The Effect of Different Selected Soil Amendments on the Growth and Yield of Tomatoes

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Abstract

A field experiment was carried out to evaluate the effect of selected soil amendment on growth and yield of tomato in Rumuola, Obio Akpor Local Government Area of Rivers State. The study was carried out in the teaching and government farm of the Department of Agricultural Technology Captain Elechi Amadi Polytechnic, Rumuola Port Harcourt. The experiment was laid out in a complete block design (CBD) with two treatments as soil amendments. The parameters measured were plant high, number of leaves, number of branches, fruits height, fruit girt, fruit weight and number of fruits. The result showed that poultry droppings increased heath of plant (231.7cm), number of leaves (458.8), number of branches (73.2) and fruit yield when compared to wood ash and control due to the presence of nitrogen and other nutrients in it.

Introduction

1.1 Background of the study

According to foolad (2018), tomato is the sixth most valuable crop in the world worth U$ 87. 9 billion in 2016 and is grown in all soil types on a small scale for family use and commercial purposes. Tomato belongs to the solanaceae family and the genus lycopersicom which is small genus within the large and diverse genera that consist approximately 90 genera (Singh et. al. 2019) and is one of the most consumed vegetables in the world. Tomato can be eaten fresh or in processed forms such as, ketchup, puree, paste, powder and soup (Buttistuzzi, 2012) tomato is also a crop which globally grown, some in the open filled others in green house. (stoleru, 2020)

Tomato plays an important role in human diet because they are good source of minerals and vitamins. Tomato contains high level of lypoene substance that are used in some pof the more pricy facial cleansers (wang, 2020). Tomato also help to prevent several types of cancer, studies indicate high levels of lypcoene in tomatoes reduce the chances of developing prostrate, and

stomach cancer, lypcoene is a national antioxidant that works effectively to slow the growth of cancerous cells (Bathla, 2019)

Tomato help maintain stong bones. This is because they contain considerable amounts of calcium and vitamin K, both nutirnts are essential on strengthening and performing mi or repairs on the bones as well as the bones tissue (Amao, 2018). Below are some varieties of tomato grown in Nigeria these are beetsteak , common beetstalk, chem, tomatoes, grape, campari, patio, branfywine, etc

Egypt has a total annual production of 8.625 million tones and is the highest producer in

Africa, while Nigeria is the second producer with the total production of 1.560 million tonnes (FAO 2014)

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Tomato originated in south America but its cultivation has today spread to nearby all parts the world. But however, it was introduced to west Africa by the portaguse in the 16th century. The world's cultivatiob of tomato is put to about 4 million hectares of which 63, 482 hectares are estimated to be cultivated. In Nigeria, FAO (2020) reported an estimated annual production of 1.7 million tonnes. But however, this was still far from demand from human consumption.

Generally, tomato production in Nigeria has been low because of low yields obtained by small scale farmers resulting from the use of unimproved local varieties with low yielding capacity which often grown in mixtures and this may prevent exploitation of crop productive capacity, environment hazards such as drought and incidents of pest and diseases, plant population including soil fertility declined and a host of their factors have also kept tomato yield output relatively low (Adekiya and ojeniyi, 2002). The use of inorganic fertilizers alone has not been helpful under intensive agriculture because it aggregates soil degradation (Sharma and Mittra, 1991). The degradation is brought about by loss of organic matter which consequently results in soil either ny natural returns through roots, stubbles, sloughed -off roots nodules, and roots exudates or by artificial application in the form of organic fertilizer such as poultry manures (Agboola and Omueti 1982). Poultry dumping is an important means of maintaining soil fertility status. It is cheap, readily available and more environmentally friendly. Nutrients contained in organic manure are realised more slowly and are retained for a longer time in the soil, thereby ensuring long residual effect (Sharma and Mittra 1991), inorganic fertilizer on the other hand have high concentration of nutrients and readily available to crops but its use is hampered by its inaccessibility to majority of the farmers due to high cost in developing countries including Nigeria (Webber et. al., 1999). The application of poultry manure was reported by Ewuol et. al. (2008) to significantly affect tomato plant height, number of branches, roots length, number and weight of fruits of tomatoes.

Poultry manure has been accepted as a source of nutrients for crop production and its application increases crop yield through a general improvement in growth parameters. Poultry farming has effects on increased utilization of organic water, Organic varying amounts of water, mineral nutrients and organic matter. Ismael (2012). While the use of poultry droppings has been in practice for century's world-wide and in the recent times. Furthermore, chicken manure is preferred amongst

Other animal wastes because of its high concentration of macro and micro nutrients (Dikinya, 2010). Application of chicken manure to soil enhances concentration of water soluble salts in

soil. Plant absorbs nutrients in the form of soluble salts, but excessive accumulation of soluble salts (or soil salinity) suppresses plant growth (Dikinya, 2010). The acidity due to poultry manure addition severely affects roots growth and seed germination

(Tiamayu, 2012). Moreover, if applied correctly chicken manure acts as a good soil amendment and/ or fertilizer (eg provides N,P and K) and can also increase the soil and leaf N,P,K, Ca and Mg concentrations. Soil chemical properties provides information on the chemical reactions, processes controlling availability of nutrients and ways of replenishing them in soils.

