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USE OF EGUSIMELON *(Citrullus lanatus Thunb.)* TO IMPROVE THE PRODUCTIVITY OF YAM MINISETT/MAIZE INTERCROP

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ABSTRACT

Studies aimed at harnessing the usefulness of egusi melon *(Citrullus lanatus* Thunb.) (henceforth simply referred to as melon) to improve the productivity of yam minisett/maize intercrop, were conducted in 1997 and 1998. The objective was to determine the effects of planting yam minisett earlier than recommended under a melon cover on seed yam and component crop yields. Melon, with or without maize, was planted first in mid-April in 1997 and 1998 and 25g yam minisetts were introduced at same time as melon (0), and at 14 and 28 days after planting (DAP) melon in 1997 and 1998. Melon population was 40000/ha in 1997 but was reduced to 20000 in 1998. Yam minisett population was kept at 40000/ha and that of maize at 20000/ha. Intercropping and time of introducing the minisetts significantly depressed seed yam yields in 1997 but only time of minisett introduction reduced seed yam yields in 1998 when melon population was reduced to 50%. Seed yam yields from yam minisett introduced same time (3.69t/ha and 3.70t/ha)) or 14 days after planting melon (DAPM) [3.10t/ha and 2.58t/ha) did not differ at 5% level but those planted 28 DAPM (1.26t/ha and 1.20t/ha) gave significantly low seed yam yields in 1997 and 1998 respectively. This study showed that yam minisetts could be introduced to melon/maize plots at same time or not later than 2WAPM.

INTRODUCTION

The yam minisett technology was developed about two decades ago by the National Root Crops Research Institute (NRCRI) Umudike in 1981 (Okoli *et al;* 1982) to address the constraint of scarcity and high cost of seed yams. Although the technology has been proven to be efficient in massive production of planting setts, farmers' feed back about a decade after (Ogbodu, 1995), showed that adoption rate was still below 40% as was confirmed by a team of investigators (Anuebunwa *et al.*1998). Reasons for the low adoption include the fact that the technology was developed under sole cropping system whereas most farmers in the humid tropics preferred intercropping (Unamma *et al.* 1985). Efforts have been made to identify compatible crops in intercrop with yam minisetts (Ikeorgu et al, 1998). The importance of melon in conserving soil moisture and reducing supra-optimal soil temperatures early in the growing season, earlier reported by Ikeorgu and Ezumah (1991), suggests the crop's suitability for intercropping with yam minisetts. However this planophyll has not been properly integrated into the yam minisett production system mainly because it is recommended that yam minisetts be planted when the rains are steady which is about mid-May, at which time it would be late to plant melon. The benefits of intercropping with egusi melon could possibly be harnessed by adjusting the planting sequence of yam minisetts. Where melon and okra were intercropped with maize and two cassava morphotypes (Ikeorgu,1991), the yield of the vegetables were better under sparce-canopy cassava and maize than those with higher leaf area index(LAI). Since yam minisetts generally have low LAI, it is expected that melon would improve the productivity of the system if proper planting sequences were observed. This study was therefore carried out to determine the performance of yam minisetts planted earlier than recommended under a under a melon cover, on component crop yields.

MATERIALS AND METHOD

The trial was conducted at the National Root Crops Research Institute Umudike research farm in 1997 and repeated in 1998. Umudike ((5° 29'N; 7° 33'E and 122m above sea level) is located in the humid rain forests of tropical West Africa with annual rainfall of over 2000mm bimodally distributed over 7-8 months of the year with peaks in July and September. Soil in the trial site is an Typic paleudult, poor in total N but medium to low in P and K. Local egusi melon used in this trial (*serewe)* was purchased from a nearby market while the maize variety TZSR-W was originally collected from IITA Ibadan but was multiplied for this trial. Yam minisetts (25g) were cut from *D. rotundata* (cultivar Obioturugo) according to the procedure described by Okoli *et al* (1982). These three crops were combined to form four cropping systems treatment combinations: sole yam minisett; yam minisett/maize; yam minisett/melon and yam minisett/maize/melon and three sequences of yam minisett introductions to already established melon (same day with melon {0 days after planting melon-DAPM}; 14 DAPM and 28 DAPM). These were laid out in a split plot arrangement of randomised complete blocks design and replicated three times in both 1997 and 1998, respectively.

Land preparation and planting

The land was ploughed and harrowed and 1m ridges made. The melon and maize components with the first set of yam minisetts (0 days after planting melon-DAPM) were planted on 2nd April 1997. The other minisett introductions were at 14 and 28 DAPM, respectively. Melon and maize were planted at 40000 and 20000 plants/ha, respectively. The yam minisetts were planted on the crest of the ridges and spaced 25cm apart while the maize (2seeds/hill) were planted on one side of the ridge and spaced 1m apart. Melon (2 seeds/hill) was planted on both sides of the ridge and spaced 1m apart in 1997. In 1998, planting was delayed by 5 days and the melon component reduced to 20,000 /ha by planting 2 seeds/hill on one side of the ridge because melon at the higher population of 40,000/ha was observed to smother the later minisett introductions. A sole yam minisett plot was established at each planting sequence to serve as control.

