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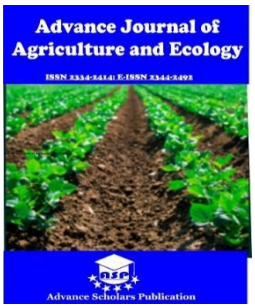

MICROBIOLOGICAL AND CHEMICAL PROPERTIES OF AGRICULTURAL SOILS AMENDED WITH URINE USING PEPPER AS A TEST CROP

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Key words: *Urine, Microbiological, Amendment and Pepper*

Abstract: *The chemical and microbiological properties of the soil is an important factor in determining the fertility status of a soil the study was done in Rivers State University teaching and research farm Port Harcourt to determine the effect of using human male and female urine with different levels on pepper. Equivalent proportion of 10ml, 20ml, 40ml, were diluted with water at different concentration (90ml,180ml,and 360ml) was applied after two weeks of planting the application was done just once. The experiment was replicated three times. Having two control soil without urine and pepper and soil with pepper after my termination Samples were collected and analyzed for chemical properties and microbial properties. The chemical properties shows that pH ranges from 4.38 to 5.28(strongly acidic) organic carbon 0.0132% to 0.0135%, total nitrogen 0.0168 to 0.0201 Available P. 4.12 to 58.23. Samples collected for microbial analysis were cultured using Nutrient Agar and Citrimide ager base. It was observed that TVC ranged from 1.8x10 to 5.2×10^7 cfu/g. bacteria identified are Kiebsiella sp, Enterobacter sp, Escherichia coli and Staphylococcus sp. Staphylococcus from the research it was observed that female urine tends to be more acidic and available P is more abundance in female urine the higher concentration the more abundance the Available P. The presence of Staphylococcus sp is more in both male and female. The study thus showed that urine is not good source of fertilizer for pepper especially in concentration.*

I. INTRODUCTION

Urine is a complex solution formed in the kidneys of humans and animals through the metabolism of endogenous wastes, drinks, drugs and food. The process by which urine is produced in the kidney is called urinalysis. The composition and properties of urine vary depending on the source, the organism's eating habits, body size and the amount of water consumed, environmental factors and the health status of the organism excreting the urine. Human urine is an aqueous solution which contains 95% water, with the

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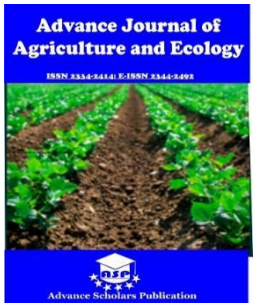

remaining constituents containing 2.5 % of urea and 2.5% of others waste product like creatinine, dissolved ions (chloride, sodium, potassium, etc), inorganic and organic compounds or salts. (Ivy Rose NM; 2003)

It is a liquid product of the human body waste secreted by the kidneys, containing large amounts of soluble nutrients. Urine is a valuable source of nutrients that has been used since ancient times to enhance the growth of plants, notably leafy vegetables and its utilization as an agricultural input. The use of urine in agriculture has become a new phenomenon in some countries in recent years but it is not accepted in developing countries. Urine contains plant nutrients that may supplement or replace commercial fertilizers for crop production (Jönsson *et al.,* 2004). It is a form of organic fertilizer that is rich in Nitrogen (N), phosphorus (P), and potassium (K), as well as other nutrients, it is an excellent source of plant nutrients, and when used appropriately it can contribute to increased crop yields and improved soil health. The beneficial effects of applying urine in agriculture have been proven by numerous researchers. The chemical composition of urine is in ionic form and its plant availability compares with chemical fertilizer (Kirchman & Pettersson; Johansson *et al.,* 2021).

Too much volume of human urine applied on agricultural land as fertilizer, may cause excess sodium in soil and eventually in plant. Sodium inhibits plant growth by interfering with water uptake in root and interfering with the uptake of competitive nutrients. Excess urine in the soil can introduce toxic levels of nutrient into the soil. Studies also have shown that urine may lead to the accumulation of a number of potentially harmful components such as salt content in crops and soils. (Winblad & Simpson-Héber; 2004).

Proper management of urine application for agriculture is essential to maximize its benefit and minimize its adverse effects (Mateo-Sagasta & Burke2010).

