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EFFECT OF PLANTING DENSITIES AND TIME OF INTRODUCTION OF MAIZE ON THE PERFORMANCE OF INTERCROPPED MAIZE AND MELON IN THE SOUTHERN GUINEA SAVANNA OF NIGERIA

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ABSTRACT
A field experiment was conducted during the rainy season (May-August) of 2013 and 2014 at the Kogi State Agricultural Development Project Research Farm, Anyigba, Nigeria to investigate the effect of population density and time of introduction of maize on the yield of melon and maize in a melon-maize intercrop. The experiment was a 5 x 3 split-plot laid in a randomized complete block design with three replications. The result indicated that population density and time of introduction of maize had no significant effect on yield and yield components of melon but significant on the number of maize cobs per plot, cob yield/ha and grain yield of maize. Maize grain yield increased with increase in maize population up to 40,000ha^{-1}. Interaction effect of time of introduction and population density was significant on the grain yield of maize. Competition indices like LER and LEC were at advantage. At each level of maize population density, LER was greater than 1, indicating efficiency of resource use while LEC values were more than 0.25 signifying potential productivity of the intercrop. Both LER and LEC values were highest at 4 weeks after planting melon and at 40,000ha^{-1} of maize.

Keywords: Melon, Maize, intercropping, and planting density

Introduction

Maize (Zea mays L.) is the most important cereal crop in the world after wheat and rice (Onwueme and Sinha, 1991). It is a major item in the diet of many tropical countries whereas in the temperate regions, maize is the main grain used for animal feed. In Nigeria, maize is consumed in many forms: as maize flour made into a thick paste ('tuwo') and eaten with soup, 'ogi' (pap) and 'agidi', boiled or roasted as fresh corn and eaten with or without groundnut, palm kernel, fried, etc. Maize is industrially important chiefly for the production of alcohol, oil and starch (Onwueme and Sinha, 1991). Melon is a popular crop in Nigeria. Like other African countries, the economic value of melon *(Colocynthis vulgaris,* Shrad *L.)* depended largely on seed size and quality (Oyolu and Macfarlance, 1982). Only the melon seed is used. According to Gorski (1985), the seeds of melon contain 4.60g carbohydrates, 0.6g proteins, 0.6g crude fiber, 33mg vitamin C, 17g Ca, 16mg P, 230mg K per 100 g edible seeds. Also, the crop responds well to organic and inorganic fertilizers, which facilitate its growth performance as good live mulch (Olaniyi and Fagbayide, 2008). The oil which is approximately 46% of the seed (Tindall, 1988) is extracted and used for cooking and other industrial purposes while the residue is used for thickening soup (Philips, 1964; Oyolu and Macfarlance, 1982).

Intercropping had long been recognized as a very common practice throughout the developing tropics. Willey (1979) defined intercropping as the growing of two or more crops simultaneously on the same area of ground. The crops were not necessarily sown at exactly the same time and their harvest times might be quite different, but they were usually simultaneous for a significant part of their growing periods so that inter specific competition occurs (Hiebsch and McCollum, 1987).

Akobundu (1980) reported that farmers intercropped for varied reasons including insurance against crop failure, prevention of erosion, better and efficient use of labour and protection against crop pests. Intercropping was also done for higher gross return per unit area of land and for better satisfaction of dietary variability (Singh, 1982; Ekanayeke *et al.*, 1997). Population studies had been carried out involving both sole maize and melon. The cultivation of maize in combination with other crops is a common practice in the tropics (Rounnet, 1987). Except on commercial farms where maize can be planted sole, most maize production in Nigeria is from the cereal based cropping systems of the Guinea Savannah and Rain Forest agro-ecological zones by the traditional small-scale farmers. The most widely practiced in the rain forest agro-ecological zone are maize/cassava, maize/yam maize/cowpea, maize/rice and maize/melon (Akobundu, 1980; Remison, 1982; Rounnet, 1987; McNamara and Morse, 1996). In these types of simple mixtures (consisting of two crops) farmers select arable crops on the basis of differences in growth habit and time of maturity (Olasantan and Lucas, 1992). It is on this basis that melon, because of its creeping growth habit and importance in the diets of Nigerians, is often found in mixture with maize, cassava, yam, sorghum and other crops in most agro-ecological zones of the country (Wahua, 1985; McNamara and Morse, 1996).

