__Original Research Article__

Effects of EcoTea Organic Fertilizer and Poultry Manure on Soil Health, Yield and Yield Components of Tomato

ABSTRACT

This study investigated the Effects of EcoTea Organic Fertilizer and Poultry manure on Tomato (*Lycopersicon esculentum* Mill.) yield and soil health. The treatments were arranged in randomized block design with three replications. The application of fertilizers significantly improved the soil chemical properties. Treatments PM + FW, C + FW and PM + AW in that order had significant effect on the fruit diameter at 8 WAT while OF + FW and OF + AW recorded an increase in fruit diameter at 11 WAT. Same trend was established in other yield components. The highest fruit yield at 8 WAT was recorded in treatments PM + AW and C + FW respectively while the lowest yield was recorded in OF + FW and OF + AW respectively. At 11 WAT, highest fruit yield was recorded in treatments PM + FW and OF + AW. Although the yield gotten from OF + FW here was not as much as the one from C + FW at 11 WAT; it was not the lowest yield (PM + AW). This is an indication that there was consistency in the yield of tomato under OF treatment; a further indication that EcoTea organic fertilizer's effect on tomato development is positive and reliable. Overall, Organic fertilizer produced a consistent and reliable impact on the soil health, fruit yield and yield components of tomato especially from 8 WAT to 11 WAT; therefore it is recommended and safe to use for tomato production under similar conditions as used in this study. Similar research should be carried out for three or more harvest cycles on the same piece of land to ascertain if the impact of EcoTea organic fertilizer will be sustained with same one time application.

Keywords: EcoTea organic fertilizer; soil chemical composition, yield, and yield components.

1. INTRODUCTION

Plants derive their nourishment from organic substances and minerals that are available in the soil. The process of agriculture involves continuous cultivation, which has been observed to disrupt the natural soil systems, including the cycling of nutrients and the release and uptake of nutrients. This observation has been made by Awodun *et al.* [2] and Bot and Benites [5]. The ongoing cultivation practices in modern agriculture lead to the depletion of soil nutrients and a decline in soil organic matter levels. Until management techniques are improved, additional nutrients are applied, crop rotation with nitrogen-fixing crops like legumes is practiced, or the land is left fallow for some time to allow for a gradual recovery of the soil through natural ecological development, this decline in soil nutrients and organic matter will continue. A reduction in the natural storage of vital nutrients for plant growth within the soil leads to a concomitant decrease in crop growth rate and yield. The predominant and widely acknowledged resolution to this predicament involves the utilization of soil modifications in the appropriate ratio, in the guise of fertilizers and manures [2, 5, 8].

Tomato output and quality are significantly influenced by soil fertility as well as adequate water, particularly during the fruiting stage. Numerous previously productive tropical lands have become unproductive due to ongoing cultivation and erosion, which has resulted in physical degradation, loss of soil organic matter, decreased cation exchange capacity (CEC), increased aluminium (Al) and manganese (Mn) toxicity, and other effects [8]. Ray *et al.* [18] as well as Li [10] have identified water scarcity and inadequate soil fertility as significant impediments to augmenting crop yield. The problem of low soil fertility in most tropical soils resulted in a growing search for soil improvement techniques, such as the adoption of appropriate and adequate fertilizer packages, involving the use of organic and/or inorganic fertilizers (chemical) to increase soil fertility; improve water retention in the soil; and improve water use efficiency, leading to an increase in crop yield [8, 18].

