.12.2 Plant Counts (plants/m^2) and Legume Dry Matter Yield (kg/ha) Daly Waters, Resown Series 1

Species	Acc./Cv.	Date Sown 22-Dec-92 ploughed out replanted on 18-Jan-94 Year 1 9-Jun-94	Population Year 2 24-Jan-95	Population Year 3 24-Jan-96	Yield Year 2 22-Jun-95
A. americana	Glenn	0.0	0.0	0 (0)	0
A. americana	Lee	0.9	0.0	0 (0)	0
A. brasiliana	92519	0.1	0.3	0 (0.5)	6
A. brasiliana	93592	0.0	0.0	0 (0.4)	10
A. histrix	93636	0.0	0.6	0 (1.1)	27
A. paniculata	93635	0.0	0.0	0 (0)	0
A. villosa	37235	0.0	1.0	0 (0)	0
A. villosa	91209	3.7	0.0	0 (0)	0
A. villosa	93621	0.3	0.0	0 (0)	0
C. rotundifolia	85836	2.1	1.7	0 (0)	23
C. rotundifolia	86172	0.3	1.3	0 (0.1)	71
C. rotundifolia	Wynn	0.5	1.5	0 (0.5)	85
Cen.brasilianum	40067	0.0	0.0	0 (0)	0
Cen.brasilianum	55696	0.0	0.0	0 (0)	0
Cli. ternatea	mix	1.2	0.3	0 (0)	0
S. hamata	Verano	0.8	1.5	2.7 (2.7)	15
S. scabra	Seca	2.9	1.9	0.3 (3.7)	750

( ) seedlings

Table 2.3.2.12.3 Plant Counts (plants/m^2), Daly Waters Series 2

	Date Sown	18-Jan-94		
Species	Sampling Date: Acc/Cv	9-Jun-94 Year 1	24-Jan-95 Year 2	24-Jan-96 Year 3
Aeschynomene falcata	Bargoo	5.7	0.	0.
Chamaecrista pilosa	CPI57503	0.	0.5	0.
Chamaecrista rotundifolia	CPI93094	0.	1.	0.
Chamaecrista rotundifolia	Wynn	1.7	0.3	0.1
Desmanthus virgatus	Bayamo	0.	0.1	0.1
Desmanthus virgatus	BB AC 10	1.2	0.4	0.1
Desmanthus virgatus	BB AC 11	0.	0.3	0.4
Desmanthus virgatus	CPI30205	0.	0.1	0.
Desmanthus virgatus	CPI33201	0.	0.	0.
Desmanthus virgatus	CPI37538	0.3	0.	0.
Desmanthus virgatus	CPI38351	0.1	0.1	0.1
Desmanthus virgatus	CPI40071	0.	0.	0.
Desmanthus virgatus	CPI55719	0.	0.5	0.1
Desmanthus virgatus	CPI79653	0.	0.	0.
Desmanthus virgatus	CPI85178	0.1	0.3	0.3
Desmanthus virgatus	CPI90754	0.	0.	0.1
Desmanthus virgatus	Marc	0.	1.3	0.9
Desmanthus virgatus	TQ90	0.2	0.7	1.1
Desmanthus virgatus	Uman	0.	0.	0.1
Macroptilium longipedunculatum	Maldonado	0.	0.	0.
Macrotyloma axillare	Archer	0.	0.	0.
Macrotyloma axillare	CPI52469	0.	0.	0.
Stylosanthes scabra	Seca	0.6	0.3	0.4

Table 2.3.2.12.4 Plant Counts (plants/m²), Daly Waters Series 3

	Date Sown	24-Jan-95	
Species	Sampling Date: **Acc./Cv.**	13-Mar-95 Year 1	24-Jan-96 Year 2
Aeschynomene americana	Lee	2.7	0 (0)
Aeschynomene brasiliana	92519	12.3	0.8 (6.3)
Aeschynomene histrix	93599	4.8	0 (0.3)
Aeschynomene histrix	93636	3.9	0 (0)
Aeschynomene histrix	93638	6.1	0 (0.5)
Alysicarpus rugosus	69487	2.4	0 (0)
Chamaecrista rotundifolia	Wynn	11.7	0 (0.1)
Desmanthus virgatus	Jaribu	7.0	0 (1.4)
Stylosanthes hamata	Verano	3.7	0.4 (1.4)
Stylosanthes scabra	Seca	1.3	0.3 (1.3)

( ) seedlings

2.3.2.13 KATHERINE, Northern Territory:

Collaborators: RT Andison, J Morrison, DPI & F

Co-operator: DPI & F

Location: Katherine Research Station. 14°28'S, 132°19'E, 4 km south of Katherine

Soil description: Red Earth (Gn 2.11) with sandy clay loam surface

Soil analysis (0-10 cm):

Depth	**pH**	**P_b (ppm)**	**K (meq %)**	**SO_4S (mg/ kg)**	**Ca (meq %)**	**Na (meq %)**	**Cl (mg/ kg)**	**C/S (%)**	**f/s (%)**	**Silt (%)**	**Clay (%)**
0-10	6.1	3	0.62	4	3.4	0.01	23	29	36	17	24
10-20	6.3						12				
20-30	6.2			5	6.6	0.01	8	16	29	15	47
30-50	6.4						8				
50-70	6.6			5	4.8	0.01	8	11	21	15	56
70-100	6.7			1	4.7	0.01	9	9	21	16	59

Dates sown: Series 1, 18 December 1992; Series 2, 13 January 1994; Series 3 23 December 1994

Rainfall (mm):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1992										35	94	137	
1993	371	240	39	0	0	0	0	0	0	6	88	346	1090
1994	154	169	261	7	0	0	0	0	0	18	141	141	891
1995	389	140	135	42	0	0	0	0	20	51	55	147	979
1996	199	57	92	121	0	0							
AAR	237	211	160	32	6	2	1	0	7	29	90	190	967

Results and Discussion:

Rainfall was close to or above average but the wet seasons seemed to finish too early for the later flowering legumes. By year 4 in Series 1 (Table 2.3.2.13.1) the only legumes considered to be adapted were the stylos and *A. brasiliana* CPI 92519. *C. rotundifolia* CPI 86172 was maintaining plant numbers but yield was low. *A. brasiliana* CPI 93592 has continued to be monitored at this site and seems adapted but lower yielding than 92519. In an earlier (1988) sowing of 16 *Aeschynomene* lines at Katherine Research Station only *A. brasiliana* CPI 92519 and 93592 remain. They are both being grazed considerably and have not spread outside of their original plots.

In Series 2 (Table 2.3.2.13.2) *C. rotundifolia* and several *Desmanthus* lines had better yield than Seca with only 1 plant/m^2. In Series 3 (Table 2.3.2.13.3) Seca population, at below 2 plants/m^2, was lower than Wynn, Jaribu desmanthus, *A. brasiliana* CPI 92519 and Verano. *Chamaecrista rotundifolia* CPI 86172 and 93094 may also have a role.

Table 2.3.2.13.1 Plant Counts (plants/m²) and Legume Dry Matter Yields (kg/ha), Katherine Series 1

Species	Acc./Cv.	Date Sown 18-Dec-92					
		Population				Yield	
		Year 1 22-Jan-93	Year 2 5-Jan-94	Year 3 13-Dec-94	Year 4 12-Feb-96	Year 1 20-May-93	Year 2 8-Jun-94
A. americana	91235	5.3	2.9	0.2	0.0	685	4
A. americana	93624	10.4	4.4	11.0	0.4	407	0
A. americana	Glenn	6.9	3.2	0.1	0.0	2279	249
A. americana	Lee	9.1	0.1	0.0	0.0	548	0
A. brasiliana	92519	30.2	21.3	11.6	7.6	1648	4714
A. brasiliana	93592	14.2	111.3	19.8	*	1801	1105
A. histrix	93636	52.0	1.0	0.4	0.0	1189	51
A. paniculata	93635	3.0	7.3	14.9	0.0	1104	1353
A. villosa	37235	25.4	49.9	21.5	0.0	315	6
A. villosa	91209	2.9	0.1	4.5	0.0	60	0
A. villosa	93621	8.0	0.0	0.1	0.0	217	0
C. rotundifolia	85836	1.0	0.5	1.5	0.9	289	10
C. rotundifolia	86172	1.4	1.1	7.3	8.7	598	253
C. rotundifolia	Wynn	12.4	1.5	2.2	1.6	689	116
Cen. brasilianum	40067	6.3	0.1	0.0	0.0	73	0
Cen. brasilianum	55696	1.9	0.1	0.4	0.0	57	0
Cli. ternatea	mix	7.4	1.2	2.5	1.9	133	0
S. hamata	Amiga	2.8	52.3	12.5	2.8	597	865
S. hamata	Verano	14.9	76.4	6.9	3.3	1332	683
S. scabra	Seca	1.8	2.8	2.1	2.6	473	1380
S. scabra	Siran	7.2	3.8	4.4	3.0	412	1878

* sprayed out

Table 2.3.2.13.2 Plant Counts (plants/m^2), Katherine Series 2

Species	Acc/Cv	Planted: 13 January 1994 11-Apr-94 Plant count Year 1	14-Dec-94 Plant count Year 2	15-Feb-96 Plant count Year 3
Aeschynomene falcata	Bargoo	5.2	1.8	0.
Aeschynomene histrix	CPI93599	12.8	4.8	0.
Aeschynomene histrix	CPI93636	3.6	1.3	0.
Aeschynomene histrix	CPI93638	5.2	2.2	0.
Chamaecrista pilosa	CPI57503	5.4	0.9	0.3
Chamaecrista rotundifolia	CPI93094	15.4	5.3	11.6
Chamaecrista rotundifolia	Wynn	13.1	2.9	3.2
Desmanthus virgatus	Bayamo	5.1	4.7	1.6
Desmanthus virgatus	BB AC 10	3.6	13.4	4.
Desmanthus virgatus	BB AC 11	2.4	1.6	0.7
Desmanthus virgatus	CPI30205	6.2	3.5	1.7
Desmanthus virgatus	CPI33201	1.5	1.4	0.1
Desmanthus virgatus	CPI37538	1.6	0.6	0.
Desmanthus virgatus	CPI38351	3.6	13.	1.7
Desmanthus virgatus	CPI40071	1.8	0.8	0.5
Desmanthus virgatus	CPI52401	5.9	3.6	1.7
Desmanthus virgatus	CPI55719	2.3	1.2	0.8
Desmanthus virgatus	CPI79653	2.6	3.6	0.1
Desmanthus virgatus	CPI85178	2.7	3.1	0.
Desmanthus virgatus	CPI90754	2.3	2.6	1.1
Desmanthus virgatus	Marc	7.3	8.8	2.5
Desmanthus virgatus	TQ90	1.7	4.2	2.3
Desmanthus virgatus	Uman	0.7	0.6	0.
Macroptilium gracile	Maldonado	11.2	7.1	0.7
Macrotyloma axillare	Archer	0.	0.	0.
Macrotyloma axillare	CPI52469	0.5	0.	0.
Stylosanthes scabra	Seca	1.4	1.4	0.9

Table 2.3.2.13.3 Plant Counts (plants/m²), Katherine Series 3

	Date Sown	23-Dec-94	
Species	Sampling Date: **Acc./Cv.**	20-Mar-95 Year 1	15-Feb-96 Year 2
Aeschynomene americana	Lee	15.8	0.1
Aeschynomene brasiliana	92519	4.0	2.3
Aeschynomene histrix	93599	4.2	0.4
Aeschynomene histrix	93636	5.3	0.1
Aeschynomene histrix	93638	4.7	0.1
Alysicarpus rugosus	69487	0.5	0.0
Chamaecrista rotundifolia	Wynn	9.3	11.5
Desmanthus virgatus	Jaribu	7.7	3.1
Macroptilium atropurpureum	84989	3.3	0.8
Macroptilium atropurpureum	Aztec	8.5	0.3
Stylosanthes hamata	Verano	9.7	4.8
Stylosanthes scabra	Seca	2.3	1.7

Conclusion:

Based on the observations made at the Back-up Legume sites in the NT over the four seasons, it appears that the dry season may be too long, hot and dry for a lot of these legume accessions. With up to 80% of the years rain falling between the months of December and March, the wet season is too short for the late flowering lines to set seed, and the dry season is too long for adult plants to perennate, especially if they do not establish well in the first year.

The local recommendation of planting Verano/Amiga and Seca/Siran looks as though it is fairly hard to beat, however *Aeschynomene brasiliana* CPI 92519 looks promising.

2.3.3 Legume adaptation summary across sites

Below average and variable rainfall during the four year period 1992/93 to 1995/96 of the BULS project has quite severely culled the numbers of legumes which could be described as well adapted to the range of sites used in the 650 mm to 1000 mm AAR zone of northern Australia.

The best performing legumes were the current stylo cultivars. The most consistent non-cultivar was *Aeschynomene brasiliana* CPI 92519. Wynn cassia and a number of

Chamaecrista rotundifolia accessions performed well but are not consistently well adapted. Bargoo jointvetch performed well at sites south of Mackay

Legume population across all sites for year 1 and year 4 in the Series 1 (1992/93) plantings are shown in table 2.3.3.1. Table 2.3.3.2 presents year 4 dry matter yields for Series 1 legumes at Gayndah, Gympie, Miriam Vale and Sarina and estimates of yield at St Lawrence and "Swans Lagoon". (Year 4 yield was not recorded at other sites.) Tables 2.3.3.3 and 2.3.3.4 present legume population in year 1 and year 3 at sites sown in Series 2 (1993/94) and in year 2 for sites sown in Series 3 (1994/95). Legume yield at Series 2 and Series 3 sites is only shown in individual site reports.

Seca stylo has been the most consistent and highest yielding legume. Siran has performed equally well at Gympie, Duaringa, St Lawrence, Sarina, Swans Lagoon, Daly Waters and Katherine where comparisons are available (Table 2.3.3.5). Similarly there is little difference between the performance of Verano and Amiga. Both are well adapted but produce considerably lower dry matter yields than Seca and Siran. At Gayndah fine stem stylo persisted and yielded better than Amiga.