About 73% of the maize produced in Nigeria was under mixed cropping (Ayeni, 1987). In most cases and under indigenous production systems, where mixtures could be complex with no distinct row arrangement, there could be difficulties in determining the population densities per unit area of cropped land. In melon cultivation, much emphasis had been on the spatial arrangement and the relative plant population that would ensure a rapid canopy cover of the soil for effective weed control as live mulch (Wahua, 1985; Olasantan, 1988, Okaka and Remison, 1999; Muoneke *et al.,* 2013), while still optimizing yields. Wahua (1985) carried out a study on the optimum population of 20,000 stands/ha of melon when intercropped with maize. This experiment which was carried out at Ibadan within the forest agro-ecological zone of Nigeria had the population of maize held constant while varying those of melon. Also, Okaka and Remison (1999) carried out an experiment to determine the effect of population density and fertilizer application on melon at Ekpoma, a forest/derived savannah zone, where increased population and fertilization increased yield of melon. These studies were location specific and for the Southern Guinea Savanna, such determinations need to be made for intercropping systems involving maize and melon. Experiments on crop mixtures involving maize had also been carried out. Some involved maize and cowpea (Enyi, 1973; Remison, 1982), cassava/maize/melon (Ijoyah *et al*; 2012) maize/groundnut (Baker,1978), maize/pigeon pea (Enyi, 1973), maize/groundnut (Baker, 1978), maize/melon (Wahua, 1985; Olasantan and Lucas, 1992) maize/cocoyam (Olasantan and Lucas, 1992), maize/bambara groundnut (Alhassan and Egbe, 2014). These studies did not reveal the optimum population density of maize especially in melon/maize mixture, neither did they specify the appropriate time of introducing maize into the mixture. There exists a dearth of information on optimum population of maize in a melon/maize intercrop and the appropriate time of introducing maize into the mixture.
The objective of this study therefore was to determine the appropriate population density and time of introduction of maize in a melon-maize intercrop.

Materials and Methods

Experimental site

A field experiment was conducted for two years (2013 and 2014) at the research farm of Kogi State Agricultural Development Project, located at Anyigba (6°20', to 02'N, and longitude 6°42', 7^0SE), 376 meters above sea level in the Southern Guinea Savanna of Nigeria. The experimental site received a total rainfall of 1195.10 and 1120.50mm in 2013 and 2014 respectively. The soil was sandy to clay-loam with very low organic matter content. The colour of the soil was redish probably due to the preponderance of oxidized ferric iron.

Soil sampling and analysis

Ten core samples of soil were collected from different parts of the experimental field from a depth of 0 to 30 cm which formed a bulk of composite sample and used in determining the physical and chemical properties of the soil (Table 1) before planting.

Experimental design, treatments and cultural practices

The plot was manually cleared with machetes and ridges formed with hands using hoes before laying the experiment as a 5 × 3 split plot set out in a randomized complete block design with three replications. Melon was the main crop with the population of 20,000 plants/ha. Time of introduction of maize was assigned to the main plot, while population density of maize was assigned to the sub-plots. The main plot treatments were made up of five periods of introduction of maize (same day -planting melon and maize on the same day; maize planted one week after planting melon; maize planted two weeks after planting melon; maize planted three weeks after planting melon and maize planted four weeks after planting melon) while the sub plot treatments were three population densities of maize (10,000 plants/ha, designated as P_1 and set out as 1 x 1m x 1 plant/stand; 20,000 plants/ha, designated as P_2 and set out as 1 x 0.50m x 1 plant/stand and 40,000 plants/ha, designated as P_3 and set out as 1 x 0.25m x 1 plant/stand). The sole maize at 40,000 plants/ha and sole melon at 20,000 plants/ha were maintained for each treatment as checks for the determination of land equivalent ratio and land equivalent coefficient. The melon used was a local variety obtained from Anyigba market, while the maize was SUWAN-l, which was medium maturing, streak and downy mildew resistance. Both crops had similar maturity periods. Intercropping was formed by planting melon at the top of the ridge while maize occupied the side of the same ridge in a 1: 1 row arrangement. The gross plot was made up of 7 ridges, spaced 1 m apart and 7 m long (49 m^2), while the net plot had 5 ridges of 5 m long (25 m^2). Melon was planted in all the plots same day (24^{th} May each year) at 1m x 0.5 x 1 plant/stand. Treatment 1 plots were planted with maize same day the melon was. Maize was introduced into the other plots at weekly intervals as specified in the treatment details. Each treatment plot received an equivalent of 300 kg of NPK: 15:15:15 fertilizer as basal dressing by broadcasting. The maize component was top-dressed with Urea at 100 kg/ha by side placement 6 weeks after planting (W AP). The experiment was weeded manually using small hand hoes at 3 and 6 W AP. Two insecticides, Decis (decamethrin) and Furadan 3G (carbofuran) were applied to control leaf eating insects in melon and stem borers in maize, respectively.

