Research Note

EXPLORATORY TESTS ON POSSIBLE INJURIOUS AFTEREFFECTS OF PIGEON PEAS ON SUBSEQUENT CROPS[1]

Pigeon peas are reputed among farmers in Puerto Rico to be "hard" on the land, the effect being particularly noticeable on yields of some other crops when sown immediately after the pigeon pea harvest. This is not unique of pigeon peas; other crops have been shown to have such deleterious effects on subsequent crops.[2,3] In some cases these after-effects have been attributed to growth inhibitors such as abscisic acid, to depletion of soil moisture, or to depletion of available nitrates as a result of the high sugar content of crop residues and roots. These sugars furnish energy for the multiplication of microorganisms which compete for some time with subsequent crops for available soil N. The role of nematodes or other pathogens cannot be overlooked. No information could be obtained in the literature from Puerto Rico to back up this ill repute of pigeon peas. Narayanan and Sheldrake,[4] under conditions in India, report that pigeon peas grown on the same soil in which the same crop had been grown the previous year, grew very poorly and the yields were reduced about 80%. They attribute the situation to possible allelopathic effects produced by chemicals released into the soil by the preceding pigeon pea crop or released by the decaying residues of this crop.

A series of exploratory laboratory and greenhouse tests was conducted at Isabela, in northwestern Puerto Rico, where pigeon peas are grown extensively.

The following tabulation summarizes the effect of applying dried pigeon pea leaves (cv. 2B-Bushy) on soil planted to beans:

Treatment	*Mean seedling emergence, %*
Soil + 2.7% of dry leaves	46
Soil + 5.5% of dry leaves	40
Soil + 11.0% of dry leaves	7

Increasing the application of oven-dried pigeon pea leaves from 5.5 to 11.0% depressed germination and emergence more than sixfold. Canopy

[1] Manuscript submitted to Editorial Board October 20, 1981.

[2] Leopold, C. A. and Kriedemann, P. E., 1975. Plant Growth and Development, McGraw-Hill, Inc. pp. 183–94.

[3] Leonard, W. H. and Martin, J. H., 1963. Grain Sorghum, in Cereal Crops, Macmillan Publishing Co., Inc., N.Y. pp. 694–5.

[4] Narayanan, A. and Sheldrake, A. R., Pulse Physiology, I. Pigeon pea Physiology, ICRISAT Annual Report 1975–76.

height and fresh weight of 25-day-old bean plants were also adversely affected.

A second test was conducted including five treatments: 0.69, 1.39, 2.78, 5.55, and 8.32% of dried pigeon pea leaves. Germination, seedling emergence, plant height and fresh weight of tops and roots were reduced substantially with increasing levels of dried leaves. The injurious aftereffects were dramatic with only a 6% germination in the 8.32% treatment.

Further tests were conducted with extracts of the leaves. The extracts were prepared by soaking the macerated leaves in water for 24 hours. Data are shown in table 1. The germination of 10 seeds of beans, soybeans, cowpeas, corn and tomatoes was dramatically affected when the concentration of the pigeon pea leaf extract was increased to 4%. The germination of pigeon peas remained unaffected at all concentrations. In a second test of the same nature, pigeon pea leaf extracts of concentrations ranging

TABLE 1.—*Germination of seeds of various crops as affected by different concentrations of pigeon pea leaf extracts*[1]

	Percentage germination at indicated extract level					
	0	0.25	0.50	1.00	2.00	4.00
Pigeon pea	100	100	100	100	100	100
Beans	100	100	100	100	100	0
Corn	100	100	100	100	100	0
Soybeans	100	100	100	100	90	0
Cowpeas	100	100	100	100	90	0
Tomato	80	80	80	80	80	0

[1] Ratio leaf:water on a percentage by weight basis.

from 0 to 5.3% were used. In this case, beans were severely affected at levels as low as 0.8%; corn and tomatoes, at 3.2%; cowpeas, at 1.6%.

The deleterious aftereffects of pigeon pea leaves and leaf extracts upon succeeding crops in a rotation are evident from the data herein reported. The cause of such aftereffects remains to be determined. One possibility that merits further study is the inhibition attributable to hormones. The presence of toxic phenols in the green leaves of some plant species is well known.[2] If these phenols persist upon drying, they could be released upon incorporation of leaves to the soil as in the work herein reported. Other major factors affecting germination, such as pH and oxygen level of the growth medium, may be affected. These possibilities were not explored in these tests. The depletion of soil moisture is discarded, since the growth medium used was either a solution or soil maintained at field capacity. It is not logical to attribute the after effects to N depletion, since the pigeon pea is a legume that fixed sizable amounts of atmospheric

N for its own consumption, and probably there is enough left over for use of subsequent crops.[5]

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[5] Lugo-López, M. A. and Abrams, R., 1981. High yields of nonfertilized 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.