Wynn cassia has outyielded Seca and Siran at Sarina (Table 2.3.3.5) but has not been as consistently well adapted as the stylos. At this stage Wynn appears to be performing equally well to other *Chamaecrista* accessions in Series 1 and Series 2 plantings.

A. brasiliana CPI 92519 has consistently established and persisted under harsh conditions and its soil seed reserves at Sarina are next highest to *Chamaecrista* lines (Table 2.3.8.1). However as is discussed in other sections of this report more information is needed on its palatability and contribution to animal production.

A. villosa lines performed best at Gympie and persisted at Sarina, Miriam Vale and Gayndah, although declining in years 3 and 4. On the basis of this data plus other longer term development plots, CPI 91209 and CPI 93621 were registered as cultivars Reid and Kretschmer respectively in August 1995 and are being promoted for use in the southern spear grass zone receiving AAR of 900 mm and above. Preliminary studies into forage quality indicate Reid has higher than average nitrogen content and lower than average ADF values (Table 2.3.7.1).

The early flowering annual *A. americana* CPI 93624 has persisted better than Glenn at Gympie, Miriam Vale and Katherine and had higher soil seed reserves at Miriam Vale. It will be monitored closely during the next two years. Conditions over the four years of this project have been too dry for Glenn and Lee jointvetch and establishment populations were low or have declined at most sites. Rainfall conditions did not allow a good set of seed in the establishment year and this has affected regeneration of *Aeschynomene* legumes, particularly the annuals.

A. histrix CPI 93636 performed best at Sarina and Miriam Vale but is not adapted to the dry conditions received. CPI 93599 has performed best of the three accessions in Series 2 and 3 plantings but all the *A. histrix* lines are late flowering and very palatable and little seed has returned to the soil (table 2.3.8.1). Bargoo jointvetch persisted well at sites in south-east Queensland and at "Glensfield", Sarina, but commercial seed is not available.

Desmanthus virgatus has grown best at "Granite Vale", St Lawrence in Series 1, 2 and 3 plantings and good seedling recruitment has occurred in the Series 1 sowing. *Desmanthus* is a legume well adapted to clay soils and growth is normally slow with "unthrifty" plants on lighter acid soils. *Desmanthus* lines have performed poorly at "Glensfield, Sarina, but quite well at "Granite Vale", St Lawrence. Results of soil profile analysis for both sites is given in this section (refer to individual site reports). The main difference which could favour *Desmanthus* at "Granite Vale" is higher silt/clay content (21/25 versus 12/9) and higher soil P in the surface (15 versus 8). Comparative information is not available for S and Mo. *D. virgatus* CPI 37538 has high populations at Gympie and Gayndah. Other accessions worth watching are AC 10, AC 11, TQ 90, CPI 38351, CPI 40071, CPI 30305. Bayamo and Marc performed in the mid range. Performance of *Desmanthus* may also be influenced by survival of CB 3126 RNB. Many lines are highly specific in their rhizobial requirements and few "lighter" soils appear to carry a native rhizobial flora capable of forming an effective association. Good planting moisture may well make a difference.

Of the other legumes evaluated *Macrotyloma axillare* CPI 52469 persisted better than cv Archer but neither was grazed. *Macroptilium, Atylosia* and *Alysicarpus* lines need more time to express their potential.

Table 2.3.3.1 Legume Counts (plants/sq m), All Sites, Series 1

Species	Date Sown / Acc./Cv.	27-Jan-93 Gympie Sexton		4-Dec-92 Gayndah 'Brian Pastures' Uc2.22 (R1)	Dd1.43(R2)	Rep Mean	25-Jan-93 Miriam Vale 'Wadeleigh' Dy3.12		10-Feb-93 Duaringa 'Sorrell Hills' Resown 1-Mar-94		3-Dec-92 St. Lawrence 'Granite Vale'		26-Nov-92 Sarina 'Glensfield'		7-Jan-93 Ayr Swans Lagoon	Oversown 25-Nov-93	18-Jan-94 Daly Waters 'Stillwater Stn'		18-Dec-92 Katherine Research Stn		All Sites Mean	All Sites Mean
		Year 1	Year 4	Year 1	Year 1	Year 4	Year 1	Year 4	Year 1	Year 3	Year 1	Year 4	Year 1	Year 4	Year 1	Year 4	Year 1	Year 3	Year 1	Year 4	Year 1	Year 4
		25-Mar-93	17-Apr-96	12-May-93	12-May-93	18-Apr-96	23-Mar-93	16-Apr-96	25-May-94	10-Oct-95	18-Feb-93	12-Jun-96	15-Jan-93	19-Mar-96	10-Feb-93	9-Feb-96	17-Jan-94	24-Jan-96	22-Jan-93	12-Feb-96		
A. americana	56282	8.3	1.9								10.1	0 (0)									9.2	1.0
A. americana	91235	40.7	0	0.0	0.0	0.0	10.4	0	0.1	0.0	6.4	0 (0)	2.1	0.0	3.9	0	0.0		5.3	0.0	6.9	0.0
A. americana	93624	22.5	10.1	0.4	0.0	0.0	6.2	5.35	0.0	0.0	3.8	0 (0.6)	17.8	0.0	5.6	0	0.0		10.4	0.4	6.7	2.4
A. americana	93661	22.6	0.5								9.5	0.6 (9)									16.1	1.0
A. americana	Glenn	83.8	0.1	0.4	0.0	0.0	8.8	1.6	0.2	0.0	15.8	0 (0)	23.1	0.2	4.9	0	0.0	0 (0)	6.9	0.0	14.4	0.3
A. americana	Lee	77.8	0	0.7	0.5	0.0	11.2	1.2	1.9	0.0	13.2	0.2 (0.7)	21.8	1.1	1.2	0	0.0	0 (0)	9.1	0.0	13.7	0.5
A. brasiliana	92519	62.0	0.2	2.0	6.8	2.7	20.6	1.5	2.6	4.0	18.1	6.4 (3.2)	47.8	22.6	10.2	11.2	0.1	0 (0.5)	30.2	7.6	20.0	7.9
A. brasiliana	93592	47.9	*	15.0	1.5	7.6	11.6	*			23.0	*	46.5	*	11.9	*	0.0	0 (0.4)	14.2	*	19.1	
A. falcata	Bargoo	46.6	13.2																		46.6	13.2
A. histrix	93636	56.2	0.8	0.8	0.7	1.0	13.2	0.7	0.3	0.6	13.1	0 (0)	53.4	8.0	0.3	0	0.0	0 (1.1)	52.0	0.0	19.0	1.5
A. villosa	37235	44.6	11.2	2.5	0.4	0.0	5.8	0	1.6	0	14.3	0 (0)	28.7	1.0	7	0	0.0	0 (0)	25.4	0.0	13.0	1.7
A. villosa	91209	28.7	6.2	1.3	0.7	0.7	15	0.5	0.2	0.0	4.8	0 (0)	28.8	4.5	2.7	0	0.0	0 (0)	2.9	0.0	8.5	1.7
A. villosa	93621	71.5	2.2	0.0	0.0	0.2	24.2	0.9	0.2	0.0	3.0	0 (4.6)	23.3	4.3	5.6	0	0.0	0 (0)	8.0	0.0	13.6	1.7
C. rotundifolia	85836	4.0	8.6	5.2	4.2	2.0	4.8	13.2	5.3	0.8	2.5	0.4 (4.4)	6.2	18.6	0.9	0	0.0	0 (0)	1.0	0.9	3.4	6.9
C. rotundifolia	86172	9.4	4.4	3.2	2.0	15.6	8.4	12.4	3.9	0.0	2.4	0 (0)	8.3	25.3	0.7	18.4	0.0	0 (0.1)	1.4	8.7	4.0	12.1
C. rotundifolia	Wynn	55.9	5.6	17.8	0.3	6.6	11.5	11.8	7.3	4.0	30.6	0 (1)	35.1	51.7	5.5	38.4	0.0	0 (0.5)	12.4	1.6	17.6	16.7
Cen. brasilianum	40067																0.0	0 (0)	6.3	0.0	3.2	0.0
Cen. brasilianum	55696																0.0	0 (0)	1.9	0.0	1.0	0.0
Cli. ternatea	mix																0.1	0 (0)	7.4	1.9	3.8	1.9
D. virgatus	Marc												13.1	0.0							13.1	0.0
D. virgatus	Bayamo										9.4	3.8 (9.5)	19.8	0.0							14.6	6.7
D. virgatus	Uman												8.4	0.0							8.4	0.0
S. guianensis	Oxley	29.3	0.9	1.8	0	3.2															10.4	2.1
S. hamata	Amiga	39	9.1	1	2	0.8			13.4	15.8	11.2	30.7 (23.5)	34.2	34.8	6.4	58.8			2.8	2.8	13.8	26.8
S. hamata	Verano	50.1	9.5				5	10.3	12.8	9.6	5.7	30.2 (13.3)	14.8	29.6	8.2	88.9	0.8	2.7 (2.7)	14.9	3.3	14.0	30.9
S. scabra	Seca	35.3	15.5				7.2	11.7	7.5	14	5.8	16.4 (13.3)	21.6	17.6	4	30	1.2	0.3 (3.7)	1.8	2.6	10.6	17.9
S. scabra	Siran	48.5	16						7.3	6.6	15.0	20.1 (13.7)	51.3	21.2					7.2	3.0	25.9	18.5

* plot sprayed out

Sown as mixture ( ) seedlings

Table 2.3.3.2 Legume Dry Matter Yield (kg/ha), (in Year 4 for sites recorded) Series 1

	Date Sown	27-Jan-93	4-Dec-92			25-Jan-93	10-Feb-93	3-Dec-92	26-Nov-92	7-Jan-93		
		Gympie	Gayndah			Miriam Vale	Duaringa	St. Lawrence	Sarina	Ayr		
		`Narrabri'	`Brian Pastures'			`Wadeleigh'	Resown	`Granite Vale'	`Glensfield'	oversown	**All Sites**	**All Sites**
			Uc2.22(R1)	Dd1.43(R2)	Rep Mean		1-Mar-94			25-Nov-93	**Mean**	**Median**
		Year 4	Year 4	Year 4	Year 4	Year 4	Year 3	Year 4	Year 4	Year 3	**Year 4**	**Year 4**
Species	Acc./Cv.	17-Apr-96	18-Apr-96	18-Apr-96	18-Apr-96	16-Apr-96	10-Oct-95	12-Jun-96	19-Mar-96	20-Apr-95	**kg/ha**	**kg/ha**
A. americana	56282	48	-	-	-	-	-	0	-	-	**24**	**24**
A. americana	91235	0	0	0	0	0	0	0	0	0	**0**	**0**
A. americana	93624	170	0	0	0	184	0	0	0	0	**71**	**0**
A. americana	93661	15	-	-	-	-	-	0	-	-	**8**	**8**
A. americana	Glenn	3	0	0	0	80	0	0	13	0	**19**	**3**
A. americana	Lee	0	0	0	0	90	0	0	38	0	**26**	**0**
A. brasiliana	92519	0	424	0	212	-	293	300	1144	2000	**414**	**256**
A. brasiliana	93592	91	1949	65	1007	-	*	*	*	*	**549**	**549**
A. falcata	Bargoo	114	-	-	-	-	-	-	-	-	**114**	**114**
A. histrix	93636	21	87	53	70	32	59	0	225	0	**70**	**32**
A. villosa	37235	78	0	0	0	0	0	0	0	0	**16**	**0**
A. villosa	91209	57	28	0	14	0	0	0	71	0	**28**	**14**
A. villosa	93621	18	81	0	41	22	0	0	72	0	**31**	**22**
C. rotundifolia	85836	174	374	134	254	242	12	0	1191	0	**372**	**242**
C. rotundifolia	86172	76	4172	901	2537	634	0	0	2297	1500	**1109**	**634**
C. rotundifolia	Wynn	59	1769	1	885	479	216	0	2147	1600	**714**	**479**
D. virgatus	Marc	-	-	-	-	-	-	-	0	-	**0**	**0**
D. virgatus	Bayamo	-	-	-	-	-	-	200	0	-	**100**	**100**
D. virgatus	Uman	-	-	-	-	-	-		0	-	**0**	**0**
S. guianensis	Oxley	2	450	20	235	-	-	-	-	-	**119**	**119**
S. hamata	Amiga	93	53	0	27	-	323	300	662	800	**271**	**197**
S. hamata	Verano	77	-	-	-	359	460	300	381	1000	**279**	**330**
S. scabra	Seca	3174	-	-	-	3042	570	600	1511	4000	**2082**	**2277**
S. scabra	Siran	3624	-	-	-	-	763	600	1951	-	**2058**	**1951**