Data Collection and analysis

The following data were collected.

1) Melon component: number of fruits per plant, number of seeds per fruit and seed yield (t/ha).

2) Maize component: number of cobs per plot, dry cob weight(t/ha) and grain yield (t/ha)

The productivity indices used to estimate the intercrop advantage were:

(a) Land equivalent ratio (LER), an accurate assessment of the biological efficiency of the intercropping situation (Ofori and Stern, 1987), was estimated as:

LER = (Xab/Xaa) + (Xba/Xbb)

Where Xaa and Xbb are yields as sole crops of melon and maize and Xab and Xba are yields as intercrops of melon and maize. LER figures greater than 1 are considered advantageous.

(b) Land equivalent coefficient (LEC), a measure of interaction concerned with the strength of relationship (Adetiloye *et al.*, 1983) was calculated thus,

LEC = PLERa × P LERb

Where, PLERa = partial LER of melon and

PLERb = partial LER of maize.

For a two-crop mixture the minimum expected productivity coefficient (PC) is 25%, that is, a yield advantage is obtained if LEC value exceeds 0.25 (Choudhary,2014).

Year × treatment interactions were not significant, so data for both years were pooled together and analyzed. Analysis of variance (ANOVA) was performed on the data generated for the maize and melon intercrops using separate error term for each main effect to detect the significance of treatments effects and their interactions. Significant means were separated using least significant difference (LSD) and Duncan multiple range test (DMRT) at 5% level of probability (Obi, 2002).

Results and Discussion

Rainfall received within the experimental period was considered adequate for crop growth and development.

Melon component

a) Number of fruits per plant

There was no significant ($P \geq 0.05$) effect of population density of maize on the number of fruits of melon per plant. Table 2 shows the effects of maize population density and time of introduction of maize on the yield and yield components of melon. The mean number of fruit per plant of melon was one. Regardless of the time of introduction of maize into the mixture, the number of fruits of melon per plant was not affected. Also interaction effect of time of introduction and population density of maize was non-significant.

b) Number of seeds per fruit and seed yield of melon

The main effects of time of introduction and population density of maize was not significant ($P \geq 0.05$) on the number of melon seeds per fruit and grain yield of melon. Interaction effect was also not-significant. Number of seeds per fruit was highest (112) at 20,000 plants and lowest (98.50) at 40,000 plants/ha of maize. Number of seeds per fruit was highest (110.40) when maize was introduced into the mixture one week after planting melon while it was lowest (105) when melon and maize were planted the same day. The highest grain yield of 0.44 t/ha was obtained when maize was introduced at four weeks after planting melon, while the least yield of 0.32t/ha was obtained when both crops were planted at the same time (Table 2). There was no defined pattern on the number of seeds per fruit and seed yield of melon as maize population density increased.