Pepper is a vegetable crop. It belongs to the Solanaceae family. The Salicaceae family includes plants such as tomatoes, Irish potatoes, and egg plants, among others. Pepper is increasingly becoming important as a food, medicinal and industrial crop (Foster *et al.,* 2004). Furthermore, the pungent nature of hot pepper renders it effective as a natural pest control product. Large amounts of pepper in developing countries are grown for export to the European Union and other markets. Pepper can be produced in the field and under greenhouse farming using conventional and organic procedures. Conventional production of pepper in the field is easily adoptable by farmers because of it productivity in the short run. However, organic production is of more benefits in the long run because its yields per unit area of land increase gradually while guaranteeing against chemical residues and environmental degradation. On the other hand, greenhouse production of pepper is capital intensive but profitable if good measures are taken to maintain sufficient crop nutrient supply as well as disease and pest free growing conditions. (Dennis *et al.,* S.Ashilenje Kitale, Kenya 2013)

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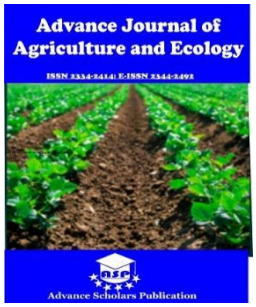

This study intends to identify the physical, chemical, and biological properties of the soil contaminated with urine in Rivers State University teaching and research farm in Nkpolu-Oroworukwo in Port Harcourt Local Government Area Rivers State.

II. MATERIALS AND METHOD

Experimental Location

Experiment site was in Rivers state University Teaching and Research Farm. It is located at Nkpolu-Oroworukwo in Port Harcourt, Rivers State of Nigeria in the Humid Tropical climate of Southern Nigeria, it lies between latitude. 4.51^{0}N and longitude 7.01^{0}E.

Experimental Materials

Experimental materials used are male and female urine collected from final year students of soil science Department` with different concentration 10ml, 20ml and 40ml and local variety of scotch bonnet pepper.

Sample Preparation

Soil

Ten kilograms (10kg) of soil sample was measured, these soils were transferred into different polythene bags for the experiments. Each sample was replicated three (3) times.

Urine

The urine samples were diluted separately with the aid of calibrated measuring cylinder at different concentration for both male and female urine samples ranging from 10ml, 20ml and 40ml respectively using 1:10 ratio, E.g 10ml of urine to 90ml of water.

Planting of Seeds

Four (4) seeds of pepper were sown in each of the prepared polythene bag for both male and female urine and later thinned to 2 seedlings

Growth Parameters Measured

Parameters measured include plant height, number of leaves, leaf area (leave length and width), which was done at two weeks interval

Soil Sample Collection

Soil samples were collected from the experimental pots and stored in sterile bottle. The samples was labeled appropriately and was taken to the laboratory for analysis.

Laboratory Analysis

The collected sample was analyzed at the laboratory. The samples for physiochemical was air dried for 72 hours before carrying out routine analysis. The sterile bottles were taken to the microbial lab for analysis. Various parameters were analyzed.

Determination of physicochemical parameters

Samples were collected, properly labelled, and then taken to the laboratory for analysis. In the laboratory, soil samples were air dried, passed through a 2 mm plastic sieve and analyzed. The pH of the soil samples was determined in distilled water at a ratio of 1:1 using a glass electrode pH meter. Organic carbon was determined using wet oxidation method of Walkey and Black (1934). The total nitrogen of the soil was extracted by Kjeldahl's method. The available phosphorous in the soil was extracted from the soil using the Bray and Kurtz (1945) solution 1. Deter mination of exchangeable cations (Ca, Mg, K and Na) was by

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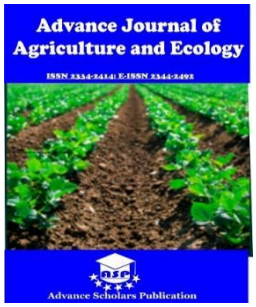

atomic absorption spectrophotometry. 30 mL of $NH_4CH_3CO_2$ (i.e. ammonium acetate) solution was added to 5 g of oven dried soil sample and shaken for 15 minutes.

Microbial analysis

Nutrient Agar (28g) was weighed (according to manufacturer's instruction) into a conical flask containing 1000ml of distilled water. The conical flask was put in an autoclave at a pressure of 15psi (121°c) for 15mins to sterilize.

Sabouraud dextrose Agar (65g) was weighed (according to manufacturer's instruction) into a conical flask containing 1000ml of distilled water. The conical flask was autoclaved at a pressure of 15psi (121°c) for 15mins to sterilize.

