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SUMMARY

Eighty-four accessions of *Centrosema virginianum* were evaluated in a pasture plant introduction nursery at Narayen Research Station (25°41'S, 150°52'E) during 1976-1981. There was considerable variation for herbage yield during the first growing season, survival during the winter and reaction to drought. No introduced line yielded as much herbage as Siratro (*Macroptilium atropurpureum*) in the second growing season, and few survived as well, but one bred line outyielded Siratro and another was equal to it. The best introduction overall was CPI 40556.

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INTRODUCTION

Centrosema virginianum is a herbaceous, perennial, twining, tropical/ subtropical legume with some potential as a pasture plant in subtropical Queensland. Between 1973 and 1981 a plant improvement program was conducted with this species, involving both the introduction and evaluation of new accessions from overseas and the exploitation of these accessions in a breeding program. The evaluation of nineteen accessions in south-east Queensland (Clements 1977) showed that none was equal to Siratro (*Macroptilium atropurpureum*) in herbage yield. However, data obtained during the breeding program (Clements and Thomson 1983) showed that high yield and reasonable persistence could be obtained by recombination and selection. This paper summarises the agronomic performance of a total of 84 accessions of *C. virginianum* grown in a plant introduction nursery at Narayen Research Station.

C. virginianum occurs naturally in tropical and subtropical regions in the Americas, including many Caribbean islands (Clements and Williams 1980). It is so widely distributed and genetically diverse that many species and varietal names have been applied to it. In classifying *C. virginianum*, fifteen geographical regions have been employed (R.J. Clements and R.J. Williams, unpublished data), each containing from one to nine geographical races. The regions are as follows: (1) Uruguay and coastal Rio Grande do Sul, Brazil; (2) North-Western Argentina; (3) Paraguayan/Bolivian Chaco; (4) pockets in Central-Western Brazil and Eastern Bolivia; (5) Andean slopes and ravines of Bolivia and Peru; (6) North-Eastern Argentina, South-Eastern Paraguay and Western Parana State, Brazil; (7) Brazilian South-East seaboard; (8) interior Minas Gerais State, Brazil; (9) semi-arid North-Eastern Brazil; (10) Colombia and Venezuela; (11) Central America and Mexico; (12) USA; (13) Bahamas; (14) Cuba; (15) remaining Caribbean islands. Thirteen of these regions are represented by the material described in this paper, so that the collection is representative of the species in terms of its geographic distribution.

MATERIALS AND METHODS

The 84 accessions listed in Tables 1-3 were evaluated in three separate experiments. *Macroptilium atropurpureum* cv. Siratro and *C. virginianum* CPI*40057 were included in each experiment as control lines, and three accessions (CPIs 40556, 51038 and 57979) were each included in two experiments. Experiment 3 also contained the two best F_5 lines from a breeding program (Clements and Thomson 1983), from a cross between CPIs 40556 and 57979.

The experiments were conducted at Narayen Research Station (25°41'S, 150°52'E) which has an annual average rainfall of 720 mm, three-quarters of which falls during the summer growing season (October-April). Dry periods within the growing season are common. About 30 frosts occur each winter, with the average lowest grass temperature each year being -4.7°C (Cook and Russell 1983). The experiments were conducted during 1976-1981, and the period in general was characterised by below-average rainfall. During experiment 1 an unusually cold winter was experienced in 1977 (35 frosts, the lowest grass temperature being -6.2°C). In experiment 2, a mild winter occurred in 1978 (26 frosts, -3.3°C) and rainfall during 1978/79 and 1979/80 was particularly low (516 and 493 mm respectively). Experiment 3 also experienced very dry conditions in 1979/80.

The soil at the experimental site was a mottled yellow podzolic soil (Dy3.41; Northcote 1971) derived from adamellite, with a sandy surface texture and a pH (1:5 water) of 6.5. Prior to planting, molybdenised superphosphate was applied at a rate of 200 kg ha^{-1}, and an additional dressing was applied during the second growing season of experiments 2 and 3 (100 and 250 kg ha^{-1} respectively).