Maize component

Number of cobs, dry cob weight and grain yield of maize:

The main effects of time of introduction of maize and maize population density was significant ($P \leq 0.05$) on the number of maize cobs per plot, cob yield/ha and grain yield/ha of maize. Table 3 shows the effects of maize population density and time of introduction of maize on the yield and yield components of maize in a melon- maize intercrop. The highest number of cobs per plot (35.90) was obtained when both crops were planted at the same time and at 4 weeks after planting (WAP) melon. The least mean value of 23.00 was obtained at 2WAP. Number of cobs/ha, weight of cobs and grain yield of maize increased with increase in population density of maize (Table3). Both cob weight (1.68t/ha) and grain yield (1.16t/ha) were highest at 40,000 stands/ha of maize. Intercropping generally resulted in reduced yields of maize as compared to sole cropping. Grain yield of maize was highest (1.32t/ha) at 4 weeks after planting melon, followed by when both crops were planted the same day (1.09t/ha) (Table 3). Interaction effects of time of introduction x population density was significant ($P \leq 0.05$) on the yield of maize (Table 4).

Productivity indices

Land Equivalent Ratio

At each level of maize population density and time of introduction of maize into the mixture, Land Equivalent Ratio (LER) values were greater than 1. Mean LER value was highest at 4W AP and at 40,000 stands/ha and lowest at 3W AP and at 10,000 stands/ha. The partial LERs indicated the relative contributions of the component crops in the mixture to the total LER at the various treatment levels (Table 5).

Land Equivalent Coefficient

This is a measure of interaction concerned with the strength of relationship usually between two crop mixture. Land Equivalent Coefficient (LEC) values followed similar trend with LER. LEC values were highest 4 WAP melon (0.62) and at 40,000 stands/ha of maize (0.59) while the lowest value was at 10,000 stands/ha (0.42) (Table 5).

Growth and Grain Yield of Melon

The mean number of fruits per plant was one. Introducing maize into the mixture had no significant effect on the number of fruits per plant, neither on the weight of fruit per hectare, nor on the number of seeds per fruit. Okaka and Remison (1999) observed that number of seeds per fruit and grain yield of melon were not significantly affected by population density of maize. These results were in agreement with the reports of Remison (1982), Olasantan and Lucas (1982), Wahua (1985), Okaka and Remison (1999) and Ijoyah *et al;* (2012). The results of these experiments indicated that varying melon population from 7,000 to 20,000 stands/ha optimized yield and that any population density within this range and with adequate management practices, the performance of melon would be satisfactory, though in mixtures, the crop gave lower yields than the sole cropping. This reduction in yield of melon intercropped with maize as compared with sole cropping could be ascribed to inter-species competition for both under-and above-ground growth resources (water, nutrients, light, air, etc.). The taller maize component shaded the low canopy legume, thus reducing light availability for optimum photosynthetic activity and subsequently culminating in the low yields of melon. Such observations are common in legume/cereal intercropping (Molatudi and Mariga, 2012; Alhassan and Egbe, 2014). In melon cultivation, emphasis was usually on the density that would rapidly cover the soil for effective weed control and live mulch while achieving better yields (Wahua, 1985; Muoneke *et al;* 2013).

Growth and yield characters of maize

Main effect of time of introduction and population density of maize was significant on the growth and yield characters of maize. This was because maize was more competitive in mixtures when planted simultaneously with creeping crops like melon, cowpea and bambara groundnut (Remison, 1982; Egbe *et al*., 2009, Alhassan and Egbe, 2014). Introducing crops into another crop that was already established would result in competitive disadvantage for the introduced crop but here melon had less competitive ability with maize since the rate of growth of most vegetative characters had slowed down at four weeks after planting melon, thus the high yield of maize at that time of introduction. Moreso, melon that flowered as from 35 days after planting would be less competitive when maize was introduced just before flowering. This might account for the high yield of maize at four weeks after planting melon. Maize yield increased as population density increased suggesting that increased yields from increased planting density beyond 40,000 plants/ha was possible. It further signifies that the optimum planting density for maize is yet to be reached. Yield was highest at 40,000 stands/ha and lowest at 10,000 stands/ha. The low yields of maize at one and two weeks after planting melon might be due to the competitive disadvantage the already established crop had on the introduced one. Again, crops sown first exploited nutrients in successive horizons in advance compared to slow or later growing species. The good yield of maize when planted with melon at the same time is an indication that maize is a better competitor (Alhassan and Egbe, 2014). In addition, this period, there had been increased rainfall which favour good maize seed emergence (Kalu *et al.,* 1987) that slowed down the growth of melon (Tindall, 1988).

