Application of Poultry and Cattle Manures under Different Housing and Packaging Systems on Yield and Yield Attributes of *Telfairia occidentalis* (Hook F.)

Abstract

Handling of animal manure before application to the field is one of the main issues influencing its nutrient content. Experiment was carried out to evaluate the yield and yield attributes of *Telfairia occidentalis* as influenced by poultry and cattle manures under different housing and packaging methods in year 2017 and 2018 at the Organic Agricultural Research Farm of Federal University of Agriculture, Abeokuta, Ogun State. Amendments include: bagged poultry manure in Zinc House at 5.6 tha^{-1} (ZPB) and unbagged at 6.0 tha^{-1} (ZPU), bagged poultry manure in open space at 5.5 tha^{-1} (OPB) and unbagged at 6.8 tha^{-1} (OPU), bagged poultry manure in palm frond house at 5.4 tha^{-1} (PPB) and unbagged at 6.9 tha^{-1} (PPU), bagged cattle manure in Zinc House at 6.5 tha^{-1} (ZCB) and unbagged at 5.6 tha^{-1} (ZCU), bagged cattle manure in open space at 5.3 tha^{-1} (OCB) and unbagged at 5.9 tha^{-1} (OCU), bagged cattle manure in palm frond house at 5.1 tha^{-1} (PCB) and unbagged at 5.5 tha^{-1} (PCU), and control The trial was a 3 X 2 X 2 factorial fitted into Randomized Complete Block design. Data collected were dry matter yield, number of seeds/pod, number of secondary vines, number of days to podding/fruiting, shelf-life, and yield. Data was subjected to Analysis of Variance (ANOVA) and significant means were separated using Duncan's Multiple Range Test. It was observed that all amendments contributed significantly to dry matter yield, number of seeds/pod, number of secondary vines, reduce number of days to podding/fruiting, prolong shelf-life, and increase the yield of *Telfairia occidentalis* above control while application of PCU at 5.5 t/ha and PPB at 5.4tha^{-1} resulted in highest. This finding therefore recommend that, for better yield and yield attributes of *Telfairia occidentalis* in the study area, it must be supplemented with unbagged cattle manure in palm frond house at 5.5tha^{-1} (PCU) or bagged poultry manure in palm frond house at 5.4tha^{-1} (PPB).

Key words: Dry matter yield, Fruiting, Podding, Seed, Shelf-life.

I. Introduction

Maintenance of soil fertility is very imperative in accomplishing high crop yield (Talpur *et al*., 2013). Most of the land used for farming in the past is based on bush fallow system and shifting cultivation (Miguel, 2008). However, it is no longer feasible in many areas to maintain the long fallow periods that are required for soil fertility replenishment because there is pressure on the land due to increasing population growth (Adjei-Nsiah *et al*., 2004). Organic materials application such as crop remains, animal manures and green manures have been substitute

Comment [c1]: Reference missing cheek because of its effects on soil organic matter content, improve soil fertility and soil physical characteristics, augument microbial activities and ameliorate metal toxicity (Escobar *et al.*, 2008). Organic farming has received recognition in current years as purchaser demand for organically produced food and sincerity of many growers to maintain or improve the soil (Dimitri and Greene, 2002).

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Animal manure is associated with bulkiness, flies, unpleasant odour which can be controlled with usage of appropriate housing system. Housing of animal manure when properly managed can control flies, odours, dust, and particulate matter. Once manure is removed from a livestock farm, the methods used to store the litter prior to land application can significantly affect the nutrient content. Three (3) different housing systems were used for this experiment which includes: zinc house, palm fronds house and open space. Zinc house has a natural, in-built durability and easy to maintain. A palm frond house is light-weight and, if tightly made, remarkably waterproof. Modern investigation established that houses built with palm frond had lower risks to the environment. Open space is undeveloped portion of land that is available to everyone. Open space is also a land area with its surface open to the sky.

