

# SELECTION OF *STYLOSANTHES GUIANENSIS* FOR THE CERRADOS OF BRAZIL

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## ABSTRACT

Progenies of intervarietal hybrid stylos (*Stylosanthes guianensis* var. *vulgaris* x *S. guianensis* var. *pauciflora*) with mid-season maturity date (early-and mid-June), high dry matter and seed yields have been identified at the National Beef Cattle Research Center (CNPQC), Campo Grande, MS, Brazil. Dry matter yields of the best selections were comparable to those of the late-flowering control, cv. Mineirão. Several mid-season hybrids produced 150 to 200 kg/ha of seed-in-pod and a single plant selection yielded in excess of 300 kg/ha. The high degree of resistance to anthracnose observed in the advanced generations is attributed to the immense genetic diversity of these heterogeneous populations which restricted the development of this highly variable pathogen. Stability of disease resistance of superior mid-season maturity types and their adaptation to a wider range of ecological situations have yet to be assessed in multilocational trials. Grazing productivity experiments are required to determine animal production and persistency of the selected materials.

## KEYWORDS

Pasture legume, stylo, intervarietal hybrids, anthracnose-resistance, yield attributes

## INTRODUCTION

Several species of the genus *Stylosanthes* are indigenous to the savannas of the American tropics and are adapted to low soil fertility conditions. 'Common' stylo (*S. guianensis* var. *vulgaris*) is a polymorphic species widely distributed from Mexico to northern Argentina. The Australian cultivars (Schofield, Endeavour and Cook) and a Brazilian cultivar, IRI 1022, are robust, thick-stemmed perennials and they are susceptible to the fungal disease anthracnose (*Colletotrichum gloeosporioides* Penz. et Sacc). Detailed screening work in the Llanos of Colombia and Cerrados of Brazil has shown that most common stylo accessions are susceptible to anthracnose, which is endemic to the Americas (Thomas and Grof, 1986). A 'tardio' stylo (*S. guianensis* var. *pauciflora*), cv. Bandeirante, was released in Brazil in 1983 and cv. Mineirão, a 'common' stylo, was commercialised in 1993. Both are resistant to anthracnose in the center of origin/diversity, however, low seed production is seriously affecting the wider commercial use of both of these stylos. Currently, only cv. Mineirão is traded commercially in Brazil. It is a robust, highly productive subshrub that produces seed late in the dry season. Consequently, seed yields are often reduced due to moisture stress. Mechanical harvesting or "direct heading" with a combine harvester is difficult due to the large volume of green foliage that this species form retains to the very end of the dry season. Cv. Mineirão has a long juvenile growth phase, and produces low seed yields in the year of establishment. Intervarietal hybrids produced by Dr. J. W. Miles of CIAT, Colombia, added a new dimension to stylo research. The aim of the breeding project was to combine traits such as high seed-yielding capacity from 'common' types with anthracnose-resistance from the 'tardio' types. A stylo improvement project was initiated at CNPQC, Campo Grande, MS, Brazil in 1991. It is based on bulk populations developed in Colombia. This on-going project seeks to identify anthracnose-resistant genotypes that flower and mature early, produce commercially acceptable seed yields, are tolerant to drought, and retain green leaves during the dry season (Grof *et al.* 1993). The intervarietal hybrids provided greater genetic diversity, not found in previous collections. Although these populations were resistant in the Colombian Llanos, several (mainly early flowering types) succumbed to anthracnose and other foliar diseases in the Cerrados ecosystem.

## MATERIALS AND METHODS

Selection was carried out over five generations. Three generations were grown in Campo Grande, Mato Grosso do Sul, and two at two different sites in the Philippines. The primary evaluation site, Campo Grande, is situated at 20°27' S, 54°37' W, and 530 m asl. It has a

typical savanna climate with a mean annual temperature of 22.4° C and a mean annual rainfall of 1526 mm. The soil is a dark-red latosol (oxisol) with pH 4.7 and low available P content (2 ppm). In the Philippines the sites were located at Los Baños: 14°13' N, 121°15' E, 23m asl, at Cavinti: 14°17'N, 121°30' E, and 305 m asl. The average annual rainfall for the Los Baños site is: 2090.7 mm, and for the Cavinti site is: 4195.8 mm, the number of rainy days are 146 and 244 p.a., respectively. Data on dry matter and seed yields was collected from the same plots. Accumulated wet season forage yields were harvested at the pre-flowering stage. Treatments were in randomised complete blocks. Sample yields of 1m<sup>2</sup> were harvested per plot and the herbage was oven-dried at 70°C until constant weight. Host-plant response to anthracnose was monitored in the field in each subsequent generation. In the fifth or most advanced generation response to local and introduced pathogenic races was tested in a glasshouse using artificial inoculation. Eight-week old plants were inoculated with spore suspensions of anthracnose containing 10<sup>6</sup> conidia/ml. Inoculum of local origin, the control treatment used in other experiments, was collected from infected plants of cv. Mineirão.

## RESULTS AND DISCUSSION

**Dry matter yields.** Late flowering accessions and hybrid stylos are generally more productive in terms of dry matter than the early types. In a small plot experiment 26 treatments included hybrids, cv. Mineirão and a local accession GC-348. These two accessions represent late maturity forms of 'common' stylo. Dry matter yields accumulated by the fifth generation hybrids during the wet season were recorded for each treatment in the pre-flowering stage at the end of March. Cv. Mineirão significantly ( $P < 0.05$ ) outyielded 21 early flowering hybrids, but yield differences were not significantly different between cv. Mineirão, the other late-maturity form, GC-348 and three mid-season hybrids (GC-1517, GC-1519 and GC-1526).

