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INFLUENCE OF FOUR VARIETIES OF SESAME (Sesame indium L.) ON MAIZE/SESAME INTERCROPPING IN THE SOUTHEASTERN RAIN FOREST BELT OF NIGERIA

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ABSTRACT

Field experiments were conducted at Obubra in the forest belt of southeastern Nigeria in 2004 and 2005 cropping seasons to study the effects of four varieties of sesame on maize/sesame intercropping. The experiment was laid out as a randomized complete block design (RCBD) with three replicates. There were nine (9) treatments, which comprised four (4) varieties of sesame (Yandev 55, O3L, OIM, and E8) planted as sole and in mixture with maize as well as sole maize (Oba super). The result obtained indicates that maize growth and yield were not adversely affected by intercropping. Sesame O3L, on average, gave significantly ($P<0.05$) higher plant height, number of branches/plant and seed yield than other varieties under sole cropping and intercropping. Yield reductions due to intercropping were 28.0, 44.7, 61.1 and 61.0% in Yandev 55, O3L, OIM and E8 respectively. Intercropping maize with sesame O3L gave high yields from both crops and a high land equivalent ratio (LER) of 1.33

KEY WORDS: sesame, maize and intercropping.

INTRODUCTION

Intercropping, which is the growing of two or more crops simultaneously on the same field (Andrews and Kassam, 1976), is the predominant cropping system in most parts of the tropics. Most farmers in the tropics grow their crops in mixtures. Intercropping, compared to mono cropping, is more dominant in the tropics because it is a viable strategy for spreading the risk of crop failure and the labour demands for critical operations of sowing, weeding and harvesting (Norman, 1974). Intercropping is common where farmers lack land and /or capital but plentiful labour. Intercropping aims at ensuring against total crop failure, and enhancing increased productivity per unit land area, judicious utilization of land resources and farming inputs (Rajat De and Singh, 1979).

Maize intercropping is common in the traditional growing system of the forest zone of South Eastern Nigeria (Okpara et al., 2004). Cropping system research has generated a lot of interest in the past decade and there are many reports in the literature of various crop combinations involving maize but very little have been reported on sesame intercropping. For instance, studies have been carried out on maize/groundnut mixture (Koli, 1975; Baker, 1978) maize/soybean mixture and maize/cowpea mixture (Okpara, 2000a, 2000b; Okpara et al., 2004). Although the cultivation of sesame is not widely practiced by farmers in southeastern Nigeria, its integration in the farming systems of the region is especially important for most peasant farmers and low-income earners for improved income and nutrition. Sesame seed contains 18-23% protein and 48-55% oil (Voh, 1998). The oil is free from undesirable nutritional or flavour component and is very stable because of the natural anti-oxidants (sesamin and sesamolin), which prevent ageing and malfunctioning of the liver (Uzo and Yermanos, 1977) and is also rich in calcium and phosphorus (Dipcharima 1998).

Improved varieties of sesame with improved growth, yield and shattering qualities (Iwo et al., 1998) have recently been released by National Cereals Research Institute (NCRI) Badeggi. There is limited information in the literature on the performance of these varieties in southeaster Nigeria. There is also limited information in the literature on the intercropping involving maize/sesame in the region. This study, therefore investigated the varietal response of sesame on maize/sesame intercropping system in the Southeastern Nigeria.

MATERIALS AND METHOD

A field experiment was conducted in 2004 and repeated in 2005 under rainfed conditions at the Cross River University of Technology research farm at Obubra, Cross River State, Nigeria. Obubra is located at longitude 8° 16' E and latitude 5° 59' N with an altitude of 184m above sea level. The experiment was established in 2004 and 2005 as a randomized complete block design (RCBD) with three replicates. Treatments consisted of four sesame varieties (obtained from NCRI, Badeggi) which were planted as sole and in mixture with maize as follows (Sole Yandev 55, sole O3L, sole, OMI, sole E8, yandev 55 + maize, O3L + maize, OIM + maize, E8 + maize and sole maize), giving a total of nine (9) treatments. The maize variety used was "Oba super1". Each plot size measured 4 m x 3 m ($12m^2$) and ridges were made at 75 cm apart on land previously slashed on 20 June, ploughed on 23 June, harrowed and rigged on 26 June in 2004 and 2005, while planting was done on 27 June and 28 June for 2004 and 2005, respectively. All the seeds were treated with apron plus prior to planting. Two seeds of maize were hand sown on the crest of the ridges at 25 cm spacing between plants while a pinch of sesame seeds thoroughly mixed with clean and dry river sand was sown between the ridges at 30 cm apart and 15 cm within the row. The sesame seedlings were later thinned at three weeks after sowing (WAS) to maintain two plants per hole while the maize was thinned to one plant per hole. Sole crops of maize and sesame were included to ensure computation of land equivalent ratio (LER). Each plot received blanket application of 40 kg/ha NPK (15:15:15) fertilizer at 4 WAS. Nitrogen (Urea) fertilizer was applied to the maize as top dressing at 8 WAS at the rate of 100 kg/ha by band placement. Plot were manually weeded twice in both years at 4 and 8 WAS. The crops were protected against insect pests and disease by spraying twice (4 and 8 WAS) with thionex at 50 ml in 20 L of water. Data were taken on plant height, number of branches per plant, number of leaves per plant, shoot dry matter, number of capsules per

