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Growth and yield performance of maize (*Zea mays* Linnaeus) in intercrop with mungbean (*Vigna radiata (L) wilczek*) and melon (*Citrullus lanatus* ThunbMansf.) at Igbariam, Anambra State

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ABSTRACT

The study of Growth and yield performance of maize (Zea mays L.) as sole crop was compared with that of maize intercrop with muungbean (Vignaradiata (L.) Wilczek) and melon (CitrulluslunatusThunbMansf.) atIgbariamAnambra State. The experiment was conducted during May -July, 2017 farming season in the Teaching and Research Farm of Crop Science and Horticulture, Chukwuemekaodumegwuojokwu University, Anambra state. The treatments were sole maize (control), maize/mungbean intercrop, maize/melon intercrop and maize/mungbean/melon intercrop and were arranged in a Randomized Complete Block Design (RCBD) with 4 replications. Maize seeds were planted at spacing of 75cmx25cm in each plot; Mungbean and melon seeds were planted in the intercrop plots at spacing of 0.60mx0.60m and 0.40mx0.40m, respectively. Results showed that maize/mungbean produced the highest mean plant height (48.04) and (96.10) at 4and 6 WAP, maize/mungbean/melon produced highest mean number of leaves (12.92). Also, maize/mungbean recorded the highest mean stem girth (6.89). However, observations in these parameters were significantly different ($p<0.05$) from that of maize in maize/mungbean intercrop, but were not significantly different ($p<0.05$) from that of maize in maize/melon intercrop, while there could have been 'mutual cooperation' of maize with mungbean. In terms of yield, there was no significant difference in the grain yield, biological yield and 1000 seed weight measured. It was concluded that mungbean can serve as compatible component in intercropping system involving maize.

KEYWORDS

performance of maize; melon; mungbean; intercropping; igbariam; Anambra state

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INTRODUCTION

Maize (Zea mays L.) is an annual cereal plant of the gramineae family, genus name Zea while the specie name is mays and is the native of Mexico and Central America (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 consumed as staple food in various ways, It is used mainly for human food and livestock feed while in the industry, it is used in the production of starch, oil and alcohol. It can be boiled, roasted or flaked and consumed. Maize can be processed into meals, scurry starchy food or flour for confectionaries (Aliand Mohammad 2012). It is recently used in production of bio-fuel and equally well accepted for feed ingredient and can contribute up to 30% protein, 60% energy, and 90% starch in animal diet. Maize has been recognized as a common component in most intercropping system. It seems to lead as the cereal constituent of intercrop and is regularly combined with dissimilar legumes (Maluekeet al., 2012).

Maize yield is generally higher in high solar intensities, lower night temperatures and lower incidence of pest and diseases (Adesojiet al., 2013).

Mungbean (Vignaradiata (L.)Wilczek) is a crop belonging to the legume specie of the family Fabaceae, and is one of the important legume crops of Asia which is gradually being widely cultivated in Nigeria. Mungbean is also regarded as one of the most important crop after groundnut and cowpea in Africa. Mungbean is consumed as a seed sprout or in processed forms that include cold jellies, sole cropping. Noodles, cakes and brew and could also be eaten roasted, fried or boiled. It is a legume cultivated for its edible seeds and sprout across Asia. The matured seeds provide an invaluable source of digestible protein for human consumption in place where meat is lacking or when people are mostly vegetarian.

Egusi melon (CitrulluslunatusThunbMansf.) 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). The edible seed/kernel of melon contains approximate 46 % oil and 36 % protein (Ogbona 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 as soup thickener (Oyolu and Macfarlance, 1982). About 70 % of cassava, 73 % of maize and 55 % of egusi melon grown in Nigeria are produced under intercropping system (Iken and Amusa, 2004; Ogbona and Obi, 2010; Ijoyah et al., 2012). Poggio (2005) reported that farmers intercropped for varied reasons, including insurance against crop pests, yield increment, weed control and high monetary returns.

Farmers practice intercropping with a wide array of crops, consisting ordinarily of a major crop and other insignificant crops, however, it is pertinent that the selection of compatible crops be given priority as this depends on their gieficial when the two crops are morphologically different, e.g. with different root system and canopy structure (Atriet al., 2000). So plant will absorb water and nutrients from different soil depth, and shoots will not compete for sunlight and gases. Moreover, higher diversity reduces the risk of damages caused by biotic and abiotic factors (Darayee, 2007). Regarding this maize\legumes intercropping has become a very common intercropping system around the world. (Darayee, 2007) reported that maize is a wide row crop with high nitrogen requirement; Mungbean is a legume capable of biological nitrogen fixation. Moreover, maize can physically support mungbean and melon.

