Misting false sandalwood with triclopyr ester in water proved ineffective at rates up to 50 g L^{-1}. Results from other misting trials on large false sandalwood (Back 1977) have also been disappointing with a maximum mortality of 38% at 150 g L^{-1} 2,4,5-T ester in distillate. Aerial applications of 0.75 kg ha^{-1} 2,4,5-T (for the control of brigalow) are ineffective on false sandalwood. There appears to be a problem with uptake and/or translocation of foliar applied herbicides as a smaller quantity of the same products gives good control when applied as a basal bark spray. Similar results have been reported for rubber vine (*Cryptostegia grandiflora*) (Harvey 1982).

Basal bark treatment of false sandalwood is not used extensively in the brigalow or gidgee regions of Queensland. Thus it is unlikely that triclopyr ester will play a major role in false sandalwood control, even if 2,4,5-T ester became unavailable. The main reasons for this situation are that suitable labour is often unavailable and the labour cost per unit area is high. Stickraking or pulling will continue to be the most widely used control measures although hexazinone will find some use in the control of false sandalwood.

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EVALUATION OF SOME *CENTROSEMA* SPECIES IN SMALL PLOTS IN NORTHERN AUSTRALIA

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ABSTRACT

Twenty-one accessions of five Centrosema *species were evaluated in cutting trials for 2–3 years at three sites (Katherine, Lansdown and Narayen Research Stations) in northern Australia, together with* Stylosanthes hamata *cv. Verano and* Macroptilium atropurpureum *cv. Siratro. At Katherine, several* C. pascuorum *accessions had herbage* *yields equalling or exceeding those of Verano, and had soil seed reserves of 1 t ha*$^{-1}$ *or more during the third dry season.* C. brasilianum *and* C. schottii *accessions were lower yielding but were persistent and productive for the duration of the experiment. The two* C. virginianum *accessions failed to persist. At Lansdown, establishment was poor but two* C. schottii *accessions, one* C. brasilianum *accession and Verano produced herbage yields exceeding 1 t ha*$^{-1}$ *in the second growing season. At Narayen, Siratro was the only successful legume.*

In a second experiment, ten C. pascuorum *accessions were grown in short rows on three soil types at Narayen Research Station and harvested for mineral nutrient analysis before flowering. There were no significant differences in N content of accessions. P, K and S contents of each accession are reported, and the mean concentrations of an additional nine elements are listed.*

INTRODUCTION

The American genus *Centrosema* contains about 35 herbaceous tropical legume species. One of these, *C. pubescens* is used world-wide in sown pastures in the wet tropics. However, several species such as *C. pascuorum*, *C. brasilianum* and *C. schottii* occur naturally in sub-humid and semi-arid regions (Clements and Williams 1980). Preliminary testing of a few accessions of these species has been undertaken at several sites in northern Australia (Cameron and Mullaly 1969; O'Donnell and Smith 1974; Winter 1978; Burt and Williams 1979; Clements and Williams 1980; Anning 1982). Promising results from some of these early trials prompted the present work.

Two experiments are described. In the first, all accessions of *C. pascuorum*, *C. brasilianum* and *C. schottii* for which seed was available in 1977 were evaluated in small plots at three sub-humid to semi-arid sites. Two accessions of *C. virginianum* were also included, one accession (CPI 55707) from the semi-arid tropics of north-eastern Brazil and a second (CPI 40057) from the humid subtropics. The aim was to provide comparative data on herbage yield and persistence of the accessions at each site. The second experiment provided comparative data on herbage yield and mineral nutrient content of *C. pascuorum* accessions on a range of soil types at a single location.

C. pascuorum and *C. schottii* are annual species with a weak ability to perennate in favourable situations. Flowering dates of the *C. pascuorum* accessions used in the present experiments were tabulated by Clements and Williams (1980). *C. brasilianum* and *C. virginianum* are perennials. Almost 100 accessions of *C. virginianum* have been evaluated in sub-humid south-eastern Queensland (Clements 1983).

