IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Early Growth Performance of Tomatoes in Various Blends of Swine Manure and Sandy Soil

[1]Dr. Christian C. Obiazi*, [2]Dr. Godwin U. Nnaji and [3]Josephine O. Ugbobor
[1]Lecturer, [2]Lecturer, [3]LGraduate of Agriculture (Crop Science)
Department of Agronomy, Forestry and Wildlife, Delta State University,
Asaba Campus, Asaba, Nigeria

Abstract: A study was carried out to evaluate the effects of blends of swine manure (SM) with sandy soil (SS) on the early growth of tomatoes [*Lycopersion esculentum* mills] from July to September, 2015. Swine manure was mixed with SS at the rate of 0, 25, 50, 75 and 100% respectively on volume/volume basis of the dry materials. The treatments were 100% SS, 75% SS+25% SM, 50% SS+50% SM, and 100% SM. The five treatments were laid out in a completely randomized design and replicated three times. Inclusion of SM in SS significantly improved the level of seedling emergence, number of leaves per plant, plants height and total biomass of tomato seedlings. Fifty and 75% levels of inclusion of SM had similar effects on most growth attributes of tomatoes seedlings; the use of 50% SM and 50% SS was the optimum in this study. An equal volume of SS and SM is suggested as the medium for producing vigorous tomato seedlings in Asaba. Seedlings raised in 50% SS+50% SM had 54.8% more seedlings emergence at ten days after sowing and 248.1% taller at six weeks after sowing relative to the ones raised in 100% SS. It is recommendation that a number of rates of less than 50% of SM be tested with SS to see if any of these rates will give similar result with 50% SM inclusion.

Index Terms **- Growth, Mixtures, Sandy soil, Swine manure, Tomato seedlings**

I. INTRODUCTION

Tomato (*Lycopersicon esculentus* Mill.) is eaten raw and in various ways which include sauces and in drinks, it is also an ingredient in a number of dishes 1.(Ganesan, 2012). Globally, tomato is the most important vegetable [2] (FAO, 2018). Tomato propagation is through the use of seeds. Normally the seedlings are raised under intensive management in the nursery for later transplanting to the field. Although tomato can be propagated directly, raising seedlings in the nursery has a number of advantages. Some of the benefits of raising seedlings in the nursery, according to 3.Opeke (1982), are: fewer seeds requirement relative to sowing directly in the field; seedlings in the nursery receive more intensive care (protection from diseases, pests and animals, regular maintenance practices, water/irrigation, maturing, application of artificial fertilizer) these help in the emergence of healthier seedlings; finally, there exist an opportunity for the planter to select well-grown, vigorous and disease free seedlings when they are raised in the nursery.

Higher yields are produced by healthy seedlings than unhealthy ones when transplanted or left *in situ*, even when they are of the same genetic constitution. Similarly, a young plant provided with good soil media, adequate nutrients and water required for growth and development will grow better the one that lacks all those resources if all other conditions remain the same. Different growth media have been used to provide favourable conditions for raising seedlings: these include animal manure, soil and sand. They are used solely or in mixtures. The required mixtures to achieve optimum plant performance depend on the type and quality of materials available in an environment. The objective of this study is to evaluate the performance of tomato seedlings in various mixing ratios of sandy soil and swine manure.

2. MATERIALS AND METHODS

The study was executed in the Department of Agronomy, Delta State University, Asaba Campus, Asaba, Nigeria. Asaba is located in the rain forest ecological zone. Bimodal is the pattern of rainfall with peaks in June and September. The rainy season starts from late March/early April with spell in August and continues till November.

