



RESEARCH PAPER

OPEN ACCESS

Effect of varying maize intra-row spacing on intercropped yields of egusi melon (*Citrullus lunatus* Thunb.) and maize (*Zea mays* L.) at Makurdi, Nigeria

Michael Ojore Ijoyah*, Amos Alexander, Fanen Felix Terna

Department of Crop Production, University of Agriculture, P.M.B. 2373, Makurdi, Nigeria

Received: 09 December 2011

Revised: 02 January 2012

Accepted: 04 January 2012

Key words: Intercropping, intra-row spacing, egusi melon, maize.

Abstract

Field experiments were conducted from June to September during the 2010 and 2011 cropping seasons, at the Research Farm, University of Agriculture, Makurdi, Nigeria, to evaluate the effect of varying maize intra-row spacing on intercropped yields of egusi melon and maize and to assess the advantages of the intercropping system. The trial consisted of five treatments, replicated three times in a randomized complete block design. Three of the treatments consisted of three intra-row spacing (20 cm, 25 cm and 30 cm) into melon plots. Monocropped maize and melon, respectively sown at their recommended intra-row spacing of 25 cm and 35 cm constituted the fourth and fifth treatments, which also served as control plots. Results obtained showed that the greatest intercropped yields of egusi melon and maize were obtained when maize was sown at the intra-row spacing of 30 cm, significantly ($P \leq 0.05$) greater than the rest treatments. Maize sown at the intra-row spacing of 30 cm into egusi melon plots, not only recorded the lowest competitive pressure but gave the highest land equivalent ratio (LER) values of 1.80 and 1.76 respectively, in years 2010 and 2011, indicating that greater productivity per unit area was achieved by growing the two crops together than by growing them separately. With these LER values, 44.4 % and 43.2 % of land were saved respectively, in years 2010 and 2011, which could be used for other agricultural purposes. Both crops were found to be highly complementary and most suitable in mixture when maize was sown at the intra-row spacing of 30 cm. The implication of study showed that to maximize intercrop yields of egusi melon and maize, the optimal maize intra-row spacing would be 30 cm. This should therefore be recommended for Makurdi location, Nigeria.

*Corresponding Author: Michael Ojore Ijoyah ✉ mikejoy2005@yahoo.com

Introduction

Egusi melon (*Citrullus lunatus* Thunb.) is a member of the family Cucurbitaceae (Badifu and Ogunsa, 1991). It originated from Africa, later introduced to Europe and Asia during the last 2000 years (Tindal, 1986) and now widely distributed throughout the tropics. The edible seed/kernel of melon contains approximately 46 % oil and 36 % protein (Ogbonna and Obi, 2010). Only the melon seed is used. The oil from seed is extracted and used for cooking and other industrial purposes, while the residue is used for thickening soup (Oyolu and Macfarlane, 1982). Maize (*Zea mays* L.) is an annual cereal plant of the gramineae family and native of Mexico (Hugar and Palled, 2008). It was introduced into Nigeria in the 16th century and based on the area cropped and quantity produced, maize was the country's third most important cereal crop following sorghum and millet (Uzozie, 2001). It is grown for its grain which contains 65 % carbohydrate, 10-12 % protein and 4-8 % fat (Iken and Amusa, 2004). The crop also contains the vitamins A, B, C and E, including mineral salts and essential trace elements such as carotene, thiamine, ascorbic acid and tocopherol (Groote, 2002). Maize is used mainly for human food and livestock feed while in the industry, it is used in the production of starch, oil and alcohol (Kling and Edmeades, 1997).

