Research Note

LACK OF RESPONSE OF PIGEON PEA (CAJANUS CAJAN L. HUTH) TO N AND K FERTILIZER ON A MOLLISOL OF PUERTO RICO'S SOUTHERN COASTAL PLAINS[1]

Pigeon peas (*Cajanus cajan* L. Huth) is a legume of major economic importance in the world. It ranks fifth after beans, sweet peas, chick peas and broadbean. India is the major world producer, accounting for 92% of the world's production.[2,3] Pigeon pea is a valuable source of high quality protein in tropical countries. It has 20% protein,[4] and its principal components are globulins cajanin and concajanin, but it is deficient in sulfur-containing aminoacids.[5]

In 1986-87, 4,318 ha of pigeon pea was planted in Puerto Rico, yielding 2,494 t/ha[6] with a total cash value of $3.6 million. The per capita consumption in 1986-87 was 1.05 kg. During this period Puerto Rico imported 950.23 ton of the fresh product.[7] The value of the 1986-87 crop was $3.6 million.

A common practice among pigeon pea farmers is to plant the crop on marginal land. Generally no fertilizer is applied to the crop. However, previous research has shown substantial nutrient uptake by pigeon pea.[8,9] Irizarry and Rivera, working on an Ultisol of the humid hills of Puerto Rico, determined uptakes of 216, 12, 160, 54 and 19 kg/ha of N, P, K, Ca and Mg, respectively. Dalal[10] obtained yield response to nitrogen fertilization of pigeon peas when nitrogen in the soil was low. Other resear-

[1]Manuscript submitted to Editorial Board 23 February 1990.

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[7]Anonymous, 1989. Consumo de Alimentos en Puerto Rico (Cosechas) 1979-80 - 1986-87. Publicación Especial, Departamento de Agricultura, Oficina de Estadísticas Agrícolas, Santurce.

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chers[8,11,12,13,14] have found no response to fertilizer applications. However, Irizarry and Rivera recommend a split application of 2 t/ha of fertilizer (15-2-10-2) for two cycles of high yielding pigeon peas per year.[2]

The present study was conducted to determine the response of pigeon peas in N and K fertilization in the high pH soils of the southern coastal plains of Puerto Rico.

Pigeon pea cv. Kaki, an indeterminate type, was planted at Santa Isabel on the southern coast of Puerto Rico in a San Antón soil (fine, loamy, mixed, isohyperthermic, Cumulic Haplustolls). Soil samples taken to a depth of 22 cm showed a pH of 7.79, 32 p/m P (Olsen method), 416 p/m K, 3830 p/m Ca and 1526 p/m Mg. A N-K fertilizer was applied. Planting distance was 0.91 m between rows and 18.4 cm between plants within the row. Each experimental unit included 5 rows 4.57 m long. The total area per experimental unit included 5 rows 4.57 m long. The total area per experimental unit was 20.9 m. The seeding rate was 7.3 kg/ha.

The experiment comprised nine treatments arranged in a 3 x 3 balanced lattice design with four replications (table 1). The fertilizer sources were ammonium sulphate (20.5% N), triple superphosphate (46% P_2O_5) and potassium chloride (60% K_2 0).

Weed control was achieved by incorporating prometryn[16] (Caparol 80) at 3.2 kg a.i./ha before planting. Nematodes and soil insects were controlled by a preplant incorporation of broadcast carbofuram (Furadan 10G) at 1.1 kg a.i./ha. Tissue samples were taken from each experimental unit to determine N-P-K content of the third uppermost branch, and a middle branch of the plant.

TABLE 1.—*Green pod yield of pigeon peas grown in San Antón soil at Santa Isabel*

	Fertilizer treatment			Green pod yield
	N	P	K	(kg/ha)
1.	0	0	0	5,952ab[1]
2.	0	29	134	6,109ab
3.	67	29	134	5,767bc
4.	134	39	134	6,181ab
5.	201	29	134	5,885ab
6.	268	29	134	6,355ab
7.	335	29	134	5,061c
8.	268	29	67	6,287ab
9.	268	29	201	6,667a

[1]Mean values in column followed by the same letters do not differ significantly (P 0.05).

