AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

MEMORIA
DE LA
28ª REUNION ANUAL

Agosto 9-15, 1992
Santo Domingo, República Dominicana

Publicado por:

Sociedad Caribeña de Cultivos Alimenticios y
Fundación de Desarrollo Agropecuario

Santo Domingo, República Dominicana

PERENNIAL PEANUT: ESTABLISHMENT AND ADAPTATION ON AN OXISOL IN PUERTO RICO.

E. Valencia, A. Sotomayor-Rios, and S. Torres-Cardona
USDA-ARS, Tropical Agriculture Research Station,
Mayagüez, P.R.

ABSTRACT

Perennial peanut species *Arachis glabrata* (rhizomatous) and *A. pintoi* (stoloniferous) are attributed with high nutritional quality, palatability, persistence and competitiveness with grasses although little is known of their agronomic value outside of Florida and areas of South America. The main liability of *Arachis* is its slow rate of establishment, often more than one year. In Puerto Rico, studies were conducted on an Oxisol during a nine-month period to determine if rhizome crowns with attached plant foliage could successfully be established and to compare them with seedlings of stoloniferous accessions in their rate of plant spread and yield. In two separate studies, evaluations were made of nine selected entries and cv. Arbrook of *A. glabrata* and related species from Florida and six *A. pintoi* accessions from CIAT. Four of the rhizomatous entries established successfully. Three had relatively slow growth in the first 12-16 weeks, with an average of 35% plot cover and high incidence of weeds. UF 99, however, had 75% soil coverage at 16 weeks and allowed little weed development. The commercial cv. Arbrook failed to establish. Three stoloniferous accessions, CIAT 18744, 18747, and 18748, exhibited a high rate of plant spread at 16 weeks (over 90% soil coverage) with little weed growth. At nine months, UF 99 had fully established (100% plot cover), and entries UF 3, UF 77 and UF 64 had a range of 75-90% coverage, with an average canopy height of 30 cm. No major insect damage or disease was observed on the plant material during the experiment. The highest dry matter yield (DMY) was obtained from UF 99, which had an average yield of 5,568 kg/ha at nine months. DMY of the three other entries averaged only 2,360 kg/ha. For the CIAT accessions, DMY averaged 4,726 kg/ha. Based on these preliminary studies, UF 99 and CIAT 18744,

18747, 18748 exhibit potential for faster rate of establishment and adaptation.

INTRODUCTION

The genus *Arachis*, to which the commercial peanut (*A. hypogaea* L.) belongs, is composed of more than 50 species. Wild species of *Arachis* are found in South America from the mouth of the Amazon River near the equator to approximately 34° S in southern Uruguay (Stalker, 1985). They have a wide ecological range and can grow on heavy soils, poorly-drained soils, and acid, infertile soils. They are present in open grasslands, broken forest, or in flood plains, where they may be growing submerged in water. Some species inhabit semi-arid regions, while others grow in areas with more than 2,000 mm of rainfall annually; and they can be found from sea level to almost 1,600m (Valls *et al.*, 1985).

Rhizoma perennial peanut (RPP) (*A. glabrata* Benth.,) perennates by its rhizomes. RPP cvs. Florigraze and Arbrook were released for use as forage by the University of Florida (Prine *et al.*, 1981 and Prine *et al.*, 1986). *A. pintoi* (Krap. et Greg.) persists by growth and nodal rooting of its stolons and developing large soil seed reserves. Pinto peanut cv. Amarillo was released in Australia for use as forage and ground cover (Cook *et al.*, 1990).

In a previous trial in Puerto Rico, 77 wild perennial *Arachis* germplasm introductions from the University of Florida were evaluated on an Oxisol. These entries exhibited a wide range of variation in plant color (dark green to light green), growth habit (prostrate to erect) and plant spread. Single plants averaged 1.77 m lateral spread one year after planting (personal notes by senior author), indicative of a faster rate of establishment of some entries. Also, a wide range of variation in vigor and agronomic traits were observed. Selected entries appear to be superior to released cvs. Arbrook and Florigraze.

The main liability of RPP is its slow rate of establishment, often more than three years for full cover (Saldivar *et al.*, 1990); it must be vegetatively established by digging and transplanting rhizomes since stems do not readily root and lack seeds (Harris *et al.*, 1982).

Nevertheless, RPP has proven to be a potential forage legume by combining the attributes of high nutritional quality, palatability, good productivity, and persistence (Williams *et al.*, 1990), while *A. pintoi* demonstrate persistence and competitiveness with grasses (Grof, 1984). Michaud *et al.*, (1989) reported that *Arachis* spp. seem to have a broad-based adaptability across climatic, edaphic, and management conditions.

The agronomic performance of RPP and *A. pintoi* accessions under the environmental conditions of Puerto Rico is unknown.