*** plot sprayed out**

Table 2.3.3.3 Legume Counts (plants/sq m), all sites, Series 2

		'Narrabri' Gympie Planted: 24 Feb 1994		'Brian Pastures' Gayndah Planted: 2 Dec 1993		'Narayen' Mundubbera Planted: 12 Dec 1993		'Sorrell Hills' Duaringa Planted: 2 Mar 1994		'Granitevale' St. Lawrence Planted: 1 Dec 1993		Seedlings	'Glensfield' Sarina Planted 16 Nov 93		'Wilunga' Nebo Planted: 7 Dec 1993		'Braceborough' Charters Towers Planted: 20 Jan 1994		'Stillwater Station' Daley Waters N.T. Planted: 18 January 1994		Research Stn Katherine N.T. Planted: 13 January 1994		All Sites	All Sites
	Sampling Date	27-May-94	17-Apr-96	1-Jun-94	18-Apr-96	11-May-94	17-Oct-95	25-May-94	10-Oct-95	7-Feb-94	12-Jun-96	12-Jun-96	5-Jan-94	19-Mar-96	1-Jun-94	14-May-96	2-Aug-94	10-Apr-96	9-Jun-94	24-Jan-96	11-Apr-94	15-Feb-96	Mean	Mean
Species	Accession No	Year 1	Year 3	Year 1	Year 3	Year 1	Year 3	Year 1	Year 3	Year 1	Year 3	Year 3	Year 1	Year 3	Year 1	Year 3	Year 1	Year 3	Year 1	Year 3	Year 1	Year 3	Year 1	Year 3
A. brasiliana	CPI92519	-	-	-	-	15.4	1.4	-		-	-	-	-	-	-	-	37.4	*	-	-	-	-	26.4	1.4
A. brasiliana	CPI93592	-	-	-	-	12.	0.	-		-	-	-	-	-	-	-	56.2	*	-	-	-	-	34.1	0.
A.falcata	Bargoo	15.	11.6	24.7	4.9	26.2	16.	13.8	0.6	10.7	0.	0.5	10.	10.2	1.1	0.	33.4	0.	5.7	0.	5.2	0.	14.6	4.4
A. histrix	CPI93599	-	-	-	-	-	-	-		-	-	-	19.3	13.3	-	-	67.8	0.	-	-	12.8	0.	33.3	4.4
A. histrix	CPI93636	-	-	-	-	-	-	-		-	-	-	5.3	5.3	-	-	17.4	0.	-	-	3.6	0.	8.8	1.8
A. histrix	CPI93638	-	-	-	-	2.6	0.	-		-	-	-	9.5	2.4	-	-	31.8	0.	-	-	5.2	0.	12.3	0.6
C. pilosa	CPI57503	7.8	7.4	16.5	16.7	5.8	1.4	10.	3.2	4.3	1.1	3.7	18.8	21.6	-	-	6.2	0.	0.	0.	5.4	0.3	8.3	6.2
C. rotundifolia	CPI85836	-	-	-	-	9.4	0.2	-		-	-	-	-	-	-	-	27.	0.	-	-	-		18.2	0.1
C. rotundifolia	CPI86172	-	-	-	-	9.8	0.8	-		-	-	-	-	-	-	-	33.6	0.	-	-	-		21.7	0.4
C. rotundifolia	CPI93094	10.8	10.9	11.	24.2	18.4	5.	22.4	9.2	6.6	1.1	12.9	17.3	34.7	-	-	24.4	1.	0.	0.	15.4	11.6	14.	12.3
C. rotundifolia	Wynn	6.4	10.7	20.	29.7	17.2	4.2	5.2	3.2	7.9	0.2	10.1	21.5	39.4	-	-	30.6	1.	1.7	0.1	13.1	3.2	13.7	11.3
D. virgatus	Bayamo	19.8	0.8	5.6	1.3	-	-	0.5	0.6	4.8	8.2	18.3	18.	0.	0.5	0.4	0.	0.	0.	0.1	5.1	1.6	6.	3.5
D. virgatus	BB AC 10	5.8	0.2	7.	1.2	5.8	3.6	6.4	2.8	2.3	4.9	5.8	5.8	0.	2.	0.7	0.	0.	1.2	0.1	3.6	4.	4.	2.3
D. virgatus	BB AC 11	9.6	0.1	7.5	1.2	6.6	2.2	2.9	4.4	3.2	5.4	13.7	4.5	0.6	1.8	1.5	0.	0.	0.	0.4	2.4	0.7	3.8	3.
D. virgatus	CPI30205	18.8	0.	2.4	0.5	-	-	11.5	7.6	5.4	3.6	2.9	7.8	0.	1.4	0.3	5.2	0.	0.	0.	6.2	1.7	6.5	1.8
D. virgatus	CPI33201	4.8	0.4	1.	0.4	-	-	2.2	1.4	0.8	1.2	1.9	3.	1.	0.4	0.6	0.	0.	0.	0.	1.5	0.1	1.5	0.8
D. virgatus	CPI37143	-	-	-	-	-	-	-		1.2	4.5	0.1	2.8	0.	0.5	0.4	0.4	0.	-	-	-		1.2	1.3
D. virgatus	CPI37538	36.8	9.6	10.	8.6	-	-	2.	0	4.	0.9	0.2	3.5	0.	1.3	0.	1.4	0.	0.3	0.	1.6	0.	6.8	2.1
D. virgatus	CPI38351	16.6	1.7	3.4	1.7	4.4	0.	1.2	0.25	3.1	8.4	19.7	5.8	0.	1.2	0.6	0.4	0.	0.1	0.1	3.6	1.7	4.	3.4
D. virgatus	CPI40071	15.8	1.8	3.2	0.5	-	-	2.8	2.2	2.9	2.6	2.7	4.8	0.	1.8	0.6	0.	0.	0.	0.	1.8	0.5	3.7	0.7
D. virgatus	CPI49728	-	-	-	-	-	-	-		4.4	3.2	1.6	11.	0.	-	-	-	-	-	-	-		7.7	2.4
D. virgatus	CPI52401	-	-	-	-	-	-	6.	3.6	5.3	6.2	9.4	5.5	0.6	1.2	0.2	0.8	0.	-	-	5.9	1.7	4.1	3.6
D. virgatus	CPI55719	2.	0.1	2.2	0.3	3.6	1.	0.5	0	1.3	1.3	1.8	1.	0.	0.2	0.	6.	0.	0.	0.1	2.3	0.8	1.9	0.5
D. virgatus	CPI67643	-	-	-	-	-	-	-		3.6	2.2	3.7	3.	0.	-	-	-	-	-	-	-		3.3	3.
D. virgatus	CPI78372	-	-	-	-	-	-	-		3.5	4.2	6.8	3.8	0.2	1.2	0.9	0.	0.	-	-	-		2.1	3.
D. virgatus	CPI79653	6.	0.	3.6	0.8	1.2	1.	4.4	1.4	3.9	1.9	1.5	1.	0.	1.5	0.4	0.	0.	0.	0.	2.6	0.1	2.4	0.7
D. virgatus	CPI85178	0.8	0.	0.3	0.	-	-	7.	1.6	1.1	0.9	0.	0.	0.2	0.	0.1	0.	0.	0.1	0.3	2.7	0.	1.3	0.3
D. virgatus	CPI90754	1.	0.1	1.4	0.8	0.4	0.	3.9	0.6	0.3	0.3	0.2	2.	0.	0.5	0.	0.	0.	0.	0.1	2.3	1.1	1.2	0.3
D. virgatus	Marc	4.6	0.6	3.8	0.8	3.4	1.2	12.4	11.6	6.9	3.7	0.7	3.5	0.	2.6	0.2	6.6	4.	0.	0.9	7.3	2.5	5.1	2.2
D. virgatus	TQ90	2.6	0.	5.4	1.8	-	-	3.	0	2.2	5.8	12.3	2.8	0.4	1.5	1.2	0.	0.	0.2	1.1	1.7	2.3	2.1	2.8
D. virgatus	Uman	0.8	0.	0.6	0.	-	-	0.2	0	0.8	0.7	0.8	0.3	0.	0.	0.	0.	0.	0.	0.1	0.7	0.	0.4	0.2
M. longipedunculatum	Maldonado	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	0.	0.	11.2	0.7	5.6	0.4
M. axillare	Archer	4.	0.	1.9	0.6	3.2	0.1	0.5	0	0.9	0.	0.	8.3	1.4	-	-	0.8	0.	0.	0.	0.	0.	2.2	0.2
M. axillare	CPI52469	12.8	0.	5.5	0.2	6.8	0.1	6.2	0	0.5	0.	0.	8.	2.2	-	-	1.6	0.	0.	0.	0.5	0.	4.7	0.3
S. scabra	Seca	16.2	5.1	8.9	7.5	9.6	4.8	0.8	1.6	5.4	11.9	9.9	7.	9.7	1.5	0.8	10.4	5.	0.6	0.4	1.4	0.9	6.2	5.8

* plot sprayed out

Table 2.3.3.4 Legume Counts (plants/sq m), all sites, Series 3

	Date Sown	17-Jan-95 Gayndah 'Brian Pastures'	12-Jan-95 Mundubbera 'Narayan'	16-Jan-95 Bororen 'Bethome'	20-Jan-95 Duaringa 'Sorrell Hills'	12-Jan-95 St. Lawrence 'Granite Vale' Adults	Seedlings	10-Jan-95 Sarina 'Glensfield'	11-Jan-95 Nebo 'Willunga'	8-Feb-95 Charters Towers 'Braceborough'	24-Jan-95 Daly Waters 'Stillwater Stn'	23-Dec-94 Katherine Research Stn	All Sites Mean	All Sites Median
	Sampling Date:	18-Apr-96	17-Oct-95	15-Apr-96	10-Oct-95	12-Jun-96	12-Jun-96	23-Feb-96	14-May-96	10-Apr-96	24-Jan-96	15-Feb-96		
Species	Acc./Cv.	Year 2	Year 2	Year 2	Year 2	Year 2	Year 2	Year 2	Year 2	Year 2	Year 2	Year 2	Year 2	Year 2
A. americana	**Lee**	2.7	0.6	7.6	0	1.0	25.0	1.9	-	0.0	0.0	0.1	**4.3**	**0.6**
A. brasiliana	**92519**	1.0	16.8	-	3.4	7.0	4.0	8.6	0.1	*	7.1	2.3	**6.3**	**5.3**
A. histrix	**93599**	1.4	9.4	10.9	2	0.0	0.0	3.9	0.0	1.1	0.3	0.4	**2.9**	**1.3**
A. histrix	**93636**	0.3	11.6	7.8	0.4	0.0	0.0	0.8	0.0	2.7	0.0	0.1	**2.4**	**0.4**
A. histrix	**93638**	0.7	6.2	5.6	1.4	0.0	0.0	1.3	0.0	1.5	0.5	0.1	**1.7**	**1.0**
A. villosa	**37235**	-	2.4	2.2		-	-	-	-	-	-		**2.3**	**2.3**
A. villosa	**91209**	-	5.4	5.9		-	-	-	-	-	-		**5.7**	**5.7**
A. villosa	**93621**	-	2.2	11.6		-	-	-	-	-	-		**6.9**	**6.9**
A. monilifer	**52343**	0.0	0.0	0.5	0	0	0	0	0.0	0.0	-		**0.1**	**0.0**
A. rugosus	**51655**	0 0	0.0	0.8	0	0	0	0.1	0.0	0.0	-		**0.1**	**0.0**
A. rugosus	**69487**	0.0	0.0	0.2	0	0	0	0	-	0.0	0.0	0.0	**0.0**	**0.0**
A. sericea	**30042**	1.1	0.0	-	0.2	0	0	0	-	0.0	-		**0.2**	**0.0**
C. brasilianum	**55698**	-		-		-	-	-	-	0.0	-		**0.0**	**0.0**
C. pascuorium	**Cavalcade**	-		-		-	-	-	-	0.0	-		**0.0**	**0.0**
C. rotundifolia	**Wynn**	14.6	22.6	33.3	2.6	0.0	34.0	13.8	0.0	14.9	0.1	11.5	**14.7**	**14.2**
D. virgatus	**37538**		4.8	-		-	-	-			-		**4.8**	**4.8**
D. virgatus	**49728**	0.5	-	1.2	0.2	5.0	2.0	-	0.0	0.0	-		**1.5**	**0.4**
D. virgatus	**52401**	0.0	-	0.7	0	2.0	2.0	-	0.0	0.0	-		**0.8**	**0.0**
D. virgatus	**67643**	0.0	-	-	0.2			-	0.0	-	-		**0.1**	**0.0**
D. virgatus	**BB AC 10**	-	-	1.2		12.0	12.0	-	0.0	0.0	-		**6.3**	**0.6**
D. virgatus	**BB AC 11**	-	-	0.3		32.0	31.0	-	0.1	0.0	-		**15.9**	**0.2**
D. virgatus	**Jaribu**	0.0	14.8	0	0.8	8.0	4.0	0	0.0	0.0	1.4	3.1	**3.2**	**0.4**
M. atropurpureum	**61232**									0.0			**0.0**	**0.0**
M. atropurpureum	**67647**									0.0			**0.0**	**0.0**
M. atropurpureum	**84989**	-	0.4	1.3	0	2.0	1.0	0.4	-	0.0	-	0.8	**0.8**	**0.4**
M. atropurpureum	**90748**	-	trace	-		-	-	-	-	-	-		**trace**	**trace**
M. atropurpureum	**90776**	-	0.4	-		-	-	-	-	-	-		**0.4**	**0.4**
M. atropurpureum	**Aztec**	-	0.2	3.9	0	2.0	14.0	3.7	-	0.0	-	0.3	**3.4**	**0.3**
M. bracteatum	**53770**	-	-	-		-	-	-	-	0.0	-		**0.0**	**0.0**
M. martii	**55782**	-	-	-		-	-	-	-	0.0	-		**0.0**	**0.0**
S. hamata	**Verano**	3.6	2.4	22	17	49.0	62.0	7.8	0.4	30.4	1.8	4.8	**20.1**	**6.3**
S. scabra	**Seca**	7.5	9.4	16.1	4.6	16.0	14.0	1.3	0	17.0	1.6	1.7	**8.9**	**6.1**

Table 2.3.3.5 Year 4 counts and presentation dry matter yield for selected legumes in Series 1. Yields for St Lawrence and Swans Lagoon are visual estimates.

