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Research Paper

Comparative Study on the Efficacy of Cowdung and N.P.K Fertilizer on the Growth of Cowpea (*Vignaunguiculata*), Soyabean (*Glycinemax*), Tomato (*Lycopersicumesculentum*) and Pepper (*Capsicumfrutescens*) in North Central Nigeria

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Abstract: *A study was carried out to compare the efficacy of cowdung and N.P.K fertilizer on the growth of cowpea (Vignaunguiculata), soya bean (Glycinemax), tomato (Lycopersiconesculentum) and pepper (Capsicum frutescens). This was carried out at the Agronomy Research Farm of the University of Agriculture, Makurdi. The experimental design was a Randomized Complete Block Design (RCBD) in three (3) replicates. The treatments examined were 150g of cowdung, 130g of cowdung and 25g of N:P:K. For all experimental plants, cowpea under150 g cowdung treatmentsresponded best, followed by 130g of cowdung. Soybean performance was enhanced by 150g and 130g cowdungwhile its least weight was recorded under NPK treatment. Tomato to which NPK soil was applied recorded the highest plant weight with the least value recorded under130g and 150g cowdung soil treatment. Performance of pepper was significantly low for all treatments. Therefore, cowdung has proven effective on the growth of cowpea, soybean, tomato and pepper. The implications of the findings in this work to agricultural enhancement in Nigeria and generally are discussed.*

Keywords: Cowdung, Cowpea, Soybean, Pepper, Tomato, Efficacy.

Introduction

Manure is anything that has been added to the soil to increase its fertility for plant growth (Holttum *et al*, 1991; Ramadan *et al*., 2007; Alexandria, 2007; Berdegue *et al*., 1994, Bray, 1945). Manures can be

divided into two classes: organic and inorganic manure (Zeidan, 2007; Bressani, 1985, Cartwright *et al*., 1990; Chang *et al*., 2007). Organic manures are derived from decaying material of plants or animal origin (Maerere *et al*., 2001; Chinma *et al*, 2008; Dave *et al*., 2003; Davis *et al*., 1991; Fall *et al*., 1999). Inorganic manures, also known as fertilizers, are derived from chemical processes, most of which are man-made. Inorganic manures (fertilizers) are relatively simple in structure, they break down easily and are available to plants rather quickly, but they usually provide only one of the many substances needed by plants for their growth (Holttum *et al*, 1991, Abou *et al*, 2006; Diwarkar, 2004; Erine, 1979; Eshbaugh *et al*., 1983).Apart from these, they fail to contribute immensely to good soil texture when compared with organic manures apart from their implication inenvironmental pollution through eutrophication and other means (Kushwaha and Ochi, 1991, Oad *et al*, 2004; Fery, 1990; Flordia, 1982; Hancock, 1992; Jone, 1999; Kent, 2002).

Therefore, some growers prefer to use organic source of nutrients instead of chemical fertilizers to grow plants. Organic sources do have the advantages of containing slow-release of nutrients, posing little risk of soluble salt injury, and contributing considerable amount of organic matter to the soil. Continued use of manures builds organic matter in soil and improves its structure. It is known that good soil structure helps improve water holding capacity, aeration and drainage (Deksissa *et al*, 2008; Lai *et al*., 2005; Leaiza *et al*., 1989; Levetin *et al*., 1998; Ronen *et al*., 2002; Schaffer, 1938).

