Niger Agric. J. 33 (2002): 50-70

EVALUATION OF NEW CASSAVA GENOTYPES FOR INTERCROPPING IN A CASSAVA – BASED SYSTEM OF SOUTHEASTERN NIGERIA.

OLOJEDE A.O[1]; O.U. OKEREKE[2]; AND J.E.G. IKEORGU[1].

1. National Root Crops Research Institute, Umudike. P M B 7006 Umuahia, Nigeria

E-mail: nrcri@infoweb.abs.net.

2. Department of Crop Science, University of Nigeria, Nsukka Nigeria.

ABSTRACT

Twenty-one cassava genotypes were screened for their intercrop performance at Umudike between 1997 and 1998 cropping seasons. The 2-year yield data were subjected to Rank-Summation Index (RSI) and Simple Regression (SR) Techniques with the view to determine the performance of the new cassava genotypes under intercrop and identify suitable cassava genotypes for maize or maize/melon intercrops. Yields of cassava under monoculture were also correlated with their yields under mix-culture.

From the RSI, 10 Cassava genotypes were found compatible with maize and melon. A linear function described the relationship between cassava fresh root yield and maize yield with a significant coefficient of determination ((R^2) = 0.889 and correlation coefficient ® of 0.94. Significant correlation was also established between sole cassava and intercropped cassava yields (r = 0.52), while a yield depression of between 20 and 60% was recorded in the cassava for the 2 years. Fitting a bi-plot, four distinct groups emerged thus; Group I – optimum performance of cassava and maize (12 genotypes), Group II – low yield of cassava and high yield of maize (5 genotypes), Group III – High yield of cassava and low yield of maize (3 genotypes) and Group IV – low yield of both cassava and maize (1 genotype). Most genotypes identified as being compatible for intercropping by the 2 techniques were similar except in few cases.

INTRODUCTION

Mixed cropping is a common practice among the peasant, resource-poor farmers in the tropics (Mutsaers et al., 1986; Okigbo and Greenland, 1976). The practice evolved as a result of attempts by the farmers to mimic the multistory/multispecies concept that characterizes the tropical agroecologies. The practice is not only socio-economically sound but also environmentally balanced (Ikeorgu et al., 1984; Mutsaers et al., 1993; Harwood and Price, 1975; Osiru and Willey, 1972, Osiru, 1982).

In Southeastern Nigeria, 88% of the farmers practice intercropping in which 2-

5 crops are combined in complex mixtures (Unamma et al., 1985; Odurukwe et al., 1996). Cassava (Manihot esculenta Crantz) is a major staple food crop in this area. It constitutes about 93% of the major starch staples. Cassava is widely accepted by the local farmers and this is attributed to its width of ecological amplitude, such as its adaptability to a wide variety of ecological and agronomic conditions (Carter et al., 1992). The farmers in this zone rarely plant cassava alone. About 50% of cassava grown by farmers is intercropped with maize, egusi-melon (Colocynthis vulgaris L) and leafy vegetables (Unamma et al., 1985; Odurukwe et al., 1996).

Attempts to improve on intercrop productivity in recent years through varietal selection for intercropping have resulted in huge turn out of some improved cassava cultivars from NRCRI/IITA collaborative Breeding Programs. However, most of these cultivars were developed and tested under sole crop condition and have not been evaluated for their intercrop compatibility. Currently, the farmers adopt very few improved cassava genotypes. This is due to the shading effect of the improved cassava cultivars on component crops when intercropped as a result of their profuse branching habit. This has consequently resulted in yield reduction of both component crops and the total system productivity. This study was therefore set up to evaluate the performance of these newly developed cultivars with a view to identifying suitable genotypes amenable to maize/melon intercrops and also ascertain the yield relationship between sole and intercropped cassava.

