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Effects of Mungbean / Melon/maize Intercrop on the Growth and Yield of Mungbean *(Vigna radiata* (L.) Wilczek*)* Cultivated in Owerri Rainforest Area

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Abstract: Growth and yield of mungbean as sole crop was compared with that of mungbean intercrop with melon and maize. The experiment was conducted during May - August, 2008 in the Teaching and Research Farm, Imo State University, Owerri. The treatments were sole mungbean (control), mungbean/melon intercrop, mungbean/maize intercrop and mungbean/melon/maize intercrop. Mungbean seeds were planted at spacing of 30cmx30cm in each plot; melon and maize seeds were planted in the intercrop plots at spacing of 50cmx50cm and 1mx1m, respectively.. Results showed that sole mungbean produced the highest mean plant height (20.7 cm), number of leaves (16.7) at 4 WAP. Also, sole mungbean recorded the highest mean number of root nodules (17.7), number of pods (6.5) and seed yield (45.1 $Kgha^{-1}$). However, observations in these parameters were not significantly different ($p<0.05$) from that of mungbean in mungbean/melon intercrop, but were significantly different ($p<0.05$) from that of mungbean in mungbean/maize intercrop, while there could have been 'mutual co-operation' of mungbean with melon. It was concluded that melon can serve as compatible component in intercropping system involving mungbean.

Key words: Mungbean · Melon · Maize · Intercrop · Growth · Yield

INTRODUCTION

Mungbean *(Vigna radiata (L.)* Wilczek*)* is one of the important legume crops of Asia which is gradually being widely cultivated in Nigeria. Mungbean is consumed as a seed sprout or in processed forms that include cold jellies, noodles, cakes and brew and could also be eaten roasted, fried or boiled [1].

Legumes are least expensive source of food protein and are two to three times richer in protein than cereals and even more than that in tubers. According to Gopalan *et al*. [2], in comparison to other legumes, mungbean has been found to be rich in dietary iron.

Agugo[3] reported that mungbean composed of reasonable percentages of moisture, digestible crude protein, fat, crude fibre, hence a good source of livestock feed.

Like other legumes, mungbean is vulnerable to myriad of production problems which include inconsistent cropping systems that hamper its production potential, especially in Nigeria. According to Agugo[3] average low yield of the crop could be due to low inherent potential but majority of the factor is attributable to the cropping system adopted in its cultivation.

The growth of two or more crop species simultaneously in the same field during a growing season, defined as intercropping [4] has many advantages over sole cropping. Intercropping is receiving increasing attention as it offers potential advantages for increasing sustainability in crop production. According to Remison [5], greater yield stability and land use efficiency including better use of growth resources are derived from intercropping.

However, Dimitrios *et al*. [6] reported that the intercropping increased competition between crops and weeds for nutrients and light. In some cases, the output of one crop may be increased through a decline in the production of the other, a situation Haymes and Lee [7] referred to as 'dominant' and 'dominated', respectively. In some other cases an increase in output of one crop some other cases an increase in output of one crop could help to bring about an increase in output of the other crop; this situation is referred to as 'mutual co-operation' by Ofori and Stern [4].

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Hauggaard-Nelson *et al*. [8] reported that the intercropping increased competitive ability of crops towards weeds; while Jensen [9] and Carruthers *et al*. [10] reported that competition improved soil fertility due to addition of nitrogen fixation and provides physical support and shelter to one another.

The incorporation of legumes in forage mixtures with grasses or cereals is an important and well established practice in some regions [11], however, in forage-annual production systems, legumes are preferred owing to several advantages over monocultures [12]. Though, according to Carruthers *et al*. [10], several factors can affect growth of species used in intercropping; these include differences in the depth of rooting, lateral roots and root densities. Carr *et al*.[13] included cultivar selection, seeding ratio and competition between mixture components as among factors that determine performance of crops in intercropping system. Higher productivity per unit area was achieved by intercropping cassava with soybean, then by growing the two crops separately [14]. Udom *et al*. [15] reported apparent increase (14%) in nodule number and weight of soybeans growing with maize, although results were not significant. According to Javanmard *et al*. [14], intercropping is popular because of its advantages over sole cropping which include security of returns and higher profitability due to higher combined returns per unit area of land. Rao *et al*.[16] reported interesting results on yield increase in groundnut through intercropping systems. Sangakkara [17] reported that germination, establishment and growth of plants and yield parameters of mungbean in close proximity to maize were reduced to a greater extent than that in cassava intercrop.

The present study aimed to investigate the effects of intercropping with maize and melon on growth and yield components of mungbean in Owerri rainforest area, under conventional planting pattern.

MATERIALS AND METHODS

The experiment was conducted during May to August, 2008 in the Teaching and Research Farm of the Faculty of Agriculture and Veterinary Medicine, Imo State University, Owerri. Owerri is located between Latitudes 5°0'N and 6°0'N and Longitudes 6°5'E and 7°0'E in the rainforest belt of South- East Nigeria. Annual average rainfall is between 2500m-3000mm, distributed between March to October. Temperature range during the cropping season is 27-30°C, with a relative humidity of 75% [18].