The cultivation of maize in combination with other crops is a common practice in the tropics (Raji, 2007). About 73 % of the maize in Nigeria is under intercropping (Iken and Amusa, 2004; Kamara *et al.*, 2005). Poggio (2005) reported that farmers intercropped for varied reasons, including insurance against crop pests, yield increment, weed control and high monetary returns to the farmers. A number of studies have been carried out on monocultured maize and melon as influenced by intra-row spacing (Kayode and Remison, 1982; Okaka and Remison, 1999), however, these studies did not reveal the optimum intra-row spacing of maize, especially in an egusi melon-maize mixture. The experiment, therefore aimed at evaluating the effect of varying maize intra-row spacing on

intercropped yields of egusi-melon and maize with the objective of identifying the optimal maize intra-row spacing that will maximize the yields of both crops in mixture.

Materials and methods

The experiments were conducted from June to September, 2010 and 2011 cropping seasons at the Research Farm of the University of Agriculture, Makurdi, Nigeria, to evaluate the effects of varying maize intra-row spacing on intercropped yields of egusi melon and maize. The study location (7° 48'N, 8° 39'E) and at an altitude of 228 m above sea level falls within the Southern Guinea savanna agroecological zone of Nigeria.

The meteorological information of the area over the trial period is provided in Table 1. The average monthly temperature over the years ranged from 21.0 °C to 31.4 °C, while the average relative humidity ranged from 76.2 % to 79.6 %. Mean daily radiation was low throughout the growth period. The month of June recorded the highest amount of rainfall and highest number of rainy days.

The local variety of egusi melon used was 'Itcheghir Dam' while that of maize was 'Oba 98'. Both varieties of crops are popularly grown by farmers and shows good adaptation to the local environment.

The experimental area (170.0 m²) which consisted of sandy-loam soil was ploughed, harrowed, ridged and divided into 15 plots. Each plot had an area of 9 m². The trial area consisted of five treatments, replicated three times in a randomized complete block design. Three of the treatments consisted of maize sown at the intra-row spacing of 20 cm, 25 cm and 30 cm into melon plots. Sole maize and sole melon respectively sown at their recommended intra-row spacing of 25 cm and 35 cm (Kayode and Remison, 1982; Okaka and Remison, 1999) constituted the fourth and fifth treatments, which also served as the control plots. In the intercrop, melon was sown 2-3 cm deep in a single row on top

of the ridge, while maize was sown 2-3 cm deep by the side of the ridge, but spaced at the different intra-row spacing. In the sole egusi melon plots, seeds were planted about 2-3 cm deep in a single row on top of the ridges, while in sole maize plots, seeds were sown 2-3 cm deep in a single row by the side of the ridges. Weeding was done manually as the need arose.

The recommended rate of compound fertilizer NPK (15:15:15) for sole maize: 100 kg N ha⁻¹, 40 kg P ha⁻¹ and 60 kg K ha⁻¹; for sole melon: mixed fertilizer NPK (15:15:15) at the rate of 120 kg ha⁻¹ and for egusi melon-maize mixture: 120 kg N ha⁻¹, 120 kg P ha⁻¹ and 120 kg K ha⁻¹ were applied (Enwezor *et al.*, 1989). The band method of fertilizer application was employed. The fertilizer was applied twice to each plot at 3 and 6 weeks after planting (WAP) for the sole crops and the intercrops.

Egusi melon was harvested when the leaves and vine were observed to have dried while that of maize was harvested at 12 WAP, when the leaves turned yellowish and fallen off which were signs of senescence and cob maturity.

Data taken for egusi melon include, days to 50 % flowering (determined as the period between date of planting to date when 50 % of the plants had flowered), number of branches per plant, number of leaves per plant, leaf length (cm), leaf width (cm), number of fruits per plant determined by counting and fruit weight (Kg). The collected fresh fruits were beaten with strong heavy sticks to break the shell. They were left for a week to allow the pulp to soften. The seeds were extracted from the pulp, washed in clean water and dried. The number of seeds per fruit was then obtained by counting. The dried seeds were weighed using an electronic weighing balance to obtain seed weight. The total seeds for each plot were also weighed to obtain the yield (t ha⁻¹).

