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Varietal responses of pigeon pea (*Cajanus cajan* (L.) Millsp.) to application of compost

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Abstract

Compost use is one of the most important factors, which contribute to increased productivity and sustainable agriculture. The study was carried out at the screen house of the Institute of Agriculture Research and Training (I.A.R&T), Ibadan to evaluate the effects of different levels of compost fertilizer on the growth and yield on three varieties of pigeon pea; A-NSWCC 24, B-NSWCC 29A and C-NSWCC 34D). Compost (Poultry manure + Mexican Sun flower) was applied in 0 tha^{-1}, 5 tha^{-1}, 10 $tha^{-1}$and 15 tha^{-1}. Growth data were collected based on days to flowering, 50% and 100 % flowering, plant height, stem height, number of leaves and stem diameter. Yield parameters were collected based on pod length, number of seeds per pod, pod weight, grain yield kg ha^{-1}, 100 seed mass (g) were sampled when the pods were matured. All data collected were subjected to Analysis of Variance using Genstat statistical package (2013) and treatment means separated using Least Significant Difference (LSD) at P=0.05. The result obtained showed the highest mean number of leaves was obtained in the compost 5 tha^{-1}on variety A (272.33) leaves. From the result considering grain weight, seed weight harvested/plot, 100 seed weight, number of seeds/pod and days to flowering the sorting order results indicated that the best mean performance was obtained in 15 tha^{-1} compost application on variety A. The application of the compost has significant effect on the three varieties and therefore can be recommended for cultivation of pigeon pea.

Keywords: Crop, Fertilizer Nutrient Soil fertility and yield

Introduction

The world population is growing at an astronomical rate and to feed this population; agricultural productivity must also increase at the same rate. This however demands that we develop different strategies and look inward in order to increase food production in the face of different environmental challenges. One of the strategies being proposed is utilization of leguminous crop species majority of which are underutilized or already going into extinction. Example is the pigeon pea (*Cajanus cajan)* a leguminous crop that has been reported to be drought resistant and of high yield.

Legumes are nutritious foods which are a good substitute for animal proteins (Adebowale and Maliki, 2011). Dry beans, peas, soya beans, groundnuts, chick peas, pigeon peas, lintels, mung beans and cowpeas are among some of the most consumed legume crops in the world. Legumes are regarded as important supplements of cereal-based foods and cheap sources of proteins (Ramakrisna et al., 2006; Pratap and Kumar, 2011). With very high protein content, legumes are of high importance in eliminating protein malnutrition.

Pigeon pea *Cajanus Cajan* (L.) Millsp. (Leguminosae) known as *fiofio* in Igbo, *otiili* in Yoruba and pigeon pea in English (Aiyeloja and Bello, 2006). It is native to India which is the world's largest producer. It is also grown in Africa and the Americas, and has been suggested to be one of Africa's drought-tolerant crops referred to as orphan crop because it falls into the group of least researched crops world-wide (Odeny, 2007). It is one of the most common tropical and subtropical legumes cultivated for its edible seeds. Pigeon pea is fast growing, hardy, widely adaptable, and drought resistant Bekele-Tessema, (2007). Because of its drought resistance it can be considered of utmost importance for food security in areas where rainfall is not reliable and droughts are likely to occur (Crop Trust, (2014). At the end of the dry season, pigeon pea provides green forage of outstanding value when other forages are not available Sloan *et al.,* (2009).

The plant is an important food legume in Nigeria. The crop is predominantly grown in the guinea savannah agro ecological zone usually in mixture with cassava, maize, yam, and sorghum Egbe and Kalu, (2006). It is an important component of traditional farming systems with its fodder having forage potential for domestic livestock during the critical dry months of December to May. The seeds and pods are consumed in many households as vegetable and also used as flour additives in soups and rice. It is an excellent food and protein source in developing tropical countries (CNCPP, 2002); Kwame, 2003). The crop is a multi-purpose leguminous crop that plays important role in food security, maintenance of soil fertility through litter fall and nitrogen fixation, provision of fodder for livestock and fuel for small-scale farmers in subsistence-agriculture Egbe and Kalu, (2006). The crop has ability to fix 41 to 250 kg ha-1 of nitrogen through symbiotic association between the root nodules and a species of bacteria, *Rhizobia* Kwame, (2003).

