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EFFECT OF RICE-HUSK INCORPORATION RATES ON THE GROWTH AND YIELD OF TOMATO (*Lycopersicum esculentum*) IN MUBI, ADAMAWA STATE

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ABSTRACT
A study was carried out to determine the effect of rice-husk incorporation rates on the growth and yield of tomato (Lycopersicum esculentum) during the rainy season of 2013 in Mubi, Adamawa state. An experimental area (9.5 m × 9.5 m) was marked out into 4 blocks with 4 plots each measuring 2 m × 2 m and separated by an alley of 0.5 m between blocks and rows. The plots were treated with 3 rates (10, 20 and 30 kg equivalent to 25, 50 and 75 tons/ha) of rice-husk and a control (0 kg) that were replicated 4 times in a Randomized Complete Block Design (RCBD). Data collected on the plant growth parameters was analyzed using the generalized linear model of Statistix 9.1 for the analysis of variance (ANOVA). The results showed that there were no significant (P>0.05) differences among the treatments at 2 weeks after transplanting (WAT). However, significant (P<0.05) differences were recorded at 4, 6, and 8-WAT, except for the plant heights at 8-WAT. The tomato yield also differed significantly (P<0.05) among the treatments across the 4 harvesting intervals. It was recommended that application of 75 tons/ha should be observed for efficient growth and yield of tomato in Mubi, Adamawa State, Nigeria.
Keywords: Tomato, Rice-husk, Incorporation-rate, Growth, Yield, Mubi, Adamawa State.

INTRODUCTION

A wide range of human diets and recipes are largely made from tomatoes and it constitute one of the major ingredients in variety of dishes. Tomato (*Lycopersicum esculentum*) plants produce edible red fruits and can be taken raw or cooked (Adams *et al*., 1978). It was believed to have been originated from South America and belongs to the night-shade family and grows up to 1-3 cm (3-10 ft) in height (Dittoh, 2008). The earliest discussion of the tomato in European literatures appeared as herbal swelling fruit used for cooking (Olayinka and Adebayo, 1985). Over the decades, Nigeria has embraced tomato delicacy and it has become a Nigerian staple food ingredient. In northern Nigeria for instance, it was adopted into stew for cooked rice (*Shinkafa*). Nigeria is among the largest consumers of tomato paste all over the world. Production indices of tomato in Nigeria as reported by the Food and Agricultural Organization (FAO, 2000), indicated an increased interest in tomato production in the last few decades. Tomatoes are heavy feeders and require high nitrogen (N), phosphorus (P), potassium (K), and Calcium (Ca) for its normal growth (Adams et al., 1978).

Production challenges ranges from low fertility, poor varieties, storage and low awareness among other problems. Low fertility and relevant measures have been identified by horticulturalists, crop and soil scientists in recent times. Rice husk manure as alternative sources of soil fertility is one of the advocated strategies to achieve high tomato performances in northern Nigeria. Previous research by Tekwa *et al.* (2010) reported higher soil nutrients from rice husk applications than cowdung in the same study area. The present study therefore intends to test the influence of rice husk manure in production of tomato in Mubi, northeast Nigeria.

MATERIALS AND METHODS

The study area

Mubi is located in the Northern part of Adamawa state between latitudes 9º 26" and 10º 10" N and longitude 13º 10" and 13º 10" E. It is bordered by the Mountain ranges of the Mandara in the republic of Cameroon to the East, Michika Local government area to the North, Hong to the South and Askira-Uba to the West and occupies a landmass of about 506,440 square kilometers (Nwagboso and Uyanga, 1999). The climate of the area is characterized by a typical wet and dry season. The dry season span for 5 months (November to March), while the wet season lasts between April and October each year. The annual rainfall ranges from 700-1,050 mm (Adebayo, 2004).

Field Study

The research was carried out between the months of June and September, 2013 at the Department of Agricultural Technology practical farm, Federal Polytechnic Mubi, Adamawa State. The tomato variety used in this study was the Roma VF and was obtained from certified seed vendors in Mubi markets, Adamawa State.