According to Law-Ogbomo [9], the utilization of chemical or inorganic fertilizers is a rapid and convenient approach to enhance crop productivity per unit of land. The continued use of chemical fertilization, however, degrades the soil's properties and fertility and may cause heavy metals to accumulate in plant tissues, which reduces the nutritional value and edible quality of fruit [20]. Additionally, chemical fertilizer lowers the protein content of crops and degrades the carbohydrate quality of such crops [14]. About 99.5% of fertilizers used in Nigeria, according to Williams [26], are inorganic fertilizers, which are harmful to plants, soil, and even people who eat the produce produced by inorganic farming. In contrast, organic fertilizer is composed of substances derived from either animals or plants. According to Ulusu and Yavuzaslanolu [23], organic fertilizers enhance soil structure and boost soils' capacity to hold water and nutrients. In the same way that inorganic fertilizers met the nutritional needs of plants, organic fertilizers do the same while also reducing pest populations [22]. According to Nileemas and Sreenivasa's [16] findings, the application of organic fertilizers resulted in a significant enhancement of soil microbial activity and nutrient availability for tomato plants. Similar to inorganic fertilizers, organic fertilizers boost crop yield and quality in a similar manner, with the exception that they release nutrients more gradually and can remain in the soil for longer periods of time [12, 15, 21].

Organic fertilizers supply vital nutrients that boost crop development and output. The utilization of organic fertilizers has the advantage of being environmentally friendly, thereby promoting the growth of subsequent crops. According to Mojeremane *et al.* [15], the suppression of plant pest populations, control of certain crop diseases, prevention of soil degradation, and reduction of water pollution are among the benefits provided by these organisms. EcoTea is a newly developed organic fertilizer made in Canada that can increase crop productivity and will be used in this study. Its first part, "A," which is a concentrated powdered milled inoculum, is made of milled peat-based worm casting. Humates, grain meals, sea-plant extracts, and rock dust are found in Part "B" and act as a binding agent for the microbial feeds.

The present study aims to examine the impact of EcoTea organic fertilizer and poultry droppings on the yield of tomatoes, as well as their chemical composition and the chemical properties of the soil. The investigation will be conducted using both fresh water and aquaculture wastewater, and will be carried out under a drip irrigation system.

2. MATERIALS AND METHOD

2.1. FIELD EXPERIMENT

This work was carried out at the Department of Fisheries and Aquaculture Technology Teaching and Research farm Obakekere of the Federal University of Technology, Akure, Nigeria from April 2022 to June 2022. The experiment was laid out in a Randomized Complete Block Design (RCBD) of three (3) fertilizer types with 2 different water applications (freshwater and aquaculture wastewater).

The factorial combination of the treatment will give a total of six (6) plots with three (3) replicates (3 × 2 × 3), making a total of 18 experimental plots. Each plot was of dimension 1.2 m by 7.1 m (combination of the 3 replicates) giving a total plot dimension of 8.52 m^2 and a total field dimension of 51.12 m^2 with 1 m alleyways in-between the plots. About four weeks old tomato seedlings were taken from the nursery and transplanted on the field. For the study, Poultry manure was one of the treatments employed in this research work it was obtained from the Poultry section of the teaching and Research Farm of Animal Production and Health department of the Federal University of Technology, Akure and was transported to the farm site.

The three types of fertilizers applied were Plot 1: Zero fertilizer (Control; C), Plot 2: Organic fertilizer (OF) – EcoTea, and Plot 3: Poultry Manure (PM). The 6 combined treatments are given as:

- C + FW which is Control + Freshwater application
- C + AW which is Control + Aquaculture Wastewater
- OF + FW which is Organic fertilizer + Freshwater application
- OF + AW which is Organic fertilizer + Aquaculture Wastewater
- PM + FW which is Poultry Manure + Freshwater application
- PM + AW which is Poultry Manure + Aquaculture Wastewater

