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Effects of Animal Dung (Cattle, Goat and Poultry) on the Growth and Flowering of Three Selected Cowpea [*Vigna unguiculata* (L) Walp] Varieties

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Abstract

The comparative effect of animal dung (cattle, goat and poultry) and inorganic fertilizer (NPK) on the growth performance of three cowpea varieties IT99K-529-2, IT07K-194-3, IT06K-134 was studied in a Completely Randomized Design (CRD) replicated twice. Each replicate contained 18 pots planted to each variety. Growth Performance, plant height, plant spread, number of leaves, percentage germination, seedling vigour, number of branches, stem circumference, leaf size, number of flowers, flower length, trace of diseases and plant performance was taken 3 weeks after planting (WAP) and 2 and 5 weeks after treatment application (WAT). ANOVA revealed that variety had significant effect on number of plants germinated, % germination, number of leaves at 3 weeks after planting, seedling vigour, plant height at 2 and 5 WAT, leaf length, leaf width, plant spread and number of leaves at 5 WAP, day of flowering and flower length. Fertilizer type had significant effect on plant spread 3 WAP, plant height at 2 and 5 WAT, plant spread 5 weeks after treatment and plant performance. Cow dung at the rates of 5 and 7.5 grams gave significantly averagely taller plants ($P \leq 0.05$) at 2 and 5 WATA than other fertilizer types. The effect of variety x fertilizer type interaction significantly ($P \geq 0.05$) influenced plant height 2 WAT, leaf length, leaf width, plant spread at 5 WAT, number of leaves at 5 WATA and day of flowering among the three cowpea varieties. IT99K-529-2 had the highest plant height 2 WAT (31.60 mm) when 7.5 grams was applied, highest plant spread 5 WAT (51.50 mm) and (49.75 mm) when 5 gram and 7.5 gram of cow dung was applied, highest leaf length (17.40) when cow dung + poultry dung at 5 grams was applied, highest leaf width (5.80) when goat dung + poutry dung at 5 grams was applied. IT06K-134 had the highest number of leaves 5 WAT (27.5) when 5 grams of cow dung was applied, and IT07K-194-3 had the highest days to flowering (48.00) when cow dung + poultry dung and cow dung at 5 gram each were applied. IT99K-529-2 showed highest response and greater potential for better productivity than other varieties when cow dung was applied at 5 grams per 79 m^2 (632.91 grams per hectare) and at 7.5 grams per 79 m^2 (949.37 grams per hectare), therefore should be adopted by farmers in Makurdi.

Keywords

Animal Dung, Cowpea Production, Growth Performance

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1. Introduction

One of the basic amenities of man is food. To survive hunger, man has cultivated many food crops including cowpea. Cowpea [*Vigna unguiculata* (L.) Walp] is an important leguminous crop widely cultivated in Nigeria and many other

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countries around the world. It is a legume grown in the savannah region, the tropics and sub-tropics. Cowpea is largely grown in the west and central African countries [1] including Nigeria. The production of cowpea for local consumption and exportation is of great importance. Its world annual production is estimated at 5,249,571 tons of dried grain of which over 64% are produced in Africa [2]. Nigeria produced about 3.5 million tons of cowpea, making it the world largest producer; followed by Niger, 2.3 million tons, Mali 215, 436 tons and Kenya 246, 870 tons [3].

Cowpea and other grain legumes are the essential source of protein for about 700 million people, particularly in developed countries of Latin, America, Asia and Africa [4], Nigeria inclusive where plants provide 83% of total protein in average diet. IITA Crop news [5] reported that Nigeria is the greatest consumer of Cowpea in the whole world. According to Maposse and Nhampalele [6], it is among the top three or four leaf vegetables used in Africa and represent cheaper plant-protein source particularly in areas where food security and malnutrition are the major challenge. It is widely grown in east Africa and south-east Asia, primarily as a leafy vegetable [7] due to its high protein content. Crude protein from seeds and leaves of cowpea range between 23 and 32% and between 13 and 17% respectively [8]. It has been reported that folic acid, and B vitamin necessary during pregnancy to prevent birth defect in the brain and spine content is found in higher quantity in cowpea compared to other plants [9]. In addition to its importance in human food, cowpea is also useful for soil fertilization through symbiotic nitrogen fixation and can be a major animal feed due to its quality leaves [8] and it can also be used as cover crop [10].

