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Full Length Research Paper

Evaluation of the productivity of low cyanide cassava varieties in cassava/soybean intercrop

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The productivity and compatibility of low cyanide cassava (*Manihot esculenta* Crantz) intercropped with soybean (*Glycine max* Merril.) were evaluated in Southeastern Nigeria, in 2002/2003 and 2003/2004 cropping seasons. Significant (P<0.05) variations in growth and yield components of cassava and soybean were evident irrespective of crop varieties. Intercropping low cyanide cassava varieties of sparse to medium branching habits (NR.84292 and Iwa) significantly (P<0.05) improved cassava plant height, number of roots and root yields. Intercropping early maturing soybean variety with low cyanide cassava varieties enhanced cassava yields. Low cyanide cassava variety- NR.84292 and TMS 4(2) 1425 could be intercropped with early maturing soybean variety TGX 1485- 2E with minimal loss of yield in both crops.

Key words: Cassava, cyanide, soybean, intercrop, compatibility.

INTRODUCTION

Intercropping cassava with maize *(Zea mays)* is common among farmers in the major cassava growing belts in Nigeria because of economic benefits and compatibility of the crops (Ikeorgu et al., 1992). Cassava is widely grown in Nigeria and Nigeria is the world's largest producer of cassava with yearly quantities of over 40 million metric tonnes (CBN, 2004). It is the basic staple food for more than 70% of Nigeria population. About 90% of cassava produced in Nigeria is used domestically for food, animal feed, industrial pharmaceutical uses and unquantifiable quantities for export. For human consumption alone, cassava is processed into over 50 food forms such as garri, lafun, bread, flakes, flour, etc.

Inclusion of legumes in intercropping systems had been shown to be advantageous especially in improving the N-economy of the soil by fixing atmospheric nitrogen (Sharma and Chouby, 1991). Studies on cassava/maize/legume mixture (Ikeorgu et al*.,* 1992), cassava/soybean (Cenpukdee and Fukai 1992), cowpea/cassava (Njoku and Muoneke 2008) and cassava/maize/legume (IITA 1978) showed some significant increase in yield and intercropping efficiency of the cassava/legume system. Eke-Okoro et al. (1999) mentioned that soybean intercropped with cassava supplied significant nitrogen and organic matter to the soil and also increased the land equivalent ratio. Extensive evidence indicates that grain legume such as soybean fixed about 55 – 168 kg N/ha. The importance of soybean in animal nutrition and the quantities required in animal diets were discussed by Sharma and Chouby (1991).

Maize is a cereal adjurant common in cassava intercropping studies in Nigeria. The nutritional advantages and cash contribution of maize to the economy of the resource poor farmers have been reported (IITA, 1978).

Until recently, 90% of cassava grown in Nigeria was mainly high cyanide cassava varieties. The use of high cyanide cassava varieties in cassava/maize or cassava/maize/ legume mixtures is very common and is a dominant feature in the cassava belt of Nigeria. The risk of cyanide poisoning is almost zero because farmers that use it have developed proper fermentation methods that reduce the cyanide potential to the barest minimum. However, many boil-and-eat 'sweet cassava' cultivars, which are very low in cyanide potential, have been in use as snack for decades in many parts of northern Nigeria and may have been introduced by trans-Saharan traders from other parts of the West African savannah. The Inter-

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Table 1. Plant height of cassava (m) in cassava/soybean intercrop at Umudike during the 2002/2003 and 2003/2004 cropping seasons.

Crop combination	Plant height (cm)		
	2003	2004	Mean
1. NR 84292 x TGX 1485-ID	2.2	2.0	2.1
2. NR 84292 x TGX 1448-2E	1.9	1.9	1.9
3. NR 84292 x TGX 1019-2E	2.0	1.9	1.9
4. TMS 4 (2) 1425 x TGX 1485-ID	1.0	1.2	1.1
5. TMS (4)2 1425 x TGX 1448-2E	1.0	1.0	1.0
6. TMS (4)2 1425 x TGX 1019	1.2	1.6	1.4
7. Local (Iwa) x TGX 1485-ID	1.7	1.9	1.8
8. Local (1wa) x TGX 1448-2E	1.5	1.4	1.5
9. Local (1wa) x TGX 1019	1.7	1.8	1.8
10. Sole NR 84292	1.8	1.7	1.8
11. Sole TMS 1425	1.8	1.8	1.8
12. Sole Local (1wa)	1.1	1.3	1.2
LSD (0.05)	0.72	0.11	

national Institute of Tropical Agriculture Ibadan in collaboration with the National Root Crops Research Institute Umudike has bred some high yielding low cyanide cassava varieties. The adaptability and compatibility of this type of cassava have not been thoroughly assessed. Low cyanide (sweet) cassava varieties are rapidly replacing the traditional high cyanide varieties especially now that there is much emphasis in use of 10% cassava flour in bread and confectioneries. There is much lower risk in cyanide poisoning in the 'sweet cassava' types than the 'bitter' types. It is expected that more farmers, especially in the Southern Guinea and humid forest zones, will grow them in combination with other traditional intercrops like legumes. This paper therefore assesses the compatibility and productivity of cassava/legume system in Nigeria.