2.2. Determination of Soil Chemical Properties

Soil samples were collected before conducting the experiment from the experimental site. Chemical characteristics of the soil were analyzed at the start and end of the study to determine nutrient build-up or depletion as a result of the treatments used. The selected soil chemical properties analyzed include Soil Organic Matter (SOM), Soil Organic Carbon (SOC), Cation Exchange Capacity (CEC) at pH 7.0, Soil pH, Nitrogen (N), Phosphorus (P; mg/kg), Potassium (K; cmol/kg), Magnesium (Mg; cmol/kg), Calcium (Ca; cmol/kg) and Sodium (Na; cmol/kg). Three soil samples were collected at different points on the experimental field for soil chemical characterization. The soil pH was determined in 20 ml of distilled water (1:2) using an electronic pH meter calibrated with pH 7.0 and pH 4.0 buffer. The Soil Organic Carbon (SOC) was determined using Walkey – Black wet oxidation procedure and the Soil Organic Matter content was derived from the organic carbon. Potassium (k^+), Sodium (Na^+), and the Cation Exchange Capacity (CEC) was determined by flame photometry. The flame photometer was set up according to the instruction in the instrument manual and appropriate filter for potassium and Sodium were selected respectively [17, 24]. Phosphorous, Calcium (Ca^{2+}), and Magnesium (Mg^{2+}) will be extracted using ammonia acetate and the total Nitrogen by Kjeldahl digestion method [17].

2.3. Characterization of EcoTea Organic Fertilizer

EcoTea is a newly developed organic fertilizer made in Canada that can increase crop productivity and will be used in this study. Its first part, "A," which is a concentrated powdered milled inoculum, is made of milled peat-based worm casting. Humates, grain meals, sea-plant extracts, and rock dust are found in Part "B" and act as a binding agent for the microbial feeds.

2.4. Growth and Yield Component

Yield components such as fruit diameter, number of fruits per plant and unit weight of fruit were measured. The development of tomato fruit (size/diameter) and was measured directly on the field. Specific tomato stands were selected for the observation, i.e. one tomato stand per treatment was selected, making a total of 6 tomato stands for the 6 treatments in 3 replicates, which is 18 tomato stands. The measurements were taken on weekly basis. Yield component (diameter) measurement started at 6 WAT. The results were recorded in centimetre (cm), was obtained using a digital vernier calliper.

2.5. Statistical Analysis

Statistical Package for Social Sciences (SPSS) was used to perform Duncan Multiple Regression Test (DMRT), and Analysis of Variance (ANOVA) to obtain the significant effects of the treatments on tomato yield and yield components, and the soil chemical characteristics.

3. RESULTS AND DISCUSSION

3.1. Soil Chemical Composition

The result of the chemical analysis carried out on the soil from the experimental field is presented in Table 1. From the results, there was an improvement in the essential soil nutrients in other treatments where poultry manure and EcoTea organic fertilizer were applied; an indication that EcoTea organic fertilizer and Poultry manure positively impacted the soil nutrients which supported tomato growth and yield. There is a more significant improvement in these nutrient especially in Organic Matter (OM) from 2.25 % to 2.94 % @ 8 WAT and 3.20 % @ 11 WAT, and in Organic Content (OC); from 1.10 % initial value to 1.46 % @ 8 WAT and 1.70 % @ 11 WAT, all in the EcoTea Organic Fertilizer (OF + FW) in comparison to the Control treatment (C + FW). The application of Organic Fertilizer significantly increased the soil organic matter content in this study. This finding is in line with previous research that showed an increase in organic matter content due to the application of organic fertilizers [1, 6, 25] The soil was acidic in treatment C + FW as soil pH increased from 4.17 to 4.96 @ 8 WAT and to 5.00 @ 11 WAT, whereas the soil pH was tending towards neutral in the other treatments. The soil pH of OF + FW improved from 4.30 to 5.06 and 5.09 @ 8 WAT and @ 11 WAT respectively when compared to C + FW. Similar trends were observed in some other soil nutrients such as Calcium (Ca), Magnesium (Mg), and Cation Exchange Capacity (CEC) as increase in these soil compositions were recorded in all treatments but OF + FW showed more improvement compared to C + FW. The results agreed to Liu *et al.,* [11] who discovered that organic fertilizer improved soil health by increasing soil Organic Matter (OM), soil Organic Content (OC) and nutrient availability which significantly enhanced tomato yield compared to inorganic fertilizer.