The purpose of this study was to determine if rhizome crowns with attached plant foliage of nine RPP and cv. Arbrook could succesfully be established and to compare them with seedlings of six *A. pintoi* accessions in their rate of plant spread and yield.

MATERIALS AND METHODS

The studies were conducted at the USDA-ARS Isabela experiment farm of the Tropical Agriculture Research Station (TARS), at lat. 18° 30' N and long. 67° 0' W, and an elevation of 128 m. The soil at Isabela is an Oxisol (Tropeptic haplorthox) Coto clay. The soil in the top 15 cm has a pH of 4.8, 5 ppm available P (Bray 11), and 0.4, 3.6, and 0.9 meq/100 g exchangeable K, Ca, and Mg, respectively. Average total rainfall of 1,600 mm is distributed from April to December, with a marked dry season from January to March. The total rainfall during the nine-month establishment period was 939 mm; mean daily temperature was 24.5° C.

Plant material used for these experiments were RPP germplasm introductions from the University of Florida and seeds of *A.pintoi* accessions originating from CIAT, Cali, Colombia.The RPP experiment consisted of a randomized complete block design with four replications, while that for the *A. pintoi* accessions had the same design with three replications. Plots measured 2.0 x 3.5 m for each planting. Well established RPP's plant foliage from a previous experiment cut at ground level was planted in furrows on July 15, 1991. Spacing between rows was 0.5 m. Seeds of six *A. pintoi*

accessions were inoculated with rhizobium strain CIAT 3101 and set in jiffy pots on July 22.

Seedlings were transplanted in Isabela four weeks later, 21 plants per accession in each plot. Plants were initially irrigated to prevent moisture stress. Plots received no fertilization and were hand weeded several times to ensure establishment. Ground cover was monitored to evaluate rate of establishment. After nine months, a 1 m^2 quadrat frame in each plot was cut at ground level. Fresh weights were recorded, and representative subsamples were weighed, bagged, and oven-dried at 60° C for 48 hours. These were subsequently used for dry matter yield and percentage of crude protein determination. Data were analyzed using analysis of variance; differences between entries and accessions were subsequently determined using LSD.

RESULTS AND DISCUSSION

Establishment. Four of the nine RPP entries, UF 99 (P-2352), UF 3 (PI 276233), UF 64 (PI 468363), and UF 77 (PI 338267), established successfully. (The commercial cv. Arbrook failed to establish). Three of these had relatively slow growth, with an average percentage of ground cover at 12,. 16 and 36 weeks of 17%, 35%, and 75%, respectively, (Table 1). Severe weed invasion was observed within these plots. UF 99 was the only RPP to exhibit vigorous establishment, with a rate of 42% and 75% at 12 and 16 weeks, respectively, and a 100% plot cover at 36 weeks.

Limited weed competition was observed during the establishment period of this entry. In the tropics, a high establishment rate of forage species is essential to avoid weed competition, particularly during the rainy season. RPP entries had an average canopy height of 30 cm at 36 weeks of growth.

Table 1. Percentage of ground cover and average plant canopy height (cm) of four entries of *Arachis* spp. at three growing intervals (weeks) during the establishment period at Isabela, Puerto Rico.

Entry No.	12	16 (Weeks)	36	Canopy Height (cm)
UF* 99	42	75	100	32
3	20	38	82	36
64	18	40	75	28
77	12	28	67	23

* University of Florida.

Three of the *A. pintoi* accessions, CIAT 18744, 18747, and 18748, exhibited an average percentage of ground cover of 38%, 63%, and 90% at 8, 12, and 16 weeks, respectively, (Table 2). The faster rate of establishment of these accessions permitted an earlier evaluation at eight weeks. Three accessions exhibited stunted growth and were not evaluated.

Table 2. Percentage of ground cover of three *Arachis pintoi* accessions at three growing intervals (weeks) during the establishment period at Isabela, Puerto Rico.

Accession No.		8	12 (Weeks)	16
CIAT*	18748	39	68	94
	18744	34	60	88
	18747	42	60	87

* Centro Internaeional de Agricultura Tropieal, Cali, Colombia.

Dry Matter Yield and percentage of Crude Protein. In an evaluation nine months after planting, mean DMY of four entries of *Arachis* spp. was significantly different ($P < 0.05$), (Table 3). UF 99

produced an average of 5,569 kg/ha of dry forage, while the remaining three entries averaged 2360 kg/ha. Significant differences ($P<0.5$) in the percentage CP were also obtained.

Table 3. Mean dry matter yield and percentage of crude protein of four entries of *Arachis* spp. at Isabela, Puerto Rico, nine months after establishment

Entry No.	DMY (Kg/ha)	CP%
UF* 99	5569 a**	15.99 a
3	2845 b	13.73 b
64	2150 b	14.08 b
77	2086 b	12.84 c

* UF University of Florida
** Different letters indicate significant differences in means (LSD at P=0. 05) .