Data taken for maize include, days to 50 % flowering, maize plant height at 50 % flowering (measured as the distance in cm from the soil

surface to the collar of the top most leaf), number of leaves per plant, number of cobs per plant, cob length (cm), cob diameter (the diameters at the head, centre and tail ends of the cob were measured in cm and averaged). The cobs were weighed using an electronic weighing balance to obtain cob weight (g). The cobs were later shelled manually and the total grains for each plot weighed to obtain the yield (t ha⁻¹).

All data were statistically treated using the Analysis of variance (ANOVA) for randomized complete block design and the Least Significant Difference (LSD) was used for mean separation ($P \leq 0.05$) following the procedure of Steel and Torrie (1980). The land equivalent ratio (LER) was determined as described by Willey (1985) using the formula:

$$LER = \frac{\text{Intercrop yield of crop A}}{\text{Sole crop yield of A}} + \frac{\text{Intercrop yield of crop B}}{\text{Sole crop yield of B}}$$

The competitive ratio (CR) as described by Willey and Rao (1980) was determined using the formula: $CR = Lm1/Lm \cdot Zo/Zm$, where Lm1: Partial LER for egusi melon; Lm: Partial LER for maize; Zo and Zm: are the sown proportion of egusi melon and maize respectively.

The percentage (%) land saved as described by Willey (1985) using the formula:

$\% \text{ Land saved} = 100 - 1/LER \times 100$. These calculations were used to assess the advantages of the intercropping system.

Results and discussion

The yield parameters of egusi melon as affected by varying intra-row spacing of maize in years 2010 and 2011 is given in Table 2. In an egusi melon-maize mixture, increasing intra-row spacing of maize up to 30 cm significantly ($P \leq 0.05$) reduced days to attain 50 % flowering. Monocropped egusi melon at its recommended intra-row spacing of 35 cm recorded the least number of days (41.6 and 42.0 days) respectively, in years 2010 and 2011 to attain 50 % flowering, while the highest number of days (46.2 and 47.0 days) were respectively recorded in years 2010 and 2011 for intercropped

egusi melon with maize sown at the intra-row spacing of 20 cm. The highest number of days taken to attain 50 % flowering might be linked to the

greater competition for growth resources as a result of the greater plant densities obtained using maize intra-row spacing of 20 cm.

Table 1. Meteorological information for Makurdi (June-September) 2010, 2011.

Year/Month	Average monthly rainfall (mm)	Average monthly temperature (°C)		Mean daily radiation (Cal cm ⁻² day ⁻¹)	Average relative humidity (%)
		Max.	Min.		
2010					
June	237.0(21) ⁺	30.6	22.3	174.3	76.2
July	235.2(20)	30.7	22.7	170.0	76.8
August	225.0(15)	30.5	23.1	175.1	77.4
September	210.0(12)	31.4	21.2	162.3	77.8
2011					
June	230.0 (18) ⁺	31.2	21.0	170.0	76.4
July	228.4(16)	30.7	21.3	173.5	75.8
August	215.0(14)	30.3	23.0	167.3	79.6
September	198.2(11)	30.0	22.3	164.0	78.0

⁺Values in parenthesis indicate number of rainy days. Source: Air Force Base, Makurdi Meteorological Station.

Table 2. Yield parameters of egusi melon as affected by varying intra-row spacing of maize at Makurdi, Nigeria in 2010 and 2011 cropping seasons.

