FORAGE ATTRIBUTES OF THE PERENNIAL GROUNDNUT *Arachis pintoi* IN A TROPICAL SAVANNA ENVIRONMENT IN COLOMBIA

B. GROF

CIAT Tropical Pastures Program, Cali, Colombia, centro. . . .

SUMMARY

In the continuing search for superior germplasm of tropical legumes adapted to Oxisol savanna conditions, a study of the perennial wild species of groundnut (peanut), *Arachis pintoi*, was initiated at Carimagua Research Station on the eastern plains (Llanos Orientales) of Colombia. *A. pintoi* is an agronomically little-known legume pasture species indigenous to South America. Its performance in grazed association with four different *Brachiaria* spp. was evaluated in terms of dry matter yield and animal weight gain.

A. pintoi was successful under conditions of heavy grazing (2.4 animal units/ha) employed on a year-round basis. Total grass and legume dry matter (DM) yields ranged from 20.5 to 25.4 t/ha/yr. *A. pintoi* in the mixture yielded 5.2 to 9.6 t/ha/yr when harvested at 4-week intervals. *B. dictyoneura* produced the highest and *B. ruziziensis* the lowest DM yield. Mean annual legume content of the legume-grass mixtures ranged from 20.0% to 44.8%. Soil seed reserves of *A. pintoi* in grazed *B. humidicola* and *B. dictyoneura* swards averaged 670 and 618 kernels/m^2, respectively. Average daily weight gain on *A. pintoi*-*Brachiaria* spp. pastures for the 594-day grazing period was 515 g/head.

The potential of *A. pintoi* appears to be good, since there are a limited number of tropical legumes species that are both adapted to Oxisols and compatible with the productive, stoloniferous *B. humidicola* and *B. dictyoneura*.

KEY WORDS: forage, germplasm, compatibility, *Brachiaria* spp.

INTRODUCTION

The chief difficulty in developing legume-grass pastures in tropical areas has been to find legumes which are not only well-adapted to environmental conditions but are compatible with aggressive grass species and are able to withstand heavy grazing. Commercial species of *Brachiaria* are productive, stoloniferous grasses which tend to suppress most associated legumes in the long run.

For some time, wild species of *Arachis* L. attracted interest as cultivated forages in tropical and subtropical regions of the world. As early as 1940 experiments were conducted in central coastal Queensland, Australia, with *A. prostrata*. This legume gave highly promising results in association with varieties of *Panicum maximum* (Miles, 1949). Surprisingly, commercial cultivars have not been developed in Australia. Extensive testing of the perennial *A. glabrata* (syn. *A. prostrata*) has been carried out in the southern United States. Cultivars Arb and Arblick were released in Florida; more recently, the cultivar Flori-graze or rhizoma peanut (a selection from Arb) was also released (Prine, 1983).

CIAT's Tropical Pastures Program initiated a study of wild species of *Arachis* with some 36 accessions introduced from the University of Florida and the USDA in Georgia between 1976 and 1978. These accessions, representing seven species (*A. Benthamii*, *A. glabrata*, *A. monticola*, *A. pusilla*, *A. villosa*, and *A. villosulicarpa*), were found to be susceptible to a

3p. Ingl., Res. Ingl., 4 Refs.

range of fungal and viral diseases which normally affect the cultivated species.

An accession of perennial peanut, A. pintoi Krapovickas et Gregory, exhibited adaptation to soils with low fertility, as well as resistance to pests and diseases in preliminary evaluation trials in the Llanos of Colombia. This paper reports the results of agronomic assessment and agro-morphological characterization of A. pintoi in grazed swards in association with four Brachiaria spp.

MORPHOLOGY AND ORIGIN OF A. pintoi

The genus Arachis is known only from South America. It is distributed east of the Andes, south of the Amazon, and north of La Plata. It is found among vegetation types from broken forest to open grasslands (Gregory et al., 1980). A. pintoi first was collected in 1954 by Geraldo C.P. Pinto in Bahía, Brazil, near the Atlantic coast.

