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Efficacy of NPK and Cow Dung Combinations on Perfomance of Chilli Pepper (Capiscum annuum L) and their Influence on Soil Properties

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Abstract: *Sustainable use of mineral fertilizer by Nigerian farmers has become a serious problem due to ever increasing cost and associated procurement difficulties. Besides this, the use of chemical fertilizers have created a lot of environmental issues thereby rekindling the interest of many researchers in the use of organic materials either in their sole form or combination with less amount of chemically produced materials . It is on this premise that a field experiment was carried out to evaluate the comparative efficacy of cow dung manure (CD) and NPK 20-10-10 in their sole and combined forms as well as their effects on some soil properties. However, the experiment consists of six treatments - NPK (0.3t/ha), CD (3t/ha) , NPK + CD combined in ratio 1:2 on weight basis (w/w) (0.5t/ha), NPK + CD at 1:4 w/w (0.75t/ha) , NPK+CD at 1: 6 w/w (1t/ha) and the control(unfertilised) pot using chilli as the test crop.The result obtained on growth and yield of chilli pepper revealed that plant height, stem girth and fresh fruit weght were significantly enhanced over the control. Plant height followed the trend -NPK >NPK + CD (1:2 w/w)/NPK + CD (1:4 w/w)/NPK + CD (1:6 w/w) / CD > Control while the order for fresh fruit weight was NPK/NPK + CD (1:2 w/w) > NPK + CD (1:4w/w) / NPK + CD (1:6 w/w) / CD > Control. Post cropping soil analysis revealed an increase in organic matter and pH with respective values of 13.2% and 4.9% in plots fertilised with cow dung.*

Key Words: *Efficacy, Organic matter, Cow dung, NPK, Fertilizer.*

I. Introduction

Chilli pepper (*Capiscum annuum* L) is a widely cultivated crop in Nigeria which belongs to the family solanaceae. It is a very rich source of vitamins A and C. It is often used as a household culinary and seasoning agent. Yields obtained by Nigerian peasant farmers are often low when compared with the ones obtained at research stations and developed countries (Adigun, 2001). Continuous cultivation of soil coupled with use of inorganic fertilizers, has been implicated in soil acidification, reduction of soil organic carbon and organic matter, nutrient imbalance, deficiency of secondary macronutrients and micronutrients (Adediran and Banjoko , 2003 ; Osundare, 2004). Due to this, many peasant farmers have resulted to use of organic wastes especially those of livestocks which are abundantly available (Nwajiuba and Chimezie, 2000).

The use of organic manure is beneficial to the soil in terms of alleviating soil acidity, improvement of soil physical properties and nutrient status (Aro and Agwu, 2005 ; Ewulo, 2005). Sole application of mineral fertilizer by local farmer is constrained by ever increasing cost and removal of subsidy. This has prompted them to result to use of organic wastes which is also confronted with problems of high quantity involved, slow release of nutrients, handling and carriage costs. Information on combined application of cow dung and NPK on performance of chilli is limited. Hence, this study was carried out to evaluate the influence of combined applications of NPK and cow dung on growth, yield and nutrient contents of chilli pepper with a view to minimising the shortcomings of their sole applications.

II. Materials And Methods

Study area, field layout and experimental details

The field experiment was carried out at the college farm site, Emmanuel Alayande College of Education, Oyo, lanlate campus, Nigeria (latitude$7^0$15'N -$7^0$55'N and longitude $3^0$0'E - $3^0$30'E) between june and September, 2013. The land (21.5mx11m) was manually cleared and divided into 18 plots of 2mx2m with 1.5m demarcation between plots leaving 1m as boundaries for the experimental field. Each plot contained 12 stands of chilli at a spacing of 60cmx60cm. The treatments consisted of NPK 20-10-10 applied at rate 0.3t/ha, cow dung (CD) at 3t/ha, NPK combined with CD in ratio 1: 2 applied at rate 0.5t/ha, NPK combined with CD in ratio 1: 4 applied at rate 0.75t/ha, NPK combined with CD in ratio 1: 6 applied at rate 1.0t/ha and the control giving six different treatments replicated thrice in a completely randomised block design.

