

# SELECTION AND UTILIZATION OF *STYLOSANTHES GUIANENSIS*, FOR GREEN COVER AND FEED MEAL PRODUCTION IN CHINA

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## ABSTRACT

This study illustrates the value of acquiring, evaluating and making available wild legume germplasm for evaluation in different production systems. A tropical legume selected for use as a pasture legume in South America proved to have greater value as a component in feed meal in intensive production systems in China, where it can return USD 1,400 per hectare, than as a pasture plant.

## KEYWORDS

legume, tropical, cover crop, feed meal, *Stylosanthes*, small farmers.

## INTRODUCTION

The legume accession, *Stylosanthes guianensis* CIAT 184, was collected in the Cauca Valley, Colombia, in 1973 by Rainer Schultze-Kraft (CIAT 1994). It was not well adapted under intensive cultivation in Colombia due to attack by anthracnose disease but was well adapted in the more humid conditions of the rain forest margins of the Peruvian Amazon where it was not susceptible to the disease (Lenné *et al.*, 1985). It was released as the cultivar 'Pucallpa' in 1985 (Reyes *et al.*, 1985; Amezcuita *et al.*, 1991).

It was introduced into China for evaluation along with other legumes in 1982. This paper describes the results of evaluation and the development of its use in China.

## METHODS

An evaluation trial for herbage production was conducted with 21 legumes from 21 March 1985 to 24 May 1987 at the Chinese Academy of Tropical Agricultural Science in Hainan. The mean annual rainfall during this period was 1750 mm. Mean temperatures in the warmest (July) and coolest month (January) were 28.0°C and 16.0°C, respectively. The soil was a reddish brown lateritic soil with pH 6.4; OM, 1.32% and available P, 3.9 ppm. Single superphosphate was applied at 225 kg/ha as a basal fertilizer before planting. No further fertilizer was applied. Seed was grown in polybags for 6 weeks and seedlings were then transplanted into the field. The first harvest was taken 4 months after transplanting. Subsequent harvests were taken every 2 months during the wet season and 4 months in the dry season. At each harvest all plants were cut to 30 cm and herbage yield was measured.

Seed was increased of the most promising accessions for regional trials. Regional trials were conducted at 3 sites in Hainan province and 2 sites in Guangdong province during 1987-1989. Soils were similar in the two provinces (pH: 5.2 - 5.5; P: 2.8 - 4.0; average rainfall: 1760 - 1840 mm/year) but mean temperatures were 2°C lower in Guangdong. Experimental details were identical to those described above.

Following evaluation, intensive methods were developed for cultivation and seed production of the most successful legume, *S. guianensis* CIAT 184, which was then released to small farmers.

## RESULTS

**Evaluation trial.** The *Stylosanthes guianensis* accessions gave higher average yields than other species of *Stylosanthes* and other legumes. Highest yields were obtained with *S. guianensis* CIAT 184

and CIAT 136 because these two grew faster than the other legumes in winter and spring when temperatures are lowest (Table 1).

**Regional trial.** In the regional trials, *S. guianensis* CIAT 184 and CIAT 136 gave similar yields in Hainan but that of CIAT 184 was higher in Guangdong. CIAT 184 was selected as the most suitable legume and released officially as *S. guianensis* cv. Reyan II Zhuhuacao.

**Cultivation.** The seed is treated with hot water (80°C) for 3-5 minutes to break down hard seed and with a fungicide before planting into seed beds. A dense seed bed of 10 m<sup>2</sup> planted at the rate of 40 kg/ha is sufficient to plant 1 hectare. After 45-50 days, seedlings 15-20 cm high are transplanted in the field in a grid of 70 cm x 70 cm (2 seedlings/hill) and 125-150 kg/ha single superphosphate applied. They are weeded during the first two months. These stands can be utilized for seed production, cover crop, green fodder or feed meal production.

**Seed production.** The plants are cut when 85% of the seed is ripe. Approximately 30% of the seed is obtained from threshing the plant and 70% collected from sweeping the soil surface. The seed is then cleaned by hand and dried until the moisture content is 12%. Commercial yields vary from 150-350 kg/ha clean seed. The first kilogram of seed of Reyan II obtained in 1996 was used to produce 150 kg seed in 1987. Seed production increased to 50 tons in 1991 and now is only limited by demand. It is produced for USD 3-4/kg and sold for USD 5/kg.

**Cover crop.** *Stylosanthes* is used as a green cover crop in young rubber and fruit trees. The plants are allowed to mature so as to form a solid cover to control other seeds. At the end of the season the stylo is usually harvested for feeding to stock or for feed meal production. Vegetable farmers have found it a valuable crop for rotation in order to decrease the disease build up of continuous cropping, in particular, with melons.

