EFFECTS OF SAWDUST AND POULTRY MANURE ON GROWTH AND YIELD OF TOMATO (*LYCOPERSICUM LYCOPERSICUM*) IN NEKEDE, OWERRI, IMO STATE, NIGERIA.

Azuka M, O[1], Njoku G, U[2], Nwaizuzu-Daniel J[3], Opara C, T and Chidinma F, N[2]
[1]Department of Crop Science Technology, Federal Polytechnic, Nekede, Owerri, Imo state
[2]Department of soil science technology, Federal .Polytechnic, Nekede, Owerri, Imo state
[3]Department of agricultural extension management, Federal Polytechnic, Nekede, Owerri, Imo state
Corresponding email: azukamethos@gmail.com

ABSTRACT
This experiment was carried out at the Department of Agricultural Technology , School Farm., Federal Polytechnic Nekede to find out the effects of sawdust and poultry manure on tomato yield, The experiment was done in a randomized complete block design (RCBD) using a 2x2 factorial layout, the factors were sawdust and poultry manure applied at 0, 5 and 10t/ ha replicated three times, the experimental plot was 10 x 27m^2 (270m^2) and the manure were applied two weeks before planting to allow mineralization to take place, the crop was transplanted, growth and yield data were recorded, Means were separated using least significant difference at 5% level of probability, Parameters measured include plant height, number of branches, stem girth, number of leaves, number of fruit and fruit length. Reading were taking 2,4 6,8 and 12 weeks, from the results obtained , it was observed that all parameters measured were significantly differently with the exception of control, it was also observed that interaction values at 10t/ha showed higher values than 0 and 5t/ha.

INTRODUCTION
Tomato is a herbaceous annual plant with weak trailing much branched stems , covered with hair at juvenile stage of development, when young, Most varieties grow erect but as they age, they are unable to carry th.eir weight and eventually slump. Tomato has well developed taproot that branches profusely to form dense root systems.

Tomato originated from the high elevation of the Andes in South America, the cherry tomato *Lycopersicum* var. which grows well in Peru - Ecuador, area, is believed to be the progenitor of the tomato in cultivation today. Tomato was introduced into West Africa by the missionaries, despite being the most important crop (Komolafe, 1985).

High cost of inorganic fertilizer has been some problem fighting the development of the crop, hence, the use of alternative nutrients sources which is cheap, efficient and eco-friendly , sawdust and poultry manure are much needed manure , they not only serve as manure but also soil amender.

Tomato belongs to the family of *Solanecae* and genus *esculentus*, other members of the family include *Capsicum annuum* and *Amarathus spp.* (Greenleaf 1986), organically, it has been shown that sawn dust and poultry manure contains nutrients elements that can support growth and yield of tomato. Production and economic purposes, the manures are eco-friendly, cheap and biodegradable and affordable unlike the inorganic fertilizers they also helps to amend the soil structure (Ahaine, 2008).

RESEARCH METHODOLOGY
Tomato originated from high elevation of Andes in south America. It was introduced into west Africa by expatriates missionaries and civil servants (Uguru, 2011) it requires warm season with temperature of 65f -85f. At higher temperatures with high humidity, foliage diseases are rampant hot dry winds reduces fruit sets of flowers drops before fertilization. Excessive precipitation during the growth period does not favour the tomato. The crop is not sensitive to day length as it can set fruits on photoperiods between seven and nineteen hours. It grows well in many kinds of soil, it however grows best in well drained loamy soil, slightly acidic having a PH range of 6-6.5 (Uguru, 2011).

Tomato species includes *L. esculentum*, *L. pempinellfolium*, *L. cheesmanic* and *L. peruriannum.* Having studied these facts, cropping operations includes planting, transplanting, stalking and growth control, irrigation, weeding, fertilizer application, maturity and harvesting.

Yielding with good crop husbandry can produce 20-30 tonnes/ ha or more.

