New *Stylosanthes guianensis* for Tropical Grasslands

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NEW *Stylosanthes guianensis* FOR TROPICAL GRASSLANDS

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Abstract

Hybrid stylos (*Stylosanthes guianensis* var. vulgaris x var. pauciflora) with durable, quantitative resistance to anthracnose, mid-season harvest maturity date (early-July), high DM and seed yields have been selected at the Embrapa Beef Cattle Research Center, Campo Grande, Brazil. The hybrids displayed improved forage traits in Brazil, the native habitat and major center of diversity of the species and its pathogen, as well as in vastly different ecosystems. Dry forage yields and anthracnose resistance of superior selections and their composites were equal, in some instances, significantly better, than those of cv. Mineirão in multilocational trials situated in the Cerrados from lat. 6^0 S to lat. 20^0 S. Selected hybrids performed well in comparison with the highly successful CIAT184 (cv.Reyan II) on Hainan Island, China. Composites have also shown good promise in seed multiplication plots in Queensland, Australia. A positive attribute of composite hybrids is their great genetic diversity in contrast to pure-line cultivars with a relatively narrow genetic base. These truly tropical forms of stylo are best adapted to regions with >1500mm average annual rainfall .

Keywords: *Stylosanthes guianensis,* intervarietal hybrids, agronomic attributes, anthracnose resistance

Introduction

Several species of *Stylosanthes* have potential or actual economic application in the Cerrados. *S.guianensis,* or "common" stylo, is native to the Americas. Commercial cultivars of stylo selected in Australia and the Brazilian cultivar IRI1022 were devastated by anthracnose (*Colletotrichum gloeosporioides* Penz. *et* Sacc.) in the early 70's. The disease is endemic to the Americas where specialised forms of the pathotype exist. Stylo anthracnose was first recorded in Brazil in 1937 and now it is known to be widespread in all countries where the species is endemic also in situations where stylo is an introduced exotic species. Disease severity varies among species, botanical varieties and across ecosystems. A 91.6% susceptibility was recorded among accessions of var. vulgaris, while 39.4% of var. pauciflora were found to be susceptible to anthracnose.

For the savanna grasslands of the world, there was a need for new cultivars of *S. guianensis* with durable resistance to anthracnose and other biotic and abiotic constraints, high dry matter yields, and commercially acceptable seed yields. The *S. guianensis* improvement project with these primary objectives was initiated at EMBRAPA/Beef Cattle Research Center in 1991.

Material and Methods

Advanced breeding lines developed by the forage breeding unit of CIAT, based on artificial hybridisation of botanical varieties, maintained durable resistance to local pathotypes of anthracnose in Colombia (Miles and Grof, 1997).

Evaluation of five of these hybrid-derived populations, representing early, mid-season and late maturity genotypes, was carried out at Campo Grande, MS, Brazil. Anthracnose severity varied within and between host populations, and ecosystem specificity of the pathogen was very much in evidence. Early maturity types were the most affected with 33.3%

tissue damage and the mid-season group (harvest maturity early July) was the least affected with 11% tissue damage. This finding prompted a new screening process for anthracnose resistance in Brazil.

Screening and agronomic characterisation of 140 hybrid-derived lines has been carried out. The results clearly defined high yielding hybrid derivatives with anthracnose resistance and commercially acceptable seed yields at the main evaluation site.

Selection was continued over five generations, three grown in Campo Grande and two in two different sites in the Philippines, under conditions of 2090mm average annual rainfall (AAR) at Los Baños and 4196mm AAR at Cavinti. Subsequently, bulk populations have been formed by physically mixing seed of single-plant selections of similar phenology, forage and seed yields and morphological characters. Components of bulk populations have been evaluated individually, and also as mixtures, referred to as composite hybrids (CH). In Brazil cv. Mineirão was the control.

The stability of disease resistance, yield attributes and adaptation of CH lines to a wide range of ecological conditions were tested in multilocational trials located at Teresina, Goiânia, Chapadão do Sul and Campo Grande along a north-south transect of the Cerrados from lat.6^0 09'S to lat.20^0 27'S. Soil pH values ranged from 4.3 to 5.2 at Teresina and Chapadão do Sul, respectively. AAR for the trial sites ranged from 1320mm at Teresina to the highest of 1800mm at Chapadão do Sul. The regional trial sites are within the well-drained, isothermic savanna ecosystem, the Cerrados, which is characterised by a potential evapotranspiration ranging from 901 to 1060mm, and a wet season mean temperature of $<23.5^0$C.

