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SOME OBSERVATIONS ON THE INTERCROPPING OF PIGEON PEA (CAJANUS CAJAN) AND CORN (ZEA MAYS) IN TRINIDAD

G.H. Shakour and R.A.I. Braithwaite

Department of Crop Science
University of the West Indies
Trinidad.

INTRODUCTION

Intercropping is widely practised by peasant farmers in Trinidad and Tobago and HENDERSON (1965) reported that pigeon pea and corn were the commonest components. Despite the prevalence of the practice it has been the subject of little research (HENDERSON, 1965; BAYNES, 1971), and FERGUSON (1972) reported that the full benefit of the practice is not derived by farmers. Some observations made in an experiment conducted to provide information on the reactions of pigeon pea and corn under different systems of intercropping are presented in this paper.

MATERIALS AND METHODS

The study was conducted on a Streatham Loam located at the Texaco Food Crops Demonstration Farm, St. Joseph, Trinidad. The soil, pH 4.0, is low in plant nutrients and exhibits imperfect drainage. There were six treatments (Table 1) replicated four times in a randomised block design. U.W.I. GI 27/4A pigeon pea and high-lysine white translucent corn were sown thickly by hand at a depth of about 5 cm. in hills on 11 and 12 January, 1973 and were thinned to one plant per hole within three weeks. Each plot was 11.25 m. long and 6 m. wide. Plant populations are shown in Table 1.

No fertilizer was applied to pigeon pea. Corn was fertilized with 628 kg/ha of a 22:11:11 compound commercial fertilizer; two-thirds of this amount applied at planting and the remainder at the onset of flowering. Weeds were controlled by prometryne (2.24 kg/ha) at planting, three hand weedings and two sprays of paraquat (0.54 kg/ha) during the growth of the crops. Pigeon pea pod borer was controlled by spraying Gardona 25 EC (1.68 kg/ha) and corn army worm with Dipterex SP80 (1.68 kg/ha).

The durations from planting to flowering, podding and harvest in pigeon pea, and from planting to silking, tasselling and harvest in corn were recorded. Plant height measurements were made at three-week intervals from the fifth to the fourteenth week after planting.

The crops were harvested at the mature green stage. The harvested areas varied with treatments and ranged from 59.5 m^2 to 60.4 m^2. Corn was sun-dried to about 14 per cent moisture content and the green pea pod weights were converted to dry weight by the ratio 3.35:1 suggested by HENDERSON (1965). The dry weight per plant, seed yield components and seed protein contents were determined and total dry matter yields and total seed protein yields were computed.

The seed yield of corn in every replicate of the mixed stand treatments was converted to seed yield in kilogrammes per hectare and the seed yield of pigeon pea, which could occupy the remaining portion of the area based on the seed yield per hectare of pure stand corn was

calculated, using the following formula:-

$yp = (1 - \frac{xc}{X}) Y$ (SPRINGER, personal communication, 1973) where

xc is seed yield (kg/ha) of corn in mixed stand

yp is seed yield (kg/ha) of pigeon pea in mixed stand

X is seed yield (kg/ha) of corn in pure stand

Y is seed yield (kg/ha) of pigeon pea in pure stand.

RESULTS

Seed yield and components of yield

The effects of different systems of intercropping on the actually observed seed yields of pigeon pea and corn both in pure and mixed stands as compared to the computed combined seed yields (using the above formula) are shown in Table 2. The real advantage of mixing the two crops was shown by the seed yield of all mixed treatments except Treatment 4 (one row of pigeon pea for every two rows of corn), where the actual seed yield was less than the computed seed yield.

Data on the yield components of the crops are presented in Table 3. There was no significant difference between the treatment effects on pigeon pea seed number per pod or pod number per plant. Pure corn produced significantly less seeds per ear and less ears per plant than the other treatments.

Seed attributes

Neither the seed protein content of pigeon pea nor that of corn was affected by the different systems of intercropping (Table 4). The highest protein yield (Table 4) was produced by Treatment 1 (pure pigeon pea) and the lowest by Treatment 2 (pure corn).

Plant characteristics

Treatments affected neither the dates of flowering and podding in pigeon pea nor the dates of silking and tasselling in corn. Pigeon pea flowered and podded in 80 and 88 days respectively after planting, and harvesting was done 118, 131 and 148 days after planting. Corn plants tasselled and silked in 53 and 63 days respectively after planting and were harvested at 118 days.

Table 5 presents the observed effects of different systems of intercropping on the height of pigeon pea and corn 11 weeks after planting. The various treatments had no effect on the height of corn. However, differences in pigeon pea plant heights were observed at 11 and 14 weeks after planting. Treatment 1 (pure pigeon pea) produced the tallest plants at both sampling dates.

The total dry matter per plant of the two crops was unaffected by the treatments (Table 6). on the other hand, Treatment 1 produced lower dry matter yields than the other treatments.

DISCUSSION

The seed yield data are, in general, consistent with the findings of EVANS (1960), DONALD (1963) and WILLEY and OSIRU (1972) who reported that higher seed yields were obtained

from mixtures than from pure stands of the component crops. The fact that corn appeared to benefit more than pigeon pea from the association confirmed the general statements of OLSON and TIHAMUKHONDI (1972) for grass-legume mixtures. In agreement with MUSSEL (1961) for a legume/non-legume association, corn plants in mixed stands probably had more available nitrogen since pigeon pea nodules could have fixed sufficient nitrogen for use by both crops. The competition stress for soil nitrogen and light which apparently occurred in pure corn stands might have reduced ear and seed numbers as previously reported by DONALD (1963), but was not statistically significant enough to affect the dry matter per plant and seed protein content of corn. However the dry matter and protein yields might have been affected.