MATERIALS AND METHODS

Experiment 1

Small swards of 25 accessions* (10 of *C. pascuorum*, 8 of *C. brasilianum*, 2 of *C. schottii*, 2 of *C. virginianum*, and one each of the control species *C. pubescens* cv. Belalto (two sites only), *Stylosanthes hamata* cv. Verano and *Macroptilium atropurpureum* cv. Siratro) were sown at three locations. Sites were: Katherine Research Station (14°28′S, 132°19′E; average annual rainfall 900 mm) on Tippera clay loam, a lateritic red earth, pH 6.7 (Gn2.11; Northcote 1971); Lansdown Pasture Research Station (19°40′S, 146°51′E; average annual rainfall 864 mm) on a homogeneous weak red podzolic soil developed on alluvium, pH 6.3 (Gn3.15) and Narayen Research Station

* Most of the *Centrosema* accessions were collected originally in north-eastern Brazil by R. J. Williams, R. L. Burt and J. P. Ebersohn. Four *C. pascuorum* accessions were obtained by correspondence from the same region (CPIs 75115, 75116) or elsewhere (Honduras: 74827; Venezuela: 83846), and CPI 65950 was collected by R. K. Jones in Ecuador. CPI 75356 *C. schottii* was obtained by correspondence from Mexico and CPI 40057 *C. virginianum* was collected by R. J. Williams in coastal São Paulo State, Brazil. Despite their small size, the collections of *C. pascuorum* and *C. brasilianum* are believed to be reasonably representative of each species.

(25°41′S, 150°52′E; averge annual rainfall 720 mm) on a mottled yellow podzolic soil derived from adamellite, pH 6.5 (Dy3.41).

The climate at each Station has been described by Cook and Russell (1983). Rainfall distribution at Katherine during the experiment was similar to the long-term average except that the 1978/79 and 1979/80 wet seasons ended rather early and rather late respectively. At Lansdown the wet season rainfall was erratic in 1977/78, with 412 mm of rain falling in a 3-day period soon after planting but only 242 mm over the next three months. Narayen rainfall during the growing season (October–April) was below average throughout the experiment, but the 1978 cool season (May–September) was unusually humid (243 mm rainfall) with only 8 mild frosts.

A randomised block design with four replicates was used at each site. Each plot was 4 × 4 m, with grassed pathways 2–4 m wide between plots, depending on the site. At Katherine the experiment was sited on land which had a history of superphosphate application; at establishment, 200 kg ha^{-1} superphosphate was applied, and 50 kg was applied annually thereafter. At Narayen, new ground was used; molybdenised superphosphate (200 kg ha^{-1}) was applied prior to planting, and superphosphate (100 kg ha^{-1}) was applied at the start of the growing season in both the second and third years. The site at Lansdown was on an old cultivated area and 100 kg ha^{-1} superphosphate was applied prior to planting. The sowing rate for all legume accessions was 4 kg ha^{-1} viable seed (4 kg ha^{-1} dehulled seed in the case of *S. hamata*), mechanically scarified to 65–90% soft seed. Seed of each legume was inoculated with an appropriate strain of *Rhizobium* and pelleted with rock phosphate.

All seeds were hand broadcast and raked into prepared seedbeds on 14 December 1977 (Narayen), 24 December 1978 (Katherine) and 18 January 1978 (Lansdown). Because of insufficient seed supplies, four acessions (*C. pascuorum* CPIs 74827 and 83846 and *C. brasilianum* CPIs 40067 and 55702) were not planted at Lansdown. Nine accessions (four of *C. pascuorum* and five of *C. brasilianum*) were not planted at Narayen in the first year, but one of the *C. pascuorum* accessions (CPI 74827) and two lines previously planted (CPIs 40060 and 55697) were sown at the same site in the following year using similar techniques. Also, at Katherine, there was sufficient seed of two *C. pascuorum* accessions (CPIs 75115 and 75116) to plant only one replicate in the first year, and further replicates of these and two additional accessions (CPIs 74827 and 83846) were planted in the second year.