MATERIALS AND METHODS

The field studies were conducted at National Root Crops Research Institute, Umudike Nigeria (05^0 29' N, 07^0 33' E) in 1997 and 1998. In 1997 nineteen new cassava genotypes were screened under intercropping system with a local variety as a check; while in 1998 a widely adopted, improved variety – TMS 30572 was added as an improved check for comparison. The new genotypes comprise 10 TMS and 9 NR series from NRCRI/IITA Breeding Programmes. Out of the 19 genotypes 8 were of low cyanogenic and 11 high cyanogenic potentials. The cassava genotypes were intercropped with a popular local maize variety (Bende White) and local egusi-melon (serewe) to serve as weed suppressant.

The experiment was planted in a randomized compete block design (RCBD) with a split block arrangement and 3 replications. Sole cassava and intercropped cassava were assigned main plots and genotypes subplots. Cassava and melon wee planted at 1 m x 1 m spacing on the crest with melon in-between two cassava plants. Maize was planted at 1 m x 0.5 m on one side of the ridges. All crop components were planted about the same time in the two years. The plot size was made of 4 ridges measured 5 m long (20 m^2) with total land area of 0.34 ha in 1997 while in 1998, 6 ridges of 4 m length were used to allow for sampling at months after planting (MAP) for plant vigour determination.

The land was ploughed, harrowed and ridged before planting. The plots were made weed free throughout the experimental period manually using weeding hoes. Karate and Furadan were applied at their respective recommended rates to check leafhoppers and stem borer in melon and maize respectively in 1997 being late season planting. Compound fertilizer was applied 3 weeks after planting (WAP) on maize and 8 weeks after planting (WAP) on cassava using 400kg of NPK 20:10:10/ha (80kg N, 40kg P, 40kg K).

Data were collected on, % establishment (2 WAP for maize and melon and 4 WAP

for cassava), primary shoot no./stand, plant height, leaf area, chlorophyll fluorescence and % photosynthetic active radiation (PAR) intercepted by cassava genotypes at 3 MAP (the last two data were collected only in 1997). Fresh tuber yield and yield components of cassava were determined at 12 MAP, while maize and melon were harvested at 4 MAP. All data collected on cassava were subjected to analysis of variance (ANOVA) for Split Block Design and that of maize and melon analyzed using analysis of variance (ANOVA) for RCBD using the MSTATC statistical package. Significant means were separated using standard error of the means. Compatibility of cassava genotypes for intercropping was determined using the Rank Summation Index – RSI (Mulumba and Mock, 1978; Dixon et al., 1994, Mba and Dixon, 1995) and simple regression of cassava tuber yield against maize yield (David and Garcia, 1983). The calculation was based on the 2-year average of actual intercrop yields of the three components for the two methods. For the RSI, the performances of individual crops in the intercrops were ranked and summed to obtain the RSI and a position assigned in ascending order starting with least RSI. Also the partial Land Equivalent Ratio (LER) and mean LER (i.e. intercrop yield/sole crop yield) for the three crop components were also calculated for comparison. For the purpose of this paper only data on cassava fresh tuber, maize and melon yields and % photosynthetic active radiation (PAR) are presented and discussed.

RESULTS AND DISCUSSION

Root Number/Stand.

Root number per stand differed significantly ($P<0.05$) among the genotypes in the two years (Table 1). Both cropping system and interaction effects were not significant on root number. In 1997, root number/stand ranged between 3.82 and 7.32 under sole cropping. NR 8420 recorded the least and TMS 82/00033 recorded the highest. Under intercrop, root number ranged between 2.92 and 8 14. TMS 90257 recorded the least and NR 8082 recorded the highest. In 1998, root number/stand ranged between 2.69 in NR 8420 and 6.50 in TMS 82/00033 under sole as against 2.73 in NR 8420 and 7.11 in TMS 82/00661 under intercropping. NR 8420 showed consistency in low root number in the two years. There was a non-significant depression (0.51) in the mean root number under intercrop as compared to sole crop conditions in 1997. However, non-significant increase (0.78***) was recorded over sole crop in 1998. The genotype mean root number across cropping systems ranged between 3.81 and 7.38 in 1997 as against 2.71 and 6.28 in 1998. Using the average value for the two years, significant correlation ($r = 0.68$***) was established between root number under sole and fresh tuber yield under the intercrop condition.