Legume/Site		Gympie	Duaringa *	St Lawrence	Sarina	Swans Lagoon *	M.V.	Daly Waters	Katherine	Mean
Verano	plants/m^2 kg/ha	10 77	13 NA	30 300	30 381	89 1000	10 359	3 NA	3 NA	24 423
Amiga	plants/m^2 kg/ha	9 93	13 NA	31 300	35 662	59 800	-	-	3 NA	15 463
Seca	plants/m^2 kg/ha	16 3174	8 NA	16 600	18 1511	30 4000	12 3042	4 NA	3 NA	13 2465
Siran	plants/m^2 kg/ha	16 3624	7 NA	20 600	21 1951	-	-	-	3 NA	13 2058
Wynn	plants/m^2 kg/ha	6 59	7 NA	0 50	52 2147	38 1600	12 479	0 NA	2 NA	17 867
A. brasiliana 92519	plants/m^2 kg/ha	-	3 NA	6 300	23 1144	11 2000	-	0.5 NA	8 NA	9 1148

* year 3 data

2.3.4 Grazing Evaluation Sites (to record LWG)

2.3.4.1 *Aeschynomene villosa* CPI 37235, 91209 (cv Reid), 93621 (cv Kretschmer)

Objective: To assess productivity of pre-release accessions of *Aeschynomene villosa* relative to that of improved pasture in the area.

Collaborators: BG Cook and AG Salmon, DPI

Co-operator: CV (the late) and JR Cotter

Location: "Narrabri", Sexton, 31 km SW Gympie.
$26^0$01'S, $152^0$27'E, 50 m ASL

Areas sown: 2 ha of each

Soil description and analysis and rainfall is similar to adaptation sites (Section 2.3.2.1).

Date sown: 18 November 1992

Methodology:

This was an unreplicated comparison, comprising two paddocks, each of about 6 ha, One was an established pasture of *Digitaria didactyla*, *D. eriantha* ssp *pentzii*, *Chloris gayana*, *Lotononis bainesii* and *Macroptilium atropurpureum*. This paddock had been established for some years and had been grazed heavily and continuously. The *Aeschynomene* paddock was cultivated in contour strips, leaving about 1 in 4 uncultivated to avoid erosion. The *A. villosa* accessions (CPI 37235, CPI 91209 (now cv Reid) and CPI 93621 (now cv Kretschmer) were sown individually into 2 ha areas separated by a row of *Paspalum nicorae* CPI 27707 or 125877. *Bothriochloa pertusa* cv Keppel was sown with the 3 accessions. All seed was broadcast over the surface, and rolled with a fluted roller on 18.11.92. Fertiliser was applied at the equivalent of 200 kg/ha superphosphate to both paddocks.

Results and Discussion:

The sown paddock established well, but in the absence of the legume developed considerable leaf area by the onset of dry condition. This exacerbated the effect of moisture stress adversely affecting flowering and seed set. Although a reasonable proportion of plants of the perennials survived, there was little recruitment of the annual, CPI 37235. This line was resown on 3 December 1993.

None of the *A. villosa* accessions developed to their potential due to the continuing dry conditions and populations have gradually declined (Table 2.3.4.1.1). Both areas were intermittently grazed by farm stock in the interest of maintaining pasture condition in preparation for the change of season. Continuing unfavourable weather conditions, the inability to access test cattle, and the untimely demise of the farmer, Mr Cotter, all contributed to the decision to relocate to an alternative site.

Table 2.3.4.1.1 Population and Yield of *A. villosa*, Sexton via Gympie

A. villosa	Legume population (plants/m^2)		Dry matter yield (kg/ha)		Total
	8.6.94	**9.5.95**	**Legume 8.6.94**	**Grass***	
Reid	5.9	4.2	238	3032	3270
Kretschmer	8.9	3.2	894	2434	3328
CPI 37235	6.3	3.5	79	2988	3067

* *Bothriochloa pertusa* cv Keppel/*Digitaria didactyla*

2.3.4.2 *Aeschynomene villosa* cvv Reid and Kretschmer compared with *Vigna parkeri* cv Shaw in a producer demonstration site

Collaborators: BG Cook and AG Salmon

Co-operator: GP Lally

Location: Wilton Road, Cedar Pocket, 26°09'S, 152°45'E, 9.5 km NE Gympie, 100 ASL

Areas sown: 4 ha x 2 paddocks

Soil description: Red podzolic on phyllite with clay loam surface.

Soil analysis (0-10 cm):

Soil Analysis (0-10 cm)	**pH**	**EC** (ms/cm)	**Ca** (me/100 g)	**Mg**	**Na**	**K**	**Cl** (ppm)	**Pb**	**$SO_4^=$/S**	**Cu**	**Zn**	**Mn**
Shaw	5.7	0.08	4.8	3.4	0.27	0.48	33	40	28	2.0	5.8	165
Aes. (hill)	5.4	0.09	3.9	2.8	0.27	0.69	42	42	38	2.1	6.8	132
Aes. (old cult.)	5.9	0.07	4.2	3.7	0.27	0.44	34	34	30	2.0	3.2	209

Vegetation:

Formerly wet sclerophyll with *Eucalyptus cloeziana* predominating. Currently a mixture of *Axonopus affinis* and *Paspalum dilatatum* with isolated areas of *Imperata cylindrica*, *Pennisetum clandestinum* and *Pteridiium esculentum*.

Date sown: 6 January 1996

Methodology: Equal mixture of *Aeschynomene villosa* cvv. Reid (CPI 91209) and Kretschmer (CPI 91209), sown at 2.5 kg/ha on 6.1.96. *Vigna pakeri* cv. Shaw sown at 2.5

kg/ha on 4.1.96. In both cases seed was pelleted with molybdenum trioxide at 300g/ha incorporated into the pelleting lime. Seed was broadcast onto the surface of a well prepared seedbed and lightly harrowed to cover. No grass was sown, assuming mat grass and paspalum would regenerate. Each paddock is about 4 ha. Pasture Plus (15.1% P, 15.2% S) was broadcast at 125 kg/ha on 19.8.96.

Rainfall (mm):

	J	A	S	O	N	D	J	F	M	A	M	J	Tot
1995/96	12	27	41	76	219	140	271	22	28	55	122	28	1041
1996/97	21	14											
Mean (Gympie)	53	37	47	73	88	135	168	162	143	87	70	63	1143

Results and Discussion:

Good rainfall was received at and soon after planting, but no good follow-up rain was received, the next substantial falls being in late April/early May. Despite this, adequate establishment was achieved, counts on 17 April, 1996 yielding values of 5.1 and 6.8 plants/m^2 for *A. villosa* and *V. parkeri* respectively. Before the onset of winter, all legumes were growing well. Frosts from June to August have killed legume tops, but will not have caused permanent damage.

The area is being lightly grazed to condition the sward while two lines of paired weaner stock are being located in preparation to weigh onto the treatments.

2.3.4.3 *Aeschynomene brasiliana* CPI 92519

Collaborators: Kev Shaw, Col Webb, DPI

Co-operator: Robert and Lorraine Henry, Sugarbag, Mt Garnet

Site details and rainfall as for Sugarbag adaptation site, Section 2.3.2.11.

Area sown: Two paddock comparison between native (57 ha) and native pasture oversown with legume (42 ha).

Date sown: 29 January 1992, and additional area 23 December 1993.

Results and Discussion:

Although designed as a grazing evaluation there has never been a sufficient area of legume to constitute a genuine comparison between the oversown and native pasture paddocks. CPI 92519 has established remarkably well despite an ongoing drought (until 1995/96). However, the area established was less than 10% of the paddock and, to date, natural spread has been slow.

Overall legume yields in each of 1994/95 and 1995/96 was 36 kg/ha which represented only 3% and 5% of total DM yield respectively. Legume was encountered in 11% and 7% of quadrats respectively. In spite of the low frequencies measured, the perception is that yield and plant numbers are increasing. In the areas of the paddock where it has established the legume yields are approximately 60% of total yield and the companion grasses are often heavily grazed which may indicate that some nitrogen transfer is occurring. The paddocks are currently being grazed by a group of spayed heifers but weight responses are not yet available.

2.3.4.4 *Aeschynomene brasiliana* 92519

Collaborators: HG Bishop, JJ Bushell, TB Hilder

Co-operator: DPI (Keith Jeppesen)

Location: Swans Lagoon Research Station, Millaroo, via Ayr
20^{0}05'S, 147^{0}15'E

Area sown: 4 ha in area of 8 ha

Soil description: clay loam, area previously filled and levelled for cane

Soil analysis (0-10 cm):

pH	EC ms/cm	Cl^- ppm	P (bicarb) ppm	Ca meq%	Mg meq%	Na meq%	K meq%
8.1	0.085	31	8	12	7.1	0.87	0.45

Date sown: 10 December 1993

Rainfall (mm): (see "Swans Lagoon" adaptation site, section 2.3.2.10)

Results and Discussion:

This site was established in 1994/95 because the Mt Garnet site had experienced drought in 1991/92, 1992/93 and 1993/94.

The site established well but has proved inadequate for measuring LWG. It is too small, has variable soils and contains other legumes (*Sesbania*, Phasey bean and *Rhyncosia*) which has prevented *A. brasiliana* CPI 92519 diet intake studies. Steers have grazed this site from April 1995 in conjunction with an adjacent 4 ha of woodland. They have grazed the *A. brasiliana* quite readily and transfer of seed via the dung and establishment of CPI 92519 in the adjacent 4 ha woodland paddock will be monitored.

Population of the sown area has been monitored by frequency counts.

Pasture components	**% freq 21.3.94**	**% freq 19.4.95***	**% freq 19.2.96**
A. brasiliana 92519	69 (9 plants/m^2)	92	56
Bisset and Sheda grass	NA	85	88
Other grasses	NA	53	NA
Broadleaf weeds	NA	32	NA
Other legumes	NA	11	20

* Visual estimate of drymatter yield on 19.4.95 when steers were introduced. was *A. brasiliana* CPI 92519 1500 kg/ha and total yield 6000 kg/ha

2.3.4.5 *Chamaecrista rotundifolia* CPI 85836, 86172

Collaborators: Kev Shaw, Col Webb, DPI

Co-operator: Mike and Helen Murdoch

Location: "Lamonds Lagoon", 80 km S of Mt Garnet, 18^{0}22'S, 145^{0}08'E

Soil description: Red earth/yellow earth with sandy loam surface and low P status.

Date sown: Paddock 1 sown 24 December 1991 and 9 January 1992. Paddock 2 sown 14 January 1993.

Methodology: Two paddocks comparison between (1) native pasture oversown with CPI's 85836 and 86172 (40 ha) and (2) Native pasture oversown with cv Wynn (10 ha).

Companion Grass: *Bothriochloa pertusa* Bowen strain (20 kg sown over approximately 10 ha).

Rainfall:

	J	A	S	O	N	D	J	F	M	A	M	J	Total
91/92	0	0	0	10	16	138	54	258	6	6	40	2	530
92/93	0	0	18	0	74	81	40	44	12	0	0	14	283
93/94	81	2	0	11	24	2	74	40	106	14	3	11	368
94/95	7	0	0	5	33	55	59	112	91	0	29	0	391
95/96	4	70	0	56	108	34	213	88	159	56	36	6	830

Results and Discussion:

Although designed as a grazing evaluation initial plant numbers were very low. Drought conditions over the entire property in 1993 and 1994 meant that these paddocks had to be utilised to the full and neither area had a good opportunity to establish. The paddocks were spelled over the 1996 wet season and establishment of most of the original sown areas is now complete with legume yields of approximately 800 kg/ha. That establishment occurred at all during the drought is surprising. In the extensive grazing lands of dry tropical north Queensland the normal time from sowing to established pasture is approximately 4 years and this has been achieved.

Both of these legumes have a capacity to produce a large bulk of material. There is a concern about their acceptability to stock and this should be resolved before any progress on release. Whether or not funding for this project continues, managed grazing will begin in 1997.

2.3.4.6 *Aeschynomene americana*, comparative demonstration of cultivars Glenn and Lee jointvetch. This project was funded as a MRC PDS Project and ran from January 1992 to June 1996 at "Tedlands", Koumala, via Mackay. The outcomes from this project are presented in Appendix 2 as a copy of a paper to be presented at the XVIII International Grassland Congress in Canada in June 1997.

2.3.5 Legume response to phosphorus

2.3.5.1 *Aeschynomene villosa*, Gympie

Collaborators: Bruce Cook, Alan Salmon, George Rayment, Dennis Baker, Mike Gilbert, DPI

Co-operator: R Bambling

Location: "Scotchy Pocket", via Gunalda; 26°01'S, 152° 31'E; 50 m ASL
26 km NW Gympie and 7 km E of the Gympie "Adaptation Site"

Rainfall: See "Adaptation Site" Section 2.3.2.1.

Great Soil Group: Soloth with loamy sand surface

Soil analysis (0-10 cm):

pH	EC	Cl^-	P_b	$SO_4^{=}/S$	Cu	Zn	Mn	Ca	Mg	Na	K
	(mS/cm)	(ppm)						(me/100g)			
5.7	0.015	10	2	2	0.1	0.3	4	0.6	0.3	0.1	0.1

Experimental Design: 6 x 6 factorial in 3 RB with plot size 5 x 2.5 m.

Treatments: The legumes were *Aeschynomene villosa* cv Reid (92109), *A. villosa* cv Kretschmer (93621) *Arachis glabrata* cv Prine (CPI 93498), *A. paraquariensis* 91419, *A. pintoi* cv Amarillo and *S. scabra* cv Seca. The P rates were 0, 10, 20, 40, 60 and 80 kg/ha.

Methodology: The existing ground cover of *Digitaria didactyla* was killed with glyphosate and the area rotary hoed. Fine seed (treats 1,2,6) were sown at 10 kg/ha, by surface broadcast. The larger seed (treats 4,5) were sown into furrows 40 cm apart, 25 cm from the plot boundary and about 5 cm deep at 50 kg/ha. High sowing rates were used to ensure a good plant population. All seed was sown on 13.10.93 and the whole area rolled. Rhizomes of 'Prine' were planted in rows as for Arachis seed on 26.10.93, using 125g rhizomes/row. The whole area was sprayed with 'Basagran' on 19.11.93, 'Sertin' on 29.11.93 and 'Verdict' on 6.3.94 and 16.3.94 to control weed growth.