Wood ash lacks nitrogen (N) but contains oxides and hydroxides of basic cat ions such that its soil application in ancient agricultural raises soil PH, a process of application which increases the availability of nutrients such as phosphorus (p). Wood ash is a non- hazardous agricultural waste which is generated as a result of oxidation process during combustion of food. It results from buring or gasifying wood and consists mainly of minerals that the tree have observed over their lifetime

except for carbon, hydrogen and nitrogen which evaporate during the firing of wood (Serafimova et. al.,) confirmed in their studies that the presence of several major crystalline phases with the predominant one being Calcite-$CaCO_3$ with smaller quantities of quartzSiO_2K and fairdice $K_2Ca(CO_3)$

Extracts when dissolved in water. The study further states that the content and mobility of toxic elements in the wood ash is in full compliance with the regulatory requirements to project soil quality and agricultural productions. Wood ash is highly basic with PH of round 12. In most cases, ash from combustion of plant wastes does not contain heavy metals and other toxic elements in concentration that could lead to secondary contamination of soil and agricultural products for recycling as a soil improver.

Therefore, the different compositions of poultry manure and wood ash mean that their support of plant growth will vary.

In the search for farming strategies, working to sustain and improve soil fertility while also being affordable and environmental friendly the use of poultry dropping and wood ash as a promising source of organic fertilizer.

Li (2018), reports that tomato is a high yielding vegetable that requires a lot of fertilizers for its proper establishment, growth and yield. However, negative effects of chemical fertilizer on the soil and environment have been recognized as one of the limiting factors in sustainable agricultural production (Chen and Rua 2018). Most farmers do not apply fertilizer due to high cost of unreliable availability of inorganic fertilizers. In addition, farmers who are chemical fertilizers, do not have adequate knowledge on the recommended data (Dalokon, 2016). Leading to applicant of high amount of chemical fertilizer hence causing soil nutrient imbalance.

Traditionally, wood ash has been used for gardening because it is a good source to potash that ameliorates the soil (Demeyer, et. al., 2011) in organic farming wood ash is use as agricultural soil nutrients because it is good source of potassium and calcium carbonate with the lather acting as a limiting agent that neutralizes acidic soil. (Gadd, 2010).

1.2 Statement of the problem

The presence of nutrients such as nitrates, phosphates and exchangeable calcium and soluble potassium remained in vermicompost. (Vermicompost contains plant growth influencing materials produced by micro organisms).

Tomato is one of the most important vegetables grown for their edible fruits tomato is cultivated in Nigeria with an annual production of six million tonnes (Idah et. al., 2007) tomato is an excellent source of vitamins, minerals and intioxidants which help control cancer, health diseases as well as improve the general health of man (Antonie et. al. 2004) most soils, in Africa are poor compared with other parts of the world (Bationo et. al, 2006) African soil nutrient depletion is a major reason overriding constraints that affects all aspect of crop production.

Therefore, it is pertinent to explore the use of organic fertilizers to increase crop productivity.

Organic fertilizer such as poultry droppings and Wood ash application on tomato production

1.3 objective of the study

The main objective of the study is to investigate the effect of poultry droppings and Wood ash as soil amendments on tomato in rumuola, Obia Akpor Local Government Area of Rivers State

Specific objective

1. To determine the effect of poultry droppings and Wood ash on the growth response of tomato
2. To determine the effect of poultry droppings and Wood ash on the yield of tomato

1.4 significance of the study

The findings obtained from the study is of significance to agriculturalist who are major users of poultry droppings and Wood ash as the study will explore their importance to tomato growth and yield. Also the study explored their importance to tomato growth and yeild. Also the study will be of importance to farmers who want to embark on tomato production farmers who intend to use organic manure to improve their crops it will also be of importance to researchers who intend to embark on a study in similar topic as the study will serve as a reference point to further research.

1.4 scope of the study

This work investigate the effect of selected soil amendments(poultry droppings and Wood ash) on tomato production, application on growth and development of tomato and on yield/fruit production

1.6 limitations of the study

There Rw some factors that limit the study which includes

a. Availability of the research material: the research material available to the researchers was insufficient, therby limit the study. However, this was over comed by visiting agricultural development program (ADP) for good planting materials also the internet was consulted for materials.

b. Time: the time frame allocates to the study did not enhance wider coverage as the reasercher has to combine other academic activities with the study. However, I created time to see my supervisor regularly, as to finish the project on time.

c. Finance: the finance available for the reaserch work may not allow for wider coverage as resources are very limited ,as the reasercher has other bills to cover. However, the issue of finance was overcome by approaching my guardians for financial Aids.

1.7 Organization of the study: this reaserch work is organised into five chapters for easy understanding as follows;

Chapter one is concerned with the introduction which consist of overview of study, objectives of study, statement of problem, significance of study, scope and limitations of study, definition of terms. Chapter two highlights the theoretical frame work in which the study is based thus the review of related literature. Chapter three deals on reaserch designed and methodology adopted in the study. Chapter four Concentrate on data collection and analysis and presentation of findings, chapter five gives summary, conclusion and recommendations.

1.8 Definition of terms

Effect

A change that results when something is done or happen

Soil amendments

This is any material added to the soil to improve it's physical properties, such as water retention, permeability, water infiltration, driange, aeration and structure soil amendments such as poultry droppings and Wood ash.

