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Cow Dung, Goat and Poultry Manure and Their Effects on the Average Yields and Groth Parameters of Tomato Crop

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Abstract
A field experiment to investigate the effects of application cow dung, goat and poultry manure on the average yield and growth parameters of a tomato variety was carried out at the Research Farm of the Federal College of Education (Technical) Potiskum, North-Eastern part of Nigeria during 2012 planting season. Treatments were laid out in a Randomized Complete Block Design (RCBD) with three replications. The variables measured were plant height, number of leaves, number of branches and fruit yield obtained. Data collected were subjected to Analysis of Variance (ANOVA). The means were separated using LSD at five percent level of significance. Results obtained indicated that growth and yield of tomato was lowest in control treatments which showed that the organic manures used in the study especially poultry manure positively influenced the performance and yield of tomato. The results also revealed that plots treated with poultry manure gave the highest number of leaves and branches per plant and fruit yield of 28.0t/ha. Comparatively, lesser fruit yield of 11.5t/ha was obtained with the application of goat manure. Cow dung produced 3.5t/ha of tomato fruits while the least yield of 1.2t/ha of tomato were recorded in the control treatments. Based on the findings of the experiments it could be deduced that poultry manure seems to promote higher growth yield of tomato. Thus, it should be recommended for growers of tomato crop in the study area. Goat manure commonly found in the area may be applied for maximum growth parameters.
Keywords: Organic manure, Growth parameter, Yield and Tomato variety.

INTRODUCTION

Tomato is a crop whose varieties are now widely grown, sometimes in greenhouses in cooler climates. Tomato is one of the most important vegetable crops in the world. The crop belongs to the family Solanaceae, genus *Lycopersicon*, which is a relatively small genus within the large and diverse family consisting of approximately 90 genera (Olaniyi and Ajibola, 2008). Lycopersicon species are native to Ecuador, Peru and the Galapagon Island though most evidence suggests that the site of domestication was Mexico (Taylor, 1986). The plant grows up to 1-3 meters (3-10ft) in height and has a weak stem that often sprawls over the ground and vines over the plants. It is a perennial in its native habitat, although often grown outdoors in temperate climates as an annual.

In Nigeria, tomato crops are grown during both the wet and dry seasons but they attract higher profits during the dry season when the demand is higher than the supply. Tomatoes play a vital role in human diet and are a good source of vitamins and minerals. The fruits are eaten raw or cooked and can be processed into soup, juice, sauce, ketchup, puree, paste and powder (Olaniyi and Ajibola, 2008). They also serve as an ingredient in stews and vegetable salads. In cases, especially in northern Nigeria the fruits are sliced and dried for sale.

Tomato crops require nutrients such as N, P, K, Mg, Ca, Na, and S for good production. These nutrients are specific in function and must be supplied to the plant at the right time and in the right quantity for proper growth and reproduction (Adekiya and Ojeniyi, 2002). However, there is renewed interest in proper and effective use of organic manure to maintain soil fertility (Olatunji and Oboh, 2012). Aside from being source of plant nutrients, organic manure, e.g. poultry manure and ruminant dung has improved agricultural productivity in West African countries. Organic manure helps to increase the population of soil micro-organisms which have some influence in protecting plant against pathogens like nematodes and soil born insects and also provides plant growth hormones like auxins (Sanchez and Miller, 1986; Agbede and Ojeniyi, 2009).

Organic manure also helps to improve the physical condition of the soil and provides the required plant nutrients. It enhances cation exchange capacity and acts as a buffering agent against undesirable soil pH fluctuations (Ngeze, 1998; Giwa and Ojeniyi, 2004; Ojeniyi *etal*, 2007; Akanni and Ojeniyi, 2008). The application of organic manure has been found to have higher comparative economic advantage over the use of inorganic fertilizer. A study conducted by Brown, (1995) and Akanbi *etal*, (2005) showed that 9-18 tons/acre of manure appropriate for good tomato production, application of broiler liter at the rate of 15t/ha, N at 40kg/ha, P at 30kg/ha and K at 30kg/ha gave higher growth of fruit yield.