Results and Discussion

All species established well despite dry conditions, although some failed to develop sufficiently to facilitate harvest. Species treatments 1,2,4 and 6 were harvested on 2 June 1994, and sorted into legume and other. The non-legume component was only appreciable in the CPI 91419 plots. The harvested quadrat area did not recover in the Seca plots and severe dry conditions caused a marked reduction in population in the *A. villosa* plots, and restricted redevelopment of stand. Further harvests were not possible due to continuing dry conditions in the 94/95 and 95/96 season.

Unfortunately, a uniformity trial was not conducted prior to establishment, and soil samples taken on the day of planting (before fertiliser application) revealed that bicarbonate extractable phosphorus levels varied from 4 to 42 ppm, despite effort to reject plots that appeared atypical due to high charcoal levels. However these values must all be suspect, since a second intensive soil sampling from the Amarillo plots revealed the following situation for the P_0 plots:

Comparative soil analysis of Amarillo PO plots on two dates

	P_b ppm in 0-10 cm		
Sampling date	**Rep 1**	**Rep 2**	**Rep 3**
13.10.93	29	21	7
2.6.94	4	5	5

N and P concentration in DM of diagnostic samples of Amarillo

	P treatment					
Nutrient level	**P0**	**P10**	**P20**	**P40**	**P60**	**P80**
N %	1.77	1.99	2.04	2.09	2.13	2.11
P %	0.18	0.23	0.30	0.37	0.31	0.35*

* disregarding the inordinately high value of 0.71 in rep.3.

Further, when P rate was graphed against soil P (2.6.94), response curves were almost identical with levels ranging between 4 and 39 (rep 1), 5 and 43 (rep 2) and 5 and 34 (rep 3). Such discrepancies make interpretation impossible. The great variability in response shown in Table 2.3.5.1.1 may be the result of marked variation in native P levels between plots or may reflect the low level of response to P in the test varieties, difference being due to some other characteristic varying between plots. The latter possibility is somewhat suggested by nutrient level response in Amarillo in the above table where N and P levels reach a maximum at about P20 and level out, which is typical of the type of response expected. If other legumes, all from tribe *Aeschynomeneae*, had showed similar nutrient concentration response, one would expect some pattern in dry matter response; there was none, positive nor negative.

The data have provided a yield comparison between Reid and Kretschmer, the latter on average producing double the yield of the former. Although the yield of *Arachis paraguariensis* was low, it should be noted that all tops of this accession constitute high quality, edible dry matter, while in the high yielding Seca, much of the total biomass is lignin.

These plots will be maintained, should the opportunity arise to pursue the issue of site uniformity and variety response.

Table 2.3.5.1.1 Dry matter yield response to applied phosphorus, 2.6.94

Treatment	Dry Matter Yield (kg/ha)			
	A.v. Reid	A.v. Kretschmer	A. par 91419	S.s. Seca
P0	1947	2651	992	4668
P10	1083	3267	966	5016
P20	1607	4752	790	6440
P40	2663	4230	572	4576
P60	563	4064	696	5168
P80	2090	4600	622	5582
Mean legume	1659	3927	773	5242
Mean total	2014	3927	1401	5242

2.3.5.2 *Aeschynomene americana*, Mackay

Collaborators: Harry Bishop, John Bushell, Terry Hilder, Mike Gilbert, George Rayment, Dennis Baker

Co-operator: Les Bredden, Manager "Tedlands"

Location: "Tedlands", Koumala, 65 km south of Mackay. $21^0$36'S, $149^0$18'E, 10 m ASL

Soil description: Podzolic (Dy 3.31) with sandy loam surface.

Soil analysis (0-10 cm):

Depth	pH	P_b (ppm)	K (meq %)	SO_4S (mg/ kg)	Ca (meq %)	Na (meq %)	Cl (mg/ kg)	C/S (%)	f/s (%)	Silt (%)	Clay (%)
B0-10	6.0				1.0	0.35	75	11	64	22	11
0-10	5.9	2	0.06	6			32	10	59	26	13
10-20	5.4						22				
20-30	5.6				0.42	0.22	17	8	53	28	19
30-50	5.5						27				
50-70	5.6				0.94	1.50	34	8	32	31	14
70-100	5.5						59	6	31	30	37

Experimental design: 6 x 4 factorial in 4 RB with plot size 5 x 2.5 m

Treatments: Four legumes (*A. americana* cv Glenn and cv Lee, *A. villosa* cv Reid and *S. scabra* cv Seca) by 6 P rates by 4 reps.

Sowing date: 27 October 1992

Rainfall:

	J	A	S	O	N	D	J	F	M	A	M	J	Total
1992/93				9	22	174	336	132	41	117	55	15	
1993/94	22	70	36	51	35	146	176	131	389	69	33	30	1188
1994/95	4	0	0	63	34	120	128	182	0	109	87	21	748
Average	13	35	18	41	30	147	213	148	143	98	58.3	22	968
75 year AAR (Koumala)	44	25	26	51	94	166	325	332	236	98	67	46	1510

Results and discussion:

Two drymatter harvests were taken in each of year 1 (1992-93), year 2 (1993-94) and year 3 (1994-95). Plots were soil sampled prior to year 2 and year 3 growing season to record soil phosphorus status prior to each growing season. Currently this data is being prepared by George Rayment as a publication for a scientific journal. This publication will be forwarded as an attachment to this report as soon as completed and full results documented in the 1998 project final report.

2.3.5.3 MT GARNET

Collaborators: Kev Shaw, Col Webb, Mike Gilbert, George Rayment, Dennis Baker, DPI

Co-operators: Robert and Lorraine Henry

Location: Sugarbag Station, 32 km SW of Mt Garnet, 17^{0}40'S 144^{0}58'E

Soil and rainfall details same as for Adaptation Site - Section 2.3.2.11.

Treatments: 4 legumes (*Aeschynomene brasiliana* CPI 93592, *Chamaecrista rotundifolia* CPI 85836, *C. rotundifolia* cv Wynn, *Stylosanthes scabra* cv Seca) by 6 phosphorus rates (0, 10, 20, 40, 60, 80 kg P/ha) by 4 reps.

Planting date: 4 November 1992

Companion grass: Native pasture

Results and discussion:

Apart from Seca stylo, establishment of all species has been poor. In 1996, dry matter yields were 4 kg/ha, 9 kg/ha, 76 kg/ha and 450 kg/ha for CPI 93592, CPI 85836, Wynn and Seca respectively. There was no effect of P rate and overall legume yield was 135 kg/ha. Variability within and between treatments was high and there seems little point in continuing this experiment. Phosphorus run down, particularly at the lower rates, would now mean that available P on these treatments would not differ from the nil treatment. If this avenue of work is considered important then the experiment should be re-established at a new site.

2.3.6 Legumes grazing acceptance:

Adaptation sites are grazed by steers locked onto the site where possible or by animals in an adjacent restricted holding paddock. An attempt was made to rate grazing acceptability during the BOTANAL recording but it was often difficult to assess each quadrat for amount of grazing and the data produced had limited application. Also animals are often reluctant to graze new legumes but acceptability changes with familiarity as well as with soil and seasonal factors.

However this exercise plus general observations across a series of sites allows the legumes to be broadly ranked into groups of grazing acceptability (Table 2.3.6.1).

Table 2.3.6.1 Ranking of legume grazing acceptability by steers across a range of sites and years as observed during data recording visits.

Legume	Grazing acceptability	
	Wet Season - active growth	Autumn - Winter
A. histrix	high	high
A. americana	moderate	high
A. villosa	moderate	high
Verano/Amiga	moderate	high
Seca/Siran	light	mod-high
A. brasiliana	light	moderate
Chamaecrista rotundifolia	light	moderate

2.3.7 Legume quality:

Selected legumes from the Sarina Series 1 site were tip sampled (0-15 cm) in February 1996 separated into leaf and stem, and analysed for nitrogen (N), phosphorus (P) and acid digestible fibre (ADF). Results are shown in table 2.3.7.1.

Lee and Kretschmer had lowest leaf ADF and highest leaf N and P content. They also had the highest proportion of leaf to stem in the tip samples. Tip stems had lower "quality" values with less variation between legumes.

Table 2.3.7.1 Quality attributes (ADF, leaf, N and P) for selected legumes (10-15 cm tips) sampled on 23 February 1996 at the Sarina Series 1 site and presented in numerical order for leaf ADF

Legume Leaf	**% ADF**	**% Leaf**	**% N**	**% P**
A. americana cv Lee	16.60	76.6	3.37	0.19
A. villosa cv Kretschmer	19.38	76.8	3.05	0.19
S. scabra cv Seca	23.10	67.2	2.52	0.14
A. brasiliana 92519	24.99	71.1	2.71	0.16
C. rotundifolia 86172	28.22	75.0	2.99	0.16
A. histrix 93636	28.91	67.7	2.97	0.17
C. rotundifolia cv Wynn	29.85	72.4	2.52	0.14
Legume Stem	**% ADF**	**% Stem**	**% N**	**% P**
A. americana cv Lee	42.18	23.4	1.43	0.15
A. villosa cv Kretschmer	42.71	23.2	1.39	0.18
S. scabra cv Seca	45.07	32.8	1.29	0.12
A. brasiliana 92519	42.87	28.9	1.23	0.16
C. rotundifolia 86172	47.93	25.0	1.01	0.18
A. histrix 93636	46.74	32.3	1.25	0.12
C. rotundifolia cv Wynn	44.39	27.6	1.13	0.12

2.3.8 Legume soil seed reserves:

Selected legume plots from selected sites in Series 1 plantings were soil sampled and processed in 1995/96 for legume seed reserves (by the method of Jones and Bunch 1988). The results are shown in table 2.3.8.1, together with counts from the Tedlands Grazing Demonstration for Glenn and Lee jointvetch (see section 2.3.4.6).

Buildup of soil seed reserves follows expected trends in that early seeding high seed yielding legumes have the highest reserves, particularly if *Chamaecrista* and *Aeschynomene* are considered separately. The drier than normal conditions at Sarina and Miriam Vale have kept Glenn and Lee reserves low due to stand decline. However Glenn had high seed reserves under wetter conditions at "Tedlands". *A. americana* CPI 93624 which flowers several weeks earlier than Glenn had higher seed reserves and legume population at Miriam Vale.

Table 2.3.8.1 Seed recovered from 0-10 cm of soil surface for selected sites.

Legumes Sown November 1992	"Glensfield"* (seeds/m^2) Sampled October '92	"Granite Vale"* (seeds/m^2) Sampled June '95	** "Tedlands" (seeds/m^2) Sampled March '95	"Wadeleigh"*** (seeds/m^2) Sampled April '95
C. rotundifolia cv Wynn	3422	-	-	6213
C. rotundifolia 86172	2292	-	-	4125
A. americana 93624	-	-	-	1324
A. brasiliana 92519	1182	883	-	-
C. rotundifolia 85836	1049	-	-	-
A. villosa 37235	764	-	-	-
A. villosa cv Reid	731	-	-	-
A. histrix 93636	519	-	-	-
S. scabra cv Seca	336	294	128	866
A. villosa cv Kretschmer	316	-	-	668
A. americana cv Glenn	295	-	5128	407
A. americana cv Lee	51	-	256	-
D. virgatus cv Bayamo and Uman	-	34	-	-

* Bulked sample of 20 x 2.5 cm cores x 2 reps
** PDS Project (50 x 2.5 cm cores)
*** Bulked sample of 10 x 7 cm cores x 2 reps

2.3.9 Seed Production

2.3.9.1 *Aeschynomene*

At the starting point in 1985, *A. americana* cv Glenn was already established, with viable commercial seed production firmly established. *A. falcata* cv Bargoo had been grown over two seasons in north Queensland and abandoned as very poorly adapted to the conditions. The seeding properties of other accessions of the genus were largely unknown, but much could be inferred from experience with Glenn and other similar contemporary material.

Walkamin Research Station was chosen as the site for further seed multiplication because of its demonstrated suitability with related legumes, and seed was multiplied over 9 of the next 11 seasons as the need to service the evaluation programme developed. The objective in every case was to provide ample amounts of the required seed to satisfy every stage in the process up to the point of transfer to commercial production; and at the same time develop seed production methods appropriate to commercial enterprise. Of the 23 accessions so handled, three have been released as cultivars (Lee, Reid and Kretschmer, formerly CPI 93574, 91209 and 93621 respectively).

Actual performance of the 44 crops grown is summarised in Table 2.3.9.1.1. The general position with the jointvetches is summarised below.

All species are strongly determinate, and produce terminal inflorescences. In some this is obvious, as they are erect plants carrying the flower and seed crop high off the ground high in, or above, the leaf canopy (e.g., *A. americana, A. histrix, A. paniculata, S. filosa*). Others conceal the determinate habit through being sprawlers, so that the shoot tips remain close to the ground and the inflorescences intermingle with the vegetative parts. A. *villosa, A. brasiliana*, and A. *elegans* are three such. The former are usually easy to harvest by direct-heading with the cutter bar held high off the ground. The latter are more likely to grow in a low, compressed tangle which is difficult to head and lend themselves more to suction harvesting.

All crops grown have been dry-season seeders. This gives them a 4-8 month life span when sown in early wet season. Most have been dependent for their success on the reliability of the dry season, since they are prone to attack from a number of diseases in prolonged cool, damp conditions, especially when the crop canopy is dense and the plants themselves flowering. This makes choice of district for seed production particularly important, and generally excludes southern districts with a significant winter rainfall risk.

The relevant diseases are *Rhizoctonia* and a *Botrytis-Sclerotinia* complex. They seem to be relatively unimportant under grazing, when infected leaf surfaces are being constantly replaced and where canopies seldom become very thick. But under seed production, which depends on dense, pure swards for maximum production, they expose a particular, characteristic weakness of the genus. In general, with proper choice of locality and occasional use of fungicide, we can live with this weakness, but in bad seasons and with especially susceptible species (e.g., *A. elegans*) it is disastrous. High susceptibility eliminates an accession from consideration as a potential cultivar, since it is obvious that it cannot reliably produce abundant cheap seed. Another very common disease of members of the genus is powdery mildew, which is almost universal in the dry season, but which, while unsightly, generally seems to cause little harm.

