

## EFFECTS OF PIG DUNG AND POULTRY MANURE WITH PLANT RESIDUE IN THE PRODUCTION OF SOME LEAFY VEGETABLES

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Accepted 6<sup>th</sup> September, 2013

### ABSTRACT

A field experiment was conducted at the organic farm unit where two types of compost heaps were made, one of pig dung (CPD) while other of poultry manure (CPM) which were to be used as soil amendment on soil sown to two leafy vegetables with no-amendment treatment (NOA). A plot unit size of 2m by 2m were cultivated on three treatment levels replicated thrice to make the total plot number of 18 plots unit. These composts types were applied two weeks before planting by dibbling and their effect on growth parameter were recorded at 2WAP, 3WAP, 4WAP and 5WAP with their microbial biomass/ population respectively.

At the end of the experiment it was observed that the use of composted pig dung (CPD) on *Amaranthus* is better among the treatments based on the performance on parameters considered, though the use of composted poultry manure (CPM) was also good when compared with no-amended treatment (NOA).

**KEYWORDS:** pig dung, poultry manure, plant residue, leafy vegetables, microbial biomass

### INTRODUCTION

In many developing countries, subsistence crops are almost entirely neglected while valuable cash crops are efficiently cultivated, harvested, graded and protected against rat, insects, and decay. If equal attention were given to crop for domestic use like leafy vegetables, the local food supply will greatly increase.

There is an increasing awareness of the value of leafy vegetables in maintaining health particularly in area where animal protein is scarce. In the tropical world the interest in vegetable production has increased rapidly as a result of greater appreciation of the food value of vegetables. At the present time compared with a few decades ago recent studies reveal advances in the tropic but the rate of progress has not been as significant as it should be. In 1980, the area under vegetable crop in the developing countries was 4830 x 10<sup>3</sup>ha higher than in the developed or temperate countries where 2798 x 10<sup>3</sup>ha was recorded but production was lower 84.6 x 10<sup>6</sup>MT in the farmer countries than the latter 97.0 x 10<sup>6</sup>MT (Anonymous; 1980).

The vegetables constitute a group of food that are essential to a well-balancing diet. Green leafy vegetables supplies all important part of the mineral and vitamin required by the human body. They are rich sources of carotene and vitamin C and also contribute to the supply of some of vitamin B.

Dark green leaves contain far more carotene and vitamin C than paler ones. Van, (1974). Vegetables are also very important for the Fe-content and in those diet where little or no use is made of milk and its product, they play a significant role in calcium supply.

Leafy vegetables also supplement protein requirement since vegetables especially young ones are not bulky after boiling they can easily be used as infant food. The bulk can be further reducing by boiling green leafy vegetables in only a very small quantity of water. Van, (1974).

In general, the daily requirement quantity per person is 3<sub>1/2</sub>-4<sub>1/2</sub> of cleaned vegetables. Van, (1974). Green leaves are more valuable as food beginning of the rains when the plant is young growing quickly and the leaves contain more nourishment. In young leaves and seeds, 4-20% of the freshly picked weight may be protein while in ordinary vegetable the percentage is only 1-2%. Van, (1974).

Many green leafy vegetables are green in West Africa and majority are harvested whole in the western status of Nigeria at least ten different kinds can be found in any bi market. Among the most popular local vegetable are the 'Tete' (*Amaranthus* varieties) and "Soko" (*Celosia* varieties). The nutritional content of the leaves of various species of *Amaranthus* varieties but in general the leaves of plant of most specie contain high level of vitamin A, calcium and potassium. Tindall, (1983). The seed of *Amaranthus* species are used as food in some tropical area and a protein content of up to 15% has been reported. High content of lysine 6.2% of total protein and methionine 2-3% have been recorded. Tindall, (1983).

*Celosia argentea* is widely in Nigeria and other parts of West Africa. The leaves and young shoot are used in soup and stew. The popularity of their local vegetable varies from area and from town to town. Most of the local vegetables belong to the solanaceae family e.g *Lycopersicon esculentum* (Tomato), *Solanum nigrum* (Odu), *Spolanimu gilo* (Igbagba) etc.