Telfairia occidentalis is a vegetable commonly cultivated for its pleasant and nourishing leaves. The leaves when compared with other tropical vegetables contain lofty nutritive value. The leaves are rich in vitamins and minerals (Olorunfemi *et al.*, 2014). Despite the significance of *Telfairia occidentalis* in Nigerian diet, a lot of challenges are been faced by farmers relative to its production. Fast reduction of soil nutrients and poor physical characteristics of soils contribute great limitations to its production (Salako, 2003).

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Housing method has been observed to be a major factor that influences the nutrient content of animal manure (Makinde and Ayoola, 2012**)**. The main objective of this research is to determine the influence of poultry manure and cow dung under different housing and packaging systems on the yield and yield attributes of *Telfairia occidentalis.*

II. MATERIALS AND METHODS

The experiment was conducted at the Organic Farm of the Federal University of Agriculture, Abeokuta (latitude 7° 13 N and longitude 3° 28 E). It is characterized by mean annual rainfall of about 1400 mm with bimodal rainfall distribution. The mean annual minimum temperature is 22.2°C while the mean annual maximum temperature is 33.3°C. Cow dung was obtained at the cattle unit of College of Animal Science farm, Federal University of Agriculture, Abeokuta while poultry manure used was obtained from Isekolowo farm, Egbeda, along Alabata road, Abeokuta. Housing systems used for the experiment are: zinc house, palm fronds house and open space and each of the housing system was constructed with a space measuring 5m x 6m (30 m^2). Mettler weighing balance was used to weigh 100kg of fresh manure into bagco Jute sack (bag) and equal size was left unbagged in every housing system and it was replicated 3 times. Manure was stored in the housing systems for 12 weeks (Harrison and Smith 2004).

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The experimental site was manually cleared and leveled using cutlass and hoes. Initial soil samples (0 - 15 cm layer) were randomly collected at different points with the aid of soil auger on the experimental site before amendments were applied, these were bulked and sub sampled for chemical analysis. The experimental land size (660 m^2) was divided into three (3) blocks. Each block had 13 plots which were replicated 3 times to give a total of 39 plots. Plot size measuring 4 m x 2 m (8 m^2) had 1 m inter and intra row spacing to allow easy movement during cultural operations.

The amendments viz: bagged poultry manure in Zinc House at 5.6 tha^{-1} (ZPB) and unbagged at 6.0 tha^{-1} (ZPU), bagged poultry manure in open space at 5.5 tha^{-1} (OPB) and unbagged at 6.8

tha^{-1} (OPU), bagged poultry manure in palm frond house at 5.4 tha^{-1} (PPB) and unbagged at 6.9 tha^{-1} (PPU), bagged cattle manure in Zinc House at 6.5 tha^{-1} (ZCB) and unbagged at 5.6 tha^{-1} (ZCU), bagged cattle manure in open space at 5.3 tha^{-1} (OCB) and unbagged at 5.9 tha^{-1} (OCU), bagged cattle manure in palm frond house at 5.1 tha^{-1} (PCB) and unbagged at 5.5 tha^{-1} (PCU), and control (i.e. no amendment) were applied as guided by the native soil nitrogen and nitrogen requirement of *Telfairia occidentalis* (60 kg Nha^{-1}) (Akanbi *et al*., 2006). These were laid out in a Randomized Complete Block Design (RCBD) with three replicates in both years. They were applied two (2) weeks before planting.

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Fluted pumpkin (*Telfairia occidentalis*) seeds were sourced locally. They were allowed to air dry for 24 hours following extraction from pods before planting. Two seeds were planted per stand with a space measuring 1 m × 1 m (Oyekunle and Oyerele, 2012). This was thinned to one seedling per stand four weeks after germination. Trellis was constructed with bamboo wood at three weeks after planting to give support to the plant. Weeds were manually controlled at two weeks interval throughout the experiment. Four plants were cut at the soil level per plot at 8 weeks after planting, the fresh weights were taken using a weighing balance. Later, the plants were oven dried to constant weight at 65°C for 48 hours (Oyekunle and Oyerele, 2012) and the dry weights were also taken to determine the dry matter yield.