The three experiments were planted in October 1976, November 1977 and November 1979 respectively, and were continued for one, three and two years respectively. Establishment techniques were the same for each experiment. Seedlings were first grown in peat pellets in a glasshouse, inoculated with *Rhizobium* strain CB1923, transplanted at 7-9 weeks of age, and watered by hand until they had become established in the field. *Experiment 1* contained 16 accessions plus Siratro, with each entry represented by a ten-plant row in each of three replicates in a randomised block design. All plants were spaced at 1 x 1 m centres. *Experiment 2* contained 19 accessions plus Siratro, in a randomised block design with three replicates. Here, accessions were grown in 5-plant plots, constructed by positioning one plant in each corner of a 1 x 1 m square grid, the fifth position being in the centre of the plot. Each plot was allowed to occupy an area of 1.5 x 1.5 m, and plots were separated by a mown path 1 m wide. *Experiment 3* contained 56 accessions plus Siratro, in a randomised block design with two replicates. Accessions were grown in 9-plant plots (3 x 3 spacing), with plants 0.5 m apart; subsequently each plot occupied an area of 2 x 2 m and was separated from its neighbours by a 1 m mown path.

Plants in experiment 1 were not defoliated. Those in experiment 2 were cut at the end of the first winter, once during the second growing season, and at the end of the second winter. Plots in experiment 3 were cut at the end of the first winter and were grazed by cattle for three months (April-June inclusive) during the second growing season. Experiment 1 was maintained in a weed-free condition by hand weeding and inter-plant cultivation; trailing stems were gathered together and thrown towards the centre of each plant. Experiments 2 and 3 were not weeded after the establishment period.

Winter survival was determined by counting plants before and after the winter period. Herbage yield was rated visually at 4- to 8-week intervals during the growing season, depending on growing conditions, using a 1-5 scale extended to include 11 classes by the use of intermediate categories (Clements and Thomson 1983). Occasionally the rating system was calibrated by cutting, drying and weighing standards, thus allowing yields to be estimated. In this paper, ratings taken during any one growing season have been pooled for convenience despite some loss of information. The sequence of dry years provided opportunities to assess response to drought during experiments 2 and 3, again using a 1-5 rating system (1 = >50% leaves dead; 3 = all leaves wilted, no leaf death; 5 = no symptoms). Pod production of accessions in experiment 3 was also assessed visually on a 1-5 scale (1 = 10-50 pods m^{-2}; 3 = 100-200 pods m^{-2}; 5 = >500 pods m^{-2}).

* Commonwealth Plant Introduction number

RESULTS AND DISCUSSION

The data are summarised in Tables 1-3. Of the 84 introductions tested, 33 had herbage yields not significantly lower than that of Siratro during the first growing season. However, most of these introductions were from experiment 3, and the relatively poorer performance of Siratro in that trial was partly due to infestation by rust which may depress herbage yield by up to 30 percent (Jones 1982). In experiments 1 and 2 (Tables 1, 2) only three out of 34 introductions had yields similar to Siratro in the first season. One introduction (CPI 83844) in experiment 3 was the only accession which had a significantly *greater* first-season yield than Siratro.

Winter survival of the introductions varied from zero to 100 percent but was in general lower than that of Siratro. Most accessions from Argentina (regions 2, 6) and several Carribean islands (15) including Cuba (14) showed good winter survival, together with one accession from the USA (12) and a few from other regions. In view of the strong correlation known to exist between latitude of origin of accessions and survival after controlled frosting (Clements and Ludlow 1977), the good survival of accessions from Argentina is not surprising; however, the relatively poor survival of some accessions from the USA (CPIs 63896, 63897 and 63898, experiment 1) and Argentina (CPI 79038, experiment 2; CPIs 78362, 78363, 83847 and 83850, experiment 3) was unexpected. The good survival of some accessions from the State of Bahia in Brazil was also unexpected. These discrepancies suggest that frost was not the only factor responsible for plant death during the winter. Perhaps moisture stress may also have been a significant factor.

