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ORIGINAL RESEARCH

Changes in soil nutrient status of a coarse-textured Ultisol and tomato growth performance following composted sawdust-household waste application

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Abstract

Purpose Waste disposal poses serious environmental challenges to mankind. This precipitated the quest for an eco-friendly waste management approach to minimize the challenges wastes pose to the ecosystem and proffer alternative use for these wastes.

Method A field study was carried out at the University of Nigeria Nsukka Teaching and Research Farm to investigate the effects of composted sawdust-household waste (SHW) with or without inorganic fertilizer addition on soil chemical properties and tomato performance. The experiment was arranged in a randomized complete block design with five treatments and three replications. The treatments were: 50% NPK + SHW 20 t/ha, SHW 40 t/ha, SHW 20 t/ha, 100% NPK, and Control.

Result The amended treatments, except 100% NPK, increased the soil pH by 3-8%, available P by 14-29%, and soil organic matter by 1.5-9.8%. Control and 100% NPK treatments had no significant effect on the soil's chemical properties. SHW 40 t/ha had significantly taller plants and a higher number of plant leaves relative to other treatments. The amended treatments recorded significantly weightier fresh root weight, dry root weight, fresh shoot weight, and dry shoot weight relative to the control treatment. Overall, SHW treatments application had more pronounced effects on plant biomass than on plant vegetative growth.

Conclusion The study suggests that composted SHW can be a viable option over chemical fertilizer for tomato cultivation as well as good soil conditioners.

Keywords Compost, Household waste, NPK fertilizer, Sawdust, Tomato performance

Introduction

Globally, wastes pose serious environmental problems, especially in developing countries. Rapid population growth, change in consumption patterns due to slightly improved standard of living and lack of efficient waste management system contribute to the volume of waste generated (Alam et al. 2008). Ineffective and improper management of waste poses enormous threats to the environment by causing air, soil, and water pollution, which inadvertently contributes to climate change impact (Ayilara et al. 2020). Composting is a widely accepted way of managing biodegradable wastes, by biologically degrading organic materials under aerobic conditions to produce a safe and stable humus-like prod-

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uct (Fernández et al. 2014). Waste composting is gaining popularity since it is cost-effective, environmentally friendly (Li et al. 2013, Ayilara et al. 2020), and the end product can be used as biofertilizer. Composting adds value to wastes, which could be used for soil organic matter restoration (Hargreaves et al. 2008 Zhao et al. 2012).

Composted waste also impacts on soil physicochemical and microbial properties (Zhong et al. 2010; Tzortzakis et al. 2012; Wei et al. 2015) as well as remediates contaminated soils (Zeng et al. 2015). Tomato (*Solanum lycopersicum* L.) is the third most important commercial vegetable in Nigeria after onions and pepper.

The annual production of tomatoes in Nigeria is about 2 million (2,000,000) tonnes (Ugonna et al. 2015). Over 80% of tomatoes is produced in the Northern part of Nigeria, where the climatic conditions, especially low rainfall and better soil conditions favour the growth of tomatoes (Shiyam et al. 2017). Tomato is rich in vitamins, minerals, and antioxidants, which help not only in controlling cancer but also in improving the overall health status (Ugonna et al. 2015). Tomato plant requires balanced soil nutrients and water for any meaningful yield (Azad 2000). With adequate nutrient provisioning, the fruit quality, such as size, colour, and taste of tomato, is enhanced (Azad 2000). Low soil fertility and unfavorable soil physical properties such as high bulk density, and low aggregate stability are among the factors that contribute to low crop yield in Nigeria. Mba (2006) opined that most African soils are poor in soil fertility status, which is a major overriding constraint that affects all aspects of crop production. Significant declines in soil organic matter lead to the deterioration of soil physical properties and imbalances in soil mineral content (Mrabet et al. 2001; Unagwu 2019). To maintain high crop productivity and improve soil properties, application of organic materials are highly recommended (Unagwu et al. 2021). Compost improves mineral nutrition of plants, particularly nitrogen, phosphate and potassium nutrition (Hasyim et al. 2014; Abdel-Fattah and Merwad 2015). Compost application has positive effect on plant growth (Rajaie and Tavakoly 2016) and on crop yields such as vine (Korboulewsky et al. 2004); rice (Kavitha and Subramanian 2007); wheat (Abedi et al. 2010); maize (Ogbonna et al. 2012) and water leaf (Uko et al. 2013). In addition to supplying plant nutrients, compost application improves the soil physical properties (Adeleye et al. 2010) by enhancing soil water holding capacity, infiltration, and aeration. Compost application also improves soil structure and reduces erosion as well as enhances the soil microbial activities, which promotes nutrient supply (Weber et al. 2014). There are limited studies on the use of compost to enhance soil properties for crop production in Nsukka, Southeastern Nigeria. More so, Nsukka produces sawdust in abundance, which is often burnt as a way of disposal, thus polluting the environment. This study examined the efficacy of sawdust-household compost application in improving the soil properties for tomato production in Nsukka.

