The Effects of Fertilizer Applications on Yields of Pigeonpeas

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INTRODUCTION

Pigeonpeas (gandules), *Cajanus cajan*, have been one of the leading protein foods of the Puerto Ricans for many centuries. It is not known when they were introduced into Puerto Rico; probably they came from Africa on some of the slave-trading ships.

Pigeonpeas grow on tall slender perennial bushy shrubs that range in height from 4 to 10 feet, depending on the variety, soil, and climate. Nearly every rural home, as well as many residences, has a small cluster of bushes in the dooryard or near the dwelling. They are planted also in rows in commercial plantings.

The plant is a legume and is sown by many farmers to enrich the soil, as the nodule-producing bacteria grow abundantly on the well-developed root systems. This plant, like most leguminous plants, prefers a neutral or alkaline well-drained deep soil for highest yields. Fortunately it produces fairly well on shallow neutral or slightly acid soils. Pigeonpeas can endure long droughts, and will grow under a great variety of climatic conditions as well as in many kinds of soil.

Although it does not rank in economic importance with such leading agricultural crops as sugarcane, pineapples, or tobacco, the pigeonpea has a farm value of over a million dollars per year. In 1956–57, 103,550 hundredweights of pigeonpeas were produced in Puerto Rico with a farm price of $13.79 per hundredweight, and a total farm value of $1,428,000. Acreage of this edible legume has increased in response to demand as a fresh product and also for canning.

No special agronomic attention has been given to the raising of pigeonpeas in Puerto Rico, aside from varietal and time-of-planting trials. Very few planters fertilize this crop, and the only cultivation necessary is to kill the weeds and keep the roots covered. However, nothing is known about the effects of commercial fertilizers on yields of pigeonpeas. To find out, the Agronomy and Horticulture Department of this Agricultural Experiment Station, undertook investigations to determine the value of fertilizers for pigeonpeas.

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PROCEDURES

The experiments used to test the response of pigeonpeas to fertilizer were conducted in two of the leading areas where this crop is grown—one at Peñuelas, the other at Isabela.

The Peñuelas experiment was planted on August 12, 1952, and harvested February 12–26, 1953. The soil used was a Yauco clay, a dark grayish-brown clay that is cohesive, calcareous, granular, and friable, but sticky and plastic when wet. It has developed on the gentle slopes of the soft limestone hills in the arid districts between Aguirre and Boquerón. The Khaki variety of pigeonpeas was planted in holes 4 feet apart, one plant per hole and nine plants per plot, giving a plot of size 12 by 12 feet, or about one three-hundredth of an acre. The experimental design was a randomized-block one, of eight treatments replicated eight times.

The Isabela experiment was planted at the Isabela Substation on a Coto clay, a yellowish-brown friable slightly acid (pH 6.5) clay which occurs on slightly rolling or undulating areas in the northwestern part of the Island. The experiment was planted on June 18, 1952, and harvested December 1–18, 1952, and a second crop was harvested between December 14, 1953 and January 7, 1954. The Vaininegro variety of pigeonpeas was used. The plants were placed 8 by 8 feet apart, six plants per plot, giving a plot size 16 by 24 feet or about one one-hundred-thirteenth of an acre. A symmetrical incomplete-block design was used, having 13 fertilizer treatments and 8 replications. For both experiments the source of nitrogen was ammonium sulfate (20-percent N); of phosphorus, superphosphate (20-percent P_2O_5), and of potassium, potassium chloride (60-percent K_2O).

RESULTS

The results of the Peñuelas experiment are given in table 1. It can be seen that there was no response to any of the fertilizer treatments. In fact the no-fertilizer treatment gave yields not significantly different from treatments with any of the fertilizer combinations used, including rates up to 150 pounds per acre of N-P_2O_5-K_2O.