MATERIALS AND METHODS

The experiment was conducted on an ultisol at the National Root Crops Research Institute, Umudike, Nigeria. Umudike (longitude 07° 33'E and latitude 05° 29'N and 122 m above sea level) is in the rainforest belt with total annual rainfall of between 2000 to 2571 mm. Annual average air temperature varies from a minimum of 22°C to an average of 32°C, Relative humidity varies from 51 to 87% and sunshine hours from 2.69 to 7.86 h per day. The first trial was carried out during the 2002/2003 while the second trial was carried out in 2003/2004 cropping seasons.

Three low cyanide cassava varieties: NR.84292, TMS 4(2)1425 and local Iwa) were intercropped with three soybean varieties: TGX 1485-ID (early maturing), TGX 1448 – 2E (medium maturing) and TGX 1019-2D (late maturing). A total of 12 treatment combinations (Table 1) were evaluated along with sole cassava treatment as control. These were laid out in a randomized complete block design (RCBD) and replicated three times. In both trials, planting was done in early August of each year. Cassava was planted on the crest of ridges and spaced I m apart. The soybean was planted on one side of the ridge and spaced 0.20 cm apart. Thus the plant geometry gave a plant population of 10,000/ha for cassava and 100,000/ha for soybean. The plot size was 5 x 4 m. Pre-emergence herbicide- primextra at 5.0/ha was applied immediately after planting and was under brushed four months after soybean was harvested. Compound fertilizer (NPK 15-15-15) was applied to cassava 8 weeks after planting by banding method at 400 kg/ha. Cassava stems and roots were harvested at 12 months after planting and weighed. The land equivalent ratio of the mixture was not determined since this has been carried out by several authors (Ikeorgu, 1984). Soybean pods were pricked from 70 to 100 days after planting (DAP). The dried pods were shelled and the grains were further dried and weighed. Statistical analysis of various treatment effects was carried out and their means were compared by LSD at 5% level of significance (Wahua, 1990).

RESULTS

Cassava plant height

Plant height of low cyanide cassava grown sole or intercropped with soybean is presented in Table 1. Intercropping low cyanide cassava varieties of sparse to medium branching habits (NR.84292 and local Iwa) with soybean significantly ($P< 0.05$) improved cassava plant height. Intercropping low cyanide cassava of profuse branching habit (TMS 4(2) 1425) decreased cassava plant height (1 to 1.4 m; Table 1). Intercropping low cyanide cassava varieties with early maturing soybean variety (TGX 1485 – ID) enhanced cassava plant height (1.8 to 2 m) (Table 1). However, intercropping low cyanide cassava varieties with medium to late maturing soybean varieties (TGX 1448 – 2E) reduced cassava plant height.

Number of root

The number of fresh roots of low cyanide cassava grown sole or intercropped is presented in Table 2. The number of roots harvested irrespective of cassava variety differed

Table 2. Number of fresh cassava roots in cassava/soybean mixture in Umudike during the 2002/2003 and 2003/2004 cropping seasons.

Crop combination	No of Roots		
	2003	2004	Mean
1. NR 84292 x TGX 1485-ID	115	205.4	160.2
2. NR 84292 x TGX 1448-2E	109	135.3	122.2
3. NR 84292 x TGX 1019-2E	110	120.3	115.2
4. TMS 4 (2) 1425 x TGX 1485-ID	94	100.2	97.1
5. TMS (4)2 1425 x TGX 1448-2E	94	95.5	94.8
6. TMS (4)2 1425 x TGX 1019	97	97.1	97.1
7. Local (Iwa) x TGX 1485-ID	98	88	93.0
8. Local (1wa) x TGX 1448-2E	92	114	103.0
9. Local (1wa) x TGX 1019	104.1	98.2	101.2
10. Sole NR 84292	112	117.3	114.7
11. Sole TMS 1425	106.2	102.4	104.3
12. Sole Local (1wa)	99.1	97.2	98.2
LSD (0.05)	2.77	18.24	

Table 3. Fresh cassava root yield (t/ha) in cassava/soybean mixture in Umudike during the 2002/2003 and 2003/2004 cropping seasons.