Organic fertilizers covers manures made from cattle dung, excreta of other animals, rural and urban waste, composts, other animal wastes, crop residues and green manure [11]. Organic manures are known for their ability to improve the soil physical, chemical and biological properties which can result to better growth and higher crop yield. Adeoye [1] asserted that, the beneficial effects of animal manure on soil physical properties and the ease with which they decompose inside soil are major advantages they have over inorganic fertilizers. Organic manures *viz*., FYM, vermin compost, poultry manure and oilcakes help in the improvement of soil structure, aeration and water holding capacity of soil. Further, it stimulates the activity of microorganisms that makes the plant to get the macro and micro-nutrients through enhanced biological processes, increase nutrient solubility, alter soil salinity, sodicity and pH [12]. Though, they contain relatively low concentrations of nutrients and handling them is labour intensive, there has been large increase in their use over inorganic fertilizers as nutrient source [13]. Therefore, the soil must be 'fed' in a way that the beneficial soil organisms necessary for recycling nutrients and producing humus are not inhibited. In recent times, many people have advocated an integrated approach involving a combination of both organic and inorganic fertilizers. Sharma [14] submitted that, to maintain the soil fertility and to supply plant nutrients in balanced proportion for optimum growth, yield and quality of crop, integrated approach is to be practiced under specific agro-ecological situation through the combined use of inorganic and organic sources of plant nutrients.

Inorganic fertilizers according to Pinell [15] are classified as those fertilizers that are synthesized or mined from non-living materials. Also known as chemical fertilizers, inorganic fertilizers are considered quick-release fertilizers; that is, the rate at which fertilizers release nutrients for the plant to absorb is relatively fast. However, too much application of inorganic fertilizers results to many problems. According to Itelima [16], intensive application of agro-chemicals leads to several agricultural problems and poor cropping systems. Similarly, Agbulu and Elaigwu [17] submitted that, some pesticides and their residues can result in chronic and acute poisoning, carcinogenicity, mutagenicity and reproductive defects.

The Federal government of Nigeria has developed the right step to diversify the country's economy through agriculture. The country is rich with large areas of land for the cultivation of food crops including cowpea. But the practice of continuous cropping, unnecessary tillage and excessive irrigation, leading to soil salination and ground water depletion has led to decline in yield. Also the constant application of inorganic (chemicals) fertilizer to improve crop yield has led to contamination of food crops. This informed the need to study the comparative effect of selected animal dung (cattle, goats and poultry dung) on the growth performance of three (3) selected cowpea varieties in order to minimize the side effect of inorganic fertilizers.

2. Materials and Methods

2.1. Sources of Materials

Cowpea varieties IT99K-529-2, IT07K-194-3 and IT06K-134 were obtained from the gene bank of Molecular Biology Laboratory of Federal University of Agriculture Makurdi (FUAM), Benue State for this study. Animal dung (cattle dung, goat dung and poultry dung) were obtained separately from Livestock and Teaching and Research Farm, FUAM. Inorganic fertilizer (NPK) was obtained from wurukum market Makurdi. The soil used for this potted experiment was obtained from the Botanical garden of the Department of Botany, FUAM.

2.2. Preparation of Soil Sample

The soil collected was air dried and larger aggregates were broken down by gentle crushing with wooden pluck [18]. Each pot was filled with 10 kg of soil and was arranged in a Complete Randomized Design. The three varieties of cowpea were planted at the rate of three seeds per pot. The first irrigation was carried out immediately after planting. Organic manure from animal dung (cattle, goat and poultry dung) collected, were dried and crushed into smaller particles. Animal dung and NPK were applied three (3) weeks after planting at the rate of 5 g and 7.5 g for animal dung and 1.3 g and 2.4 g for NPK 15:15:15 respectively.