Tomato is the number one crop in terms of uses and importance followed by pepper (Uguru, 2011). About 94% of tomato fruits is water, other constituents includes soluble sugar, citric acid and malic acids, minerals, salt and vitamin A, B and C. It is a major source of *Lycopersicum*, an anti-oxidant that has prophylactic properties against prostate cancer in men. Tomato is used in making salad, soup and sauce (Uguru, 2011). Tomato is highly an economic demand.

Major pest includes nematodes or eelworm, white flies (*Bemisia tabacci*), lady bird (*Epilachia spp.*), tomato fruit worm (*heliothistea*) and mole cricket (*Scapteriscus vicinus)* (Uguru, 2011).

Major diseases include *Fusarium* caused by *Fusarium oxysporum*, damping off, blossom end rot and bacterial wilt caused by *Pseudomonas solanicerum.* Generally, cigarette smokers and individuals who handle tobacco leaves are carrier and can help some viral diseases which include the leaf cud, streak

tomato mosaic and spotted wilt. Chemicals are ineffective in controlling these diseases roughing is therefore recommended (Uguru, 2011).

The available plant nutrient in sawdust and poultry manure has made them suitable and efficient in the nutrient provision for tomato. Good agronomic practices and application of organic manure can make a difference in tomato production. Sawdust which is materials from fallen trees contains different nutrient elements needed by crops. Sawdust when decayed forms humus which stores and releases nutrients slowly which the residual cropping will benefit. Sawdust is a soil amender.

Soil fertility is usually maintained by the application of organic fertilizers where soil fertility is low; there is usually soil cover and favourable soil conditions that minimizes erosion and soil degradation (Okigbo, 1985).

Soil fertility decline has been found to be an important cause of low soil productivity for most soils (Lai, 1989; Sanchez, 2002) in the region; therefore, there is need for adoption of efficient low input management strategies to boost soil fertility. The use of livestock waste can benefit soil of south-east and south western Nigeria because of its ability to supply balanced soil nutrient , improve soil structure and stimulate biological processes that helps to build fertility (Smith and Ayenigbara, 2011) Maerere *et al.*, 2001, Emilo , 2005

It contains two to three times as much nitrogen, three to five times as much phosphorus and about the same amount of potassium as other farm manure and it also an important soil conditioner, increasing the soil water retaining capacity and nutrient holding capacity. The use of poultry manure as soil conditioner/amender to sustain adequate crop yield like maize and yam in Nigeria has been found to be effective for major food production (Ezebuike *et al*., 2009, Adeloye *et al.*, 2010). Livestock manure is traditionally a key fertilizer in organic and sustainable soil management practices and is most effectively used in combination with other sustainable practices. Poultry manure (pm) has been proved to be a good supplement for chemical fertilizer (Amanullah *et al.*, 2007). It contains not only N, but also other elements like P, K, S Ca, Mg and micro nutrient (Mullins, 2002). Approximately , 75% of the total N and majority (90-100%) of P and K in poultry litter are available for plant during the year of application (Hammond *et al*., 1997) . it is application increases total Carbon and nitrogen fertilizer (inorganic) increased neither carbon nor nitrogen in the soil (Dick and Chris, 1995).

Despite the nutritive values obtained from different crops, it is observed that farmers are facing a lot of problems on it sustained productivity as soil tends to be highly weathered and have low inherent fertility. Continuous cultivation which had replaced the traditional shifting cultivation causes soil nutrient depletion thus, crop production is not profitable without additional nutrients supply.

In Nigeria, farmers realize the need for soil amendment through using available resources such as crop waste, farm yard manure and animal waste. However, the quality and quantity required of these materials limits their use. Good quality soil is important for sustainable crop production especially under continuous cultivation. Poultry manure contains nutrient elements that supports crop production and enhance the physical and chemical properties of the soil (Adediran *et al*., 2003; Omisore *et al.*, 2009, Irene *et al.*, 2011).