III. RESULTS AND DISCUSSION

Microbial Analysis of Soil

The results of the study in Table 4.1 shows that Total viable count TVC of bacteria ranged from $1.8x10^4$ to 5.2×10^7cfu/g. The higher the concentration of the urine the more the TVC range with male urine (NP) having the highest range of the TVC Total Identification of bacteria

Table 1: Microbial Count and Identification

Rate	Treatment	Microbial count (cfu/g)	Microorganisms Identified
0 ml	0(NT)	4.3×10^3	*Kiebsiella sp, Enterobacter sp Escherichia coli*
0 ml	0(Pepper)	1.8×10^4	*Kiebsiella sp, Enterobacter sp*
10 ml	F (NP)	5.1×10^7	*Staphylococcus sp, Kiebsiella sp, Escherichia coli*
10 ml	M (NP)	5.2×10^7	*Staphylococcus sp, Kiebsiella sp, Escherichia coli*
10 ml	F (P)	4.5×10^6	*Staphylococcus sp, Kiebsiella sp,*
10 ml	M (P)	4.3×10^6	*Staphylococcus sp, Kiebsiella sp,*
20 ml	F (P)	3.7×10^4	*Staphylococcus sp, Kiebsiella sp,*
20 ml	M (P)	3.5×10^4	*Staphylococcus sp, Kiebsiella sp,*
40 ml	F (P)	2.1×10^3	*Staphylococcus sp, Kiebsiella sp,*
40 ml	M (P)	2.2×10^3	*Staphylococcus sp, Kiebsiella sp,*

KEY: 0 ml NT = 0 ml of urine, No treatment
NT = No Treatment
0 ml Pepper = 0 ml of urine with pepper planted
F (NP) = Female urine (No pepper)
10 ml F (NP) = 10 ml of female urine only
M (NP) = Male urine (No pepper)
10 ml M (NP) = 10 ml of male urine only
F (P) = Female urine (with pepper)

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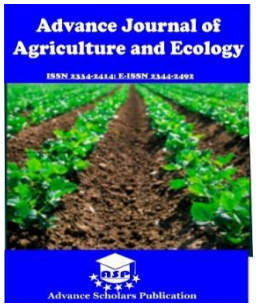

10ml F (P) = 10 ml of female urine with pepper
M (P) = Female urine (with pepper)
10ml M (P) = 10 ml of male urine with pepper
20ml F (P) = 20 ml of female urine with pepper
20ml M (P) = 20 ml of male urine with pepper
40ml F (P) = 10 ml of female urine with pepper

Chemical Properties of Soils

Soil pH

The results of soil pH are shown in Table 4.1. The pH values of the soils in the study area were between 4.12 and 5.28 An increase in pH was observed in female and male urine with the concentration of 10ml after applying the treatment. This results indicate that female urine is more acidic than male urine the higher the concentration the lower the pH values statistically there is a significant difference ($p>0.05$) between treatment and control.

The mechanism responsible for this increase in soil pH could be due to ion exchange reactions that occur when the terminal OHs of Al or Fe^{2+} hydroxyl oxides are replaced by organic anions, which are decomposition products of the manure. (Besho and Bell, 1992; Van *et al.,* 1996; Pocknee and Summer, 1997; Hueand Amiens, 1989).

Total Organic Carbon and Nitrogen (N)

The organic carbon content was between 0.0132 and 0.0135 while the total nitrogen in the soils was between 0.0168 and 0.0201. There was no significant increase between the treatment means of these parameters. The treatment M (P) and F (P) 40ml have the highest percentage of organic carbon (0.0135). This could be because the availability of organic matter increases the availability of organic carbon in the soil compared to the soil without organic matter application this indicate that the higher the concentration the higher organic carbon percentage. M (P) 40ml had the highest mean TN of 0.0201 followed by M (P) 20ml this showed that higher concentration of male while contain more Nitrogen while the control and F10ml had the lowest mean TN of 0.0168%. The high TN in the male urine plot may be due to the fact that male urine contains high amount of Nitrogen which had increased the availability of nitrogen in that treatment.

Available Phosphorus (P)

Available phosphorus (Av.P) values ranged from 42.12 to 58.23 Mg/kg F(P) 40ml have the highest content of Available P this result indicates that Available P is more abundant in female urine the higher the concentration of the female urine the more the presence available phosphorus

Exchangeable Cations

Exchange cations in all the treatment we're significantly different. The treatment F(P) 40ml tends to have the highest values for all the cations (sodium, calcium and magnesium) this indicate that the female urine contains more of this cations. There were no significant differences in the value of potassium for both the control and the treatment. The soils generally had higher values of calcium (ca) magnesium and (mg) for all the treatments including the control when compared to Potassium (K) and Sodium (Na) which have relatively lower values. This indicate that the soils generally have low exchangeable bases which be as a result of the high intensity of rainfall in the area resulting in the leaching of basic cations.