Poultry manure (droppings)

This is an organic waste material comprising of urine and fees of poultry birds e.g chickens Poultry

These are domesticated birds kept by humans for their eggs, their meat or their feathers

Wood ash

This is the poultry residue remaining after the combustion of wood, such as burning wood in a fireplace, bonfire, or and industrial power plant. It is largely composed of calcium compounds along with other non-combustible trace elements present in the wood

Tomato

A round, red fruit with allt of seeds, eaten cooked or uncooked as vegetable, for example in salads or sauces it is edible berry of the plant solanum lycopersicum, commonly known as tomato plant

Tomato production

The cultivation of tomato for it's friuts

2.1 theoretical frame work

Description of tomato

The tomato (lycopersicum esculentum) belongs to the family of solanaceae. It is one of the most important vegetable in Nigeria and in many parts of the tropical and sub-tropical, regions of the world. According to hussaini etc al, (2000) the crop rank first in importance among vegetables in Nigeria. It is grown mainly for it's friuts, which is use almost daily in every home. Tomato is an Annual climbing, herbaceous plant which takes 75 to 85 days to attain maturity. The plant may reach a height of 2m depending on the variety. The plant leaves are covered with shining hairs which are usually prostate only the tips being erect. The leaves are large, greenish, deeply cleft with many leaflets. The leaves are arranged alternatively along the both leaves and stem have strong smell. The flowers are pinkish to yellow on colour, borne in clusters of four to six flowers sometimes are formed on the stems between the leaves (Zeist, 2017). The flowers are about one centimeter in diameter. (Wan. 2020) tomato fruits exist in many shapes appearing large and round, oval or elongated, depending on the varieties (Sinha 2020).

The fruits may be red, orange or yellow when ripe, usually with numerous kidneys or peer shaped, hairy light brown seeds (Brono 2018, Tondal 1993) pink stage, some of the portion of the fruits is red, pink but the fruit is not fully ripe. It is suitable for local markets. Tomato is a warm season plant that requires temperature of about 20-70^{0}C for the most cultivars. Excessive rain fall and high relative humidity can be harmful to it. A deep loamy soil well drained rich in organic material with PH of 6.2-6.8 for optimum growth and development. It is a nutritious vegetable with increasing demand in Nigeria. As documented by United States dietary allowance (2008) tomato fruits provide 95%water of its edible portion and the remaining 5% compose of miscellaneous compound among which includes carotenoids, ascorbic acids, alcohol, insoluble solids (proteins) cellulose, pectins, polysaccharides and inorganic compound which gives the fruits characteristic flavour and aroma. It also contains vitamin A which is a remedy for night blindness.

2.2 Conceptual Frameworks

2.2.1 Composition of poultry droppings

Poultry manure is an organic waste material comprising of urine and feces of poultry birds

e.g chickens. The manure is obtained by removing and cleaning the beddings in the poultry houses along with poultry feces (Sheikh, 2013.) by population, chickens produces the largest poultry manure boith as egg producer and meat (Drozdz et. al, 2020). Poultry manure contains almost 65.5% of nitrogen (N), 83.5% of potassium (K) and 68.5% of phosphorous (P). It also contains calcium (Ca), Magnesium (Mg), Cupper (Cu), Iron (Fe), manganese (Mn), sulphur (S), Boron (B), Molybdenum (Mo), Cobalt (Co) and zinc (Zn). These are mostly both found in inorganic fertilizer (Singh, 2019, 2020). Plant nutrients originate from the feed, supplements, medications and water consumed by the animals using poultry droppings as a fertilizer for crops or trees may provide a portion or the entire plant requirement. The amount of nutrients provided depends on the nutrient content of the manure and the amount of manure applied.

According to Alonso (2012) poultry manure is of different types such as deep litter manure, boiler manure, cage and deep-pit manure. Deep litter manure is produced by the layer birds during laying period and boiler manure is produced by meat producing birds during fattening period. Ashworth (2020) in a similar work reported that the amount of nutrients in poultry manure may differ due to different factors like breeds of the birds, litter used and moisture content of the manure and deity of the birds.

Poultry droppings help in the following ways:

- Nutrients enrichment: poultry dropping are rich in nutrients like nitrogen, phosphorous and potassium. When properly applied, they can enhance soil fertility and provide essential nutrients for tomato plants
- Soil structure improvement: organic matter from poultry droppings can improve soil structure by enhancing water retention, drainages and aeration.
- Microbial activity: poultry dropping contribute to proliferation of beneficial so microorganism which aid in nutrient cycling and dieses suppression.
- Potential challenges: excessive application of poultry dropping can lead to nutrient imbalances, such as excessive nitrogen levels causing lush vegetative growth at the expense of fruiting odour and pathogen concerns might arises if not managed properly.

2.2.2 Composition of wood ash

Wood ash has been used for gardening it is a good source of potash that ameliorates the soil (Demeyer, et al, 2011) in organic farming wood ash is used as agricultural soil nutrients, it is a good source of potassium and calcium carbonate. Wood ash contains all the mineral element that were in the wood, potassium (K)m, calcium (Ca),l and magnesium carbonate or oxides are present in comparatively large qualities giving the ashes a strong alkaline reaction which can neutralize acid soils, wood sash is a good source of many micrtonutrients, for adequate plant growth. Wood ash lacks nitrogen (N) but contains oxides and hydroxides of basic cat ions such that its soil application in ancient agriculture raises soil PH, a process of application which i9ncrese the availability of nutrients such as potassium (K), (S Karki 2002).