Materials and methods

Site description

The experiment was carried out at the Faculty of Agriculture's Teaching and Research Farm, University of Nigeria, Nsukka. Nsukka is located at latitude 06° 52`N and longitude 07° 24`E at an altitude of approximately 400 m above sea level. Nsukka climate is characterized by mean annual rainfall of about 1600 mm and mean annual evapotranspiration (ET) of about 1560 mm. The temperature is relatively high throughout the year, with mean minimum and maximum annual values of 21°C and

31°C, respectively. The soil is a deeply weathered brownish red coarse-textured ultisols that is characteristically low in organic matter (Unagwu et al. 2021).

Compost production, treatments and experimental design

A 3 m × 3 m × 3 m pith was dug for the purpose of collecting and composting sawdust and household wastes. The household wastes comprised banana peels, spoilt oranges, yam peels, eggshells, and potato peels. The sawdust and household wastes mix were in the ratio of 30:70. There is huge quantity of sawdust in Nsukka, but sawdust is rarely used as soil amendments for crop production due to its inherit low nutrient content. The choice of incorporating sawdust in the mix is to provide carbon and enrich the soil organic matter content. The compost heap was irrigated with one liter of water and manually turned at three-day intervals, for a period of 96 days, until the compost is mature, cured, and ready for use (Ayilara et al. 2020). The present experiment was set up in a randomized complete block design with five treatments and three replications. The treatments were: 50% NPK + sawdust-household (SHW) 20 t/ha; SHW 40 t/ha; SHW 20 t/ha; 100% NPK and Control, zero addition. The treatments were weighed out, spread on the experimental area, incorporated into the soil, then watered and left for two weeks to stimulate soil microbial activities. The experimental plot size was 9 m × 4 m (36 m^2) while the sub-plot was 60 cm × 100 cm (0.60 m^2). The experimental plot was manually cleared using a cutlass, then ridged with a handheld hoe. Prior to experimental plot establishment, tomato seeds, UC 82B variety, were sown in a flat nursery bed and later transplanted to the field, one month after emergence. The tomato seedlings were transplanted at the rate of one seedling per hole at a spacing of 20 cm by 20 cm. After transplanting, the seedlings were irrigated twice daily (mornings and evenings) at two (2)-day intervals for a period of two (2) weeks. This is to reduce shock due to the transplanting process and ensure plant quick establishment in the new environment. The experimental sub-plots were manually weeded at three-week intervals throughout the duration of the study.

Plant growth parameters assessment

The plant parameters measured were: plant height; number of plant leaves, number of plant branches, stem girth, plant root length, and fresh and dry plant biomass. Except for plant root length, fresh biomass, and dry plant biomass data, which were taken after plant harvest, the other plant parameters were taken at weekly intervals from 14-71 days after transplanting. The plant height and plant root length were obtained with the aid of measuring tape, while the number of plant leaves and plant branches was obtained by counting. The plant stem girth was obtained with the aid of a micrometer screw gauge. Prior to measuring the plant root length, the tomato plant was carefully uprooted when the soil was wet, to minimize damage to the plant roots; then gently rinsed with water to remove soil particles that adhered to the plant roots. Plant root length and fresh biomass were obtained from freshly uprooted plants while the dry biomass was obtained after air-drying the fresh plant biomass for a week period. These plant data were taken from four tagged middle tomato plants in each experimental sub-plot.

Soil sampling and analysis

Soil samples were collected from the field prior to crop establishment and after crop harvest. The soil samples were analysed in the laboratory for pH, nitrogen, available phosphorus, potassium, organic carbon, organic matter, cation exchange capacity, and electrical conductivity. Soil pH was determined using a glass electrode pH meter in water in the ratio of 1:2.5 (Maclean 1982).

