

Full Length Research Paper

Effect of intercropping varieties of sweet potato and okra in an ultisol of southeastern Nigeria

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A field experiment was conducted at the research farm of the National Root Crops Research Institute (NRCRI), Umudike in 2000 and 2001 cropping seasons to access the productivity of three sweet potato cultivars intercropped with three okra cultivars. Intercropping generally increased okra plant height while intercropping with TIS 2532 OP.1.13 sweet potato significantly increased the number of pods per plant of okra than intercropping with other sweet potato cultivars. Tuber yield in sweet potato was higher in TIS 87/0087 than other cultivars. Both pod and tuber yields were not affected by intercropping. Land equivalent ratio was higher with intercropping TAE 38 okra and TIS 87/0087 sweet potato.

Key words: Sweet potato, okra, intercropping, Nigeria.

INTRODUCTION

Sweet potato (*Ipomoea batatas* L. Lam) is an important crop grown in Nigeria. While sweet potato is grown for its tuberous root, which is a source of carbohydrate, okra is grown for its tender fresh pods, which are rich in vitamins and minerals as well as protein and oil (Epenhuijsen, 1974; Martin, 1982). The slimy and drawing quality of okra enhances its acceptability for soup preparation and as soup thickener. Growing a high calorie food such as sweet potato with a vegetable crop like okra would ensure the supply of dietary carbohydrate, vitamins and minerals of the rural populace.

Intercropping has been associated with such advantages as better utilization of environmental factors, greater yield stability, soil protection, variability of food supply, increasing the return per unit area and insurance against crop failure (Beets, 1982). According to Adetunji (1993), intercropping using improved cultivars of crop and improved agronomic practices remains the most feasible approach to optimize crop production and maximize the use of available land.

In southeastern Nigeria, increasing urbanization and deforestation due to high demographic pressure as well

as ecological problems, particularly soil erosion has decreased the amount of arable land available to farmers (Chukwu, 1997). The traditional cropping system is prone to the use of low yield crop cultivars, resulting in low yield of sweet potato in farmers' fields (NRCRI, 1988). Although okra has been intercropped with other vegetables, legumes and food crops, there is dearth of information on its intercropping with sweet potato. The purpose of this study is to determine the productivity of intercropping systems involving three cultivars of sweet potato and three cultivars of okra.

MATERIALS AND METHODS

The study was conducted at the Eastern Research farm of the National Root Crops Research Institute (NRCRI) Umudike, Abia State, Nigeria. Umudike is located on latitude 5° 29' N and longitude 7° 30' N, 122 m above sea level. The top soil (0 - 20 cm) texture of the experimental site is sandy loam. The soils are classified as typic paleudult, derived from coasted plain sands (Chukwu and Ifenkwe, 1996). The soils are acidic and are deficient in nitrogen (N) and potassium (K). The experimental field was slashed, ploughed, harrowed and ridged between 18 and 24 June 2000. In 2001, the land preparation was between 15 and 22 June. Four soil samples were collected from different part of the experimental field, then bulked into a composite sample and used for determination of the chemical and physical properties of the soil before planting.

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Table 1. Effect of intercropping sweet potato and okra on number of tubers and tuber yield of sweet potato in 2000 and 2001 cropping seasons.

Treatment	Number of tubers per plant		Tuber yield (t/ha)	
	2000	2001	2000	2001
Cropping system				
Sole	2.39	2.21	23.67	15.88
Intercrop	2.52	2.46	19.27	16.59
LSD	0.24	0.30	10.44	0.25
Significance	NS	NS	NS	NS
Sweet potato cultivars				
TIS 87/0087	2.90	2.63	23.87	16.03
TIS 8164	2.18	1.96	24.39	15.57
TIS 2532.OP.1.13	2.29	2.41	15.87	16.67
LSD	0.28	0.39	12.80	3.03
Significance	**	*	NS	NS
Cropping system x Sweet potato cultivars				
Sole TIS 87/0087	2.80	2.43	24.67	16.03
Sole TIS 8164	2.20	1.90	30.38	14.10
Sole TIS 2532.OP.1.13	2.17	2.30	15.33	16.60
Intercrop TIS 87/0087	2.99	2.84	23.47	16.00
Intercrop TIS 8164	2.15	2.02	17.93	17.06
Intercrop TIS 2532.OP.1.13	2.41	2.52	16.40	16.93
LSD	0.39	0.54	18.10	4.29
Significance	*	*	NS	NS
Sweet potato x okra				
TIS 87/0087 x Nhae 47-4	3.30	2.07	25.00	17.10
TIS 87/0087 x TAE 38	2.67	2.73	20.60	17.83
TIS 87/0087 x UM 38	3.03	3.00	24.50	18.63
TIS 8164 x Nhae 47-4	1.87	2.40	15.17	16.60
TIS 8164 x TAE 38	2.30	2.00	20.17	15.63
TIS 8164 x UM 38	2.30	2.53	18.20	15.73
TIS 2532.OP.1.13 x Nhae 47-4	2.33	2.70	15.97	16.90
TIS 2532.OP.1.13 x TAE 38	2.80	2.57	17.43	14.63
TIS 2532.OP.1.13 x UM 38	2.13	2.93	16.00	16.33
LSD	0.49	0.87	6.57	3.21
Significance	*	*	NS	NS

*, ** = Significant at 5%, 1%, respectively. NS = Not significant.