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Mature leaves were first harvested at 8 weeks after planting and subsequent harvesting was done at 2 weeks interval. Fresh weights of harvested leaves were taken using Mettler weighing balance and the weight was recorded, with the cumulative weight taken as yield. Number of secondary vines was done by physical counting. Shelf-life was determined by storing harvested leaves in jute bag (sack) bagco type under a shade with 75% relative humidity and monitored daily for signs of deterioration (Ubani and Okonkwo, 2011). Number of days to poddimg /

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fruiting was determined by counting from the day of planting till the day of pod / fruit emergence. Number of pods was done by physical counting. Pod weight was determined by taken the weight of pod / plot using Mettler weighing balance and the weight was recorded. Number of seeds / Pod was done by physical counting.

All data collected was subjected to Analysis of Variance (ANOVA) using Statistical Analysis System (SAS, 1999). Significant means was separated using Duncan's Multiple Range Test (DMRT) at 5 % level of probability.

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III. Results

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Effect of Poultry Manure and Cow dung from Different Housing Systems and Stacking methods on Dry Matter Yield of *Telfairia occidentalis* in 2017 and 2018

Figure 1 shows that in year 2017, application of poultry manure bagged in zinc house (ZPB) at 5.6 tha^{-1} resulted into significantly ($P \leq 0.05$) higher dry matter yield (6.17g $plant^{-1}$) of *Telfairia occidentalis* compared to the unamended plants (control). Likewise, in year 2018, *Telfairia occidentalis* plants with the application of poultry manure bagged in zinc house (ZPB) at 5.6 tha^{-1} and poultry manure bagged in palm fronds house (PPB) at 5.4 tha^{-1} were higher in dry matter yield than every other *Telfairia occidentalis* plants.

Effect of Poultry Manure and Cow dung from Different Housing Systems and Stacking methods on Number of Days to Podding/Fruiting of *Telfairia occidentalis* in 2017 and 2018

Number of days to podding/fruiting in year 2017 was observed to be highest on unamended *Telfairia occidentalis* plants (Figure 2) although, not significantly ($P \leq 0.05$) higher than the number of days to podding/fruiting of *Telfairia occidentalis* plants amended with ZCU at 5.6 tha^{-1}. Also in year 2018, application of amendments significantly influenced number of days to podding/fruiting as all amended plants had lower number of days to podding/fruiting compared to unamended plants (control). *Telfairia occidentalis* plants amended with PPB at 5.4 tha^{-1} was observed to have the least number of days to podding/fruiting which was also significantly lower than the number of days to podding/fruiting of all other *Telfairia occidentalis* plants.

Effect of Poultry Manure and Cow dung from Different Housing Systems and Stacking methods on Shelf-life of *Telfairia occidentalis* in 2017 and 2018

In year 2017 (Figure 3), it was observed that application of amendments significantly ($P \leq 0.05$) influenced shelf-life of *Telfairia occidentalis* plants. Longest shelf-life was observed on *Telfairia occidentalis* plants with the application of poultry manure bagged in palm fronds house (PPB) at 5.4 tha^{-1} and it was also significantly longer than the shelf-life of every other *Telfairia occidentalis* plants either amended or unamended. Likewise, in year 2018 (Figure 3), application of amendments significantly influenced shelf life above unamended (control) plants. *Telfairia occidentalis* plants with the application of PPB at 5.4 tha^{-1} had longest shelf-life compared to other *Telfairia occidentalis* plants and were also significantly longer than the shelf-life of every other *Telfairia occidentalis* plants. Unamended *Telfairia occidentalis* plants (control) had the least shelf-life and was also significantly shorter than the shelf-life of all amended *Telfairia occidentalis* plants.

