Influence of poultry manure on the agronomic performances of okra and tomato under different cropping systems.

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ABSTRACT

Field experiment was conducted at the Teaching and Research Farms of the Federal University Technology Minna, Gidan Kwanu campus to determine the agronomic performances of okra and tomato under different cropping systems as influenced by poultry manure. The experiment was arranged in a randomized complete block design with three replicates. The treatments were four different cropping patterns: sole cropping with poultry manure, sole cropping without poultry manure, okra intercropped with tomato in ratio 2:1 with poultry manure application and okra intercropped with tomato in ratio 2:1 without application of poultry manure. There were significant ($p<0.05$) differences in the plant height among sole and inter cropped systems. Intercropped okra and tomato plots that were treated with poultry manure had significantly highest plant height, number of fruits and fruit weight than other treatments. In terms of land use efficiency, intercropped okra and tomato plots had highest land equivalent ratio (LER). The result showed that, the application of poultry manure produced the highest yield of okra and tomato under intercropping system when compared with sole cropping and could be recommended for farmers in guinea savannah agro-ecological zones of Nigeria.

Keywords: Poultry manure, okra, tomato, mixed cropping, sole cropping

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INTRODUCTION

Okra, *Abelmoschus esculentus* L. Moench, is of the family Malvaceae. It is widely cultivated fruit vegetable by subsistence farmers of Guinea and Sudan savanna zones of West Africa. The production of okra in Nigeria has rapidly increased in recent years. The seasonal supply of okra to a large extent determines how much of it is being consumed by the majority of the people. Okra contains proteins, carbohydrate and vitamin C (Lamont *et al.* 2004; Goplan *et al.,* 2007; Arapitas, 2008, Dilruba *et al.,* 2009). Okra plays a vital role in human diet (Kahlon *et al*., 2009). Consumption of young immature okra pods is important fresh fruits, and can be consumed in different forms (Ndunguru and Rajabu, 2004). Fruits can be boiled, fried or cooked (Akintoye *et al*., 2011).

Tomato consumption benefits the heart, amongst other body organs (Hosseini *et al.,* 2011). Tomato has medicinal properties because its consumption has been associated with decreased risk of breast cancer (Cheng *et al*., 2009). Tomato consumption is beneficial for reducing cardio-vascular risk associated with type diabetes (Hosseini *et al.,* 2011).

Research has shown that intercropping is an efficient soil conservation practice due to the increased ground cover that it provides as well as the exploitation of different soil layers due to the different depth of root systems of the two species being intercropped (Jarenyama *et al*., 2000).Through more effective use of water, nutrient and solar energy, intercropping can significantly enhance crop productivity compared with the growth of sole crops (Hussaini *et al*., 2001). Studies have shown the utility of intercropping as one of the crop contingency strategies against any sole cropping failure. Furthermore,

intercropping has a great potential for pests, and diseases reduction (Baumann *et al*., 2000). It has been acclaimed globally that, intercropping is most reliable approach to safeguard the sustainability of crop production (Ayoola and Agboola, 2001). Manures provide a source of all necessary macro- and micro-nutrients in available forms, thereby improving the physical and biological properties of the soil (El-Magd *et al*., 2006).

Sustainability in agro-ecosystems involves environment-friendly techniques based on biological and non-chemical methods (Ridray and Bonato, 2007). Tomato is grown by using conventional and organic fertilizers. However, fertilizer sources can have a significant effect on tomato quality (Toor *et al*., 2006). Nonetheless, there is growing interest in using organic amendments and compost extracts to improve soil conditions and prevent crop diseases in tropical, arid and temperate climates (Litterick *et al*., 2004). They may also reduce the severity of diseases caused by foliar plant pathogens (Abbasi *et al*., 2002). Using organic fertilizers, composts and additions of rock minerals not only supplies plant nutrients but increases tolerance and resistance to insects and diseases; helps control weeds; retains soil moisture; and enhances fruit quality. The combination of animal and chicken manures provide an excellent sources desirable natural nitrogen (N), phosphorus (P), potassium (K) and sulfur (S) nutrient to the soil (Ghanbarian *et al*., 2008). The objective of the study is therefore to assess the influence of poultry manure on some agronomic characters of okra and tomato under different cropping systems.

MATERIALS AND METHODS

Field experiment was conducted during the 2012 cropping season at the Teaching and Research Farms of the Department of Crop Production, Federal University of Technology Minna, Gidan Kwanu campus located at Latitude 6^0 33 E and Longitude 9^0 37 N in the Southern Guinea Savannah Zone of Nigeria. The average rainfall ranges between 750 mm-1250 mm. The soil textural class of the experimental site was sandy loam. The experiment consisted of two sources of nutrients (poultry manure at 5.2 t/ha and no soil amendment) and three cropping patterns (sole cropping of tomato, sole cropping of okra and okra intercropped with tomato). Tomato variety (UC-82B) and okra variety (LD88-1) were used. The plastic buckets were filled with sandy loam top soil. The tomato seeds were sown into perforated plastic buckets by broadcasting method and watered daily. The seedlings were transplanted to the field 30 days after sowing at 50 cm × 75 cm inter row and 75 cm intra spacing. Okra seeds were sown directly to the field seven days after transplanting. Tomato plants were staked using wooden poles to provide support for the tomato plants. Weeding was done manually at 2, 4, 6 and 8 weeks after sowing. Five stands of okra and tomato were randomly selected and tagged from each plots for data collection. Data collected included days to 50% flowering, plant height, number of leaves, fruit diameter, number of fruit and fruit weight. All data collected were subjected to analysis of variance (ANOVA) and means were separated using least significant difference (LSD) at 5% level of probability.