Established legume seedlings were counted at each site, and further plant counts were made at Narayen at the start of the second and third growing seasons. Herbage was cut at a height of 5 m within two quadrats (1.0 × 0.5 m) per plot to determine herbage yield and legume content at Katherine and Narayen towards the end of the first two growing seasons; plots were cut and herbage removed after seeds had shattered in each year. Herbage yield and legume content were measured during the third growing season at Katherine from two cuts, one of which was made in February when all cut herbage was removed, and the other at the end of the season (April). Seed reserves were measured at Katherine in each year in the dry season by sweeping and collecting seed within one quadrat (0.6 × 0.6 m) per plot; seed was cleaned using seives, winnowers and flotation techniques (Jones and Bunch 1977). Legume material harvested at Katherine during the first two years was separated into leaf, stem and seed pod fractions and analysed for N, P and S content. At Lansdown, herbage yield was measured once only, at the end of the second growing season.

Experiment 2

Ten accessions of *C. pascuorum* were grown in replicated rows on contrasting soils at Narayen Research Station during the 1978/79 growing season. Soils were: (a) mottled yellow podzolic, as in experiment one (Dy3.41); (b) sandy red earth, pH 6.0 (Gn2.14); (c) fertile red smooth-ped earth (brigalow soil), surface pH 7.5 increasing to 8.5 at 10 cm depth (Gn3.13). All received 100 kg ha^{-1} molybdenised superphosphate prior to planting.

Seedlings were established in peat pellets in a shadehouse, inoculated with *Rhizobium* strain CB1923, transplanted in January 1979, and watered until they had become established. Each accession was planted in a ten-plant row in each of three replicates in a randomised block design at each site. Rows were 3 m apart, and plants within rows were 0.3 m apart. Weed competition was reduced by hand weeding and mowing of paths. Whole rows were harvested in March–April 1979, just before the earliest accession commenced flowering, in order to reduce variation in nutrient content associated with differences in flowering date and stage of growth. The dried material was weighed, ground and analysed for N, P, K, S, Ca, Na, Mg, B, Mn, Cu, Zn, Fe and Mo contents.

RESULTS

Experiment 1

Contrasting results were obtained from the three sites. At Katherine, several *C. pascuorum* accessions yielded well in each year and produced large quantities of seed (Table 1). The best accessions overall were CPI's 40060, 40063 and 55697. Each of these accessions gave herbage yields greater than or equal to Verano, and had seed reserves of 1 t ha^{-1} or more (4500–12000 seeds m^{-2}) during the third dry season. CPI 40060 was significantly more leafy than CPI 55697. Another three accessions, CPI 75115, Q9855 and Q10050 were potentially high yielding (as indicated by their first-year yields) but flowered later, and set less seed. The slump in seed reserves in 1979 followed the early end to the 1978/79 wet season whereas the high seed inputs in 1980 probably reflected the good late rains during the 1979/80 wet season. There were no significant differences among *C. pascuorum* accessions or between any species in N, P or S content of leaf or stem material averaged over years. Mean concentrations of these elements were 3.0%, 0.16% and 0.26% respectively for leaves and 1.3%, 0.12% and 0.14% for stems. Most accessions of *C. pascuorum* were much more leafy than Verano.

At Katherine, some accessions of *C. brasilianum* and *C. schottii* also grew well, but *C. virginianum* performed poorly. The highest yielding accession of *C. brasilianum* averaged over years was CPI 40062, which was also consistently the best seeder and was very leafy. In general, *C. brasilianum* accessions had lower herbage and seed yields than *C. pascuorum* but were more leafy. Verano usually yielded more herbage than *C. brasilianum* and *C. schottii* accessions and Siratro, although its superiority was not always significant.