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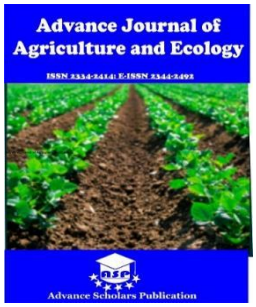

Table 2: Result Showing Chemical Properties of the Soil .

Rate	Treatment	pH	TN (%)	Org. C (%)	Av. P (mg/kg)	Exchangeable ions (meq/100g of soil)					
						K	Ca	Mg	Na	H^+	Al^+
0 ml	NT	4.39	0.0168	0.0132	42.12	0.005	1.2	3.4	0.39	3.44	0
0 ml	Pepper	4.41	0.0168	0.0132	42.36	0.005	1.2	3.4	0.39	3.51	0
10 ml	F (NP)	4.38	0.0168	0.0133	44.22	0.005	1.3	3.6	0.42	3.49	0
10 ml	M (NP)	5.12	0.0171	0.0133	42.42	0.005	1.3	4.1	0.42	3.32	0
10 ml	F (P)	4.12	0.0173	0.0132	49.14	0.005	2.0	4.4	0.49	3.48	0
10 ml	M (P)	4.17	0.0179	0.0132	42.68	0.005	1.4	4.6	0.43	3.44	0
20 ml	F (P)	5.11	0.0186	0.0133	51.17	0.005	2.3	4.5	0.57	3.52	0
20 ml	M (P)	5.17	0.0193	0.0133	42.83	0.005	1.5	5.1	0.45	3.59	0
40 ml	F (P)	5.09	0.0189	0.0135	58.23	0.005	2.5	4.7	0.63	3.42	0
40 ml	M (P)	5.28	0.0201	0.0135	43.26	0.005	1.7	5.8	0.48	3.47	0

KEY: 0 ml NT = 0 ml of urine, No treatment
NT = No Treatment
0 ml Pepper = 0 ml of urine with pepper planted
F (NP) = Female urine (No pepper)
10 ml F (NP) = 10 ml of female urine only
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F (P) = Female urine (with pepper)
10ml F (P) = 10 ml of female urine with pepper
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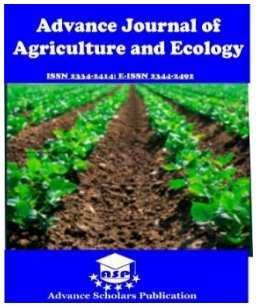


40ml F (P) = 10 ml of female urine with pepper

Effect of Different Treatments on Growth Parameters of Scotch Bonnet Pepper (Capsicum Chinense)