Wood ash helps in the following ways:

- Soil PH adjustment: wood ash is alkaline and be used to raise soil PH in acidic soils, creating more favourable environment for tomato growth.
- Nutrient source: wood ash containing potassium, calcium, and magnesium, which are essential nutrient for plant growth application which can supplement soil nutrient levels.
- Heavy metal concerns: depending on the source of wood and combustion temperature, wood ash might contain heavy metals, caretal selection of wood sources and moderation in application is important to prevent heavy metal accumulation in soils
- Cat ion exchange capacity (CEC): wood ash can contributes to the CEC of soils, influencing nutrient availability and retention.
- Improvement in soil structure: like poultry droppings, wood ash can contribute to soil structure improvement, particularly in heavy clay soils

- Cat-ions: excessive application of wood ash can lead to over alkaline soils and nutrient imbalances. Its important to test soil PH and nutrient levels before applying wood ash .

2.3 Empirical Literature

2.3.1 Effect of poultry droppings on tomato plant

Using organic manure and chemical fertilizer has show that soil organic matter and total nitrogen are high in soil where organic manure was applied (Ojeniys, 2010) . organic materials such as poultry manure are recognized as suitable organic fertilizer. Poultry manure for soil maintenance, growth and yield of tomato has been reported by Olorode (2020). A study by Gand (2020) indicated that poultry manure was rich in plant nutrients and the acidity was near that neutral. The results revealed that their significantly increases in numbers of branches and plant height using poultry droppings the significances increase of the numbers of branches suggest more numbers of fruits and invariably more tomato yield which is the ultimate goal of the farmer. This also agrees with the work of (Ayeni et al. 2020) who reported significant increase in plant height, number of branches and number of leaves as a result of application of poultry droppings. Demir (2010) stated that there was a significant differences in number of tissue, flower and fruit per plant than the control where poultry dropping (manure) was applied. He also reported that fruit weight increased with increasing manure source. Poultry manure significantly improved growth and yield of okro (Abelmoschus, esculentus) (Akanbi et al.)

Adediran et al (2003) also reported that poultry manure gave the highest tomato yield in the rainforest region of south-western Nigeria, the effect of organic manure on growth and yield of tomato in relation to application of poultry dropping had been widely report by many workers. (Togun et al, 2014) reported that a significant higher yield was recovered when cabbage and onions were given similar treatment. According to Akanbi and Togun (2002) similarly, yield increase in amaranth, maize, okra and tomato when grown on soils fertilizer with poultry manure application to pumpkin and observed to have positive effect on soil physical, chemical and biological properties.

A study by Ewulo et al (2008) found that the application of poultry manure significantly increased tomato plant height, number of branches root length, number and weight of fruits. The study also found that poultry manure application had a positive effect on the quality of the tomato as measured by the Brix value (a measure of sweetness).

Another study conducted at the teaching and research farm of joseph ayo babalola university, ikeja Arakeji, Nigeria investigated the effect of integrating poultry dropping and NPK 15-15-15 fertilizer on soil fertility and tomato yield. The experiment was laid out as a randomised complete block design (RCBD) with four treatments and three replicate. The results showed that the application of poultry droppings significantly affected the growth and yield of tomato.

Another study published in frontiers in plant science found that vermin compost and chicken manure compost more effectivel promoted plant growth including stem diameter and plant height compared with other fertilizer treatments.

In Ethiopia, poultry manure found to be effective in influencing maize growth. Plant growth was highly achieved when the poultry manure was applied compared to cow manure, although the application rates differed, higher application of poultry manure highly promoted vegetative growth and flowering the nitrogen in poultry manure is most needed by plants to enable plants development (Miranda, et al. 2012) materechera & Salagae, (2016) found out that partially

decomposed poultry manure treatments produced higher plant height, stem diameter, leaves per plant, dry matter yield and tissue concentration of protein, Nitrogen (N) and phosphorous (P) then cattle manure. The responses of maize due to manure application were higher in the loan than clay soil. Application of cattle manure application produced responses which were less than control in many cases. This was presumed to be due to microbial immobilization of nutrients. However, wood ash only improved maize growth response in loamy soils and not in clay. In addition, the addition of wood ash to manure in clay reduced plant height dry, matter yield, plant tissue protein and phosphorous of maize (Boureima, et al, 2016)

According to Wacal et al (2019) growth response of Sesemae (Sesanum indicun L.) is greatly influenced by the presence of vital nutrients such as nitrogen, phosphorous, potassium and magnesium, calcium in the soil. By treating plants with decomposed manure such as poultry manure, plant registered vigorous growth as compared to those that had applied wood ash only. Poultry manure is crdit for containing very important microbial bacterial that breaks down the dropping into the plants nutrients. In consideration, chicken consumes a variety of protein rich and vitamin carbohydrates crop that is in a good source of nitrogen, potassium and phosphorous, iron, calcium and magnesium. Since the digestion is not often complete, the nutrients are presented almost low for decomposition and with appropriate decomposition aided ny the abundance of micro organism in the manure. The plants are able to absorb the needed nutrients hence better growth. (Chastain, et al, 2018).

Eipason (2017) reported that wood ash poultry manure have significant variations in their effect to Seasame. It was determined that sole application of poultry manure has significant variations in their effect to sesame. It was determined that sole applications of poultry manure treatment rapidly enhance plant growth. The plant height, leaf length, leaf width, flowering and stem girt were highly attained in poultry treatments than in wood ash./ this was largely attributed to the adequacy of nitrogen potassium which aid in the plant growth.

