Effects of Organic and Inorganic Manure on the Growth and Yield of Pepper (*Capsicum Annum L.)* In the University of Uyo Agricultural Education Skills Acquisition Farm

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Abstract
Pepper is a spicy vegetable consumed by households all over the world because of its importance and spicy quality in food. Over the years the production of this important crop has been abysmally low leading to high price and increase in household food consumption expenditure. This however informed the decision of the researcher to carry out the study on the topic "Effect of Organic and Inorganic Manures on the Growth and Yield of Pepper (capsicum annum L.) in the University of Uyo Agricultural Education Skills Acquisition Farm". Two research questions and two hypotheses respectively were formulated to guide the study. The study adopted a Randomized Complete Block Design (RCBD). The population of the study comprised 500 stands of pepper plants raised in the nursery following nursery planting operations. Samples of 400 stands of pepper were thinned for the study using purposive sampling technique. Calibrated meter ruler was used to collect data on the height of pepper plant; number of pepper fruit was determined by counting and computing using scientific calculator while the weight of pepper fruits and the manures was measured using spring balance scale. The measurement apparatus were already validated and standardized but was cross checked by the researcher's supervisor to be sure they are functional. Data collected were analyzed using mean to answer research questions and Analysis of Variance (ANOVA) was used to test the null hypotheses at 0.05 level of significance. Findings of the study indicated that poultry manure has greater growth effect on the height, the number of fruits and on the weight of fruits of pepper plant followed by NPK (15:15:15) and no manure in University of Uyo Agricultural Education Skills Acquisition Farm. Furthermore, significant effect was observed in the height, the number of fruits and on the weight of fruits of pepper grown with poultry manure followed by N:P:K (15:15:15) and no manure in the study area. On the basis of the findings it was recommended among others that prospective and existing farmers should apply poultry manure to enhance the yield performance of pepper to meet its market demand within and outside Uyo Local Government Area.

Keywords: Inorganic manure, Organic manure and pepper production.

Introduction

Capsicum annuum L. is a spice and also regarded as a fruit vegetable widely cultivated in the world and its importance in human food cannot be overemphasized (Dias, Gomes, Moraes, Zottich, Rabelo, Carvalho, Moulin, Gonçalves, Rodrigues & Cunham, 2013). Moreover, the consumption of fresh pepper fruits facilitates starchy food digestion; pepper has antioxidant, anti-mutagenesis, hypocholesterolemic and immunosuppressive properties and

also inhibits bacterial growth and platelet agglomeration. *Capsicum annuum* is usually grown as an herbaceous annual crop in temperate areas. However a vast majority of pepper are cultivated as pungent and non-pungent (sweet) peppers in the temperate as well as some tropical areas. They are rich in proteins, lipids, carbohydrates, fibres, mineral salts (Ca, P, Fe) and in vitamins A, D_3, E, C, K, B_2 and B_{12}. The fruits are excellent source of health-related phyto-chemical compounds, such as ascorbic acid (vitamin C), carotenoids (pro-vitamin A), tocopherols (vitamin E), flavonoids, and capsaicinoids that are very important in preventing chronic diseases such as cancer, asthma, coughs, sore throats, toothache, diabetes and cardiovascular diseases (El-Ghoraba, Javedb, Anjumb, Hamedcand & Shaabana, 2013).

Peppers may require adequate amounts of major nutrients; such as Nitrogen (N) and Phosphorous (P). Nitrogen occupies a conspicuous place in plant metabolism. All vital biochemical processes in plants are associated with protein, of which nitrogen is an essential constituent. Consequently to get more pepper crop production, nitrogen application may be indispensable and unavoidable as it plays an important role in various physiological processes in plants such as the formation of dark-green color in plants, promotes leaves, stem and other vegetative part's growth and development. Moreover, it also stimulates root growth, produces rapid early growth, improves fruit quality and enhances the growth of leafy vegetables. Availability of Nitrogen enhances higher productivity and harvest with better quality of pepper. (Nasim, Ahmad, Hammad, Chaudhary & Munis, 2017). Phosphorus plays an important role in an array of cellular processes, including maintenance of membrane structures, synthesis of biomolecules and formation of high-energy molecules. It also helps in cell division, enzyme activation/inactivation and carbohydrate metabolism. In pepper plant, phosphorous, stimulates seed germination, development of roots, stalk and stem strength, flower and seed formation, pepper yield and quality. In addition, availability of Phosphorus increases the Nitrogen fixing capacity of leguminous plants. Hence, Phosphorous is essential at all developmental stages, right from germination till maturity of pepper. Both phosphorous and nitrogen are found in organic and inorganic manures (John, Almazan & Paria, 2017).