However, there are certain misconceptions about organic fertilizers such as harboring of pest and disease organisms, bulkiness which demands large storage space and high transportation and labour cost (Somani and Totawat, 1996; Agboola and Omueti, 1982). When only inorganic fertilizers are used in highly weathered soil of the tropics, poor physical structures and nutrient retention characteristics would adversely affect crop growth (Okwuagwu *et al.*, 2003).

Poultry manure or droppings refers to the waste product or materials from which poultry litters is made , with sawdust, wood shave and grass cutting , this combinations provides an excellent source of nitrogen, potassium, phosphorus and sulphur (Ewulo, 2008).

Just like chemical fertilizers, adequate organic fertilization programme supply the amount of plan nutrient needed to maximize crop production and net returns. Manure application in excess of crop needs can cause a significant build up of phosphorus, nitrogen and other ions and salt into the soil. Incorporating moderate amount of poultry manure into the soil is an established agricultural practices generally recognized to have beneficial effects on the soil physical, chemical and biological properties (Chao *et al*., 1996).

Poultry manure has been shown to improve the biodiversity and long term productivity of crop (Ewulo *et al*., 2008). Poultry manure increases the abundance of soil organism such as termites, fungi by providing organic matter and micronutrient for organisms such as fungi and mycorrhiza (Pimental et al., 2005).

The supply of poultry manure allows direct uptake by plants of specific chemicals needed for the development of their immune system. It contributes to the anti-phyto pathogens potentials of soils. This is particularly important in the case of fungi damping off diseases *Rhizotinin*, *fusarium* and pythium (Lamkin, 1990). Various studies found that in the organic versus conventional agriculture, organic crop yielded 91-100% along with 50% low expenditure on fertilizer and energy (Stanhill, 1990).

Crops applied poultry manure withstands severe weather conditions better than conventional non tillage farming which suggest long term yield benefits from organic farming (Doncomis, 2007).