The daily vegetable consumption per capital recorded was 101g in the developing countries, as compared to 221 in the developed countries. Grubben, (1977). Because of highly perishable nature of the commodity, trading of vegetables especially leafy vegetables by the industries is very necessary to maintain the quality of freshly produce and

improved rapid transport on land, sea and air . The use of controlled atmosphere in storage readily increased the trading of vegetable among countries in recent years by industries.

Vegetables are usually grown in mono-culture in small holding but sometimes in multiple cropping systems where land is scarce however an effort has been made by some institutes such as National Seed Service, National Institute of Horticultural Research (NIHORT) and Agricultural Development Program (ADP) etc. to provide information on the current status of leafy vegetables in the country.

Fertilization is an essential part of any vegetable production system. In intensive production systems, inorganic form of nutrients are usually applied before sowing or transplanting or just afterward.

The problem of soil fertility cannot be easily solved by the application of in-organic fertilizer due to expensive nature and logistic problem in its distribution (Adetunji *et al.*, 2005). Organic source such as cow dung, poultry dropping are slow nutrient releasers.

Compost is the fertilizer made from deliberate biological and chemical decomposition and conversion of organic or plant residue.

It can be a source of both macro and micro elements and it is used increasingly in vegetable production especially in organic production. Benefits derived from the usage of compost include the addition of organic matter, which is the most important because it provided food for soil life and increases stability of the soil. It also add nutrients and encourage a wide range of activities of soil organism.

Compost is used because it is relatively cheaper than in-organic fertilizers and can be easily prepared by the farmers. Furthermore the attention of crop graves of concern for reduced chemical intake. Compost application is known to influence the quality of crop produce. This effect may be directly or indirectly due to the relationship between crop plant and its biological environment (Hamis 1976, Aman *et al.*, 1992).

The degree of crop response to organic fertilizers (compost) is dependent on several factors including the type of compost, the method and time of application (Mongel and Kirkby, 1987).

## MATERIAL AND METHODS

### Description of experimental site

The field experiment was carried out in the organic farm unit behind FADAMA farm of Federal University of Agriculture, Abeokuta. Nigeria, where the compost heaps were made. This was use to amend soil sown to *Celosia argenticia* and *Amaranthus caudatus*.

### Compost preparation

The composting materials which includes plant residue (maize stover, soya bean residue and *Leucaena*

*leucocephala*). Animal residue (pig dung and poultry manure). Wood ash, water, black nylon and bamboo stick etc.

The compost was formulated using the plant residue and animal residue a ratio of 3:1, 3 volume of plant residue use is the heap method. A bamboo of length 1.5m long was erected at the four angles and this was surrounded with a black nylon to prevent conserved heat and loss of composting materials.

The composting materials were applied in layers, which were uniformly spread with a garden fork. Each layer consisted of underlying bed of plant residue with animal manure spread on the plant residue and wood ash formed the top portion of the layer. Water was applied to each layer in other to enhance the take-off of the decomposition process. A wooden pole was inserted into the compost heap in other to provide ventilation within the compost.

Finally moist cultivated soil was spread on the composting material and cover with well insulated nylon to prevent water loss from the compost. The compost temperature was monitored and recorded.

## Experimental design and treatment

The experimental design was Randomized Completely Block Design (RCBD) with three treatments which were composted poultry manure, composted pig dung and no amendment. These were applied two weeks before sowing the two leafy vegetables (*Celosia argenticia* and *Amaranthus caudatus*), by dibbling on the top soil and mixing it thoroughly to enable uniform distribution of the compost applied on each plot.

Each plot consisted of bed with size of 2m by 2m i.e 4m<sup>2</sup>. The treatments were replicated thrice with two leafy vegetables *Celosia argenticia* and *Amaranthus caudatus* to make the total of 18 plot unit.

## Cultural practices

Weeding was done manually with cutlass and hoe, while planting method was by broadcasting uniformly two weeks after compost incorporation. Harvesting was done by primary and secondary later uprooting i.e. total harvesting of all the harvesting on each plot. This harvesting was at two weeks interval.

## Description of variety

The two types of variety of leafy vegetables used in the experiment include *Celosia argenticia* and *Amaranthus caudatus* which were local types obtained from the nearby market in Abeokuta.