The Isabela experiment results are given in table 2. Once again there was no significant response to nitrogen, phosphate, or potash fertilizers. The no-fertilizer treatment, as in the Peñuelas experiment, produced yields as high as, or in some cases higher than those made under fertilizer applications. Filter-press cake, an organic byproduct of the sugarcane grinding mills, also failed to increase yields. From these results it appears that pigeonpeas are quite capable of obtaining sufficient nutrients from the soils tested to maintain high yields, and the supplemental fertilizer additions of nitrogen, phosphates, or potash are not needed at present. Inas-

TABLE 1.—*Yields of pigeonpeas from fertilizer experiment at Peñuelas*

Treatment No.	Treatment per acre			Yield per acre of pigeonpeas with pods, green weight
	N	P_2O_5	K_2O	
	Lb.	*Lb.*	*Lb.*	*Cwt.*
1	0	0	0	21.0
2	0	150	150	20.3
3	75	150	150	21.4
4	150	0	150	22.0
5	150	75	150	19.2
6	150	150	0	19.8
7	150	150	75	17.7
8	150	150	150	16.7
Least significant difference needed between treatments:				
5-percent level				4.82
1-percent level				6.43

TABLE 2.—*Yields of pigeonpeas from fertilizer experiment at Isabela Substation*

Treatment No.	Treatment per acre			Yield per acre of pigeonpeas with pods, green weight	
	N	P_2O_5	K_2O	First crop, 1953	Second crop, 1954
	Lb.	*Lb.*	*Lb.*	*Cwt.*	*Cwt.*
1	0	0	0	13.0	15.5
2	0	225	225	11.5	16.4
3	75	225	225	13.5	14.5
4	150	225	225	13.5	16.9
5	225	0	225	13.3	14.6
6	225	75	225	15.0	11.0
7	225	150	225	14.3	12.7
8	225	225	0	12.6	15.3
9	225	225	75	14.8	11.4
10	225	225	150	14.0	12.0
11	225	225	225	13.9	11.6
12[1]				13.5	18.4
13[2]				10.9	17.2
Least significant difference needed between treatments:					
5-percent level				3.63	3.45
1-percent level				4.82	4.59

[1] 20 tons of filter-press cake per acre.
[2] Treatment No. 12 plus ½ treatment No. 11.

much as the pigeonpea is a legume, it can produce enough nitrogen to satisfy its needs in a Yauco clay and a Coto clay; the latter is known to require high rates of nitrogen for good sugarcane yields (*1*).[2] Either its demands for phosphates are low or it can make effective use of such phosphates as are found in these soils. Coto clay is noted as a phosphate-deficient soil for sugarcane and vegetables (*1*, *2*), and yet good yields of pigeonpeas were obtained without additional phosphates on this soil at Isabela.

Farmers generally recognize the fact that pigeonpeas can grow well where other crops require fertilizer applications. Although work is still lacking on its fertilizer requirements on very acid soils it can be said that pigeonpeas growing in the slightly acid to alkaline soils of Puerto Rico showed no response to fertilizer applications in our experiments. Fertilizer applications to pigeonpeas on these soils seem unwarranted.

SUMMARY

Experiments with pigeonpeas grown in slightly acid to alkaline soils at Peñuelas and Isabela, P. R., indicated that applications of fertilizers (N-P_2O_5-K_2O) had no effect on yields.

RESUMEN

Experimentos sobre el abonamiento del gandur llevados a cabo en Peñuelas y en Isabela demostraron que las aplicaciones de abonos completos (N-P_2O_5-K_2O) no influyeron sobre los rendimientos de esta cosecha.

LITERATURE CITED

1. Landrau, P., Jr., and Samuels, G., Response of four sugarcane varieties to fertilizers during the first Isabela cycle, 1946–51, *J. Agr. Univ.* P.R., **38** (2) 73–95, 1954.
2. ——, Influence of fertilizers on the yields of the Plamar variety of tomatoes on a Coto clay, *J. Agr. Univ. P.R.* **39** (2) 77–83, 1955.

[2] Italic numbers in parentheses refer to Literature Cited, p. 72.