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Full Length Research Paper

Growth and yield performance of some improved soybean varieties as influenced by intercropping with maize and cassava in two contrasting locations in Southwest Nigeria

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Four improved varieties of soybean (TGX 1448-2E, TGX 1445-2E, TGX 1485-1D and TGX 1019-2E) were evaluated for growth and yield performance under intercropping system with maize and cassava at Ibadan and Oniyo in 2001 and 2002. Plant height at harvest, number of pods per plant, weight of 100 seeds and seed yield were used to assess the performance of improved varieties of soybean while grain yield and fresh tuber yield were considered for maize and cassava under the intercropped. Combined analysis of variance of growth and yield parameters showed variations among improved varieties of soybean, maize and cassava for intercropping, location, year and their interactions. Soybean variety TGX 1485-1D with highest number of pods per plant, weight of 100 seeds and seed yield was the most desirable variety for intercropping with maize and cassava across the two locations. Maize grain yield and cassava fresh tuber yield were similar among the four improved varieties of soybean in their response under the intercropped across the two locations. Higher seed yields of soybean varieties were obtained from Oniyo (derived savanna agro ecology) compared to Ibadan (rain forest agro ecology) probably due to differences in climatic conditions. The study has indicated that TGX 1485-1D, which was highest yielding across the different locations, will fit well into the farming systems of small-scale farmers of Southwest Nigeria.

Key words: Intercropping, soybean varieties, improved, cassava, maize.

INTRODUCTION

Farmers in the tropics cultivate their crops through intercropping, which is the common form of traditional farming (Waddington and karigwindi, 2001). Intercropping involves planting together on the same piece of land crops that differ in productivity, growth habit and phonological characteristics (IITA, 1980). Intercropping is widely practiced by small-scale farmers as a strategy for increasing crop yields, crop diversity and the stability of crop production (Gomez and Gomez, 1983). Soybean (*Glycine max* (L) Merr.) is an important crop component in the farming system of most parts of Nigeria. According to Olufajo (1992) in the traditional soybean growing areas of Nigeria, soybean is most commonly intercropped with cereal crops like maize, sorghum and millet.

The newly recommended improved varieties of soybean have a wide range of maturity and diverse morphology. Apart from these, they are high yielding, have good quality, desirable agronomic characteristics and moderate to good tolerance to pod shattering (Olufajo, 1992). However, since these improved varieties were developed under monocropping conditions, it is of interest to investigate their performance when intercropped with other crops like cereal and tuber crops. Moreso, the largest quantity of soybean production in the

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Table 1. Mean square values from the analysis of variance for growth and yield of soybean, maize and cassava intercropped grown in two years at two locations.

Source of variation	Degree of freedom	Soybean Plant height	Average number of pods/plant	Weight of seeds	Soybean Seed yield	Maize Grain yield	Cassava fresh tuber yield
Intercropping (I)	3	645.22**	1712.58**	146.26**	0.216**	0.15 ns	0.71 ns
Location (L)	1	12.81 ns	11.02 ns	46.41**	0.56**	0.34**	63.94**
Year (Y)	1	151.23 ns	0.52 ns	46.41**	0.12**	2.80**	6.16**
I x L	3	1.91 ns	0.41 ns	0.24 ns	1.66 ns	1.45 ns	0.18 ns
I x Y	3	103.0 ns	29.02 ns	0.35 ns	9.44 ns	1.00 ns	0.75 ns
L x Y	1	11.02 ns	0.52 ns	0.97 ns	6.75 ns	2.00 ns	18.01**
I x L x Y	3	0.55 ns	0.24 ns	9.55 ns	1.39 ns	1.16 ns	0.40 ns
Error	32	129.51	33.67	0.89	5.83	4.18	0.51

** Significant at 0.05.
ns: non significant.

traditional soybean growing areas takes place under intercropping systems. Maize is commonly grown in mixtures in intercropping systems. Okigbo and Greenland (1976) reported that about seventy-five percent of the area of maize in Nigeria is in association with other crops. Cassava is a significant component of cropping systems across a wide range of the tropical environment. According to Carter et al. (1992) cassava is widely accepted by the peasant farmers and this is attributed to its width of ecological amplitude, such as its adaptability to a wide range of ecological and agronomic conditions.

It seems that differences in the maturity time and growth habit of the component crops are important determinants of the productivity under intercropping systems (Rao and Willey, 1983). Ezumah and McGuire (1982) had earlier indicated that soybean and maize that mature at the same time are competitively mutually exclusive and that such a mixture should be used when equal importance is attached to maize and soybean yields. The objective of this study therefore, was to evaluate the performance of some improved varieties of soybean as influenced by intercropping with maize and cassava in two contrasting agro ecologies of Southwest Nigeria.