Root number has been identified as one of the indices for selecting cassava for high yield performance under sole crop condition (Dixon *et al.*, 1994). However, significant correlation between root number under sole crop and tuber yield under the intercrop in this study, suggests that root number under sole crop could also be used as selection index for cassava tuber yield performance under intercrop condition.

Average Root Size (g/root).

Root size ranged between 300g and 556.5g in sole as against 341.4g and 629.6g in intercrop in 1997 (Table 2). In 1998, the range was between 344g and 690g in sole as against 346 and 728g in the intercrop. TMS 30474 recorded the least tuber size among the genotypes in 1997 while TMS 91934 recorded the least in 1998. An increase in root size was recorded under intercrop in 1997 while a decrease was recorded in 1998.

Table 1. Effect of Intercropping on Root Number per Stand in 1997 and 1998

	1997			1998		
Genotype	Sole	Intercrop	Mean	Sole	Intercrop	Mean
NR 8230 (B)	6.14	3.03	4.59	2.70	4.00	3.35
" 8420 (S)	3.82	3.92	3.87	2.69	2.73	2.71
" 84104 (S)	4.94	4.58	4.76	4.06	4.68	4.37
" 84292 (S)	4.56	4.42	4.49	2.94	3.09	3.02
" 8083 (B)	6.73	5.44	6.09	2.98	4.31	3.64
" 84151 (S)	4.69	4.83	4.76	4.63	4.82	4.72
" 8082 (B)	6.72	8.14	7.38	6.42	5.07	5.74
" 8220 (B)	4.92	5.14	5.03	4.27	5.63	4.95
" 8212 (B)	4.44	3.67	4.06	3.94	4.72	4.33
TMS 1095-D(B)	5.62	6.16	5.89	4.45	5.25	4.85
" 82/00447 (S)	5.20	5.28	5.24	5.65	4.71	5.18
" 82/00058 (B)	5.62	6.16	5.89	4.45	5.25	4.85
" 30474 (S)	4.50	5.25	4.88	3.00	5.36	4.18
" 7176 2(S)	5.04	5.00	5.02	4.29	5.49	4.89
" 90257(B)	4.70	2.92	3.81	5.09	5.17	5.13
" 82/OOO33 (S)	7.32	5.65	6.48	6.51	6.04	6.28
" 82/00661(B)	5.42	5.47	4.45	3.38	7.11	5.25
" 82/0010(B)	5.26	4.33	4.80	3.73	4.89	4.31
" 91934 (B)	4.70	3.57	4.13	5.71	6.15	5.93
" 30572 (B)	-	-	-	3.16	4.39	3.77
" LOCAL (B)	4.89	3.69	4.29	5.11	5.56	4.33
MEAN	5.24	4.73	-	4.17	4.95	-

SE for Cropping System 0.18(NS) 0.20(NS) " " Genotypes 0.58(*) 0.55(*)" Interaction 0.82(NS) 0.78(NS")Note: S = Sweet; B = Bitter; NS = Not Significant; *=Significant at 5%

Cropping system, genotype and interaction effects were not significant on root size in the 2 years. Root size is genetically controlled in cassava (Dixon *et al.*, 1994), hence the differences reported among the genotypes. Genotypes of low cyanogenic potential (sweet varieties) have smaller root size as compared to genotypes of higher cyanogenic potentials, which probably explain why "sweet" cassava varieties are characteristically low yielding.

Cassava Fresh Tuber Yield (t/ha.)

Significant yield differences were recorded among the genotypes in 1997 and 1998 (Table 3). Cropping system was not significant in both years. However, interaction between genotypes and systems was significant in 1997 but not in 1998. Fresh tuber yield ranged between 1.17 t/ha and 27.9 t/ha under sole as against 4.09 t/ha and 26.4 t/ha under intercrop in 1997. In 1998, a yield range of 4.81 t/h and 22.1 t/ha was recorded under sole as against 6.46 and 25.2 t/ha under intercrop. Genotype mean yield ranged from 2.63 t/ha in TMS 30474 and 27.2 t/ha in NR 8082 in 1997 while in 1998, the range fell between 5.64 t/ha in NR 84292 and 23.5 t/ha in TMS 71762. Non-significant yield depression was recorded under the intercrop in 1997 as against yield increase in 1998. About 60% and 20% of the genotypes recorded yield depression in 1997 and 1998 respectively. Low NCN genotypes reacted the same way as their high NCN counterparts, likewise the two checks used, although the low HCN genotypes generally yields low as compared to high HCN varieties.