Soil Analysis

The pH was determined in distilled water with the aid of pH meter. Total N was determined by macrokjeldahl method as described by Bremner (1965). Nitrogen content of the digest was thereafter read on Technicon Autoanalyser. Available P was determined using Bray P-1 extractant (0.03M NH_4F and 0.025M HCl) and was later read on spectrophotometer after colour development with ascorbic acid salt in Murphy and Riley reagent (Murphy and Riley,1962) Exchangeable bases (Ca, Mg, K and Na) were determined by the method described by Jackson (1962) in which 1M neutral ammonium acetate (1M NH_4OAc pH 7.0) solution was used as extractant. Sodium, potassium and calcium in the filtered aliquot of the extracted solution were determined by flame photometry while Mg was determined with the aid of atomic absorption spectrophotometer (AAS). Organic carbon (C) was determined by wet dichromate digestion method (Walkey and Black, 1934).Organic matter was extrapolated from organic C by multiplying its value with Van Bemmeller constant of 1.723 (Allison, 1982). Texture was determined by hydrometer method (Bouyoucos, 1965).

Cow dung Analysis

Dried ground samples of cow dung was subjected to wet oxidation by nitric–sulphuric-perchloric acid (HNO_3- H_2SO_4-$HClO_4$) mixture. The filtrate was used to determine N, P K Ca and Mg. N was determined by MicroKjeldah method, K was determined by flame photometer while Ca and Mg were determined by AAS.

Blending of Cow dung and NPK

15 kg of NPK was thoroughly mixed with 30 kg CD to produce CD + NPK 1 : 2 w/w, 15 kg of NPK was thoroughly mixed with 60 kg CD to produce CD + NPK 1 : 4 w/w, 15 kg of NPK was mixed thoroughly with 90 kg CD to produce CD + NPK 1 : 6 w/w.

Statistical Analysis

Collected data were subjected to analysis of variance (ANOVA) and treatment means were compared using Ducan multiple range test at 5% level of significance.

III. Result And Discussion

Table 1 shows the pre-planting soil analysis. It was a loamy sand with a pH (H_2O) of 6.3, total N 0.12%, available P 8.8 mg/kg, organic C 1.63%, organic matter (OM) 2.81%. The respective values for exchangeable K,Ca, Mg and Na were 0.31,0.72,2.5 and 0.11 Cmol/kg.. The OM falls within 0.5-4.0% established for soils of southwestern Nigerian(Adepetu and Corey, 1976) but lower than critical level of 3% specified by Akinrinde and Obigbesan(2000). With the exception of Mg, the total N, available P and exchangeable Ca fell below critical level levels of 0.15% N, 10.0mg/kg available P, 2.0 cmol/kg exchangeable Ca and 0.4 cmol/kg established for crop production in southwestern Nigeria by Akinrinde and Obigbesan,2000. Hence, response to the applied fertilizers is expected.

In table 2. Nutrient contents of the cow dung was shown. It had, 16.4% OM, 2.7% N,0.15 % P, 0.42% K, 0.21% Ca and 0.1% Mg. These values deviate from what was obtained by Ewulo et. al. (2007) and Adediran et. al.(1999). The reason could be adduced to the fact that system of keeping livestock and the type of feed or pastures given to them influences the nutrient contents of their manure (Murwiwa and Kirchmann,1993).