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plant, number of seeds per capsule and seed yield for sesame. Maize data were collected on plant height leaf area index (LAI), shoot dry matter 100-seed weight and grain yield . The data collected were subjected to statistical analysis according to the procedures outlined by Gomez and Gomez (1984). The productivity of the mixture was evaluated by the land equivalent ratio (LER) (the sum of the ratios of yields of the intercrop to that of sole crop component of each variety on the relative yields totals).

RESULTS

The soil physico-chemical properties and rainfall data for 2004 and 2005 summarized in Table (1), indicated that soil pH was acidic. Soil texture at both sites was sandy loam. Rainfall in 2004 and 2005 was consistently high and over 245 mm per month in June through October, declining sharply from 330.4 mm in October to 105.5mm in November 2004 and from 264.9mm in October to 56.4 mm in November 2005. Total rainfall for the period was 1558 mm and 1460 mm for 2004 and 2005, respectively.

The effect of maize/sesame intercropping on maize growth and yield are shown in Table (2). Intercropping significantly ($P<0.05$) affected maize leaf area index (LAI) of maize in 2005, but did not influence the plant height, shoot dry matter and grain yield of maize in both cropping seasons. Leaf area index (LAI) of maize intercropped with sesame OIM variety in 2005 was significantly ($P<0.05$) higher than those of the sole maize crop and maize intercropped with sesame E8.The average yield of maize obtained from the two cropping seasons showed that intercropping tended to reduce maize grain yield in maize + Yandev 55, maize + O3L, maize +OIM and maize +E8 intercrops by 29, 25, 31 and 40% respectively.

The effect of maize/sesame intercropping on the growth and yield of sesame is also given on Tables (3) and (4), respectively. Intercropping maize with sesame significantly ($P<0.05$) affected the plant height and number of branches/plant of sesame in 2005. Sesame O3L variety consistently produced plants that were taller in both sole crop (168.7 cm) and intercropping (143.3 cm) situations. Average plant height obtained from the two cropping systems, (sole crop and intercropping) in 2005 showed that the plant height (156 cm) of O3L variety was higher than that of Yandev 55, O1M and E8 by 66, 107 and 99% respectively. Intercropping maize with sesame did not significantly ($P>0.05$) reduce the plant height on any of the sesame verities. The number of branches/plant in 2005 was significantly ($P<0.05$) higher in O3L than other varieties except OIM. The average number of branches/plant in both cropping systems in 2005 showed that the number of branches/plant in O3L was higher than in Yandev 55, OIM and E8 by 136, 188, and 103%, respectively. However, intercropping significantly ($P<0.05$) increased the number of branches/plant in Yandev 55. In both years, the number of leaves/plant and shoot dry matter of sesame were not significantly ($P>0.05$) affected by the cropping systems.. Under sole cropping, the number of capsules/plant was significantly ($P<0.05$) higher in OIM in 2004 and in O3L in 2005, compared to other varieties. On the average, under intercropping, O3L consistently and significantly ($P<0.05$) maintained higher number of capsules/plant than other varieties. However, intercropping reduced considerably the number of capsules harvested per plant in OIM in 2004. The number of seeds per capsule was higher in OIM in both cropping systems in 2004. Intercropping did not significantly ($P>0.05$) reduce the number of seeds per capsule in both years. Sesame O3L produced significantly ($P<0.05$) higher seed yield in both cropping systems. The mean seed yield of sesame O3L variety obtained from the two cropping systems, in 2004 and 2005 cropping seasons was higher than the yield values of Yandev 55, OIM and E8 by 232, 119 and 29%, respectively. On the other hand, the average seed yield of sesame obtained from 2004 and 2005 cropping seasons indicated that intercropping significantly ($P<0.05$) reduced the seed yield of sesame by 28.0, 44.7, 61.1 and 61.0 percent in Yandev 55, O3L, OIM and E8, respectively.