Table 1: Variations in Soil Chemical Properties in each treatment

Soil Parameter	Period	PM + FW	PM + AW	OF + FW	OF + AW	C + FW	C + AW	FAO Range
pH	0	4.76 ± 0.00^{e}	4.55 ± 0.00^{e}	4.30 ± 0.00^{f}	4.65 ± 0.00^{f}	4.17 ± 0.00^{e}	5.02 ± 0.00^{f}	
	1	5.00 ± 0.87^{e}	5.18 ± 0.38^{e}	5.06 ± 0.34^{f}	5.00 ± 0.20^{f}	4.96 ± 0.12^{e}	4.91 ± 0.39^{f}	6.5 – 8.5
	2	5.06 ± 0.60^{e}	5.25 ± 0.25^{e}	5.09 ± 0.21^{f}	5.02 ± 0.02^{f}	5.00 ± 0.30^{e}	4.75 ± 0.05^{f}	
OC (%)	0	1.05 ± 0.00^{c}	0.77 ± 0.00^{c}	1.10 ± 0.00^{c}	0.75 ± 0.00^{c}	1.46 ± 0.00^{c}	0.75 ± 0.00^{c}	
	1	1.85 ± 0.05^{c}	1.75 ± 0.11^{c}	1.46 ± 0.06^{c}	2.15 ± 0.08^{c}	1.12 ± 0.08^{c}	2.10 ± 0.23^{c}	2.0
	2	1.67 ± 0.63^{c}	1.47 ± 0.31^{c}	1.70 ± 0.05^{c}	2.07 ± 0.07^{c}	1.34 ± 0.06^{c}	2.07 ± 0.03^{c}	
OM (%)	0	1.82 ± 0.00^{d}	1.32 ± 0.00^{d}	2.25 ± 0.00^{e}	1.25 ± 0.00^{e}	2.51 ± 0.00^{d}	1.18 ± 0.00^{e}	
	1	2.87 ± 0.13^{d}	2.54 ± 0.36^{d}	2.94 ± 0.06^{e}	3.57 ± 0.43^{e}	2.31 ± 0.31^{d}	3.37 ± 0.53^{e}	2.0++
	2	2.89 ± 0.11^{d}	2.65 ± 0.25^{d}	3.20 ± 0.20^{e}	3.70 ± 0.30^{e}	2.10 ± 0.15^{d}	3.38 ± 0.49^{e}	
N (%)	0	0.14 ± 0.00^{a}	0.10 ± 0.00^{a}	0.19 ± 0.00^{a}	0.10 ± 0.00^{a}	0.22 ± 0.00^{a}	0.08 ± 0.00^{a}	
	1	0.22 ± 0.02^{a}	0.20 ± 0.05^{a}	0.22 ± 0.01^{a}	0.29 ± 0.01^{a}	0.18 ± 0.02^{a}	0.24 ± 0.01^{a}	0.2
	2	0.20 ± 0.04^{a}	0.20 ± 0.02^{a}	0.25 ± 0.03^{a}	0.32 ± 0.02^{a}	0.15 ± 0.05^{a}	0.23 ± 0.01^{a}	
P (mg/kg)	0	16.72 ± 0.00^{g}	16.49 ± 0.00^{g}	17.30 ± 0.00^{h}	16.50 ± 0.00^{h}	17.89 ± 0.00^{g}	16.64 ± 0.00^{h}	
	1	8.24 ± 0.34^{g}	9.10 ± 0.90^{g}	10.27 ± 0.98^{h}	8.56 ± 0.94^{h}	19.37 ± 1.28^{g}	17.21 ± 1.65^{h}	20
	2	8.20 ± 0.20^{g}	9.08 ± 0.12^{g}	10.15 ± 0.85^{h}	8.48 ± 0.18^{h}	19.56 ± 0.89^{g}	17.80 ± 1.20^{h}	