The influence of the fertilizer application on performance of chillies was shown in table 3.The unfertilized pepper plants had the least plant height, stem girth, and fruit weight.NPK solely applied plots had the tallest plants which were significantly taller than plants grown with CD and CD+NPK combinations. Highest value of stem girth was observed in plants fertilized with NPK +CD (1:2 w/w) followed by NPK with unfertilized plants having the least. Statistical similarity was observed with shoot biomass yield among the fertilized plants but differs from the control. In terms of fruit yield, NPK significantly outperformed CD but did not significantly produce better yield than plants fertilised with various combinations of NPK with CD. Nutrient content of chilli leaf was shown in table 4. It reveals that N ranges from 2.7-5.5% with control having the least and NPK has the highest. P ranges from 0.11 to 0.21%, K from 2.1 to 2.91%, Ca from 0.65 to 0.89% and Mg from 0.28 to 0.43%. Statistically, nutrient contents (N, P, K, Ca and Mg) are generally similar among fertilized plants.. The effect of fertilizer addition on soil properties was shown in table 5. Cow dung and its various combinations increases pH values and organic matter content while sole application of NPK reduces pH value thereby increasing soil acidity. Calcium and magnesium contents of soil increased in plots fertilised with CD and its various combinations indicating that the soil benefited from additional nutrients found in the CD unlike NPK which did not supply any other nutrients apart from its constituents- N, P and K. This observation accords with that of Ewulo et. al. (2007) Therefore it can be concluded from the study that combination of cow dung with NPK 20-10-10 in a ratio of 1: 6 on weight basis at an application rate of 1t/ha, had beneficial effect on the

soil by alleviating acidity and increasing the organic matter content. Besides these, growth and fruit yield of chillies were also enhanced.

Table 1.Pre-cropping soil analytical Data

Parameter	Value
pH (H_2O)	6.30
Organic Carbon (%)	1.63
Organic matter (%)	2.81
Total N (%)	0.12
Available P (mg/kg)	8.80
Exchangeable K (cmol/kg)	0.31
Exchangeable Ca (cmol/kg)	0.72
Exchangeable Mg (cmol/kg)	2.50
Exchangeable Na (cmol/kg)	0.11
Sand (%)	87.8
Silt (%)	5.40
Clay (%)	6.80
Texture	Loamy sand

Table 2. Nutrient composition of cow dung

Parameter	Value (%)
Organic matter	16.70
N	2.70
P	0.15
K	0.42
Ca	0.21
Mg	0.10

Table 3.Influence of NPK and Cow dung combinations on Chillies

Treatments	Plant Height (cm)	Stem girth(cm)	Fruit weight (g/plant)	Shoot biomass yield (g/plant)
Control	41.4c	2.9d	187.9d	14.2b
CD	50.9b	3.3bc	197.2bc	16.5a
NPK	56.7a	3.6a	215.9a	17.3a
NPK +CD 1:2	53.1b	3.7a	211.1ab	17.2a
NPK +CD 1:4	51.8b	3.5a	202.5 b	16.8a
NPK +CD 1:6	52.0b	3.2c	201.7 b	16.7a

CD- cow dung. Means followed by the same letters along the same column are not significantly different at 5% level according to Duncan Multiple Range Test (DMRT)

Table 4.Nutrient contents of Chilli leaf as influenced by NPK and cow dung combination

Treatments	N	P	K	Ca	Mg
	←		%		→
Control	2.70b	0.11b	2.10c	0.65c	0.18b
CD	4.60a	0.21a	2.91a	0.83ab	0.41a
NPK	5.10a	0.22a	2.77ab	0.74b	0.30a
NPK +CD 1:2	4.90a	0.19a	2.60ab	0.89a	0.35a
NPK +CD 1:4	4.70a	0.18a	2.72ab	0.85ab	0.37a
NPK +CD 1:6	4.80a	0.20a	2.56b	0.81ab	0.39a

Means followed by the same letters along the same column are not significantly different at 5% level according to Duncan Multiple Range Test (DMRT)

Table 5. Influence of NPK and Cow dung combinations on soil properties

Treatments	pH	OM	Total N	Av. P	K	Ca	Mg
		%	%	mg/kg	←	cmol/kg	→
Control	6.1b	2.21b	1.10c	8.50b	0.22b	1.10c	2.30c
CD	6.6a	3.11a	1.52a	15.90a	0.33ab	2.20b	2.80a
NPK	5.9b	2.67a	1.60a	16.10a	0.42a	1.20c	2.20c
NPK +CD 1:2	6.4a	2.88a	1.48a	15.70a	0.39a	2.40a	2.50b
NPK +CD 1:4	6.5a	2.85a	1.33b	16.20a	0.36a	2.40a	2.60b
NPK +CD 1:6	6.6a	2.91a	1.27b	16.60a	0.35a	2.30ab	2.60b