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[14]Lugo-López, M. A. and R. Abrams, 1981. High yield of non-fertilizer protein-rich pigeon peas on tropical soils of low inherent fertility in Puerto Rico: An explanation of a paradox. *J. Agric. Univ. P.R.* 65 (1): 21-28.

[16]Trade names in this publication are used only to provide specific information. Mention of a trade name does not constitute a warranty of equipment of materials by the Agricultural Experiment Station of the University of Puerto Rico, nor is this mention a statement of preference over other equipment or materials.

The pigeon peas were harvested twice and the yield data recorded. Pods and peas were analyzed for N-P-K-Ca-Mg at each harvest.

Results indicated no response of pigeon peas to the various N and K levels applied (table 1); in fact, 89.2% of the maximum yield was obtained with the no-fertilizer treatment (5,952 kg/ha of fresh pods). The maximum yield (6,667 kg/ha) was recorded with the application of 268 kg/ha N, 29 kg/ha P and 201 kg/ha K. The difference in yield was not statistically significant; however, results showed a significant yield decrease with the highest N rate (335 kg/ha) applied. A mean yield of 8,104 kg/ha of fresh pods was reported by Irizarry and Rivera in an Ultisol at the AES Corozal. On the basis of their studies, they concluded that to obtain optimum yields in this soil, applications of 296 kg/ha N, 32 kg/ha P and 175 kg/ha K should be made. The highest yield in the present study was obtained with nutrient amounts close to their recommendations (table 1, treatment 9).

No significant differences among treatments were found in the nutrient contents of the hulls or of the peas. The mean values for the hulls were 1.24% N, 0.22% P, 2.10% K, 0.28% Ca and 0.25% Mg; for the peas, 3.13% N, 0.44% P, 2.00% K, 0.12% Ca and 0.19% Mg.

In general, the N and P content of the hulls was lower than that of the peas, whereas the Ca and Mg were higher. The K content of the pods with and without seeds was similar. Similarly, no significant differences in the nutrient content of the third uppermost branch and the middle branch were found among treatments. The nutrient content in the upper branch averaged 3.47% N, 0.35% P and 1.57% K; for the middle branch, 3.18% N, 0.31% P and 1.60% K. Although no large difference between N and P content of the upper and middle branches was observed, the N and P content of the upper branches was consistently higher (fig. 1 and 2).

The results show that pigeon peas did not respond to fertilization in the fertile San Antón soil of Santa Isabel. Soils of the lowlands of the south (San Antón, Santa Isabel and Aguirre) are among the most fertile