Treatments	Days to 50 % flowering (cm)		Number of branches per plant		Number of leaves per plant		Leaf length (cm)		Leaf width (cm)		Number of fruits per plant		Fruit weight (Kg)		Number of seeds per fruit		Seed weight per fruit (Kg)		Yield (t ha ⁻¹)	
	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
SM (35 cm)	41.6	42.0	4.5	4.9	47.0	45.2	13.5	12.8	13.0	12.8	16.2	14.7	1.5	1.1	27.2	25.1	1.5	1.3	2.0	1.8
MI-M (20 cm)	46.2	47.0	2.0	2.2	27.2	20.6	11.3	10.8	10.6	10.1	10.3	8.0	0.7	0.5	18.1	20.0	0.6	0.4	1.0	1.3
MI-M (25 cm)	44.5	45.0	3.3	3.2	33.2	31.5	12.0	11.7	9.8	10.1	8.0	6.7	0.9	0.6	15.0	15.1	0.5	0.4	1.0	1.2
MI-M (30 cm)	42.2	43.6	3.0	3.5	30.0	33.8	12.2	11.9	11.0	10.5	11.2	9.0	1.0	0.8	20.4	22.6	0.8	0.6	1.6	1.5
Means	43.6	44.4	3.2	3.5	34.4	32.8	12.3	11.8	11.1	10.9	11.4	9.6	1.0	0.9	20.2	20.7	0.9	0.7	1.4	1.5
LSD (P≤0.05)	1.5	1.3	0.4	0.5	2.5	5.8	0.5	0.7	1.0	0.1	4.2	2.5	0.2	0.2	6.0	7.8	0.2	0.1	0.2	0.1
Cv(%)	2.2	1.5	5.8	5.8	10.4	8.9	6.2	2.8	3.4	0.3	10.3	12.9	15.3	20.6	12.0	18.8	7.4	10.9	12.3	8.6

SM (35 cm): Sole egusi melon sown at recommended intra-row spacing of 35 cm. MI-M (20 cm): Egusi melon intercropped with maize sown at intra-row spacing of 20 cm. MI-M (25 cm): Egusi melon intercropped with maize sown at intra-row spacing of 25 cm. MI-M (30 cm): Egusi melon intercropped with maize sown at intra-row spacing of 30 cm.

The number of branches per plant, number of leaves per plant, leaf length and leaf width of intercropped egusi melon were significantly (P≤0.05) reduced when maize was sown varying intra-row spacing as compared to those obtained from monocultured

egusi melon at its recommended intra-row spacing of 35 cm. This view agreed with Silwana and Lucas (2002) who reported that intercropping reduced vegetative growth of component crops.

Table 3. Yield parameters of maize as affected by varying intra-row spacing of maize at Makurdi, Nigeria in 2010 and 2011 cropping seasons.

Treatments	Days to 50% flowering		Maize plant height (cm) at 50% flowering		Number of leaves per plant		Number of cobs per plant		Cob length (cm)		Cob diameter (cm)		Cob weight (Kg)		Yield (tha ⁻¹)	
	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
SM (25 cm)	52.0	53.3	127.5	123.0	12.5	10.4	2.2	1.9	18.2	17.7	12.0	11.7	0.7	0.4	5.0	5.6
MI-M (20 cm)	58.6	59.7	130.0	127.6	11.2	10.0	1.7	1.4	13.0	12.6	12.2	12.9	0.2	0.2	3.0	2.8
MI-M (25 cm)	57.2	57.0	125.2	122.3	8.0	9.9	1.6	1.4	16.0	15.6	12.0	11.6	0.1	0.2	3.5	3.7
MI-M (30 cm)	55.0	56.0	116.8	118.4	11.0	10.0	2.0	1.8	18.0	17.0	12.7	11.4	0.3	0.4	5.0	5.2
Means	55.7	56.5	124.9	122.8	10.7	10.1	1.9	1.7	16.3	15.7	12.2	11.9	0.3	0.2	4.1	4.3
LSD (P≤0.05)	1.0	1.9	2.4	2.6	1.2	0.4	0.2	0.4	1.8	0.8	3.2	1.7	0.4	0.1	1.0	0.5
Cv(%)	5.3	1.7	3.1	1.1	5.2	1.9	14.0	10.9	6.5	2.4	10.1	7.3	9.3	13.8	7.2	5.5

SM (25 cm): Sole maize sown at recommended intra-row spacing of 25 cm. MI-M (20 cm): Egusi melon intercropped with maize sown at intra-row spacing of 20 cm. MI-M (25 cm): Egusi melon intercropped with maize sown at intra-row spacing of 25 cm. MI-M (30 cm): Egusi melon intercropped with maize sown at intra-row spacing of 30 cm.