The growing crop suffers little from insects, though occasionally infestations of inflorescences by lepidopterous larvae call for routine control measures. Crop management of all species is simple, and consists mainly of ensuring good growing conditions over the vegetative period, with then a transition to mild stress to encourage vigorous reproduction, (i.e., conventional legume management). Weed control is of variable difficulty, depending primarily on the susceptibility of each specific accession to 2,4-D. Some are resistant, some not, within the same species; and as 2,4-D is still the most useful herbicide for dicotyledonous weed control, this is important. Familiar pre-emergence and grass-killing herbicides are mostly safe.

Provided circumstances allow adaptation of harvest method to the particular crop, that is, either direct heading or suction or both, harvest presents few problems. An exception is the extremely sticky *A. brasiliana* CPI 92519, which blocks all machinery even in the form of dry windrows. However this accession, although well adapted to harsh conditions, has yet to demonstrate its contribution to animal liveweight gain. Viability of commercial seed production would have to be re-assessed in light of its contribution to animal production before considering cultivar status.

In spite of a number of recorded low yields, the jointvetches are (mostly) potentially heavy seed producers. Poor seed production was mostly attributable to difficult seasons (e.g., 1990), extreme susceptibility to disease (e.g., *A. elegans*), or occasionally inexperience of specific peculiarities such as rapid seed shedding (e.g., *A. americana* 91235 in 1989). The security of getting good yields increased greatly with the loan in latter years of a suction harvester. The three cultivars (Lee, Reid and Kretschmer) have provided to be good seed producers, though the recent two will need to rely on suction harvesting.

The pods of most accessions fragment when ripe into segments in which the single seed is contained within a persistent, protective envelope of the pod tissue, and this becomes the seed unit for most purposes. Some, however, including the recently released accessions of *A. villosa*, shed the seed naked. This increases the difficulties of suction harvesting, but facilitates cleaning. On the whole, jointvetch seeds are easy to clean, and high purities are the normal state of seed lots. This, coupled with robust seed structures, generally ensures high all-round quality as commercial seed.

Perhaps the worst feature of the jointvetches in farm land is their weed potential. When opportunities for rotation are not infinite, they contaminate one another with volunteer plants derived from persistent hard seed surviving from former crops; and they may become serious general crop weeds, particularly the cultivars of *A. americana*.

Summary:

Forty-four crops of 23 accessions of 8 species have been grown over 9 seasons to provide seed for advanced evaluation and for cultivar transfer (3) to commercial production. Satisfactory seed yields have generally been possible, though dependent on good seasonal conditions (even in a climatically suitable district). Adequate experience and information has been accumulated to allow a smooth transition to reliable commercial seed production. Susceptibility to the diseases *Rhizoctonia* and *Sclerotinia-Botrytis* has been identified as the Achilles heel of the genus when crops are grown for seed.

Table 2.3.9.1.1. Record of seed production of *Aeschynomene* spp. at Walkamin RS between 1985 and 1995. Production is of cleaned seed, yield in kg/ha pure seed. "1st flr" records date at which flowering was first noted. "Harv." is date of harvest (if more than one, then the first).

Species	Accession	Year	Dates		Area	Prodn	Yield
			1st flr	Harv.	(m^2)	(kg)	(kg/ha)
americana	53950	1988	24/3	7/6	89	11.4	1076
	87835	1990		4/9	253	3.7	139 y
	91102	1988	7/3	26/5	160	9.4	540
	91235	1988	24/3	7/6	56	5.6	900
	91235	1989	13/3	14/6	429	12.1	276 d
	93554	1985	20/6	16/9	61	2.15	298
	93573	1990	23/4	26/6	106	3.4	301 y
	93574*	1985	23/4	13/8	53	1.94	364
	93574*	1986	1/4	8/8	818	31.9	380
	93574*	1990	9/5	20/8	488	13.2	260 y
	93574*	1991	/5	28/8	6713	400	596 b
	93624	1988	24/3	18/5	504	32.0	597
	93661	1990	3/9	117	3.5	265 h	
	93667	1988	1/7	6/9	168	27.5	1621
	93667	1989	11/7	5/9	226	19.0	784 v
	93667	1990	9/5	4/9	263	7.2	251 y
brasiliana	92519	1985	9/4	1/8	49	0.99	125
	92519	1986	10/3	26/8	597	12.9	212
	92519	1990	23/4	5/9	338	3.6	91 y
	92519	1991	L/4	28/10	2720	98.1	361 +sb
	92519	1992	12/8		2720	210.2	773 rb+s
	93592	1987	M/3	7/8	760	31.0	404 b
	93592	1988	9/3	18/5	690	46.0	615 rb
elegans	92523	1987	L/3	31/7	461	14.8	313
	92523	1988	24/3	23/5	461	1.5	27 b
	92523	1989			161	Abandoned	z
filosa	85843	1989	4/4	7/6	206	39.0	1870
histrix	93599	1995	18/4	31/7	1265	95.0	748 b
	93636	1987	L/4	19/8	712	25.5	344 b
	93636	1988	7/4	27/5	712	54.0	629 rb
	93636	1995	18/4	1/8	1089	60.7	547 b
paniculata	93653	1987	8/4	23/6	190	12.8	627
	93653	1988	18/1	22/3	152	14.0	799**
sp.	52332	1989	20/3	16/5	104	17.7	1636 h
villosa	37235	1991	E/4	7/8	560	68.6	1225 s
	91209+	1991	E/4	1/8	737	43.4	589 s
	91209+	1995	27/3	25/5	2061	206.0	965 z+s
	93616	1985	13/4	18/6	45	1.70	365 swept
	93616	1986	28/4	5/6	517	6.5	122 b
	93616	1988	14/3	3/6	611	20.0	164 d
	93621x	1991	E/4	14/8	764	53.6	701 s
	93621x	1995	10/4	6/7	1820	173.0	924z+s
	P6811	1988	6/4	7/6	170	1.9	58
	P6811	1989	15/2	6/4	260	13.7	479

Accession column:- * = cv. Lee. + = cv. Reid. x = cv. Kretschmer.
1st flr column:- E, M and L mean early, mid and late.
Far right:- **Harvest:-** headed if not otherwise noted; h = hand-cut; s = suctioned; +s = both headed and suctioned. ** = total yield of 2 crops, one hand-cut, one headed, the second taken on 2/6. **Disease:-** b = *Botrytis-Sclerotinia* severe; z = *Rhizoctonia* severe. **Second-year crops:-** r = ratoon crop; v = volounteer seedling crop. **Misfortunes:-** y = a bad year for weather; d = much seed dropped before it could be headed.

2.3.9.2 *Chamaecrista*

In order to service the extensive evaluation of two selections, CPI 85836 and 86172, from a number of accessions of *C. rotundifolia*, seed was multiplied in the 1990 and 1992 seasons. Crops were grown conventionally and were both direct headed and suction harvested. Yields were consistently heavy. Records of production are tabulated below. Sowing date for all crops was 12 December in the preceding year.

Accession	**85836**		**86172**	
Year	1990	1992	1990	1992
Harvest date	25/9	20/8	28/9	8/7
Crop area (m^2)	149	1953	398	2005
Production (kg pure)	29.9	385.3	61.3	392.6
Yield (kg/ha pure)	2008	1973	1541	1958

2.3.9.3 Multiple accessions (for second phase evaluation)

Bob Walker commenced second phase seed increase (up to 2 kg) at Walkamin Research Station, using supplementary irrigation, as part of COPE II activities (Pengelly and Staples 1996). This, together with the pre-COPE II seed increase at Walkamin, has enabled rapid passage of accessions from first stage evaluation to second stage (large plot) field evaluation at a wide range of sites. There were 46 accessions seed increased for BULS. Some were not actually sown due to insufficient seed but the list is shown in Table 2.3.9.3.1.

Table 2.3.9.3.1 COPE accessions evaluated in *Back-up legumes for stylo* (BULS)

Species	Accessions
Aeschynomene americana	sown 56282, 93624, 91235, 93574 (cv Lee), 93661
Aeschynomene brasiliana	sown 92519, 93592
Aeschynomene histrix	sown 93599, 93636, 93638
Aeschynomene paniculata	sown 93635
Aeschynomene villosa	sown 37235, 91209, 93621
Alysicarpus monilifer	sown 52343
Alysicarpus rugosus	sown 51655, 69487, seed increase 84470
Atylosia scarabaeoides	seed increase 29670
Atylosia sericea	sown 30042
Chamaecrista pilosa	sown 57503
Chamaecrista rotundifolia	sown 85836, 86172, 93094
Desmanthus virgatus	sown 30205, 33201, 37143, 37538, 38351, 40071, 49728, 55719, 67643, 78372, 78373 (cv Marc), 79653, 82285 (cv Bayamo), 85178, 90750, 92803 (cv Uman), TQ90
Macroptilium atropurpureum	sown (84989)
Macroptilium psammodes	seed increase 39098
Macrotyloma axillare	sown 52469
Rhynchosia sublobata	seed increase 52727
Rhynchosia verdcourtii	seed increase 52724

2.3.9.4 Commercial cultivars

This refers to stylos and their alternatives in Queensland and is an assessment made in September, 1996.

The position with the *scabra* stylos is that there was carry-over of Siran in 1995/96, but that Seca was sold out. This year there will be reasonable amounts of Seca, though not excess. A number of former producers have left the industry for reasons of age, etc., and not been replaced, and this reduces production compared with a few years ago. A little less than 100 t seems a reasonable estimate, and if so it will probably go close to satisfying a market depressed by low cattle prices. Siran may reach the teens of tonnes. Its sale is hard to predict.

As for the *hamata* stylos, Verano production will be down on expectation (about 60 t) as a result of a difficult season, and will almost certainly clear. Amiga production remains fairly small (10 t), but its seed may sell once Verano is cleaned out. Its extreme similarity to Verano, coupled with its higher price, makes it generally the second choice.

Fine-stem stylo (there seems to be no true cv Oxley) is produced in southern Queensland where two growers harvest 2 to 5 tonne of seed per year depending on season and demand. There is little beyond a small export market for the *guianensis* stylos, and little present seed production. The *aff. scabra* stylos encountered an unforeseen establishment problem in their commercial season, but enough seed still exists to get both promotion and full-scale seed production under way without serious delay to the planned commercialisation.

The jointvetches offer limited markets because of their limited adaptation to coastal tropical pastures, which are easily satisfied by two main growers. Seasonal variation in production is smoothed out by carry-over, and good, cheap seed is always available. Average annual production may be about 30 t for Glenn and 20 t for Lee. Seen from a northern perspective, commercial seed production of Bargoo has been unsuccessful. Limited experience in the north has been totally discouraging but a further attempt by a Mundubbera seed producer will be made utilising irrigation and suction harvesting.

Wynn cassia is produced by one main grower, usually about 10 t. It trickles away, but is not a particularly large or buoyant market, despite being a potentially useful legume over the large areas. It has at times acquired an unwarranted bad reputation for unpalatability as a result of localised but publicised difficulties.

Aztec atro has virtually replaced Siratro. There is one grower satisfying what is probably a 10-20 t market. Aztec is effectively what Siratro was before rust appeared, but Siratro itself was by that time only a relatively minor niche legume. Atros remain useful components of mixtures because of their early growth, but there are always doubts about their persistence.

Overall, the stylos remain the dominant legumes for the less fertile soils of the grazing lands of the seasonally dry tropics and sub-tropics.

2.3.10 Herbicides tolerance/susceptibility

Objectives:

To characterise promising legumes for survival following spraying with herbicides for weed control under seed production mode as well as identifying herbicides which will control the legume if it develops a weed problem situation. This work is being conducted at Gympie by DPI's Don Loch and Greg Harvey.

Screening of about 10 legumes at seedling stage in pots against a wide range and types of herbicides at varying rates is nearing completion and data will be processed and presented as a publication. Outcomes will be fully documented in the 1998 final report.

2.4 SUCCESS IN ACHIEVING OBJECTIVES:

Objective (i): By July 1995, to study and understand the general agronomy and ecology of three well adapted legume cultivars (particularly from *Aeschynomene* and *Chamaecrista* species) and develop commercial management practices to speed their integration into the commercial grazing industry.

Achievement: Two new legume cultivars were registered in September 1995 and in liaison with the licensee and extension personnel, commercial management packages will be compiled for *A. villosa* cvv. Reid (CPI 91209) and Kretschmer (CPI 93621), including herbicide tolerance/susceptibility information. Updated management recommendations for current cultivars, Lee, Glenn and Bargoo jointvetch and Wynn cassia, as well as for Seca/Siran and Verano/Amiga stylos can now be prepared using results from the BULS project. With project sites on commercial properties and with pasture walks for producer groups at several sites, new technology is already being transferred to the beef industry. Over the next two summers special note will be taken of legume/grass stability of both new lines (*A. brasiliana* and *C. rotundifolia*) relative to some recent concerns with loss of grasses from grazed Seca pastures.

Objective (ii): By July 1995, to demonstrate the animal production potential of the new cultivars.

Achievement: Measurement of liveweight gain has been severely restricted by drought. At Mt Garnet *A. brasiliana* CPI 92519 has taken till 1994/95 to establish but still with insufficient coverage to weigh cattle. *Chamaecrista rotundifolia* CPI 85836 and 86172 has only now (poorly) established in 1995/96. The *A. villosa* site at Gympie has established but drought has interrupted LWG recording. A new site of Reid and Kretschmer has established this summer and cattle will be weighed in 1996/97. Both new cultivars are readily eaten by cattle.

Objective (iii): By October 1995, to produce a minimum of 100 kg of seed of the three new cultivars for time of release.