Organic carbon content was determined by the wet dichromate acid oxidation method (Nelson and Sommers 1982), then the organic matter was obtained by multiplying the organic carbon value by a factor of 1.724. Kjeldahl method was used to determine soil total nitrogen (Bremner and Mulvaney 1982) while available phosphorus was determined using Bray II method (Bray and Kurtz 1945). Exchangeable potassium and sodium were determined by flame photometer as described by Rhoades (1982). The soil cation exchange capacity was obtained via the ammonium acetate method (Chapman 1965).

Percentage changes in the soil properties relative to the initial soil nutrient status were obtained by calculation, thus:

$$K = \frac{Y-X}{Y} * 100$$

where K is the percentage change in the soil properties

X is the initial soil properties prior to amendment application

Y is the soil properties after plant harvest

Statistical analysis

All the data obtained were subjected to analysis of variance (ANOVA) using Genstat 9.2 edition. The treatment means were compared using Fisher's least significant difference at 5% probability level.

Results and discussion

The soil test showed low fertility status based on the initial soil chemical properties (Table 1). The soil test pH tended to be neutral (6.7) and had low organic matter contents (2.56%) (Unagwu 2019). Total N and available phosphorus were low 0.14% and 0.07 mg/kg, respectively (Unagwu 2019) (Table 1). It is worth mentioning that, prior to this study, the test field was fallowed for one year after it had been under mixed cropping for about four years. The low nutrient status of the test soil is typical of most soils in Southeastern Nigeria. This is why the region is associated with low arable crop yields. Hence, there is need to enhance the soil fertility conditions of the test soil to boost food production. The chemical composition of sawdust-household waste compost (SHW) was relatively high in the essential nutrients required for the growth and development of the plant (Table 1). The SHW pH was alkaline and had about 78% organic matter content (Table 1).

Table 1 Baseline chemical characteristics of organic amendment and initial soil sample

Treatments	pH H_2O	pH KCl	Total Nitrogen %	Available phosphorus mg/kg	Organic Matter %	Exchangeable Na cmol/kg	Exchangeable K cmol/kg	CEC cmol/kg
SHW	9.6	9.0	0.63	1.34	77.6	0.18	0.54	-
Soil sample	6.7	6.3	0.140	0.07	2.56	0.07	0.20	8.40

SHW, sawdust-household waste compost

The effects of treatments on soil properties

Following SHW application, 50% NPK + SHW 20 t/ha treatment had significant ($p < 0.05$) increase (4.35%) in soil pH level relative to the control treatment and other amended treatments (Table 2). However, SHW 20 t/ha, SHW 40 t/ha and 100% NPK treatments had no significant effect on the soil pH relative to the control treatment. The soil Electrical conductivity was not significantly ($p > 0.05$) affected following treatment application (Table 2). Treatments SHW 40 t/ha and SHW 20 t/ha had significantly higher total N relative to 50% NPK + SHW 20 t/ha, 100% NPK and control treatments. Although, treatment SHW 40 t/ha had the highest ($p < 0.05$; 0.133%) total N content, it was statistically at par with SHW 20 t/ha treatment. The trend in the total N content is as follows: SHW 40 t/ha > SHW 20 t/ha > 50% NPK + SHW 20t/ha > 100% NPK = control treatment. Except for SHW 40 t/ha treatment, which had the highest ($p < 0.05$; 0.09 mg/kg) available P, the available P associated with all the other treatments did not differ statistically (Table 2).

The trend in the soil available P is as follows: SHW 40 t/ha > 50% NPK + SHW 20 t/ha ≥ SHW 20 t/ha = 100% NPK ≥ control. Except for 100% NPK and SHW 40 t/ha treatments, which recorded a significantly lower exchangeable K as compared with the control treatment, all other treatments did not differ statistically in their soil exchangeable K. Except SHW 40 t/ha treatment, all other amended treatments had a significantly higher exchangeable Mg relative to the control treatment.

100% NPK treatment had the highest ($p < 0.05$; 1.70 mg/kg) exchangeable Mg although, it was statistically at par with 50% NPK+SHW 20 t/ha treatment, while SHW 40 t/ha had the least (0.70 mg/kg) value. The trend in the exchangeable Mg is thus: 100 NPK ≥ 50% NPK + SHW 20 t/ha > SHW 20 t/ha > control > SHW 40 t/ha.