Legume percentages of total yield (data not presented) were nearly always high at Katherine. At the end of the first growing season *C. pascuorum* accessions contributed 74–93% of the total herbage; at the end of the third season they contributed 48–92% except for CPIs 74827 (11%) and 83846 (17%). Ranges for *C. brasilianum* were 32–70% in the first season and 36–50% in the second season, and for *C. schottii* were 46–76% and 41–61% respectively. However, percentages of Verano declined from 70% to 31%, Siratro from 80% to 34%, and *C. virginianum* from 13% to less than 1%. In the case of Verano this decline was partly an artifact of the cutting schedule; Verano regrew poorly after the February cut.

At Lansdown, the unusual rainfall distribution after sowing resulted in poor establishment, with plant populations of only three accessions exceeding 2 plants m^{-2}; these were Verano (4.9 plants m^{-2}), CPI 40063 *C. pascuorum* (3.3) and CPI 55705 *C. schottii* (2.5). Despite this poor start, four accessions yielded more than 1 t ha^{-1} of herbage in the second growing season: Verano (1.9 t ha^{-1}), CPI 55705 *C. schottii* (1.5), CPI 75356 *C. schottii* (1.4), and CPI 40062 *C. brasilianum* (1.6). Siratro yielded only 0.2 t ha^{-1}, and all other accessions yielded only trace amounts.

At Narayen, all of the *Centrosema* accessions and Verano eventually failed, whereas Siratro persisted. Although the Siratro yields were very low because of the sequence of dry years (Table 2), the plots ultimately became legume-dominant in 1980/81 when good summer rains were received after the experiment ended. The only *Centrosema* accessions to show some promise were CPI 40057 *C. virginianum* and CPI

55696 *C. brasilianum*. The failure of *Centrosema* accessions at Narayen was not due to poor establishment (see seedling counts on 13/1/78, Table 2), but to inability of the accessions to maintain satisfactory plant populations subsequently. Thus, although CPI 55696 *C. brasilianum* plants survived well during the relatively mild 1978 winter and contributed about 25% of the total herbage during the following growing season, they were unable to set seed and regenerate when the initial plant population died. No other *C. brasilianum* accession, and only one *C. pascuorum* accession (CPI 55697) was able to set seed in this year. The *C. pascuorum* plants counted on 27/11/78 were all survivors from the initial population except in the case of CPI 55697. Populations established in the repeat plantings of CPI's 40060 and 55697 in 1978/79 behaved similarly (data not presented), and even the early flowering accession CPI 74827 was unable to persist although it did set some seed. Although the *C. virginianum* accessions did set some seed and CPI 40057 was able to maintain a good plant population in the second growing season and contribute 12% of the total herbage, neither accession was still surviving in 1980/81.

TABLE 1

Herbage yields, soil seed reserves and leaf: stem ratios of sown legumes at Katherine, N.T.

Species and accession*	Herbage yield of legume (t ha^{-1})			Soil seed reserves (kg ha^{-1})			Leaf: stem ratio§
	1977–78	1978–79	1979–80‡	1978	1979	1980	
C. pascuorum							
40060	4.0	5.4	3.6	452	126	974	1.13
40063	4.3	5.1	6.7	580	67	1 410	0.99
55697	5.3	5.7	6.2	589	150	1 025	0.74
65950	2.9	3.9	3.9	814	330	368	0.59
74827		trace	0.3		24	58	0.98
75115	4.7†	4.1	4.1	9†	109	498	1.11
75116	6.2†	1.6	2.5	4†	34	202	0.83
83846		trace†	0.7†		trace†	0	n.a.
Q9855	4.2	3.3	2.9	35	34	145	0.89
Q10050	5.0	3.9	3.2	32	70	201	1.05
C. brasilianum							
40061	1.3	1.0	2.1	175	42	78	1.24
40062	1.4	2.7	3.4	286	42	210	1.16
40065	0.6	2.5	3.7	149	29	120	1.09
40067	1.0	1.9	2.1	221	25	n.a.	0.93
55696	0.8	2.8	1.8	145	27	63	1.05
55698	1.0	3.1	1.9	221	36	56	1.06
55702	0.3	0.3	1.7	32	6	17	0.93
CQ1320	1.1	2.5	2.0	129	33	79	0.89
C. schottii							
55705	2.7	3.2	2.6	345	212	619	0.96
75356	1.0	3.2	3.6	131	57	411	0.91
C. virginianum							
40057	0.3	trace	trace	1	0	0	1.30
55707	trace		trace	1	0	0	n.a.
M. atropurpureum							
cv. Siratro	2.7	2.6	3.0	126	28	40	0.99
S. hamata							
cv. Verano	3.2	4.7	3.3	264	6	41	0.51
L.S.D. (P = 0.05)	1.1	1.6	2.1	331	137	296	0.30