The production of pigeon pea in Nigeria is very important considering its economic importance and ability to enrich the fertility status of the soil. In addition, most soils on which the farmers grow their crop are low in fertility, to this end; increase in production of Pigeon pea could be achieved through fertilizers application. It is expected that the use of different organic amendments which will increase the growth and yield of pigeon pea will in turn encourage the production of pigeon pea and enhance food security.

Soil fertility maintenance is very essential in achieving and maintaining high crop yields over a period of time. There is need to apply fertilizers to maintain soil fertility. Fertilizer is an important input that contributes to crop production. It increases the productivity of the soil for plant growth and improves the quantity and quality of produce. Fertilizer can either be organic or inorganic. Before the introduction of inorganic fertilizers, organic fertilizers, particularly animal manures, crop residues, green manure and composts, were practically the only source of nutrients for crop production

Compost use is one of the most important factors, which contribute to increased productivity and sustainable agriculture. In addition, compost can solve the problem faced on farmers with decreasing fertility of their soil. Due to soil fertility problems, crops returns often decrease and the crops are more susceptible to pest and disease because they are in bad condition (Madeleine *et al*. 2005), Compost consists of the relatively stable decomposed organic materials resulting from the accelerated biological degradation of organic materials under controlled, aerobic conditions (Paulin and Peter, 2008).

Aim of this investigation is to evaluate the effects of different levels of compost fertilizer on the growth and yield on three varieties of pigeon pea

Materials and Methods

The study was carried out at the screen house of the Institute of Agriculture Research and Training (I.A.R&T), Ibadan, located on Derived Savannah Latitude 07^{o} 22^{1} 29.7$^{11'}$N and Longitude E003^{0} 50^{1}.18.2$^{11''}$E altitude 195m above sea level). Soil samples were collected at 0-30cm depth from the experimental field (Teaching Research stations of the Institute of Agriculture Research and Training (I.A.R&T) at Ibadan. The soils were air dried and sieved with 2mm sieve, and properly mixed to ensure homogeneity while composite samples were selected for the physical and chemical analyses in the laboratory.

Planting operation

Three varieties of pigeon pea were used (A) NSWCC 24 (B) NSWCC 29A (C) NSWCC 34D acquired from Grain Legume Improvement Programme IAR&T Ibadan. 25kg of soil was filled into each polythene bag with space at the top to make allowance for watering and the polythene bag perforated at the bottom to enhance soil aeration and leaching of excess water. Compost (Poultry manure + Mexican Sun flower) was mixed with the soil in each polythene bag two weeks before sowing the seeds. Two seeds of Pigeon pea were sowed and thinned to one plant per polythene bag after two weeks.

Factorial experiment fitted in to Complete Randomized Design (CRD) which involves three (3) varieties of pigeon pea, compost fertilizer, three (3) application rate and control. Four replicate times was chosen, resulting to a total of forty-eight (48) polythene bag. The compost applications were in 0 tha^{-1}, 5 tha^{-1}, 10 tha^{-1}and 15 tha^{-1}.

Growth data were collected at vegetative stage (pre-flowering/flowering and post anthesis on flowering stage**:** days to flowering was collected when the plants attained 50% and 100 % flowering, while plant height, plant height, stem height, number of leaves and stem diameter.–Yield parameters were collected on pod length, number of seeds pod-1, pod weight, grain yield kg ha-1, 100 seed mass (g) were sampled when the pods were matured.

All data collected were subjected to Analysis of Variance using Genstat Statistical Package (2013). Treatment means separation was analyzed using Least Significant Difference (LSD) at P=0.05.

Treatment code

Variety A = NSWCC 24
Variety B = NSWCC 29A
Variety C = NSWCC 34D
TACOMP1 = Treatment on Variety A Compost at 5 tha^{-1}
TACOMP2 = Treatment on Variety A Compost at 10 tha^{-1}
TACOMP3 = Treatment on Variety A Compost at 15 tha^{-1}
TACONT = Treatment on Variety A Control
TBCOMP1 = Treatment on Variety B Compost at 5 tha^{-1}
TBCOMP2 = Treatment on Variety B Compost at 10 tha^{-1}
TBCOMP3 = Treatment on Variety B Compost at 15 tha^{-1}
TBCONT = Treatment on Variety B Control
TCCOMP1 = Treatment on Variety C Compost at 5 tha^{-1}
TCCOMP2 = Treatment on Variety C Compost at 10 tha^{-1}
TCCOMP3 = Treatment on Variety C Compost at 15 tha^{-1}
TCCONT = Treatment on Variety C Control