Treatments application had no significant ($p > 0.05$) effect on soil cation exchange capacity, CEC. As anticipated, the amended treatments, except for 100% NPK, had significant ($p < 0.05$) effect on the soil organic matter (SOM) content. SHW 40 t/ha treatment recorded the highest (2.81%) SOM. SHW 40 t/ha treatment had 37.8% higher SOM content relative to the control treatment.

Similarly, 50% NPK + SHW 20 t/ha and SHW 20 t/ha treatments had 27% and 27.5% higher SOM as compared with the control treatment, respectively. In contrast, SOM associated with 100% NPK treatment was 14.2% lower than that in the control treatment, although both treatments are statistically the same.

The higher SOM recorded for SHW 40 t/ha treatment can be attributed to the high application rate. The results obtained corroborate the findings of other studies.

For instance, Sayğı (2021) found that poultry manure, slurry manure, and green manure application increased exchangeable K, available P, and total N. Karmakar et al. (2013) reported increases in soil chemical properties (pH, exchangeable K, available P, total N, and organic matter) following the application of organic amendment (farm yard manure and vermicompost) relative to the control treatment.

Unagwu et al (2019) reported that the application of mushroom compost, poultry manure, and PAS-100 (commercially composted household waste) compost improved the chemical soil conditions of a degraded ultisol relative to the untreated control.

Table 2 Effect of treatment application on soil chemical properties after crop harvest

Treatments	pH H_2O	pH KCl	EC µs/cm	Total N	Available P	Ex. K mg kg^{-1}	Ex. Mg mg kg^{-1}	CEC mg kg^{-1}	Organic Matter %
50% NPK +SHW 20 t/ha	7.2	6.5	69.5	0.112	0.08	0.135	1.30	8.80	2.59
SHW 40 t/ha	6.9	6.3	59.5	0.133	0.09	0.105	0.70	8.40	2.81
SHW 20 t/ha	6.9	6.6	64.0	0.126	0.07	0.155	1.20	8.20	2.60
100% NPK	6.8	6.5	60.0	0.105	0.07	0.110	1.70	8.60	1.75
Control	6.9	6.6	71.0	0.105	0.06	0.145	0.60	9.00	2.04
LSD	0.10	0.24	NS	0.009	0.02	0.020	0.45	NS	0.39

SHW; Sawdust-household waste compost, EC, Electrical conductivity; Avail., Available, CEC; Cation exchange capacity; Ex., exchangeable; LSD, least significant difference

The present study shows that treatments application has positive effects on soil properties. This is evidenced by the percentage changes in the soil parameters measured at the end of study relative to the initial soil characteristics (Table 3). Relative to the initial soil pH (6.7), treatment 50% NPK + SHW 20 t/ha increased the soil pH by 7.5%, which is about 60-77.8% more than the contributions from treatments SHW 40 t/ha, SHW 20 t/ha, control and 100% NPK, respectively. Treatment 100% NPK contributed the least effect in improving the soil pH. This may explain why application of inorganic NPK fertilizers often has negative effects on soil pH conditions. This observation corroborates other research findings. For instance, Lee et al. (2019) reported a plunge in the soil pH for the control and NPK fertilizer treatments relative to the organic amended treatments. Unagwu et al. (2019) reported decreases in soil pH for organic amendment with NPK addition as compared with treatment application without NPK addition.

For Total N and exchangeable K, all the treatments applied had a negative contribution to the soil. The possible reason for the observed negative contribution may be linked to plant nutrient uptake. Study shows that N is a critical nutrient required for better quality and yield of tomato since N stimulates the vegetative growth and flowering of tomato plant (Direkvandi et al. 2008; Du et al. 2018). Secondly, unlike available P and organic matter content, the sawdust-household waste compost that was used as soil conditioner was not superbly rich in total N and exchangeable K when compared with the values obtained for the initial soil properties (Table 1). These, no doubt could contribute to the observed negative contributory effect. 50% NPK + SHW 20 t/ha and SHW 40 t/ha treatments enhanced the soil available P by 14.3% and 28.6% while the control treatment depleted soil available P by 14.3%. Treatments 100% NPK and SHW 20 t/ha showed no contributory effect on soil available P probably due to plant nutrient up. Further, the amended soils with or without NPK addition had positive contributory effect on the soil organic matter content relative to the 100% and control treatments (Table 3). Treatment SHW 40 t/ha had the highest (9.8%) contributory effect on soil organic matter content followed by Treatments SHW 20 t/ha (1.6%) and 50% NPK + SHW 20 t/ha (1.2%). Treatment 100% NPK had least contributory effects on the soil organic matter content. This study confirms reports of other studies on the roles of organic amendment application in enhancing soil organic matter content and the negative contributory effects of chemical fertilizer application on soil organic matter content (Unagwu et al. 2019, Unagwu et al. 2021, Sayğı 2021).