2.3. Experimental Design

The experiment was a potted experiment, arranged in a Complete Randomized Design (CRD) consisting of organic manure from animal dung (cattle, goat and poultry), inorganic from NPK and a control block without any treatment. The organic manure was applied singly and in combination. There were 18 pots for each cowpea variety and each of these pots was replicated to give 36 pots per variety making the total number of 108 pots for the three varieties.

Table 1, Represents the treatment combination for Animal dung from cattle, goat and poultry at 5 g/79 m² and 7.5 g/79 m²; Inorganic fertilizer (N PK) at 1.3 g/79 m² and 2.4 g/79 m²; and Control = No inorganic and organic manure (0.0)

Table 1. Treatment Combination and Interpretation.

Treatment combination	Interpretation
CD_X	Cow dung at quantity 5g
CD_Y	Cow dung at quantity 7.5g
GT_X	Goat dung at quantity 5g
GT_Y	Goat dung at quantity 7.5g
PT_X	Poultry dung at quantity 5g
PT_Y	Poultry dung at quantity 7.5g
$C+G_X$	Cow dung + Goat dung at quantity 5g
$C+G_Y$	Cow dung + Goat dung at quantity 7.5g
$C+P_X$	Cow dung + Poultry dung at quantity 5g
$C+P_Y$	Cow dung + Poultry dung at quantity 7.5g
$G+P_X$	Goat dung + Poultry dung at quantity 5g
$G+P_Y$	Goat dung + Poultry dung at quantity 7.5g
$C+G+P_X$	Cow + Goat + Poultry dung at quantity 5g
$C+G+P_Y$	Cow + Goat+ Poultry dung at quantity 7.5g
NPK_X	NPK at quantity 1.3g
NPK_Y	NPK at quantity 2.4g
CTL	0
CTL	0

2.4. Parameters Evaluated

Data were collected three weeks after planting, two and five weeks after treatment application. The following growth performance were evaluated; Number of leaves (NOL), Plant spread (PS), Plant height (PH), Percentage germination (%Ger), Seedling vigor (SV), Stem circumference (SC), Leave width (LW), Leave length (LL), Days to flowering (DTF), Number of flowers (NOF), Flower length.(FL), Number of branches (NOB), Trace of diseases (TOD), Plant performance (PP).

2.5. Data Analysis

The data were expressed as mean + or – standard error of mean (SEM) and were compared using one way Analysis of variance (ANOVA) using Mini Tab 17.0 version. Statistical significance was accepted at $p<0.05$.

3. Results and Discussion

Analysis of variance (Table 2) revealed a highly significant effect of variety on percentage germination, number of leaves at 3 weeks after planting, seedling vigour, plant height at 2 and 5 weeks after treatment application, leaf length, leaf width, plant spread at 5 weeks after treatment application, number of leaves at 5 weeks after treatment application and day of flowering. The Significant differences observed for most measured traits in response to varietal effect shows that inherent genetic variation existed among the cultivars evaluated. Hence, it could be said that a significant genetic difference existed among the three cowpea varieties evaluated, which could be explored for improvement. This agrees with the findings of Agyeman [19] who reported significant differences in plant height, number of stems and number of days to flowering in cowpea, but fails to corroborate with significant variation observed for stem diameter.

Fertilizer type showed highly significant effect on plant spread at 3 weeks after planting, plant height at 2 and 5 weeks after treatment application and plant performance (Table 2). The response of cowpea growth to fertilizer types used in this study could likely be as a resulted of the contribution of these fertilizer types to soil organic matter. According to Nwokwu [20] soil organic matter is a major contributor to agricultural production in Africa and it influences soil properties and consequently plant growth. Ahmed and Elzaawely [21] reported from their study that, application of chicken manure combined with cattle manure or pigeon manure combined with chicken manure, cattle manure or rabbit manure was superior and significantly increased plant height, number of leaves, number of branches, leaf area, number of pods, seed index and seeds total yield. They also stated that organic manures could be used as safe, cheap and environmentally-friendly substitutes to mineral fertilizers. This position is supported by Bartwal and Patel [22], who reported from their investigation that response of cowpea growth attributes and yield and yield components to chemical fertilizers and manure was

significant and at par. The use of organic manures could potentially boost the production capacity of resource disadvantage farmers who are the major producers of cowpea. This could also have practical implications for field production in the light of the negative impact on soil and environment of prolonged use of chemical fertilizers.