Table 1: Origin and agronomic performance of *Centrosema virginianum* accessions grown at Narayen Research Station in 1976/77: Experiment 1.

CPI or Q number[1]	Origin: Country, State (brackets: geographical group number[2])	Mean yield rating, first growing season[3]	Survival (%) during first winter (brackets: arcsin [x + 0.1])
33218	Puerto Rico (15)	2.8	90 (75)
37654	Bolivia, Cochabamba (10)	3.1	16 (20)
40057	Brazil, São Paulo (7)	2.3	8 (11)
58483	Mexico, Veracruz (11)	3.2	27 (31)
58484	Mexico, Veracruz (11)	3.7	43 (40)
58492	Mexico, Veracruz (11)	3.5	36 (36)
63896	USA, Alabama (12)	2.0	43 (41)
63897	USA, Texas (12)	3.4	24 (25)
63898	USA, Texas (12)	2.2	33 (35)
69935	Argentina, Misiones (6)	3.1	48 (44)
70260	Argentina, Misiones (6)	2.5	61 (52)
75365	Argentina, Misiones (6)	2.8	73 (64)
75366	Cuba (14)	1.9	83 (66)
75367	Argentina, Misiones (6)	2.4	88 (73)
Q9856	Brazil, Pernambuco (9)	3.0	8 (11)
Q10049	Brazil, Paraiba (9)	2.9	5 (9)
Siratro	-	6.5	100 (90)
L.S.D.	(P = 0.05)	0.7	- (25)

[1]CPI = Commonwealth Plant Introduction; Q = Queensland Department of Primary Industries accession.
[2]Geographical regions used by R.J. Clements and R.J. Williams (unpublished data) to classify *C. virginianum*
[3]1-5 scale (1 = least vigorous; 5 = most vigorous) extended to include Siratro; mean of two ratings on 24/1/77 and 28/2/77

Table 2: Origin and agronomic performance of *Centrosema virginianum* accessions grown at Narayen Research Station in 1977/80: Experiment 2.

CPI number[1]	Origin: Country, State (brackets: geographical group number[2]	Mean yield rating first growing season[3]	Estimated yield,[4] first growing season ($t\ ha^{-1}$)	Mean yield rating, second growing season[5]	Survival (%) during second winter (brackets: arcsin [x + 0.1])	Drought response rating, 22/1/79[6]	Yield rating 11/2/80[7]
26259	USA, Texas (12)	1.5	0.9	1.5	87 (72)	1.5	2.3
34154	Honduras (11)	3.6	1.9	3.1	20 (23)	3.0	2.0
40055	Brazil, São Paulo (7)	1.5	0.7	1.0	20 (23)	1.0	trace
40056	Brazil, São Paulo (7)	2.2	0.9	1.9	47 (43)	1.5	1.2
40057	Brazil, São Paulo (7)	2.1	1.0	1.9	27 (26)	1.7	1.0
40059	Brazil, Pernambuco (9)	2.4	1.2	1.7	40 (39)	2.8	1.3
40556	Colombia, Cundinamarca (10)	4.2	3.8	3.0	20 (27)	1.7	1.3
51038	Argentina, Córdoba (2)	2.9	1.2	2.0	53 (48)	2.0	2.3
55695	Brazil, Bahia (9)	3.3	2.0	1.1	7 (10)	n.a.	trace
55707	Brazil, Bahia (9)	2.6	1.2	1.3	0 (2)	2.7	trace
55709	Brazil, Bahia (9)	3.2	1.5	1.3	7 (10)	3.7	trace
57979	Brazil, São Paulo (4D)	2.4	1.0	0.8	0 (2)	n.a.	0.7
68891	Brazil, Minas Gerais (8?)	3.2	2.2	1.0	7 (10)	n.a.	1.0
75845	Brazil, Bahia (9)	2.8	1.1	1.3	0 (2)	1.0	nil
75846	Brazil, Bahia (9)	2.6	1.0	2.2	53 (47)	2.2	1.7
75847	Brazil, Bahia (9)	2.4	1.2	1.0	0 (2)	n.a.	nil
75848	Brazil, Minas Gerais (9)	3.7	2.6	0.8	7 (10)	n.a.	trace
79037	Argentina, unknown location (2?)	2.3	1.1	2.1	53 (47)	1.8	1.2
79038	Argentina, unknown location (2?)	2.6	1.2	1.0	7 (10)	1.7	trace
Siratro	-	4.2	2.5	4.1	87 (77)	1.0	6.5
L.S.D.	($P = 0.05$)	0.9	1.5	0.9	- (29)	1.3	2.0