* Commonwealth Plant Introduction (CPI) number, Queensland Department of Primary Industries (Q) number or CSIRO Queensland (CQ) number.
§ Leaf: stem ratios averaged over years.
† Unreplicated data.
‡ Total yields from two cuts (February and April).
n.a. Data not available.

TABLE 2

Herbage yields, percentages of total sward yield, and plant population densities of sown legumes at Narayen, Qld.

Species and accession*	Herbage yield of legume (kg ha^{-1})		Legume content of sward (%)		Legume population (plants m^{-2})		
	1977–78	1978–79	1977–78	1978–79	13/1/78	27/11/78	15/10/79
C. pascuorum							
40060	50	trace	1.0	trace	9.0	0.6	0
40063	20	0	trace	0	6.3	0.3	0
55697	211	75	3.5	4.3	9.8	5.6	0
65950	242	0	4.2	0	20.3	0	0
Q9855	412	0	6.3	0	20.8	0.1	0
Q10050	351	0	6.2	0	12.0	0.1	0
C. brasilianum							
40061	78	0	1.6	0	11.8	1.6	0
40062	55	trace	2.3	trace	9.5	0.4	0
55696	134	525	2.5	24.9	14.0	9.1	3.5
C. schottii							
55705	122	0	1.9	0	9.5	1.7	0
75356	12	0	trace	0	1.8	0.1	0
C. virginianum							
40057	84	252	1.2	12.0	11.5	11.5	2.5
55707	11	21	trace	0.9	4.5	2.8	0
C. pubescens							
cv. Belalto	trace	0	trace	0	5.8	0	0
M. atropurpureum							
cv. Siratro	331	450	5.6	19.2	22.5	12.0	10.6
S. hamata							
cv. Verano	93	36	1.5	2.4	21.5	2.1	0.3
L.S.D. (P = 0.05)	166	230	3.3	9.8	7.6	4.6	3.7

* Commonwealth Plant Introduction (CPI) number or Queensland Department of Primary Industries (Q) number.

Experiment 2

There were no significant *C. pascuorum* accession × site interactions for herbage yield or nutrient content in this experiment. The average yields of the accessions are shown in Table 3. The early flowering accession CPI 74827 was low yielding even though the rows were cut early in order to avoid any adverse effects of flowering on herbage yield.

The data for chemical composition showed no significant differences between accessions for N content (mean 2.4% N), but there were significant differences in the concentrations of most other mineral nutrients. Data for P, K and S concentration are shown in Table 3. CPI 40060 had consistently high nutrient concentrations and CPI 55697 consistently lower concentrations, but in general the differences between accessions were relatively small. The mean concentrations of other nutrients, averaged over accessions and sites, were as follows: 0.022% Na, 1.05% Ca, 0.36% Mg, 25 ppm B, 42 ppm Mn, 7.8 ppm Cu, 27 ppm Zn, 457 ppm Fe and 1.09 ppm Mo. Data for individual sites and accessions are available upon request from the senior author.