Variety x fertilizer type interaction had significant effect only on plant spread at 5 weeks after planting. This implies that influence of fertilizer type on traits evaluated was independent of cowpea variety. This shows that the observed variation was a direct outcome of the inherent genetic potential of the cowpea varieties evaluated and the positive influence of the fertilizer types.

Varietal main effect was significant for germination percentage, number of leaves at 3 weeks after planting, seedling vigour, plant height at 2 and 5 weeks after treatment application, leaf length and width, plant spread at 5 weeks after treatment application and day of flowering, with varying performance of these traits among the three cowpea genotypes evaluated as shown in Table 3.

Varieties (IT07K-194-3 and IT06K-134) performed better in terms of seed emergence (78.70% and 75.00% respectively. With variety IT99K-529-2 recording poor seed germination at 55.55% (Table 3). Significant varied percentage seed germination has been reported by some authors [23, 24, 25]. Poor seed germination in agriculture has been implicated as a major constraint to increased productivity. The finding of this study confirms the report of Wada and Abubakar [23] who studied germination among some varieties of cowpea in Northern Nigeria with observable variation in seed germination. Thus suggesting that the delayed radical emergence observed in some seed of Sampea-6 and Sampea-12 could be attributed to differences in the composition of seed cotyledon and hardness of seed testa. He also observed that varietal difference in emergence may be related to difference in seed size.

The Variation in seedling vigor observed, agrees with the research of Ajala [26], who examined the variability for seedling vigor in 10 Nigerian tropical cowpea varieties and reported the presence of significant difference. As indicated by ISTA [27] seed size could be responsible for variation in seedling vigor which is usually influenced by a higher electrical conductivity.

As indicated in Table 3, the significant differences in the number of leaves counted after five weeks of treatment application (5WAT) shows that varieties IT99K-529-2 and IT07K-194-3 produced fewer numbers of leaves (17.00 and 14.00 respectively) when compared to the relatively higher number of leaves produced in variety IT06K-134 (23:00) at five weeks after treatment application (5WAT). The reverse was however observed for leaf width as reduced leaf width was recorded for variety IT06K-134 with more number of leaves. These varieties (IT99K-529-2 and IT07K-194-3) could however compensate for the amount of photosynthesis through their increased leaf width.

The study also shows that difference in flowering time was significant among the varieties evaluated. Variety IT06K-134 showed earliness in flowering time (34.00) compared to the relatively late flowering time observed for variety IT99K-529-2 and IT07K-194-3 (46.00 and 40.00 respectively). Early flowering time in plants cowpea is known to be an indication for earliness. Hence variety IT06K-134 possess genetic potential for an important attribute which points to earliness.

Main effect of fertilizer type was significant for plant spread at 3 weeks after planting, plant height at 2 and 5 weeks after treatment application and plant performance, with varying performance of these traits among the fertilizer types evaluated as shown in Table 4. Itelima [16] studied the effect of various manure types and reported significant responses in growth and yield characters of cowpea such as plant height, leaf area and stem circumference. Also, from the report of Joshi [28], different organic manure treatments had significant influence on the growth attributes of cowpea such as plant height, plant spread, leaf area index and dry weight of the root nodules per plant.