Genotype	Sole	1997 Intercrop	Mean
NR 8230(B)	438.1	566.1	502.1
" 8420(S)	556.5	506.5	531.5
" 84104(S)	440.7	478.0	459.4
" 84292(S)	402.9	436.7	419.8
" 8083(B)	401.3	494.4	447.9
" 84151(S)	551.0	427.3	489.2
" 8082(B)	477.9	346.7	412.3
" 8220(B)	412.2	341.4	376.8
" 8212(B)	488.1	512.7	500.4
TMS 1095-D(B)	514.6	548.7	531.6
" 82/00447(S)	474.7	447.9	461.3
" 82/00058(B)	330.9	397.2	364.1
" 30474(S)	300.0	322.1	311.1
" 71762(S)	448.0	585.9	516.9
" 90257(B)	432.0	629.6	530.8
" 82/00033(S)	413.0	473.5	443.3
" 82/00661(B)	371.2	504.9	438.1
" 82/0010(B)	517.5	583.3	550.4
" 91934(B)	512.9	494.6	503.7
" 30572(B)	-	-	-
" LOCAL (B)	284.9	376.9	330.9
MEAN	438.4	473.7	-

SE for Cropping System23.0 (NS) 0.03(NS)
" " Genotypes 56.2(*) 0.07(*)
" " Interaction 79.5 (NS) 0.10(NS)
Note: S = Sweet; B = Bitter; NS = Not Significant; *=Significant at 5%

Table 3. Effect of Intercropping on Cassava Fresh Tuber yield (t/ha.) in 1997 and 1998

Genotype	Sole	1997 Intercrop	Mean	Sole	1998 Intercrop	Mean
NR 8230(B)	19.6	14.8	17.2	8.13	11.4	9.76
" 8420(S)	27.5	14.8	21.2	9.87	7.67	8.77
" 84104(S)	17.0	14.2	15.6	14.9	21.8	13.4
" 84292(S)	6.61	6.75	6.68	4.81	6.46	5.64
" 8083(B)	18.4	17.3	17.8	10.5	15.5	13.0
" 84151(S)	12.5	14.6	13.5	16.2	16.4	16.3
" 8082(B)	27.9	26.4	27.2	15.9	25.2	20.5
" 8220(B)	18.4	16.2	17.3	11.9	13.9	12.9
" 8212(B)	16.1	15.0	15.5	12.9	13.9	13.4
TMS 1095-D(B)	16.5	10.2	13.4	16.8	11.3	14.1
" 82/00447(S)	15.0	19.9	17.4	14.7	18.3	16.5
" 82/00058(B)	10.8	12.0	11.4	9.77	18,0	13.9
" 30474(S)	1.17	4.09	2.63	6.79	8.17	7.48
" 71762(S)	13.6	19.5	16.5	22.1	24.9	23.5
" 90257(B)	16.8	8.42	12.6	20.5	23.0	21.8
" 82/00033 (S)	21.1	18.3	19.7	16.2	16.0	16.1
" 82/00661(B)	16.7	31.4	24.0	13.9	15.5	14.7
" 82/0010(B)	14.1	23.5	18.8	13.5	10.6	12.0
" 91934(B)	16.7	15.2	15.9	17.8	19.1	18.5
" 30572(B)	-	-	-	12.2	13.9	13.1
" LOCAL (B)	17.7	10.2	13.9	4.87	8.02	6.45
MEAN	16.2	15.6	-	13.1	15.2	-

SE for Cropping System 1.08(NS) 1.63(NS)
" " Genotypes 2.34(*) 1.76(*)
" " Interaction 3.31(NS) 2.94(NS)
Note: S = Sweet, B = Bitter, NS = Not Significant, *=Significant at 5%