[1]CPI = Commonwealth Plant Introduction
[2]Geographical regions used by R.J. Clements and R.J. Williams (unpublished data) to classify *C. virginianum*
[3]1-5 scale (1 = least vigorous; 5 = most vigorous); mean of four ratings on 13/1/78, 24/2/78, 23/3/78 and 5/4/78
[4]Calibrated rating on 23/3/78
[5]1-5 scale; mean of four ratings on 30/10/78, 6/12/78, 23/2/79 and 5/4/79
[6]1-5 scale (1 = >50% leaf death, all leaves wilted; 3 = all leaves wilted but no leaf death; 5 = no wilting, no leaf death); n.a. = insufficient material to rate.
[7]1-5 scale, extended to include Siratro

Table 3: Origin and agronomic performance of *Centrosema virginianum* accessions grown at Narayen Research Station in 1979/81: Experiment 3

CPI[1] Number	Origin: Country, State (brackets: geographical group number[2])	Mean yield rating, first growing season[3]	Drought response rating, 21/4/1980[4]	Pod production rating 21/4/1980[5]	Survival (%) during first winter (brackets: arcsin [x + 0.1])	Mean yield rating, second growing season[6]	Estimated yield, second growing season ($t\ ha^{-1}$)[7]
40057	Brazil, São Paulo (7)	2.6	2.5	2.0	78 (69)	1.3	0.8
40556	Colombia, Cundinamarca (10)	3.8	2.3	4.0	73 (60)	1.1	3.4
51038	Argentina, Cordoba (2)	2.5	2.0	4.0	95 (81)	1.3	1.0
57979	Brazil, São Paulo (4D)	1.1	1.8	4.5	50 (45)	0.8	0.5
70328	West Indies, St. Kitts (15)	3.9	4.0	3.3	88 (75)	1.2	0.8
70329	West Indies, Antigua (15)	2.9	4.3	3.0	82 (72)	2.2	0.8
70330	West Indies, Antigua (15)	2.3	3.5	3.8	100 (90)	0.9	0.6
70331	West Indies, Antigua (15)	2.3	3.0	4.0	55 (48)	1.0	0.6
70332	West Indies, Montserrat (15)	2.4	3.3	3.3	81 (64)	2.2	1.0
70333	West Indies, Montserrat (15)	1.3	2.3	3.5	55 (48)	1.2	0.8
70334	West Indies, Antigua (15)	2.0	4.0	3.0	92 (78)	1.3	1.1
73457	West Indies, Antigua (15)	1.8	4.3	3.0	77 (62)	1.5	0.7
73458	West Indies, Antigua (15)	2.2	3.5	3.8	84 (73)	0.9	0.5
73459	West Indies, Nevis (15)	2.2	4.0	3.3	100 (90)	2.3	1.3
73460	West Indies, St. Lucia (15)	2.2	3.5	3.3	49 (45)	1.1	1.3
73671	Bahamas (13)	died after transplanting					
75121	West Indies, Antigua (15)	2.0	2.5	4.0	73 (59)	1.5	0.8
76001	Mexico, Yucatan (11)	3.7	2.8	3.5	84 (67)	1.3	1.0
76002	Mexico, Yucatan (11)	3.6	2.5	3.8	77 (61)	1.0	0.8
76003	Mexico, Yucatan (11)	3.6	3.0	4.0	58 (50)	1.6	3.4
76004	Mexico, Yucatan (11)	2.5	2.3	4.5	70 (58)	1.2	2.2
76005	Mexico, Campeche (11)	2.6	2.8	4.3	33 (35)	0.9	0.5
76006	Mexico, Yucatan (11)	2.0	2.3	4.3	0 (2)	0.5	0.5
77382	Dominican Republic (15)	0.9	4.0	4.0	75 (68)	0.9	0.6
78360	Argentina, Cordoba (2)	2.1	2.0	4.3	84 (67)	1.7	0.5
78361	Argentina, Salta/Jujuy (2)	1.8	1.0	3.8	62 (52)	0.8	0.5
78362	Argentina, Jujuy (2)	2.4	0.8	4.5	45 (42)	0.6	0.5
78363	Argentina, Jujuy (2)	1.8	0.8	4.8	41 (40)	0.6	0.5
78586	Brazil, Minas Gerais (9)	1.4	2.3	4.0	72 (60)	0.8	0.8
83494	Colombia, Cauca (10)	3.3	2.5	4.0	58 (50)	1.5	1.4
83496	Colombia, Valle del Cauca (10)	1.7	1.7	4.3	20 (27)	0.6	0.8
83512	Colombia, Cauca (10)	2.3	2.2	4.3	42 (39)	0.9	0.7
83513	Colombia, Narino (10)	1.0	2.5	3.0	50 (45)	0.7	0.5
83517	Colombia, Antioquia (10)	2.3	2.8	4.0	65 (54)	0.8	0.5