McLeod (1983); Tindall (1986); Luther (1987); Stuessy (1990) and Kushwaha and Ochi (1999) had observed that the use of animal wastes in crop production resulted in a larger net benefit to society than the use of mineral fertilizer and therefore advocated the use of animal waste as environment friendly manure. According to Simpson *et al*. (1986), organic manures can be used to supplement the inorganic fertilizers, particularly cowdung which has been found to possess manuring effect to crop which could serve as a substitute for the NPK fertilizer. It has been reported that cowdung contains approximately 0.6% nitrogen, 0.1% phosphorus and 0.5% potassium (Lombini *et al.*, 1991; Oikeh *et al.*, 1993; Reyhan *et al.*, 2006; Pickergill, 1989). Fermentation of this organic manure is important so as to bring easy utilization of the minerals available by the plants for better performance (Obi *et al.*, 1995; Oad, 2004; Shi *et al.*, 2000; Rowell *et al*., 2002; Krsendu, 1999; Giovanuncci, 1999; Extension Service of Mississippi State University, 1986). Ande (2000) tested the effect of cowdung on the growth of maize and reported that the effect of cowdung on maize was very close to the manuring effect of NPK fertilizer. Cowdung manure has subsequently been tested on other crops like tomato, pepper, cowpea and soybean to compare its manuring effect with that of NPK fertilizer.

Crops do better and yield more when fertilizer is applied. However, due to its exorbitant price and lack of steady supply, it is hardly applied by most farmers. Even when applied, it is rarely sufficient. In such situations, crop yields are bound to drop. Therefore, it is pertinent to seek alternative means of sustaining high crop yields. This study aimed at comparing the efficacy of cowdung as organic manure and NPK fertilizer as inorganic manure on the growth of cowpea, soyabean, tomato and pepper in Nigeria.

Materials and Methods

Seeds of tomato, chilli pepper, cowpea and soybean were bought from Wadata and Wurukum markets in Markudi, Nigeria. Dried cowdung was collected from cattle market in NorthBank, Makurdi. N:P:K fertilizer (15:15:15)was bought from Modern market in Makurdi. The experimental site was located in the Agronomy Research Farm of the University of Agriculture, Makurdi. The same quantity of soil was measured in perforated containers and used for all the treatments. Seeds were planted following the method of Aguoru *et al*. (2015b). The experiment was designed in such a way that there were three (3) treatments for each plant and each treatment had three replicates.130g cowdung, 150g cowdung and 25g NPK fertilizer were compared accordingly. All the treatments were left for one week before planting to allow for soil microbial decomposition essential for nutrient availability. Cultural practices were maintained in the screen house to ensure plant survival and zero insect interference. Measurement of growth parameters commenced two (2) weeks after germination. This

was maintained at two weeks interval. The following parameters were measured under varying treatments: plant height, number of leaves per plant, number of branches per plants and fresh weight of plants. Data were appropriately analyzed for descriptive statistics. Analysis of variance (ANOVA) was computedas test statistics at 95% confidence limit.

Results and Discussion

Mean plant height at different treatments is presented in table 1. The highest growth (98.4cm) was recorded for cowpea at 130g of cowdung. 63cm was recorded for cowpea at 150g of cowdung. Pepper gave 19.6cm at 150g cowdung (fig 1). Tomato responded best to NPK followed by 130g of cowdung. Soybean recorded its highest height from 130g cowdung. This clearly indicates that plant growth was generally enhanced by organic manure.

Soybean to which 150g of cowdung was applied recorded the highest number of leaves (108) while soybean to which 130g of cowdung was applied recorded (88 leaves) (Table 2). Tomato to which 25g of NRK was applied performed closely (87 leaves). The least number of leaves (27) was recorded for pepper to which 150g of cowdung was added. This is displayed in figure 2. Tomato responded better than NPK followed by that to which 150g of cowdung was added. Cowpea appears to have been favoured most by 150g cowdung soil closely followed by 130g cowdung soil, recording its least number of leaves from NPK soil. This has proven thatleaf production in cowpea, soybean and tomatoes was enhanced by 150g cowdung, 130g cowdung and 25g NPK soils respectively. Results obtained from ANOVA showed significant difference to treatment interactions in each plant. Tomato however showed no significant difference to treatment.