Experimental plot design

An experimental land area covering 9.5 m × 9.5 m was ploughed in the second week of June 2013. Individual plots were marked out on a 2 m × 2 m sizes and separated by an alley of 0.5 m apart. The plots were laid out in a Randomized Complete Block Design (RCBD).

Each of the blocks comprised of 4 plots treated with 3 levels (10, 20 and 30 kg equivalent to 25, 50 and 75 t/ha) of rice-husk manure with 0 t/ha as the control treatment. The experiment was replicated 4 times with a total of 16 trial plots.

Data Collection

Seedlings were selected at random and were then marked with a paper tape after establishment. Relevant data on seedling establishment and vegetative growth were taken at 2, 4, 6 and 8-WAT.

Seedling establishment counts

Percentage seedling establishment was calculated at 2-WAT using the formula below.

$$\% \text{ establishment} = \frac{\text{Number of seedlings established}}{\text{Number of seedlings transplanted}} \times 100$$

Plant height: The height of the plants was measured and recorded at 2, 4, 6, and 8-WAT using a meter tape.

Number of leaves: The number of tomato leaves were counted physically and recorded at 2, 4, 6 and 8-WAT.

Stem diameter: Stem diameter of the selected tomato seedlings in each plot was measured using Vanier caliper.

Statistical analysis

Data collected was analyzed following the generalized linear model of Statistix 8.0 version 2004 for the analysis of variance (ANOVA). Mean values were separated using LSD at 0.05 level of significance.

RESULTS AND DISCUSSION

Soil properties

The soil properties in the study area had been described earlier by Tekwa *et al*. (2010) (Appendix 1). They reported that soils in the area are mainly sandy clay loam in texture, and consisted of high sand (49.43%), and low silt (17.92%) and clay (32.65%) contents. They also reported that WHC was 15.09%, while the soil particle density was 1.21 Mgm^{-3} in the low to non-plastic soils. The authors also reported that soils are inherently low in fertility with exchangeable K^+ (0.33 Cmol(+)/kg), Ca^{2+} (1.47 Cmol(+)/kg), Na^+ (0.09 Cmol(+)/kg) and Mg^{2+} (3.33 Cmol(+)/kg) contents that varied between low and high.

Effect of rice-husk manure incorporation rates on tomato growth

Growth parameters such as plant height, stem diameter and numbers of leaves per plant per plot were collected at 2-WAT and are presented in Table 1. The treatments had no significant effect on the parameters including the control. This implies that at 2 weeks, the growth of tomato was insignificant. However, plant height increased from 2.09 cm (25 tons/ha) to 2.49 cm (50 tons/ ha).

Table 1: Effect of Rice Husk application rated on tomato growth

Rice-husk fertilizer Material (tons/ha)	Establishment count	Plant height (cm)	Stem Diameter (mm)	Number of leaves per plant per plot
		2-WAS		
0	15.000	2.095ab	4.273	56.438
25	14.750	2.095ab	4.893	44.250
50	15.000	2.49a	4.800	53.688
75	15.000	2.00a	4.800	53.688
	NS	NS	NS	NS

Means followed by the same letter(s) in a column are not significantly different at P<0.05

The lack of difference may be attributed to the fact that production of dry matter which directly associated with growth did not pick up. This is in full agreement with the findings of Aliyu *et al*., (2011) that at the second week, plant heights were not significantly affected by rate of application of the amendment. However, the non- significant (P<0.05) effects on stem diameter and number of leaves were perhaps due to gradual increase in such parameters in relation to the rice-husk incorporation period. This behavior was similarly reported by Polycarp (2010), that incorporation of the rice-husk manure may not influence some growth characters of tomato seedlings at early stages.

The effect of rice-husk application rates on tomato growth parameters at 4 and 6-WAT is shown in Table 2. There were significant (P < 0.05) differences in plant height at 4-WAT between all application rates with the control which showed lower plant height. The application of 50 t/ha of rice-husk gave the tallest plants. The stem diameter followed the same pattern with plant height at 4-WAT. There were no significant differences between the application of 0, 50 and 75 t/ha in terms of number of leaves per plant (Table 2). However, 50 t/ha the highest number of leaves. The study clearly indicated that application of 50 t/ha was better than the other treatments in terms of plant height, stem diameter and number of leaves at 50 t/ha at 4-WAT.