Table 4. Land equivalent ratio (LER), Competitive ratio (CR) and Percentage (%) land saved from intercropping egusi melon and maize sown at varying intra-row spacing in 2010 and 2011 cropping seasons.

Treatments	Sole crop yield (t ha ⁻¹)				Intercrop yield (t ha ⁻¹)				Egusi melon – Maize mixture										
	Sole egusi melon		Sole maize		Egusi melon		Maize		LER		L _m		L _m		CR		% Land saved		
	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	
Soles	2.0	1.8	5.0	5.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MI-M (20 cm)	-	-	-	-	1.0	1.3	3.0	2.8	1.10	1.22	0.50	0.72	0.60	0.50	0.83	1.44	9.1	18.0	
MI-M (25 cm)	-	-	-	-	1.0	1.2	3.5	3.7	1.20	1.33	0.50	0.67	0.70	0.66	0.71	1.02	16.7	24.8	
MI-M (30 cm)	-	-	-	-	1.6	1.5	5.0	5.2	1.80	1.76	0.80	0.83	1.00	0.93	0.80	0.89	44.4	43.2	

Soles: Sole crops of egusi melon and maize sown at their recommended intra-row spacing. MI-M (20 cm): Egusi melon intercropped with maize sown at intra-row spacing of 20 cm. MI-M (25 cm): Egusi melon intercropped with maize sown at intra-row spacing of 25 cm. MI-M (30 cm): Egusi melon intercropped with maize sown at intra-row spacing of 30 cm.

$$LER = \frac{\text{Intercrop yield of crop A}}{\text{Sole crop yield of Crop A}} + \frac{\text{Intercrop yield of crop B}}{\text{Sole crop yield of Crop B}}$$

L_m: Partial LER of melon; L_m: Partial LER of maize

$$CR = \frac{L_{m1}}{L_m}$$

L_m (Division of the partial land equivalent ratios of the component crops)

$$\% \text{ land saved} = 100 - 1/LER \times 100$$

The number of fruits per plant, fruit weight, number of seeds per fruit, weight of seeds per fruit and yield of intercropped egusi melon were significantly (P≤0.05) reduced when maize was sown varying intra-row spacing as compared to those obtained from monocropped egusi melon. This could be due to interspecific competition of the component crops and depressive effect of the intercropped maize. Shading by taller maize plants in mixture could have also reduced the photosynthetic rate of egusi melon (a lower growing plant), thereby reducing number of fruits, fruit weight, number of seeds, weight of seeds and yield as compared to those produced from monocropped egusi melon. Higher yield in sole over intercropped plants had been

reported by Olufajo (1992) and Muneer *et al.*, (2004).

The yield of egusi melon in mixture with maize sown at the intra-row spacing of 30 cm was significantly (P≤0.05) greater by 37.5 % and 13.3 % respectively, in 2010 and 2011, compared to that obtained in mixture with maize at the intra-row spacing of 20 cm, and by 37.5 % and 20.0 % respectively, in 2010 and 2011 compared to that obtained in mixture with maize at the intra-row spacing of 25 cm.

The yield parameters of maize as affected by varying intra-row spacing of maize in years 2010 and 2011 is given in Table 3. In an egusi melon-maize mixture,

increasing maize intra-row spacing significantly ($P \leq 0.05$) prolonged days to attain 50 % flowering for maize compared to monocultured maize sown at its recommended intra-row spacing of 25 cm. Monocultured maize recorded the least number of days (52.0 and 53.3 days) respectively, in 2010 and 2011 to attain 50 % flowering, while the highest number of days (58.6 and 59.7 days) were respectively recorded in 2010 and 2011 for intercropped maize sown at the intra-row spacing of 20 cm. The greatest plant density obtained from maize intra-row spacing of 20 cm might have exerted greater demand on growth resources, thereby prolonging days to attain 50 % flowering as compared to other intra-row spacing employed including that of monocropped maize sown at its recommended intra-row spacing of 25 cm.