In a small plot trial on Hainan Island, China, components of CH were compared with CIAT184, a highly promising cultivar in SEAsia.

Disease severity was assessed on a ten-point scale, 0=no visible damage; 9=100% tissue damage.

Results and Discussion

Multilocational trials were carried out on selections representing early, mid-season and late maturity types, a composite of four and another composite of two hybrid-derived lines were included along with one resistant and one susceptible control. Selected hybrids performed well in comparison with cv. Mineirão in Brazil and CIAT184 in China (Changjun and Guodao,1999). In general, the var. vulgaris lines produced more forage DM and seed than the pauciflora types. The mid-season components of CH produced more DM than early maturity types. The robust, late maturity cv. Mineirão, which is a poor seed producer, was significantly outyielded by a few mid-season maturity types which are fine stemmed and produce a good seed crop.

At Campo Grande, a component of the four-in-one CH outyielded ($P<0.01$) cv. Mineirão. Two other components of the same synthetic population produced significantly ($P<0.05$) higher DM yields than the control, and the yield of the fourth component of this CH was not significantly different from that of cv. Mineirão. Anthracnose severity ratings for three components of the CH were lower ($P<0.01$) than those of cv Mineirão and one component showed no significant difference from the control in response to anthracnose.

At Goiânia no significant differences were obtained in DM production between the four-in-one, two-in-one CH and cv. Mineirão. Annual yields of CH were 9.1 and 11.4t/ha, respectively, and cv. Mineirão produced 10.9t/ha. Anthracnose ratings ranged from 1.25 to 3.75 and cv. Mineirão had a 3.0 rating, the four-in-one CH had a lower ($P<0.05$) disease severity rating (1.75) than cv. Mineirão. The anthracnose susceptible control was 6 on the rating scale of 0 to 9.

At Chapadão do Sul DM yields of both CH (11.2 and12.9t/ha, respectively) were not significantly different from the control treatment (10t/ha) in the year of establishment. In 1998, however, cv. Mineirão (13.7t/ha) outyielded ($P<0.05$) two-in-one CH (9.7t/ha) but no significant difference was recorded between four-in-one CH (10.8t/ha) and cv. Mineirão. Only the hybrids produced commercially acceptable seed yields ranging from 100kg/ha to 162kg/ha.

The lowest annual yields (4.4-5.5t/ha) were recorded at Teresina that represents the lowest rainfall site in the regional trial network. The control yielded 5.3t/ha. The second season was the driest in a decade and the stylos showed poor performance. Anthracnose severity was low in this environment of erratic rainfall, tissue damage was <1% in all treatments in the dry as well as in the wet season.

In China DM yields for the four elements of the composite ranged from 5.4t/ha to 5.9t/ha and CIAT184 yielded 5.8t/ha. Anthracnose severity ratings were 2.3 for the hybrids and 2.1 for the control. Seed yields for the hybrids were 70,119,143 and 154kg/ha, the control produced 30kg/ha.

Parental genotypes of the superior four-in-one CH (GC 1585) originated from Brazil and Colombia.

Unquestionably, *S. guianensis* is well adapted to edaphic and climatic conditions of the Cerrados ecosystem. The combination of high seed and forage yields coupled with durable resistance to anthracnose has eluded researchers for three decades. These characteristics of composite hybrids were confirmed in the native habitat and probable center of diversity of the species and its pathogen, as well as in vastly different ecosystems. According to Lenné (1985) the most pathogenic isolates of anthracnose to each particular species of *Stylosanthes* exist in the native habitat of the host. Consequently, the species should be tested in its native habitat as well as in the site where it will be utilised. This basic principle was exploited to the full

extent in our *Stylosanthes* improvement program. Selected hybrid lines performed well in comparison with cv. Mineirão in Brazil, also with the highly successful CIAT184 in China. The same selected composites have also shown promise in seed multiplication plots in Queensland, Australia.

A distinct advantage of composite hybrids is their considerable genetic diversity in contrast to pure-line cultivars with a relatively narrow genetic base.

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