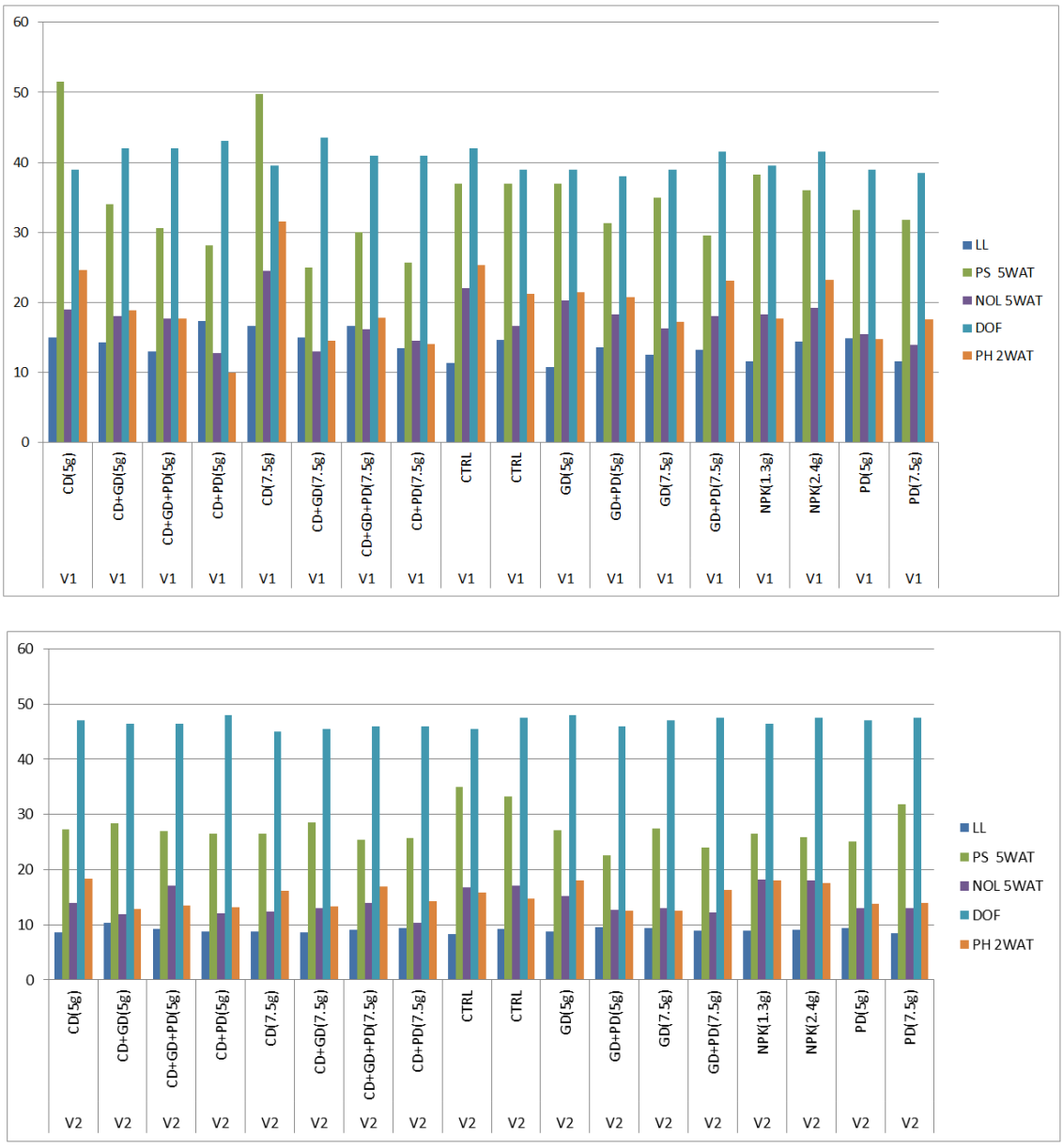
The beneficial effects of organic fertilizers on growth attributes of cowpea were noticeable in this study as reflected by the differential impact of organic fertilizers, inorganic fertilizer and control in Table 4, thus providing evidence about the possibility of using organic manures for cowpea production [21]. Organic fertilizers offers a better option for the growth and yield of cowpea and will help in reducing the use of agrochemical, and also help to maintain soil fertility and strength [16]. Hence, organic manures could be used as safe, cheap and environmentally friendly substitutes to inorganic fertilizers.

At two and five weeks after treatment application, the plant height of cowpea supplied with only cow dung manure at the rate of either 5 grams or 7.5 grams were higher and statistically taller than plant height produced with either a combination of cow dung + poultry dropping manure at the rate of 5 grams or a combination of cow dung + goat dung manure at the rate of 7.5 grams. The findings of the study shows that cow dung manure in sole applications are favourable for cowpea growth. But are however not favourable for cowpea growth when in combination with either poultry dropping manure at the rate of 5 grams or with goat dung manure at the rate of 7.5 grams. Similarly, at five weeks after treatment application (5WAT), the significantly taller plants observed when only cow dung manure at the rate of either 5 grams or 7.5 grams was applied

were better than plant heights obtained from control plots as well as when inorganic fertilizers was applied (Table 4). Joshi [28] attributed significant differences in plant height to availability of nutrients from inorganic sources and favourable conditions created in uptake of plant nutrients by the crop.