Results and Discussion

The pre planting soil physicochemical analysis showed that the soil pH is slightly acidic at 6.21 with a very high percentage of sand. This soil showed a sandy clay soil property. The essential nutrient estimates are nitrogen

(0.09%), phosphorus (8.17) and potassium (0.42 Cmol/kg). For the compost analysis, the essential nutrients are nitrogen (1.92%), phosphorus (7.84) and potassium (6.82). The compost have higher values of magnesium, potassium, sodium, total nitrogen and total organic carbon. The results of this study were in agreement with the results of several studies that have shown organic manure treatment increased soil pH, but chemical fertilizer treatments, such as NPK fertilizer, decreased soil pH (Warren and Fonteno 1993; Whalen *et al.* 2000; Liu *et al.* 2010).

The mean of stem height of three varieties of pigeon pea as affected by the three levels of compost application is shown in Figure 1. The result obtained showed steady progression of increase in the stem height. At week 10, the control variety A had the highest mean of 198.33cm. Also, the application of compost at 10 tha^{-1} 2 and 3 on variety B and C having 193.33cm and 186.67cm respectively were also having high means of stem height. The least mean was recorded in compost1 application on variety A and B having 161.67cm and 154.33cm respectively.

The mean number of leaves of three varieties of pigeon pea as affected by compost application was shown in Figure 2. There was an increase as the weeks progressed. At week 10, the least mean number of leaves (160.33) was recorded with the compost 2 application on variety of C, while the highest mean number of leaves (272.33) was obtained in the compost 10 tha^{-1} application on variety A. The mean stem diameter of three varieties of pigeon pea as affected by compost application was shown in Figure 4. The result showed that there was an increase as the weeks progressed. At week 10, the lowest mean stem diameter (12.67mm) was produced in variety C with the application on compost 10 tha^{-1}, while the highest mean stem diameter (15.67mm) was recorded in variety C control.

The mean leaf area of three varieties of pigeon pea as affected by compost application was shown in Figure 3. The result showed that there was no steady increase as the weeks progressed. The least mean (29.89cm^2) was obtained at variety C on control having, while the highest mean (46.53cm^2) was recorded in variety B with compost 15 tha^{-1} at week 10.

The results on the yield components for the three varieties of pigeon pea as affected by compost application showed there was a significant response in the pod weight /plant, pod length, grain weight, 100-seed weight and seed weight harvested/plot. However, there was no significant response of the assayed varieties to the compost application in terms of number of seed/pod, days to flowering, days to 50% flowering, days to 100% flowering and days to podding. From these results in view of the grain weight, seed weight harvested/plot, 100 seed weight, number of seeds/pod and days to flowering, the sorting order results indicated that compost 1 on variety B and compost 2 on the three varieties were sorted lower than the control application on the three varieties, while the best mean performance was obtained in compost 3 application on variety A.

Conclusion

The results of the study proved to have significant effect on the three varieties of pigeon pea. Compost 5 tha^{-1} and 15 tha^{-1} significantly showed highest yield response. The implication for crop improvement during cultivation of pigeon pea is imperative therefore. These can be recommended for growing other crops.

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Conflict of Interests

The authors declare no conflict of interests

Tables, Figures and Charts

Table 1: Physical and Chemical Analysis for Pre planting Soil and Dried Compost

Parameters	Soil	Dried compost
pH	6.21	
Sand%	91.2	
Silt %	4.2	
Clay	4.6	
ECEC	10.86	
Base salt	98.9	
Calcium Cmol/ kg	7.8	0.43
Magnesium Cmol/ kg	1.72	11.87
Potassium Cmol/ kg	0.42	6.8
Sodium Cmol/ kg	0.8	14.8
Acidity Cmol/kg	0.6	
Manganese mg/g	91.9	16
Iron mg/g	20.9	9.73
Copper mg/g	3.25	75
Zinc mg/g	7.03	2.05
Total Nitrogen %	0.09	1.92
Total Organic Carbon %	1.25	16.7
Av. Phosphorus	8.17	7.84