Cultural Management

Plots without melon were weeded thrice at 3,8 and 12 weeks after planting (WAP) while those with melon were weeded at only 3 and 12 WAP because the melon component completely covered the soil between 6 and 10 WAP and saved the second weeding. Compound fertilizer (15-15-15; 600kg/ha) providing 60kgN, 26kgP and 50kg K ha^{-1} was applied to each plot in split application of 3 WAP to maize and melon and 12 WAP to yam minisetts. The yam minisetts were staked with 1.50m split bamboos using the pyramid staking method, as soon as the yam vines were up to 30cm high (at two minisetts to one split bamboo). Data were taken on yam minisett establishment at 10 WAP, stand count at harvest and yield of melon maize and yam minisetts at harvest.

Analysis of variance for split-plot arrangement of randomised complete blocks design was used to assess treatment effects with the aid of the SAS computer software. Means were compared by Fisher's Least Significant Difference at 5% level. Calorie productivity was calculated using FAO (1968) Food Composition Tables for Africa.

RESULTS AND DISCUSSION

1.Plant establishment

The mean sprout count of yam minisetts at 10 WAP and the final stand count at harvest are presented in Table 1. Intercropping did not significantly affect the number of minisett sprouts at 10 WAP, but sprouting was adversely affected by introducing yam minisetts into melon later than 14 days after planting melon. This trend was confirmed by the data from stand count at harvest. This work also indicated that yam minisetts introduced into maize/melon 14 DAPM* performed better than earlier and later introductions.

2. Egusi melon yields

The dry seed yield of melon in the various crop combinations and sequences for the two years of this study are presented in Table 2. There were no significant yield differences among the melon means. This was expected because the melon component in plots with melon, was planted on the same day. This result therefore suggests that neither yam minisetts nor maize grown in combination with melon significantly depresses melon seed yield. Melon seed yields in 1997 were higher than those in 1998 because the melon population used in 1998 was 50% of that in 1997. This was to minimize interspecific competition observed in 1997.

3. Maize grain yields

The grain yield of maize intercropped with melon and or yam minisetts are shown in Table 3. No significant yield differences were observed among the means but maize yields increased with delay in introduction of yam minisetts. It was interesting to observe that maize grain yield in maize/melon/ yam minisett where the minisetts were introduced 14 days after the maize/melon (1.27 t/ha) was the highest maize yield obtained. It is suspected that the melon component must have contributed in some way to improved maize yield. Ikeorgu et al (1989) had earlier shown that the presence of vegetables such as melon and okra did not depress maize or cassava yields but helped to improve total productivity of the intercrop system.

4. Seed yam yields

Seed yam yields from yam minisetts intercropped with maize and melon in three sequences in 1997 and 1998 are presented in Table 4. In 1997, both intercropping and sequence of yam minisett introduction significantly depressed seed yam yield but there was no cropping system x sequence interaction. Seed yam yields from sole yam minisetts (5.86 t/ha) was depressed by over 50% by intercropping with maize or melon. But where both melon and maize were intercropped with yam minisett at the same time, the yield depression was 31.7%. This indicates that interspecific competition between maize and melon may have reduced their competitive effects on the yam minisetts and may explain some factors responsible for intercropping advantage. Seed yams produced from minisetts planted on the same day did not differ from those planted 14 DAPM but differed significantly from those planted at 28 DAPM. This indicates that early planting of sole or intercropped yam minisetts will enhance higher tuber yields.

Intercropping did not have any significant depressive effect on seed yam yields in1998. Seed yam yields from minisetts planted at the same time with melon and those planted 14 days after melon/maize did not differ significantly, but those planted 28 days after melon differed from those planted on the same day with melon. Therefore best time to introduce yam minisett to egusi melon/maize intercrop is either at the same time or not later than two weeks after the melon had been planted.

5. System productivity expressed in energy values.

Two-year system productivity of the yam minisett/melon/maize intercrop expressed in energy values, are presented in Table 5. Intercropping system generally yielded higher calories than sole cropping. This had earlier been observed by several investigators (Okigbo and Greenland, 1976; Willey, 1979; Wahua and Miller, 1978 and Ikeorgu et al. 1989). This work also shows that maize and melon are a compatible intercrops of the yam minisett. Maize had been reported as the most dominant intercrop of root and tuber crops and egusi melon has also been shown to improve the performance of associated intercrops (Ikeorgu et al. 1989). In 1997, system productivity was highest in yam minisett/ maize/melon intercrop where the minisetts were introduced 28 days after melon, but in 1998 when the melon population was reduced by 50%, system productivities were highest in both yam minisett/maize/melon 0 WAPM and 14 WAPM, respectively. The implication of these results is that the higher maize (1.27 t/ha) and egusi melon (about 1.00 t/ha) yields were to compensate for the low seed yam yields in 1997 while in 1998, the three crop combination where minisetts were introduced at 0 and 14 WAPM favoured higher seed yam yields. The stand geometry for melon in 1997 was applied to all plots with melon. In 1998 when melon population was reduced by 50%, it was also applied to all plots with melon such that only year effects were affected.. The most acceptable option therefore is the system where the yam minisetts are intercropped with melon/maize either on the same day or are introduced not later than 14 days after melon, provided the melon population is 20000/ha.