Soil used for the study was obtained from a three-year old fallow land near the rubber plantation in Asaba Campus of Delta State University, Nigeria, while the well composited swine manure was obtained from the Piggery Unit of Delta Investment Limited located in the same Asaba Campus of Delta State University. The soil was sieved to remove leaves, wood and other foreign materials and it was mixed thoroughly. Similar treatment was given to swine manure. Swine manure used in the study had very high nitrogen relative to the soil used in the mixture with the swine manure (Table 1). The soil was of sandy soil textural class. Physical and chemical properties of the soil and some chemical properties of the swine manure used in the study are shown in Table 1. For each treatment that requires mixture of swine manure and swine manure, thorough mixing was carried out after the appropriate ratio has been put in a big bowl. Before the next treatment was mixed, the bowl was thoroughly cleaned of the previous mixture. Sandy soil at the rates of 0, 25, 50, 75 and 100% respectively on volume of sandy soil/volume of swine manure basis; 100% SANDY SOIL (SS), 75% SS + 25% SM (Swine manure), 50% SS + 50% SM, 25% SS + 75% SM and 100% SM, these mixtures constituted the five treatments involved in the study which lasted from July to September, 2015.

The trial was organized in a randomized complete block design and replicated three times. Fifteen plastic containers were used, each container had diameter of 19 cm at the top and 17cm at the bottom while the length was 18cm. Soap and water were used to properly clean the containers and were positioned in the sun in an upside situation to drain the water. Four drainage holes were made at the bottom

of each of the containers; the holes were equally spaced from each other. Appropriate sandy soil/ swine manure mixtures were put in each of the containers.

Data collected were number of tomato seedlings emergence per pot (fifteen seeds were planted per pot), number of leaves and number of branches per plant, leaves, stem and roots dry weights per plant.

Table 1: Characteristics of the soil and swine manure used in the study

Parameter	Sand soil	Swine manure
pH (H_2O)	6.2	-
Total Nitrogen (%)	0.014	1.121
Organic carbon (%)	0.03	0.8
Organic matter	0.06	-
Available P (mg kg^{-1})	15.0	0.3
Exchangeable Ca (c mol kg^{-1} soil)	1.6	0.72
Exchangeable Mg (c mol kg^{-1} soil)	0.02	0.696
Exchangeable K (c mol kg^{-1} soil)	0.11	-
Exchangeable Al^{3+} acidity (H^+)	traces	-
Base Saturation (%)	63.21	-
Exchangeable Ca (c mol kg^{-1} soil)	1.6	0.72
Particle size (%)		
Sand	86	-
Silt	9	-
Clay	5	-
Textural class	Sandy soil	-

Stem diameter was measured at 10 cm height by using razor to make a cross section of the stem and using transparent ruler to measure the stem diameter. The dry weights of the plant were collected by harvesting the plants at termination of the experiment at six weeks after sowing. The plant materials were put in papers that were labelled according to treatment and placed in the oven set at 70°C; the samples were dried to constant weight.

Data collected were subjected to analysis of variance and Duncan's Multiple Range Test (DMRT) at 5% level of probability was used to detect differences between means.

3. RESULTS

3.1 Seedling emergence and growth of tomatoes

Effects of the different mixture ratios of sandy soil and swine manure on seedling emergence are shown in Figure 1. The least level of seedlings emergence at 3 DAS (Weeks After Sowing) occurred in 100% Sandy Soil (SS) and the highest level took place in the pots which were 100% Swine manure (SM), the other treatments had similar seedling emergence at 3 DAS. As from 6 DAS up to 10 DAS, sandy soil and 25% SS+75% SM had the least seedling emergence which was significantly less than the other treatments. Seedling emergence in pots which had 50% to 100% swine manure inclusion were similar and greater than that of the other pots with less swine manure inclusion from 6 to 10 days after sowing.

Number of tomato leaves per plant ranged from four (at three weeks after sowing in sandy soil) up to 11.1 (in 100% swine manure at six weeks after sowing) (Figure 2). Tomato in 100% sandy soil had the least number of leaves per tomato plant at each growth stage. All the tomato seedlings which had 25% swine manure inclusion up to 100% swine manure had similar number of leaves per plant right from 3 WAS up to 6 WAS, inclusion of swine manure beyond 25% did not significantly increase the number of leaves per plant.

