CP045

S421

RESIDUAL EFFECTS OF PIGEONPEA (*CAJANUS CAJAN*)

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Summary

An experiment conducted on a Vertisol field at ICRISAT compared the residual effect of monocropped pigeonpea, intercropped pigeonpea sorghum (1 row:2 rows) with 0 and 80 kg N/ha, monocropped sorghum with 0 and 80 kg N/ha, and fallow treatments on a subsequent maize crop. Monocropped pigeonpea had a large residual effect on maize, increasing the grain yield by 57% and total plant dry matter by 32% over fallow. Intercropped pigeonpea had little residual effect on maize. Benefits from a previous crop of monocropped pigeonpea were equivalent to about 40 kg N/ha applied to the maize crop grown in land kept fallow during the previous rainy season.

INTRODUCTION

While the role of legumes in maintaining agricultural productivity in temperate regions is well documented, there are few papers showing benefits from grain legumes in the tropics. In Nigeria a previous groundnut crop increased the yield of a subsequent maize crop (Jones, 1974). Giri & De (1979) reported that yields of pearl millet were significantly increased when grown after legume crops such as groundnut (22.6%), cowpea (24.2%), or pigeonpea (12.1%), instead of after pearl millet.

Pigeonpea (*Cajanus cajan*) is an important grain legume of the semiarid tropics. In India it is grown mostly as an intercrop with sorghum, millet or maize, but it is also planted in monoculture. There is little information on the residual effect of pigeonpea grown as either a sole or intercrop on the availability of soil N for subsequent cereal crops. Because of this we conducted an experiment to test the growth and yield of maize when grown after pigeonpea in monocrop or intercropped with sorghum.

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Papers presented at a Workshop, 9-13 Mar 1981, Cali, Colombia (Graham, P.H., and Harris, S.C., eds.)

MATERIALS AND METHODS

Six treatments were compared for residual effect:

Pigeonpea, monoculture.
Sorghum, monoculture, with 0 N applied.
Sorghum, monoculture, with 80 kg/ha N applied.
Sorghum/pigeonpea intercropped with 0 N.
Sorghum/pigeonpea intercropped with 80 N.
Fallow.

They were planted in 1979 in randomized plots 50 m x 6 m, replicated four times in a split plot design. The soil used was a Vertisol with 0.03% total N (0-30 cm depth), 40 ppm available N, and 4 ppm available P. Single superphosphate was broadcast before planting to supply 17 kg P/ha.

Sorghum cv. CSH-6 (3.5 months duration) and pigeonpea cv. ICP-1 (maturity about 6 months) were sown alone, or in a constant arrangement of two rows of sorghum to one row of pigeonpea, in rows 45 cm apart on broad beds of width 1.5 m. The pigeonpea seed was inoculated with peat inoculant containing a mixture of four effective *Rhizobium* strains. The crops were grown under rainfed conditions. At harvest, observations on grain yield and biological yield were taken, and all aboveground plant parts were removed, except for fallen plant parts of pigeonpea.

In 1980, the former main treatments were divided into subplots, each 9x5 m, and received 0, 20, 40, 60, or 80 kg N/ha, applied as urea. The 60 and 80 kg N/ha treatments were split, with 40 kg N/ha applied before planting and the remainder after two months. The whole area was then planted to 'Deccan hybrid 101' maize, at a spacing of 75 cm between rows and 20 cm between plants. At maturity, observations on grain yield and biological yield were made on plots 7x3 m.

RESULTS AND DISCUSSION

Seed and total top yields of pigeonpea and sorghum grown as sole or intercrops in the 1970 planting are given in Table 1. The yields were normal for the cultivars in this environment. Total land equivalent ratios (LER's) for the intercrops showed a yield advantage of 47% and 37% in grain and plant top dry matter yields, respectively, over monoculture pigeonpea and sorghum (see Table 1). However, at 80 kg N, the yield advantage of intercropping was less than at 0 kg N/ha, suggesting more effective utilization of available resources by intercropping under limitations of land, water and nutrients.