MATERIALS AND METHODS

The studies were carried out at the Institute of Agricultural Research and Training farm at Ibadan (Lat 07° 22''N, 3° 50''E) in the rainforest agro-ecology and Oniyo (Lat. 08° 02"N, 04° 02"E) an adopted village in the derived savanna agro-ecology of Southwest Nigeria. The mean annual rainfall in Ibadan varies from 1000 to 1350 mm and Oniyo varies from 1000 to 1150 mm. The dominant soil of the experimental areas in Ibadan and Oniyo is an alfisol. The treatment combinations consisted of four improved varieties of soybean from International Institute of Tropical Agriculture (IITA) Ibadan intercropped with maize (Suwan -1) and cassava (TMS 30572). The soybean varieties evaluated are:

TGX 1448-2E (medium maturing, erect type)
TGX 1445-2E (late maturing, erect type)
TGX 1485-1D (early maturing, erect type)
TGX 1019-2E (early maturing, erect type)

The experiment was laid out in a randomized complete blocks design (RCBD) replicated three times with plot size 4 m x 5 m. Cassava cuttings and maize seeds were sown at the same time on second week of July in 2001 and 2002 cropping seasons. The soybean seeds were sown a week after in-between cassava and maize rows at 50 cm intra-row spacing. Cassava and maize plants were spaced 1 m x 1 m apart. Immediately after planting of maize and cassava, Galex (Metolacholor + Metabromuron in the ratio of 1:1), pre-emergence herbicide was applied at the rate of 400 ml in 200 litres of water to control weeds, thereafter the plots were maintained weed free by hoeing. After three weeks of planting, 150 kg per hectare NPK 20–10–10 fertilizer was applied to maize. At maize tasselling, 60 kg per hectare of urea was applied as second dose. At maturity, yield data was taken on maize and cassava. Data collected on soybean were plant height, number of pods per plant, weight of 100 seeds and seed yield at harvest. The data obtained were analyzed for variance using SPSS statistical package.

RESULTS AND DISCUSSION

The mean squares from the analysis of variance for growth and yield of soybean, yield of maize and yield of cassava are presented in Table 1. The intercropping of four improved soybean varieties with maize and cassava effect was significant for the agronomic characters investigated, other than maize grain yield and cassava fresh tuber yield. This implies that improved varieties of soybean responded differently to intercropping system, while intercropping of the three component crops did not affect the yields of maize and cassava. Location and year effects were significant for weight of 100 seeds, soybean seed yield, maize grain yield and cassava fresh tuber yield. This shows that soybean seed yield, maize grain yield and cassava fresh tuber yield differed between the two locations and the two years. The location x year interaction effect was significant for soybean seed yield and cassava fresh tuber yield. TGX 1448-2E gave the highest values for plant height from both locations in 2001 and 2002 (Table 2). It was TGX 1485-1D, however,

Table 2. Mean growth and yield of improved soybean varieties in intercropped with maize and cassava at Ibadan and Oniyo in 2001.

Treatments	Plant Height (cm)		Average	Pods/plant	Weight of	100 seeds (g)	Seed	Yield (t/ha)
	Ibadan	Oniyo	Ibadan	Oniyo	Ibadan	Oniyo	Ibadan	Oniyo
C/M/TGX 1019-2E	55.07ab	56.47ab	62.33b	63.33b	17.80b	19.90b	0.73b	0.87bc
C/M/TGX 1440-1E	48.13b	48.60b	40.67d	42.67d	12.76d	15.17d	0.57c	0.73c
C/M/TGX 1448-2E	67.37a	66.00a	46.33c	47.00c	14.87c	17.33c	0.80b	0.93b
C/M/TGX 1485-1D	44.80b	44.60b	67.67a	68.67a	21.10a	23.13a	0.97a	1.10a
Mean	53.84	53.91	54.25	55.41	16.63	18.88	0.77	0.91

Means in a column with similar letter(s) are not significantly different at 5% level according to Duncan Multiple Range Test.
C = cassava and M = maize.

Table 3. Mean growth and yield of improved soybean varieties in intercropped with maize and cassava at Ibadan and Oniyo in 2002.

