EFFECT OF LENGTH OF TIME OF STORAGE OF POULTRY DROPPINGS ON NUTRIENT COMPOSITIONS, GROWTH AND YIELD OF VARIETIES OF OKRA IN KABBA, KOGI STATE NIGERIA.

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Abstract
The experiment was carried out for two consecutive growing seasons (2017 and 2018) at the Research Site of Agronomy Section, College of Agriculture, Kabba. Experiment was laid out in split plot design with sixteen treatment combinations. Length of time of storage of the poultry as subplot factor A (A1=Apply at the day of collection, A2=stored for three weeks before application, A3=Stored for six weeks before application andA4=Stored for nine weeks before application and variety of okra as main plot factor B (B1=LD88, B2=Lady's finger, B3=Clemson spineless and B4=Local cultivar (Owo-Agbinrin)). Each plot measured 4 x 3 m ($12m^2$) 1 and 0.5 m pathways between each replication and plot respectively. The results indicated that plant height and leaf area were highest when poultry manure was stored for six weeks before applied onto the field. However, plot with poultry manure stored for three weeks before application recorded the highest values of number of leaves and produce thickness plant. Individual pod weight, pod length, pod diameter and pod yield were greatest in plot planted with Clemson spineless. Storage of poultry manure for six weeks before used recorded the highest values of individual pod weight, pod length, pod diameter and pod yield. However, this was not significantly better than plot treated with manure stored for three weeks before application. Though, Lady's finger produces the best growth characters (plant height, number of leaves and leaf area). Clemson spineless recorded the highest pod yield of okra and is therefore recommend to okra growers. For poultry manure use efficiency on okra, it should be stored for between three and six weeks before application so as to give maximum yield of okra in the study area.

Keywords: Okra, variety, composition, length of time, storage, poultry dropping

Introduction
Okra *(Abelmoschus esculentus* (L.) Moench) is an annual vegetable crop in tropical and sub-tropical parts of the world (Thakur and Arora, 1986). It is one of the important nutritious vegetable crops grown in Nigeria. Rashid, (1999) reported that100g green pod of okra contains among others, protein 1.8g, carbohydrate 6.4g, fiber 1.2g, vitamin C 18 mg and Ca 90 mg. The importance of okra as a vegetable crop lies in its 'drawing quality' that aids easy consumption of bulky staple foods like Gari, Fufu and pounded yam (Agbogidi and Nweke, 2005). The mucilaginous extract from okra is reportedly useful in curing ulcers as well as for the relief of hemorrhoids and also as a cleansing agent in sugar processing. Schippers (2000) noted that the tender pods contain vitamins A and C and traces of B vitamin. Okra provides good source of calcium and other body building materials that contribute to healthy living. The nutritional importance of okra pod has reawakened interest in bringing the crop into commercial production. Despite the nutritional value of okra, its optimum yields (2-3 t ha-1) and quality have not been attained in the tropical countries partly because of a continued decline in soil fertility.

The adoption and use of inorganic fertilizers, has been characterized by several problems such as inadequate supply or even unavailability of fertilizer at the time of need, adulteration and high cost (Adekiya and Agbede, 2009). And also, cultivation with persistent application of mineral fertilizers increase soil acidity and soil physical degradation which may reduce crop yield (Ojeniyi *et al*., 2007; Adeniyan and Ojeniyi, 2005).

On the other hand, the use of organic manure cannot be over emphasized because of its usefulness in the improvement of physical conditions of soil and the nutrients it supplies for soil productivity. According to Yai and Radav (2004), crops cultivated with organic manures are not only free from harmful chemicals; they are also safer, healthier and tastier. They are of high nutritional quality and are devoid of all forms of pollution that arise from agricultural techniques Yai and Radav (2004). It is in this context, that this research study is therefore designed to evaluate the impact of length of time of storage of poultry droppings on different varieties of okra in Kabba, Kogi State Nigeria.