Nitrogen as it is has been highlighted is a building block of plant life, hence plants that attain more of it nitrogen register growth (fan, et al; 2018)

A study in enugu state on application of wood ash poultry manure and NPJ towards the growth and yield of okra, showed that sole application of wood ash poultry manure and NPK registered significant differences in growth response, with higher plant growth leaf length and width, stem girt and even flowering attained. Throughout this seedlings, vegetative and flowering stage, wood ash and poultry manure treated plots highly attained fast and better growth. This was linked to the availability of nitrogen essential for plant growth (Anyaegbu, et al 2019)

An improvement in crop yields under manure application is the goal of both farmers and researchers (Ayodele & Agboola, 2016). Studies have reported a

The wood ash was applied as a sole treatment, Poultry droppings was also applied as a sole treatment, while the control treatment was not applied any poultry dropping or wood ash treatment. A plot having a width of 3.5m and length of 5m shade free was used to carry out the field experiment. The block was measured with a length of 4.5m and width of 0.7m respectively. Shallow draining of 0.5m wide was constructed within blocks to avoid erosion and prevent treatment from flowing from one block to another.

3.3**Methods**

3.3.1 **Experimental procedure and research design**

Land preparation

The plot was cleared, debris removed and beds/blocks measuring a width of 0.7meter and length of 4.5m was constructed for cultivation in a dark loam soil.

3.3.2 Experimental factor and design

Treatments

The first block constructed which is the control block did not receive any application of the treatment. The second block constructed was used for wood ash treatment which was applied after a week interval, the last block constructed was used for poultry droppings treatment which was also applied after a week interval

3.3.3 **Agronomic Practice**

3.3.3.1 **Planting**

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An improved tomato variety (Roma-vf) was raised in the green house using a poly bag half filled with loam soil for 3 weeks after which they were transplanted to the field using the space of 0.9m within blocks and 1.20m

MATERIALS AND METHODS

3.0**Materials and Methods**

3.1**Ecology and location of study**

The study was conducted at the Teaching and Research Farm of the Department of Agricultural Technology, Captain Elechi Amadi Polytechnic, Rumuola, Port Harcourt located between latitude 4.45°N -4.60°N and longitude 6.50E 8.00°E (PHC priority tables national pop.com 92000). It has the characteristics of rainforest climate condition with more than 9 mnonths double maximum rainfall (National Human

Development Report 2018)

3.2. **Materials and Experimental Design**

The materials used were; improved tomato variety (Roma- VF) purchased from Agricultural Development Program (ADP) Rumuodumaya, Obio/Akpor Local Government Area of Rivers State, Poutry droppings were sourced from Henry's Farm at Eagle Island Agip, Obio/Akpor Local Government Area of Rivers State. Wood ash was sourced from a local Kitchen in Biara Community in Gokana Local Government Area of Rivers State.

Other materials were loam soil, poly bags, spade, hand glove, wheelbarrow,hand trowel, measuring tape and weighing scale.

The experiment was conducted in a Complete Block Design(CBD), two materials were used as soil amendments, poultry dropping and wood ash.

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The material was treated as follows;

1. Control
2. Wood ash
3. Poultry droppingsapplication of poultry droppings and wood ash improve the quality of tomatocs,as measured by the Brix index (a measure of sugar content)

Another study published in the journal "Agronomy journal" in 2016,found that the application of poultry droppings and wood ash to tomato plants increases the concentration of lycopene in the tomatoes. Lycopene is a carotenoid that has been shown to have antioxidant and anti-cancer properties (Afolabi et al;2015)

Another study published in the journal "plant and soil" in 2018, found that the application of poultry droppings and wood ash to tomato plants increased the resistance of the plants to pest and diseases. These studies suggest that the application of poultry droppings are wood ash can be a beneficial practice for tomato production. However, it is important to note that the results of these studies may vary depending on the specific conditions of the study,such as the type of poultry droppings and wood ash applied, and the climate.

It is also important to note that the application of poultry dropping and wood ash can also have some negative environmental impacts, such as the pollution of water ways therefore, it is important to use these materials responsibly and to minimize their environmental impact.

Overall, the literature review suggests that the application of poultry droppings and wood ash can be a beneficial practice for tomato production,but it is important to weigh the potential benefits and risks before applying these materials.

Cassava tuber and 48 and 75% increases in groundnut yields over the no burn plot duetoslight,moderate and heavy burning respectively in Cameroon (Anyaegbu;et 21

al,2019)

Studies in southwest Nigeria have found positive response of yield and nutrients content of amaranthus and okra to application of 2,4,6,8t/ha ash increased okra pod count and weight, soil organic matter N,P,K, Ca and MMg contents (Iderawumi, 2018). Another investigation showed that wood ash applied at 0,2,4, 6 and 8t/ha to two maize crops increased soil organic matter contents N,P,K,Ca and Mg contents and leaf K, Ca and Mg contents. Wood ash increased maize plant height and grain weight by 44, 52,37 and 56% respectively.The use of ash at 4t/ha was recommended (Iderawumi 2020). In Canada addition of 1126and 2252kg/ha crop residue ash increased dry matter yield of maize significantly (Antoniassi, et al 2013).