The partial and total land equivalent ratio (LER) is shown in Table 5. On the average, the total land equivalent ratio (LER) for the intercrops was higher when maize was intercropped with sesame varieties O3L (1.33) and Yandev 55 (1.47) than the other cropping systems. The lowest average total LER of 1.05 was obtained when maize was intercropped with sesame E8 variety. The partial LER for both crops was high in O3L and Yandev 55 varieties.

DISCUSSION

Maize crop growth and yield were not significantly ($P<0.05$) affected by intercropping with sesame, probably because maize was the taller plant in mixture. Maize occupied a higher canopy layer than sesame and this gave the former competitive advantage over the later. Palaniappan (1985), Obasi (1989), Olasantan and Lucas (1992) and Muoneke et al. (1997) had noted that canopy height is one of the important features that determines competitive ability of plants for light. Palaniappan (1985) observed that when one component is taller than the other in an intercropping situation, the taller component intercepts major share of the light such that the growth rates of the two components will be proportional to the quality of the photosynthetically active radiation they intercepted. In one out of two years, leaf area index (LAI) of maize intercropped with Sesame variety OIM was higher than that of the sole maize crop or maize combined with E8, probably due to competition. Despite the lack of significant effect of intercropping on maize, grain yield of intercropped maize appeared reduced in sesame varieties Yandev 55, O3L, OIM and E8 by 29, 25, 31 and 4% respectively. In the present study, sesame O3L gave significantly ($P<0.05$) higher value for plant height, number of branches/plant, number of capsules/plant, and seed yield under sole cropping and intercropping with maize. The mean seed yield of sesame O3L variety obtained from the two cropping systems and in both cropping seasons was higher than the yield values of Yandev 55, OIM and E8 varieties by 232, 119 and 29% respectively. The higher yields obtained with the O3L under sole cropping and intercropping could be attributed to the greater height and branching by the variety, which made it possible for it to intercept greater incident radiation. Okwor, (1990) and Ikeorgu et al., (1983) noted that the most important feature of plants that determines their competitive ability for light is height. The general trend in most intercropping experiments is that yields of one or all crops in mixture are less than the yields of the crop grown alone, but total productivity per unit area of land is usually greater for mixtures than for sole crops (Willey, 1979; Natarajan and Willey, 1980, Mpairwe et al., 2002; Okpara, 2000; Okpara et al., 2004).

The reduction in sesame yields in intercrops relative to sole stands in this study could be attributed to shading or reduction of light intensity that was imposed on sesame by maize, which reduced that rate of photosynthesis (Mpairwe et al., 2002). Among the sesame varieties tested, the magnitude of yield depression due to intercropping was greater in OIM and E8 than other varieties. Although Yandev 55 generally gave the lowest yield under sole cropping situation, yield depression due to intercropping was least in the variety.

The total land equivalent ratios (LER^s) of the maize and sesame mixtures were all above 1.0, indicating that higher productivity per unit was achieved by growing the two crops together than by growling them separately. The mean LER value obtained from both years showed that, the highest LER occurred when maize was combined with sesame varieties O3L (1.33) and yandev 55 (1.47). It was of interest to note that although yandev 55 gave the lowest seed yield, LER in mixture involving the variety was high because its yield was not depressed much by intercropping. Chowdhury (1979) indicated that the total LER of any intercrop system could be unity or

greater than unity and yet the expected income from the enterprise could be substantially low. The O3L variety not only gave high yields in both cropping systems but also gave high total land equivalent ratio (LER) of 1.33. The high partial LER obtained for both maize and sesame variety O3L, showed that competitive pressures among the component crops were low and that maize and sesame variety O3L could be complimentary in mixture. Muoneke and Asiegbu (1999) obtained similar results in okra and cowpea intercropping. The increased competitiveness of sesame O3L compared to ot varieties could be explained by its greater height branching, which ensured greater interception of incid radiation by the variety. Overall, the results indicated maize and sesame could be successfully intercropped. Ma yield was not seriously affected compared to the associa sesame, indicating that sesame was the more sensi component of the mixture. For high yields from sesame, ma should be intercropped with O3L variety.

Table1: Soil properties of the sites and the monthly rainfall for the experimental periods.