DISCUSSION

The most important result from these experiments was the good performance of *C. pascuorum* at Katherine, confirming earlier results with CPI 55697 (Winter 1978). Under an infrequent cutting regime several accessions had herbage yields equal to or greater than *S. hamata* cv. Verano. CPIs 55697 and 40063 were the highest yielding accessions, outyielding Verano by 54% and 44% respectively over the three years. Both accessions also had very high seed reserves in the third year, but CPI 55697 was less

TABLE 3

Mean yield and chemical composition of herbage of C. pascuorum accessions grown on three soil types at Narayen Research Station

Accession*	Mean herbage yield (g row^{-1}) (brackets: mean log. yield)	Mineral nutrient content (%)		
		P	K	S
40060	1 201 (3.00)	0.17	1.8	0.21
40063	761 (2.85)	0.17	1.5	0.23
55697	1 026 (2.94)	0.15	1.5	0.19
65950	625 (2.68)	0.15	1.5	0.18
74827	726 (2.82)	0.18	1.4	0.19
75115	1 093 (3.00)	0.16	1.6	0.21
75116	713 (2.81)	0.18	1.6	0.20
83846	857 (2.90)	0.15	1.5	0.19
Q9855	1 103 (3.01)	0.16	1.7	0.21
Q10050	1 062 (2.96)	0.16	1.6	0.20
L.S.D. (P = 0.05)	(0.12)	0.02	0.1	0.02

* Commonwealth Plant Introduction (CPI) number or Queensland Department of Primary Industries (Q) number.

leafy than most other accessions and had slightly lower contents of P, K and S in the herbage (leaf + stem) at Narayen, presumably reflecting its lower leaf:stem ratio since no significant differences were detected in nutrient content of individual plant parts at Katherine. CPI 40060 was another promising accession.

C. pascuorum deserves close attention from pasture agronomists in the Northern Territory. At the present time the only legumes suitable for improved permanent pastures in semi-arid parts of the region (650–1000 mm annual rainfall) are *Stylosanthes* species (*S. humilis*, *S. hamata*, *S. scabra*; Sturtz *et al.* 1975; Winter *et al.* 1984) and perhaps *Alysicarpus vaginalis* (Martin and Torssell 1974; Winter *et al.* 1984). The potential of *C. pascuorum* as a legume for short rotation ley farming is being studied at Katherine (Peake *et al.* 1983). *C. pascuorum* accessions are also showing considerable promise in cutting trials in northeastern Thailand (Topark-Ngarm and Moolsiri 1982).

C. pascuorum was not successful at Lansdown or Narayen. Although the results at Lansdown could perhaps be discounted because of the poor initial establishment, they agree with previous experience with CPI 55697 at Lansdown (R. L. Burt personal communication; Jones 1979), Southedge (145°14′E, 18°11′S) (Anning 1982) and other seasonally dry sites in north Queensland, where the species has eventually failed irrespective of the level of initial establishment. Two accessions (Q9855 and Q10050) also failed to persist at two highland tropical sites on the Atherton Plateau and one site on the wet tropical coast of north Queensland (O'Donnell and Smith 1974). The reasons for these failures are not clear. Perhaps *C. pascuorum* requires a climate with well-defined and reliable wet and dry seasons. However, Ludlow *et al.* (1983) have shown that this species can tolerate very high internal water deficits, and some of the later flowering accessions in experiment 1 were able to flower and set seed while undoubtedly experiencing severe moisture stress.

The failure of *C. pascuorum* at Narayen is consistent with other experience at this site (R. J. Clements, unpublished data). Even in occasional years following abundant seed set the species fails to compete successfully with the native grasses (principally *Heteropogon contortus*) which are able to take advantage of spring and early summer rains when temperatures appear to be too low for *C. pascuorum*. However, in the absence of competition the species grows vigorously during the warmer months in south-eastern Queensland. Anning (1982) has also commented on the apparent inability of *C. pascuorum* to withstand competition from native grasses in north Queensland. At Katherine, *C. pascuorum* established readily in the presence of competing native annual grasses (e.g. *Digitaria ciliaris*), quickly became dominant and remained dominant in each subsequent growing season. However, there is a need to examine the competitive ability of this species with sown perennial grasses and under other management systems. Preliminary results at Katherine (W. H. Winter, unpublished data) show that *C. pascuorum*/*Urochloa mosambicensis* pastures can maintain a high legume content when grazed in the dry season, a result apparently in contrast to that of Anning (1982).