Table 4 also shows that the response of cowpea to organic and inorganic fertilizer application observed in plant spread at five weeks after planting (5WAP) followed similar trend. The application of cow dung manure at the rate of 5 gram and 7.5 gram both recorded the highest plant spread, while lower plant spreads were obtained for combined application of cow dung + poultry dropping manures. This corroborates with the findings of Ahmed [21] who reported significant variation in plant height and plant spread of cowpea.

Interaction of variety x fertilizer type had significant effect on leaf length, plant spread at 5 weeks after treatment application, number of leaves at 5 weeks after treatment application, day of flowering and plant height 2 weeks after treatment application among the three cowpea varieties. This implies that the response these parameters were due to the interplay of variety and fertilizer factors in combination. Variety IT99K-529-2 (V1) and IT06K-134 (V3) generally produced the best record of the above parameters when cow dung manure at the rate of 5 grams and 7.5 grams were applied (Figure 1). On the other hand, variety IT07K-194-3 produced the best record of the above parameters in the control (Figure 1). This suggests that different cowpea varieties will respond differently to application of different fertilizer types at different rates. This observation is supported by the fact that different researchers have recommended different rates and fertilizer types in their reports.



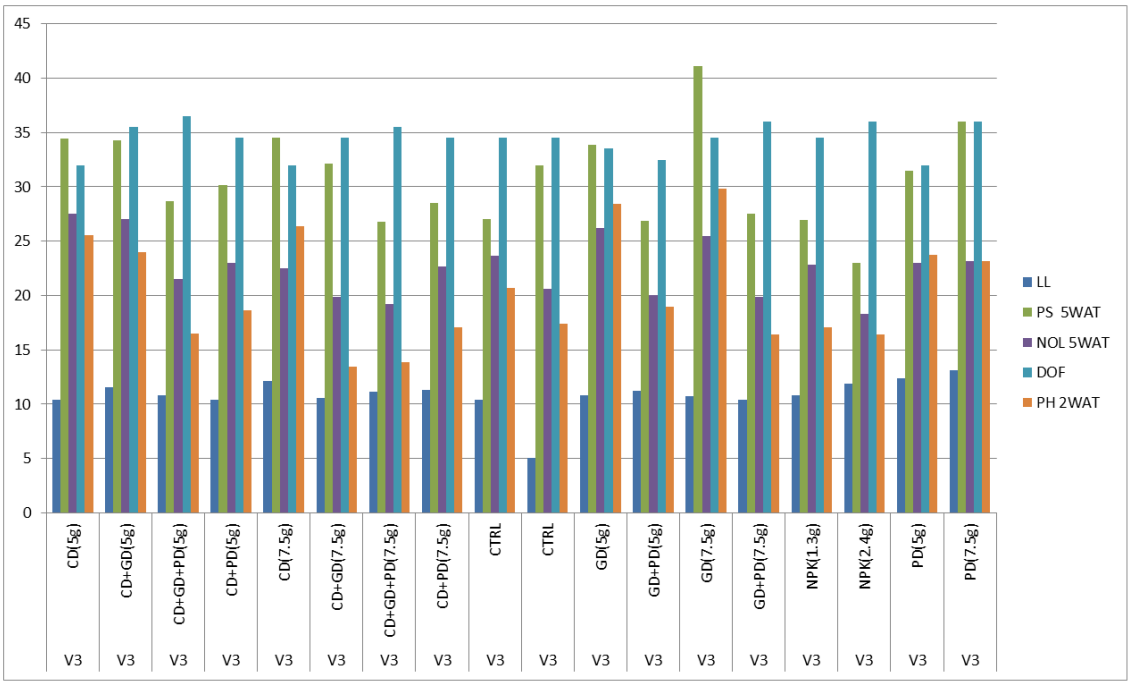


Figure 1. Interaction effect of variety x fertilizer on some growth parameters of IT06K-134 supplied with organic and inorganic fertilizers.