K	0	0.39 ± 0.00^{a}	0.38 ± 0.00^{a}	0.28 ± 0.00^{a}	0.36 ± 0.00^{a}	0.30 ± 0.00^{ab}	0.36 ± 0.00^{a}	
(cmol/kg)	1	0.44 ± 0.14^{a}	0.29 ± 0.06^{a}	0.34 ± 0.11^{a}	0.37 ± 0.06^{a}	0.35 ± 0.05^{ab}	0.31 ± 0.04^{a}	0.6 – 1.2
	2	0.49 ± 0.05^{a}	0.32 ± 0.01^{a}	0.36 ± 0.02^{a}	0.39 ± 0.05^{a}	0.38 ± 0.07^{ab}	0.31 ± 0.04^{a}	
Ca	0	1.70 ± 0.00^{d}	2.00 ± 0.00^{d}	1.80 ± 0.00^{d}	2.40 ± 0.00^{d}	1.80 ± 0.00^{d}	2.40 ± 0.00^{d}	
(cmol/kg)	1	3.00 ± 0.64^{d}	2.20 ± 0.45^{d}	2.20 ± 0.31^{d}	2.50 ± 0.15^{d}	2.00 ± 0.25^{d}	2.50 ± 0.03^{d}	10 – 20
	2	3.20 ± 0.24^{d}	2.50 ± 0.05^{d}	2.45 ± 0.35^{d}	2.65 ± 0.35^{d}	2.18 ± 0.18^{d}	2.54 ± 0.46^{d}	
Mg	0	0.80 ± 0.00^{b}	1.00 ± 0.00^{b}	0.80 ± 0.00^{b}	1.00 ± 0.00^{b}	0.80 ± 0.00^{bc}	1.10 ± 0.00^{b}	
(cmol/kg)	1	1.30 ± 0.30^{b}	1.00 ± 0.10^{b}	1.00 ± 0.00^{b}	1.10 ± 0.10^{b}	0.90 ± 0.10^{bc}	1.00 ± 0.10^{b}	3.0 – 8.0
	2	1.46 ± 0.26^{b}	1.05 ± 0.05^{b}	1.10 ± 0.17^{b}	1.15 ± 0.13^{b}	0.92 ± 0.08^{bc}	1.00 ± 0.05^{b}	
CEC	0	6.46 ± 0.00^{f}	6.38 ± 0.00^{f}	6.40 ± 0.00^{g}	6.95 ± 0.00^{g}	5.90 ± 0.00^{f}	7.32 ± 0.00^{g}	
(cmol/kg)	1	7.80 ± 0.20^{f}	7.00 ± 0.85^{f}	7.30 ± 0.70^{g}	7.90 ± 0.10^{g}	6.30 ± 0.75^{f}	8.50 ± 0.20^{g}	10.00
	2	8.00 ± 0.30^{f}	7.48 ± 1.12^{f}	7.80 ± 1.03^{g}	8.50 ± 0.55^{g}	6.70 ± 1.10^{f}	8.90 ± 0.17^{g}	

*** Difference in letter of superscript in the same row means there is significant difference ($p<0.05$)*

Where 0, 1, 2 represent soil chemical properties at initial stage (before planting), and at the end of first and second harvest cycles (8 WAT and 11WAT) respectively.

3.2. Fruit Diameter

Table 2 shows the statistical analysis using Duncan Multiple Range Test (DMRT) carried out on the effect of treatments on the fruit diameter from 6 WAT to 11 WAT. It was observed that OF + FW, OF + AW, PM + FW, PM + AW, etc have significant effect on the fruit diameter. It was observed that PM + FW had the highest effect with average mean of 4.196 cm followed by C + FW (3.862 cm), and PM + AW (3.831 cm) while OF + FW produced the least effect with average mean of 2.850 cm. This might be because organic fertilizers are usually low in nutrient concentration and they give lesser yield when used alone and their release rate can be slower in comparison to synthetic fertilizers leading to lower plant uptake and development [3, 19]. Also the number of weeks after transplanting also had significant effect on the fruit development and size. All the treatments had great effect on fruit size at both 8 WAT and 11 WAT. Overall, there was a significant increase in the fruit development from the first harvest cycle (6 WAT – 8 WAT) to the second harvest cycle (9 WAT – 11 WAT) in treatments OF + FW and OF + AW while at 11 WAT, there was a reduction in fruit development in all treatments when compared to the result of 8 WAT except for treatments OF + FW and OF + AW that gave an increase. This might can attributed to the fact that EcoTea Organic fertilizer is a micrologically inoculated fertilizer whose effect is expected to keep multiplying within the soil while the nutrients in the plots of other treatments were beginning to deplete. This is in agreement with the findings of Belay *et al.,* [4] who stated that organic fertilizer releases nutrients rather slowly and steadily over a longer period of time and improve the soil fertility by activating the soil microbial biomass.