The higher but non-significant yield reported under intercrop as against sole crop is in agreement with Ikeorgu et al., (1984). The yield difference was ascribed to modified soil micro-environment such as reduced temperature, increased water holding capacity and microbial activities which result in high nutrient turn-over thus favouring the growth and performance of cassava inn the multiple species. Significant correlation (r= 0.58***) established between sole crop yield and intercrop yield in the 2 years confirm the report of Osiru and Ezumah (1993). They reported significant correlation between sole crop and intercrop yields of cassava with v-value of 0.94. Although the coefficient of correlation between sole and intercrop yields appeared relatively low in this case, the practical significance in breeding is the possibility of using the sole crop performance as an index of selecting genotypes for intercropping.

Table 4. Maize and Melon Yields (kg/ha) in 1997 and 1998 with Photosynthetic active Radiation (% PAR) intercepted by cassava at 3 MAP in 1997.

Genotype	% PAR	Maize Yield			Melon Yield		
		1997	1998	Mean	1997	1998	Mean
NR 8230(B)	60.3	168.8	890.4	443.8	223.3	5.75	114.5
" 8420(S)	63.2	581.3	843.8	712.6	185.0	7.11	90.1
" 84104(S)	64.6	318.8	781.2	550.0	145.8	10.9	78.3
" 84292(S)	51.7	675.0	796.9	790.7	185.0	17.7	101.4
" 8083(B)	63.9	312.5	1250.0	781.3	191.7	18.4	105.1
" 84151(S)	62.5	550.0	515.7	657.8	137.5	2.79	70.1
" 8082(B)	73.1	137.5	867.2	420.3	163.3	7.36	85.3
" 8220(B)	59.3	412.5	1015.5	714.0	175.0	4.55	89.8
" 8212(B)	50.9	1031.3	515.6	921.9	131.7	4.27	67.9
TMS 1095-D(B)	65.7	437.5	679.7	671.9	167.5	2.63	85.1
" 82/00447(S)	64.6	356.3	1109.4	732.9	196.7	1.73	99.2
" 82/00058(B)	71.1	1293.8	1125.0	1209.1	62.5	21.5	42.0
" 30474(S)	65.8	468.8	968.8	718.8	195.0	7.52	101.3
" 71762(S)	71.7	437.5	1265.7	695.3	198.3	10.9	104.6
" 90257(B)	61.6	693.8	890.6	737.7	151.7	8.83	80.3
" 82/OOO33(S)	70.9	250.0	1031.3	640.7	171.7	15.1	93.4
" 82/00661(B)	72.8	281.3	1007.8	554.7	200.0	11.8	105.9
" 82/0010(B)	56.4	787.5	796.9	846.9	188.5	3.98	96.2
" 91934(F)	58.6	1106.3	773.5	1014.1	225.7	4.71	115.2
" 30572(B)	-	-	1054.7	-	-	8.74	8.74
" LOCAL (B)	61.5	600.0	734.4	667.2	217.5	4.65	110.1
MEAN	3.95	81.3	87.7	-	26.0	41.4	-

Maize and Melon Yield (Kg/ha).

Maize and melon yields vary significantly (P<0.5) among the genotypes (Table 4). Maize yield ranges from 137.5 kg/ha (NR 8082) to 1293.8 kg/ha under TMS 82/00058 in 1997 as against a range of 515.6 kg/ha under NR 8212 and 1255.7-kg/ha under TMS 71762 in 1998. Cassava canopy architecture determines to a large extent the performance of component crops in association with cassava. Hence, the low yield of maize reported under the dense canopy, heavily and profuse branching NR 8082 as against the sparse canopy and moderate branching TMS 82/00058. For melon, yield ranged from 62.5 kg/ha in TMS 82/00058 to 225.7 kg/ha under TMS 91934 in 1997 as against 1.73 to 21.50 kg/ha in 1998. Melon yield in 1998 was very low as compared to performance in 1997. This was due to

early high rainfall experienced during the growth period as melon is highly sensitive to waterlogged condition. Because maize and melon have the same growth duration, a close interaction was recorded as a result of completion for limited growth resources especially light. Maize being a dominant crop in the mixture affected both the growth and yield of melon. Based on two-year average, a significant inverse correlation (r = -0.71 ***) was established between maize and melon yields. This is probably due to the effect of maize on melon, which is susceptible to shading.