The mean DMY and percentage of CP of the three *A. pintoi* accessions were not significantly different. Their DMY averaged 4,726 kg/ha, with an average of 16% CP.

No major insect damage or disease was observed on both the rhizomatous and stoloniferous *Arachis*.

CONCLUSION AND RECOMMENDATIONS.

Entry UF 99 of the *Arachis* spp. and *A. pintoi* accessions CIAT 18744, 18747, 18748 are well adapted to the Oxisols of Puerto Rico and capable of producing high DMY with a good protein content. Establishment of the RPP UF 99 by rhizome crowns with attached plant foliage should be further evaluated for adaptation and yield in the humid regions of the Island. Yield and canopy data indicate its potential as hay crop on the Island or elsewhere in the Caribbean. RPP in association with dwarf elephant grass (*Pennisetum purpureum* Schum.) or a local forage sorghum cultivar Millo Blanco

(*Sorghum bicolor* L. Moench), should also be evaluated. RPP cv. Florigraze has successfully been established in association with dwarf elephant grass (Valentim *et al.*, 1988) and with runner-type grasses (Valentim *et al*; 1986) in Florida. The aggressive growth of *A. pintoi* accessions could be utilized in association with runner type grasses. Lascano and Thomas (1988) reported high performance of *A. pintoi* associated with *Brachiaria* spp.

ACKNOWLEDGMENTS

Sincere appreciation is expressed to Dr. K. H. Quesenberry (University of Florida) and Dr. P. Argel (CIAT) for their assistance and provision of germplasm material for this experiment.

REFERENCES.

Cook, B.G., R.J. Williams, and G.P.M. Williams. 1990. Registration of *Arachis pintoi* Krap. et Greg. (Pinto peanut) cv. Amarillo. Australian Journal of Experimental Agriculture. 30:445- 446.

Grof, B. 1984. *Arachis pintoi*, una leguminosa forrajera promisoria para los llanos orientales de Colombia. Pastos Tropicales, Boletin Informativo 7(1). Centro Internacional de Agricultura Tropical (CIAT). 12 pp.

Harris, H.C., J. Ferguson, and S.H. West. 1982. Rooting of perennial peanut cuttings. Soil Crop Sci. Soc. Fla. Proc. 41:29- 30.

Lascano, C.E. and D. Thomas. 1988. Forage quality and animal selection of *Arachis pintoi* in association with tropical grasses in the eastern plains of Colombia. Grass and Forage Science 43: 433-439.

Michaud, M.W., Y. Soso De Rosa, and A.E. Kretschmer, Jr. 1989. The assessment of grazing persistence and vigor of tropical forage legumes for the Caribbean. In: Proc. 16th Intl. Grassld. Cong., Nice, France. pp. 1499-1500.

Prine, G.M., L.S. Dunavin, J.E. Moore, and R.D. Roush. 1981. 'Florigraze' rhizoma peanut. A perennial forage legume. Fla. Agric. Exp. Stn. Circ. S-275.

Prine, G.M., L.S. Dunavin, R.J. Glennon and R.D. Roush. 1986. Arbrook rhizoma peanut. A perennial forage legume. Fla. Agric. Exp. Stn. Circ. S-332.

Saldivar, A.J., W.R. Ocumpaugh, R.R. Gildersleeve, and J.E. Moore. 1990. Growth analysis of 'Florigraze' rhizoma peanut: forage nutritive value. Agron. J. 82:473-477.

Stalker, H.T. 1985. Cytotaxonomy of *Arachis*. In: Proc. Intl. workshop on cytogenetics of *Arachis*, ICRISAT Center, India. pp. 65-78.

Valentim, J.F., O.C. Ruelke, and G.M. Prine. 1986. Yield and quality responses of tropical grasses, a legume and grass-legume associations as affected by fertilizer nitrogen. Soil and Crop Sci, Soc. Fla. Proc. 45:138-143.

Valentim, J.F., O.C. Ruelke, and G.M. Prine. 1988. Evaluation of forage yield, quality, and botanical composition of a dwarf elephant-grass-rhizoma peanut association as affected by nitrogen fertilization. Soil and Crop Sci. Soc. Fla. Proc. 47:237-242.

Valls, J.F.M., V. Ramanatha Rao, C.E. Simpson, and A. Krapovickas. 1985. Current status of collection and conservation of South American groundnut germplasm with emphasis on wild species of *Arachis*. In: Proc. Intl. workshop on cytogenetics of *Arachis*. ICRISAT Center, India. pp 15-32.

Williams, M.J., A.C. Hammond, and W.E. Kunkle. 1990. Rhizoma perennial peanut (*Arachis glabrata*) based animal production systems for the Caribbean Basin. In: XXVI Annual Meeting. Proc., Caribbean Food Crops. Mayagüez, Puerto Rico. pp. 611-624.