Achievement: Approximately 200 kg of seed of each of Reid and Kretschmer has gone to the licensee for commercial seed increase in 1996/97. The licensee is combining with QDPI and NSW Agriculture, in using some of this seed to sow on farm demonstration areas of the new cultivars in 1996/97.

Objective (iv): By October 1995, to determine field nutrition requirements and responses and develop appropriate seed technology packages for each new cultivar.

Achievement: The response of Glenn, Lee and Reid to different rates of phosphorus fertiliser relative to the response of Seca has been documented and the information is being prepared for use in commercial management packages. Recording response patterns for *A. brasiliana* CPI 92519, *C. rotundifolia* CPI 86172, and Wynn at Mt Garnet has not been possible due to drought. At Gympie data on the response of *A. villosa* cvv Reid and Kretschmer to P has been limited by drought and apparent site variability.

Objective (v): By June 1996, to release the three cultivars to complement and back up currently used legume cultivars (particularly for the *Stylosanthes* species)

Achievement: This project has expedited the release of two new cultivars Reid and Kretschmer which were registered by the QHPLC in September 1995 with commercial seed production commencing in 1996/97. Although these varieties of *A. villosa* were identified in early evaluation work the COPE and BULS projects have provided the necessary supporting data for release. Potential cultivar release of *A. brasiliana* CPI 92519 is on hold until LWG data indicates this legume contributes to improved animal performance and its early growing season stickiness poses no problem to animal acceptance or potential weediness. Insufficient data are currently available to justify release of *C. rotundifolia* CPI 85836 and 86172.

Objective (vi): By June 1996, to select 5 new legumes for pre-release.

Achievement: Three accessions of *A. histrix* (CPI 93599, 93636, 93638) were placed on QHPLC pre-release in August 1994 and will continue to be recorded till 1998. *A. americana* CPI 93624 which flowers several weeks earlier than Glenn indicates better regeneration than Glenn at several sites but is not yet proposed for pre-release. Several *Desmanthus virgatus* accessions demonstrate variation in adaptation to lighter acid soils. More data from better rainfall years are required before selecting further legumes for pre-release.

2.5 IMPACT ON THE BEEF INDUSTRY:

The BULS project has undertaken **a major pasture legume evaluation program** involving a wide range of sites and environments and using large sward plots under grazing. As well as evaluating promising new legume material from earlier and current primary stage evaluation work, it has been the most comprehensive and wide-ranging evaluation of current sown pasture legumes undertaken in northern Australia, with particular emphasis on Queensland.

This project will have a positive impact on the beef industry in several ways:

1. **Better information on the adaptation and production potential of recent and current cultivars** and the better management packages now being developed.

2. **Two new cultivars** (*A. villosa* cvv Reid and Kretschmer) have been released which will increase legume options for the southern spear grass zone.

3. Working with producers, who have provided trial sites and interacted with the evaluation process, has already commenced the process of **technology transfer**.

Currently there are few well adapted alternative legumes to the stylos. During the 1980's when Seca (1977 release) and Verano (1975) were exerting their dominance on sown pasture development, the only alternative legumes for below 1000 mm AAR zone were Siratro (rust problem), Bargoo jointvetch (no seed) and Miles Lotononis (site specific). A few other legumes were available but only marginally adapted. Wynn cassia (1983) and Glenn (1983) started to develop commercially in the late 1980's. Others to follow were Lee (1991), Marc, Bayamo and Uman (1991), and Aztec (1993).

It is also interesting to note the list of stylos which were overtaken by anthracnose disease after release. (Appendix 1). Amiga (1988) and Siran (1990) were released as anthracnose resistant or tolerant stylo cultivars.

Reid and Kretschmer are early seeding, with perennial crowns, fine stems, high quality forage and prostrate growth habit. These are favourable attributes in a pasture legume and wider commercial use and development will further define their future adaptation and role.

These new cultivars increase options for the southern speargrass zone (particularly its southern half) where cooler temperatures have restricted the widespread use of and value of stylos and Wynn cassia. These new cultivars respond well to higher fertility and provide high quality forage (Table 2.3.7.1). Their relative cold tolerance should allow them to make better use than stylos of early spring rainfall which is more reliable in south-east Queensland.

It is expected that Reid and Kretschmer will extend the areas now growing Glenn and Lee in central and north Queensland into slightly lower rainfall areas (from 900 to 1000 mm down to 800 to 900 mm). This will improve sown pasture options for the wetter and more fertile margins of the black spear grass zone as well as the coastal forest areas possibly as far south as Taree. This, together with its better general adaptation in the southern spear grass zone, could potentially add another 1 m ha to the area where viable sown pasture development can occur or existing production improved. This could potentially increase cattle equivalents by about 150,000 head. More importantly these legumes will better allow producers to meet market specification in terms of turnoff and product. Actual animal production data are not yet documented for these cultivars.

The use, adaptation and value of stylo legumes (and the alternative legume cultivars) has been promoted and encouraged through the wide distribution and range of BULS project sites and the partnerships developed with producers. In particular performance of stylos at the two NT sites and the sub-tropical sites at Miriam Vale, Gympie, Narayan and Gayndah has been noted by producers and R & D workers. Bargoo jointvetch has yet again proved itself a persistent legume well adapted to variable rainfall (even harsh) conditions and its performance has renewed calls by some producers for renewed effort into seed production.

Established sites will continue to be used as focal points for keeping producers updated and for promoting the use and value of sown (legume) pastures to property management, production, drought preparedness and sustainability of resources.

These impacts are improving the ability of the northern Australian beef industry to meet market requirements through better breeder herd nutrition (higher calving percentage), rapid growth of weaners and store steers for live export and finishing markets, and younger turnoff of finished cattle. Higher performing sown pastures allow options for more flexible management, and therefore sustainability, of native pasture areas.

2.6 INTELLECTUAL PROPERTY:

Two new cultivars were released during the tenure of this project, namely *A. villosa* cvv Reid and Kretschmer. Plant Breeder Rights (PBR) are being sought and the licence to grow and market commercial seed of these cultivars has been awarded to Mr John Rains, Southedge Seeds, Mareeba.

2.7 DATA INFORMATION STORAGE:

A project with 32 different sowings involving 55 legumes over three years does generate a lot of data. Currently this data is held in office files of individual site collaborators and also in a master set of files held by the Project leader in Mackay. Most of this data has been processed and tabulated using software package Excel.

This interim final report presents this data by individual sites and compares data across all sites. However there is still much of the BOTANAL data (pasture composition by weight) and grazing ratings which is not presented. This data can be retrieved as required.

QPASTURES

Over the next two years species data will be recorded onto QPASTURES (Queensland Pasture Species Evaluation Database), as resources permit and in collaboration with Richard Silcock. QPASTURES is described in the Final Report of project CS054/185 and DAQ 053/081 "Development of new legumes and grasses for the cattle industry of Northern Australia" (Silcock 1996).

Transfer of new technologies

New information and updated technology gained from this project will progressively be transferred to producers and relevant professionals via farm walks and farm note/fact sheets, conferences and workshops, and scientific publications.

2.8 RECOMMENDATIONS

1. **Adaptation sites should be monitored for as long as possible.** Four years of evaluation, particularly under the prevailing variable rainfall conditions, is not sufficient to determine adaptation of pasture legumes. Series 2 and Series 3 plantings have run for three and two years respectively. These established sites, particularly Series 1 which used large (50 m x 20 m) plots, together with local district practice on commercial cultivars, will continue to provide realistic assessment of current cultivars and promising new legumes. Staff availability and time and operating money will be the limiting resource. MRC has offered limited operating money until June 1998 and all avenues for attracting resources to maintain monitoring will be canvassed.

2. All of the original **grazing evaluation sites need to be monitored** over the next two years as resources permit. Liveweight gain information is an important consideration for commercial release and industry uptake. The stated objectives of recording liveweight gain for nominated legumes have not yet been met due to prolonged drought and variable rainfall.

3. **Decision support packages** tying pasture cultivars to particular environments should be developed, **to ensure most appropriate use of these cultivars** and hence their wider adoption by industry.

4. **Pre-release legumes need to be progressed to release or removed** from pre-release status. Considerations will include data from the next two growing seasons of recording at adaptation sites and LWG sites. However it will also need a review of environmental weed concerns which create doubts for legumes *A. brasiliana* CPI 92519 and any alternative *C. rotundifolia* accessions. The reasons for variability in (actual and perceived) grazing acceptance between sites is not well understood.

5. The **positive aspects of introduced pasture plants need to be emphasised** by all RD&E professionals and primary producers. Without introduced species we would not meet certain markets even with supplementary feeding. Without sown pastures the concept of sustainabiltiy would be further from our grasp.

6. Vigilance is required to **avoid environmental weed problems**, but over apologetic and defensive attitude to exotic species should be avoided.

7. The group formed to **review the benefit/cost of sown pastures** (initially lead by Bob Clements) needs to be re-activated. The reason for having introduced pasture plants is increasingly being questioned, particularly in light of recent concerns with environmental weeds. The major concern currently is maintaining grass/legume stability in native pastures augmented with introduced legumes. Systems with smaller, intensively managed areas of sown legume based pastures, rather than oversowing rangelands with legumes, could be compared.

8. **A review of all pre-release legumes should be undertaken by the Northern Australia Pasture Plant Evaluation Committee** (NAPPEC) with regard to environmental weed concerns. This could involve a review of all data available plus field visits to inspect

evaluation sites and be undertaken in April/May 1998 and a report prepared prior to the August HPLC meeting.

9. **Effective and realistic management guidelines for on farm sites** containing "not to be released" accessions with questionable palatability to cattle, should be developed by (or over-seen by) NAPPEC.

10. Funding bodies and Research Institutions (DPI, CSIRO and Universities) all need to **commit sufficient resources (money, time, personnel) to achieve responsible follow-up of** evaluation programs and **field sites, with regard to potential environmental weeds** and their potential economic impact.

11. **Deficiencies in knowledge of nutritional requirements** of new and potential cultivars (particularly P response in *A. brasiliana* CPI 92519) should **be documented into a request** to Universities, **for potential student projects**.

12. The **release of specific cultivars in a specified time frame should not be written as (non-negotiable) milestones** but rather in terms of "rapid advancement" of elite-material to cultivar status. While commitment is necessary, milestones should be achievable.

13. Organisations such as DPI and CSIRO, involved in plant evaluation, **need a resource person** with background training and experience in plant geography, taxonomy, genetic resources, evaluation processes, data storage and retrieval, release and development procedures and sourcing project funds to lead and coordinate plant evaluation activities.

2.9 CONCLUSIONS

Significant achievements and findings of this project include:

1. Major re-evaluation of significance and value of currently available legume cultivars.

2. New "promising" legumes have been introduced into the wider evaluation process (*A. villosa, A. brasiliana, A. histrix, Chamaecrista rotundifolia, Desmanthus virgatus, Macroptilium* spp).

3. The superior adaptation of and dependence on Seca and other stylos for sown legume based pasture development in northern Australia has been confirmed.

4. Outcomes from short term evaluation projects are very dependent on climatic conditions and a wide network of evaluation sites has only partially overcome this problem in BULS. There is insufficient time to introduce management practices, such as fire, into the evaluation process.

5. The extent of change in recommendations on adaptation and management of new cultivars is directly related to length of time since release and size of commercial area sown.

6. Producers in the beef industry have supported the objective of funding and developing alternative legumes to the stylos.

7. The methodology used in BULS (many sites spread across northern Australia) has advantages of broad coverage of potential adaptation to climate, valuable contacts with RD & E people in DPI and other institutions and partnership activities with a wide cross-section of beef producers.

8. Producers and RD & E professionals remain confused on the dividing line between adapted legume and environmental weed. However it appears the "precautionary principle" is being embraced more readily, judging from recent comments and actions. For example QHPLC draft minutes of 7 August 1996, item 7, pre-release proposals, "and it is seemed likely that most of them will never go through to release stage". Also the experiences and comments of collaborators and co-operators in BULS with *A. brasiliana*, the non cultivar legume best adapted to the variable climatic conditions. The decision was made to eradicate CPI 93592 from all sites, several site controllers decided to also eradicate CPI 92519. By year 4 a number of sites are concerned about the performance of the later flowering *Chamaecrista rotundifolia* lines CPI 85836 and 86172. More producers are now concerned about the legume dominance of their Seca and Wynn pastures.

2.10 PROJECT PUBLICATIONS

2.10.1 Current

Conference poster papers:

- Bishop, H.G. (1994). Finding backup legumes for stylos. Proceedings of 8th Australian Rangeland Conference, Katherine, NT, May 1994. p. (Poster paper).

- Bishop, H.G. Bushell, J.J. and Hilder, T.B. (1996). Back-up legumes for stylos. Poster paper at Fifth Tropical Pasture Conference, Atherton, Q'land, June 1995. in *Tropical Grasslands*, 30:153.

Reports:

- Bishop, H.G. and T.B Hilder 1996. *Aeschynomene* accessions evaluated in COPE plantings: in Development of new legumes and grasses for the cattle industry of Northern Australia, Final Report of MRC Projects CS 054/185 and DAQ 053/081 (compilers B.C. Pengelly and I.B. Staples). Published by CSIRO and DPI, c/- CSIRO Cunningham Lab., St Lucia, Q 4067, p 155-165.

- Report to DPI by Leone M. Bielig, Dept of Botany and Tropical Agriculture, James Cook University. "Chromosome numbers in the legume *Aeschynomene* L."

- Report to QHPLC by H.G. Bishop and B.G. Cook (6 September 1995). "Proposal for release of *Aeschynomene villosa* CPI 91209 and 93621".

Field days and pasture walks (handouts):

- "Wadeleigh", Miriam Vale Rural Science and Landcare Group inspected the adaptation site on 4 May 1994 (100 people) and 1 May 1996 (50 people) as part of a half day district tours.

- "Granite Vale", St Lawrence. Inspected and discussed with the Marlborough Landcare group (30 people), 17 May 1995.