Grain yield of maize grown without N in the 1980 planting was significantly affected by the crop planted in 1979; the most beneficial effect being that from pigeonpea in monoculture (see Table 2). Maize after sole cropped pigeonpea significantly outyielded maize following fallow, sole cropped sorghum, and sorghum/pigeonpea intercrop, with or without N, in 1979. This superiority

TABLE 1: Seed and total top dry matter yield (kg/ha) of crops grown in the first year (rainy season, 1979).

Treatment		Seed yield		Total dry matter	
		Sole	LER[1]	Sole	LER
Pigeonpea		1630	1.0	6040	1.0
Sorghum at 0 kg N		3950	1.0	9870	1.0
Sorghum at 80 kg N		5000	1.0	12610	1.0
Sorghum/pigeonpea at 0 kg N	S	3800	0.96	9035	0.92
	P	840	0.51	2690	0.45
	S + P		1.47		1.37
Sorghum/pigeonpea at 80 kg N/ha	S	4730	0.95	11550	0.92
	P	680	0.42	2460	0.41
	S + P		137		1.33
Fallow		0	–	0	–

[1] LER – Land equivalent ratio: the relative land area required for sole crop(s) to produce the yield(s) achieved in intercropping. An LER of 0.5 for a given crop indicates that it has produced in intercropping the equivalent of 50 % of its sole crop yield.

TABLE 2: Effect of previous cropping and fertilizer treatments on grain yields of maize (kg/ha) (rainy season, 1980).

Previous crop	N fertilization in the 1980 planting (kg/ha)					Mean
	0	20	40	60	80	
Pigeonpea	1364	2095	2595	3153	4385	2720
Sorghum at 0 kg N	300	620	1450	1924	2963	1450
Sorghum at 80 kg N	508	954	1373	2105	3463	1680
Sorghum/pigeonpea at 0 kg N	768	861	1406	2236	2956	1650
Sorghum/pigeonpea at 80 kg N	629	1064	1893	2148	3411	1830
Fallow	530	898	1387	2765	3086	1730
Mean	680	1080	1680	2390	3380	

Comparison of Means	S.E. of means
Previous crops	± 119
Nitrogen rates	± 85
Previous crops x N rates	± 220

was maintained with the treatments receiving additional N, although the magnitude of the yield difference varied. In terms of total biological yield, pigeonpea as a sole crop again had the maximum beneficial effect (see Table 3). There were significant differences in response between the levels of N applied to maize but no significant interaction between the effects of previous crops and the rates of N applied to maize. In terms of both grain yield and total dry matter, yields of maize following pigeonpea in monoculture were similar to maize yields obtained with 40 kg N following sorghum or fallow. In the absence of applied N, intercropped pigeonpea only provided a small benefit — it is evident from Table 1 that its growth and yield were only half that of sole pigeonpea.

Although the mechanism has not been clarified, the present experiment shows the beneficial effect of pigeonpea as a sole crop on following maize, increasing grain yield by 57% and dry matter by 32% over fallow. A feature of pigeonpea growth in this environment is the considerable leaf fall, calculated to provide 30-40 kg N/ha (Sheldrake & Narayanan, 1979). There is clearly a need to further examine this and other potential sources of the N that has apparently been made available to the subsequent crop.

TABLE 3: Effect of previous cropping and fertilizer treatments on total top dry matter yield of maize (kg/ha) (rainy season, 1980).

Previous crop	N fertilization in the 1980 planting (kg/ha)					Mean
	0	20	40	60	80	
Pigeonpea	5925	7842	8856	8863	11016	8500
Sorghum at 0 kg N	2177	3945	6148	6651	8901	5560
Sorghum at 80 kg N	2249	4547	6292	6922	9175	5840
Sorghum/pigeonpea at 0 kg N	3267	4618	5979	7175	8574	5920
Sorghum/pigeonpea at 80 kg N	3049	5176	7177	6941	9150	6300
Fallow	3129	4931	6466	8550	9089	6430
Mean	3300	5180	6820	7520	9320	

Comparison of means	S.E. of means
Previous crops	± 295
Nitrogen rates	± 178
Previous crops x N rates	± 488

REFERENCES

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