Studies carried out at cocoa research institute of Nigeria showed that burnt cocoa pod husk compared favorably with NPK fertilizer in maize performance (Ibukuno & Uwa, 2015). In Ghana, shoot and root dry matter of maize increased with increasing application of ash of cocoa pod husk. Cocoa pod husk ash is used as source of Potassium in most oil palm plantations with mills, the empty bunch wastes are often incinerated into ash and the ash is used for fertilizer for oil palm trees (Woode, et al 2014). In Northern Nigeria, ash derived from grasses improved the yield of sorghum, cotton and maize compared to incorporation of the grasses (Owolabi & Dada, 2012)

2.4 Evaluation of Literature

In evaluation, the effect of poultry dropping and wood ash application on tomato production, a study published in the journal of "Horticultural Science" in 2014found that the application of poultry droppings and wood ash to tomato plants increased the yield of tomatoes by 15%. The study also found that the

Another study by Osuagwa et al (2012) found that the application of wood ash significantly increased the yield of tomatoes. The study also found that wood ash application had a positive effect on the quality of the tomatoes as measured by the vitamin c content.[19]

According to Fernandez et al; (2015) a number of macro nutrients are abundant in wood ash. The extent to which these are dissolved and the rate at which they are made plant available varies between elements. Oxides and hydroxides of Potassium (k) are normally dissolved quickly, while the dissolution of Calcium (Ca) and Magnesium (Mg) depends on the dilution (faster when ash/water ratio is (low). In acid soils, phosphorous contained in the ash may remain insoluble or become immobilized through complex formation with ions Fe or Al. The content of nitrogen and sodium is low in ash, since most compounds containing these elements are almost completely oxidized and emitted as gases during incineration. Despite that, plant available nitrogen may increase due to ash application, if higher PH results in higher microbial activity and increased mineralization (Pitman, 2016).

Researchers at the Sahelian Centre of the International Crop Research Institute for the Semiarid Tropics (ICRISAT) in Niger Found that wood ash was a source of Calcium (Ca) and that its use increased yield and quality of groundnut.Collected and stored throughout the year, wood ash was applied to groundnut crop at flowering. By increasing calcium (ca) levels with wood ash, yield in large seed groundnut varieties (ICRISAT, 2019).

Experiments conducted in Kenya also confirmed that wood ash used as a soil amendment and as trace elements fertilizer. Although fly ash is deficient in Nitrogen and phosphorous, it contains appreciable amounts of trace elements as well as calcium and magnesium. Fly ash derived burning sugarcane biogases was beneficial to cassava and groundnut yields because of large quantities of Potassium and Phosphorous in the ash. There were 9, 15 and 27% increase in

proportion of litter droppings the manure handling system and the litter type (Ali & Jan,2014).

2.3.2 **Effect of Wood ash on tomato**

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Resenfeld and Henry (2016) reported that wood ash contains empirical elements that are essentially needed for plant growth and yield although their levels are relatively low for plant growth, wood ash contains potassium which is essential in regulating water in plants cells and plays a role in food transportation and creation of starch and sugar in plant. If plants don't get sufficient potassium from soil, they are more susceptible to diseases, pest,drought and frost (Etiegril and Campbell, 2019). A study in Enugu state on application of wood ash on okra showed a significant difference in growth, leaf length and width, stem girt and even flowering. This was linked to the availability of nitrogen that is essential for plant growth (Anyacgbu, et al; 2019). Oluwole (2017) while comparing the effect of wood ash on the growth of millet also reported a significant outcome on plant growth. However, wood ash may improve maize growth response on loam soil and not in clay. The beneficial effects of wood ash on soil structure and physical proportion have been reported to contribute to plant growth response.It was indicated that ash produced during burning could contribute to increase in moisture retention in uneroded soil thus playing the same role as much cover hence promoting growth of crops (Dayo-Olagbendi, et al 2018). In a related study by Glem and Ames (2009) they noted that the presence of cat ions in the ash was attributed to the highest groundnut yield. Slightly high and more or less stable yield were obtain when ash residues were applied to unburnt plots.Similarly (Mugwe et al; 2018) also observed 6% increase in maize yield over the non burn plots.

yield increase in many different crops, including Bermuda grass, cor,fescue,orchord grass, rice and wheat under application of poultry. This increase of yields is attributed to the rich nutrients especially Nitrogen (N) and phosphorous (p) in poultry manure. (Mitchel & Tu, 2015). The fertilizer value of one tone of dried cage poultry manure is

equivalent to 100kg urea, 150kg super phosphate,50kg potash, 12kg sodium chloride,

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10kg magnesium sulphate, 5kg ferrus sulphate 1kg manganese sulphate, zinc sulphate and other trace minerals each and is available at a cheaper rate than other market available inputs (Warman &Cooper,2011)

Mohamed Amanallah et al (2010) reported that the application of poultry manure containing the bacterial used in the poultry's digestive process, which works to breakdown organic matter and wood ash containing nutrient such as potassium. Boron, magnesium essential for yield and pest and disease resistance

The compositing process and bacterial make the nutrients soluble, which means that the plant can more readily absorb them from the soil and used to promote growth and improve yields of crops (Akande, et al; 2015). A 12 year long term rescarch (1998-2009) found that corn yields under corn soya bean rotation system under application of poultry manure was much higher than yields of field applied with urea ammonia nitrogen.However, yield is usually a difficult indicator of comparison (Singer, et al 2014)