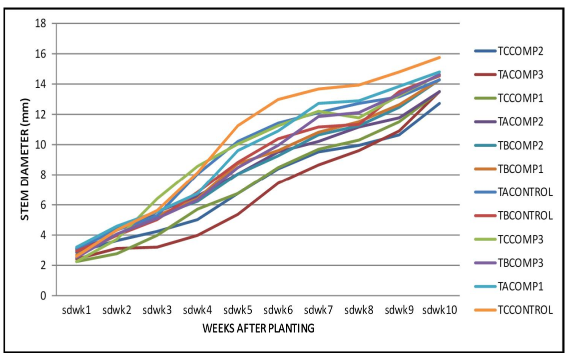

Figure 1: Mean stem diameter (mm) of three varieties of pigeon pea as affected by compost application

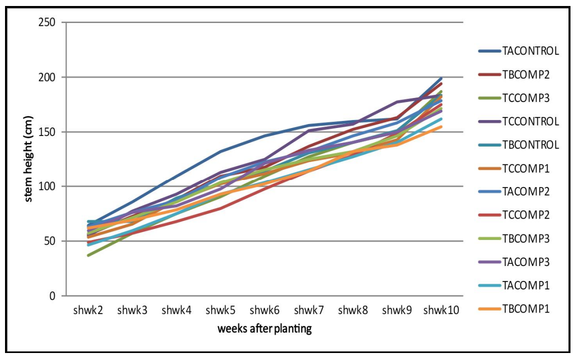

Figure 2: Mean stem height (cm) of three varieties of pigeon pea as affected by compost application

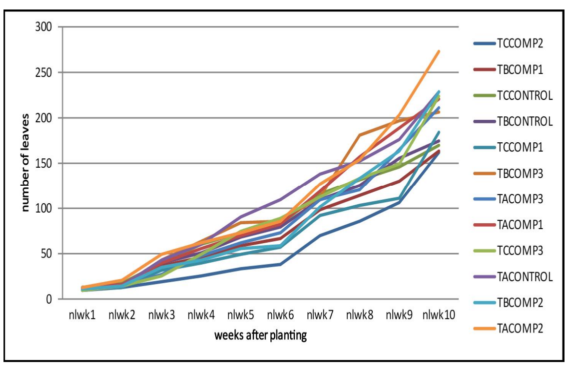

Figure 3: Mean number of leaves of three varieties of pigeon pea as affected by compost application

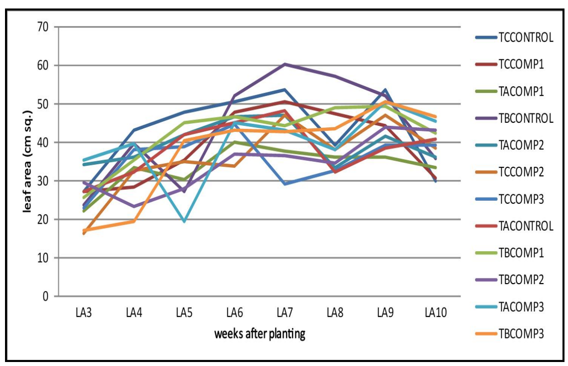

Figure 4: Mean leaf area of three varieties of pigeon pea as affected by compost application

Table 2: Mean of days to flowering, days to 50% flowering, days to 100% flowering and days to podding of three varieties of pigeon pea as affected by compost application

Variety	treatments	DAYs to FLOWERing	Days to 50% flowering	Days to 100% flowering	DAYs OF PODDING
A	COMP1	130.00a	134.50a	145.00a	177.50a
	COMP2	133.50a	138.50a	145.00a	170.00a
	COMP3	125.00a	135.00a	148.00a	172.50a
	CONTROL	128.00a	138.50a	143.50a	172.50a
B	COMP1	128.00a	136.00a	156.50a	180.00a
	COMP2	121.50a	135.00a	150.00a	175.00a
	COMP3	132.00a	141.50a	150.00a	172.50a
	CONTROL	131.50a	140.00a	152.50a	173.00a
C	COMP1	141.00a	153.00a	160.50a	174.00a
	COMP2	140.50a	146.50a	155.00a	177.50a
	COMP3	138.00a	147.50a	155.00a	172.50a
	CONTROL	124.00a	138.00a	154.50a	175.00a

Means with the same letters are not significantly different at 5% level of probability.