Poultry farms and other agro-allied produce high amount of poultry manure that are typically rich in nutrient which can be well used in agriculture to conserve nutrients as well as reduce waste discharge from use of chemical fertilizer (Ogundare, 2012). Some crops are highly nutrient exhausting, examples pawpaw and other fruit crops because of their quick growth, continuous fruiting habit and heavy fruit yield. Nutrient removal studies conducted at Tamil Nadar agricultural university, in India showed that at the time of harvest, a plant removal of about 310, 105,530, 3,337 and 185kg/ha of NPK and Magnesium respectively (Veerannah and Selvraj, 1984) consequently, judicious application of fertilizer is needed to meet up with the plant nutrient requirement.
In Nigeria and other world generally, there has been efforts geared towards maintaining sustainable agricultural system in recent times. Sustainability is the ability of a system to continue. Unfortunately, very few organizations in Nigeria such as organic agriculture project in tertiary institutions in Nigeria (OAPTIN) and Association of Organic Practitioners of Nigeria (OAPN) are raising local awareness on the merits and business opportunities in organic agriculture because of it potential in sustainable agriculture, especially in crops that are easily managed with little or no fertilizers which recently becoming more expensive to the resource poor farmers in Nigeria and Africa.
Organic agriculture also has the potential to provide benefits in terms of environmental protection, conservation of non-renewable resources, improves food quality and reorientation of agriculture towards area of market demands. Although, inorganic fertilizer used in conventional production system readily provides nutrients for plants, the use is associated with increased soil acidity and nutrient imbalance (Adedirem *et al*., 2004).
Also, Nigerians and other West African farmers also have limited access to these fertilizers because of low production, availability, procurement and poor distribution. This is a major constraint to production in this part of the world; more so, there is a growing realization of the harmful effects of the various agrochemicals utilized in crop. Cultivation with the aim of increasing production level (Narayanmy, 2006).
Poultry manure is rich in organic manure such as uric acid which is most prevalent fresh manure; the uric acid is rich in nitrogen to the 40-90% of total nitrogen. While urea and ammonia are present in small quantities (Kroghali and Dahlgard, 1981).
The application of poultry manures at 10t/ha was observed to improve soil (Ravikumar and Krishna-moorthy, 1975). Soil physical properties such as bulk densities, water holding capacity and percentage water stable aggregate were noted to be favourably influenced by poultry manure addition in the soil (Weil and Kroonje, 1977).
Mbagwu 1992 reported that poultry manure significantly decreased bulk density and increased total and macro porosity, infiltration capacity and available water capacity. Mullins 2002 revealed that poultry litters contain a considerable amount of organic matter due to bedding materials. Litters can also have impact on soil PH and liming due to varying amount of calcium carbonate in poultry feed. Organic manure also serves as a soil amendment. Any bulk biodegradable materials incorporated into the soil, such materials are intended to improve the soil structure and contain nutrients to increase the nutrient content of the soil. It is said to be soil amendment (Francis, 19970. Soil amendments are added to the soil to improve the soil physical, chemical and biological properties of the soil. The aims and objectives of the soil amendment is to provide better environment for roots to do its work either penetration or absorption of nutrients, amendments must be thoroughly mixed into the soil (Weils *et al.,* 1979).
Application of organic materials to soil can cause a change in soil micro-flora and micro-fauna including nematodes (Renco, 2013).
Organic amendment has effect on soil physical properties. During the past three decades, there has been increased awareness of the soil degradation and it negative impact on its productivity. Such agricultural practices have led to progressive impoverishment in the organic matter content in the A-horizon and hence, a remarkable decrease of the initial productivity of those soils derived from unsuitable chemical properties.
The organic matter content is a significant component and key indicator of the quality of the soil. In fact, this parameters is directly related to physical soil properties namely; bulk density, porosity, water infiltration and water holding capacity to circumvent the loss of the organic matter amendment using solid waste has been attempted. Examples includes, manure and compost which have received much interest and positive impact on soil structure, stability, nitrogen and carbon content have been reported (Master, 2011).
Structural stability as for chemical parameters, the addition of organic amendment as associated with a significant ($p \leq 0$) improvement of the structural ability of the soil (Kashi *et al*., 2002). Permeability in general amendment allows better water infiltration (Bouajila, 2011)

RESULT AND DISCUSSION

Table 1; effect of sawdust and poultry manure on tomato plant height 4 weeks after transplanting (cm)

sawdust	Poultry manure			
	0t/ha	5t/ ha	10t/ha	Mean
0	8.67	8.09	9.84	9.53
5	10.07	10.92	10.13	10.73
10	11.87	12.30	13.30	12.49
Mean	10.23	10.43	11.90	

LSD (0.05) Poultry manure = 0.86
LSD (0.05) Sawdust = 0.86
LSD (0.05) Sawdust x poultry manure = 1.49

Table 1 shows the effects of sawdust and poultry manure 4 weeks after transplanting in cm on plant height. The result showed 10t/ ha interaction of sawdust and poultry manure to have the highest value (13.30) followed by (12.30) from 10t/ ha sawdust and interaction with 5t/ha. All amended portions showed significant difference. The 0t/ ha had the least value of (8.67). The growth of the manure applied portion showed that the manures had positive effects on the growth of the tomato plants. This observation is also in line with the work of (Loribin *et al.,* 1991) who said that the use of organic manure especially cow dung, poultry droppings and house-hold refuse for crop production is an age long agricultural practice in subsistence farming. Ezeibekwe *et al.,* 2009; Adeleye *et al.,* 2011 observed that livestock manure is traditionally a key fertilizer in organic and subsistence and other organic manure are good supplement for chemical fertilizer. All the nutrients needed for rapid growth of plants are available in organic manure.