Initially, the pigeon pea plants in mixed stands were apparently poor competitors since corn exhibited a greater visible top growth and appeared to have well established root systems. At later stages the corn plants had a height advantage over the pigeon pea plants. This height advantage may have caused shading of pigeon pea plants possibly resulting in reduced vegetative growth.

The present findings are different from those of EVANS (1960) and MUSSEL (1961) in that, while for pigeon pea the dry matter yield in mixed stands was higher than that of the pure stand, the converse was true for corn. It would seem that the yields were generally influenced by the plant population density and particularly by the relative proximity of the component plants in mixed populations.

THOMPSON (1957) and MUSSEL (1961) reported a higher protein yield from mixtures than from either component crop grown alone. The present findings differ in that protein yields from mixtures of corn and pigeon pea were no better than those from either of the pure stands.

It would appear that plants in mixtures are able to utilise environmental resources more efficiently than those in pure stand. Moreover, it is evident from Table 2 that alternate row planting of pigeon pea and corn produced the highest total yield. In this system of intercropping the proximity of pigeon pea plants to each other and to the neighbouring corn plants is greatest. This is presumably the cause of the outstanding performance obtained. Studies with higher plant population densities and more systematised pigeon pea and corn ration should be conducted to investigate further the validity of this inference under similar local conditions and to provide essential data on net economic returns.

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TABLE 1. The intended plant population (plants per hectare) for pigeon pea and corn in pure and mixed stands.

Treatments	Plant populations	
	Pigeon Pea	Corn
1. Pure pigeon pea	44,444	-
2. Pure corn	-	53,333
3. Alternate row planting	22,222	26,667
4. One row of pigeon pea for every two rows of corn	14,815	35,555
5. Alternate planting within the row	22,222	22,222
6. One plant of pigeon pea for every two plants of corn within the row	14,815	29,629

TABLE 2. Effect of different systems of intercropping on the seed yields (kg/ha) of pigeon pea and corn.

Treatments		Actual observed seed yield	Seed yield computed with formula
1. Pure pigeon pea		6,960	6,960
2. Pure corn		5,939	5,939
3. Alternate row planting	Pigeon pea	4,056	2,627
	Corn	3,659	3,659
4. One row of pigeon pea for every two rows of corn	Pigeon pea	1,281	1,670
	Corn	4,653	4,653
5. Alternate planting within the row	Pigeon pea	3,234	1,775
	Corn	4,427	4,427
6. One plant of pigeon pea for every two plants of corn within the row	Pigeon pea	1,819	1,253
	Corn	4,865	4,865

TABLE 3. Effect of different systems of intercropping on some yield components of pigeon pea and corn.

Treatments	Pigeon pea		Corn	
	Seed number per pod	Pod number per plant	Seed number per ear	Ear number per plant
1. Pure pigeon pea	5.3*a	51.5a	-	-
2. Pure corn	-	-	368.8 b*	1.0 b
3. Alternate row planting	5.5 a	52.3a	455.5 a	1.5 a
4. One row of pigeon pea for every two rows of corn	5.4 a	52.3a	448.8 a	1.3 a
5. Alternate planting within the row	5.4 a	51.8a	474.0 a	2.0 a
6. One plant of pigeon pea for every two plants of corn within the row	5.3 a	51.3a	470.3 a	1.7 a
S.E ±	0.09	1.20	17.41	0.04

* Values in the same vertical column with a common letter do not differ significantly at the 5% probability level based on Duncan's Multiple Range Test, in this and subsequent tables.

TABLE 4. Effect of different systems of intercropping on the seed protein content and protein yield of pigeon pea and corn.

Treatments	Seed protein content (percentage on a moisture-free basis		Protein yield (kg/ha)
	Pigeon pea	Corn	
1. Pure pigeon pea	24.1	-	1673 a
2. Pure corn	-	12.6	746 b
3. Alternate row planting	23.2	13.0	1326 ab
4. One row of pigeon pea for every two rows of corn	22.7	13.0	1025 ab
5. Alternate planting within the row	23.4	12.8	1326 ab
6. One plant of pigeon pea for every two plants of corn within the row	23.5	12.7	1047 ab
S.E ±	0.41	0.51	183.6

TABLE 5. Effect of different systems of intercropping on pigeon pea and corn heights (cm.) at eleven weeks after planting.

Treatments	Plant heights at 11 weeks after planting	
	Pigeon pea	Corn
1. Pure pigeon pea	94.4 a	-
2. Pure corn	-	265.3 a
3. Alternate row planting	92.2 b	263.4 a
4. One row of pigeon pea for every two rows of corn	90.4 b	267.8 a
5. Alternate planting within the row	90.9 b	269.1 a
6. One plant of pigeon pea for every two plants of corn within the row	90.4 b	268.9 a
S.E. ±	0.92	2.41

TABLE 6. Effect of different systems of intercropping on the plant dry weight of pigeon pea and corn and dry matter yields.

Treatments	Plant dry weight (g.)		Dry matter yield (kg/ha)
	Pigeon pea	Corn	
1. Pure pigeon pea	335.2	-	14899 b
2. Pure corn	-	416.6	22219 a
3. Alternate row planting	313.1	450.2	18964 a
4. One row of pigeon pea for every two rows of corn	293.3	429.2	17698 a
5. Alternate planting within the row	262.8	452.3	17901 a
6. One plant of pigeon pea for every two plants of corn within the row	267.4	445.2	17154 a
S.E±	43.06	47.76	1277.0