CODARIOCALYX GYROIDES - A NEW FORAGE OPTION FOR THE HUMID TROPICS

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ABSTRACT

The Southeast Asian shrub legume, *Codariocalyx gyroides* is adapted to acid, low-fertility soils with poor drainage. Data from 19 RIEPT (International Network for Evaluation of Tropical Pastures) trial sites conducted in the American humid and subhumid tropics were used to define the range of adaptation of *C. gyroides*. The results show that *C. gyroides* performs better under high rainfall conditions of the humid tropics with hardly any dry season, and it responds to soil fertility (Ca, P). Future research needs are identified. The release of a commercial cultivar in Colombia is being prepared.

KEYWORDS

Genetic resources, humid forest, multilocational evaluation, shrub legume

INTRODUCTION

Codariocalyx gyroides has been thoroughly tested under cutting and grazing regimes in Belize (Lazier, 1981a; 1981b). This shrub legume is native in Southeast Asia, and occurs, e.g., in Papua New Guinea, up to altitudes of 1900 m.a.s.l. It is adapted to acid, low-fertility soils, and grows well on sites with high ground water table and poor drainage, but does not resist drought (Soedomo, 1992). The plants are very sensitive to cutting height (Lazier, 1981a) and this is, probably, the main reason for its lack of persistence in some cases, whereas pest and disease problems were identified in other instances (Soedomo, 1992). Although *C. gyroides* may not persist in the long term, its main advantage is its initial vigor and subsequent high yields of edible forage (Soedomo, 1992).

METHODS

One accession of *C. gyroides* (CF 29, donated by J. R. Lazier to CIAT in 1982, where it was registered as CIAT 3001) was included in type B regional trials of the International Network for Evaluation of Tropical Pastures (RIEPT, its Spanish acronym) at 37 sites of the American humid and subhumid tropics, from Cuba to Bolivia. After establishment in 7 m^2-plots, the plants were managed and evaluated as recommended in the RIEPT methodology (Toledo, 1982). Measurements included dry matter (DM) production (g/m^2) in periods of maximum and minimum rainfall.

Stepwise multiple regression analyses were conducted with the geographic, climatic and edaphic data available on experimentation sites, using the procedure described by Amézquita *et al.* (1991), to relate agronomic performance to environmental factors, in order to determine the range of adaptation of *C. gyroides* in the American tropics. Edaphic variables chosen for the analysis were sand content (%), P (ppm), Ca and K (mg/100 g soil), and pH, whereas rainfall (mm), altitude (m.a.s.l.) and latitude stand for geographic and climatic variables from 19 locations in 9 tropical American countries (Table 1). The sites included offered a wide range of environmental conditions.

RESULTS AND DISCUSSION

The regression parameters indicate that DM production of *C. gyroides* CIAT 3001 was higher under high rainfall conditions (Table 2). Except rainfall, no other common environmental factor was correlated to the performance across both seasonal periods. In the maximum rainfall period, latitude was an important factor related to performance of *C. gyroides*, although the regression was not significant ($r^2 = 0.43$; Prob.(F) = 0.0620); this indicates that performance improved closer to the equator. In the minimum rainfall period, performance was strongly influenced by soil Ca and P availability in addition to rainfall. These three factors together explain 88% of the variation encountered (Prob.(F) = 0.0001). In this analysis, adaptation may be confounded with management effects caused by the low cutting height (30 to 40 cm) applied and the species' known sensitivity to cutting height. Thus the data were analyzed once more using the first performance cut, independent whether it was carried out in the minimum or maximum rainfall period. Rainfall came up as the most important variable before location altitude although, again, the regression was not significant ($r^2 = 0.54$; Prob.(F) = 0.0028). This study shows that rainfall was the most important environmental parameter that influenced DM production of *C. gyroides*, and this even more so when performance during the period of minimum rainfall was analysed. Hence this species should not be grown in a long dry season environment, unless a high groundwater table is available. The findings of this study are supported by agronomic evaluation of more diverse and partly larger germplasm collections, where *C. gyroides* showed good adaptation to the environment of the humid tropics, e.g., in Bolivia (Vallejos and Cardona, 1995) and the Colombian Amazon (Maass *et al.*, 1996), where it has been tested since 1983 (J.E. Velásquez, unpublished data).