From table 3, soybean to which 130g of cowdung was applied recorded the highest number of branches (7) followed by cowpea and soybean (6 each) at 150g cowdung. However, tomato at 130g and 150g of cowdung recorded the least result (1 branch each) as shown in figure 3. This shows that 130g of cowdung increased the production of branches of soybean, followed by 150g of cowdung soil and the least in NPK. Cowpea produced the highest number of branches from 150g cowdung soil followed by 130g cowdung and the least number with 25g NPK soil. In terms of weight (table 4), cowpea to which 150g cowdung was applied gave the highest value (80g) while soybean to which the same quantity ofcowdung was applied gave (50.5g). Soybean under 130g of cowdung performed closely (50.1g). Tomato under 25g of NPK treatment recorded (49. 6g).Least mean weight was recorded for pepper at 150g of cowdung (9.2g) as illustrated in figure 4.

For all experimental plants, cowpea under150 g cowdung treatmentsresponded best, followed by 130g of cowdung. Soybean performance was enhanced by 150g and 130g cowdungwhile its least weight was recorded under NPK treatment. Tomato to which NPK soil was applied recorded the highest plant weight with the least value recorded under130g and 150g cowdung soil treatment. Pepper performed significantly low for all treatments. This aligns with the work of Bill (2001); Zdenka *et al*. (2010); Toapanata (2001) and Mehka (2002) where application of organic matter was found to enhance crop performance.

The performance of these crops, could be as a result of the high content of nitrogen, phosphorus and potassium contained in cowdung (Lombini *et al.,* 1991; Oikeh *et al.,* 1993; Reyhan *et al.,* 2006). Nitrogen is particularly important for enzyme (protein) synthesis while both nitrogen and phosphorus are active components of nucleic acids and ATP (energy packet). This corroborates the findings of Holttum *et al.* (1991) where nitrogen was essential in the healthy growth plantorgans such as leaf and stem.

This research has proven that in a third world country like Nigeria where poverty ravages the people and agricultural inputs like inorganic fertilizer is almost out of reach and most often unavailable, where cowdung litters the streets, the farmers could turn to this cheap source of organic manure which

enhances the growth of crops in this experiment. This reduces the cost of input material and raises harvest. These are natural organic manures which have low tendency for environmental pollution.

Table 1: Mean plant height (cm) for all treatments at 12 weeks after planting

Treatments	2week	4week	6week	8week	10week	12week
A(130g of cowdung)						
Cowpea	17.0	24.5	25.7	31.0	37.3	98.4
Soya bean	16.0	28.6	42.9	43.7	46.5	47.3
Tomato	12.8	17.6	22.5	34.6	37.3	49.5
Pepper	6.2	8.8	15.4	17.6	19.3	27.0
B (150g of cowdung)						
Cowpea	17.2	23.3	30.0	36.1	59.3	63.0
Soyabean	15.9	28.0	43.3	51.0	56.0	60.1
Tomato	10.5	19.0	22.6	28.3	38.0	42.0
Pepper	8.7	10.6	12.0	14.2	16.4	19.6
C (25g of cowdung)						
Cowpea	19.4	24.3	27.1	31.0	42.7	51.0
Soyabean	15.4	32.6	42.3	45.8	48.0	50.8
Tomato	8.7	15.7	20.5	32.0	44.0	58.0
Pepper	5.7	7.2	8.0	14.0	16.0	20.7