Materials and Methods
Study area
The experiment was carried out for two consecutive growing seasons (2017 and 2018) at the Research Site of Agronomy Section, College of Agriculture, Kabba. The site is located on latitude 07° 35' N and longitude of 06° 08' E and is 435m above sea level, in Southern Guinea Savanna Agro Ecological Zone of Nigeria, where the dry seasons are dry and hot while, wet seasons are cool. The rainfall spans between April to November with peak in June. The dry season extends from December to March. The mean annual rainfall is 1570mm per annum with an

annual temperature range of 18°C - 32°C. The mean relative humidity (RH) is 60% (17). The major soil order within the experimental site is Ultisol (Babalola, 2010).

Experiment and Experimental design

The experiment was carried out for two consecutive growing seasons (2017 and 2018) at the Research Site of Agronomy Section, College of Agriculture, Kabba. The experiment was laid out in split plot design with sixteen treatment combinations. Length of time of storage of the poultry manure as subplot factor A (A1=Apply at the day of collection, A2= stored for three weeks before application, A3= stored for six weeks before application and A4= stored for nine weeks before application) and varieties of okra as main plot factor B (B1=LD88,B2=Lady's finger, B3=Clemson spineless and B4=a local cultivar (Owo-Agbirin)). Each plot measured 4 x 3 m ($12m^2$) 1 and 0.5 m pathways between each replication and plot respectively. The treatments were carried out on the same plots in growing seasons. Site was cleared manually using cutlass and later ridged with hoe. Organic manure (10 t/ha^{-1}) were uniformly spread on the flat beds and incorporated with hoe. The seeds were planted at the rate of one-plant-per-hole at a spacing of 75cm by 50cm which make up twenty-one stands per plot. Plots were weeded manually at three weeks interval.

Collection and treatment of sample

Thirty mature pods of okro (*Abelmoschus esculentus*) were collected. They were brought to the laboratory and rinsed with distilled water to remove any attached dirt. The pods of *Abelmoschus esculentus* were chopped into slice and oven dried at 50^oC for 72 h. The sample was ground into fine powder using Kenwood food blender and kept in polyethylene bags prior to analyses.

Proximate analyses

The proximate analyses of sample for moisture, crude fibre and total ash were carried out in triplicate according to the methods of Association of Official Analytical Chemists (AOAC, 2000). Nitrogen was determine by the micro –Kjeldahl method and the percentage nitrogen converted to crude protein by multiplying by 6.25 (AOAC, 2000).

Data collection

The data collected includes plant height, stem girth, number of leaves per plant, number of fruit per plant, fresh fruit weight and fruit length.

Data analyses

All the data collected were subjected to analysis of variance and means separated at 5% probability using least significant difference (LSD).

Results and Discussion

Condition of the soil before the experiment

Table 1 present the result of soil used for the trials which indicated that the soil was mostly sandy clay loam in texture, slightly acidic. The soil was moderately porous, low in organic matter and essential nutrients required for optimum growth of crop such as maize. Aduayi *et al*. (2002), Jones and Wild (1975) reported that most Nigerian soils are deficient in nitrogen, phosphorus and potassium. The chemical characteristics of poultry manure used showed that it was relatively high in all the essential nutrients especially nitrogen phosphorus and potassium (Table 2). The relatively low C/N ratio indicated its high rate of decomposition when applied to the soil.

Growth characters

Table 3 reported the effect of length of time of storage of poultry manure on the growth characters of four varieties of okra. Plant height, stem girth, number of leaves and leaf area were significantly affected by the different varieties of okra used.

Plant height, number of leaves and leaf area were highest in cultivar lady's finger, this was followed by plots with local cultivar in plant height while plot with Clemson spines followed in term of leaf area. However, plot with LD88 produced shortest, thinnest and lowest number of leaves.

Differences in growth characters were observed in the different cultivars used. This could be that the cultivar differs genetically and in their ability to utilize nutrient. The result was not in agreement with the work of Gudugi (2013) who reported that varietal difference was not significant in most of the growth parameters measured.