RESULTS AND DISCUSSION

The result presented on Table1 showed that there was no significant difference in plant height of sole okra and inter planted okra at 3, 6 and 9 weeks after sowing (WAS). However, application of poultry manure produced highest plant height in intercropped okra. Plants from the control plot in both sole and intercropped had similar heights. Significant differences were observed in plant height in the sole tomato and intercropped tomato at 3, 6 and 9 WAS after the application of poultry manure. The highest plant height was observed where poultry manure was applied, especially to tomato sole crop while the lowest plant height was recorded in both sole and intercropped where there was no soil amendment.

The result presented on Table 2 revealed that there was no significant difference in the number of days for both sole and intercropped okra to attain 50% days to flowering. However, plants supplied with poultry manure attained 50% flowering in lesser days. Significant differences were recorded in fruit length and fruit diameter of sole and intercropped tomato after the application of poultry manure. Highest fruit length and fruit diameter were recorded in plants supplied with poultry manure while the lowest fruit length and diameter were observed where there was no soil amendment.

Table1: Effects of poultry manure on plants height (cm) of okra and tomato under different cropping patterns

	Okra			Tomato		
Treatments	3WAS (cm)	6WAS (cm)	9WAS (cm)	3WAS (cm)	6WAS (cm)	9WAS (cm)
Sole + C	8.4	31.1	86.4	23.7	40.3	49.7
Sole + PD	8.1	33.8	85.7	23.2	43.9	58.5
Inter + C	8.5	30.4	88.6	17.7	27.5	46.2
Inter + PD	8.3	38.7	97.2	17.5	29.0	50.4
SE±	0.8	3.3	3.4	1.7	4.2	1.8
$LSD_{0.05}$	2.9	11.4	11.8	5.9	14.6	6.4

Foot note: C – control; PD - Poultry dropping at 5.2t/ha; Inter- Inter-planting.

Table 2 Effect of poultry dropping on 50% flowering, fruit length (cm) and diameter (cm) in okra and tomato under different cropping patterns.

	Okra			Tomato		
Treatments	50% flowering (days)	Fruit length (cm)	fruit diameter (cm)	50% flowering (days)	Fruit length (cm)	Fruit diameter (cm)
Sole +C	68.3	6.5	2.4	45.7	5.1	3.7
Sole + PD	69.3	7.5	2.7	44.3	5.3	3.9
Inter + C	66.0	6.7	2.7	44.7	4.7	3.1
Inter + PD	60.8	7.7	3.0	44.7	4.7	3.2
SE±	3.9	0.3	0.1	1.2	0.1	0.1
$LSD_{0.05}$	13.4	0.9	0.3	4.3	0.3	0.5

Foot note: C – control; PD - Poultry dropping at 5.2t/ha; Inter - Inter-planting.

Table 3. Effect of poultry dropping on the number of fruits and yield in okra and tomato (tha^{-1}) mixtures.

	Okra		Tomato		
Treatments	Number of fruit per plant	Yield (t/ha)	Number of fruit per plant	Yield (t/ha)	LER
Sole + C	5.1	2.9	1.8	2.4	-
Sole + PD	6.8	3.1	2.4	3.5	-
Inter + C	5.2	3.2	1.5	2.2	2.02
Inter + PD	8.1	4.2	1.9	2.4	2.05
SE±	0.3	0.2	0.2	0.2	
$LSD_{0.05}$	1.1	0.8	0.8	0.7	

Foot note: C – control; PD - Poultry dropping at 5.2t/ha; Inter- Inter-planting.

There were significant differences in the number of fruits and fruit yield in sole and intercropped okra (Table 3). Number of fruits and yield from plants supplied with poultry manure in intercropped okra were significantly higher than those of sole okra. However, similar number of fruits were produced in intercropped where there was no soil amendment. Significant differences were recorded in number of fruits and yield in sole and intercropped tomato after the application of poultry manure.

Nutrient source is one of the most important inputs contributing to crop production because it increases productivity and improves yield and quality (Akande *et al.,* 2010). Plants that were treated with poultry manure had greater vegetative performance in okro intercropped over sole okro. This findings is in agreement with Akande *et al.,* (2010) who reported that application of organic base fertilizer, poultry dropping, enhanced plant growth and development. The fruit yield was higher in intercropped than in sole okra. This result agreed with the findings of Adeniyi and Omotunde (2011) who reported that best response was obtained in okra-tomato intercrop. It was also reported that application of poultry resulted in higher yield. The significant effect of poultry dropping on the number of fruits and yield could be attributed to the improvement of the soil fertility by poultry dropping through the addition of macro and micro nutrients (Adeniyan and Oyeniyi 2005). Their findings also corroborates the works of Akande, *et al* (2010) who attributed higher okra plant height to the application of organic manure. It had been reported that organic and soil nutrients increases with the application of poultry manure; and that poultry manure contains organic matter, N, P, Ca and Mg which are released into the soil (Adenawoola and

Adejoro, 2005). Depletion of organic matter under intensive cropping can be amended by proper addition of poultry manure into the soil. However, spacing of crop under intercropping and sole cropping systems significantly affected plant height and vegetative growth. The low performance of intercrop tomato could be traced to the presence of inter specific competition and okra being more competitive in terms of resource utilization than tomato (Tunku *et al.,* 2010)

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