At 6-WAT plant height, stem diameter and number of leaves were higher than the control. However, application of 75 t/ha gave the highest plant height and stem diameter. Even though 50 t/ha gave the highest number of leaves there was no significant differences between it and application of 50 t/ha. It was further observed that there were significant (P < 0.05) between the treatments in these three growth parameters measured. This clearly showed that as application rates were increased from 0 to 75 t/ha, plant growth also increased from 2 to 6-WAT.

At 8-WAT, no significant difference was observed in plant height. However, significant (P < 0.05) differences existed between the treatments in terms of stem diameter and number of leaves. This agrees with the report of Tekwa (2010) who reported proportional effects between rice- husk rate and stem diameter.

In general, applications of 50 and 75 t/ha clearly influenced growth parameters of tomato in Mubi. This agrees with the report of Fermandes *et al.,* (2001) and Macrere *et al.,* (2001) that the role of rice-husk material provides essential nutrients for effective growth parameters.

Table 2: Effect of rice-husk application rates on tomato growth parameter at 4 and 6-WAT

Rice-husk manure rate (tons/ha)	Plant height (cm)	Stem diameter (mm)	Number of leaves per plant per plot
	4-WAT		
0	3.838[b]	5.833[b]	66.730[ab]
25	4.763[ab]	6.995[ab]	50.705[b]
50	5.035[a]	7.788[a]	81.333[a]
75	4.663[ab]	7.045[ab]	71.782[ab]
S.E(±)	0.439	0.7277	10.715
	6-WAT		
0	3.838[c]	4.330[d]	97.93[c]
25	5.738[b]	7.605[c]	98.55[bc]
50	6.940[ab]	9.600[b]	112.00[a]
75	8.073[a]	11.100[a]	111.26[ab]
S.E(±)	0.7106	0.6505	5.7001
	8-WAT		
0	6.813	5.380[c]	112.0[4b]
25	7.190	8.655[b]	117.31[ab]
50	6.820	11.553[a]	133.62[a]
75	6.645	11.480[a]	140.93[a]
S.E(±)	NS	0.7673	6.3622

Mean values followed by the same letter(s) in a column are not significantly different at P<0.05.

Effect of rice-husk on the yield of tomato (*Lycopersicum esculentum*) at different harvesting period

Results of yield showed significant (P < 0.05) differences among the treatments as presented in Table 3.

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Table 3: Tomato (*Lycopersicum esculentum*) yields at 4 harvesting intervals

Rice-husk manure rate (ton/ha)	First Harvest	Second Harvest	Third Harvest	Fourth Harvest
0	0.500[d]	1.15[d]	1.57[d]	2.150[c]
25	2.150[c]	4.40[c]	3.50[c]	2.950[b]
50	4.100[b]	6.65[b]	7.77[b]	2.950[a]
75	6.625[a]	11.23[a]	12.65[a]	5.900[b]
S.E(±)	0.6679	0.8170	0.5385	0.6345

Mean values followed by the same letter(s) in a column are not significantly different at P<0.05.

Generally, treatments 50 t/ha and 75 t/ha gave the highest yield at all harvesting intervals very much above the absolute control. However, 75 t/ha was the best treatment. These treatments were followed by 25 t/ha and then lastly, the control. At all harvesting times/number, yield increased with increase in treatments from 0 to 75 t/ha. Therefore, significant (P < 0.05) differences existed among the treatments (Table 3). These results concur with the findings of Tekwa *et al.,*(2010) and Afolabi (2010) who also reported high yields upon application of 50 and 75 t/ha.