Increasing maize intra-row spacing up to 30 cm significantly ($P \leq 0.05$) reduced maize plant height taken at 50 % flowering. This view agreed with that of Silwana and Lucas (2002) who reported that intercropping reduced vegetative growth of crops.

The numbers of leaves per plant, number of cobs per plant and cob length were greater for monocultured maize compared to those obtained for intercropped maize sown varying intra-row spacing. Muoneke and Asiegbu (1997) obtained similar results in experiment involving plant population of okra in intercropping situation.

Although, cob diameter was not significantly ($P \leq 0.05$) affected by varying maize intra-row spacing, however, cob weight and grain yield of intercropped maize were significantly ($P \leq 0.05$) greater when maize was sown at the intra-row spacing of 30 cm as compared to other intercropped treatments. It could be possible that at the maize intra-row spacing of 30 cm, the component crops were able to make better overall use of growth resources. In addition, the greatest number of cobs obtained from intercropped maize sown at the intra-row spacing of 30 cm might have also accounted for its greatest intercrop grain yield.

Grain yield of intercropped maize produced from the intra-row spacing of 30 cm was significantly ($P \leq 0.05$) greater by 40.0 % and 46.2 % respectively, in 2010 and 2011, compared to that obtained from intra-row spacing of 20 cm and by 30.0 % and 28.8 % respectively, in 2010 and 2011, compared to that obtained from maize intra-row spacing of 25 cm.

In both years, land equivalent ratio (LER) values increased with increase in maize intra-row spacing (Table 4). This view contradict that of Prasad and Brook (2005) and Muoneke *et al.*, (2007) who reported that LER increased at closer spacing. The reason for the contradiction could be due to differences in resource utilization of the component crops in mixture. The LER values of egusi melon-maize intercrop were all above 1.00. This could be due to greater efficiency of resource utilization in intercropping. Mohta and De (1980) reported that LER increased to maximum of about 48.0 % by intercropping maize with soyabean compared with the cereal sole crops. Intercropping egusi melon with maize sown at the intra-row spacing of 30 cm gave the highest LER values of 1.80 and 1.76 respectively, in years 2010 and 2011, indicating that greatest productivity per unit area was achieved by growing the two crops together than by growing them separately. With these LER values, 44.4 % and 43.2 % of land were saved respectively, in 2010 and 2011, which could be used for other agricultural purposes.

The average of both years, showed that competitive pressure was lowest when maize was sown at the intra-row spacing of 30 cm, thus indicating that both crops were highly complementary and most suitable in mixture.

Conclusion

From the results obtained, it can be concluded that the greatest intercropped yields of egusi melon and maize were obtained when maize was sown at the intra-row spacing of 30 cm, significantly ($P \leq 0.05$) greater than the rest intercrop treatments. Both crops were found to be highly complementary and

most suitable in mixture when maize was sown at the intra-row spacing of 30 cm. This is associated with the lowest competitive pressure, highest land equivalent ratio values and greatest percentage of land saved. It is however, recommended that further investigation be done to evaluate a wider range of egusi melon and maize varieties in intercrop and across different locations within the Guinea savannah agroecological zone of Nigeria.

Acknowledgement

The authors are grateful to the research technicians of the University of Agriculture Research Farm in Makurdi, for their assistance in the field operations.

References

Badifu GIO, Ogunsa AO. 1991. Chemical composition of kernels from some species of cucurbitaceae grown in Nigeria. *Plant Foods and Human Nutrition* **41**, 35-44.

Enwezor WOE, Udo J, Ajotade KA. 1989. Fertilizer procurement and distribution. Fertilizer use and management practice for crops in Nigeria. Savenda Publishers, Nsukka, Nigeria, 25-28.