Impact of length of time of storage of poultry manure had significant effect on the growth characters of okra observed. Plant height and leaf area were highest when poultry manure was store for six weeks before applied onto the field. However, plot with poultry manure application stored three weeks before application recorded the highest value of number of leaves (13.4 leaves) and produced thickest stem (3.2cm). The least plant height, stem girth, number of leaves and leaf area were recorded when poultry manure was stored for nine weeks before usage. This was significantly inferior to when poultry manure was applied at point of collection (fresh) in all the growth characters observed. Growth characters were better when poultry manure were stored for between 3 and 6 weeks after collection. Eghball (2002) reported that when stored manure is incorporated to the soil, it nitrogen content is immediately made available to the plant, since a great portion of total N is ammonium. This means that manure mineralized fast and releases its nutrient within short period of application when stored. Plots with manure stored for nine weeks before incorporation into the soil recorded the least value of all the growth parameter observed. This could be that most of the essential nutrients in the manure must

have been broken down by microbes in the store and lost through volatilization into the atmosphere before been incorporated into the soil. This could greatly reduce the nutrient supply capacity of the applied manure; the result is in agreement with Iren et al. (2011).

Yield Characters

The effect of different varieties of okra on individual pod weight, pod length, pod diameter and pod yield were presented in Table 4. Individual pod weight, pod length, pod diameter and pod yield were greatest in plot planted with Clemson spineless. This was significantly better than other varieties in term of individual pod weight and pod yield (t/ha). This was followed by variety Lady's finger (4.11t/ha) and LD88 (3.71 t/ha). The least values of individual pod weight, pod length, pod diameter and pod yield were lowest in the local cultivar used.

All the improved cultivar used performed better than the local cultivar in both individual weight and pod yield. This could be due to difference in genetic makeup of the different cultivars and their responses to the nutrients supply by both the amendment and inherent soil nutrients. The results of this work supported the work of Odeleye and Odeleye (2001) who stated that differences in crop growth and yield might be attributed to specific genetic makeup. Clemson spineless had the greatest yield among the improved varieties used this could suggest that it adapted better to the environment and also response better to the nutrient applied.

The effect of length of time of storage of poultry manure before application on the field on yield characters of okra are presented in Table 4. Storage of poultry manure for six weeks before application recorded the highest values of individual pod weight, pod length, pod diameter and pod yield. However, this was not significantly better than plot treated with manure stored for three weeks before application.

Nutrient Composition

The effect of varietal difference and length of time of storage of poultry manure on nutrients compositions of okra fruits are presented in table 5. Significant differences were observed in moisture content, crude fibre and crude protein due to differences in variety of okra planted. However, there was no significant difference in the ash content of the varieties (Table 5).

Moisture content was highest in variety Lady's finger which was closely followed by the local cultivar used, than Clemson spineless. All these were significantly better than LD88 in moisture content. Moisture content is high in all the cultivar used which is more than the range value (2.1%) for most seeds and legumes (Robert and Eastwood, 1981). The result implies that this vegetable has low storage capacity and can be easily perishable. The results support the work of Aremu *et al* (2014). They reported high moisture content in okro compared to bush mango. Though, no significant difference was observed in ash content due to the varietal differences. The content was high in all the varieties which suggest the presence of array of minerals as well as high molecular weight elements Ejiofor *et al.* (1987).Crude protein was high in all the cultivars but highest in cultivar LD88. Crude protein of between 18.6 and 23.8% is high and compared favorably with 24% in *Amaranthus vividis*; 20.72% in *Moringa oleiefera*; 21.0% in Lasianthera Africana and 15.0% in *Heinsia crinata* (Ramola and Raw, 2003; Udoka *et al* 1998). The results indicated that okro is a good source of protein (Aremu *et al*, 2014). Effect of length of storage of poultry manure on nutrient composition of okra fruit are presented in Table 5. The result indicated that effect of length of time of storage of poultry manure on moisture; Ash, crude fibre and crude protein contents of okra fruit were not statistically significant. Also in the growth yield and nutrient contents observed, there was no significant interaction between varieties used and length of storage of poultry manure.