Arachis has been divided into seven generic-sections, and it contains 22 described species and one of uncertain sectional affinity. Possibly, it also includes 40 or more as yet undescribed annual or perennial, 3-4 foliolate, herbaceous species. A. pintoi was assigned to the generic section Caulorhizae and it is a diploid species (2n=20) (Gregory et al., 1973).

A. pintoi is a perennial, prostrate legume. The leaves are large, quadrifoliate, and dark green; the leaflets are broadly ovate. One of its most important characteristics is its stoloniferous habit of growth. Well-developed stolons may reach a length of 1 m and root frequently at the nodes. A. pintoi (like the cultivated species of groundnut) has an indeterminate flowering habit. Flowering is continuous in the Llanos, interrupted only for short periods during moisture stress or excessive rainfall.

METHODS AND MATERIALS

The experiment was sited at Carimagua Research Station, 320 km east of Villavicencio, at N 4° 34', W 71° 20', and 160 masl. The Llanos south of the Meta River are predominantly isohyperthermic, well-drained savannas where the wet season mean temperature is > 23.5°C. The region is defined as a savanna ecosystem by total wet season potential evapotranspiration of 1060 mm and a wet season lasting 8 months. Annual rainfall averages 2337 mm, and is distributed from April through November. A very marked dry season occurs from mid-December to late March. The soil is an Oxisol (pH 4.3-4.5 in H_2O) of low base status, deficient in N, P, K, Ca, Mg, S, and some microelements. In addition, the cation exchange capacity of the soil is 86% Al-saturated.

A. pintoi (CIAT 17434) was established in one-grass/one-legume associations with four species of Brachiaria, i.e. B. humidicola (CIAT 679), B. dictyoneura (CIAT 6133), B. brizantha (CIAT 664), and B. ruziziensis (CIAT 6291). The grasses and the legume were square-planted in alternate rows 1 m apart. Each treatment was established in 1227.5 m^2 plots and arranged in two randomized blocks. All treatments were established by crown splits or stolons. Fertilizer was applied at planting at the rate of 20 kg P, 20 kg K, 12 kg of Mg, and 12 kg of S/ha. The same amount of fertilizer was applied in two split dressings in the second year under grazing. The two 0.5-ha blocks were grazed on a rotational system of 7 days' grazing and 21 days' deferment by five cross-bred heifers (Criollo x Zebu). Replications were subdivided by a permanent fence. To avoid preferencial grazing of grass treatments, individual treatment plots were controlled by an electric fence.

Yields (i.e. pasture dry matter present on each sampling date) and their botanical composition were estimated at 1-month intervals from four 1-m^2 random quadrats per treatment cut at 3-cm height. Pasture growth rate and seasonal distribution of DM yield were measured with the use of four moveable cages of 1.5 m^2 per treatment. Herbage was hand-separated into grass and legume components and oven-dried at 75°C. Nutrient content of herbage was determined for each grazing period.

Seed reserves in the soil contribute to plant replacement and pasture species persistence. A. pintoi exhibits multiple annual peaks of flowering. Consequently, seed production is extended over a long period. Soil seed reserves in B. humidicola-A. pintoi and B. dictyoneura-A. pintoi pastures were recorded to a 10-cm depth from 13-cm diameter soil cores. Seeds in the shell were wet-sieved and air-dried; all seeds were counted and weighed.

RESULTS

DRY MATTER YIELDS

Total sampling yields of the four grass-legume associations over 594 grazing days were not significantly different, and there were no significant differences between total legume yields in association with each one of the four Brachiaria spp. Monthly growth rates of all four Brachiaria spp. were characterized by a pronounced peak in April-June. B. dictyoneura showed the highest growth rate and total annual DM yield. It significantly outyielded B. ruziziensis, but not B. humidicola or B. brizantha (Table 1). The good associative ability of A. pintoi with the Brachiaria spp. was clearly indicated by the high legume content in the dry matter of the mixtures, from 20 to 44%.

B. humidicola significantly out-yielded the three other grasses in the experiment early in the wet season in both years under grazing. This grass exhibited a rapid recovery after

the spittlebug (Zulia spp.) attack which affected the four Brachiaria species in both years. A second peak of sampling yields was recorded in B. humidicola during the post-wet season.