CPI[1] Number	Origin: Country, State (brackets: geographical group number[2])	Mean yield rating, first growing season[3]	Drought response rating, 21/4/1980[4]	Pod production rating 21/4/1980[5]	Survival (%) during first winter (brackets: arcsin [x + 0.1])	Mean yield rating, second growing season[6]	Estimated yield, second growing season (t ha^{-1})[7]
83843	Brazil, Mato Grosso (4B)	1.6	1.3	3.3	12 (20)	0.2	0.5
83844	Brazil, Minas Gerais (4C)	4.6	3.0	3.8	84 (67)	2.2	0.8
83847	Argentina, Salta/Jujuy (2)	2.3	1.0	4.8	28 (26)	0.6	0.5
83847a	Argentina, Salta/Jujuy (2)	1.8	1.3	4.3	64 (53)	0.9	0.5
83848	Argentina, Salta/Jujuy (2)	2.5	1.1	4.7	67 (60)	0.3	0.5
83849	Argentina, Salta/Jujuy (2)	2.2	1.8	2.5	89 (76)	1.7	0.9
83850	Argentina, Salta/Jujuy (2)	1.8	0.8	3.5	11 (15)	0.6	0.5
87891	Brazil, Bahia (9)	2.0	2.5	2.8	64 (54)	1.8	0.6
87918	Brazil, Mato Grosso (4B?)	1.6	3.0	1.3	76 (62)	0.3	0.5
87919	Colombia, Valle del Cauca (10)	3.2	2.0	5.0	17 (19)	0.5	0.5
87920	Colombia, Valle del Cauca (10)	1.3	2.8	4.5	54 (48)	0.8	0.5
87921	Colombia, Valle del Cauca (10)	1.7	3.1	5.2	0 (2)	0.3	0.5
87923	Brazil, Bahia (9)	2.7	2.6	5.2	88 (75)	1.1	0.5
87924	Brazil, Bahia (9)	3.7	2.3	4.3	89 (71)	1.9	1.0
87925	Brazil, Bahia (9)	2.3	2.8	4.3	76 (61)	1.7	0.6
87926	Brazil, Bahia (9)	1.4	2.8	4.0	50 (46)	1.2	0.9
87927	Brazil, Bahia (9)	1.7	1.8	3.8	62 (53)	1.3	0.8
87928	Brazil, Bahia (9)	2.3	2.5	5.0	65 (55)	1.7	1.4
87930	Colombia, Valle del Cauca (10)	0.6	1.9	3.3	22 (22)	0.6	0.5
87947	Venezuela, Bolivar (10)	1.4	3.8	2.3	51 (46)	0.8	0.5
31N11//7	Bred line	3.6	1.8	3.5	100 (90)	4.3	7.4
31N11//8	Bred line	3.9	2.0	3.3	94 (80)	3.3	5.0
Siratro	-	3.2	1.5	3.5	100 (90)	3.3	5.5
L.S.D.	(P = 0.05)	1.2	1.1	1.4	- (27)	0.8	0.8