## Data collection

The collected data include the following Temperature of the composted pig dung and composted poultry manure which shows that composting process was going on.

The microbial count which include fungal population, microbial biomass carbon, microbial biomass phosphorus and microbial biomass nitrogen and total viable count. Also the compost made was digested in laboratory treated as fertilizer.

Soil nutrient analyses were carried out to determine the particle size of the soil used, the pH level, exchangeable bases and percentage organic carbon. Total Nitrogen, Available phosphorus, the cation exchangeable capacity and acidity were done also.

The growth parameters obtain from the sown vegetables on each plot include the number of leaf, plant height and leaf area.

The fresh weight and dry weight of the harvested sample were also recorded and the plant tissue analyses were done

to obtain Nitrogen, Phosphorus and Potassium plant tissue uptake on each plot.

#### Analysis of data

The data obtain were statistically analyze using Analysis of Variance to generate the means. The means were then separated using LDS (Least Significant Difference) at 0.005 level.

#### RESULTS AND DISCUSSION

Table 1 below showed that the soil belongs to textural class of LOAMY SAND, with highest percentage of silt, low percentage of clay and silt, which is of lowest percentage. Also the percentage organic Carbon and total Nitrogen is low in value. The pH value of 5.86 indicated that the soil was slightly acidic with value of exchangeable bases of Na 0.47cmol kg<sup>-1</sup>, Mg 0.39cmol kg<sup>-1</sup> and Ca 0.49cmol kg<sup>-1</sup>. This

**TABLE 1:** Physicochemical Properties of the initial soil (0-15cm)

Soil properties	
Sand, g 100g <sup>-1</sup>	81.8
Silt, g 100g <sup>-1</sup>	6.8
Clay, g 100g <sup>-1</sup>	11.4
Textural class	Loamy Sand
pH (1:1 soil-water suspension)	5.86
Organic Carbon, g C kg <sup>-1</sup> soil	0.47
Exchangeable bases	
Na <sup>+</sup> cmol kg <sup>-1</sup>	0.47
K <sup>+</sup> cmol kg <sup>-1</sup>	0-20
Ca <sup>2+</sup> cmol kg <sup>-1</sup>	0.49
Mg <sup>2+</sup> cmol kg <sup>-1</sup>	0.39
Available (Bray 1) P, mgkg <sup>-1</sup>	2.35
Total Nitrogen, g kg <sup>-1</sup>	0.15

Table 2 below showed the nutrients status of the composted pig dung and composted poultry manure to be used as soil amendment factor in the production of *Amaranthus caudatus* and *Celosia argentia*. The pH value was slightly high and the composted pig dung (CPD) has the higher C: N ratio when compared with composted poultry manure (CPM).

Table 3 below showed the effect of composted pig dung (CPD), composted poultry manure (CPM) and No-

amendment (NOA) on number of leaves of *Amaranthus caudatus* and *Celosia argentia*. As shown, the number of leaves was significant with *Amaranthus* at 3WAP when more leaves were produced with composts than No-amended plot, though there were no significant differences of 2 WAP, 4WAP and 5WAP. In *Celosia*, compost amendment (CPD and CPM) produced significant increase in number of leaves at 3 WAP and 5 WAP as shown in table over the No-amended plot while 2 WAP and 4 WAP there was no significant difference.

**TABLE 2:** The chemical analysis of composts made from Pig dung (CPD) and Poultry manure (CPM)

COMPOST	Ph	TN	O.C	C/N	AV.P	Na	Ca	K	Fe	Zn	Mo	H+	Mn	Cu	CEC
		%	%		(mgkg <sup>-1</sup> )	%	%	%	←		mgkg <sup>-1</sup>			→	
<b>CPD</b>	6.50	3.51	40.30	11.43	1447.66	0.38	2.81	1.47	95	283	0.63	0.08	483	449	5.37
<b>CPM</b>	6.20	4.63	40.70	9.65	2687.68	0.71	3.55	2.50	5540	430	0.88	0.10	683	85	7.47

**TABLE 3:** Effects of composted Pig dung (CPD) and Poultry manure (CPM) on the leaves of *Amaranthus caudatus* and *Celocia argenticia* at 2, 3, 4 and 5 weeks after planting (WAP)