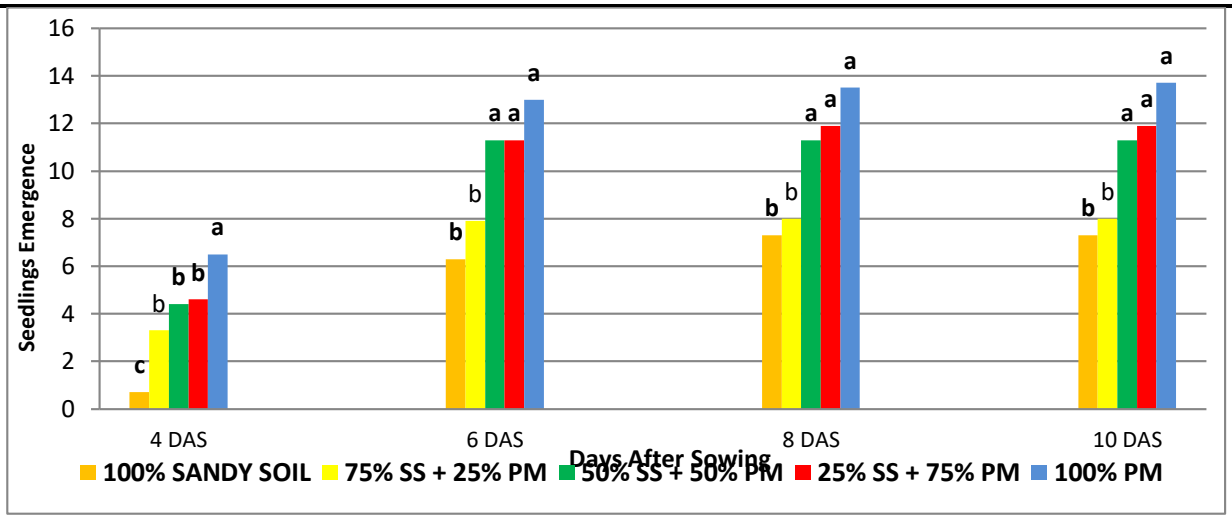

Figure 1 Effects of different ratios of mixtures of sandy soil and swine manure on seedlings emergence

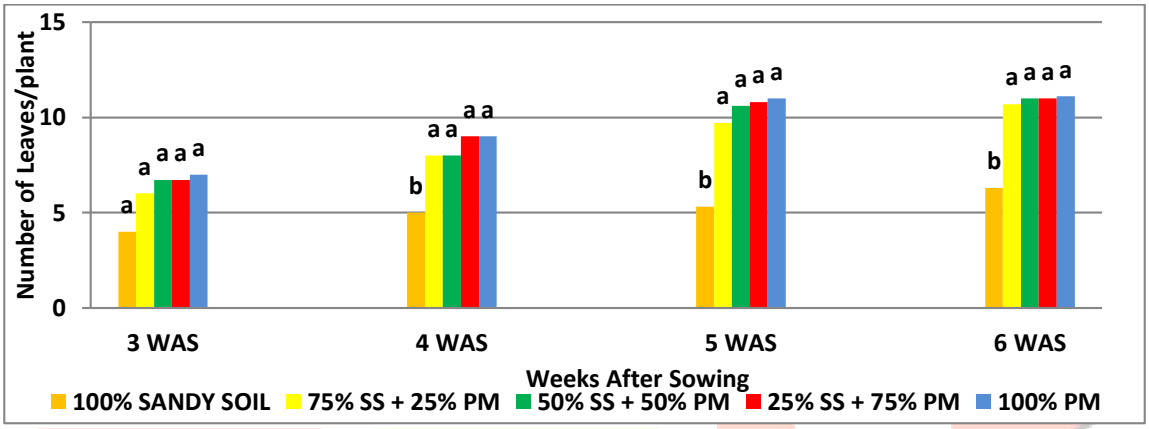

Figure 2 Effects of different ratios of mixtures of sandy soil and swine manure on number of leaves per tomato plant
Bars with the same letter(s) within a growth stage are not significantly different at 5% level of probability using DMRT
Note: SS = Sandy Soil, SM = Swine manure