Poultry manures are the feaces of chickens used as organic manures, especially for soils low in nitrogen. Of all animal manures, it has the highest amount of nitrogen, phosphorus, and potassium (Morris & Ayu, 2015). Poultry manure is sometimes pelletized for use as manure, and this product may have additional phosphorus, potassium or nitrogen added. Poultry manure pellet are formed from the mixture of water, feed and sawdust or wood ash sticking together in the poultry pen. Poultry manure provides three primary nutrients which are essential in pepper production: Nitrogen (N), Phosphorus (P) and Potassium (K). Nitrogen supports vegetative growth. Phosphorus improves roots and flowering. Potassium strengthens resistance to environmental assaults, from extreme temperatures and to pest attacks (Telkamp, 2015).

Inorganic manures are synthetic plant nutrients which comprised minerals and synthetic chemicals. Most of the minerals in inorganic manures are mined from the earth and balanced inorganic manures are high in all the three macronutrients (N P & K) and can contain ammonium sulphate, magnesium sulphate and potassium chloride. NPK 15:15:15 is a complex

fertilizer (also known as compound fertilizers) made from mixing two or more of macro-nutrient type manures. It is usually in granular form. They may also be further blended with elements that provide some of the less-common plant nutrients (known as secondary nutrients such as Sulfur, Calcium and Magnesium). Compound fertilizers can be packaged and distributed in liquid or granular form. A numbering system is used to determine the percentages of the three essential plant nutrients. For example, a NPK 15:15:15 fertilizer would contain 15 percent Nitrogen (N), 15 percent Phosphorus (P) and 15 percent Potassium (K).

Statement of the Problem

Sustainable crop production requires judicious use of inputs such as manures. The use of inorganic fertilizer has drastically declined following the untimely, unavailability and high cost. Inorganic fertilizer has largely been aggravated by the removal of fertilizer subsidies by the government. This has resulted in low crop yields due to deteriorating soil productivity. A large number of livestock such as cattle, goats, sheep, pigs, donkeys and poultry are reared in Nigeria with the urine and excreta being wasted. Efficient use of animal manure could therefore alleviate the problem of declining soil productivity in Uyo Local Government Area. Irrespective of the enormous manure production potential, very little amount of the available animal manure is being utilized for crop production by farmers in Uyo Local Government Area of Akwa Ibom State. Under intensive livestock grazing systems and only a few farmers apply animal manure on soil, indicating serious under-utilization of such resources. Poor soil fertility is one of the major challenges affecting the production of pepper in Uyo Local Government Area. This is due to the excessive rainfall in the area which leads to erosion and leaching, also mono cropping and continuous cropping lead to the depletion of soil nutrients. In view of the above mentioned problems, prompts the researcher to seek to determine the effects of growth and yield of pepper (*capsicum annum l.)* based on the application of organic and inorganic manures in University of Uyo Agricultural Education Skills Acquisition Farm.

Research Questions

1. What is the effect in the mean number of fruits of pepper plant grown with poultry manure, N: P: K (15:15:15) and no manure in University of Uyo Agricultural Education Skills Acquisition Farm?
2. What is the effect in the mean fruits weight of pepper plant grown with poultry manure, N: P: K (15:15:15) and no manure in University of Uyo Agricultural Education Skills Acquisition Farm?

Research Hypotheses

1. There is no significant effect in the number of fruits of pepper grown with Poultry Manure, N: P: K (15:15:15) and no manure in University of Uyo Agricultural Education Skills Acquisition Farm.
2. There is no significant effect in the fruits weight of pepper grown with Poultry Manure, N: P: K (15:15:15) and no manure in University of Uyo Agricultural Education Skills Acquisition Farm.