Land Equivalent Ratio and Land Equivalent Coefficient

All intercrop treatments produced LER values above unity and LEC values beyond 0.25 signifying superiority of the intercrop. Mean LER values increased as maize population increased from 10,000 to 40,000stands/ha. This was in line with the findings of Huxley and Maingu (1978) that LER might increase as plants became closely spaced and competition between dissimilar crop components set in. This increase would only occur if the same level of management was given to both the sole cropping plot and the intercropped plot (Willey, 1979). The LER mean values of 1. 30, 1.41 and 1.55 were indications of biological efficiency and high productivity of the intercrop. At wide spacing (10,000stands/ha), LER tended closer to 1, while at higher plant population, the increasing effect of interference in sole crop maize compared with relatively diminishing effect of competition on maize in the mixture could increase total land equivalent ratio (Huxley and Maingu, 1978). A LER of 1.58 might either be taken as 58% greater area requirement for the sole cropping system or as a 58% greater relative yield for intercropping. Either way, the figure indicated a 58% greater biological efficiency for intercropping (Willey, 1985). From this experiment, the greatest biological efficiency was obtained at 40,000stands/ha. Land equivalent coefficient of 0.59 at 40,000stand/ha of maize and 0.62 at 4 weeks after planting melon were indicative that the intercrop has superior stable potentials to their component sole crops (Adetiloy *et al.*, 1983). The favourable LEC values suggest that the mixture has an inbuilt tendency to give stable yield advantages as the number of component crops and intercrop plant population increases (Choudhary, 2014).

Conclusion

The decision by farmers to intercrop is not without reasons. In melon cultivation, emphasis was usually on the density that would rapidly cover the soil for effective weed control and live mulch while obtaining reasonable grain yields. To obtain the highest grain yield of both melon and maize, maize should be introduced into the mixture four weeks after planting melon at 20,000 stands/ha of melon and 40,000 stands/ha of maize.

References

Adetiloye, P.O., Ezedinma, F.O.C., and Okigbo, B.N (1983). A land coefficient concept for evaluation of competitive and productive interactions on simple complex mixtures. *Ecol. Model*. 19:27-39.

Akobundu, I.O. (1980), Weed control in maize-cassava intercrop. Tropical root crops research strategies for the 1980. Eds Terry, E.K Oduro KA and Caveness F. UTA Ibadan Pp.299

Alhassan, G.A. and Egbe, O.M. (2014). Bambara groundnut/maize intercropping: Effects of planting densities in Southern guinea savanna of Nigeria. *African Journal of Agricultural Research*, 9(4):479-486

Alhassan, G.A., Kalu, B.A., and Egbe, O.M (2012). Influence of planting densities on the performance of intercropped Bambara groundnut with cowpea in Makurdi, Benue State, Nigeria. *International Journal of Development and Sustainability*, 1(3): 622-1198

Ayeni, AO. (1987). Maize production in Nigeria: problem and prospects. *Journal of Food and Agriculture*, 2: 123-129.

Baker, E.F.I. (1978), Mixed cropping in Northern Nigeria - cereals and groundnuts. *Experimental Agriculture*, 14: 293-298

Choudhary, V. K. (2014). Suitability of maize-legume intercrops with optimum row ratio in mid hills of eastern Himalaya, India. *SAARC J. Agri*., 12(2): 52-62

Ekanayeke, I.J., Osiru, D.S.O., and Porto M.C (1977). Agronomy of cassava. IITA Research Guide No.60, UTA Ibadan. 30 pp

Enyi, B.A.C. (1973), Effects of intercroping maize or sorghum with cowpea, pigeon peas or beans. *Experimental Agriculture* 9: 83-90.

Gorski; S. F. (1985). Melons. In: Detecting mineral nutrient deficiencies in tropical and temperate crops, *Journal of Plant Nutrition*, 8: 283 – 291.

Hiebsch, C.K and Mccollum, R.C. (1987). Area x time equivalency ratio: A method for evaluating the productivity of intercrops. *Agronomy Journal*, 79: 15 - 23.