Tomato in equal mixing ratios had similar height with the ones grown in pots with higher inclusions of swine manure at three and four WAS but at five and six WAS the ones with higher inclusions of swine manure had significantly taller plants (Figure 3). Tomato grown in pots with 75% sandy soil + 25% swine manure had greater stem height at 4 and 6 WAS than ones grown in sandy soil but not as tall as the ones grown in pots with higher inclusions of swine manure from four to six WAS. The tomato seedlings in 100 % sandy soil had minimal increase in height of 1 cm between 3 and 4 weeks after sowing; and did not increase in plant height right from four to six WAS.
Effects of the treatments on stem diameter at 6 WAS are shown in Table 2. The thinnest tomato stems of 0.35 cm were in pots with 100% sandy soil and the thickest stems of 1.56 cm were in pots with 25% sandy soil and 75% swine manure. Stem diameter of seedlings in pot mixtures with swine manure inclusion of 50% and above had similar stem diameter of 1.34 – 1.56 cm, they were significantly greater than 0.35 cm observed in pots with 100% sandy soil.

3.2 Tomato biomass

Apart from SS 25% + 75% SM which had 1.56 g/plant leaf dry weight while 100% SM had 1.27 g/plant, there was general increase in leaf, stem and root biomass with increase in SM inclusion (Table 2). There was significant increase in tomato leaf biomass with increase in SM inclusion from 25% up to 50%; tomato leaf biomass increased in the following orders: 100% SS (0.35 g/plant) < 75% SS + 25% SM (0.80 g/plat) < 50% SS + 50 SM (1.34 g/plant) = 25% SS + 75% SM (1.56 g/plant) = 100% SM (1.27 g/plant). Similar trend was observed in stem and root biomass though not significant in these two cases. There was general increase in leaf, stem and root biomass with SM inclusion up to 75%, but most of such inclusions were not significant. The leaf and root biomass in sandy soil were less than that of any of the tomato seedlings grown in the other treatments with the inclusion of at least 25% SM.

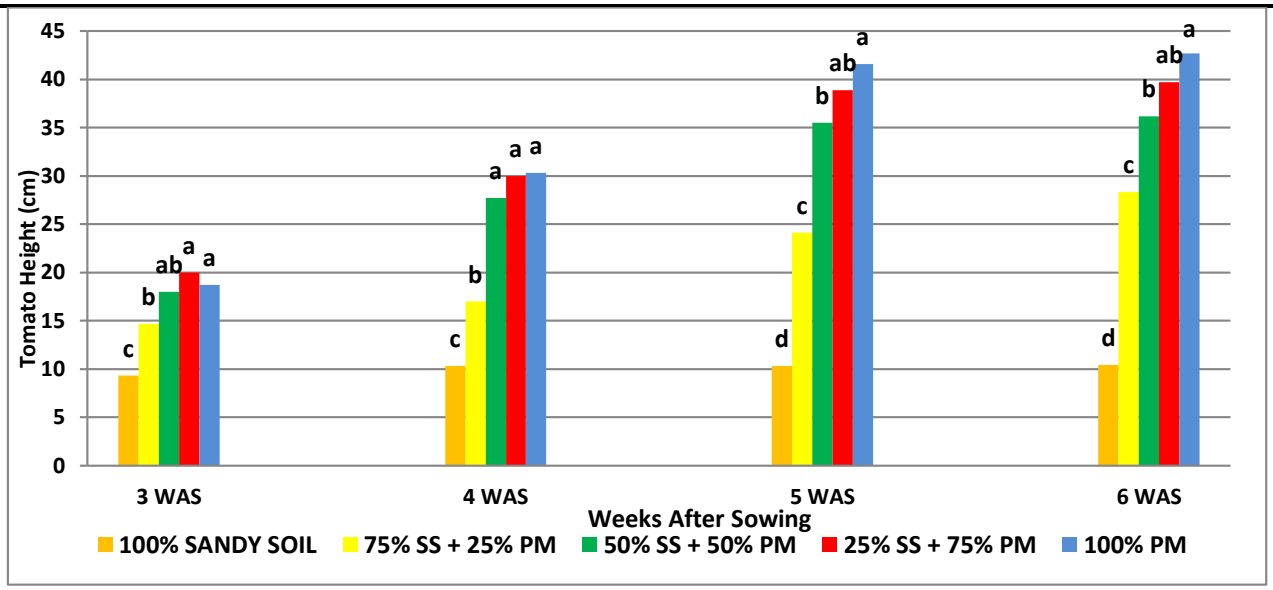

Figure 3 Effects of different ratios of mixtures of sandy soil and swine manure on tomato stem height