The experiment was a 3 x 3 factorial arrangement fitted into a randomized complete block design (RCBD) with 3 replications. Treatments were three sweet potatoes (TIS 87/0087, TIS 8164 and TIS 2532. OP. 1.13) cultivars intercropped with three okra (Nhae 47-4, TAE 38 and UM39) cultivars to give nine intercropped treatments. Sole component of each crop for each variety were maintained for comparison thus giving a total of 15 treatments. Each plot measured 6 x 5 m (30 m²)

Sweet potato vine cuttings measuring 20 cm with 4 nodes were planted at the crest of ridges at the spacing of 1 x 0.5 m to give 33,000 plants per hectare. Three okra seeds were sown at the side of the ridges at a spacing of 1 x 0.5 m and later thinned to one per stand to give 20,000 plants per hectare. The trial was weeded as when due. Fertilizer NPK 15:15:15 was applied on both sides of the ridge 4 weeks after planting (WAP) at the rate of 400 kg/ha (Enwezor et al., 1989)

Tender immature fresh pods of okra were harvested at intervals of 3 to 4 days starting from 8 WAP whereas sweet potato was

harvested at 16 weeks after planting when the leaves had turned yellowish and vine drying with sap exuding from mature tubers, which are sign of senescence and tuber maturity. The data collected were subjected to analysis of variance (ANOVA) according to the procedure outlined by Steele and Torrie (1980) for factorial experiment. Comparison of treatment means for significance at 5% was done using the least significant differences (LSD). The land equivalent ratio (LER) (Willey, 1979) was used to determine the productivity of the intercropping system.

RESULTS AND DISCUSSION

In both cropping seasons, TIS 87/0087 produced significantly ($P < 0.05$) higher number of tubers per plant than other cultivars which had similar values (Table 1). The presence of okra did not significantly affect tuber yield of sweet potato. Interactions of cropping system and sweet

Table 2. Effect of intercropping sweet potato and okra on okra plant height, number of pods and fresh pod yield of okra in 2000 and 2001 cropping seasons.

Treatment	Plant height (cm)		No. of pods per plant		Fresh pod yield (t/ha)	
	2000	2001	2000	2001	2000	2001
Cropping system						
Sole	67.86	61.39	8.28	7.90	3.29	3.67
Intercrop	66.87	64.83	6.09	5.39	3.24	3.68
LSD	3.12	2.58	1.32	1.38	0.12	0.54
Significance	NS	*	**	**	NS	NS
Okra cultivars						
Nhae 47-4	83.55	59.42	7.13	7.12	3.15	4.07
TAE 38	64.58	60.85	7.85	6.82	2.99	3.18
UM 38	54.10	49.00	6.57	6.60	3.75	3.32
LSD	4.01	3.15	1.62	1.68	1.47	0.71
Significance	**	**	NS	NS	NS	*
Cropping system x okra						
Sole Nhae 47-4	85.33	78.23	8.37	8.53	3.30	4.30
Sole TAE 38	65.23	57.97	8.20	8.17	2.63	3.10
Sole UM 38	53.00	47.97	8.27	7.00	3.93	3.60
Intercropped Nhae 47-4	81.77	80.60	5.90	5.70	3.00	3.83
Intercropped TAE 38	63.93	63.73	7.50	5.47	3.17	3.27
Intercropped UM 38	55.20	50.17	4.87	5.00	3.57	3.03
LSD	5.40	5.47	2.21	2.37	2.07	0.96
Significance	NS	NS	NS	NS	NS	NS
Okra x sweet potato						
Nhae 47-4 x TIS 87/0087	87.40	81.73	5.13	5.90	2.07	3.10
Nhae 47-4 x TIS 8164	76.60	75.90	7.13	3.90	3.53	4.57
Nhae 47-4 x TIS 2532 OP.1.13	81.23	84.13	5.40	7.30	3.43	3.80
TAE 38 x TIS 87/0087	63.80	63.43	7.13	7.27	3.23	3.43
TAE 38 x TIS 8164	63.33	62.60	7.30	3.20	3.47	3.20
TAE 38 x TIS 2532 OP.1.13	64.70	65.13	8.07	5.93	2.80	3.17
UM 38 x TIS 87/0087	53.83	53.57	8.03	8.27	3.43	3.07
UM 38 x TIS 8164	55.47	49.77	3.80	3.00	3.50	3.47
UM 38 x TIS 2532 OP.1.13	56.63	47.17	5.70	3.77	3.73	2.83
LSD	6.36	6.87	3.96	2.55	1.35	1.29
Significance	NS	NS	NS	*	NS	NS