Effect of Poultry Manure and Cow dung from Different Housing Systems and Stacking methods on Number of Pods, Pod Weight and Number of Seeds/Plot of *Telfairia occidentalis* in 2017 and 2018

Table 1 shows that in year 2017, application of amendments did not statistically ($P \leq 0.05$) influence number of pods of *Telfairia occidentalis* plants. Number of pods ranged from 1250 pods ha^{-1} to 2500 pods ha^{-1}. However, in year 2018, *Telfairia occidentalis* plants amended with PCU was observed to have highest number of pods which was not statistically higher than the number of pods of *Telfairia occidentalis* plants of all other amended *Telfairia occidentalis* plants including unamended (control) plants

However, highest pod weight in year 2017 (Table 1) was observed on *Telfairia occidentalis* plants amended with PPB at 5.4 tha^{-1} which was not statistically higher than the pod weight of *Telfairia occidentalis* plants amended with PCU at 5.5 tha^{-1}, PPU at 6.9 tha^{-1}, OPB at 5.5 tha^{-1}, OCB at 5.3 tha^{-1}, OPU at 6.8 tha^{-1} and ZPU at 6.0 tha^{-1} but was statistically 8989higher than the pod weight of every other *Telfairia occidentalis* plants. Whereas, in year 2018, *Telfairia occidentalis* plants amended with PCU at 5.5 tha^{-1} had highest pod weight which was not statistically higher than the pod weight of *Telfairia occidentalis* plants amended with ZCU at 5.6 tha^{-1} and PPB at 5.4 tha^{-1} but was statistically higher than the pod weight of every other *Telfairia occidentalis* plants.

Table 1 showed that in year 2017, number of seeds per pod (seeds/pod) was observed to be highest on *Telfairia occidentalis* plants amended with poultry manure bagged in open space (OPB) at 5.5 tha^{-1}. Unamended *Telfairia occidentalis* plants (control) were observed to have the least number of seeds/pod. However, in year 2018, highest number of seeds/pod was observed on *Telfairia occidentalis* plants amended with PPB at 5.4 tha^{-1} Also, unamended *Telfairia occidentalis* plants (control) was observed to have the least number of seeds/pod.

Effect of Poultry Manure and Cowdung from Different Housing Systems on Yield of *Telfairia occidentalis* (Hook F.)

It was observed in both years (2017 and 2018) that application of amendments significantly influenced the yield of *Telfairia occidentalis* plants as all amended plants had yield significantly higher than that of control (unamended) plants. *Telfairia occidentalis* plants amended with PPB had highest yield in both years while unamended (control) plants had the least yield which was significantly lower than the yield of all amended plants (Figure 4).

IV Discussion

Highest agronomic parameters observed in *Telfairia occidentalis* plants as a result of the application of PPB at 5.4 tha^{-1} could be because PPB had higher pH, organic carbon and nitrogen which would have assisted in promoting the growth and yield parameters. This corroborates the findings of Myint *et al*. (2010) who stated that organic manure had been proven to enhance efficiency and improve soil fertility and soil health. Uwah *et al*. (2012) affirmed that poultry manure contributes to the availability and sufficient supply of organic matter. Also, Watson, *et al*. (2002) asserted that organic farming systems rely on the management of soil organic matter to optimize crop production due to the fact that consumers are demanding for organically grown produce because of its health benefits as confirmed by Dimitri and Greene (2002). Furthermore, Mugisa (2002) and Muhereza (2005) also established that animal manure is commonly used to improve crop yield. Ndor *et al*. (2012) stated that to keep soil more productive, it must be supplemented with adequate nutrients. Meanwhile, the close to neutral level of pH at which PPB was could influence the release of plant nutrient to tested plants. Number of days to podding/fruiting were hasten by the application of PPB at 5.4 tha^{-1} which could be attributed to why PPB mineralized faster when compared with other amendments. *Telfairia occidentalis* plants amended with PCU at 5.5 tha^{-1} was also observed to have higher number of pods/plot, pod weight and number of seeds/pod which could be attributed to probably because cow dung had slower rate of mineralization which made the amendment to have later effect when compared to poultry manure and also PCU was observed to have higher phosphorus content than poultry manure and phosphorus helps in seed and fruit formation as reported by Shamim *et al*. (2015). It was also observed that yield of *Telfairia occidentalis* plants was lower on unamended (control) plants. This supported the findings made by Ayoola (2006) and Mugwe *et al*. (2007) that crop yields are usually reduced in unfertilized or control plots because crops had to use the limited

