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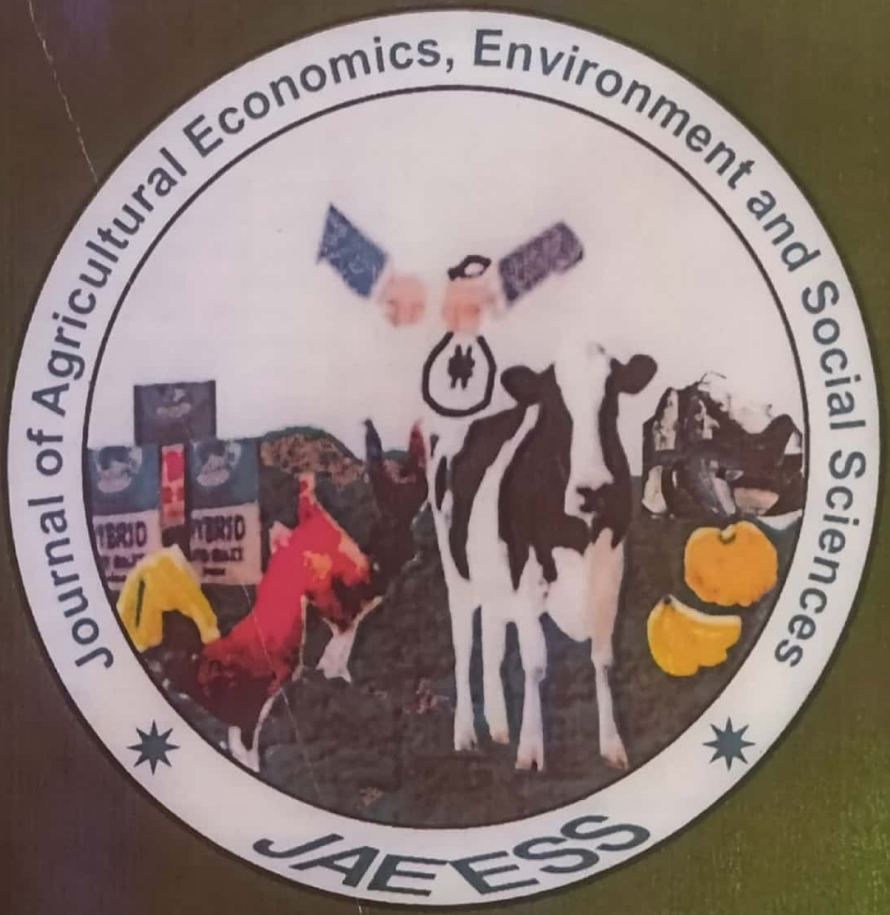

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GROWTH AND YIELD OF TOMATO IN RESPONSE TO APPLICATION OF DIFFERENT ORGANIC MANURES ON AN ALFISOL IN MOKWA SOUTHERN GUINEA SAVANNAH, NIGER STATE, NIGERIA

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Abstract

The study was carried out to investigate the effects of different organic manure sources to access the growth and yield of tomato in Mokwa Southern guinea savannah ecological zone of Nigeria. The study was carried out in Teaching and Research Farm of Niger State College of Agriculture in 2019 cropping season. Mokwa lies on Longitude 9.2394^0 N and latitude 5.3103^{0}E. The soil samples were collected and analyzed for physical and chemical properties. The treatment consisted of 20t/ha of each of kitchen waste, poultry droppings, cow dung and a control. The experiment was laid out in Randomized complete Block Design (RCBD) with three replications. The result of this study revealed that some plant nutrient such as N and P are very low and hence they can be supplemented by some organic manure such as poultry droppings. The optimum yield can be obtained in Mokwa and other agro-ecological zone, if 20t/ha^{-1} of poultry droppings was applied to 1 hectare of land, the optimum yield can be obtained under good agronomic practices.

Keywords: *organic manure, kitchen waste, cow dung, poultry droppings.*

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Introduction

Declining crop yield has being a major concerned among the farming communities all over the world. In Nigeria today, tomato (*Lycopersicum esculentum)* has an average yield of 10t/ha^{-1}, this is lower than the world average of 22t/ha^{-1} reported by Ojeniyi *et al* (2017). The major factor that contribute to low yield is soil fertility status and inadequate use of fertilizers (Ogbahur, 2019; Dantata *et al.*, 2016. Dantata and Hassan (2019). The declining in soil fertility leads to land degradation this is because the soil cover may be completely removed and organic matter depleted. The addition of organic matter to the soil is a old and modern technologies being exploited by the farmers to restore such low fertility on the degraded soils (Togun *et al.*, 2014). The organic manure supply nutrients to soil such as N.P.K and some essential micro nutrients to crops (Jacobsen, 2015). It improves soil physical properties, improve water holding capacity, which favours root growth and increase drought tolerance of crops (Joshua *et al.*, 2008). The effect of organic manure on the growth and the yield of tomato in relation to application of agro wastes had been widely reported by many workers (Togun