- "Sugarbag", Mt Garnet. Grazing evaluation inspected and discussed by 16 people from 7 properties following a "Best Practices" group meeting on 14 March 1996.

- "Sugarbag", Mt Garnet. Grazing evaluation of *A. brasiliana* CPI 92519 inspected and discussed with 60 people on the Atherton Tropical Grassland Conference Field Trip on 29 June 1996.

- "Tedlands", Mackay. Phosphorus response trial and Glenn/Lee grazing demonstration site inspected and discussed with 25 people on a DPI/Mackay Rural Production Society field day on 22 July 1994, and with 40 people on 8 June 1996.

- New cultivars of *A. villosa* (Reid and Kretschmer) in 5 year old plots at "Tedlands" were inspected by John Rains, Southedge Seeds, Mareeba, and John Hughes, Crokers/IAMA, Mackay, on 2 August 1996.

- "Glensfield", Sarina. Inspected by COPE/BULS/LCS workshop participants in October 1993 and October 1995. Also various student and DPI groups.

- Katherine Research Station, NT. The BULS site was inspected by NAPEC group in May 1994.

2.10.2 Proposed publications:

- Bishop, H.G. and Cook, B.G. (in prep). Release case for *Aeschynomene villosa* cvv Reid and Kretschmer. Register of Australian Herbage Plant Cultivars.

- Bishop, H.G., Bushell, J.J. and Hilder, T.B (in prep). More *Aeschynomene* pasture legumes for the Tropics and Sub-tropics. in preparation as a poster paper for the XVIII International Grassland Congress, Canada, June 1997.

- Bielig, Leone M. and Bishop, H.G. (in prep). Chromosome numbers in the legume *Aeschynomene* L.

- Response of *Aeschynomene americana* cvv Glenn and Lee and *A. villosa* cv Reid to rates of applied phosphorus. in preparation (Raymond, G., Bishop, H.G., Bushell, J.J., Hilder, T.B. and Baker, D.).

- Tolerance/susceptibility of a range of Tropical legumes to a range of herbicides (Loch, D.S. and Harvey, G.L.)

- Adaptation and performance of a range of Tropical legumes in the 600 mm to 1000 mm rainfall zone of north-eastern Australia
  (i) Yield and persistence in grazed swards.
  (ii) Palatability and contribution to animal performance.
  (iii) Legume-grass relationships; managing for stability.

2.11 REFERENCES

Bishop, H.G. and T.B. Hilder 1996. *Aeschynomene* accessions evaluated in COPE plantings; in Development of new legumes and grasses for the cattle industry of Northern Australia, Final report of MRC Projects CS 054/185 and DAQ 053/081 (compilers B.C. Pengelly and I.B. Staples). Published by CSIRO and DPI, c/- CISRO Cunningham Lab., St Lucia Q 4067, p 155-165.

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2.12 APPENDICES

Appendix 2.12.1. Tropical forage legumes that may be adapted to 1000 mm AAR or below and released by the Queensland Pasture Liaison Committee and by the Queensland, New South Wales and Northern Territory Herbage Plant Liaison Committees 1961 to 1995.

Species	Cultivar Name	Common Name	Year of Release	Releasing authority
Lotononis bainesii	Miles	lotononis	1962	Q
Macrotyloma uniflorum	Leichhardt	biflorus	1965	Q
Stylosanthes guianensis+	Oxley	fine-stem stylo	1965	Q
*Stylosanthes guianensis**	Schofield	stylo	1966	Q
Macrotyloma axillare+	Archer	axillaris	1966	Q
*Stylosanthes humilis**	Lawson	Townsville stylo	1968	Q
*Stylosanthes humilis**	Gordon	Townsville stylo	1968	Q
*Stylosanthes humilis**	Paterson	Townsville stylo	1969	Q
*Stylosanthes guianensis**	Endeavour	stylo	1971	Q
Stylosanthes guianensis	Cook	stylo	1971	Q
Aeschynomene falcata+	Bargoo	jointvetch	1973	NSW
Stylosanthes hamata+	Verano	caribbean stylo	1973	Q
Stylosanthes scabra+	Seca	shrubby stylo	1976	Q
*Stylosanthes guianensis**	Graham	stylo	1978	Q
*Stylosanthes scabra**	Fitzroy	shrubby stylo	1979	Q
Aeschynomene americana+	Glenn	jointvetch	1983	Q
Chamaecrista rotundifolia	Wynn	roundleaf cassia	1993	Q
Centrosema pascuorum	Cavalcade	centurion	1984	NT
Centrosema pascuorum	Bundey	centurion	1986	NT
Stylosanthes hamata+	Amiga	caribbean stylo	1988	Q
Stylosanthes scabra+	Siran	shrubby stylo	1990	Q
Desmanthus virgatus+	Marc	desmanthus	1991	Q
Desmanthus virgatus+	Bayamo	desmanthus	1991	Q
Desmanthus virgatus+	Uman	desmanthus	1991	Q
Aeschynomene americana+	Lee	American jointvetch	1991	Q
Macroptilium atropurpureum+	Aztec	atro	1993	Q
Aeschynomene villosa+	Reid	villose jointvetch	1995	Q
Aeschynomene villosa+	Kretschmer	villose jointvetch	1995	Q
Centrosema pubescens	Cardillo	centro	1995	Q
Stylosanthes sp. aff *S. scabra*	Primer	Caatinga stylo	1996	Q
Stylosanthes sp. aff. *S. scabra*	Unica	Caatinga stylo	1996	Q

Major introduced pasture plants which were either commercialised before 1961 or have not been registered by the HPLC'S.

Species	Common Name
Centrosema pubescens	centro
Macroptilium atropurpureum	Siratro (1960)
Macroptilium lathyroides	Murray phasey bean (1966)
*Stylosanthes humilis**	common Townsville stylo

* No longer available commercially due to susceptibility to anthracnose.
+ Planted in the BULS project.

Appendix 2.12.2 Draft of conference paper submitted to the XVIII International Grassland Congress, Winnipeg, Manitoba, Canada, June 1997.

ID NO. 1798

TITLE

PASTURE YIELD AND ANIMAL PERFORMANCE FROM *AESCHYNOMENE AMERICANA* CULTIVARS GLENN AND LEE

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Abstract

An on farm demonstration site was used to promote and compare the performance of the tropical legumes Glenn American jointvetch and Lee American jointvetch (*Aeschynomene americana*). Both legumes are widely sown in tropical Australia and are being increasingly sown in South-East Asian pasture projects. Glenn and Lee both grew well and persisted in grass/legume pastures over a 5 year period. Liveweight gain of steers, at a stocking rate of 1.5/ha, slightly favoured the Glenn pasture and gains of 0.49 kg/day for a 595 day period were achieved. Soil seed reserves were much higher under the annual Glenn than for the later flowering perennial Lee. Current recommendations are to sow equal portions of Glenn and Lee in legume/grass pasture mixture.

Keywords: Glenn jointvetch, Lee jointvetch, *Aeschynomene americana*, liveweight gain, dry matter production, soil seed reserves.

Introduction

Aeschynomene americana cultivar Glenn, an annual, was released in 1984 (Oram 1990) and cultivar Lee, a perennial, was released in 1990 (Bishop *et al* 1995). Based on seed production figures Glenn and Lee American jointvetch are now the most used tropical legumes in northern Australia, outside of the *Stylosanthes* cultivars (Bishop and Hilder 1993).

In tropical Australia Glenn and Lee are sown along the Queensland coast in areas receiving 1000 mm to 1600 mm average annual rainfall (AAR). Use in the "Top End" of Northern Territory and in particular situations such as the Ord irrigation area of Western Australia is increasing. Glenn and Lee are also being evaluated and sown in many South East Asian and Pacific Island pasture development projects (Stür *et al* 1995).

Separate areas of Glenn based legume/grass mixed pasture and Lee based legume/grass mixed pasture were sown as a Producer Demonstration in January 1992 to promote the use and value of the recently released Lee cultivar. Cattle weights were recorded to compare animal performance from Glenn, which is an annual, with that of Lee which is perennial.

Materials and Methods

The unreplicated demonstration site was on "Tedlands" ($21^{0}36$'S, $149^{0}18$'E, Altitude 15 m), 60 km south of Mackay and in a 1400 mm average annual rainfall zone. Eighty percent of the AAR is received in the five summer months, December to April. The soil had a sandy loam A horizon overlying clay with 4 ppm phosphorus (bicarbonate extract) in the surface.

Superphosphate (9% P, 11% S, 20% Ca) was applied at sowing (275 kg/ha) with 100 kg/ha triphos (21% P, 1% S, 15% Ca) applied 3 months and 12 months after planting.

Glenn and Lee were sown into separate 10 ha paddocks each with a pasture mixture of *Stylosanthes scabra* cv Seca (1 kg/ha), *Chloris gayana* cv Callide (0.6 kg/ha) and *Brachiaria humidicola* cv Tully (1 kg/ha). Glenn and Lee were each sown at 3 kg/ha. Sowing took place on 22 January 1992 and grazing commenced on 21 August 1992. Each 10 ha paddock was stocked at 1.5 Adult Equivalents (400 kg LW)/ha, starting with weaner steers at around 200 kg LW. The number of steers was reduced as their bodyweight increased but due to an irregular weighing schedule stocking rate actually varied from 1.3 to 2.0 AE/ha during the project.

Pasture yield and botanical composition were estimated towards the end of the growing season each year using the BOTANAL visual estimation procedure (Tothill *et al* 1992). Population of legumes and frequency of grasses were also recorded during this activity. Cattle were weighed four to five times per year with each draft remaining on site for up to 2 years.

Results and Discussion

Rainfall over the five year period of the project was variable and below average but sufficient to produce good pasture establishment and growth. Pasture dry matter yield on offer at the end of each growing season, together with legume population and grass frequency, are shown in table 1. Both Glenn and Lee maintained good plant populations and dry matter production. Seca stylo persisted, but had lower populations and dry matter production than Glenn and Lee in this moist environment, growing with competitive companion grasses.

Glenn is a heavy seeder and flowers 4-6 weeks earlier than Lee (Oram 1990, Bishop *et al* 1995). Sampling for soil seed reserves in March 1995 found 5128 seeds/m^2 for Glenn and 256/m^2 for Lee in the surface 10 cm of soil. This translates to 150 kg seed/ha for Glenn and 6 kg seed/ha for Lee, indicating much more Glenn seed is returning to the soil. However a plant count in January 1994 showed that seedling recruitment was occurring for Lee (56 seedlings/m^2 and 41/m^2 for Glenn). The drop in Lee plant numbers recorded after the 1995 summer (table 1) was also visually obvious when many large woody (original) Lee plants died during the spring and early summer of 1994.

The change in grass frequency over the five summers (table 1) documents the reasons for the now accepted practice of sowing Callide rhodes grass (a quick establishing and very palatable species) with Tully grass (a very slow establishing but subsequently a dense sward forming grass very resistant to grazing). Tully was starting to suppress legume yields by year 5 and will probably greatly reduce regeneration of the annual Glenn in the 1996/97 summer.

Steer growth rates have been good with the Glenn pasture giving slightly better weight gains throughout the project. Caution is required in interpreting a two paddock demonstration with cattle only weighed 4 or 5 times per year. Table 2 presents starting and finishing weights for three different drafts of steers, with drafts 2 and 3 grazing the pastures concurrently.

At the time of release it was expected the perennial Lee, with green leaf available for longer, would improve steer weight gains during autumn, winter and spring. The annual Glenn dies in winter and regenerates the following summer. There were short periods during autumn/spring when Lee steers gained more than the Glenn steers, but Glenn animals maintained slightly better annual weight gains throughout the project. Although supporting data was not collected it could be a matter of the (annual) Glenn having better recycling of the nitrogen in the pasture system whereas the (perennial) Lee would tie up some of its nitrogen in the living perennial plants.

At the stocking rates used, both pastures have been very productive relative to expectations from other commercial pastures on the "Tedlands" property. On the results of this demonstration project general pasture recommendations are to mix equivalent portions of Glenn and Lee jointvetch in the pasture seed mixture.

Acknowledgments

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Table 1 **Pasture yield on offer at end of growing season (kg/ha), legume population (plants/m^2) and grass frequency (%). Population and frequency data are shown in ( ).**

Lee Paddock	June '92	May '93	May '94	Aug '95	May '96
Lee	(8)	2252	5108 (35)	198 (8)	765 (13)
Seca	(2)	118	56 (3)	44 (9)	62 (3)
Callide	(96)	811 (85)	778 (84)	775 (81)	193 (14)
Tully	(17)	48 (14)	1088 (40)	1587 (87)	4977 (91)
Total		3229	7030	2604	5997
Glenn Paddock					
Glenn	(8)	1248	6191 (44)	44 (3)	339 (15)
Seca	(2)	405	76 (4)	4 (2)	63 (2)
Callide	(90)	1245 (95)	1870 (92)	725 (70)	183 (14)
Tully	(11)	94 (15)	1501 (52)	2289 (84)	6406 (94)
Total		2992	9638	3062	6991

Table 2. LW Gain of Steers over the duration of the demonstration. Stocking rate in Adult Equivalents varied over the period of grazing from 1 to 2/ha with an average around 1.5 AE/ha

	Start	Finish	Cumulative LW Gain*	kg/day
Draft 1	**21/08/92 (30 steers)**	**19/07/94 (14 steers)**	(697 days)	
Glenn	208	547	331	0.47
Lee	206	527	305	0.44
Draft 2	**19/07/94 (10 steers)**	**19/06/96 (7 steers)**	(701 days)	
Glenn	225	528	295	0.42
Lee	218	506	271	0.39
Draft 3	**2/11/94 (20 steers)**	**19/06/96 (6 steers)**	(595 days)	
Glenn	198	526	292	0.49
Lee	198	483	267	0.45

* Cumulative LWG was calculated by adding LWG at each weighing (some animals were removed after each weighing to maintain stocking rate as the animals' liveweight increased).