In intercropping system practice in Igbariam, most farmers do mixed intercropping without any row arrangement or spacing; this tends to reduce the number of crop planted per hectare or even cause overcrowding which makes weeds and other farm operation difficult. Reduction in yield of component crop may occur due to intense competition (Thole, 2009). The situation in which two or more plants share the same growth factors each far below their combined demands and in the same environment is known as competition. The cereal component in a cereal-legumes intercrop has advanced growth rate, height advantages and it upper hand in competition with associated legumes. The objective of this study is to determine the growth and yield performance maize when intercropped with mungbean and melon. The experiment will help us determine if intercropping maize with mungbean and melon can be used as production strategy for boosting the yields of the intercropped crops. This work was justified by the fact that it will provide an enlightment to farmers and related researchers, on the growth and yield performance of maize when intercropped with mungbean and melon.

MATERIALS AND METHODS

The experiment was carried out at the Teaching and Research Farm of the Department of Crop Science and Horticulture, Faculty of Agriculture, ChukwuemekaOdumegwuOjukwu University, Igbariam Campus, Anambra State. The experimental plot area lies within latitude 6023'26.4"N and Longitude 6056'38.7"E, and is located within the humid tropical rainforest zone characterized by both wet and dry season, with high rainfall and high temperature of 220c - 360c and the soil series belong to the utisols.

The experimental site was manually cleared and a land area of 15m x 19m was mapped out using measuring tape, ropes, pegs and ranging poles. The area was divided into 4blocks. Each block was further divided into 4 plots measuring 3m x 4m each. Each replicates was separated by 1m spacing in between.

Maize seeds was sourced from Anambra State Agricultural Development Programme and planted on each plot at a spacing of 75cm x25cm, in both the sole maize plots and the intercrop plots. Mungbean and Melon seeds was collected from Anambra State Agricultural Development Programme and planted alternately to maize on the same plots, except in the maize sole crop plot, at spacing of 0.60cm x 0.60cm and 0.40cm x 0.40cm for Mungbean and Melon respectively.

The experiment was arranged in a Randomized Complete Block Design (RCBD), with four replications and four treatments.The treatments were represented by the following:
T1 = Maize sole crop (control)
T2 = Maize / Mungbean intercrop
T3 = Maize / Melon intercrop
T4 = Maize / Mungbean / Melon intercrop

(1) Cultural Practices

Poultry manure was applied a week before planting. The plots were weeded using the native hoe as the need arose. The use of the native hoe is a typical practice by farmers in the area at 3weeks interval till harvesting time of Maize.

(2) Data Collection and Statistical Analyses

i. Days to 50% emergence - This was obtained by calculating the number of days from sowing of maize to when half of the total population in a plot germinates.

ii. Plant height (cm) - Plant height was measured from the base of the plant to the tip of the plant with the aid of a measuring tape or ruler and will be recorded, data collected will be expressed in cm.

iii. Stem girth (cm) - The stem girth was measured by using a measuring tape to determine the circumference of the maize plant at 2cm from the ground.

iv. Leaf area (cm) – leaf area was obtained by measuring the longest and broadest leaf with a measuring tape. The leaf length was measured from the point of attachment of the leaf to the tip of the leaf while the leaf width was measured across the widest portion of the surface of the leaves.

v. Number of leaves per plant at flowering - The leaves of six sampled plants was counted and recorded.

vi. 1000 seed (grain) weight (g) - This was obtained by weighing one thousand seed per can. Final weight of grain will be determined at 15% moisture content.

vii. Number of grain per Cob (g) - This was determined by counting the number of grain per Cob in a plant.

viii. Grain weight at 15% moisture content - The weight of seeds at 15% moisture content was weighed using a weighing balance.

Data collected from the various parameters was subjected to analysis of variance (ANOVA), according to the procedure in Randomizied Complete Block Design (RCBD) ,while treatments means were separated and tested for significance difference using the least significance different test (LSD) at 5% level of significance.