	TREATMENTS	2WAP(cm)	3WAP(cm)	4WAP(cm)	5WAP(cm)
<i>AMARANTHUS</i>	CPD	7.6667 <sup>a</sup>	11.0000 <sup>a</sup>	13.3333 <sup>a</sup>	15.6667 <sup>a</sup>
	CPM	7.3333 <sup>a</sup>	11.0000 <sup>a</sup>	13.3333 <sup>a</sup>	15.6667 <sup>a</sup>
	NOA	6.6667 <sup>a</sup>	9.6667 <sup>b</sup>	12.6667 <sup>a</sup>	15.3333 <sup>a</sup>
<i>CELOSIA</i>	CPD	9.6667 <sup>a</sup>	14.6667 <sup>a</sup>	22.3333 <sup>a</sup>	22.3333 <sup>a</sup>
	CPM	9.3333 <sup>a</sup>	14.3333 <sup>a</sup>	21.6667 <sup>a</sup>	22.3333 <sup>a</sup>
	NOA	9.0000 <sup>a</sup>	12.0000 <sup>b</sup>	19.3333 <sup>a</sup>	19.6667 <sup>b</sup>

Table 4 below showed the effect of compost amendments on the plant height of *Amaranthus caudatus* and *Celocia argenticia*. As shown in the table, at 2 WAP there was no significant difference in the plant height parameters.

However at 3 WAP, 4WAP and 5WAP there was significant difference in the plant height. CPD was compared to NOA at 4 WAP and 5 WAP, CPD produced higher plant height than other treatments with *Amaranthus*. In *Celocia*, at 3 WAP, 4 WAP and 5 WAP compost amendment (CPD and CPM) gave higher plant height than No- amended plots.

Table 5 showed the response on leaf area of *Amaranthus caudatus* and *Celocia argenticia* to the treatment (CPD, CPM and NOA). At 4 WAP, the table indicate that there was no significant difference with *Amaranthus* on leaf area among all the treatment, however, at 2 WAP, 3WAP and 5WAP CPD was significant higher than NOA and also higher than CPM at 5 WAP while leaf area in CPM was higher than NOA at 2 WAP and 3 WAP.

However, with *Celocia*, CPM produce leaf area than other treatment at 2 WAP and NOA was lower at 3, 4, and 5 WAP.

**TABLE 4:** Effects of composted Pig dung (CPD) and Poultry manure (CPM) on the height of *Amaranthus caudatus* and *Celocia argenticia* at 2, 3, 4 and 5 weeks after planting (WAP)

	TREATMENTS	2WAP(cm)	3WAP(cm)	4WAP(cm)	5WAP(cm)
<i>AMARANTHUS</i>	CPD	4.563 <sup>a</sup>	11.000 <sup>a</sup>	13.333 <sup>a</sup>	15.6667 <sup>a</sup>
	CPM	4.117 <sup>a</sup>	8.880 <sup>ab</sup>	19.027 <sup>b</sup>	26.380 <sup>b</sup>
	NOA	2.343 <sup>a</sup>	5.541 <sup>b</sup>	12.713 <sup>b</sup>	18.767 <sup>c</sup>
<i>CELOSIA</i>	CPD	5.034 <sup>a</sup>	11.180 <sup>a</sup>	29.667 <sup>a</sup>	44.933 <sup>a</sup>
	CPM	4.987 <sup>a</sup>	10.780 <sup>a</sup>	32.333 <sup>a</sup>	40.000 <sup>a</sup>
	NOA	4.240 <sup>a</sup>	7.123 <sup>b</sup>	20.467 <sup>b</sup>	27.933 <sup>b</sup>

**TABLE 5:** Effects of composted Pig dung (CPD) and Poultry manure (CPM) on the leaf area of *Amaranthus caudatus* and *Celocia argenticia* at 2, 3, 4 and 5 weeks after planting (WAP)