CONCLUSION

The study showed that the growth of tomato was insignificant at two weeks irrespective of rice-husk application rates of 0, 25, 50, and 75 t/ha. However, growth increased progressively from 2, 4, 6 and 8 weeks after transplanting as the application rates increased. Applications of 50 and 75 t/ha increased growth parameters than the application of 0 and or 25 t/ha. The study also showed that 75 t/ha gave the highest yield.

Recommendation

Based on the results of the study, farmers are advised to apply 75 t/ha of rice-husk for increased and sustainable growth and yield of tomato in the study area.

Contribution of Authors

The authors contributed towards designing the experiment, monitoring the field work as well as in writing and correction of the manuscript.

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REFERENCES

Adams, P., Davies, J.M. and Windsor, W. (1978). Effects of nitrogen, potassium and magnesium on the quality and chemical composition of tomatoes grown in peat. Journal of Horticultural Sciences, 53: 115-122.

Adebayo, A. A. (2004). *Mubi region: A geographical synthesis* (1st Edition). Paraclete Publishers, Yola, Nigeria. Pp 17-25.

Afolabi, G. (2002). Effect of rice-husk incorporation rates on the growth and yield of Okra in Mubi. A Diploma project, Federal Polytechnic, Mubi (Unpublished).

Aliyu, T.H, Balogun, O.S and Alade, O.O. (2011). Assessment of the effect of rate and time of application of rice-husk powder as an organic amendment on cowpea (*Vigna unguiculata L.,walp*) inoculated with cowpea mottle virus.A*griculture and Biology Journal of North America*.pp. *2151-7517.*

Dittoh, J.S. (2008). *The economics of dry season vegetable production in Nigeria*. Paraclete Publishers, Yola, Nigeria. Pp 22-27.

Fernandes, J., Martines, I.A., Cordoba, S. (2001). Sesame and Seaflower. *Newsletter*. Pp 61.

Food and Agricultural Organization (FAO)(2000). Crop overview of the cultivated species. Chatam, UK Natural Resource Institute, LACP-EU Technical Centre for Agricultural Resources and Cooperation. Pp 24.

Macrere, A.P., Kumbi, G.G. and Nonga, D.L.M. (2001). Comparative effectiveness of animal manures on soil chemical properties, yield and root growth of Amaranthus (*Amaranthus cruentus L.*). African Journal of Science and Technology, 1: 14-21.

Nwogboso, N. J. and Uyanga, J. (1999). Population. *In*: Adebayo, A. A.and Tukur, A. L. (Eds). *Adamawa State in Maps*. Department of Geography, FUT, Yola. Paraclete Publishers. Pp 92.

Olayinka, A. and Adebayo, A. (1985). The effects of methods of application of sawdust on plant growth, plant nutrient uptake and soil chemical properties. Ife Journal of Agriculture, 12: 36-44.

Tekwa, I. J., H.U. Olawoye and H. Yakubu (2010). Comparative effects of separate incorporation of cowdung and rice-husk materials on nutrient status of some Lithosols in Mubi, N.E Nigeria. *International Journal of Agriculture and Biology*. Vol. 12:857-860. Faisalabad-Pakistan

Appendix 1: Physico-chemical properties of soils of the study area

Soil Property	Mean Value
Sand	49.43
Silt	17.92
Clay	32.65
Texture	Sandy clay loam
Particle Density (Mg/m^3)	1.21
Bulk Density (Mg/m^3)	1.60
Porosity (%)	24.29
Water Holding Capacity (%)	15.09
Soil Reaction (pH) (1:2.5 Soil: Water)	7.36
Electrical Conductivity	34.38
Organic matter (%)	1.31
Total Nitrogen (CMol+/kg)	0.06
Exchangeable Phosphorus (ppm)	0.01
Exchangeable Potassium (CMol+/kg)	0.33
Calcium (CMol+/kg)	1.47
Magnesium (CMol+/kg)	3.33
Sodium (CMol+/kg)	0.09
Total Exchangeable Acid	0.65
Total Exchangeable Bases (CMol+/kg)	5.31
Cation Exchange Capacity (CMol+/kg)	7.67
Cation Exchange Capacity (CMol+/kg)	7.67

Adapted from Tekwa et al. (2010).