Table 5. Actual intercrop Yield of Cassava (t/ha), maize (kg/ha), melon (kg/ha), Rank-Sum Index and LER based on 2-year average for 1997 and 1998.

Genotype Yield	Tuber LER	Partial yield	Maize yield	Melon Index	Rank-Sum	Position LER	Mean
NR 8230 (B)	13.1(16)	1.04	443.8(20)	114.5(2)	38	15th	0.80
" 8420 (S)	11.2(17)	0.72	712.6(12)	90.1(12)	41	18th	0.78
" 84104 (S)	18.0(5)	1.09	550.0(19)	78.3(17)	41	18th	0.94
" 84292 (S)	6.61(20)	1.06	790.7(6)	101.4(7)	33	7th	1.41
" 8083 (B)	16.4(9)	1.08	781.3(7)	105.1(5)	21	2nd	1.13
" 84151 (S)	15.5(11)	1.17	657.8(16)	70.1(18)	45	2oth	0.79
" 8082 (B)	25.8(1)	0.90	420.3(21)	85.3(14)	36	11th	0.72
" 8220 (B)	15.1(11)	0.89	714.0(11)	89.8(13)	36	11th	0.78
" 8212 (B)	14.5(14)	0.92	921.9(4)	67.9(19)	37	13th	0.82
TMS 1095-D (B)	10.8(18)	0.87	671.9(14)	85.1(15)	48	21st	0.72
" 82/00447 (S)		1.15	732.9(9)	99.2(9)	22	3rd	0.85
" 82/00058 (B)	19.1(4)	1.45	1100.1(1)	42.0(20)	34	8th	1.31
" 30474 (S)	15.1(12)	1.69	718.8(10)	101.3(8)	39	17th	1.12
" 71762 (S)	6.13(21)	1.78	695.3(13)	104.6(6)	22	3rd	1.20
" 90257 (B)	22.2(3)	0.92	737.7(8)	80.3(16)	34	8th	0.86
" 82/OOO33 (S)	15.7(10)	0.92	640.7(17)	93.4(11)	34	8th	0.95
" 82/00661 (B)	17.2(6)	1.54	554.7(18)	105.9(4)	24	6th	1.09
" 82/0010 (B)	23.5(2)	1.69	846.9(5)	96.2(10)	23	5th	1.09
" 91934 (B)	17.1(8)	0.98	1014.1(3)	115.2(1)	10	2st	0.96
" 30572 (B)	17.2(6)	1.49	1054.7(2)	8.74(21)	38	15th	1.07
" LOCAL (B)	9.11(19)	1.43	667.1(15)	110.1(3)	37	13th	0.99

Note: Ranks in Parentheses.

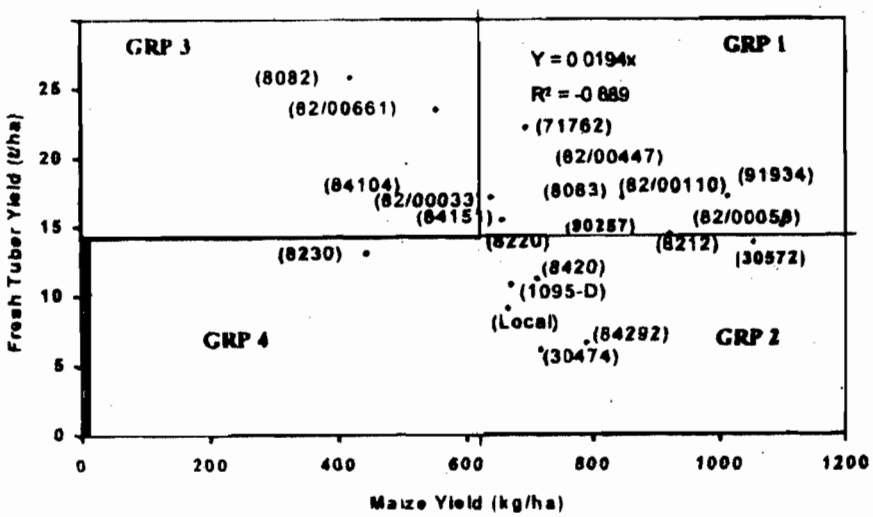
Intercrop Performance.