et al., 2014), reported that a significant higher yield was recovered when cabbage and onions were given similar treatment. According to Akanbi and Togun (2002) similarly, yield increases in Amaranth, maize, okra and tomato when grown on soils fertilized with organic manures. (Akanbi, 2002, Togun *et al.*, 2014) Also carry out similar studies on organic manure application to pumpkin and observed to have positive effects on soil physical, chemical and biological properties.

Despite the potential of these organic wastes as fertilizers against the inorganic sources which is characterized by its scarcity, high cost and inappropriate knowledge on its uses particularly on vegetables. (Ogbahur, 2019; Dantata and Hassan, 2019. Dantata *et al.*, 2016) there is need to taste the suitability of these organic materials as fertilizer for optimum growth and development of these crops (tomato) across different ecologies (Togun *et al.*, 2014). The carbon nitrogen ratio or contents of most of these organic materials determined their biodegradation and bioavailability of nutrients (Li and Mahler, 2015). Very scanty information was available on the use of organic manures in tomato production in this agro-ecology. Hence, the objective of this study is to investigate the possibility of improving tomato production on cultivated Alfisol with the application of different organic waste such as kitchen refuse, poultry droppings, and cow dung.

Materials and Methods

This field study was conducted at the Teaching and Research farm of Niger state College of Agriculture Mokwa, the study area lies on latitude 8^0 30 N and 11 N and longitude 4^0 30 E and 6^0 8930^1 E in the southern guinea savannah and 308m above sea level. It lies within guinea savannah belt of Nigeria. It is characterized by rainy season and a short dry season. Mean annual precipitation is 1,175mm per year. Evapotranspiration is 2,149mm, temperature is 28^0C and sunshine period is 8 hrs. The soil moisture is austic and soil moisture regime is hyperthermic (Arbang, 2015). The vegetation of the study area is characterized with tall grasses and scattered trees. The study area is under cultivation for over some decades now, the arable crops grown in the study area include maize, soyabeans, cassava and yam while vegetable crops such as Amaranthus, okro and tomato are also grown in the study area. The major soil order within the study area is Alfisol (Mohammed and Aduloju 2008; Babalola, 2010). After clearing the study site, a composite soil sample was collected with soil augar to a depth of 0-30cm. the samples were air-dried sieved through 2mm mesh sieve for physical and chemical analysis according to IITA (1979). The experimental area measuring 18.5m x 12.5m were marked out into 12 plots each measuring 2.5m x 2.5m and each plot separated by 0.5m. The treatment consisted of 20 t/ha^{-1} each of kichten waste, poultry droppings, cow dung and a control (check). The experimental design used was a randomized complete block design (RCBD) with three replications. Tomato seedlings (Roma VF cv.) were raised in the nursery for four weeks, after which they were transplanted (WBT). Weed control were carried out appropriately. Plants were evaluated for growth and yield parameters at harvest. Data collected were subjected to analysis of variance and means were compared by least significant difference (LSD) at 5% probability level.

Results and Discussion

Table 1: Physico-chemical Properties of the Experimental Site before Cropping in 2019 Raining Season at Mokwa Southern Guinea Savvanah of Nigeria

Soil properties	0-30cm depth
Physical properties	
Sand (g kg^{-1})	418
Silt (g kg^{-1})	272
Clay (g kg^{-1})	310
Chemical properties	
pH (H_2O) (1:2)	6.4
Total nitrogen	1.0
Available phosphorus	11.2
Exchangeable bases	
K	0.31
Ca	9.7
Mg	0.34
Na	0.21

Soil chemical and physical data are presented in table 1. The soils are slightly acidic, contains slight and clay mixture that is good enough to hold adequate moisture for good crop growth in tomato which invariably improved and develop the economic parts of the crop as reported by Togun *et al.* (2014). However, the soils investigated are low in some nutrients, especially, the total nitrogen (N) and potassium (K), this is a characteristic of most of tropical soils according to Singh (2007). Kendagarama *et al.* (2019) as well as Adekiya and Ojeniyi (2013). The low N and P content of the soil suggested that the soil could not be cropped with tomato on a sustainable basis, without being fertilized or amended. Tomato is known to be a veracious feeder of soil nutrients, especially, the soil-N (Dantata *et al.*, 2016., Dantata and Oseni, 2016).