Also, as a result of increased popularity of organic vegetable production, more information is needed comparing the growth and yield of vegetable crops produced organically or using inorganic fertilizer. The objective of this study was to evaluate the effects of three different organic manures application on the growth performance and yield potentials of tomato grown in North-Eastern part of Nigeria.

MATERIALS AND METHODS

The experiment was conducted at the Research Farm of the Federal College of Education (Technical) Potiskum, North-Eastern part of Nigeria during the 2012 planting season. The area lies at latitude $12^0$00'North and longitude $11^0$30'East. The annual rainfall ranges from 500mm-100mm with temperatures ranging from 39^0- 42^0C. The period of rainy season in the area varies from place to place, but generally lasts for about 120days in the North and more than 140days in the South. The rainy season is normally from June to September in the North and May to October in the South. The two vegetation zones are the Sahel in the North and the Sudan Savannah in the South (YSGN, 2008) where the study area is located.

Nursery beds with good humus content were used and measured 1.2M X 6M with a 1M pathway between the beds. Seeds of tomato variety Roma VF were sown on three beds on the 4th of June, 2012 by broadcasting method then covered with dead grasses and watered. Germination occurred after four days of sowing. Fresh water was supplied every morning to avoid wilting and for normal plant development. Weeding was done manually by hands after every one week. The beds were gently covered with sorghum straws and leaves to prevent lizard attack found to be very common with the area.

The soil samples were collected with auger to a depth of 0-30cm for analysis before the field was manually cleared. The soil pH was determined both in water and 0.01m $CaCl_2$ using the glass electrode pH meter. The particle size analysis was determined using the hydrometer method. Total Nitrogen was determined using the regular macro-kjedahl method. Available phosphorus was determined using the method of Bray and Kurtz-Bray I extraction. Exchangeable cation (Ca and Mg) were extracted using $1MNH_4$ OAC and determined on atomic absorption spectrophotometer. The K in the soil sample was determined using a flame photometer.

The tillage operations include ploughing and preparation of beds to conserve the soil and its nutrients (Olaniyi, 2007). The experimental area measuring 42M X 11M ($462M^2$) were marked out into 36 plots per block each measuring 3M X 3M and each plot separated by 0.5M and 1M in between three blocks containing 12 plots each. Treatments consisted of 20t/ha each of cow dung, goat and poultry manure and a control. The experimental design used was a randomized complete block design (RCBD) with three replications. Tomato seedlings were raised in the nursery for four weeks, after which they were transplanted. Organic manures were incorporated into the soil a week before transplanting.

Transplanting was carried out in the evening with seedlings transplanted at a spacing of 0.5M X 0.5M to give a total population of 40,000 plants/ha. Plants were watered immediately after transplanting. Data on the plant height and number of leaves were collected at two weeks intervals. It was then followed by number branches and yield obtained. Data collected were subjected to analysis of variance. The means were separated using the Least Significant Difference test at five percent probability level.

RESULTS AND DISCUSSION

The soils used for the experiment contains silt, clay mixture and was low in organic matter, N, P, and CEC. Therefore, the need for application of different organic manures cannot be over-emphasized. The pH (H2O) 6.5, pH (CaCl2) 6.4, Organic matter 1.28%, Total N 1.0%, Available P 11.0 Mg/Kg, exchangeable K, Ca, Mg, and Na being 0.30, 9.0, 0.35 and 0.25 Cmol/Kg respectively and CEC of 6.5 Cmol/Kg.

The experimental result showed that plant height observed to increase with plant age (Table 1). At two weeks after transplanting (WAT), there were no significant differences in plant height of tomato treated with three different organic manures (20t/ha each of cow dung, goat and poultry manure). However, between 4 and 8 WAT, there was significant differences observed in plant heights among the treatments. 20t/ha of poultry manure used showed its superiority over others in plant height with a plant height of 38.02. The result also revealed that tomato treated with 20t/ha of cow dung and goat manure at 8 WAT readings taken of the plant heights had the maximum of 27.36 and 28. 92 respectively.