The rank-summation index and the mean LER computed from two-year average of intercrop yields are presented on Table 5. For the cassava intercrop performance over 2 years, NR 8082 occupied the top position and TMS 30474 the last. Eleven cassava genotypes gave a higher yield over their sole yield with partial LER of cassava ranging from 0.72 in NR 8420 to 1.78 in TMS 71762. Maize yielded better under TMS 82/00058 while the least was recorded under NR 8082. For melon, the highest yield was obtained under TMS 91934 and the least was obtained under TMS 30572. Using the rank summation index based on the actual yields of the three component crops. TMS 91934 came first and TMS 1095-D came last.

The mean Land Equivalent Ratio (LER) calculated from the partial LER for the 3 components range from 0.72 in NR 8082 t0 1.41 in NR 84292. Although LER has been the simplest and most extensively used tools in evaluating intercrop performance, it is defective in over estimating intercrop advantage in situation where there is considerable difference in growing cycle of the component crops (Hiebsch and McCollum, 1987; Fukai, 1993). Furthermore, it has been observed that farmers are more concerned with the

absolute crop yields, hence, the rank summation index (Mulumba and Mock, 1978; Dixon *et al.*, 1994: Mba and Dixon, 1995) and regression of the intercrop performance (Davis and Gracia, 1983) could then be more appropriate in selecting genotypes that are amenable to intercropping. These methods have an over ridding advantage of selecting genotypes that will give moderate yield across the components without jeopardizing the yield of any crop within the system as against the LER.

Fig 1: Relationship between fresh cassava Tuber Yield (t/ha) and maize yield (kg/ha) averaged over 2 years (cassava genotypes in parenthesis)



On the basis of RSI, best top 10 genotypes for intercropping in descending order are: TMS 91934, NR 8083, TMS 82/000447, 71762, 82/00110, 82/00661, NR 84292, TMA 82/00058, 90257 and 8/00033. With the exception of TMS 82/00661, 71762, 82/00058 and 82/00033 which have high percentage of PAR in the order of 72.8, 71.7, 71.1 and 70.9 respectively, others had moderate light interception at 3 MAP ranging from 51.7% to 64.6% PAR (Table 4). Using a regression method and having a scatter plot of the tuber yield on maize yield, a linear function describing the relationship was developed with a significant negative coefficient of determination-R^2=-0.889 (r =0.94). The prediction equation was:

y=0.0194x,

where y=cassava tuber yield in tons/ha and

x = maize yield in kg/ha.

Fitting a bi-plot on the scatter plot, four distinct groups were obtained: Group I – optimum performance of cassava and maize (12 genotypes), Group II, - low yield of cassava and high yield of maize (5 genotypes), Group III-high yield of cassava and low yield of maize (3 genotypes) and Group IV –low yield of both cassava and maize (1 genotype) –Fig. 1. Genotypes found in Group I are similar to those identified by the enlarged rank-sum method except for one or two genotypes.

CONCLUSION.

Considering the 2-yeae results, most of the genotypes tested showed moderate degree of yield depression under intercropping

system. Likewise the yield reduction of intercropped maize and melon as a result of intercropped cassava a re within the economic threshold except for some genotypes Most of the new genotypes tested are quite compatible or amenable to cassava/maize/melon intercrop. They also had moderate light interception within their canopies. Ten genotypes based on the rank summation index of the three component crop yields in descending order are TMS 91934, NR 8083, TMS 82/000447, 71762, 82/00110, 82/00661, NR 84292, TMS 82/0058, 90257 and 82/0033. This was also confirmed by the regression/bi-plot method with the exception of slight differences; however, the regression bi-plot method has the added advantage in offering the opportunity of selecting genotypes based on farmers' production objectives

REFERENCES.