C. brasilianum also showed promise for the Katherine region. The best accessions produced less herbage than Verano, but they have a notable ability to remain green during the dry season (W. H. Winter, unpublished data). Their potential for providing high quality feed at a time when other herbage is low in nutritive value deserves further study. Anning (1982) included two of the present accessions (CPIs 55698 and 55702) in his trials in north Queensland and commented favourably on their persistence, spread and seed production under dry-season grazing, but his data indicate that their population densities three years after planting were much lower than those of well-adapted *Stylosanthes* species (0.9–2.6 plants m^{-2} for *C. brasilianum versus* 202 plants m^{-2} for Verano and 55.9 plants m^{-2} for *S. scabra* cv. Fitzroy). In a paddock of *C. brasilianum* at Katherine subjected to dry-season grazing for four years the species has shown only a limited ability to increase its population density following a reasonable initial establishment (W. H. Winter, unpublished data). *C. brasilianum* has also shown promise at several locations in Colombia, Venezuela and Brazil, but *Rhizoctonia* foliar blight is a limiting factor (Anon. 1982).

C. schottii showed less promise at Katherine but was the best of the *Centrosema* species at Lansdown. Previous experience with CPI 55705 near Lansdown prompted its inclusion among eight bred lines of *M. atropurpureum* in an evaluation experiment (Jones *et al.* 1980) at that site. Although the establishment and initial growth of the accession was good, it yielded less than Siratro under both cutting and grazing treatments. Yields in spring (December) were much lower than for Siratro, although comparable yields were obtained in summer and autumn (R. J. Jones, personal communication). It compared most favourably with Siratro on the more fertile soils.

Accessions of *C. virginianum* from semi-arid habitats have not been agronomically successful in similar environments in Australia, and the present results with CPI 55707 agree with previous experience (Anning 1982). However, both CPIs 55707 and 40057 have persisted in plots under common grazing (1.5 beasts ha^{-1}) on the humid subtropical coast of south-east Queensland for more than four years (Clements and Jones 1983). No introduced accession of *C. virginianum* has been successful at Narayen (Clements 1983), but bred lines have persisted and outyielded Siratro over a two-year period (Clements and Thomson 1983).

The mineral nutrient levels observed in *C. pascuorum* accessions are within the range of values tabulated by Minson (1977) and Bruce (1978) for tropical pasture legumes. Concentrations of N and P contents are lower than, concentrations of Ca, Mg and Na similar to, and concentrations of Cu higher than those commonly found in *C. pubescens* (Minson 1977). The P contents in Table 3 are close to the critical minima defined by Andrew and Robins (1969) for a number of tropical pasture legume species (e.g. 0.16% P for *C. pubescens*). Contents of most nutrients were above the levels required by cattle (Agricultural Research Council 1980), but contents of Na were below animal requirements.

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SHORT-TERM FLOODING TOLERANCE OF SEVENTEEN COMMERCIAL TROPICAL PASTURE LEGUMES

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ABSTRACT

Studies were undertaken on the waterlogging tolerance of commercial cultivars of 17 tropical legumes. Plants were grown in pots and divided into two groups: a control group was watered to field capacity and a flooded group set in 20 l tanks with water to 15 cm up the stem of the erect group and 5 cm with the prostrate group. Flooded plants were taken after 10 days and 21 days of immersion and harvested 7 days later. The two most tolerant were Macroptilium lathyroides *and* Desmodium intortum. *In most cases* Macroptilium lathyroides *grew better, with highest weight, including nodule weight in flooded conditions. The more prostrate legumes* Desmodium heterophyllum, Lotononis