Means followed by the same letters along the same column are not significantly different at 5% level according to Duncan Multiple Range Test (DMRT)

References

[1]. Adigun, J. A. (2001). Influence of Intra-Row Spacing and Chemical Weed Control on Growth and Yield of Chilli Pepper in the Nigerian Northen Guinea Savanna. Journal of Horticultural Science 5:67-73

[2]. Adediran, J. A. And Banjoko, V. A. (2003). Comparative Effectiveness of some Compost Fertilizer Formulations for Maize in Nigeria. J. Soil Sci. 13:24-49.

[3]. Adediran,, J. A. , Akande, M. O.,Taiwo, L. B., and Sobulo, R. A. (1999). Comparative Effectiveness of Organic based Fertilizer with Mineral Fertilizer on CropYield. Babalola O.(Ed.).Proceedings of the Soil Science Society of Nigeria Conference, November 21-25, Nigeria pp 91-95.

[4]. Adepetu J. A. And Corey, R. B. (1976). Changes in N and P fractions in Iwo series from Nigeria under Intensive Cultivation.Plant and Soils 46 : 309-316

[5]. Akinrinde E. A. And Obigbesan G. O. (2000). Evaluation of the Fertility Status of Selected Soils for Crop Production in five Ecological Zones of Nigeria.Proceedings of the 26th Annual Conference of Soil Science Society of Nigeria, October 30-November 3, 2000, Ibadan, Nigeria, pp279-288

[6]. Allison, F. E (1982). Soil Organic Matter and its Role in Crop Production. El-Sevier, Amsterdam. pp317.

[7]. Aro, O. A. And Agwu, J. A. (2005).Effect of animal manure on selected soil chemical properties. J. Soil Sci. 15:14-19.

[8]. Bouyoucos G. J. (1965). Hydrometer Method for making Particle Size Analysis of Soils. Agron J 54: 464-465.

[9]. Bremner J. M. (1965).Total Nitrogen in C. A Black (ed) Method of Soil Analysis part 2. American Soc. Of Agronomy, Madison, USA. pp 1174-1178.

[10]. Ewulo, B. S. (2005). Effect of Poultry Dung and Cattle Manure on Chemical Properties of Clay and Sandy Clay Loam Soils. J. Anim. Vet. Adv,4: 839-841.

[11]. Ewulo, B. S., Hassan, K. O. and Ojeniyi, S. O. (2007). Comparative Effect of Cowdung Manure on Soil and Leaf Nutrient and Yield of Pepper. International Journal of Agricultural Research,2: 1043-1048

[12]. Jackson M. L.(1962). Soil Chemical Analysis.Prentice Hall inc. Englewood Cliff pp 59-62Murphy, J. and Riley, J. P. (1962). A Modified Single Solution Method for Determination of Phosphate in natural Waters. Anal. Chim. Acta 27: 31-36

[13]. Murwiwa, H. and Kirchmann, H. (1993). Carbon and Nitrogen mineralization of cattle manures subjected to different treatments in Zimbabwean and Swedish soils. InSoil Organic matter dynamics and sustainability of Tropical Agriculture. Mulongoy K and Merckx R. (Eds). Wily-Sayce Co publication, London pp189-198

[14]. Nwajiuba, C. and Chimezie, P. (2000). The use of Livestock wastes in soil fertility regeneration in Imo state, Nigeria. Proceedings of the 1st Annual Conference of the College of Agriculture and Veterinary medicine, September 10-13, 2000, Abia State University, Nigeria, pp137-140.

[15]. Osundare, B. (2004). Effect of different companion Crops and Fertilizer types on Soil nutrient Dynamics and Performance of Cassava. Nig. J. Soil Sci 14: 13-17.

[16]. Walkey, A. And Black, I. A. (1934). An examination of the Degtajareff Method for determining Organic Matter and proposed Modification of the Chromic Acid Titration Method. Soil Sci 37:29-38