Table 3 Percentage change in the key soil properties relative to the initial soil nutrient status

Treatments	pH_H_2O (%)	Total N (%)	Available P (%)	Exchangeable K (%)	Organic Matter (%)
50% NPK + SHW 20 t/ha	7.5	-19.7	14.3	-32.5	1.2
SHW 40 t/ha	3.0	-5.0	28.6	-47.5	9.77
SHW 20 t/ha	3.0	-10.0	0.0	-22.5	1.56
100% NPK	1.5	-25.0	0.0	-45.0	-31.6
Control	3.0	-25.0	-14.3	-27.5	-20.3

SHW; Sawdust-household waste compost

The effects of treatments application on plant growth parameters

Treatments application had varied effects on the tomato plant height throughout the plant vegetative growth stage (Fig. 1). Plots amended with SHW 40 t/ha treatment maintained significantly taller plants from 2-8 weeks after transplanting (WAT) relative to other treatments. In contrast, 50% NPK + SHW 20 t/ha treatment had the shortest plant heights from 2-7 WAT except at 8 WAT, where it was statistically at par with SHW 20 t/ha and control treatments.

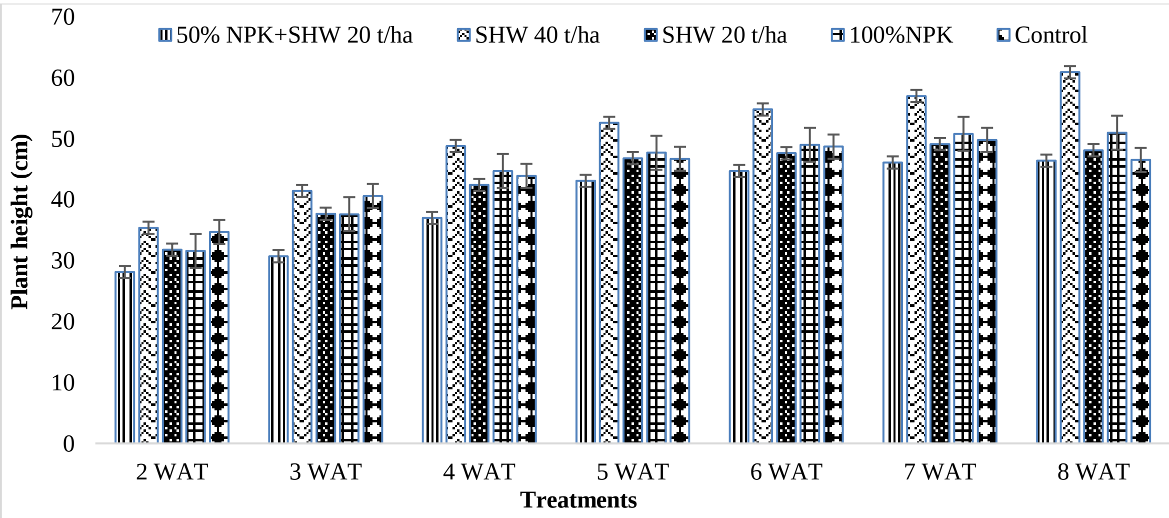

Fig. 1 Effect of treatment application on tomato plant height

SHW: Sawdust-household waste compost; WAT: Weeks after transplanting; bars represent least significant difference (LSD)

At 2 and 4 WAT, treatment SHW 40 t/ha had significantly ($p < 0.05$) greater number of plant leaves as compared with all other treatments (Fig. 2). From 5-8 WAT, SHW 40 t/ha and 100% NPK treatments did not differ significantly in their effects on the number of tomato leaves but both treatments had the greatest ($p < 0.05$) number of plant leaves. From 4-8 WAT, treatments 50% NPK + SHW 20 t/ha, SHW 20 t/ha and control did not differ ($p < 0.05$) in their effect on the number of tomato plant leaves.