Carter, S.E. Fresco, L. O. Jones, P. G., and Fairbarin J. N. 1992. An Atlas of cassava In: Africa: Historical, agro ecological and demographic aspects of crop distribution. Cali. Colombia: Centro International de Agricultural Tropical (CIAT).

Davis, J.H.C. and Gracia, S. 1993. Competitive ability and growth habit of indeterminate beans and maize intercropping. Field Crops Res., 6;59-75.

Dixon A.G.O., Asiedu R. and Hahn S. K. 1994. Genotype stability adaptability: analytical methods and implications for cassava breeding for low-input agriculture. Proceeding of the 9th Symposium of the International Society for Tropical Root Crops. 20-26 October 1991. Accra Ghana.

Fukai, S. 1993. Introduction: Intercropping-bases of productivity. Field Crops Res., 34: 239-245.

Harwood, R.R, and Price, E.C. 1975. Multiple Cropping in Tropical Asia. In. Multiple Cropping Symp. (Proc.) Amer. Soc. Agron., Meeting, Knoxville, Tennessee, 24-28 August, 1975.

Hiebsch, C. k. and Mc Collum, R. F., 1987. Area x Time Equivalent Ratio: A method of evaluating the productivity of intercrops. Agron. J., 79;15-22.

Ikeorgu J. E. G. 1984. Some micro-environmental changes under cassava (Manihot esculenta Crantz) – Maize (Zea mays L.) intercrops grow with okra (*Abelmoschus esculentus* L.) and 'Egusi-melon (Colocynths vulgaris L.) Ph. D Thesis, University of Ibadan.

Ikeorgu, J. E. G., Wahua, T. A. T. and Ezuma, H.C. 1984. Crop performance of complex mixtures, melon and okra in cassava-maize mixture. Proc. 2nd ISTRC-AB Symp. Douala Cameroon. Terry et al (eds) IDRC-221e pp 3 – 66,

Mba R. E. C. and A. G. O. Dixon. 1995. Correlation studies among yield and various stability parameters and an enlarged rank-sum method for identifying high yielding, stable cassava clones. In. Root Crops and Poverty alleviation. (Eds.) M. O. Akoroda and I. J. Ekanayake. Proc. 6th Symp. ISTRC-AB, 22-28 October 1995, Lilongwe, Malawi, pp261-266.

Mulumba N.N and Mock J.J. 1978. Improvement of yield potential of the Eto Blanco maize (Zea mays L). Population breeding for plant traits. Egyptian J. Genet. Cytol. 7:40-51.

Mutsaers, H. J. N., Fisher, N. M., Vogel, W.O, and Palada, M.C. 1986. A field guide for on-farm Research Farming Systems IITA, Ibadan.

Mutsaers, H. J. N., Ezumah H. C., and Osiru, D.S.O. 1993. Cassava-based intercropping: a review. Field Crops Research, 34: 431-457.

Odurukwe, S.O., A. Udealor, J.E.G. Ikeorgu, F.O. Anuebunwa and A.W. Iloka. 19956. Diagnostic survey of Farming Systems in Southeastern States ADPs: A REFILS Project of NARP, NRCRI, Umudike.

Okigbo, B.N., and Greenland. D.J. 1976. Intercropping Systems in Tropical Africa. In: Multiple Cropping Symposium. (Proc.) American Society of Agronomy Annual Meeting, Knoxville. Tennessee. 24-29, 1975.

Osiru, D.S.O., and Willey, R.W. 1972. Intercropping: a review of the possible advantage. In: Proc. Indian Statistical Institute Golden Jubilee Int. Conf. Frontiers of Research in Agriculture (ed.) S.K. Roy. Calcutta. Sept. 27-Oct. 1st, 1972.

Unamma, R.P.A., Odurukwe S.O., Okereke H.E., Ene L.S.O. and Okoli O.O. 1985. Farming: A Bench mark survey of the Farming Systems of the Eastern Agricultural Zone of Nigeria. ARRLS, Umudike, Nigeria.