Bars with the same letter(s) within a growth stage are not significantly different at 5% level of probability using DMRT. Note: SS = Sandy Soil, SM = Swine manure

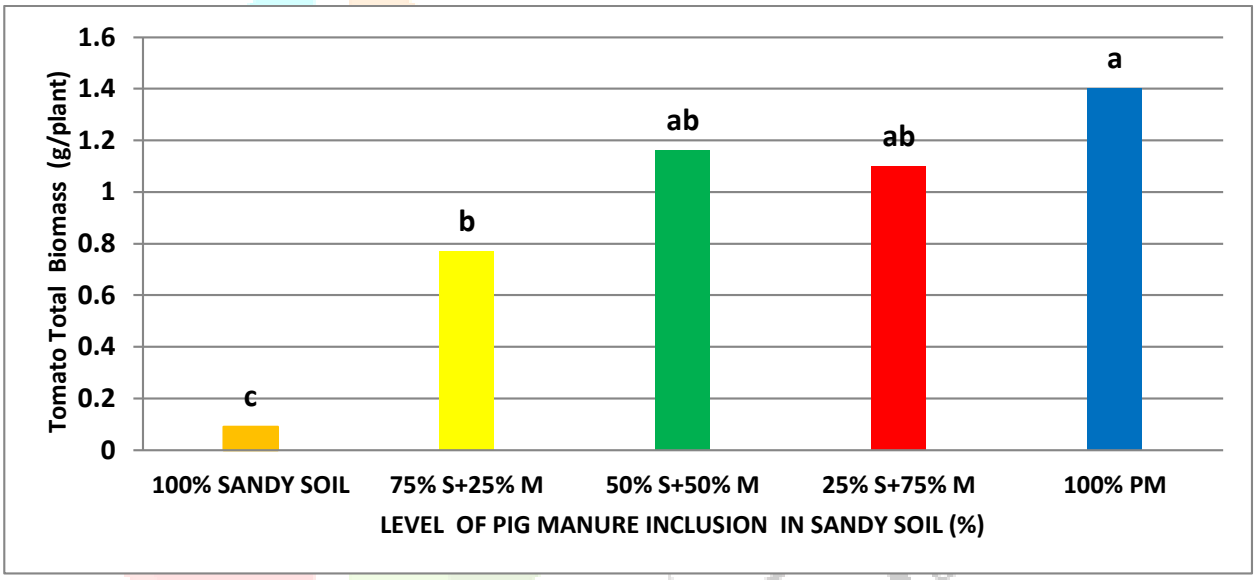

Figure 4 Effects of different ratios of mixing sandy soil and swine manure on total tomato biomass at eight weeks after sowing
Bars with the same letter(s) are not significantly different at 5% level of probability using DMRT.

Table 2 Effects of different mixing ratios of sand and swine manure on tomato stem diameter, leaf dry weight, stem dry weight and root dry weight at eight weeks

Mixture ratio in the pot	Diameter of stem	Leaf dry weight	Dry weight of stem	Dry weight of roots
100% SANDY SOIL	0.35 c	0.04 c	0.05 d	0.02 b
75% SS + 25% SM	0.83 b	0.34 b	0.25 cd	0.18 a
50% SS + 50% SM	1.34 a	0.50 a	0.48 bc	0.18 a
25% SS + 75% SM	1.56 a	0.52 a	0.60 b	0.19 a
100% SM	1.27 ab	0.62 a	0.91 a	0.23 a
SE ±	0.207	0.066	0.105	0.041