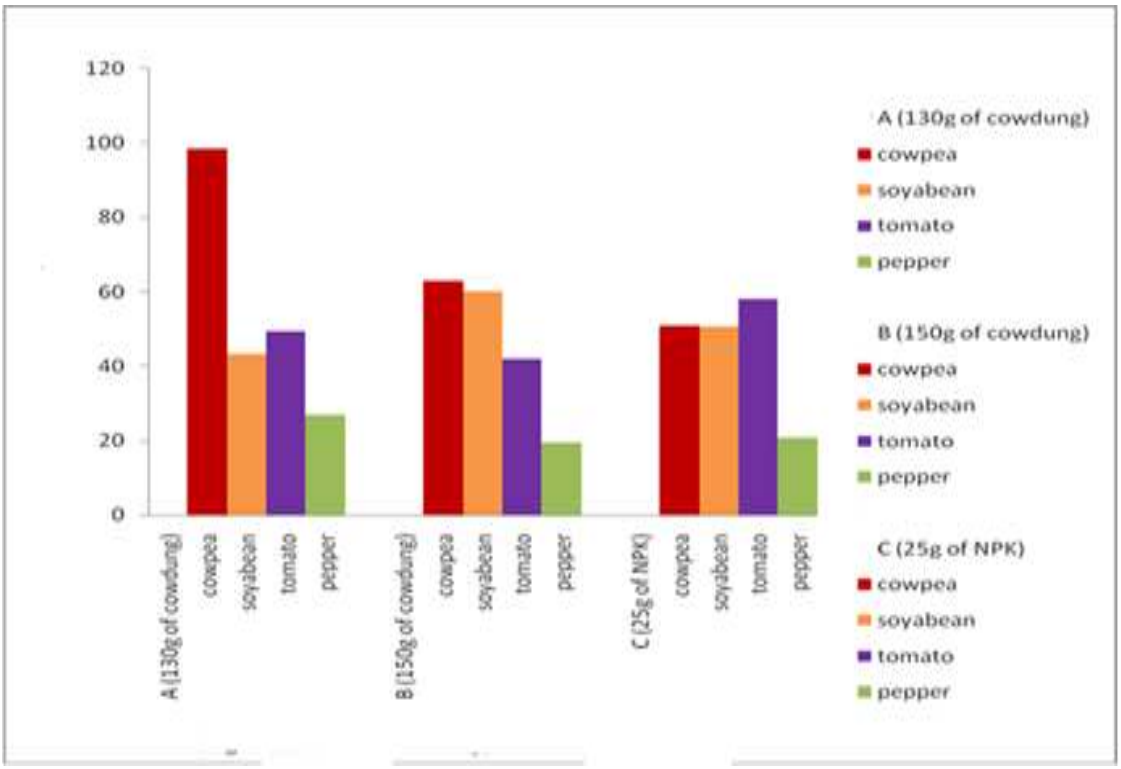

Fig 1: Plant height at 12 weeks after planting

Table 2: Mean number of leaves for all the treatments at 12 weeks after Planting

Treatments	2week	4week	6week	8week	10week	12week
A(130g of cowdung)						
Cowpea	20	48	65	68	72	73
Soyabean	12	22	26	52	84	88
Tomato	23	36	45	50	56	58
Pepper	7	13	17	21	24	28
B(150g of cowdung)						
Cowpea	18	27	60	63	68	70
Soyabean	12	26	34	46	99	108
Tomato	17	35	38	44	64	78
Pepper	7	11	14	18	20	27
C(25g of NPK)						
Cowpea	28	32	40	47	51	55
Soyabean	15	27	33	44	52	53
Tomato	13	28	33	55	63	87
Pepper	6	15	20	24	30	37