Huxley, P.A and Maingu Z., (1978), Use of a systematic spacing design as an aid to the study of inter cropping: Some general considerations, *Experimental Agriculture*,14: 49-56

Ijoyah, M. O., Bwala, R. I. and Iheadindueme, C. A. (2012). Response of cassava, maize and egusi melon in a three crop intercropping system at Makurdi, Nigeria, *International Journal of Development and Sustainability*, 1(2): 35 – 144.

Kalu, B.A., Ojo, A.A, Ablorh, F.S. and Agbede, 0.0. (1987).Yield Responses of maize to planting dates under both upland and lowland preparation methods in Benue State of Nigeria. *Nigerian Journal of Agronomy*, 2(1):15-20

McNamara, N. and Stephen Morse, (1996). Developing on-farm research - The broad picture; Stream Publishers Ltd. Cloghrose, Blarney, Co. Cork, Ireland. 173 pp

Molatudi, R.L., and Mariga, I.K. (2012). Grain yield and biomass response of a maize/dry bean intercrop to maize density and dry bean variety. *Afr. J. Agric. Res*. 7(20):3139-3146

Muoneke, C. O., Mbah, E.U., Orji, U. (2013). Weed control and yield of sweet corn Zea may (L.) var. saccharata)/egusi melon (Colocynthis citrullus (L.) O. Kitz) intercrop as influenced by plant population of egusi melon in the humid tropics. *Nigerian Journal of Crop Science*, 1(1):1 - 9

Obi, I. U. (2002). Statistical Methods of Detecting Differences Between Treatment Means and Research Methodology. AP issues in Laboratory and Field Experiments. AP Express Publishing Company Limited, Nsukka, Nigeria, 116 pp.

Ofori, F., and Stern, W.R. (1987). Cereal- legume intercropping systems. Adv. Agron. 41:41-90

Okaka, V.B., and Remison, S.U. (1999). Effect of density and fertilization on the performance of melon: *Nigeria Agricultural Journal*, 30: 49-58.

Olaniyi, J. O and Fagbayide, J. A. (2008). Growth and seed yield response of egusi melon to nitrogen and phosphorus fertilizers application, *American-Eurasian Journal of Agriculture and Environmental Science*, 6: 707 – 712.

Olasantan, F.O. and Lucas, B.O. (1992). Intercropping maize with crops of differing canopy heights and similar or different maturities using different spatial arrangements. *Journal of Agricultural Science and Technology*, 2(1): 13-22.

Onwueme, I.C. and Sinha, T.D. (1991). Field crop production in tropical Africa, principles and practice. CT A, Ede, the Netherlands.

Oyolu, C. and MacFarlance, N. (1982). A study of the oil and the soluble protein components of five egusi (Colocynthis citrullus, L) Cultivars. In abstracts on tropical agriculture, 10 (1): 104

Philips, I.A. (1964), An agricultural note book, Longman (Nigeria) Ltd, Ibadan. 248 pp.

Remison, S.U. (1978). Neighbour effects between maize and cowpea at various levels of N and P. *Experimental Agriculture*, 14: 205-212.

Remison, S.U. (1982). Interaction between maize and cowpea in poor acid sandy soils. *Nigeria Journal of Agricultural Science*, A. (1) 7 - 13

Rouanet Guy, (1978), Maize. Tropical agriculturist series. Ed. Rene' Coste. Macmillan Publishers, London, 101 pp.

Singh, D.V. (1982). Economics of mixed cropping in the arid zone farming systems of Rajasthan. Annuals of arid zone (India), 21(4): 289-297.In: Abstracts on Tropical Agriculture, 10(2): February, 1985.

Tindall, H.D. (1988). Vegetables in the tropics. Macmillan education Ltd, London.533 pp.

Wahua T.A.T. (1985). Effects of melon (Colocynthis vulgaris) Population density on intercropped maize *(Zea mays* L.) and melon. *Experimental Agriculture*. 21: 281-289.

Willey, R.W. (1979). Intercropping - Its importance and research needs Part I. competition and yield advantages. Field crop abstracts. Commonwealth Bureau of Pastures and Field Crops, 32 (1): 1-10

Willey, R.W. (1985). An evaluation and presentation of inter cropping advantages. *Experimental Agriculture*, 21: 119-155.