	TREATMENTS	2WAP(cm)	3WAP(cm)	4WAP(cm)	5WAP(cm)
<i>AMARANTHUS</i>	CPD	5.220 <sup>a</sup>	23.467 <sup>a</sup>	48.700 <sup>a</sup>	74.252 <sup>a</sup>
	CPM	4.343 <sup>a</sup>	17.143 <sup>a</sup>	36.327 <sup>b</sup>	54.370 <sup>b</sup>
	NOA	1.707 <sup>b</sup>	8.857 <sup>b</sup>	32.160 <sup>b</sup>	53.770 <sup>b</sup>
<i>CELOSIA</i>	CPD	8.843 <sup>a</sup>	20.090 <sup>a</sup>	30.973 <sup>a</sup>	27.883 <sup>a</sup>
	CPM	6.630 <sup>b</sup>	21.307 <sup>a</sup>	31.977 <sup>a</sup>	33.987 <sup>a</sup>
	NOA	5.550 <sup>b</sup>	11.907 <sup>b</sup>	17.250 <sup>b</sup>	15.173 <sup>b</sup>

Table 6 showed the effect of composted pig dung (CPD) and poultry manure (CPM) on the fresh and dry yield of *Amaranthus caudatus* and *Celocia argenticia*. From the table, there was no significant difference in fresh and dry weight at first harvest in fresh and dry weight than other treatments. In the total fresh weight, CPD was highly significant and there was no significant difference in the total dry weight among the treatment with *Amaranthus*.

However, there was no significant difference among all treatments at first, second and total harvest of fresh and dry weight of *Celocia*.

As shown in Table 7, the CPD produced significantly higher N,P and K uptake than NOA and significantly higher N and K uptake than CPM in *Amaranthus*. However, with *Celocia* uptake of N, P and K were the same in all treatment.

**TABLE 6:** Effects of composted Pig dung (CPD) and Poultry manure (CPM) on the fresh dry yield of *Amaranthus caudatus* and *Celocia argentia* at harvesting

	TREATMENTS	1st HARVEST		2nd HARVEST		TOTAL	
		FRESH(g)	DRY(g)	FRESH(g)	DRY(g)	FRESH(g)	DRY(g)
AMARANTHUS	CPD	273.08 <sup>a</sup>	21.500 <sup>a</sup>	85.633 <sup>a</sup>	14.363 <sup>a</sup>	358.72 <sup>a</sup>	35.863 <sup>a</sup>
	CPM	185.71 <sup>a</sup>	16.513 <sup>a</sup>	56.630 <sup>a</sup>	10.563 <sup>a</sup>	243.70 <sup>b</sup>	30.337 <sup>a</sup>
	NOA	178.67 <sup>a</sup>	19.773 <sup>a</sup>	65.027 <sup>a</sup>	8.573 <sup>b</sup>	8.573 <sup>b</sup>	25.090 <sup>a</sup>
CELOSIA	CPD	178.81 <sup>a</sup>	19.283 <sup>a</sup>	93.51 <sup>a</sup>	13.097 <sup>a</sup>	272.02 <sup>a</sup>	32.380 <sup>a</sup>
	CPM	171.92 <sup>a</sup>	18.630 <sup>a</sup>	66.53 <sup>a</sup>	8.833 <sup>a</sup>	239.45 <sup>a</sup>	27.463 <sup>a</sup>
	NOA	97.86 <sup>a</sup>	11.577 <sup>a</sup>	46.10 <sup>a</sup>	6.773 <sup>a</sup>	140.96 <sup>a</sup>	18.290 <sup>a</sup>

**TABLE 7:** Effects of composted Pig dung (CPD) and Poultry manure (CPM) on N, P and K uptake in *Amaranthus caudatus* and *Celocia argentia*

	TREATMENTS	N-UPTAKE(mg)	P-UPTAKE(mg)	K-UPTAKE(mg)
AMARANTHUS	CPD	18.120 <sup>a</sup>	20.653 <sup>a</sup>	7.810 <sup>a</sup>
	CPM	10.333 <sup>b</sup>	13.027 <sup>b</sup>	4.087 <sup>b</sup>
	NOA	11.830 <sup>b</sup>	16.013 <sup>ab</sup>	5.423 <sup>b</sup>
CELOSIA	CPD	12.200 <sup>a</sup>	20.443 <sup>a</sup>	
	CPM	10.373 <sup>a</sup>	10.860 <sup>a</sup>	4.527 <sup>a</sup>
	NOA	7.453 <sup>a</sup>	12.507 <sup>a</sup>	3.930 <sup>a</sup>