*, ** = Significant at 5%, 1%, respectively. NS = Not significant.

potato cultivars significantly affected total number of tubers per plant but not tuber yield. Irrespective of okra cultivar, TIS 87/0087 intercrop produced more tubers than TIS 8164 intercrop in 2000 and 2001. In sweet potato cultivar x okra cultivar, intercropping TIS 87/0087 sweet potato with NHAe 47-4 or UM 38 okra in 2000 and TIS 87/0087 with UM 38 in 2001 gave the highest number of tubers per plant. Okwuowulu and Asiegbu (2000) and Okorie and Okpala (2000) also reported superior performance of TIS 87/0087 compared with other cultivars.

The effect of okra and sweet potato on okra plant height, number of fresh pods per plant and fresh pod yield are presented in Table 2. In 2001, intercropped okra

was taller than the sole crop. Muoneke et al. (1997) reported that the taller okra plants obtained in intercrop with maize was in a bid to display their leaves for solar radiation. Palaniappan (1985) and Olasantan and Lucas (1992) had noted that canopy height is one of the important features that determine competition 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 growth rates of the two components will be proportional to the quantity of the photosynthetically active radiation they intercepted. Among the okra cultivars, NHAe 47-4 was significantly the tallest on average, while UM38 was the shortest.

Table 3. Land equivalent ratio (LER) of okra and sweet potato intercrops in 2000 and 2001.

	Partial LER				Total LER		
	2000		2001		2000	2001	Mean
	Okra	Sweet potato	Okra	Sweet potato			
Nhae 47-4 x TIS 87/0087	0.9	1.0	0.7	1.1	1.9	1.8	1.86
Nhae 47-4 x TIS 8164	1.9	0.7	1.0	1.2	2.6	2.2	2.40
Nhae 47-4 x TIS 2532 OP.1.13	2.1	1.0	1.0	1.0	3.1	2.0	2.55
TAE 38 x TIS 87/0087	2.2	0.7	1.0	1.1	2.9	2.2	2.55
TAE 38 x TIS 8164	1.8	0.8	1.1	1.1	2.6	2.2	2.40
TAE 38 x TIS 2532 OP.1.13	1.5	1.2	1.0	0.9	2.7	1.9	2.30
UM 38 x TIS 87/0087	1.6	1.0	0.9	1.1	2.6	2.0	2.35
UM 38 x TIS 8164	1.4	.8	1.0	1.1	2.2	2.1	2.15
UM 38 x TIS 2532 OP.1.13	1.6	1.1	0.8	1.2	2.7	2.0	2.35

Intercropping okra with sweet potato significantly reduced the number of pods per plant in both years. The number of pods per plant was higher in the sole crop than intercrop by 36% in 2000 and 47% in 2001. Fresh pod yield was not significantly influenced by the cropping system. The presence of sweet potato, a planophile did not depress okra fresh pod yield probably because the sweet potato conserved soil moisture and reduced weed growth. IITA (1975), Fagbamiye (1977) and Ikeorgu (1984) had reported that melon (planophile) improved the yield of companion crops by conserving soil moisture and reducing high noon temperature, thereby making the environment more conducive for plant growth and development. Among the cultivars, however, NHAe 47-4 gave significantly higher fresh pod yield than others in 2001. The various interactions were generally not significant for okra growth and yield, except for the number of pods per plant in 2001 in which intercropping UM 38 okra with TIS sweet potato and NHAe 47-4 okra x TIS 2532.OP.1.1.3 sweet potato produced the highest number of pods whereas UM 38 x TIS 2532.OP.1.1.3 and TAE 38 x TIS 8164 had the least number of pods per plant.

The total land equivalent ratios of the sweet potato and okra mixture were all above 1.0, indicating that higher productivity per unit area was achieved by growing the two crops together than by growing them separately (Table 3). The highest LER of 2.6 was obtained by intercropping NHAe 47-4 okra with TIS2532 OP. 1. 13 sweet potato or TAE 38 okra with TIS 87/0087 sweet potato, depicting 160% yield advantage in growing those cultivars together. The high partial LER obtained for both okra and sweet potato showed that competitive pressures among the component crops were low and that both crops could be complementary in mixture. Muoneke and Asiegbu (1997) obtained similar results in okra/cowpea intercropping. Sweet potato serving as a cover crop or planophile conserved soil moisture reduced temperature and added organic matter to the soil through its leaves and these were advantageous to the mixture.

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