The experimental site was manually cleared and then divided into 3 blocks. Each block was further divided into 4 plots, measuring 10m x 2m each, with 1m path in between. The experiment was arranged in a Randomized Complete Block Design, with three replications and four treatments. The treatments were represented by the following; T_1 = mungbean sole crop (control), T_{2-} = mungbean/melon intercrop, T_3 = Mungbean / maize intercrop, T_4 = mungbean / melon/Maize intercrop.

Mungbean seeds were collected from Michael Okpara University of Agriculture, Umudike and planted on each plot at a spacing of 30cm x 30cm, in both the sole mungbean plots and the intercrop plots giving mungbean plant population of 222 plants plot^{-1}. Melon and maize seeds were collected from the Imo State Agricultural Development Programme (Imo ADP) and planted alternately to mungbean on the same plots, except in the mungbean sole crop plot, at a spacing of 50cm x 50cm for melon and 1m x 1m for maize giving a total of 80 melon plants and 20 maize plants plot^{-1}, respectively.

The plots were weeded at 3 weeks interval till harvesting time of mungbean seeds. Fertilizer (NPK 15:15:15) was applied at the rate of 400kgha^{-1} at 3 weeks after planting. Data were collected on mungbean plants based on the following parameters: plant height (cm), number of leaves plant^{-1} measured at 2 and 4 weeks after planting (WAP), number of branches plant^{-1} measured at 4 WAP, respectively, number of nodules plant^{-1} measured at flowering stage, number of pods plant^{-1},, 100-seed weight(g) and seed yield (kgha^{-1}) measured during harvest, respectively. Data collected were subjected to analysis of variance, while treatments were separated by the Least Significance Difference Test (LSD) at 5% level of significance [19].

RESULTS

Effects of Mungbean / Melon/maize Intercrop on Mungbean Plant Height: The results of the study revealed slight differences in plant height of mungbean at 2WAP. Although mungbean/melon intercrop had the highest (4.7cm) mean plant height value, it was not significantly different from values obtained in mungbean/maize (4.5cm) and sole mungbean (4.6cm), but had a significant difference ($P \leq 0.05$) from the value recorded for mungbean/melon/maize intercrop with mean plant height of 4.1cm (Table 1).

At 4WAP, results obtained showed that the highest plant height (20.7cm) was recorded in the mungbean sole plants. However, this value was not significantly different from the mean plant height recorded under mungbean/melon intercrop, but was significantly different

Table 1: Mean Plant height and mean number of leaves of mungbean plants under melon and maize intercrop

	Mean plant height (cm)		Mean no. of leaves	
Cropping system s	2WAP	4WAP	2WAP	4WAP
Sole mungbean	4.6a	20.7a	5.0a	16.7a
Mungbean/melon	4.7a	20.2a	5.0a	17.6a
Mungbean/maize	4.6a	15.0b	5.0a	14.2b
Mungbean/melon/maize	4.1b	13.2b	5.0a	13.0b

Means in the same column with the same letter are not significantly different at $P \leq 0.05$, according to LSD test.

Table 2: Mean number of branches and root nodules of mungbean plants under melon and maize intercrop.

Cropping systems	Mean no. of branches At 4 WAP	Mean number of root nodules at flowering
Sole mungbean	7.5a	17.7a
Mungbean/melon	7.7a	16.4ab
Mungbean/maize	5.4b	15.0bc
Mungbean/melon/maize	4.4c	14.4c

Means in the same column with the same letter(s) are not significantly different at $P \leq 0.05$, according to LSD test.

Table 3: Mean number of pods, 100 seed weight (g) and seed yield ($kgha^{-1}$) of mungbean plant under different cropping systems

Cropping systems	No. of pods plant-1	100-seed wt (g)	Seed yield (Kgha-1)
Sole mungbean	6.5a	5.0a	45.1a
Mungbean/melon	5.4b	5.0a	42.2a
Mungbean/maize	5.4a	4.9a	35.2ab
Mungbean/melon/maize	3.8c	5.2a	26.3b

Means in the same column with the same letter(s) are not significantly different at $P \leq 0.05$, according to LSD test

($P \leq 0.05$) from mungbean/maize (15.0cm) and mungbean/melon/maize (13.2cm) intercrops, respectively (Table 1). Mungbean/melon/maize intercrop had the least mean plant height which was not significantly different ($P \leq 0.05$) from the value recorded in mungbean /maize intercrop (Table 1).