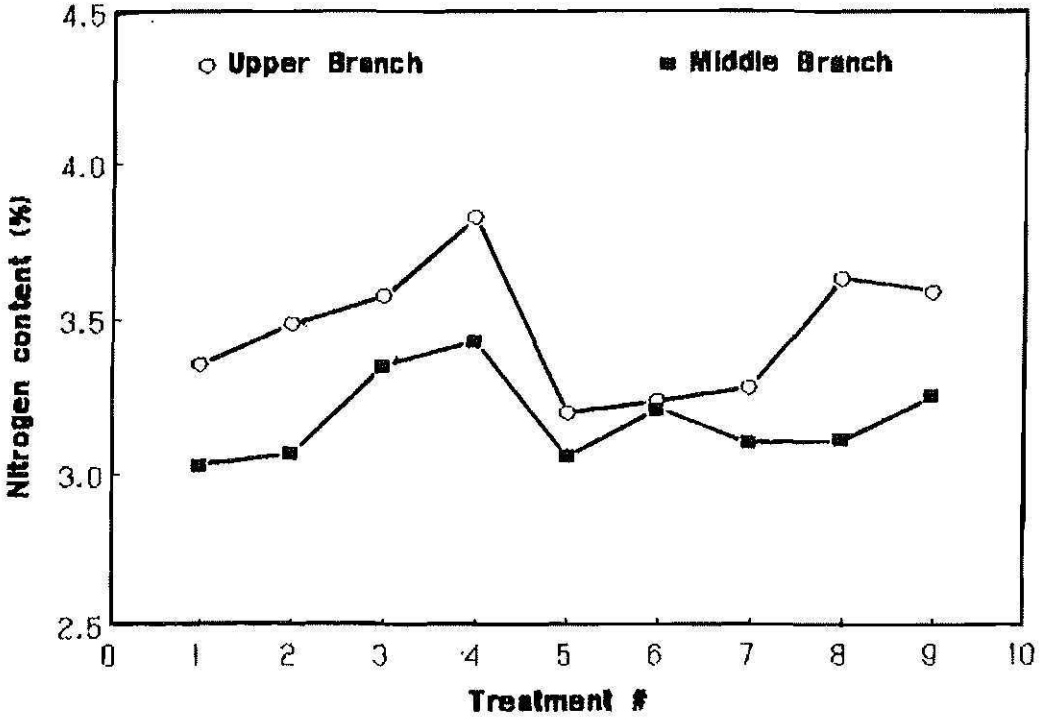

Fig. 1.—Nitrogen content of the upper and middle branches of pigeon peas.

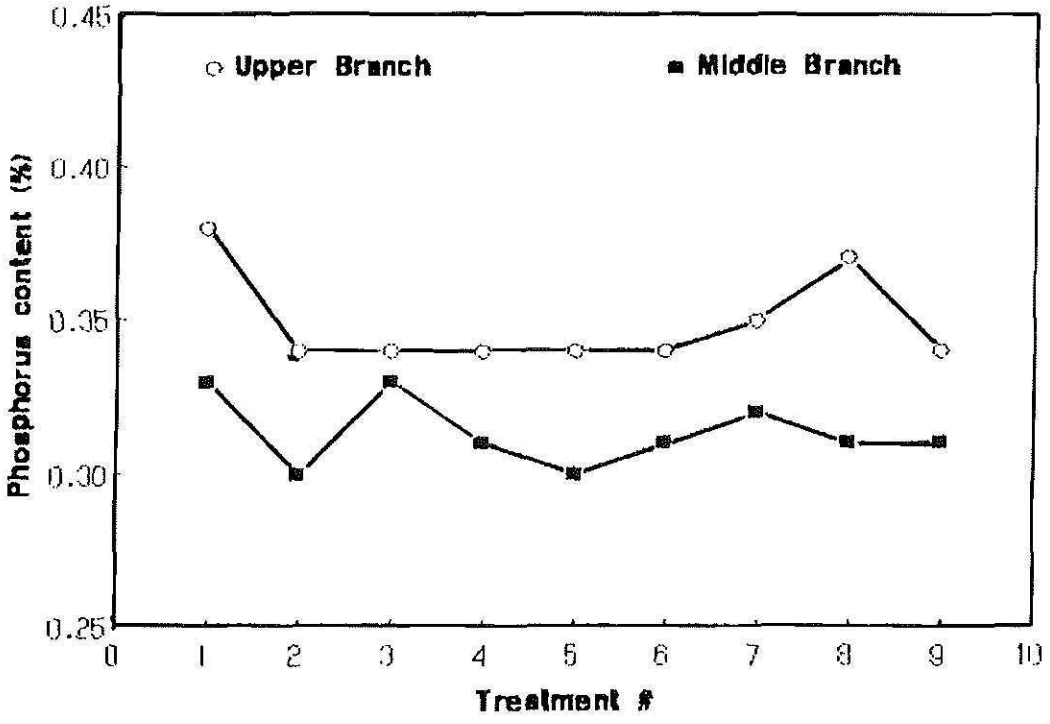

Fig. 2.—Phosphorus content of the upper and middle branches of pigeon peas.

soils in Puerto Rico[16] and are rich in available K.[17,18] While studying the K-supplying power of six Mollisols in Puerto Rico, Abruña found that the Ustic Mollisols as a group released an average of 176 kg/ha of K during the fourth year of his study and estimated the long term K-supplying power of this soil group to be about 140 kg/ha.

The results suggest that an experiment with continuous cropping of pigeon peas on the same land would be desirable to determine the soil fertility level and plant nutrient content at which pigeon pea responds to fertilizer application. The soil nutrient content of 32 p/m P, 416 p/m K, 3,830 p/m Ca and about 1,526 p/m Mg appears to be adequate to sustain the crop for various cycles without the application of fertilizer in spite of the large requirements of K by the plant.

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[17]Abruña, F., 1983. Potassium supplying capacity of six upland Mollisols from Puerto Rico. *J. Agric. Univ. P.R.* 67 (4): 394-406.

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