Conclusion

All the improved okra cultivars performed better in growth and yield than the local cultivar used. Though, Lady's finger recorded the best growth characters measured (plant height, number of leaves and leaf area). However, Clemson spineless gave the greatest pod yield of okra. For poultry manure use efficiency, it should be stored for between three and six weeks before application so as to give maximum yield of okra in the study area.

Table 1: Condition of the soil before the experiment

Properties	*Values*
Sand (%)	64.5
Clay (%)	20.0
Silt (%)	15.5
Soil texture	Sandy clay loam
Soil Ph	6.2
Bulk density (g/cm^3)	1.41
Total porosity (%)	42.5
Organic matter (%)	2.14

Total N (%)	0.16
Available P (mg/kg)	2.72
Exchangeable cation (cmol/kg)	
K	0.46
Ca	2.5
Mg	2.54

Table 2: Chemical composition of poultry manure

Properties	***Poultry manure***
Organic carbon (%)	38.36
Total n (%)	3.60
C:N	10.66
Phosphorous (%)	1.34
Potassium (%)	3.12
Calcium (%)	1.23
Magnesium **(%)**	0.32

Table 3: Impact of length of time of storage of poultry manure on growth characters of two varieties of okra (mean of two years).

Treatments	*Plant height (cm)*	*Stem girth (cm)*	*Number of leaves*	*Leaf area (m2)*
Cultivar				
LD88	52.4	2.4	09.4	681
LF	68.6	2.7	13.6	714
CLS	53.8	3.1	12.9	699
LC	61.4	2.9	12.4	689
LSD 0.05	7.83	3.91	1.2	34.4
Length of storage				
Fresh	57.1	2.9	10.1	611
SF3WS	63.4	3.2	13.4	625
SF6WS	68.3	3.0	12.6	714
SF9WS	46.8	2.4	09.4	554
LSD 0.05	11.81	0.61	1.89	54
Var vs LS				
LSD 0.05	Ns	ns	ns	ns

Table 4: Impact of length of time of storage of poultry manure on yield characters of two varieties of okra (mean of two years).

Treatments	*Individual pod weight (g)*	*Pod length (cm)*	*Pod diameter (cm)*	*Pod yield (t/ha)*
Cultivar				
LD88	09.8	5.6	4.3	3.71
LF	10.3	6.7	4.0	4.11
CLS	13.2	7.2	4.7	5.29
LC	08.7	7.7	3.7	2.96
LSD 0.05	2.34	1.31	0.39	0.78
Length of storage				
Fresh	12.8	6.4	3.8	3.84
SF3WS	13.1	6.4	3.9	4.02
SF6WS	13.6	6.7	4.1	4.17
SF9WS	09.1	6.0	3.6	2.97
LSD 0.05	2.71	ns	0.21	0.93
Varvs TOS				

LSD 0.05	ns	ns	ns	ns

Table 5: Impact of time of storage of poultry manure on nutrient composition of okra fruit

Treatments	*Moisture content*	*Ash*	*Crude fibre*	*Crude protein*
Variety				
LD88	25.2	8.6	4.6	23.8
LF	27.2	9.0	4.3	21.6
CLS	26.9	8.7	3.6	19.0
LC	27.1	8.9	4.7	18.6
LSD 0.05	0.67	ns	0.36	1.84
Length of storage				
Fresh	26.4	8.6	4.2	22.4
SF3WS	26.4	8.5	4.0	21.6
SF6WS	25.9	8.4	4.2	22.0
SF9WS	26.1	8.5	3.9	22.1
LSD 0.05	Ns	ns	ns	ns
VRar vs LS				
LSD 0.05	ns	ns	ns	ns

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