Another small plot experiment contained 36 hybrids, with cv. Mineirão and GC-348 again being used as standards for comparison. At the end of wet season cv. Mineirão was outyielded ( $P < 0.05$ ) only by two hybrids (GC-1573 and GC-1561). Both of these hybrids are mid-season types and they combine the desirable traits of high dry matter production and mid-season flowering. There was no significant difference between the top-yielder (GC-1573) and the five other hybrids (GC-1561, GC-1579, GC-1565, GC-1461 and GC-1482) and the other late-maturity control (GC-348) (Fig.1).

**Flowering dates and seed production.** There was a wide range of variability in these traits among hybrid derivatives and controls. A small number of hybrids (GC-1459, GC-1512, GC-1516, GC-1518, GC-1519, GC-1524 and GC-1527) were in the "full flower" stage by mid-April and were classified as early flowering types. A larger group reached the "full flower" stage between the end of April and May 15. These were denoted as mid-season types. The late flowering control accessions and some "tardio" types commenced flowering on or about May 15. Early and mid-season flowering selections evaluated in three separate experiments at Campo Grande matured seed from the first week of June (shortening photoperiod) prior to the period of severe moisture stress normally experienced during July and August. In the same experiments cv. Mineirão was harvested on August 28, well into the dry season and approximately two months after seed ripening on the early and mid-season hybrid selections.

**Seed yields.** Seed production potential of selected hybrids was determined on a dark-red latosol (oxisol) at Campo Grande in an experiment containing cv. Mineirão and the local accession GC-348. Seed yield of the 20 hybrid-derived selections ranged between 10 and 200 kg/ha. Controls yielded 10.4 kg/ha (Mineirão) or 19 kg/ha (GC-348) (Fig. 2). Single plants with specific characteristics were

selected from some populations. A productive, semi-erect, mid-season flowering stylo yielded 330 kg/ha of seed-in-pod, the highest seed-yield obtained from a component of the populations evaluated.

**Reaction to anthracnose.** The populations have been screened for their response to anthracnose over five successive generations. Anthracnose infection was generally light in the fourth and fifth generations with only a few individual plants being affected by the milder form of the disease (*C. truncatum*). Artificial inoculation of ten hybrids with two local pathogenic races and three introduced races resulted in a slight infection by the local pathogen isolated from cv. Mineirão, whilst the hybrids inoculated with introduced races remained symptom-free.

**Basal leaf area.** Leaf area remaining after defoliation, an attribute associated with the rate of regrowth of some stylos, was higher for five of 22 hybrid selections than for cv. Mineirão. Most stylos, particularly the thick-stemmed forms, are intolerant of close defoliation and this can adversely affect the persistency of stylos in grazed associations. Determination of basal leaf area and leaf retention at maturity were used in the current evaluation process and were found to be important selection criteria for stylo cultivars. Cultivar Pucallpa (CIAT-184), initially selected on the basis of high basal leaf area, proved to be resistant to short defoliation by cutting (Grof, unpublished).

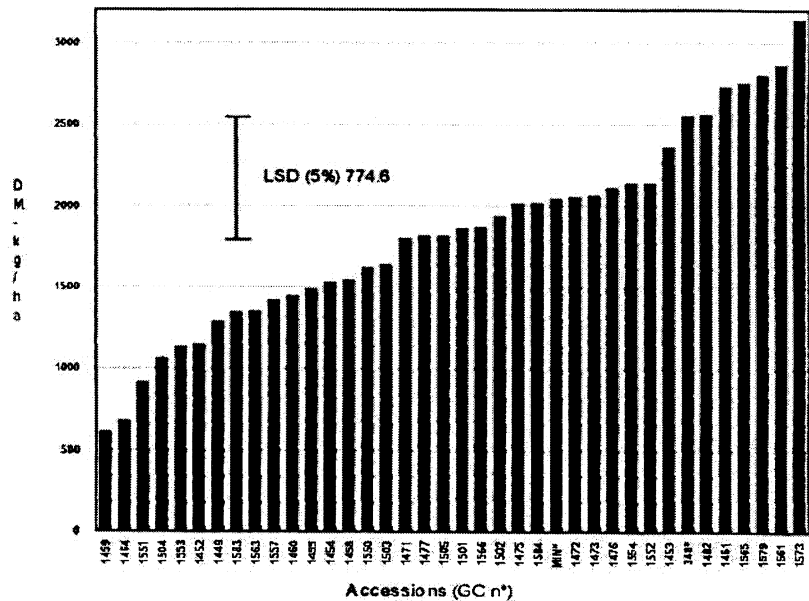
**Development of heterogeneous populations.** Four bulk populations

have been formed by physically mixing seed from single-plant selections of similar phenology, seed yield and morphological characters. Progenies of intervarietal hybrid stylos of mid-season maturity with dry matter yields comparable to the late-maturity cv. Mineirão and with significantly higher seed yields than the control have been identified. The high degree of resistance to anthracnose is attributed to genetic diversity of these heterogeneous populations which effectively restricts the development of this endemic pathogen. In Colombia, lower disease severities were recorded in a susceptible accession of stylo in mixtures compared with pure stands. Lenné (1985) concluded that mixtures of accessions of stylo have some potential for controlling anthracnose. Stability of disease resistance of superior mid-season maturity types and their adaptation to a wider range of ecological situations have yet to be assessed in multilocational trials. Grazing productivity experiments are required to determine animal production and persistency of the selected materials.

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**Figure 1**  
 Accumulated wet season yields (DM kg/ha) of *Stylosanthes guianensis* hybrids.  
 \* controls



**Figure 2**  
 Cleaned seed yields of *Stylosanthes guianensis* hybrids \* late-flowering controls