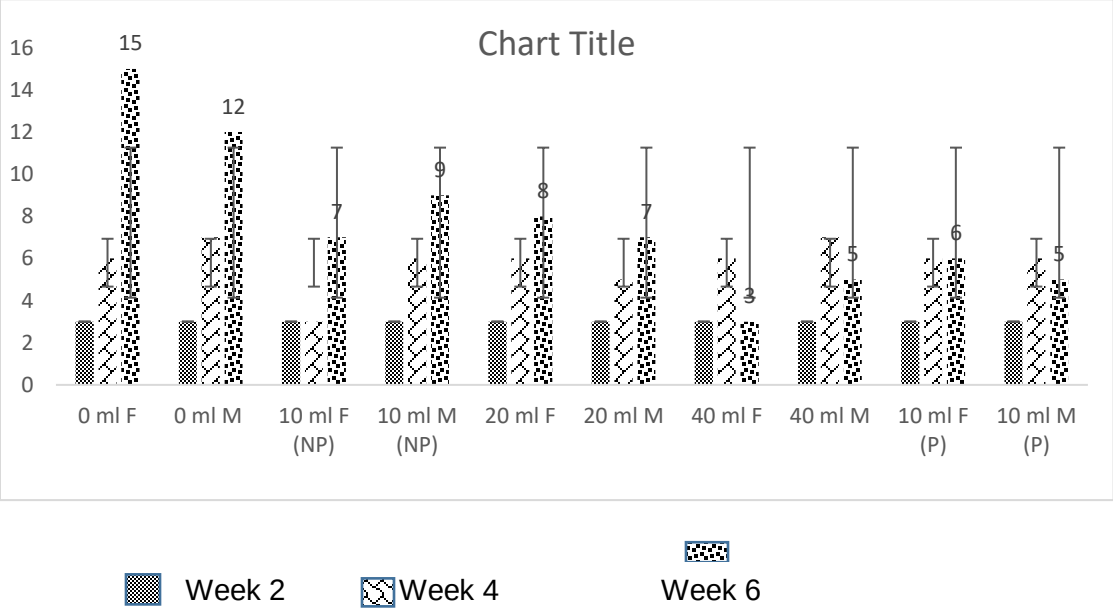
Plant Height

The experiment showed that the plant height was influenced by the treatment application in all the plots. Two weeks after the application, I observed stunted growth in the plot where the concentration was higher (20ml, 40ml) while the control and the 10ml concentration increased in height. I observed that the higher the concentration the more damages it causes to the plant growth and development.

Numbers of leaves

The number of leaves was significantly influenced by treatment application in lower concentration (10ml)but all treatments, number of leaves increased gradually weeks after application However the plot with 10ml concentration and the control have the highest numbers of leafs while the plot with higher concentration (20ml,40ml) have the least numbers of leaves at week six (6) the leaves of the plot with the higher concentration gradually reduced.

Plant Height



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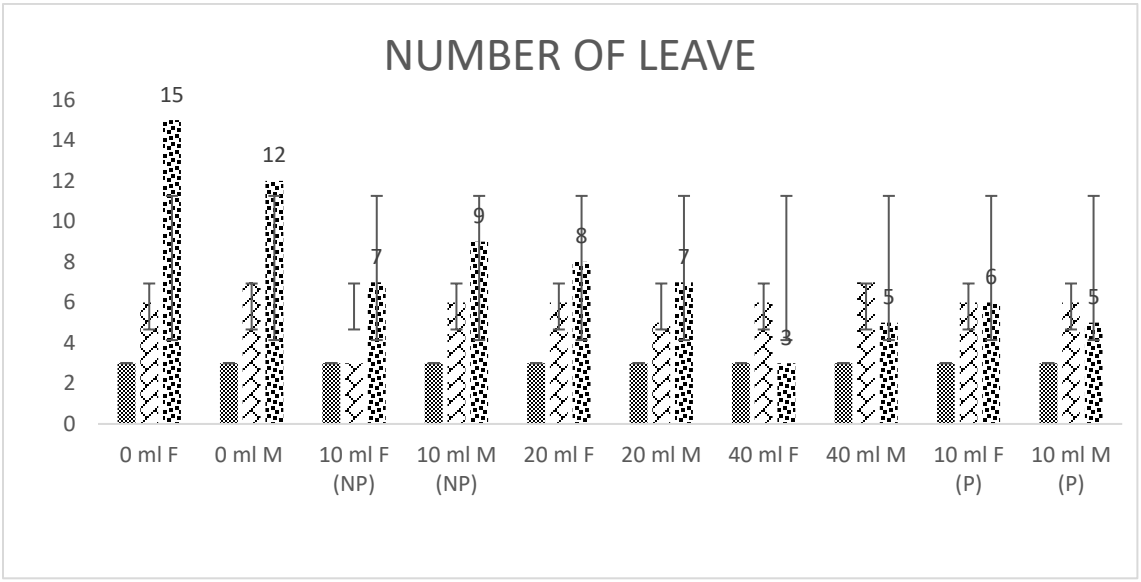

IV. CONCLUSION

In conclusion, various parameters such as soil ph, soil organic carbon, available p. Total Nitrogen and exchangeable bases and microbial were determined from the samples obtained from the experiments plot. The pH levels of the soil read strongly acidic soils with the male urine been more acidic, available phosphorus were observed to be more abundant in female urine the higher the concentration the more increase in the available phosphorus while male urine have higher percentage of total nitrogen, the higher concentration the more increase in the percentage of total nitrogen. The study shows that Staphylococcus sp is more abundant in both male and female urine which is absence in the control.

The growth parameters such plant height and numbers of leaves were stunted, the plants with the higher concentration of urine dies off after two weeks of application. Which show that the higher

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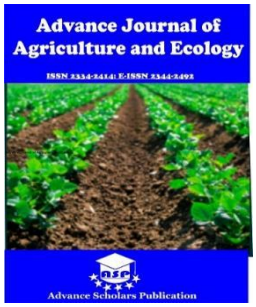

the concentration the more damages it causes to crop.

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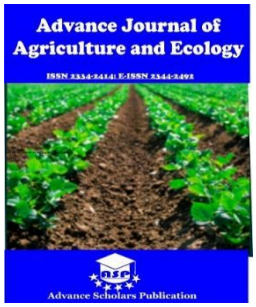

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