Prospects: The shrub legume *C. gyroides* has potential as a forage component in the American humid tropics, where it may also play a role in the reclamation of soils and degraded pastures. There is a need to further investigate environmental and genotypic effects on performance and forage quality in order to assess the real potential of *C. gyroides*. Finally, production systems need to be identified to integrate this shrub legume. In the Colombian Amazon region, *C. gyroides* is being promoted as one component within a development program that aims to increase milk and beef production through the reclamation of degraded pastures. Plots are established at small- to medium-sized farms to complement cut and carry grasses fed as supplements. Seed of the most promising material is being produced at a Colombian research station in Caquetá to prepare the release of a commercial cultivar in the near future.

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REFERENCES

Amézquita, M.C., J.M. Toledo and G. Keller-Grein. 1991. Agronomic performance of *Stylosanthes guianensis* cv. Pucallpa in the American tropical rain forest ecosystem. Trop. Grasslands **25:** 262-267.

Lazier, J.R. 1981a. Effect of cutting height and frequency on dry

matter production of *Codariocalyx gyroides* (syn. *Desmodium gyroides*) in Belize, Central America. Trop. Grasslands **15:** 10-16.

Lazier, J.R. 1981b. Performance of three persistent native legumes and *Codariocalyx gyroides* (syn. *Desmodium gyroides*) with *Brachiaria mutica* under grazing (Belize). Trop. Agric. (Trinidad) **58:** 235-243.

Maass, B.L., G. Keller-Grein and C.G. Meléndez. 1996. *Codariocalyx gyroides* - leguminosa arbustiva promisoria para el trópico húmedo. Pasturas Trop. (In press).

Soedomo, R. 1992. *Codariocalyx gyroides* (Roxb. ex Link) Hassk. Pages 97-98 *in* L. 't Mannetje and R.M. Jones, eds. Plant Resources of South-East Asia. No. 4 Forages. Pudoc, Wageningen, Netherlands.

Toledo, J.M., ed. 1982. Manual para la evaluación agronómica. Red Internacional de Evaluación de Pastos Tropicales. Centro Internacional de Agricultura Tropical (CIAT), Cali, Colombia. 170 p.

Vallejos, A. and R. Cardona. 1995. Adaptación y producción de leguminosas forrajeras arbustivas en la región tropical húmeda de Bolivia. Pasturas Trop. **17(3):** 2-11.

Table 1
Range of environmental conditions at 19 RIEPT evaluation sites used for analysis

Parameter	Minimum	Maximum	Variables highly correlated (r^2) with and not included in analysis
Geography and climate			
Location latitude	1½37'	21½28'	Longitude (-0.66)
Altitude (m.a.s.l.)	4	1500	Soil Organic Matter (0.66)
Rainfall accumulated in 12 weeks (mm)			
period of minimum rainfall	16	1202	
period of maximum rainfall	296	1424	
Soil			
Sand (%)	4	78	Loam (-0.71), Clay (-0.88)
pH	3.9	5.8	Al (-0.83), Al Saturation (-0.79)
Ca (mg/100 g soil)	0.16	13.3	Mg (0.99)
K (mg/100 g soil)	0.06	0.50	
P (ppm)	0.9	29.4	

Table 2
Agronomic performance and environmental parameters shown to affect production of *Codariocalyx gyroides* CIAT 3001 at RIEPT evaluation sites

DM yield as an agronomic indicator (g/m^2 in 12 weeks)						Multiple regression analysis					
Seasonal or management period	Sites (no)	Mean	M.S.E.	C.V.	Range	Coefficient (r^2)	Prob. >F	Environmental parameters that affect indicator	b	F	Prob. >F[1]
Minimum rainfall	16	1992.9	908.3	46	43-7677	0.88	0.0001	Ca	526.24	51.48	0.0001
								Rainfall	4.40	28.56	0.0002
								P	67.14	3.89	0.0721
Maximum rainfaill	13	2699.4	1037.2	38	934-5273	0.43	0.0620	Location latitude	-148.78	6.08	0.0334
								Rainfall	1.58	2.76	0.1275
First performance2	17	1802.3	1132.0	62	43-6437	0.54	0.0028	Rainfall	2.60	14.30	0.0018
								Location altitude	0.95	2.77	0.1169

[1] Maximum admissible Prob. >F = 0.15
[2] Includes either minimum or maximum rainfall periods, depending in which season the first performance cut was carried out