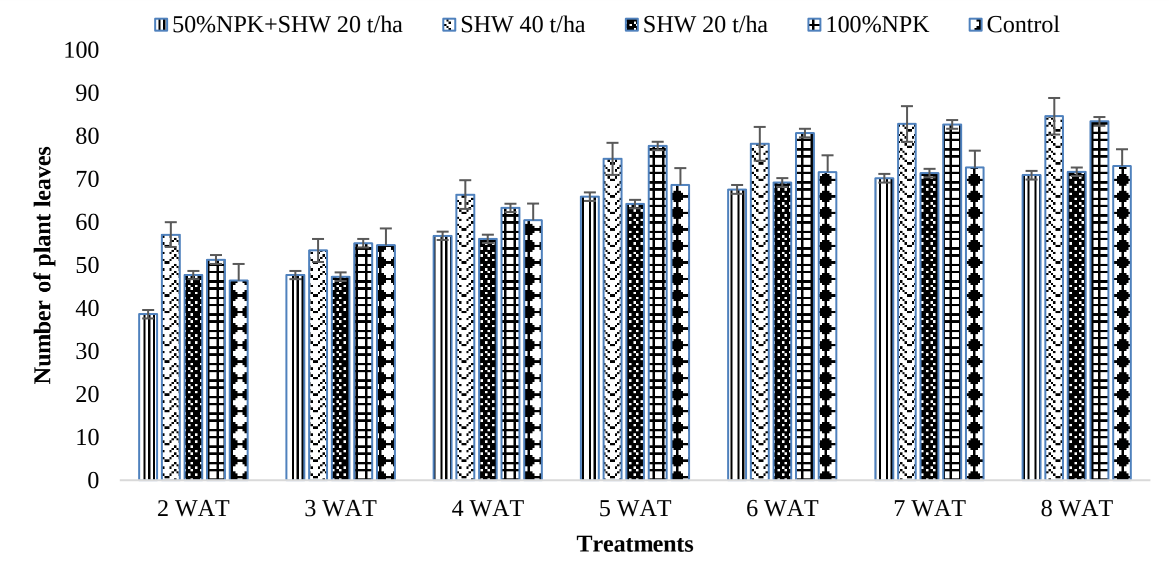

Fig. 2 Effect of treatment application on number of tomato leaves

SHW: Sawdust-household waste compost; WAT: Weeks after transplanting; bars represent; bars represent least significant difference (LSD)

SHW 40 t/ha and 100% NPK treatments differed statistically but had the greatest ($p < 0.05$) number of branches as compared with all other treatments (Table 4). Similar to the trend observed in Fig. 2, treatments 50% NPK + SHW 20 t/ha, SHW 20 t/ha and control did not differ significantly ($p < 0.05$) in their effect on the number of plant branches produced. There is no clear cut pattern on the effect of treatment application on tomato stem girth (Table 4). Composts, like other organic amendments, are slow in releasing their nutrient content. Thus, the varied effects on the plant height, number of plant leaves, number of branches and stem girth following treatments application can be ascribed to the amount of nutrients available for plant uptake at the various stage of plant development. The observed positive tomato growth performance can be attributed to improve soil conditions, which enhanced nutrient uptake following organic amendment application. The present data support the reports of Sayğı (2021) whose findings showed that poultry manure, slurry manure, green manure application had better plants performance relative to the control treatment. The author attributed the better plant performance to improving in soil K, available P, total N, and organic matter following treatments application.

Effect of treatment on tomato plant root length, fresh and dry plant biomass

Plant root length, fresh root weight and dry root weight were significantly affected following treatments application (Table 5). Tomato plants grown on SHW 40 t/ha treated plots had the longest root length (9.28 cm) but were not significantly longer when compared with all other treatments. The amended treatments, except 100% NPK, had higher ($p < 0.05$) fresh root and dry root biomass as compared with the control treatment. Across the organic amended treatments, SHW 20 t/ha treatment had a significantly ($p < 0.05$) higher fresh root (6.86 g) and dry root (2.73 g) biomass relative to 50% NPK + SHW 20 t/ha and SHW 40 t/ha treatments.