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nutrients available in the soil without any external inputs. This also reaffirms the findings of Law-Ogbowo *et al.* (2012) who stated that the major limitation in the production of *Telfairia occidentalis* plants in Nigeria is as a result of low fertility of soil. Application of PPB at 5.4 tha^{-1} also increased the leaf yield and shelf-life of *Telfairia occidentalis* plants which could be probably because palm fronds house is cooler and this could make the poultry manure under this housing system to be cool which now showed its effect in contributing positively to the yield and shelf-life. This supported the findings of Ubani and Okonkwo (2011) who postulated that *Telfairia occidentalis* leaves can only be kept for 6 days. It was also observed that *Telfairia occidentalis* plants amended with PPB at 5.4 tha^{-1} gave tremendous increase in yield above every other amendment.

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Furthermore, Mugisa (2002) and Muhereza (2005) also concluded that animal manure is commonly used to increase crop yield. Ndor *et al*. (2012) also stated that to keep soil more productive, it must be supplemented with adequate nutrients.

V Conclusion

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The result obtained revealed that yield and yield attributes of *Telfairia occidentalis* responded well to the application of PCU at 5.5 t/ha and PPB at 5.4tha^{-1} compared with every other amendments and control in the study. Therefore, based on the result of this finding, it is recommended that unbagged cow dung in palm fronds house (PCU) at 5.5 t/ha and bagged poultry manure in palm fronds house (PPB) at 5.4 tha^{-1} will be sufficient for optimum yield and yield attributes of *Telfairia occidentalis* in the study area.

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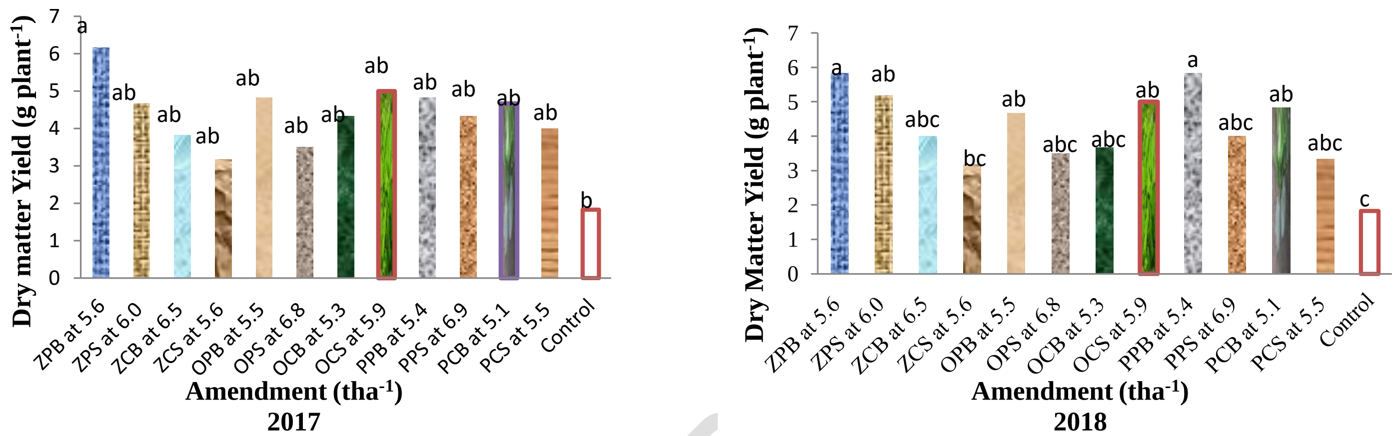

Figure 1: Effect of Poultry Manure and Cow dung from Different Housing Systems and Stacking methods on Dry Matter Yield of *Telfairia occidentalis* in Year 2017 and 2018