The result of the study revealed that plant heights at harvest differ significantly among treatments with the highest recorded in plots fertilized with poultry manure. Similar report had been obtained in vegetable Amaranth (Akanbi and Togun, 2002). Table 2 shows the number of leaves of tomato in response to application of three different organic manures. Plots treated with poultry manure produced the highest number of leaves per plant. The fertility status of the soil proved to be beneficial, with poultry manure than any other organic manure in this research. Poultry manures are known to supply adequate nutrient to the soil, precipitate rapid vegetative growth in crops (Agbede and Kalu, 1995; Aiyelaagbe *etal*, 2005; Katung *etal*, 2005).

Table 3 shows the significant effects of organic manures on number of branches in tomato. Poultry and goat manures gave the highest number of branches. The same trend was also observed between the cow dung and control. The behavior in the number of branches observed in the study agreed with the earlier report made by Dantata *etal*, (2011). Furthermore, poultry manure gave the highest fruit yield of 28.00t/ha. Comparatively lesser fruit yield of 11.50t/ha was obtained with the application of goat manure. Cow dung produced 3.50t/ha of tomato fruits while the least yield of 1.20t/ha of tomato were recorded in the control treatment. The observed behavior of tomato fruit yield in the experiment was also in line with the report of Dantata *etal*, (2011).

CONCLUSION

Application of 20t/ha cow dung, goat and poultry manure had a significant effect on plant heights, number of leaves and branches per plant. The results obtained revealed that tomato responded well to the application of poultry manure compared to other organic manures and control treatment in the study. Based on the findings of this study, it may be recommended that 20t/ha of poultry manure is adequate for maximum growth and yield tomato crop in the study location. Goat manure which is common in the area may be applied in the absence of poultry manure for greater growth parameters.

Table 1: Plant Height (CM) of Tomato as Affected by Cow Dung, Goat and Poultry Manure during 2012 Planting Season

Treatments	Weeks After Transplanting (WAT)			
20t/ha	2	4	6	8
Control	5.42	7.20	10.16	15.08
Cow dung	7.10	12.90	16.94	27.36
Goat manure	7.30	12.92	17.48	28.92
Poultry manure	7.88	13.20	19.09	38.02
Means	6.91	11.56	15.92	27.34
LSD (0.05)	0.15	4.38	0.30	1.40

Table 2: Number of Leaves of Tomato as affected by Cow Dung, Goat and Poultry Manure during 2012 Planting Season

Treatments	Weeks After Transplanting (WAT)			
20t/ha	2	4	6	8
Control	5.00	11.00	20.00	30.00
Cow dung	5.00	15.00	24.00	36.00
Goat manure	7.00	19.00	35.00	50.00
Poultry manure	8.00	20.00	38.00	55.00
Means	6.25	16.25	29.25	42.75
LSD (0.05)	0.34	1.56	0.47	0.62

Table 3: Number of Branches of Tomato as affected by Cow Dung, Goat and Poultry Manure during 2012 Planting Season

Treatments	Weeks After Transplanting (WAT)			
20t/ha	7	8	9	10
Control	3.00	5.00	7.00	10.00
Cow dung	3.00	6.00	10.00	19.00
Goat manure	5.00	8.00	10.00	19.00
Poultry manure	6.00	8.00	13.00	25.00
Means	4.25	6.75	10.00	18.25
LSD (0.05)	0.65	0.26	0.31	0.32

Table 4: Average Yield of Tomato obtained as affected by Cow Dung, Goat and Poultry Manure during 2012 Planting Season

Treatments 20t/ha	Average Yield t/ha
Control	1.20
Cow dung	3.50
Goat manure	11.50
Poultry manure	28.00
Means	11.05
LSD (0.05)	0.45

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