Table 1: Physical and Chemical Properties of the Surface Soil (0 to 30 cm) at the Experimental Site in Anyigba in 2013 and 2014

	Anyigba	
Parameter	**2013**	**2014**
Sand (%)	76	74
Silt (%)	5	5
Clay (%)	19	21
Textural class	Sandy clay loam	Sandy clay loam
pH (H2O)	5.6	5.8
Organic carbon (g kg-1)	9.00	8.80
Total N (g kg-1)	0.7	0.9
Available P (cmol kg-1 soil)	12.5	11.70
Ca^2+ (cmol kg-1soil)	4.20	4.00
Mg^2+ (cmol kg-1 soil)	2.60	1.50
K+(cmol kg-1 soil)	0.15	0.11
Na+ (cmol kg-1soil)	0.68	0.79
ECEC (cmol kg-1soil)	7.62	6.50

Table 2: Effects of Maize Population Density and Time of Introduction of Maize on the Yield and Yield Components of Melon in a Melon-Maize Intercrop

Treatment	**No. of fruits/plant**	**No. of fruits/plot**	**Wt. of fruit/ha(t)**	**No. of seeds/fruit**	**Seed (t/ha)**
Time of introduction					
Same day with melon	1.00	16.30b	1.55	105.00	0.32
1 WAP melon	1.11	26.10a	2.98	110.40	0.38
2 WAP melon	1.00	31.00a	3.22	102.10	0.42
3 WAP melon	1.00	29.20a	2.64	110.00	0.39
4 WAP melon	1.00	29.20a	3.25	108.30	0.44
Population					
10,000	1.00	27.50	2.85	110.00	0.39
20,000	1.06	27.91	2.79	112.90	0.40
40,000	1.00	23.90	2.54	98.50	0.38
Interaction					
Time x Population	N.S	N.S	N.S	N.S	N.S

Means followed by the same letter(s) are not significantly different at 5% level of probability using LSD.

Table 3: Effects of Maize Population Density and Time of Introduction of Maize on the Yield and Yield Components of Maize in a Melon-Maize Intercrop

Treatment	**Yield and yield components**		
	No of cob/plot	**Cob wt (t/ha)**	**Grain yield (t/ha)**
Time of introduction of maize			
Same day with melon	35.90a	1.04c	1.09b
1 WAP melon	29.20ab	0.97c	0.80c
2 WAP melon	23.00b	0.89c	0.80c
3 WAP melon	34.30a	1.35b	0.92bc
4 WAP melon	35.90a	2.09a	1.32a
Population			
10,000	16.50c	0.86c	0.79c
20,000	32.30b	1.26b	1.01a
40,000	46.20a	1.68a	1.16a
Interaction			
Time x Population	N.S	*	*

*= Significant at 5% level of probability

Means followed by the same letter(s) are not significantly different at 5% level of probability using LSD.

Table 4: Interaction Effect of Time of Introduction of Maize x Maize Population Density on the Grain Yield of Maize

	Maize population (plant/ha)		
Time of introduction	**10,000**	**20,000**	**40,000**
Same day with melon	0.74	1.27b	1.25b
1 WAP melon	0.73	0.84cd	0.84cd
2 WAP melon	0.84	0.53d	1.02bc
3 WAP melon	0.79	0.94bc	1.03bc
4 WAP melon	0.86	1.45ab	1.66a

Means followed by the same letter(s) are not significantly different at 5% level of probability using DMRT

Table 5: Land Equivalent Ratio (LER) and Land Equivalent Coefficient (LEC) of Maize-Melon Intercrop as Affected by Time of Introduction and Population Density of Maize

Treatment	**Partial**		**LER**	**LEC**
	Maize	**melon**		
Time of introduction				
Same day with melon	1.05	0.46	1.51	0.48
1 WAP melon	0.60	0.89	1.49	0.53
2 WAP melon	0.82	0.65	1.47	0.53
3 WAP melon	0.60	0.71	1.31	0.42
4 WAP melon	0.74	0.84	1.58	0.62
Population				
10,000	0.60	0.70	1.30	0.42
20,000	0.71	0.70	1.41	0.49
40,000	0.87	0.68	1.55	0.59