	2004	2005
Mechanical properties of soil		
Sand (%)	63.8	63.80
Clay (%)	12.2	10.20
Silt (%)	24.0	26.00
Texture class	Sandy loam	Sandy loam
Chemical properties of soil		
O.M (%)	2.388	1.772
N (%)	0.098	0.098
K (meq/100g soil)	15.68	16.97
pH (H_20)	0.34	0.36
	4.73	5.29
Monthly rainfall (mm)		
June	245.8	301.3
July	304.0	289.1
August	250.6	261.9
September	321.7	301.3
October	330.4	264.9
November	105.5	56.4
Total rainfall for the period	**1558.0**	**1459.9**

Table 2: The effect of maize and sesame intercropping on maize growth and yield

Crop combination	Plant height (cm)		Shoot dry matter (g/plant)		Leaf area Index(LAI)		Number of seed/crop		100-seed weight (g)		Grain yield (kg/ha)	
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
Sole maize	82.3	112.7	60.4	139.7	1.2	0.7	127.3	162.2	21.3	18.7	1440.0	1973.7
Maize +Yadev 55	106.7	108.6	80.2	39.3	2.0	0.9	122.3	184.3	15.0	14.7	980.7	1427.7
Maize + O3L	113.3	112.0	84.3	104.3	1.7	0.8	117.7	148.6	19.0	17.7	1176.3	1385.4
Maize + OIM	90.3	108.1	47.3	43.3	1.8	1.0	93.7	134.4	19.3	18.7	973.3	1379.9
Maize + E8	115.8	114.4	80.2	57.7	1.5	0.7	84.0	120.1	16.7	19.7	809.3	1247.3
LSD (0.05)	NS	NS	NS	NS	NS	02	NS	NS	NS	NS	NS	NS

Table 3: The effect of maize and sesame intercropping on sesame growth

Crop combination	Plant height (cm)		Number of leaves/plant		Number of branches/plant		Shoot dry matter (g/ plant)	
	2004	2005	2004	2005	2004	2005	2004	2005
Sole Yandev 55	85.3	101.3	29 3	70 7	2 6	7 9	24 9	24 7
Sole O3L	125.0	168.7	33.4	78.8	3.9	12.1	24.7	58 3
Sole OIM	75.9	77.7	36 4	55.3	3 3	9 7	16 0	35.0
Sole E8	92.2	73.5	28.7	31.8	2.1	6.0	24 0	32 3
Yandev 55	78.0	86.9	29.4	43.1	3 1	7.3	24 2	22.3
Maize + O3L	112.2	143.3	46.7	72.0	4.8	11.4	34.7	43 0
Maize + OIM	77.1	72.9	77.1	51 0	1 9	8.4	17.0	25 0
Maize + E8	99.4	83.6	99.4	32.8	2.8	5.6	26.7	31.7
LSD (0.05)	NS	25.5	NS	NS	NS	3.9	NS	NS

Table 4: Effect of maize and sesame intercropping on sesame yield

Crop combination	Number of Capsules/plant		Number of seed/capsule		Seed yield (kg/ha)	
	2004	2005	2004	2005	2004	2005
Sole Yandev 55	42.0	65.5	42 9	46.3	231.0	257 0
Sole O3L	53.3	91.5	58.9	56.6	863.0	931 0
Sole OIM	77 3	53.1	61.2	53 4	355 3	558.3
Sole E8	54 7	40.5	53.1	53.4	766 7	783 3
Yandev 55	40 0	60.7	41.0	49.3	190 3	161 3
Maize + O3L	52 7	82 9	52.0	51.5	432 3	559.3
Maize + OIM	33.3	58.6	57 0	55 6	164 3	191 3
Maize + E8	52.0	34.3	51 5	54 1	269 7	335 0
LSD (0.05)	7.8	20.7	6.8	NS	76 63	52 30

Table 5: Partial and total land equivalent ratio (LER) of sesame and maize intercrop in 2004 and 2005 cropping seasons

Crop combination	Partial LER				Total LER		Two year mean
	2004		2005		2005	2004	
	Maize	Sesame	Maize	Sesame			
Yandev 55 + Maize	0.743	0.833	0.731	0.631	1.58	1 36	1 42
O3L + Maize	0.845	0.503	0 708	0 601	1.35	1.31	1 33
OIM + Maize	0.673	0.485	0 704	0 341	1 16	1.05	1 10
E8 + Maize	0.669	0.353	0.650	0 428	1.02	1 08	1 05

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