[1]CPI = Commonwealth Plant Introduction
[2]Geographical regions used by R.J. Clements and R.J. Williams (unpublished data) to classify *C. virginianum*
[3]1-5 scale (1 = least vigorous; 5 = most vigorous); mean of three ratings on 11/2/80, 31/3/80 and 21/4/80
[4]1-5 scale (1 = >50% leaf death, all leaves wilted; 5 = no symptoms)
[5]1-5 scale (1 = 10-50 pods m^{-2}; 3 = 100-200 pods m^{-2}; 5 = > 500 pods m^{-2})
[6]1-5 scale; mean of three ratings on 22/9/80, 10/12/80 and 28/1/81
[7]Calibrated rating, 25/2/81

In the second growing season Siratro outyielded every introduced line of *C. virginianum* (Tables 2, 3), usually by a great margin. Only one bred line (31N11//7) outyielded Siratro, while the other bred line was equal to Siratro in yield. The best introductions were CPIs 34154 and 40556 (experiment 2) and CPIs 40556 and 76003 (experiment 3). Of these three lines, CPI 40556 was also the highest yielding introduction in the first growing season in experiment 2 and was ranked third in the first season in experiment 3, and was overall the highest yielding introduction. The discrepancy between its rather low mean yield rating in the second growing season in experiment 3 and its estimated yield of 3.4 t ha^{-1} (Table 3) was due to its poor performance early in the growing season; most of its production occurred during a six-week period in January-February 1981 when 230 mm of rainfall was recorded. CPIs 34154 and 76003 also grew well during the first growing season. CPI 83844 (Table 3) which had been outstanding in the first season was disappointing in the second growing season.

Experiment 2 was the only trial to extend into a third growing season, and the data in Table 2 show that Siratro was clearly superior to all *C. virginianum* accessions by this time. More than half the accessions in the experiment had virtually disappeared from the plots, and all remaining accessions (including CPI 40556) received low yield ratings.

The estimated herbage yields of *C. virginianum* introductions ranged from 0.9-3.8 t ha^{-1} (mean 1.5 t ha^{-1}) in the first growing season (Table 2), and from 0.5-3.4 t ha^{-1} (mean 0.8 t ha^{-1}) in the second growing season (Table 3, excluding the two bred lines), compared with 2.5 and 5.5 t ha^{-1} respectively for Siratro. The estimated Siratro yields are within the range of yields measured by Hutton *et al.* (1978) in other years on undefoliated plots at Narayen. The average estimated yield of the *C. virginianum* introductions was 60% of that of Siratro during the first growing season (experiment 1) but only 15% of that of Siratro during the second season (experiment 3), again emphasising the generally poor performance of *C. virginianum* after the first year. In contrast, the estimated yield of the bred lines in the second growing season was greatly superior to the mean of the introductions and better than the best introduction (Table 3).

