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KUDZU (*Pueraria phaseoloides*) PIONEER LEGUME WITH POTENTIAL TO INCREASE ANIMAL PRODUCTION IN THE CARIBBEAN BASIN

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ABSTRACT

This forage legume is native to Southeast Asia with adaptability to the major soil types of the Caribbean Basin and quite tolerant to diseases and insects. Its ability to fix nitrogen under natural conditions is excellent and increases organic matter content in the soil and crude protein in the forage. Even though its nutritive value is considered moderate due to limited voluntary intake during the rainy season, its contribution to increasing forage quality and animal production in the dry season is significative in conditions of pure swards or "protein banks". Increased animal productivity has been reported even in the case of natural pastures. This legume in association with improved tropical grasses also increases animal productivity in the dry season. Its persistence under grazing is excellent due to its capacity to grow aggressively during the rainy season. For these reasons it is considered a pioneer legume to show the benefits of forage legumes and for the implementation of a forage legume program by livestock producers.

INTRODUCTION

The use of forage legumes in the tropic for animal feeding is limited, yet it remains a feasible means of increasing animal productivity in the tropics, especially during the dry season.

The selection of adapted species to conditions of low soil fertility and prolonged dry periods, highly resistant to disease and insects, compatible with grasses in the region, high nutritive value, and relatively high palatability and persistence to grazing are characteristics difficult to find in native legumes. For this reason, very few species have been utilized by livestock producers in Latin America (Kretschmer, Jr., 1986).

Kudzu is a legume native to Southeast Asia that was introduced in Tropical America as a cover crop. Its use as a forage plant has helped to demonstrate the value of tropical leguminous plants in increasing significantly animal production in the humid tropics (Rivera-Brenes, 1947).

ADAPTATION

1. Climate.

This species is essentially for the humid tropics that require average temperature of 15°C for optimum growth and development and it is easily killed by frost (Skerman et al., 1988). Rainfall requirements are relatively high, in excess of 2,000 mm and can tolerate short dry periods, 2-3 months, with proper soil moisture retention.

2. Soil Requirement.

Kudzu has a wide range in soil adaptability, from sand to clays, independent of soil texture and pH, although it does not grow well in tight heavy clays. Loustalot and Telford (1948) found pH of 4-5 to be best, meanwhile in Puerto Rico, Landrau et al. (1953) and Smith and Vicente-Chandler (1951) quote good growth at pH 4.5-5.1 and 5.5, on a lateritic and clay soil respectively, with best growth at pH 5.5.

Caro-Costas and Vicente-Chandler (1963) found in Puerto Rico, increased growth with liming in a soil of pH 4.8, which explains the need to increase nutrition with calcium, decrease magnesium toxicity and the increase in nitrogen fixation. On the other hand, Spain et al. (1975) found negative effects in application of 1-2 tons/ha of lime in oxisols of pH 4.3 in Colombia, however, the application of 150 kg/ha had a positive effect in the mineral nutrition of plants in relation to increasing phosphorus and calcium content and decreasing magnesium toxicity.

Kudzu is one of the best tropical forage legumes for tolerance to water logging and nodulates freely on wet soils. It can stand short periods of flooding, but is not tolerant to salinity.

3. Diseases and Insects.

This plant is characterized by being resistant to diseases and insects. Even though Pueraria is among the genus of tropical forage legumes where 30 pathogens were detected and identified in Tropical America, none of the diseases or insects is considered of economic importance in this genus (Lenne et al., 1987).

MINERAL NUTRITION

The main nutrient limitations in the soils for the growth of tropical legumes are P, K, Ca, S, and Mo, also other deficiencies of Mg and minor elements like Cu, Zn and B can occur (Kerridge, 1978). Even though kudzu is adapted to soils of low fertility, in Puerto Rico they found significative response

to applications of P, K, Ca, and Mg in acid soils, increasing yield and percentage of the legume in association with Melinis minutiflora, as well as chemical composition of the forage (Caro-Costas and Vicente-Chandler, 1963). Also response to P and S in terms of dry matter yield, nodulation, nitrogen fixation and chemical composition were reported by Ortega and Samudio (1973), Tergas (1979), and CIAT (1985). In the case of the association of kudzu with tropical grasses it is reported higher compatibility when K is applied during maintenance (CIAT, 1983). Fertilization with minor elements has not shown significant response in terms of production and quality of the forage (Samuels and Landrau, 1953).