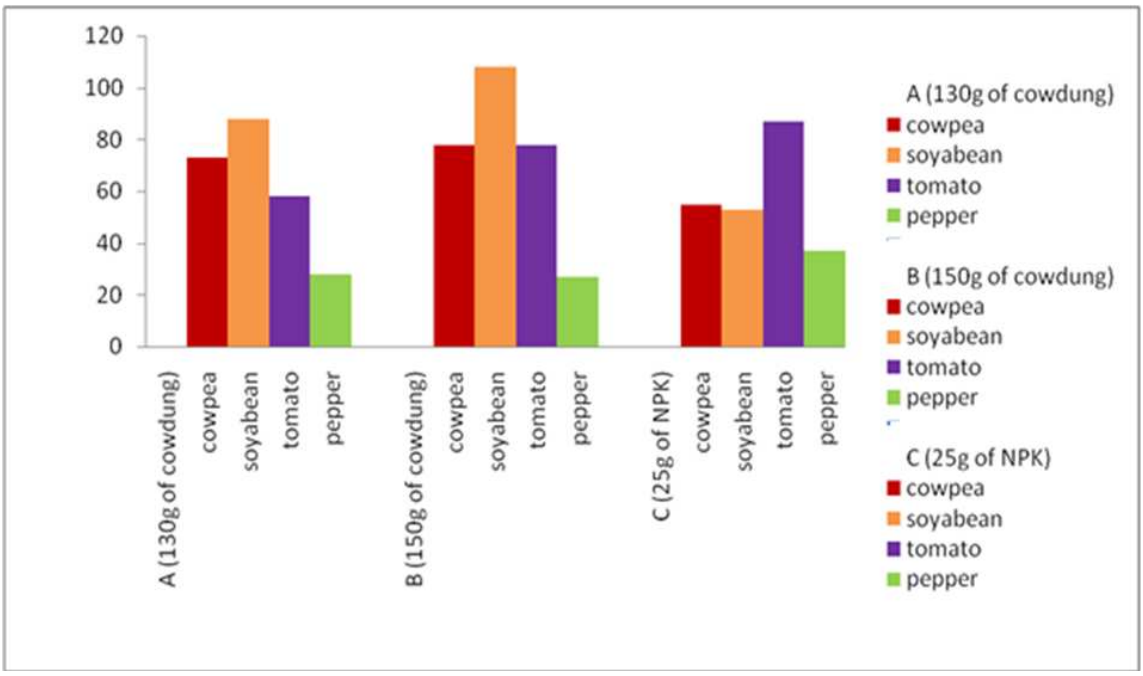

Fig 2: Mean Number of leaves with different treatments at twelve weeks after planting

Table 3: Mean Number of branches for all the treatments at 12 Weeks after Planting

Treatments	2week	4week	6week	8week	10week	12week
A(130g of cowdung						
Cowpea	-	-	4	4	4	5
Soyabean	-	-	3	4	6	7
Tomato	-	-	-	1	1	1

Pepper	-	-	-	2	2	2
B(150g of cowdung						
Cowpea	-	-	2	3	4	6
Soyabean	-	-	2	3	6	6
Tomato	-	-	-	1	1	1
Pepper	-	-	-	1	2	2
C(25g of NPK)						
Cowpea	-	-	3	3	4	4
Soyabean	-	-	3	3	4	5
Tomato	-	-	-	3	3	3
Pepper	-	-	-	2	2	2