Table 2. Mean squares from Analysis of Variance for growth parameters of cowpea in response to organic and inorganic fertilizers.

SOV	Df	%G	NOL (3WAP)	PS (3WAP)	PH (3WAP)	SV (3WAP)	PH (2WAT)	PH (5WAT)	SC
Replicate	1	370.30	25.42	158.66	9.78	0.30	57.79	17.52	0.17
Variety	2	5566.60**	89.59**	87.49^{ns}	0.52^{ns}	91.78**	295.06**	170.75**	0.04^{ns}
Fertilizer type	17	658.50^{ns}	6.00^{ns}	63.45**	1.44^{ns}	15.84^{ns}	53.70**	35.62**	0.30^{ns}
Variety/fertilizer type	34	489.60^{ns}	8.4l^{ns}	26.75^{ns}	3.14^{ns}	13.35^{ns}	27.45*	22.86^{ns}	0.18^{ns}
Error	53	496.20	5.13	31.00	3.51	18.15	17.62	17.56	0.66
Total	107								

(P= 5.01, P< 0.05). NOG=Number of germinated; %G= percentage germination; NOL= Number of leaves; PS= Plant spread; PH= Plant height; SV= Seedling vigor; SC= Stem circumference; (3WAP) = 3 weeks after planting; 2WAT= 2 Weeks after treatment; 5WAT= 5 Weeks after treatment.

Table 2. Continued.

SOV	Df	LL	LW	PS 5WAT	NOL 5WAT	DOF	NOF	NOB	TOD	PP
Replicate	1	36.17	0.82	176.84	126.10	5.79	0.00	0.52	0.33	0.15
Variety	2	218.88**	5.79**	447.81**	660.86**	1362.95**	0.58^{ns}	9.29^{ns}	0.06^{ns}	0.12^{ns}
Fertilizer type	17	4.24^{ns}	0.38^{ns}	73.32**	18.01^{ns}	5.58^{ns}	0.37^{ns}	1.36^{ns}	0.55^{ns}	0.70**
Variety x fertilizer type	34	4.41*	0.40^{ns}	42.17**	13.05*	2.96*	0.36^{ns}	2.05^{ns}	0.27^{ns}	0.40^{ns}
Error	53	4.43	0.50	22.92	13.18	3.92	0.36	5.70	0.26	0.39
Total	107									

* = Significant at P< 0.05. ** = Significant at P< 0.001. ns= Not significant.. LL= Leave length; LW= Leave weight; DOF = Day of flowering; NOF = Number of Flowers; FL= Flower length; NOB= Number of branches; TOD = Trace of diseases; PP= Plant performance.

Table 3. Main effect of variety on the growth parameters of cowpea supplied with organic and inorganic fertilizers.

Variety	%Ger 3WAP	NOL 3WAP	SV 3WAP	PH 2WAT	PH 5WAT	LL	LW	PS 5WAT	NOL 5WAT	DOF
IT99K-529-2	55.55 ^{b}	8.00 ^{b}	7.34 ^{b}	19.52 ^{a}	26.42 ^{a}	13.90 ^{a}	3.82 ^{a}	34.48 ^{a}	17.00 ^{b}	40.00 ^{b}
IT07K-194-3	78.70 ^{a}	7.00 ^{c}	10.39 ^{a}	15.08 ^{b}	22.57 ^{b}	9.02 ^{b}	3.84 ^{a}	27.43 ^{c}	14.00 ^{c}	46.00 ^{a}
IT06K-134	75.00 ^{a}	10.00 ^{a}	9.66 ^{ab}	20.43 ^{a}	26.26 ^{a}	10.85 ^{b}	3.14 ^{b}	30.85 ^{b}	23.00 ^{a}	34.00 ^{c}

Means within a column with similar alphabets are not statistically different at 95 % probability level.

Table 4. Main effect of organic and inorganic fertilizers some growth parameters of three selected cowpea varieties.