Table 2: Effect of Treatments on Fruit Diameter from 6 WAT to 11 WAT

Treatment	6 WAT (cm)	7 WAT (cm)	8 WAT (cm)	9 WAT (cm)	10 WAT (cm)	11 WAT (cm)
PM+FW	3.05±0.96^{c}	3.92±0.86^{c}	5.43±0.85^{c}	3.00±1.04^{c}	4.35±0.70^{c}	5.42±1.05^{c}
PM+AW	3.02±0.85^{bc}	4.17±0.75^{bc}	5.50±0.67^{bc}	2.62±0.73^{bc}	3.59±0.58^{bc}	4.07±0.60^{bc}
OF+FW	0.00±0.00^{a}	2.42±0.86^{a}	3.20±1.26^{a}	2.70±1.00^{a}	3.90±0.83^{a}	4.87±0.94^{a}
OF+AW	0.85±0.98^{b}	3.40±0.96^{b}	3.80±0.99^{b}	3.23±1.00^{b}	4.12±0.63^{b}	4.98±0.93^{b}
C+FW	2.94±0.43^{bc}	4.09±0.22^{bc}	5.08±0.33^{bc}	2.70±0.51^{bc}	3.82±0.50^{bc}	4.55±0.38^{bc}
C+AW	2.56±0.60^{b}	3.81±0.52^{b}	5.12±0.48^{b}	2.51±0.64^{b}	3.41±0.46^{b}	4.52±0.57^{b}

**Means that do not share the same letter are significantly different*

*** Difference in letter of superscript in the same row means there is a significant difference ($p < 0.05$)*

3.3. Number of Fruits per Plant

Table 3 shows the average effect of treatments on the number of fruits per plant for both 8 WAT and 11 WAT. It was observed that all the treatments have significant effect on the number of fruits per plant in both periods. Poultry Manure (PM) under both water applications had more effect on the number of fruits per plant compared to the other treatments. Zero fertilizer (C) under both type of water applications have similar range of number of fruits per plant and as such, there is no significant difference between C + FW and C + AW within the said period. Organic fertilizer (OF); although produced the least effect compared to other treatments had a slight difference in the range of number of fruits per plant under both water applications. This result is in line with the submission of Makinde *et al.* [13] that treated plots significantly produced more fruits than the untreated (control) plots and that the Organic fertilizer treated plot gave better result at the fifth harvest cycle even though the result was not significantly different from other treated plots.

3.4. Unit weight of Fruit and Total Fruit Yield

The average effect of all treatments on the unit weight of fruit for both 8 WAT and 11 WAT is shown in table 3 below. It was also observed that all treatments have significant effect ($p < 0.05$) on the unit weight of fruits in both periods. Poultry manure (PM) under both water applications had more effect on the unit weight of fruit compared to others, while organic fertilizer under aquaculture wastewater did better than Zero fertilizer (C) plots under both water application. Also, it was recorded that there was no significant difference between OF + AW and C + FW. The average fruit weight and fruit number for all treatments had a significant correlation with the average fruit yield per treatment in both period.