Table 2: Effect of Organic Manures on Plant Height (cm) of Tomato during the Raining Season (2019) in Mokwa Southern Guinea Savannah

Treatments	plant height (cm)
Control	44.5
Kitchen waste	48.2
Poultry droppings	67.7
Cow dung	57.5
LSD (0.05)	3.59

The result of this study revealed that application of organic manures influence plant height in tomato (Table 2). Plant height at harvest differs significantly among treatments with taller plant recorded in plot fertilized with poultry droppings. Similar reports as been obtained in vegetable amaranth (Akanbi and Togun, 2002). The taller plant were recorded in soils treated with poultry droppings, reflects the availability of the quantity of nutrient contained in the organic material. This concurs with the findings of Togun *et al.* (2014) who worked on the response of tomato to three different plant wastes (maize stover, guinea grass and cow pea stover).

Table 3: Effect of Organic Manures on Number of Nranches of Tomato during the (2019) Raining Season in Mokwa Southern Guinea Savannah

Treatments	number of branches
Control	5.9
Kitchen waste	6.1
Poultry droppings	6.1
Cow dung	5.9
LSD (0.05)	0.2

Table 3 shows the significant effects of organic manures of number of branches in tomato. kitchen waste and poultry droppings gave the highest number of branches. The behavior in number of branches of tomato observed between the control treatment and cow dung. The behavior in number of branches of tomato observed in this study agreed with the earlier reports made by Ja'a'far (2007). Aiyelaagbe *et al.* (2015) and Dantata (2018).

Table 4: Effect of Organic Manures on Number of Leaves of Tomato during the (2019) Raining Season in Mokwa Southern Guinea Savannah

Treatments	Number of leaves
Control	39.3
Kitchen waste	58.3
Poultry droppings	87.7
Cow dung	70.4
LSD (0.05)	1.92

Table 4 shows the number of leaves of tomato in response to different organic materials. Plots treated with poultry droppings produce the highest number of leaves per plant among treatments. The fertility status of the soil proved to be more beneficial, with poultry droppings than any other treatments in this study. Poultry droppings are known to precipitate rapid vegetative growth(Aiyelaagbe *et al.*, 2015; Katung *et al.*, 2005; Dantata, 2008). The number of leaves recorded with poultry droppings in the current work collaborates with the findings of Ja'a'far (2007)who reported significant difference among organic fertilizers use in tomato.

Table 5: Effect of Organic Manures on Fruit Yields of Tomato during the (2019) Raining Season in Mokwa Southern Guinea Savannah

Treatments	Number of leaves
Control	0.7
Kitchen waste	1.2
Poultry droppings	27.5
Cow dung	10.5
LSD (0.05)	0.4

Table 5 shows the yield of tomato in response of application of different organic manure. Poultry droppings gave the highest fruit yield of 27.5 t ha^{-1} comparatively lesser fruit yield of 10.5t ha was obtained with application of cow dung. kitchen waste produce 1.2 t ha^{-1} of tomato fruit while least yield (0.7 t/ha^{-1}) of tomato was recorded in the control treatment. The observe behavior of tomato fruit yield in this experiment is in line with those reported on maize stover, guinea grass, cowpea stover, wood ash as well as sorghum brewery waste, ground cocoa husk, household waste and market waste as organic fertilizers in tomato production in Nigeria (Ja'a'far, 2007; Adediran *et al.*, 2013; Togun *et al.*, 2014; Haggai and Aliyu, 2015; Ojeniyi *et al.*, 2007). It was reported that better crop yield occurs, most especially when soil is amended with organic manure sourced from materials of low C:N ratio (Li and Mahler, 2015).

Our experiment however contradicts the proceeding report; reasons for the disparities may be associated with the work authored by Asiegbu (2009). This author showed that disparities in crop performance may be related to such factors as the level of native soil-N, other edaphic and climatic factors such as rainfall and sunshine. The work authored by Togun *et al.* (2014) also lends credence. These researchers reported that C: N ratio of organic materials and their state of decomposition at the time of application are some of the factors affecting availability and uptake of nutrients from them for enhanced plant performance.

Conclusion

It can be concluded that for optimum growth and yield of tomato in Mokwa and related agro-ecologies, application of 20 t ha^{-1} of poultry droppings as organic soil amendment is adequate. However, further work is required to validate the present report.

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