Methodology

The study was carried out in Agricultural Education Skills Acquisition Farm in University of Uyo, Uyo. The study adopted a randomized complete block design (RCBD). The total number of 500 stands of pepper plant was raised in the nursery following nursery planting operations. Sample of 400 stands of pepper were thinned for the study using purposive sampling technique. Calibrated meter ruler was used to collect data on the height of pepper plant; number of pepper fruit was determined by counting and computing using scientific calculator while the weight of pepper fruit and the manures was measured using spring balance scale. The measurement apparatus were already validated and standardized. The study followed the following experimental procedures, site selection**:** the experimental site was pegged and marked out using measuring tape; soil test: the soil was tested and analyzes to ascertain the proportion of the elements in the soil, land preparation: the plot was cleared manually with the aid of machete. Making of the seed beds size of 5x2m was made with the use of spade, garden line and tape, planting operation: the seeds of *Capsicum annum L.* were purchased from a reputable source, the Akwa Ibom State Agricultural Development Project (AKADEP). Marking of planting distance and preparation for planting was done. Transplanting of seedlings from the nursery and supplying was done at stands that die off; nursery operation: construction of shed in the nursery site to prevent the seeds from excessive sunlight, plouhging of the site was done manually with the use of spade, viability test was carried out after which the seeds was planted in the nursery by broadcasting, the bed was watered regularly to ensure germination and weeding was done twice. After 4-8 weeks, the seedlings are mature for transplanting which was done at 45-50 days after planting in the nursery and in the evening; application of treatments (poultry manure): poultry manure was purchased at Akeset poultry farm and was air dried to reduce the heat before application at 360g/stand at two weeks after planting and repeated same after four weeks for two months using ring method of application, Weeding: weeding was carried out chemically through the application of pre-emergence herbicide at two weeks after land preparation. The researcher with the help of a research assistant collected the data at three weeks interval after planting for four times at the duration of four months. The parameters measured were number of fruits was done through counting and computing using scientific calculator and weight of pepper fruits was measured using spring balance scale (g). Data collected was analyzed using mean to answer research questions and Analysis of Variance (ANOVA) was used to test the null hypotheses at 0.05 level of significance.

Result

Research Question 1: What is the effect in the mean number of fruits of pepper plant grown with poultry manure, N: P: K (15:15:15) and no manure in University of Uyo Agricultural Education Skills Acquisition Farm?

Table 1: Mean effect in the number of fruits of pepper plant grown with of poultry manure, N:P: K (15:15:15) and no manure in University of Uyo Agricultural Education Skills Acquisition Farm

Treatments	Number of Stands	Mean	Std. Deviation
Poultry manure	80	30.05	4.16
N:P:K(15:15:15)	80	25.88	3.59
No Manure	80	15.10	2.27
Total	**240**	**71.03**	**10.02**

Results in Table 1 shows that the mean score for the number of fruits of pepper plant grown with poultry manure is 30.05, pepper grown with NPK (15:15:15) is 25.88 and pepper grown with no manure is 15.10. This implies that, poultry manure has greater growth effect on the number of fruits of pepper plant followed by NPK (15:15:15). No manure showed least effect on the number of fruits of pepper plant.

Research Hypothesis 1: There is no significant effect in the number of fruits of pepper grown with Poultry Manure, N: P: K (15:15:15) and no manure in University of Uyo Agricultural Education Skills Acquisition Farm.

Table 1(a): Analysis of Variance showing effect in the number of fruits of pepper grown with Poultry Manure, N:P:K (15:15:15) and no manure in University of Uyo Agricultural Education Skills Acquisition Farm

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.	Decision
Between Group	9525.30	2	4762.65	403.84	.000	Sig
Within Group	2794.98	237	11.79			
Total	12320.29	239				

Result in the Table 1(a) indicated that the calculated F-value 403.84 and the F-Sig .000 at 2 and 237 degrees of freedom and 0.05 level of significance. Since the F-Sig value .000 is less than the p-value of .05 the null hypothesis which stated that There is no significant effect in the number of fruits of pepper grown with Poultry Manure, N: P: K (15:15:15) and no manure in University of Uyo Agricultural Education Skills Acquisition Farm is rejected. Hence, there is a significant effect in the number of fruits of pepper grown with Poultry Manure, N:P:K (15:15:15) and no manure in University of Uyo Agricultural Education Skills Acquisition Farm. Since there is a significant effect, a post hoc analysis was employed using Scheffe Post Hoc analysis. The result of the analysis is presented in table 1(b)

Table 1(b): Analysis of Variance showing effect in the number of fruits of pepper grown with Poultry Manure, N:P:K (15:15:15) and no manure in University of Uyo Agricultural Education Skills Acquisition Farm.