Means followed by the same letter(s) within a column are not significantly different at 5% level of probability using DMRT
Note: SS = Sandy Soil, SM = Swine manure

4. DISCUSSION

Results of this study show that the inclusion of swine manure in sandy soil improved the robustness of tomato seedlings. The shorter tomato seedlings grown in the unmixed sandy soil (10.4 cm) relative to that grown in swine manure (42.7 cm) at six weeks after sowing and the similar trend observed in the other parameters shows the usefulness of the inclusion of swine manure to sandy soil for the production of vigorous tomato seedlings. It was noted by [4] that sandy soils are poor in nutrient and may not supply the essential nutrients required by young plant as it progresses in growth after sprouting. Pig manure improved the nutrient status of the sandy soil hence the enhancement in the growth of the tomato seedlings. Similar outcome was observed by [5] when pig manure, NPK fertilizer and their combinations increased height of tomato plant significantly ($p<0.05$). Similarly, [6] reported that the seedlings of *Afzelia Africana* had different responses to different potting mixtures with sharp sand and cow dung mixture producing the highest growth characteristics hence sharp sand 50 % and cow dung 50 % was recommended to *A. Africana* growers. It was observed that the swine manure used in the study had high nitrogen content while the sandy soil was low in nitrogen. Inclusion of at least 25% of swine manure into sandy soil brought about significant increase in dry root yield of tomato seedlings. Inclusion of swine manure must have improved the soil structure which has resulted in the improved root yield. It was reported by [7] that root production can be affected by soil structure or texture and added that potential for root elongation is associated more with bigger roots than with smaller roots hence can enhance better nutrient and water uptake and overall root production.

5. CONCLUSION

Inclusion of swine manure in sandy soil significantly improved seedling growth. Inclusion of swine manure at 50 and 75% had similar effect on most growth parameters of tomato seedlings recorded. It is therefore recommended that equal volumes of swine manure be mixed with sandy soil at Asaba area for the raising of vigorous local tomato seedlings.

Since the inclusion of 50% swine manure to sandy soil had similar effect on tomato seedling relative to 75% swine manure inclusion in most of the growth parameters measured, for cost efficiency on procurement of swine manure, the mixture of 50% swine manure (volume/volume) will be more acceptable to commercial farmers. It is suggested for further studies that various levels of swine manure inclusion between 25 and 50% be evaluated to find out if rates of inclusion between these levels will give similar results with 50% inclusion of swine manure.

REFERENCES

[1]. Ganesan M., Rajesh, M., Solairaj, P. and Senthilkumar, T. 2012. Tomato as a pioneer in health management. International Journal of Pharmaceutical, Chemical and Biological Sciences, 2(3): 210-217.

[2]. FAO. Food and Agriculture Organization. *Tomato.* 2018. http://www.fao.org/faostat/en/#data/QC/.

[3]. Opeke, L. K. 1982. *Tropical Tree Crops*. Ibadan, Spectrum Books Limited. p20.

[4]. Brady, N. C. and Weil, R. R. 1999. The nature and properties of soils. New York. McMillan Publishing Company.

[5]. Giwa and Ojen Giwa, D. D. and Ojeniyi, S. O. 2005. Effect of integrated application of pig manure and NPK on soil nutrient Content and Yeild of Tomato (*Lycoperscicum esculentum* Mill.) proceedings of the 29th Annual Conference of the Soil Society of Nigeria Held at University of Agriculture, Abeokuta, Nigeria. Pp 164-169.

[6]. Agbogidi, O. M. and Avwevughware, O. I. 2011. Growth response of *Afzelia africana* (SM. EX PERS.) seedlings to different potting mixtures. *International Journal of Agricultural Sciences* Vol. 1 (1), pp. 017- 019. Available online at www.internationalscholarsjournals.org

[7]. Dou F., Soriano, J., Tabien R. E., Chen, K. 2016. Soil Texture and Cultivar Effects on Rice (*Oryza sativa* L.) Grain Yield, Yield Components and Water Productivity in Three Water Regimes. PLoS ONE 11(3): e0150549. doi:10.1371/journal.