Groote HM. 2002. Identifying farmers preference for new maize varieties in Eastern Africa. 1st edition, CIMMYT Publishers, Nairobi, 102.

Hugar HY, Palled YB. 2008. Studies on maize-vegetable intercropping systems. *Karnataka Journal of Agricultural Science* **21**, 162-164.

Iken JE, Amusa NA. 2004. Maize research and production in Nigeria. *African Journal of Biotechnology* **3**, 302-307.

Kamara AY, Markir A, Ajala SO. 2005. Performance of diverse maize genotype under nitrogen deficiency in the Northern Guinea savanna of Nigeria, *Experimental Agriculture* **41**, 199-212.

Kayode GO, Remison SU. 1982. Effect of intra-row spacing and nitrogen on maize in the Southern

Guinea savanna zone of Nigeria. *Nigeria Agricultural Journal* **17/18**, 22-31.

Kling JG, Edmeades G. 1997. Morphology and growth of maize. Research Guide No. 9 Training Programme. International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria, 3-6.

Mohta NK, De R. (1980). Intercropping maize and sorghum with soybean. *Agricultural Science Journal* **95**, 112-122.

Muneer AP, Fida HM, Mumtaz AK, Muhammad IS. 2004. Performance of maize in intercropping system with soybean under different patterns and nitrogen levels. *Journal of Applied Sciences* **4(2)**, 201-205.

Muoneke CO, Ogwuche MAO, Kalu BA. 2007. Effect of maize planting density on the performance of maize/soybean intercropping system in a Guinea savannah agroecosystem. *African Journal of Agricultural Research* **2(12)**, 667-677.

Muoneke CO, Asiegbu JE. 1997. Effects of okra planting density and spatial arrangement in intercrop with maize on the growth and yield of the component species. *Journal of Agronomy Crop Science* **179**, 201-207.

Ogbonna PE, Obi IU. 2010. Aspects of reproductive character of Egusi melon. Proceedings of the 34th Annual Conference of Genetics Society of Nigeria, 22-27.

Okaka VB, Remison SU. 1999. Effects of intra-row spacing and fertilization on the performance of melon. *Nigeria Agricultural Journal* **30**, 49-58.

Olufajo OO. 1992. Response of soybean to intercropping with maize in a sub-humid tropical environment. *Tropical Oil Seeds Journal* **1**, 27-33.

Oyolu C, Macfarlane N. 1982. A study of the oil and the soluble protein components of five egusi

cultivars. In abstracts on Tropical Agriculture **10(1)**, 104.

Poggio SL. 2005. Structure of weed communities occurring in monoculture and intercropping of field pea and barley. *Agric. Ecosystem Environment* **109**, 48-58.

Prasad RB, Brook RM. 2005. Effect of varying maize densities on intercropped maize and soybean in Nepal, *Expl. Agric.* **11**, 365-382.

Raji JA. 2007. Intercropping soybean and maize in a derived savanna ecology. *African Journal of Biotechnology* **6(16)**, 1885-1887.

Silwana TT, Lucas EO. 2002. The effect of planting combinations, weeding and yield of component crops of maize-bean and maize-pumpkin intercrops. *Journal of Agricultural Science* **138**, 193-200.

Steel RGD, Torrie JH. 1980. Principles and Procedures of Statistics. A Biometrical Approach. 2nd edition. McGraw Hill, New York, 633pp.

Tindall HD. 1986. Vegetables in the Tropics. 1st edition, Macmillan Publishers, Hong Kong, 325-327.

Uzozie PR. 2001. Effect of time of interplanting maize on the performance of cassava-maize intercrop. *Journal of Agricultural Science* **12**, 18-21.

Willey RW. 1985. Evaluation and presentation of intercropping advantages. *Expl. Agric.* **21**, 119-133.

Willey RW, Rao MR. 1980. A competitive ratio for quantifying competition between intercrops. *Expl. Agric.* **16**, 117-125.