Conclusions

We can draw the following conclusions from this study:

1. Yam minisetts performed better when grown early in the season, either as sole crop or as intercrop.
2. Intercropping yam minisetts was more productive than sole cropping, in terms of total productivity.
3. For optimum yield of the component crops, the yam minisetts should be introduced into melon/maize either on the same day with melon or not later than two weeks after planting melon.

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Table 1. Mean sprout count at 10 WAP and at harvest of yam minisetts introduced to melon at 3 sequences in a yam minisett/maize/melon intercrop in 1997.

Crop Combination	DAYS AFTER PLANTING EGUSI MELON					
	Stand count at10 weeks after planting			Stand count at harvest		
	0	14	28	0	14	28
Sole yam minisett	98	114	24	84	72	50
Yam minisett/maize	101	114	27	74	96	34
Yam minisett/melon	83	81	23	52	72	24
Yam minisett/maize/melon	71	71	32	50	94	32
$LSD_{(0.05)}$	Intercrop=NS Sequence=57.2 Sequence x Intercrop=NS			Intercrop=NS Sequence=22 Sequence x Intercrop=NS		

Table 2Mean seed yield of egusimelon (t/ha) from yam minisett/maize/melon intercrop where the yam minisetts were introduced to melon at three sequences in 1997 and 1998.

Crop combination	Dry seeds of egusi melon (t/ha)		
	1997	1998	Mean
Melon/ minisett at 0 DAP	1.13	0.70	1.01
Melon/ minisett at14 DAP	1.09	0.90	1.00
Melon/minisett at 28 DAP	1.01	0.95	0.98
Melon/maize/minisett at 0	0.63	1.00	0.82
Melon/maize/minisett at14 DAP	0.76	0.60	0.68
Melon/maize/melon at 28 DAP	1:00	0.85	0.93
$LSD_{(0.05)}$	NS	NS	

Table 3 Mean grain yield of maize (t/h) in yam minisett/maize/melon intercrop where the minisett component was introduced at 3 sequences in 19^07 and 1998 (combined).

Crop combination	Mean maize grain yield (t/ha)
Maize/yam minisett 0 DAP	0.97
Maize/yam minisett 14 DAP	0.90
Maize/yam minisett 28 DAP	1.08
Maize/minisett/melon 0 DAP	0.64
Maize/minisett/melon 14 DAP	0.85
Maize/minisett/melon 28 DAP	1.27
$LSD_{(0.05)}$	NS

Table 4. Seed yam yields (t/ha) from yam minisetts intercropped with maize and egusi melon where the minisetts were introduced at three sequences in 1997 and 1998.

Crop combination	SEQUENCE (DAP) 1997				1998			
	0	14	28	Mean	0	14	28	Mean
Sole yam minisett	5.86	4.80	2.60	4.42	3.38	3.10	1.53	2.67
Minisett/maize	2.74	2.60	1.38	2.24	3.24	2.88	1.24	2.75
Minisett/egusi melon	2.14	1.56	0.36	1.35	3.01	2.22	1.02	2.08
Minisett/maize/egusi melon	4.00	3.44	0.70	2.71	4.18	2.10	1.01	2.43
Mean	3.69	3.10	1.26		3.70	2.58	1.20	
$LSD_{(0.05)}$	Intercrop= 1.14 Sequence= 1.05 Sequence x Intercrop = NS				Intercrop=NS Sequence=0.99 Sequence x Intercrop = NS			

Table 5. Energy productivity ($x10^3$ Kcals/ha) of yam minisett/maize/melon intercrop where the yam minisett component was introduced at 3 sequences in 1997 and 1998.

Crop combination	Total Energy ($x10^3$ Kcals/ha)	
	1997	1998
Sole yam minisetts 0 DAPM	4.10	2.40
Sole yam minisetts 14 DAPM	3.41	2.29
Sole yam minisetts 28 DAPM	1.85	2.20
Minisett/maize 0 DAPM	6.98	5.44
Minisett/maize 14 DAPM	5.06	5.84
Minisett/maize 28 DAPM	5.16	5.61
Minisett/melon 0 DAPM	7.37	5.77
Minisett/melon 14 DAPM	6.76	4.23
Minisett/melon 28 DAPM	5.49	6.24
Minisett/maize/melon0 DAPM	6.54	8.69
Minisett/maize/melon14 DAPM	9.41	8.69
Minisett/maize/melon28 DAPM	11.78	7.54
S.E.	0.25	0.19