Eltilib et al (2013) showed that poultry manure was very effective in conteracting the salinity effect, which was reflected in the proportionate promotion of growth and yield in response to the applied amount, leaf was reduced by salinity and increased by the addition of poultry manure in okra.Elgale et al 2010 reported that applied poultry manure is an excellent source of nutrients and can be incorporated into most fertilizer programs. The nutrient composition of poultry manure varies with type of birds, the feed ration,the

decomposed manure such as poultry manure, plant registered vigorous growth as compared to those that had applied wood ash only. Poultry manure is credit for containing very important microbial bacterial that breaks down the dropping into the plants nutrients. In consideration, chicken consumes a variety of protein-rich and vitamins carbohydrates crop that is in a good source of Nitrogen,Potassium and Phosphorous, Iron, Calcium and Magnesium. Since the digestion is not often complete, the nutrients are presented almost low for decomposition and with appropriate decomposition aided by the abundance of micro-organism in the manure, the plants are able to absorb the needed nutrients hence better[16]

growth.(chastain, et al,2018).

Elpason (2017) reported that wood ash and poultry manure have significant variations in their effect to Sesame. It was determined that sole applications of poultry manure treatment rapidly enhance plant growth. The plant height, leaf length, leaf width, flowering and stem girt were highly attained in poultry treatments than in wood ash. This was largely attributed to the adequacy of nitrogen potassium which aid in the plant growth. Nitrogen as it is has been highlighted is a building block of plant life, hence plants that attain more of it nitrogen register growth (fan,et al; 2018)

A study in Enugu state on application of wwood ash poultry manure and NPK towards the growth and yield of okra, showed that sole application of wood ash poultry manure and NPK registered significant differences in growth response,with higher plant growth leaf length and width, stem girt and even flowering attained. Throughout this seedling, vegetative and flowering stage, wood ash and poultry manure treated plots highly attained fast and better

growth. This was linked to the availabilityof nitrogen essential for plant growth (Anyaegbu, et al 2019)

An improvement in crop yields under manure application is the goal of both farmers and researchers (Ayodele & Agboola, 2016). Studies have reported a

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between blocks and plants. The soil amendments were applied after a week interval starting from 2 weeks after transplanting (2WAT) per block except the control block

3.3.3.2 **Weeding**

Weeding was carried out immediately as weed emergence occurred for the first weeding and subsequently weeding was done after a week interval regularly on the plot to be weed-free and prevent pest invasion particularly weed-host pest and also to prevent competition of nutrients between plants and weeds throughout the periodof the experiment.

3.3.3.3 **Harvesting**

At the end of the experiment, the fruit from each tomato plant were harvested,counted and weighed to determine the treatment that was more productive.

3.4. **Data collection**

Three tomato stands, one from each block were tagged and used for collecting data to measure growth trend in each treatment. The following parameters were measured:

1. Plant height after transplanting: This was measured after 2weeks interval tillharvest using a measuring tape to measure from the ground level to the highest part of the plant
2. Number of leaves: These were counted after 2weeks interval till harvest andvalues recorded

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3. Number of branches: The visible branches were observed and counted after

   2weeks interval till harvest and values recorded

Number of fruits per replicate: All visible and set fruits in each replicated bed were recorded

Fruit weight: The weight of fruit from each replicated bed wereweighed and value recorded

Fruit length: The length of fruit from each replicated bed was measured from the top to the base of the fruit using measuring tape.

Fruit girt: A string were wrapped round the widest part of the fruit from each replicated bed

.5**Analysis of data**

All measurement and recorded values were analyzed using some descriptive statistics (tables) indicating the growth and yield from the tagged tomato stand in the each treatment

Results, Analysis and Discussion

This chapter present and discussed the summary of measurements taken from the field.

Table 4.1: Summary of plant height

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	Treatment		
	Control	Wood ash	Poultry droppings
3 WAT	37	42.7	56.5
6 WAT	67.7	79	165.3
9 WAT	109.2	139.3	261.5
12 WAT	171.7	206.8	316.6
15 WAT	236	269.4	358.4
Total	621.6	737.2	1158.3
Average	124.3	147.4	231.7

Source:field survey,2023

TABLE 4.1 The above table shows the average plant heights in each blocks/bed in centimeters. The table also showed that the poultry droppings treatment had the highestgrowth with the average height of 231.7cm followed by Wood Ash treatment with the average height of 147.4cm. The control plot where no wood ash or poultry droppings were applied had the least height.

Discussion

The result unveils that poultry droppings block had the highest height of plants.This is because poultry droppings does not contain lignin (khalil et. Al., 2005)and their decomposition is relatively fast and they release a high concentration of organic acid which increases nitrogen up take and its availability in the soil.

The wood ash block had lower growth when compared to poultry droppings block due to the fact that it lacks nitrogen which is essential for plant growth (Skarki, 2002). The control block had the lowest growth due to the fact that poultry droppings nor wood ash was applied to it.

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Table 4.2Number of leaves

	Treatment		
	Control	Wood ash	Poultry droppings
3 WAT	9	21	19
6 WAT	52	64	133
9 WAT	122	156	347
12 WAT	223	294	601
15 WAT	305	471	1,213
Total	711	1,006	2,294
Average	142.2	201.2	458.8

Source:Field survey 2023

Table 4:2 The above table shows the average number of leaves in each blocks/bed. The table also showed that the poultry droppings blockhad the highest number of leaves, followed by wood ash block and control block.