RESULTS AND DISCUSSION

Data showed that there were no significantly differences in plant height of maize at 2WAP. Although sole maize intercrop had highest (23.46) mean plant height value, it was not significantly different from value obtained in maize/mungbean (23.27) and maize/melon (22.04) Table 1.

At 4WAP, data obtained showed that the highest plant height (48.04) was recorded in the maize sole plant. However, the value was not significantly different from the mean plant height rescored under maize/mungbean intercrop but was significantly different (P 0.05) from maize/melon (44.96) and maize/mungbean/melon (4.71cm) intercrops, respectively (Table 1). Maize/mungbean/melon intercrop had the least mean plant height which was not significantly different (P 0.05) from the value recorded in maize/melon intercrop (Table 1). At 6WAP there was significant difference among the treatments.

According to Haymes and Lee (1999.), the mungbean intercropped with the maize may have 'dominated' it, thus it does not have the competitive ability against the intercrop. The 'domination' of maize plants by the maize intercrop was evidenced by the higher number of leaves recorded in the maize plants grown under intercrop system than in the sole cropping system.

TABLE 1: Effect Of Intercropping On Mean Maize Plant Height (cm) At 2, 4 And 6 Weeks After Planting (WAP).

Treatment	Mean plant height(cm)		
	2WAP(cm)	4WAP(cm)	6WAP(cm)
Sole Maize	23.46	47.41	12.63
Maize/Mungbean	23.27	48.04	96.10
Maize/Melon	22.48	44.96	89.00
Maize/Mungbean/Melon	23.18	46.36	89.90
$LSD_{(0.05)}$	2.04	4.71	10.79

There was significant difference in the mean of stem girth produced by maize plants under different intercrops. Maize/mungbean intercrop gave the highest (6.89) mean stem girth, though not significantly different. ($p > 0.05$) from sole maize plots.

It was observed that maize plants in maize/melon intercrop had mean leaf area of (6.33) which was not significantly different from that produced by maize plants in maize/mungbean/melon in Table 2. In terms of 50% flowering of maize there was no significant difference between the treatments in Table 2.

TABLE 2: Effect of Intercropping On Mean Days To 50% flowering (50%F) Maize, Stem girth of Maize (cm) and Leaf area (cm) of maize.

Treatments	50 % F(cm)	Stem girth(cm)	Leaf Area(cm)
Sole Maize	47.50	6.79	421.00
Maize/Mungbean	48.20	6.89	427.00
Maize/Melon	49.50	6.33	388.00
Maize/Mungbean/Melon	43.20	6.67	458.00
$LSD_{(0.05)}$	18.28	10.79	119.50

The grain yield and the biological yield of maize showed no difference, also there was no significant difference in the 1000-seed weight of mungbean seeds among the various cropping systems as shown in Table 3. However, it was observed that maize plants intercropped with melon alone, gave results that were significantly comparable to that of sole maize plants. Maize plants recorded least in the measured parameters in the maize/mungbean/melon intercrop, which were significantly (P 0.05) comparable to that of maize/mungbean intercrop.

This observation could be as a result of higher competitive ability which mungbean has over maize. According to Carruthers*et al*. (2005) and Carr *et al*. (2002), differences in the depth of rooting, lateral root spread and root densities are some of the factors that affect competition between the component crops in an intercropping system for nutrients.

TABLE 3: Effect of intercropping on grain yield, biological yield and 1000 seed weight of maize.

Treatments	Grain Yield Kg/ha	Biological Yield kg/ha	1000 - Grain Weight (g)
Sole Maize	4002.37	13804.52	242.16
Maize/Mungbean	3964.54	13432.18	239.67
Maize/Melon	3995.3	13472.1	240.42
Maize/Mungbean/Melon	19922.05	67613.08	1202.34
LSD	NS	NS	NS

CONCLUSION

The study growth and yield performance of maize in intercrop with mungbean and melon was assessed by evaluating it performance in an intercrop system. From the results of this study, it was observed that intercropping maize with mungbean was more compatible than intercropping maize with melon. This was evident in the growth and yield components of maize which were observed to be significantly similar (P 0.05) in the maize plants in the sole crop condition and the maize mungbean intercrop. Based on results of study, maize + mungbean intercropping proved to be more productive and remunerative cropping system under complementary application of poultry manure, it is therefore concluded that mungbean can be used as a compatible crop for effective production of maize.

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