Fertilizer Type	PS 3WAP	PH 2WAT	PH 5WAT	PS 5WAT	PP
CD (5g)	21.55 ^{ab}	22.85 ^{ab}	29.12 ^{ab}	37.73 ^{a}	1.83 ^{ab}
CD+GD (5g)	15.63 ^{ab}	18.58 ^{abcd}	26.12 ^{abcde}	32.20 ^{abc}	1.67 ^{ab}
CD+GD+PD (5g)	16.25 ^{ab}	15.88 ^{abcd}	23.28 ^{de}	28.73 ^{abc}	1.50 ^{ab}
CD+PD (5g)	15.00 ^{ab}	13.88 ^{cd}	21.98 ^{e}	28.27 ^{abc}	1.17 ^{ab}
CD (7.5g)	20.05 ^{ab}	24.72 ^{a}	30.53 ^{a}	36.93 ^{ab}	2.00 ^{a}
CD+GD (7.5g)	13.13 ^{b}	13.73 ^{d}	22.07 ^{e}	28.53 ^{abc}	0.67 ^{b}
CD+GD+PD (7.5g)	16.80 ^{ab}	16.17 ^{abcd}	23.60 ^{de}	27.37 ^{bc}	1.50 ^{ab}
CD+PD (7.5g)	16.08 ^{ab}	15.13 ^{bcd}	23.02 ^{de}	26.63 ^{c}	1.33 ^{ab}
CTRL	24.07 ^{ab}	20.58 ^{abcd}	27.20 ^{abcd}	33.00 ^{abc}	1.67 ^{ab}
CTRL	25.15 ^{a}	17.75 ^{abcd}	25.30 ^{bcde}	34.05 ^{abc}	1.67 ^{ab}
GD (5g)	17.07 ^{ab}	22.62 ^{abc}	28.50 ^{abc}	32.65 ^{abc}	1.67 ^{ab}
GD+PD (5g)	20.58 ^{ab}	17.40 ^{abcd}	24.12 ^{cde}	26.90 ^{bc}	1.33 ^{ab}
GD (7.5g)	16.38 ^{ab}	19.88 ^{abcd}	26.00 ^{abcde}	34.53 ^{abc}	1.50 ^{ab}
GD+PD (7.5g)	15.48 ^{ab}	18.62 ^{abcd}	23.28 ^{de}	27.02 ^{bc}	1.00 ^{ab}
NPK (1.3g)	19.00 ^{ab}	17.60 ^{abcd}	24.25 ^{cde}	30.57 ^{abc}	1.83 ^{ab}
NPK (2.4g)	16.80 ^{ab}	19.05 ^{abcd}	24.67 ^{cde}	28.28 ^{abc}	1.67 ^{ab}
PD (5g)	14.95 ^{ab}	17.40 ^{abcd}	23.25 ^{de}	29.88 ^{abc}	1.00 ^{ab}
PD (7.5g)	17.10 ^{ab}	18.25 ^{abcd}	25.20 ^{bcde}	33.22 ^{abc}	1.33 ^{ab}

Means within a column with similar alphabets are not statistically different at 95 % probability level.

4. Conclusion

The findings of this study revealed that application of animal dung as an alternative to inorganic fertilizers showed significant influence on growth and yield characters of cowpea such as, plant height, plant spread, number of leaves and day of flowering. Hence, organic fertilizers can be an appropriate treatment to stimulate cowpea growth response.

However, cow dung when applied singly was more favourable to cowpea growth than when combined with other animal dung such as goat and poultry dung. Also, the response of leaf length, number of leaves, day of flowering, plant height, and higher plant spread observed in variety IT99K-529-2 to cow dung manure application at the rate of 5 grams per 79 m^2 (632.91 grams per hectare), followed by 7.5 grams per 79 m^2 (949.37 grams per hectare), makes this variety outstanding and a potential for better cowpea growth stimulation.

Therefore, the application of animal dung, especially cow dung, at the rate of 632.91 grams per hectare or 949.37 grams per hectare should be adopted by farmers in Makurdi for cultivation of cowpea as alternative to inorganic fertilizers application.

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