Table 2: effect of sawdust and poultry manure on tomato plant height at 6 weeks after transplanting.

Sawdust	Poultry manure			
	0t/ ha	5t/ ha	10t/ ha	Mean
0	12.62	14.07	14.87	13.85
5	15.07	20.97	26.13	24.05
10	33.87	45.30	57.30	45.49
Mean	18.20	26.78	32.43	

LSD (0.05) for poultry manure = 0.86
LSD (0.05) for sawdust = 0.86
LSD (0.05) Sawdust x poultry manure = 1.49

Table 2 shows the effect of sawdust and poultry manure on tomato 6 weeks after transplanting. The highest value gave (57.30). This was followed by (45.30) from 10t/ha poultry interaction with 5t/ha poultry manure. The single effect of 10t/ha poultry manure had (14.87cm) while the least was (12.62cm) from 0t/ ha. This rapid growth from the amended portion is attributed to the applied manure. This is in agreement with the finding of (Adediran et al., 2003; Omisore *et al.,* 2009; Irene *et al.,* 2011 and John et al., 2013) who observed that the poultry manure contains nutrient element that can support crop production and enhance the physical and chemical properties of the soil.

Table 3; effects of sawdust and poultry manure on tomato number of leaves 6 weeks after transplanting

Sawdust	Poultry manure			
t/ha	0t/ ha	5t/ ha	10t/ha	Mean
0	6.60	8.00	10.80	8.46
5	10.07	10.97	12.13	11.56
10	13.00	13.30	15.30	13.43
Mean	9.89	10.75	14.10	

LSD (0.05) PM = 0.86
LSD (0.05) SD = 0.86
LSD (0.05) SD x PM = 1.49

Table 3 shows the effects of sawdust and poultry manure on tomato number of leaves 6 weeks after transplanting. The result showed (15.30) to be the highest value from 10t/ha and SD interaction. This was followed by (13.30) from also 10t/ha interaction between sawdust 5t/ha poultry manure. Single effect 10t/ha sawdust had (13.00) while poultry manure single effect had (10.80). The control 0t/ha had the least value of (6.60). The observable rapid growth from the amended portion shows that the manure supplied nutrients which the plant leaves absorbed. This is in agreement with Duruigbo (2007) who stated that poultry manure supply some nutrients

for plant and the carbon containing compounds which improves the structure of the soil, cementing the particles together and encouraging good root growth by providing enough pores for the right size and preventing the soil from becoming too rapid when dry or completely water logged and containing varying percentage of nitrogen and their nitrogen will require some days to neutralize after incorporation into the soil.

Samuel *et al*., (1985) stated that poultry manure application into the soil significantly increases the yield and growth of crops.

Table 4; effects of sawdust and poultry manure on number of tomato fruits 12 weeks after transplanting.

Sawdust	Poultry manure			
	0t/ha	5t/ha	10t/ha	Mean
0	8.64	10.07	11.80	10.13
5	11.07	10.91	12.13	11.13
10	13.00	16.30	20.30	16.53
Mean	16.93	12.42	14.74	

Table 4 shows the effect of sawdust and poultry manure on tomato number of fruits at 12 weeks after transplanting. The amended portion recorded the highest value with high significant difference. 10t/ha interaction of both manure gave the (20.30) which was the highest value followed by 10.30 from 10t/ha sawdust interaction with 5t/ha poultry manure. The geometrical yield in the amended portion is as a result of the applied manures. This is in agreement with Brandjes (1996) who stated that organic manure contains varying nitrogen in various animal manure sources which supports plant growth.

CONCLUSION

Poultry manure and sawdust are agricultural waste products that contain macro and micro nutrient elements and the application in the soil improved soil fertility and reduces the strength of the acidity.

As the rate of poultry manure and sawdust increases, there is a corresponding increase in the growth and yield of tomato. Application of 10t/ha PM and SD recorded the highest growth and yield.

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