Table 1. Dry matter yields of four mixtures of A. pintoi-Brachiaria spp harvested at 4-week intervals.

	Grass	Legume	Total	Legume content
		kg/ha/yr		%
B. dictyoneura-A. pintoi	20,138 a*	5,237 a	25,375 a	20.0
B. brizantha-A. pintoi	15,951 ab	5,228 a	21,564 a	24.3
B. humidicola-A. pintoi	15,744 ab	5,820 a	21,180 a	26.2
B. ruziziensis-A. pintoi	10,849 b	9,641 a	20,490 a	44.8

* Values followed by the same letter are not significantly different ($P < 0.05$) by Duncan's Multiple Range Test.

Legume growth rates exhibited a dry season low and wet season (July-October) peak. The legume content on a dry matter basis of the B. humidicola-A.pintoi mixture ranged from 8.3% in the dry season to the highest level of 44.5% in the second wet season. For the B. dictyoneura-A. pintoi association the range was from 9.5% to 36.4%. The rotational system of seven days' grazing and 21 days' deferment permitted increases of legume in all four associations. The legume content increased significantly (up to about 70%) in the B. ruziziensis-A. pintoi mixture in July and August when this grass was severely affected by spittlebug. The "gaps" left by B. ruziziensis were readily colonized by the legume. A short period of legume dominance (72%) was also recorded in the B. brizantha-A. pintoi association in August due to the same reason. Soil seed reserves of A. pintoi in grazed B. humidicola and B. dictyoneura swards averaged 670 and 618 kernels or 48g and 57g/m^2, respectively.

NUTRITIVE VALUES

The crude protein (CP) content of A. pintoi averaged 14.81% in the first year and 16.63% during the second grazing period of 229 days. The range of P content in the dry matter (0.18-0.20%) was adequate; K (1.28-1.42%) and Ca (1.92-2.00%) contents were above the requirements of beef cattle. Mean percentage of CP in the associated Brachiaria spp. ranged from 6.7-7.25%, which is approximately at maintenance level.

PERFORMANCE UNDER GRAZING

A. pintoi is highly tolerant of defoliation and will stand heavy grazing. It is well accepted by cattle, but not grazed exclusively in association with Brachiaria spp. The four pasture mixtures were grazed at an average stocking rate of 2.4 animal units/ha (one animal unit=420 kg) on a year-round basis. The cumulative weight gain was 642.7 kg/ha/yr. The average gain for the 594-day grazing period was 515 g/head/day.

PESTS AND DISEASES

A. pintoi is relatively free of major pests and diseases. Anthracnose caused by Colletotrichum truncatum (C. dematium) has been identified on stolons of A. pintoi (Lenné, personal communication). The pathogen caused black lesions on the stolons, but no long-term or serious damage has been observed from this or other diseases. Also, no build-up of pathogenic nematodes has been observed in this wild species of groundnut during the 5-year observation period in the Llanos.

DISCUSSION

The data presented in this paper indicate that A. pintoi is a new addition to the very limited range of tropical legumes adapted to Oxisols, one that is also compatible with the aggressive, mat-forming species of B. humidicola and B. dictyoneura. The prostrate, rooted stems of this legume have growing points well-protected from grazing and trampling damage. Even close defoliation of this legume does not completely remove the growing points.

LITERATURE CITED

Gregory, W.C., Gregory, M. Pfluge, Krapovickas, A., Smith, B.W. and Yarbrough, J. (1973). In Peanuts - Culture and Uses, American Peanut Research and Education Association, Inc., Stillwater, Oklahoma, pp. 47-133.

Gregory, W.C., Krapovickas, A. and Gregory, M. Pfluge (1980). Structure, variation, evolution and classification in Arachis. In: Advances in Legume Science, eds: Summerfield, R.J. and Bunting, A.H., Vol. 1. Proceedings of the International Legume Conference, Kew, pp. 667.

Miles, J. F. (1949). Plant introduction trials in Central Coastal Queensland 1936-46. CSIRO Divisional Report No.6.

Prine, G.M. (1983). Rhizoma peanut: perennial warm season forage legume. In: Proceedings of the XIV International Grassland Congress, Lexington, Kentucky. Westview Press.