**Renovation of eroded hillsides.** Seedlings are planted along the contour on steep slopes and allowed to grow to maturity in degraded land and then utilized as fodder for livestock.

**Feed meal production.** Plants are allowed to grow until there is a complete cover of the ground. When mature but still green, plants are then cut with a small tractor mower or by hand and allowed to dry in the field. The dry material is then passed through a hammer mill. In some localities a cooperative supplies a portable mill and markets the meal. In other areas the dried plants are carried to a central point for hammer milling. Stands last for 3 years. Farm yields average 15 t/ha and the meal is sold for USD 140/ton. Because of this high return, growing *S. guianensis* for meal production has spread rapidly in Hainan and Guangdong. It is estimated that more than 3,000 ha are grown annually in Hainan and Guangdong. The largest use of the meal is in poultry feed to increase the depth of yolk color and its inclusion has been observed to reduce cannibalism.

**Animal feeding.** Beef and draft cattle can be grazed on a grass-stylo association while dairy cows are fed cut stylo along with other cut

grass, though use for cattle feed is not widespread. Pigs can be fed a feed ration containing 10-15% of stylo meal or green stylo cut into 2-4 cm pieces and cooked with other food wastes before feeding. Poultry are fed a ration containing 3-5% stylo meal and for ducks it is included in a swill. For ponded fish, green stylo material is thrown directly into the pond as with grasses or use 1% leaf meal in the compound feed.

#### Discussion

A new use has been demonstrated for *Stylosanthes guianensis* in China, in particular, for feed meal production. Its cultivation can be quite intensive compared to the use for pasture or fodder because of the high return per hectare. An advantage of this intensive cultivation for cover crop, fodder or meal production is that *S. guianensis* maintains high productivity for 3-4 years whereas under grazing it does not usually persist more than 2 years.

The limiting factor in meal production is the rate at which air-dried material can be hammer milled with the limited machinery available. Timing of harvests also depend on availability of machinery and as a result some stands become over mature and the protein content of the meal is low. Thus there is a need to (i) improve harvesting and processing, (ii) increase persistence and leaf proportion through management, and (iii) secure long-term production through the identification of new *S. guianensis* germplasm with broad-based resistance to anthracnose and alternative legume species for leaf meal production.

**Table 1**

Performance of all accessions of *Stylosanthes* spp. and the other best performing legumes from an evaluation of 21 accessions, Hainan.

Legume accession	Accession No/cultivar	Shoot yield (kg/ha/year)	Crude protein (%)	Ca (%)	P (%)
<i>Stylosanthes guianensis</i>	CIAT 184	13600	15.1	1.13	0.19
“	CIAT 136	13000	16.9	1.19	0.18
“	CIAT 1283	10300	15.1	1.46	0.21
“	cv Graham	9100	15.5	1.48	0.22
<i>Stylosanthes hamata</i>	CIAT 147	10000	11.5	1.26	0.19
“	cv Verano	8500	14.4	n.a.	n.a.
<i>Stylosanthes scabra</i>	cv Seca	10800	14.7	1.15	0.18
<i>Centrosema macrocarpum</i>	CIAT 5065	11100	21.7	0.84	0.23
<i>Centrosema pubescens</i>	CIAT 438	8200	14.0	0.91	0.27
<i>Codariocalyx gyroides</i>	local	11700	17.7	0.82	0.17
“	CIAT 3001	9400	17.8	0.77	0.19
<i>Desmodium ovalifolium</i>	CIAT 350	8100	13.4	0.83	0.11
<i>Desmodium heterophyllum</i>	CIAT 349	8600	17.2	0.91	0.14
<i>Desmodium heterocarpum</i>	CIAT 3787	7800	13.2	1.0	0.14
“	local	7600	15.2	0.87	0.17

**Table 2**

Mean annual yield of legumes grown at 3 sites in Hainan and 2 sites in Guandong.

Species	Accession/cultivar	Shoot yield (kg/ha DM)	
		Hainan	Guandong
<i>S. guianensis</i>	CIAT 184	5550	9600
<i>S. guianensis</i>	CIAT 136	5900	5750
<i>S. guianensis</i>	cv Cook	1800	4550
<i>S. scabra</i>	cv Seca	4000	3400
<i>D. ovalifolium</i>	CIAT 350	4900	3450
<i>Codariocalyx gyroides</i>	CIAT 3001	5950	200

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