NITROGEN FIXATION

Kudzu is considered an excellent legume for use as a cover crop because it increases soil fertility by providing great amount of organic matter and nitrogen (Hernández and Berríos, 1968). One of the advantages of this legume is its ability to nodulate effectively (Tang, 1986). Halliday (1979) reported that in Colombia, kudzu produced 61% more organic matter when it was inoculated with a Rhizobium strain after three months, but at five months the difference with plants not inoculated was not significant.

Very few research work has been done in the Caribbean Basin to determine the capability of kudzu to fix nitrogen. In other tropical areas it is estimated its nitrogen contribution to the soil at 99 kg/ha/an (Nutman, 1976) but can reach levels of more than 140 kg/ha/ and in association with grasses (Skerman et al., 1988). However, we know that tropical forage legumes have the ability to duplicate the amount of fixed nitrogen when grown in pure swords and not associated with grasses (Whitney et al., 1967).

RESULTS AND DISCUSSION

1. Dry matter yield at cutting

Due to its growth characteristics this plant does not tolerate frequent cuttings of less than 6 weeks. Dry matter yield increases with an increase of rainfall, which is the case of a shorter dry season in the Caribbean Basin, and longer cutting frequency of 9-12 weeks (Table 1).

2. Nutritive Value

Even though kudzu is highly palatable, especially during the dry season, and its protein content good compared to other tropical forage legumes (20.7%); its nutritive value is considered average due to a low voluntary intake during the rainy season (CIAT, 1983). Nevertheless, it contributes significantly to increase the consumption of poor quality

forage, for instance, native pastures or improved grasses during the dry season (CIAT, 1983).

Table 1. Dry matter yield of kudzu in different ecosystems in the Caribbean Basin.

Ecosystem	Country	Cutting frequency (weeks) 6	9	12
			kg/ha	
1.Savannas	Cuba	1,930	2,549	4,369
1,500-2,000 mm	Mexico	1,051	2,211	2,440
2.Rain forest	Mexico	3,220	3,500	4,828
2,000-2,500 mm	Rep. Dom.	1,602	2,561	2,972
	Trinidad	1,008	1,570	3,045
3. Rain forest	Mexico	3,710	5,144	10,303
2,500-4,000 mm	Nicaragua	1,159	2,224	3,306
	Venezuela	1,148	1,849	3,953
	Average	1,853	2,701	4,402

Source: RIEPT, 1982; RIEPT, 1985.

3. Animal Productivity

Due to the high nutritive value of this legume during short dry seasons, it has been recommended that kudzu be used complementary to grazing of natural pastures. In conditions of savannas that are burned and pure swards or "protein bank", it has been possible to increase animal weight gain during the dry season and animal weight gain per animal at low stocking rates (Table 2). In Belize gains of 142 kg/ha/an on the acid soils of low fertility, with stocking rates four times greater than normal conditions under continuous grazing was reported (Valencia, 1989).

Other reports from the Caribbean Basin indicate good results in weight gains on grazing of tropical grasses in association with kudzu in soils of low and medium fertility which are representative of Tropical America (Table 3).

MANAGEMENT AND PERSISTENCE UNDER GRAZING

Kudzu is considered an aggressive and persistent plant under adequate rainfall distribution and soil fertility when in association with the principal tropical grasses, based also that the plant has a reduced palatability during the rainy season. Under continuous grazing and in association with grasses Kudzu

has persisted for more than 8 years (CIAT, 1986). However in some cases when the grass in association is highly palatable, a rotation grazing with two paddocks is recommended.

Table 2.- Summary of average animal weight gains on savannas and "protein banks" of kudzu.

Stockingrate	Seasonal production dry	wet	Animal production animal	area
an/ha	---- g/an/day ----		kg/an	kg/ha
0.25	183	383	118	30
0.375	460	280	124	46
0.50	78	365	101	51
0.75	293	285	105	76

Source: Tergas, 1987.

Table 3.- Average weight gains from the association of Kudzu with different grasses in the Caribbean Basin.

Grasses	Stocking rate	Average daily gain	Animal gain animal	area	Source
	an/ha	g/an/day	kg/an	kg/ha	
A. gayanus	1.7	498	182	31	(25)
A. gayanus	2.0	503	181	363	(14)
	4.0	381	137	549	(14)
B. decumbens	1.6	508	183	294	(24)
H. rufa	2.0	502	I8I	362	(14)
	4.0	350	126	504	(14)
M. minutiflora	2.5	550	198	490	(1)
P. maximum	3.0	496	181	542	(4)
P. purpureum	4.0	496	139	556	(4)

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