Discussion

The result reveals that poultry droppings block had the highest number of leaves plant. The addition of poultry droppings provide sufficient amount of micronutrients for crop growth. The wood as also increased the number of leaves when compared to the control but not as much as poultry dropping due to the bsence of nitrogen. The control results shows control had the least number of eaves due to the fact that poultry droppings or wood ash were applied. 26

Table 4.3Number of branches

	Treatment		
	Control	Wood ash	Poultry droppings
WAT	2	2	5
WAT	14	23	25
WAT	28	36	63
12 WAT	47	53	105
15 WAT	63	80	168
Total	154	194	366
Average	30.8	38.8	73.2

Source: Field survey 2023

Table 4.3 the above table shows that the poultry droppings block has the highest number of branches, followed by the wood ash block and control

Discussion

The results showed the poultry dropping block had the highest number of branch due to the presence of Nitrogen which is essential for plant growth and branches formation, the wood ash block had increased the number of branches when

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Table 4.3Number of branches

compared to the control block due to the fact that wood ash lacks nitrogen but contains other nutrients.

Table **4:4 Number of fruits Harvested from each treatment**

Treatment	Control	Wood Ash	Poultry Droppings

Number of fruit Harvested	10	14	28

Source: Field survey 2023

Table 4.4 shows the poultry dropping plot had the highest (28)number of fruit allowed by wood ash plot (14) and the control plot which has the least number of fruit harvested (10)

Discussion

The result reveals that poultry droppings were rich in nutrient than wood ash and control plot. The poultry droppings consists both macro and micro nutrients needed for fruit formation

Table 4.3Number of branches

Treatment	Control	Wood Ash	Poultry Droppings

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Table 4.5 Length of fruit harvested from each treatment

Length of fruits	5.5	6.8	7.0

Source: Field survey 2023

Table 4.5: The above table showed that fruits from poultry droppings plot were the longest with the length of 7.0cm, followed by fruit from wood ash with the length of 6.8cm and fruits from control plot were the shortest with the length of 5.5cm

Discussion

The results in the table reveals that fruit from poultry droppings plots were the longest when compared to fruits from wood ash plot and control reason been that poultry droppings contains more nutrients and are readily available for plant use.

Table 4:6 Fruit girt from each replicated

Treatments	Control	Wood Ash	Poultry Droppings
Length	8.8	9.6	11.9

Source: field survey 2023

Table 4.6 shows the fruit from poultry droppings had the largest girt of 11.9cm,followed by fruits from wood ash with the girt of 9.6cm while the control had the smallest girt of 8.8cm

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Table 4.3Number of branches

Discussion

The result reveals that poultry droppings increase the size of the fruit over wood ash and control. Poultry droppings are rich in nutrient.

Table 4.7 Weight of fruits from each treatment

Treatment	Control	Wood Ash	Poultry Droppings
Number of fruit weighed	10	14	28
Weight in kg	0.23	0.37	0.73

Source: Field survey,2023.

Table 4.7: Showed the 28fruits of tomato were harvested from poultry dropping plot, 14 fruits of tomato were also harvested from wood ash plot while in the

control plot 10 fruits of tomato were harvested. 28 fruits of tomato from the poultry droppings plot weighed 0.73kg while 14 fruits of tomato from the wood ash plot are weighed 0.37kg and 10 fruits of tomato from the control weighed 0.23kg

Discussion

The result indicated that the fruits from the poultry droppings plot had the largest weight. Followed by the wood ash plot and control plot due to the fact that poultry droppings nutrient is easily absorbed.

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Summary, Conclusion and Recommendation

5.I Summary

this study, effect selected soil amendments on growth and yield of tomato in Rumuola, Obio/Akpor Local Government of Rivers State, conducted in the Teaching and Research Farm of the Department of Agricultoral Technology Captain Elechi Amadi Polytechnic Rumuola, Port Harcourt RIvers State, aims at determining the effect of selected soil amendments (poultry droppings and wood ash) on growth and yield of tomato in Rumuola, Obio/Akpor Local Government of Rivers State. To obtain this, the experiment was conducted in a complete block design. Two treatments were used. Observations were analyzed using statistical descriptive method. The results indicated a significant variation in the use of poultry droppings and wood ash over control block. The result from the analysis indicated that poultry droppings block showed a higher growth (in terms of height, number of leaves, number of branches, fruit length,

fruit girt and fruit weight) and yield, when compared to wood ash block as a result, rendering it more reliable and preferable to farmers.

Moreover, the wood ash plants were more productive over the control plants. The result also indicated that the poultry droppings block and wood ash block were more effective than the

control block in both growth and yield. The determination in productivity level using poultry droppings and wood ash as organic soil amendments has shown that farmers can rely on the use of poultry droppings for the cultivation of tomato rather than wood ash due to the availability of nutrients and its fast rate of decomposition.

5.2**Conclusion**

This study indicated the tomato growth and yield from the application of poultry droppings were significantly higher than the wood ash. The analysis of data in table 4.1 to table 4.7 indicated poultry droppings were more effective in terms of height,

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number of leaves, number of branches, fruit length, fruit girt, fruit weight and fruit yield followed by wood ash and control.

5.3**Recommendation**

For sustainable tomato production,(Roma-VF) the use of poultry droppings as soil amendments will be appropriately recommended. This is because of beneficial effects on soil and the crop. Also, Roma-VF is a good high yielding and disease resistance tomato variety.

I am also recommending for further research.

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