Table 4 Effect of treatment on tomato plant growth parameters

Treatments	2 WAT	3 WAT	4 WAT	5 WAT	6 WAT	7 WAT	8 WAT
			Number of plant branches				
50% NPK +SHW 20 t/ha	8.0	9.60	11.9	13.0	13.3	14.9	14.9
SHW 40 t/ha	9.7	10.7	13.6	14.9	15.9	17.3	17.7
SHW 20 t/ha	8.4	9.40	12.4	12.7	13.8	14.2	14.3
100% NPK	9.8	10.8	11.6	15.7	16.7	16.8	16.8
Control	9.2	10.7	11.9	13.2	14.1	14.2	14.3
LSD	**1.48**	**1.18**	**1.50**	**2.20**	**2.58**	**2.09**	**1.98**
			Stem girth (cm)				
50% NPK +SHW 20 t/ha	1.49	1.70	1.89	1.98	2.02	2.6	3.0
SHW 40 t/ha	1.74	2.00	2.07	2.26	2.38	2.8	3.3
SHW 20 t/ha	1.56	1.73	2.24	2.34	2.40	2.7	3.5
100% NPK	1.74	1.97	2.11	2.19	2.34	2.6	3.4
Control	1.57	1.79	2.12	2.10	2.20	2.4	3.1
LSD	**0.25**	**0.34**	**0.31**	**0.35**	**0.43**	**0.17**	**0.36**

SHW: Sawdust-household waste compost; WAT: Weeks after transplanting; LSD, least significant difference.

Table 5 Effect of treatment application on tomato plant root length, fresh and dry root biomass

Treatments	Plant root length (cm)	Plant fresh root weight (g/plant)	Plant dry root weight (g/plant)
50% NPK +SHW 20 t/ha	8.83	2.20	1.36
SHW 40 t/ha	9.28	4.10	2.18
SHW 20 t/ha	8.94	6.86	2.73
100% NPK	8.53	1.60	1.19
Control	8.78	0.70	0.94
LSD	NS	1.35	0.313

SHW: Sawdust-household waste compost; LSD: least significant difference

Treatments effect on tomato fresh shoot biomass varied ($p < 0.05$) across the treatments (Fig. 3). SHW 20 t/ha treatment had highest (38 g/plant) fresh shoot biomass relative to all other treatments while the control treatment gave the least (3.8 g/plant) fresh shoot biomass. The result (Table 5) shows that treatment effect on tomato fresh shoot biomass was as follows: SHW 20 t/ha > SHW 40 t/ha > 50% NPK + SHW 20 t/ha > 100% NPK > control. A similar trend was observed for tomato dry shoot biomass, except that treatment SHW 20 t/ha and SHW 40 t/ha treatments were statistically at par (Fig. 4).

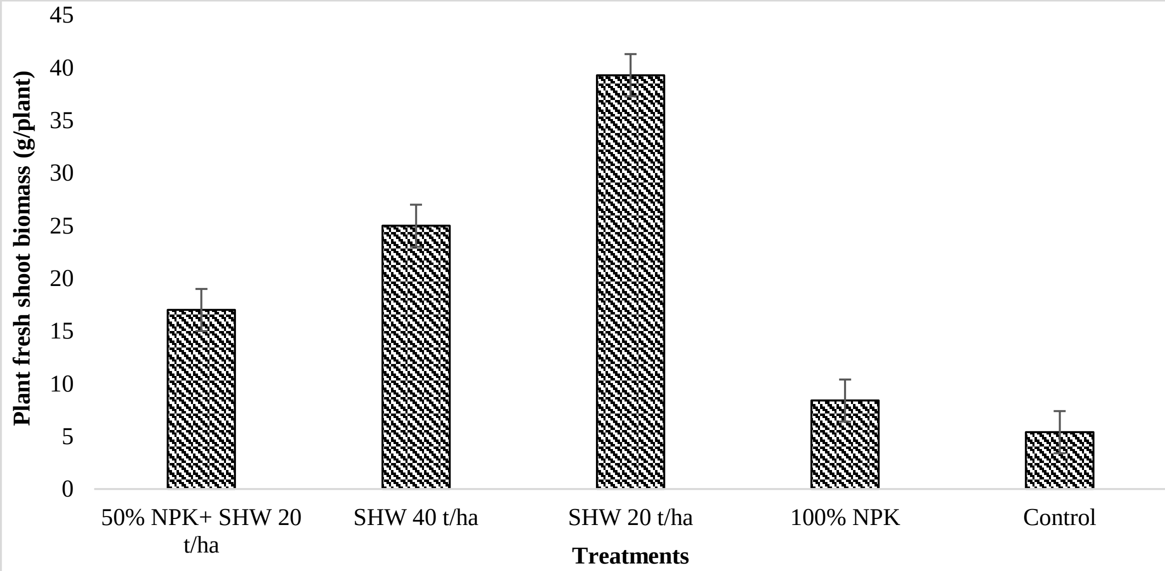

Fig. 3 Effect of treatment application on tomatoes fresh shoot biomass (g)