Crop combination	Yield (t/ha)		
	2003	2004	Mean
1. NR 84292 x TGX 1485-ID	22.4	25.2	23.8
2. NR 84292 x TGX 1448-2E	20.8	20.9	20.9
3. NR 84292 x TGX 1019-2E	19.2	20.6	19.9
4. TMS 4 (2) 1425 x TGX 1485-ID	21.2	23.7	22.5
5. TMS (4)2 1425 x TGX 1448-2E	19.1	20.1	19.6
6. TMS (4)2 1425 x TGX 1019	17.2	19.7	18.5
7. Local (Iwa) x TGX 1485-ID	14.5	17.2	15.9
8. Local (1wa) x TGX 1448-2E	16.5	15.3	15.9
9. Local (1wa) x TGX 1019	21.4	22.4	21.9
10. Sole NR 84292	20.3	20.7	20.5
11. Sole TMS 1425	20.3	21.2	20.8
12. Sole Local (1wa)	15.7	13.7	14.7
LSD (0.05)	3.3	5.2	-

significantly ($P<0.05$). Low cyanide cassava variety-NR.84292 sustained the highest mean number of fresh roots (160.2) when grown sole or intercropped. Low cyanide cassava varieties TMS 4(2) 1425 and local Iwa gave the lowest mean number of fresh roots (98 to 104 (Table 2). Intercropping NR84293 with early maturing soybean variety TGx 1485 – ID gave the highest mean number of roots. This combination also sustained the highest mean plant height across the seasons.

Cassava fresh root yield

The fresh root yields of low cyanide cassava grown sole or intercropped are presented in Table 3. Intercropping low cyanide cassava with soybean significantly gave the highest cassava root yields (19.0 - 23.8 t/ha). Generally, intercropping cassava with legume improved cassava mean yields more than the mean yield of sole cassava (14.7-20.0t/ha; Table 3.

Soybean seed yield

The yields of soybean varieties as affected by intercropping with cassava are presented in Table 4. Soybean TGX 1485 – ID/NR84292 intercrop gave the highest soybean grain yields (242.5 and 357.4 kg/ha), while the lowest soybean yields (46 and 57.4 kg/ha) were from TGX 1485 – ID/ TMS 4(2)1425 intercrop in 2002/2003 and

Table 4. Grain yield (kg/ha) of soybean varieties intercropped with cassava in Umudike during the 2002/2003 and 2002/2004 cropping seasons.

Crop combination	Soybean grain yield (kg/ha)		
	2002/2003	2003/2004	Mean
TGX 1485-ID/NR 84292	242.5	357.4	299.9
TGX 1448-2E/NR 84292	152.5	215.6	184.1
TGX 1019/NR 84292	47.5	87.2	67.4
TGX 1485-ID/TMS (4) 2 1425	46.0	57.4	51.7
TGX 1448-2E/TMS (4) 2 1425	129.2	175.4	152.3
TGX 1019/TMS (4) 2 1425	101.7	102.3	102.0
TGX 1485-ID/Local (1wa)	118.5	122.7	120.6
TGX 1448-2E/Local (1wa)	141.7	153.2	147.5
TGX 1019/Local (1wa)	94.2	110.12	102.2
10. Sole TGX 1485-ID	211.7	372.2	291.9
11. Sole TGX 1448-2E	108.5	242.2	175.4
12. Sole TGX 1019	66.5	98.9	82.7
L.S.D (0.05)	10.72	13.14	-

2003/2004 cropping seasons, respectively.

DISCUSSION

The improved plant height recorded by low cyanide cassava intercropped with early maturing soybean variety (Table 1) could be attributed to early production of nitrogen fixing nodules by the soybean. This nitrogen was later released into the soil by the early maturing soybean variety for the growth of cassava. This corroborates the findings of Tsay et al. (1988) that early maturing soybean varieties increased leaf index and root yield in cassava. The low cassava plant height recorded when profuse branching habit low cyanide cassava (TMS 4(2) 1425) was intercropped with soybean was as a result of shedding of soybean (lower stratum) which adversely influenced its early growth and nitrogen fixing capacity hence was unable to support vigorous cassava growth.

The outstanding performance of NR84294 in terms of higher number of roots when intercropped with soybean could be attributed for its early growth which made it to capture sunlight earlier than the rest treatment combinations. Also the nitrogen contribution of soybean variety (TGX 1485 –ID) improved the growth and enhanced number of fresh roots obtained.

Intercropping early maturing soybean variety (TGX 1485-1D) gave higher mean cassava yield especially with improved low cyanide cassava varieties (NR 84292 and TMS 4(2)1425; Table 3). These observations may be attributed to the ability of the legume (soybean) to improve the N – economy of the soil through both nodulation and high biomass returns. Similar observation has been made and also reported by Reddy and Willy (1983), Njoku and Muoneke (2008) and Eke-Okoro et al. (1999).

The branching habits of the low cyanide cassava varieties significantly influenced the mean soybean yields. The low yields estimated when TMS 4 (2)1425 was intercropped with soybean variety was as a result of its profuse branching habit which shaded the under storey crop (soybean). According to Ikeorgu et al. (1992) shading of crops reduces yield of component crops.

Conclusion

Low cyanide cassava varieties are compatible with soybean in cassava/soybean mixture. Low cyanide cassava varieties NR.84292 and TMS 4(2) 1425 could be intercropped with early maturing soybean variety TGX 1485 – 2E with no loss of yields to both plants.

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