(I)Categories	(J) Categories	Mean Difference	Std. Error	Sig.
Poultry Manure	NPK(15:15:15)	4.162	.542	. 000
	No Manure	14.950	.542	.000
NPK(15:15:15)	Poultry	-4.162	.542	. 000
	No manure	10.787	.542	.000
No Manure	Poultry	-14.950	.542	.000
	NPK(15:15:15)	-10.787	.542	.000

* The mean difference is significant at the 0.05 level.

Result in Table 1(b) indicated that the categories of poultry manure had the greatest mean effect in height of pepper plant. Thus, poultry manure was responsible for the significant effect in the number of fruits of pepper.

Research Question 2: What is the effect in the mean fruits weight of pepper plant grown with poultry manure, N: P: K (15:15:15) and no manure in University of Uyo Agricultural Education Skills Acquisition Farm?

Table 2: Mean effect in the weight of fruit of pepper plant grown with of poultry manure, N:P: K (15:15:15) and no manure in University of Uyo Agricultural Education Skills Acquisition Farm

Treatments	**Number of Stands**	**Mean**	**Std. Deviation**
Poultry manure	4	130.25	14.24
N:P:K(15:15:15)	4	118.00	11.19
No Manure	4	65.25	2.87
Total	**12**	**313.5**	**28.3**

Results in Table 2 reveals that the mean score for the weight of fruits measured in grams of pepper plant grown with poultry manure is 130.25, pepper grown with NPK (15:15:15) is 118.00 and pepper grown with no manure is 65.25. This implies that, poultry manure has greater growth effect on the weight of fruits of pepper plant followed by NPK (15:15:15). No manure showed least effect on the weight of fruits of pepper plant.

Research Hypothesis 2: There is no significant effect in the fruits weight of pepper grown with Poultry Manure, N: P: K (15:15:15) and no manure in University of Uyo Agricultural Education Skills Acquisition Farm

Table 2(a): Analysis of Variance showing effect in the fruits weight of pepper grown with Poultry Manure, N:P:K (15:15:15) and no manure in University of Uyo Agricultural Education Skills Acquisition Farm

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.	Decision
Between Group	9543.50	2	4771.75	42.54	.000	
Within Group	1009.50	9	112.16			Sig
Total	10553.00	11				

Result in the Table 2(a) indicated that the calculated F-value 42.54 and the F-Sig .000 at 2 and 237 degrees of freedom and 0.05 level of significance. Since the F-Sig value .000 is less than the p-value of .05 the null hypothesis which stated that there is no significant effect in the fruits weight of pepper grown with Poultry Manure, N: P: K (15:15:15) and no manure in University of Uyo Agricultural Education Skills Acquisition Farm is rejected. Hence, there is a significant difference in the fruits weight of pepper grown with Poultry Manure, N:P:K (15:15:15) and no manure in University of Uyo Agricultural Education Skills Acquisition Farm.

Since there is a significant effect, a post hoc analysis was employed using Scheffe Post Hoc analysis. The result of the analysis is presented in table 2(b).

Table 2(b): Analysis of Variance showing effect in the fruits of pepper grown with Poultry Manure, N:P:K (15:15:15) and no manure in University of Uyo Agricultural Education Skills Acquisition Farm.

(I)Categories	(J) Categories	Mean Difference	Std. Error	Sig.
Poultry Manure	NPK(15:15:15)	12.250	7.488	. 310
	No Manure	65.000	7.488	.000
NPK(15:15:15)	Poultry	-12.250	7.488	. 310
	No Manure	52.750	7.488	.000
No Manure	Poultry	-65.000	7.488	.000
	NPK(15:15:15)	-52.750	7.488	.000

*. The mean difference is significant at the 0.05 level

Result in Table 2(b) indicated that the categories of poultry manure had the greatest mean effect in height of pepper plant. Thus, poultry manure was responsible for the significant effect in the fruits weight of pepper.