SHW: Sawdust-household waste compost; bars represent least significant difference (LSD)

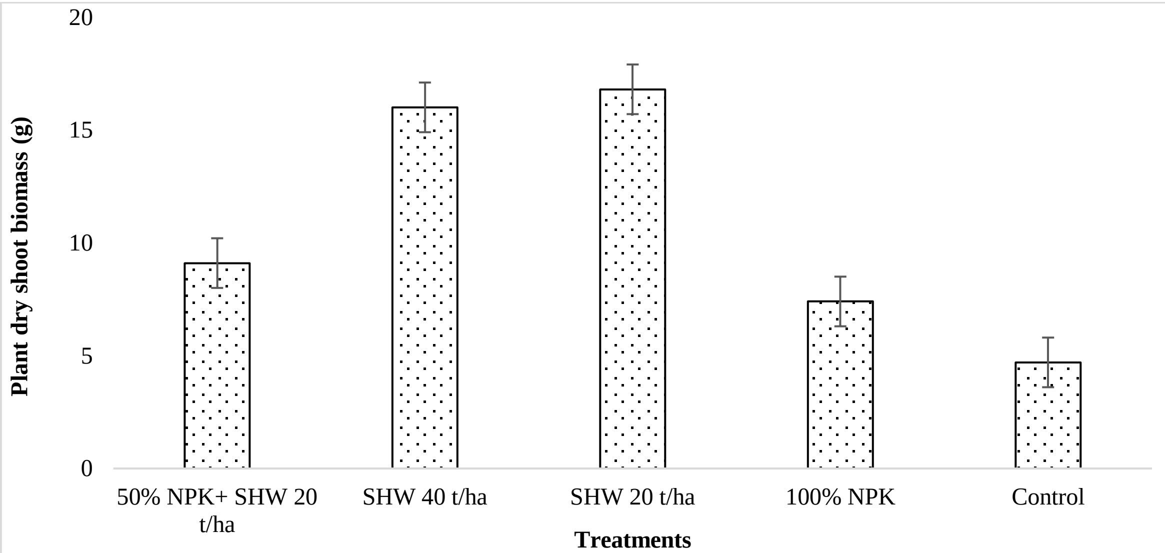

Fig. 4 Effect of treatment application on tomatoes dry shoot biomass (g)

SHW: Sawdust-household waste compost; bars represent least significant difference (LSD)

Tomato yield data was not presented. This is because, beyond 10 WAT, there was pest infestation, silver leaf whitefly (*Bemisia tabaci* Gennadius), which infected the experimental plots. The attack had huge impact on the plants resulting to loss of tomato fruits produced due to fruit abortion. Studies have shown that pesticide application can have negative effects on soil properties (Aktar et al. 2009, Sebastian et al. 2017) as soil microbial biomass (Widenfalk et al. 2008), whose activities help in organic matter decomposition, could be negatively affected. Thus, no pesticides were applied for fears of contaminating the experimental objectives, one of which was to evaluate the effect of treatment application on soil nutrient status.

The observed pest attack in addition to low soil nutrient status, that is associated with soils of southeastern Nigeria, is among the challenges hampering tomato production in Nsukka, southeastern Nigeria.

Conclusion

SHW treatments application has varying effects of on soil properties as well as on tomato growth parameters measured. While SHW 40 t/ha treatment tended to outperform the other treatments regarding some measured plant growth parameters, SHW 20 t/ha treatment showed superiority over the other treatments regarding the plant biomass obtained. Overall, no clear trajectory effect was observed across the SHW treatments although, SHW treatments outperformed all other treatments. The present study suggests that composted sawdust-household waste can be a viable option over chemical fertilizer for tomato cultivation as well as a good soil conditioner.

Compliance with ethical standards

Conflict of interest The authors declare that there are no conflicts of interest associated with this study.

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