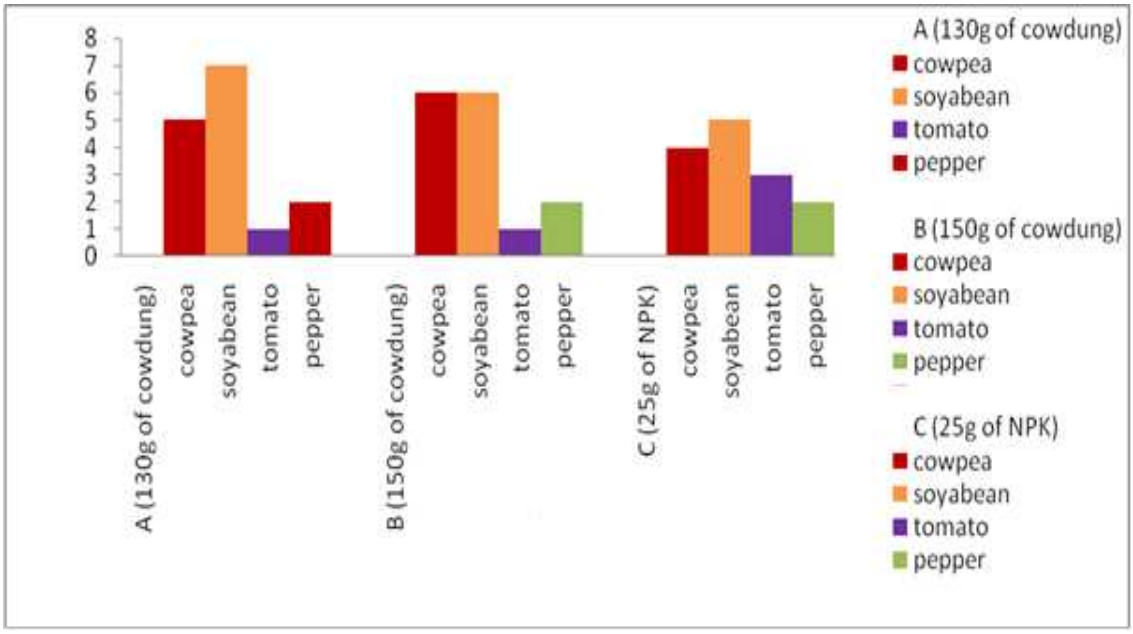

Fig 3: Number of branches with different treatments at 12 weeks after planting

Table 4: Mean Fresh Weight of plants (g) after Experiment

Treatment	**Mean Fresh Weight (g)**
A(130g cowdung)	
Cowpea	46.1
Soybean	50.1
Tomato	13.5
Pepper	14.7
B (150g of cowdung)	
Cowpea	80.0
Soybean	50.5
Tomato	21.1
Pepper	9.2
C (25g of NPK)	
Cowpea	27.1

Soybean	23.7
Tomato	49.6
Pepper	20.6

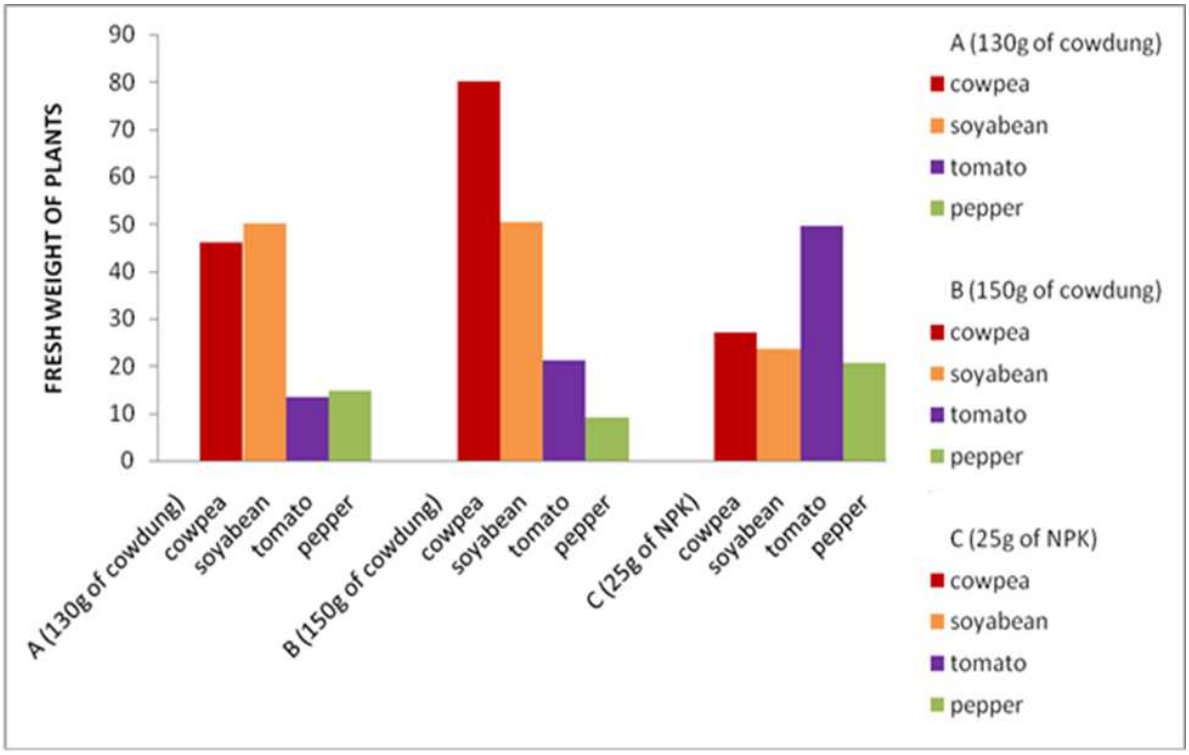

Fig 4: Fresh weight of plant under different treatments after experiment

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