Table 3: Mean of harvestable yield components of three varieties of pigeon pea as affected by compost application

var	Trt	pod weight per/plt	pod length per plant	No of seed per pod	Grain weight	100 seed weight per/plant	Seed weight per rep
A	COMP1	39.63 ab	5.93ab	4.13a	30.73ab	9.13cd	122.93ab
	COMP2	19.40 b	5.43b	4.00a	14.50c	9.97bcd	58.00c
	COMP3	40.13 ab	5.83ab	4.67a	33.33a	11.43ab	133.33a
	CONTL	18.93 b	4.93b	3.67a	16.60c	8.57d	66.40c
B	COMP1	26.53ab	5.53b	4.33a	12.53c	9.00cd	50.13c
	COMP2	32.17ab	5.23b	4.33a	13.83c	10.37abcd	55.33c
	COMP3	42.67ab	7.10a	4.67a	22.93abc	9.67bcd	91.73abc
	CONTL	25.20ab	4.63b	4.00a	16.70c	8.37d	66.80c
C	COMP1	46.07ab	5.03b	4.00a	20.73abc	12.47a	82.93abc
	COMP2	30.40ab	5.30b	4.67a	12.63c	8.27d	50.53c
	COMP3	58.93a	5.50b	4.33a	25.60abc	10.87abc	102.40abc
	CONTL	31.83ab	4.67b	4.00a	17.26bc	9.77bcd	69.07bc

Means with the same letters are not significantly different at 5% level of probability.

References

Adebowale OJ and Maliki K (2011). Effect of Fermentation Period on the Chemical Composition and Functional Properties of Pigeon pea Seed Flour. *International Research Journal* 18:1329-1333.

Aiyeloja AA and Bello OA (2006). Ethno botanical Potentials of Common Herbs in Nigeria: A case study of Enugu State. *Educational Research and Review* 1: 16–22.

Bekele -Tessema A (2007). Profitable Agroforestry Innovations for Eastern Africa: Experience from 10 agro Climatic Zones of Ethiopia, India, Kenya, Tanzania and Uganda. World Agroforestry Centre (ICRAF), Eastern Africa Region

CNCCP (2002). Centre for New Crops and Plant products. *Cajanus cajan* (L) Millsp. Purdue University http:// www.hort.purdue.edu/new Crop/duke – energy/cajanus.html

Crop Trust (2014). Pigeon Pea: Food for Drought. www.croptrust.org

Egbe OM and Kalu BA (2006). Farming system study: Participatory Rural Appraisal of Pigeon pea cropping systems in Southern Guinea Savanna of Nigeria. J. of Environ. (Abia State University Environmental Review). 5(1): 37-47.

Kwame FP (2003). Correlation and Path Coefficient Analysis of Yield and Yield Components in Pigeon pea. *Pakistan J. Bio. Sci* 6 (19): 1689- 1694.

Liu E, Yan C, Mei X, He W, Bing SH, Ding L, Liu Q, Liu S and Fan T. (2010). Long-term Effect of Chemical Fertilizer, Straw, and Manure on Soil Chemical and Biological Properties in Northwest China. *Geoderma* 158 (3):173–180.

Madeleine I, Peter S, Tim T and Tom V (2005). The Preparation and Use of Compost.Agrodok no. 8. Agromisa Foundation, Wagenningen.

Odeny DA (2007). The Potential of Pigeon pea (*Cajanus cajan* (L.) Millsp.) in Africa. *Natural Resources Forum,* 31: 297-305.

Paulin B and Peter OM (2008). Compost Production and Use in Horticulture. *Western Australian Agri. Authority, Bulletin* 4746. [Online] Available: www.agric.wa.gov.au (Nov. 2013).

Ramakrisna V, Rani P and Roa PR (2006). Anti-nutritional factors during germination in Indian bean seeds. *World Dairy and Food Sciences J*. 1:06-11.

Sloan J, Heiholt J, Iyer H, Metz S, Phatak S, Rao S and Ware D (2009). Pigeon pea: A multipurpose, Drought Resistant Forage, Grain and Vegetable Crop for Sustainable Southern Farms. 2009 Annual Report, *SARE Research and Education Project*.

Warren SL and Fonteno WC (1993). Changes in physical and chemical properties of a loamy sand soil when amended with composted poultry litter. *J Environ Hortic*. 11:186–190.

Whalen JK, Chang C, Clayton GW and Carefoot JP (2000). Cattle manure amendments can increase the pH of acid soils. *Soil Sci Soc Am J*. 64(3):962–966.