Effects of Mungbean / Melon/maize Intercrop on the Number of Mungbean Plant Leaves: Data in Table 1 showed that there was no significant difference in the mean number of leaves produced by mungbean plants under different cropping systems at 2WAP. However, at 4WAP, mungbean melon intercrop gave the highest (17.6) mean number of leaves, though not significantly different ($P \leq 0.05$) from sole mungbean plots. It was observed that mungbean plants in mungbean/maize intercrop had mean number of leaves of 14.2 which was not significantly different from that produced by mungbean plants in mungbean/melon/maize intercrop (Table 1).

Effects of Mungbean/melon/maize Intercrop on the Number of Branches of Mungbean Plant: As shown in Table 2, mungbean plants intercropped with melon produced the highest number of branches (7.7), though not significantly different from the mean number of branches produced by sole mungbean plants. Mungbean plants in mungbean/melon/maize intercrop produced the least branches which was significantly different ($P \leq 0.05$) from the other cropping systems (Table 2).

Effects of Mungbean/melon/maize Intercrop on the Number of Nodules Produced by Mungbean Plant Roots: Table 2 showed that mungbean plants in the sole cropping system produced the highest mean number (17.7) of nodules and this was significantly different ($P \leq 0.05$) from the mean number of nodules produced by mungbean plants in the other cropping systems (Table 2).

Effects of Mungbean / Melon/maize Intercrop on the Yield and Yield Components of Mungbean

Number of Pods Plant^{-1}: The results in Table 3, showed that mungbean plants in the sole cropping system produced the highest mean number of pods (6.5) which was significantly different ($P \leq 0.05$) from the other cropping systems. The least number of pods was produced by mungbean plants in the mungbean/melon/maize intercrop (Table 3).

100-seed Weight of Mungbean Seeds(g): There was no significant difference in the 100-seed weight of mungbean seeds among the various cropping systems as shown in Table 3.

Seed Yield of Mungbean (Kgha^{-1}): From the Table 3, it was shown that, mungbean plants in the sole cropping system gave the highest mean seed yield of 45.1kgha^{-1}, though, this was not significantly different ($P \leq 0.05$) from the mean seed yield recorded in mungbean plants under mungbean/melon intercrop. It was also shown that the least mean seed yield of 26.3kgha^{-1} was recorded in mungbean plants in mungbean/melon/maize intercrop which was significantly different from the mean seed yield in the other cropping systems (Table 3).

DISCUSSION

Results of this study indicated that intercropping mungbean with melon or maize had influence in some growth and yield parameters of mungbean. Higher plant height was observed in mungbean plants grown in sole

cropping system than in the intercrop plots at 4WAP. This type of observation was also recorded in the number of leaves produced by the mungbean plants; mungbean plants in the sole cropping system produced more leaves than mungbean grown in the intercrop condition. The lowest plant height and number of leaves of mungbean plants in the intercrop system could be attributed to competition for available growth resources in the intercrop environment. According to Haymes and Lee [7], the maize intercropped with the mungbean may have 'dominated' it, thus it does not have the competitive ability against the intercrop.

The 'domination' of mungbean plants by the maize intercrop was evidenced by the higher number of branches and number of root nodules recorded in the mungbean plants grown under sole cropping system than in the intercrop system. However, it was observed that mungbean plants intercropped with melon alone, gave results that were significantly comparable to that of sole mungbean plants. Mungbean plants recorded least in the measured parameters in the mungbean/melon/maize intercrop, which were significantly ($P \leq 0.05$) comparable to that of mungbean/maize intercrop. This observation could be as a result of higher competitive ability which maize has over mungbean. According to Carruthers *et al*. [10] and Carr *et al*. [13], 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. The maize in this experiment, is taller, has a faster growing or more extensive root system and is competitive for soil nitrogen [20].

Nonetheless, contrary to observations in the mungbean /maize intercrop; mungbean/melon intercrop seems to agree with the findings of Ofori and Stern (1987)[4]. Records of plant height, number of leaves /plant, number of branches and number of root nodules were found to be significantly similar ($P \leq 0.05$) among mungbean in sole cropping system and the mungbean/melon intercrop. This, according to Ofori and Stern [4] could be as a result of 'mutual co-operation' that existed between the mungbean and melon in the intercrop environment.

The yield and yield components of mungbean were higher in the mungbean plants in sole cropping system, though not significantly different ($P \leq 0.05$) from that of mungbean/melon intercrop.

Since mungbean plants in the sole cropping system recorded higher plant height, number of leaves, number of branches and number of root nodules, it is consequential that these attributes may have encouraged better photosynthetic activity in the mungbean under sole crop condition.

From the results of this study, it was observed that intercropping mungbean with melon was more compatible than intercropping mungbean with maize. This was evident in the growth and yield components of mungbean which were observed to be significantly similar ($P \leq 0.05$) in the mungbean plants in the sole crop condition and the mungbean melon intercrop. This observation also indicated absence of 'dominant' competition among mungbean and melon as against the observation in mungbean/maize intercrop.

It is therefore concluded that melon can be used as a compatible crop in mungbean intercropping.

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