Treatments	Plant Height (cm)		Average	Pods/plant	Weight of	100 seeds (g)	Seed	Yield (t/ha)
	Ibadan	Oniyo	Ibadan	Oniyo	Ibadan	Oniyo	Ibadan	Oniyo
C/M/TGX 1019-2E	56.87a	54.33a	61.33a	60.67ab	17.43b	16.30b	0.83b	0.60ab
C/M/TGX 1440-1E	48.03a	44.33a	41.33b	40.33c	13.50c	11.33c	0.76b	0.47b
C/M/TGX 1448-2E	55.07a	53.67a	52.00ab	51.00bc	14.57c	12.87c	0.90b	0.60ab
C/M/TGX 1485-1D	45.33a	43.00a	67.00a	66.67a	21.03a	19.30a	1.03a	0.70a
Mean	51.33	48.83	55.42	54.67	16.63	14.95	0.88	0.60

Means in a column with similar letter(s) are not significantly different at 5% level according to Duncan Multiple Range Test.
C = cassava and M = maize.

Table 4. Mean yield of maize and cassava in maize/cassava/soybean intercropped at Ibadan and Oniyo in 2001.

Treatments	2001 Maize Yield (t/ha)		2002 Maize Yield (t/ha)		2001 Cassava Yield (t/ha)		2002 Maize Yield (t/ha)	
	Ibadan	Oniyo	Ibadan	Oniyo	Ibadan	Oniyo	Ibadan	Oniyo
C/M/TGX 1019-2E	2.50a	2.36a	2.02a	1.85a	15.97a	15.10a	17.57a	14.23a
C/M/TGX 1440-1E	2.30a	2.17a	1.94a	1.67a	15.30a	14.30a	18.40a	14.10a
C/M/TGX 1448-2E	2.62a	2.49a	2.09a	1.89a	15.33a	14.30a	17.20a	13.63a
C/M/TGX 1485-1D	2.38a	2.27a	1.97a	1.77a	16.00a	14.56a	17.20a	14.27a
Mean	2.45	2.32	2.01	1.79	15.65	14.57	17.59	14.06

Means in a column with similar letter(s) are not significantly different at 5% level according to Duncan Multiple Range Test.
C = cassava and M = maize.

that gave the highest values for average number of pods per plant and weight of 100 seeds from Ibadan and Oniyo in 2001 and 2002. Also, TGX 1485-1D gave the highest seed yield values from Ibadan and Oniyo, respectively, in 2001 (0.97 and 1.10 t/ha, respectively) and (0.70 and 1.03 t/ha, respectively) in 2002.

The results indicated that regardless of the location and year, TGX 1485-1D performed best under intercropping system with maize and cassava. The performance of this particular soybean variety in relation to its highest yield could be deduced from its ability to produced highest number of pods per plant and weight of 100 seeds. The influence of location on yield (Table 3) showed that, the mean soybean seed yields (0.91 and 0.88 t/ha) in 2001 and 2002, respectively, from Oniyo were higher than that from Ibadan mean yields (0.77 and 0.60 t/ha) in 2001 and 2002, respectively. This confirmed the earlier findings of Heathcote and Stocking (1970) and Olufajo (1992) that soybean performs best in the Guinea savanna ecological zone of Nigeria. Variations in climatic factors in both locations might have been partly responsible for the difference since the experiment was conducted in two different agro ecologies.

Table 4 shows the mean yields of maize and cassava under maize/cassava/soybean intercropped in Ibadan and Oniyo in 2001 and 2002. There were no significant differences for maize grain yield and cassava fresh tuber yield with respect to intercropping system. Apparently, both the maize and cassava yields did not show any significant difference under different soybean varieties

when intercropped. Consequently, all the soybean varieties investigated exerted the same kind of effects on maize and cassava yields when intercropped. It seems that differences in the maturity time and growth habit of the component crops are important determinants of the productivity under intercropping systems as indicated by Rao and Willey (1983). Ezumah and McGuire (1982) had earlier indicated in their work that soybean and maize that mature at the same time are competitively mutually exclusive and that such a mixture should be used when equal importance is attached to maize and soybean yields. However, the competition among the maize, cassava and soybean is supposed to be less due to temporal difference in their growth pattern.

In conclusion, the farmers in any agro ecology in the Southwest Nigeria could adopt cassava/maize/soybean intercropping system. Thus, in an intercropping system, soybean variety with maximum number of pods per plant should be combined with maize and cassava. From this study, TGX 1485-1D (early maturing, erect type) is recommended for wide cultivation under improved farming systems across the agro ecologies of South western Nigeria because of its higher number of pods per plant and its better yield potential under intercropping system.

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