Observations on drought response (Tables 2, 3) showed that Siratro and *C. virginianum* react differently to moisture stress. Siratro is known to possess a drought avoidance strategy involving a deep root system, excellent stomatal control of water loss, leaf movements (paraheliotropy) to reduce radiation load and leaf temperature, and leaf shedding (Ludlow 1980), and in the present experiments Siratro shed its leaves during periods of moisture stress (ratings of 1.0 and 1.5 respectively in experiments 2 and 3). Very few *C. virginianum* accessions shed their leaves to the same extent as Siratro, paraheliotropy was not observed and leaf wilting was common. Accessions from a given geographical region usually behaved similarly. The apparent drought resistance of lines from the Caribbean islands (region 15) was a feature of the results (Table 3). Accessions from coastal São Paulo State, Brazil (region 7) received low ratings, and these results agree with observations on these accessions in other experiments at Narayen and at other sites in south-east Queensland with contrasting rainfall regimes (R.J. Clements, unpublished data), i.e. they have little tolerance of drought. Accessions from Argentina (regions 2 and 6) also received consistently low ratings. Accessions from Mexico and Central America (region 11), Colombia and Venezuela (region 10) were nearly always intermediate in response while those from Bahia State, Brazil (region 9) were rather more variable but commonly intermediate. The two bred lines had rather low ratings (Table 3).

Almost all *C. virginianum* accessions produced large numbers of pods. Only five of the 56 accessions in experiment 3 produced less than 100 pods m^{-2}. Four of these (CPIs 83849, 87891, 87918 and 87947) appeared to be atypical of the region from which they came, i.e. they produced *fewer* pods than other accessions from the same region. However, CPI 40057 produces *more* pods than other accessions from region 7 (R.J. Clements, unpublished data) which often produce a relatively small number of pods and have characteristically large seeds. At more humid sites CPI 40057 produces more seeds than the present results might indicate (Clements 1977; R.M. Jones and R.J. Clements, unpublished data). In general, seed production does not seem to be a problem with *C. virginianum*. Seedling regeneration was not measured in these experiments but was commonly observed to occur; however, regeneration was apparently insufficient to allow good herbage yield in the second and later growing seasons.

The experiments provided very little data on acceptability to grazing animals or resistance to grazing of the accessions. By the time cattle were introduced to the experimental area in experiment 3, many accessions had already disappeared or were so unproductive that assessment of their acceptability was difficult. However, a visual assessment of the severity of grazing of each accession was attempted at the end of the grazing period. This showed that most accessions were readily grazed. Five accessions were relatively heavily grazed (CPIs 40556, 76003, 76004 and 87926 and Siratro), and several accessions from Argentina (CPIs 78360, 83847, 83849, 83850 and perhaps others) and Antigua (CPIs 70332 and 70333) were lightly grazed.

The present experiments were conducted at only a single site which has a more severe climate than those at the sites used to evaluate an earlier set of introductions (Clements 1977). Nevertheless, the conclusions from the previous study remain essentially unaltered. By comparison with Siratro, *C. virginianum* lacks vigour at Narayen, and none of the introductions warrants more extensive testing in the speargrass region of south-east Queensland, though they may be useful in more benign environments nearer to the coast. The primary deficiencies are failure to persist through the winter and through dry periods, and low herbage yield after the first growing season. Good winter survival is apparent in accessions from subtropical climates, good drought resistance seems to be present in material from the West Indies, and good herbage yield potential is found in individual accessions from a number of regions (notably CPI 40556 from Colombia). However, no introduction has a satisfactory combination of characters for the Narayen environment. The two bred lines included in experiment 3 which were derived from the cross CPI 57979 x 40556 (Clements and Thomson 1983) possessed a combination of characters outside the range observed among the introductions. Their performance underlines the previous conclusion (Clements 1977) that the potential of *C. virginianum* may be greater than the performance of the parent lines suggests.

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