Table 8 shows that with *Amaranthus* there was no significant difference among the treatments in microbial biomass carbon and nitrogen but CPD was highly significant in microbial biomass phosphorus. Also CPD has significant higher total

viable count than NOA. Total viable count and total fungal count and microbial biomass P were comparable in CPM and NOA. The microbial parameters were same for all treatment planted to *Celocia*

**TABLE 8:** Effects of composted Pig dung (CPD) and Poultry manure (CPM) on Microbial population, Microbial biomass carbon, Phosphorus and Nitrogen on the soil sown to *Amaranthus caudatus* and *Celocia argentia*

	TREATMENTS	Total viable count (cfug <sup>-1</sup> )	Fungal count (cfug <sup>-1</sup> )	Microbial biomass P (mg/kg)	Microbial biomass P (mg/kg)	Microbial biomass N (mg/kg)
AMARANTHUS	CPD	1420000 <sup>a</sup>	183333 <sup>a</sup>	13.510 <sup>a</sup>	14.310 <sup>a</sup>	0.138 <sup>a</sup>
	CPM	1093333 <sup>a</sup>	76667 <sup>a</sup>	9.967 <sup>a</sup>	9.860 <sup>a</sup>	0.066 <sup>a</sup>
	NOA	993333 <sup>ab</sup>	8667 <sup>ab</sup>	9.113 <sup>a</sup>	9.220 <sup>b</sup>	0.077 <sup>a</sup>
CELOSIA	CPD	980000 <sup>a</sup>	73333 <sup>a</sup>	9.933 <sup>a</sup>	9.700 <sup>a</sup>	0.067 <sup>a</sup>
	CPM	1093333 <sup>a</sup>	76667 <sup>a</sup>	9.967 <sup>a</sup>	9.860 <sup>a</sup>	0.099 <sup>a</sup>
	NOA	750000 <sup>a</sup>	56667 <sup>a</sup>	8.793 <sup>a</sup>	7.157 <sup>a</sup>	0.020 <sup>a</sup>

Table 9 shows the nutrient level of soil planted to *Amaranthus* and *Celocia* after total harvesting. It was

observed that there was no significant difference among the treatments both in the soils sown to *Amaranthus* and *Celocia*.

**TABLE 9:** Nutrients level of soil planted to *Amaranthus caudatus* and *Celocia argentia* after total harvesting

	TREATMENTS	AV.P (mg kg <sup>-1</sup> )	Total Nitrogen %	Organic Matter %	Organic Carbon %
<i>AMARANTHUS</i>	CPD	3.339 <sup>a</sup>	0.083 <sup>a</sup>	1.767 <sup>a</sup>	1.023 <sup>a</sup>
	CPM	4.770 <sup>a</sup>	0.120 <sup>a</sup>	2.307 <sup>a</sup>	1.337 <sup>a</sup>
	NOA	2.862 <sup>a</sup>	0.073 <sup>a</sup>	1.313 <sup>a</sup>	0.763 <sup>a</sup>
<i>CELOSIA</i>	CPD	3.498 <sup>a</sup>	0.077 <sup>a</sup>	1.550 <sup>a</sup>	0.900 <sup>a</sup>
	CPM	3.975 <sup>a</sup>	0.090 <sup>a</sup>	1.707 <sup>a</sup>	0.099 <sup>a</sup>
	NOA	3.339 <sup>a</sup>	0.077 <sup>a</sup>	1.663 <sup>a</sup>	0.967 <sup>a</sup>

## CONCLUSION AND RECOMMENDATION

Therefore it is concluded that composted pig dung with plant residue used as soil amendment increases the growth and yield of *Amaranthus caudatus* when compared with the composted poultry manure.

The following recommendations are hereby made while further experimentation should be carried out on other leafy vegetables.

Also composted pig dung and composted poultry manure should also be combined as soil amendment factor in further experimentation.

Farmer should adopt the use of composted pig dung in their farming maximize the yield of leafy vegetables.

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