In the overall fruit yield result, the highest yield of tomato at 8 WAT was 34.32 t/ha and 23.98 t/ha which were recorded in PM + AW and C + FW treatments respectively while the lowest yield was 1.61 t/ha and 4.37 t/ha recorded in OF + FW and OF + AW respectively. This response can be attributed to the fact that the organic fertilizer released its nutrient to the soil slowly [7] and there was late fruit development in the plots that were treated with the organic fertilizer as against the Poultry Manure and Control which started fruit development at 6 WAT. This in turn negatively affected the yield gotten from the Organic fertilizer plots at 8 WAT. At 11 WAT, the highest yield of tomato fruit was recorded in treatments PM + FW and OF + AW which had a yield of 29.15 t/ha and 17.58 t/ha respectively. Although the yield from OF + FW was not as much as that of C + FW at 11 WAT (17.05 t/ha > 13.64 t/ha), it was still not the least (PM + AW = 10.22 t/ha). This indicated a tremendous improvement in the impact of the EcoTea Organic fertilizer on tomato yield at 11 WAT when compared to the 8 WAT; representing approximately an 8 times increase between 8 WAT and 11 WAT. In other words, there was consistency in the yield of tomato under Organic fertilizer treatment, a further indication that EcoTea Organic fertilizer's effect on tomato development was positive and reliable. This might be attributed to the fact that EcoTea Organic fertilizer is a micrologically inoculated fertilizer whose effect is expected to keep multiplying within the soil per time and also, the nutrients in the other plots (i.e. PM and C) were beginning to deplete. This is in line with the discovery of Belay *et al.* [4] who discovered that organic fertilizers release nutrients rather slowly and steadily over a longer period and also improve the soil fertility status by activating the soil microbial biomass.

Table 3: Effects of treatments on number, unit weight and yield of tomato fruits

Treatment	Period (WAT)	Average Mean Value Number of fruits per plant	Average Mean Value Unit weight (g)	Total Fruit Yield (t/ha)
PM + AW	8	12.75±2.38^{bc}	100.75±1.99^{c}	34.32
	11			10.22
PM + FW	8	13.88±1.46^{c}	95.84±5.23^{c}	16.54
	11			29.15
OF + AW	8	9.50±4.63^{ab}	79.93±3.19^{b}	4.37
	11			17.58
OF + FW	8	8.00±5.68^{a}	64.51±16.46^{a}	1.61
	11			13.64
C + AW	8	10.25±2.66^{abc}	72.20±4.69^{ab}	22.90
	11			14.27
C + FW	8	10.63±1.77^{abc}	78.81±4.69^{b}	23.98
	11			17.05

**Means that do not share the same letter are significantly different*

** *Difference in letter of superscript in the same column means there is a significant difference ($p < 0.05$)*

4. CONCLUSION

The different type of soil amendments applied (EcoTea organic fertilizer, Poultry manure and Zero fertilizer) contributed to the favourable chemical composition of the soil, tomato yield and also affected the fruit chemical composition as essential soil nutrients such as Nitrogen, Potassium, Organic Content, Organic Matter, Calcium, CEC, etc improved in all treatments. This is an indication that the soil amendments had positive effects on the soil nutrients which effectively supported the tomato growth. Treatments PM + FW, PM + AW, C + FW, and C + AW in that order performed better compared to OF + FW and OF + AW in yield components (fruit diameter, unit weight of fruit, and number of fruits per plant) in the first harvest cycle (6 WAT – 8 WAT) while Organic fertilizer (OF) began to thrive well at 8 WAT and recorded an increase in the second harvest cycle (8 WAT – 11 WAT). The highest yield of tomato fruit at 8 WAT were recorded in PM + AW, followed by Control in C + FW, while the lowest yield was recorded in Organic fertilizer under both water applications. At 11 WAT (second harvest cycle), the highest yield were recorded in PM + FW, followed by Organic fertilizer in OF + AW. The yield gotten from OF + FW improved but not as much as C + FW. Results obtained from this research proved that EcoTea Organic fertilizer was effective and gave a steady and reliable increase compared to other treatment types in the long run. Poultry manure gave a significant yield and yield components performance; impacted the fruit chemical composition positively and also improved soil health. It could serve as alternative soil fertility enhancement material for the cultivation of tomato and other crops. This is necessary, especially now that there is a growing interest all over the world about organically grown food/food safety and also depletion in soil health and groundwater contamination as a result of indiscriminate and leaching of synthetic/inorganic fertilizers.

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