Discussion of Findings

Effects of Poultry Manure, N: P: K (15:15:15), and No Manure in the number of fruits of Pepper Plant.

Findings of the study reveal that Poultry manure has greater growth effect on the number of fruits of pepper plant followed by NPK (15:15:15) and No manure in University of Uyo Agricultural Education Skills Acquisition Farm. Also There is significant effect in the

number of fruits of pepper grown with Poultry Manure, N:P:K (15:15:15) and no manure in University of Uyo Agricultural Education Skills Acquisition Farm.

The significant response to poultry manure by these parameters (number of fruits of pepper) might be as a result of improved nutrient supply, as well as positive manipulation of soil physical properties such as moisture retention, soil structure and aeration. Moreover, poultry manure contains essential nutrient element associated with high photosynthetic activities and thus promoted root and vegetative growth. The findings of the study is in conformity with the findings of Dauda, Ajayi and Ndor, (2018) who reported that poultry manure promotes vigorous growth, increases meristematic and physiological activities in plant due to supply of plant nutrients and improvement in soil properties. This often results in syntheses of more photosynthetic which are used in producing fruits. The response of poultry manure to growth and yield components such as number of leaves and branches, number of fruits per plant, fruit diameter , fresh fruit yield in both locations could be attributed to the ability of poultry manure to supply N and K and gradually these nutrients slowly leading to longer period of supply, that induced sustained luxuriant growth. This observation agrees with the findings of Aliyu and Kuchinda (2012), Aliyu (2012) and Dauda, Aliyu and Chiezey (2015) who reported that nutrients in poultry manures most especially nitrogen and other nutrients become available more slowly and a considerable amount is still available towards the latter part of the growing season. Tisdale and Nelson (2016) also noted that crop response to poultry manure application is affected by nutrient reserve in the soil and that crop response to fertilizer application in soil with low nutrient content will respond low than soils with high nutrient reserves.

Effects of Poultry Manure, N: P: K (15:15:15), and No Manure on fruits Weight of Pepper Plant.

Finding of the study indicated that Poultry manure has greater growth effect on the weight of fruits of pepper plant followed by NPK (15:15:15) and No manure in University of Uyo Agricultural Education Skills Acquisition Farm. Also There is significant effect in the fruits weight of pepper grown with Poultry Manure, N: P: K (15:15:15) and no manure in University of Uyo Agricultural Education Skills Acquisition Farm.

The significant response to poultry manure by these parameters (fruits weight of pepper) might be as a result of improved nutrient supply, as well as positive manipulation of soil physical properties such as moisture retention, soil structure and aeration. Moreover, poultry manure contains essential nutrient element associated with high photosynthetic activities and thus promoted root and vegetative growth. The findings of the study agrees with the findings of Alabi (2015) who found that application of organic waste, poultry droppings increases growth and yield component of Capsicum significantly more than inorganic fertilizers. A similar result was observed by Anonymous (2015) who reported that poultry manure significantly increased fresh fruit weight of chilli pepper, Capsicum annum variety Tattasai at a rate of 2% by volume in combination with 60 kg N ha-1. Aliyu and Kuchinda

(2012) working with different organic manure at Samaru, to determine their effect on yield and composition of pepper reported that yield of pepper increased with increase in the rate of manure. However, poultry manure and guano to produce more fruit yield than farm yard manure.

Conclusion

Poultry manure have greater growth effect on the number of fruits and on the weight of fruits of pepper plant followed by NPK (15:15:15) and no manure in University of Uyo Agricultural Education Skills Acquisition Farm. Furthermore, there is significant effect in the number of fruits and on the weight of fruits of pepper grown with poultry manure followed by N:P:K (15:15:15) and no manure in the study area which poultry manure was responsible.

Recommendations

1. Pepper farmers in Uyo Local Government Area should apply poultry manure in large quantities this will enhance the growth and yield performance of pepper.
2. Pepper farmers should utilize poultry manure because it will enable them to produce pepper at the commercial level thus meeting the demand for pepper within and outside the Local Government Area.

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