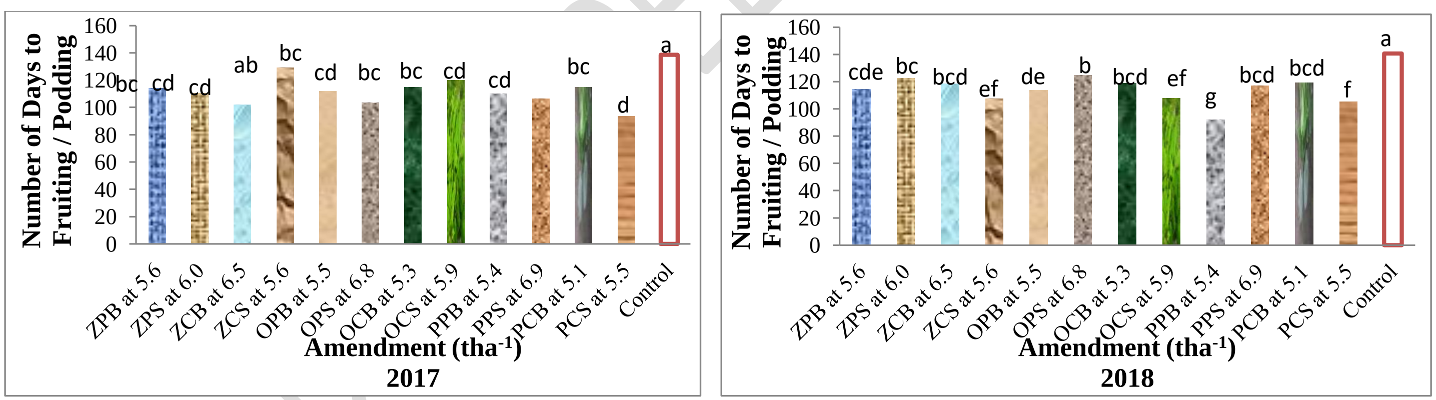

Figure 2: Effect of Poultry Manure and Cow dung from Different Housing Systems and Stacking methods on Number of Days to Podding/Fruiting of *Telfairia occidentalis* in Year 2017 and 2018

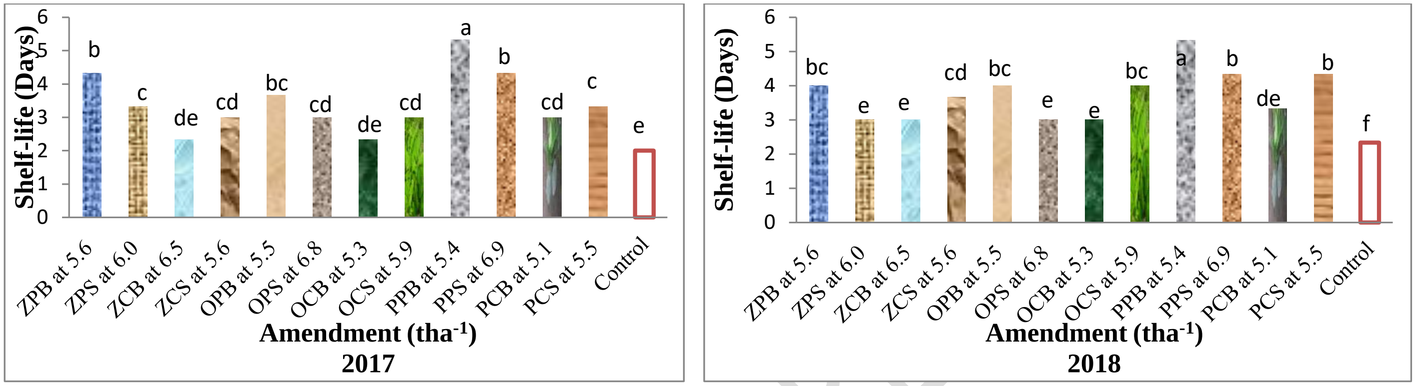

Figure 3: **Effect of Poultry Manure and Cow dung from Different Housing Systems and Stacking methods on Shelf-life of *Telfairia occidentalis* in Year 2017 and 2018.**

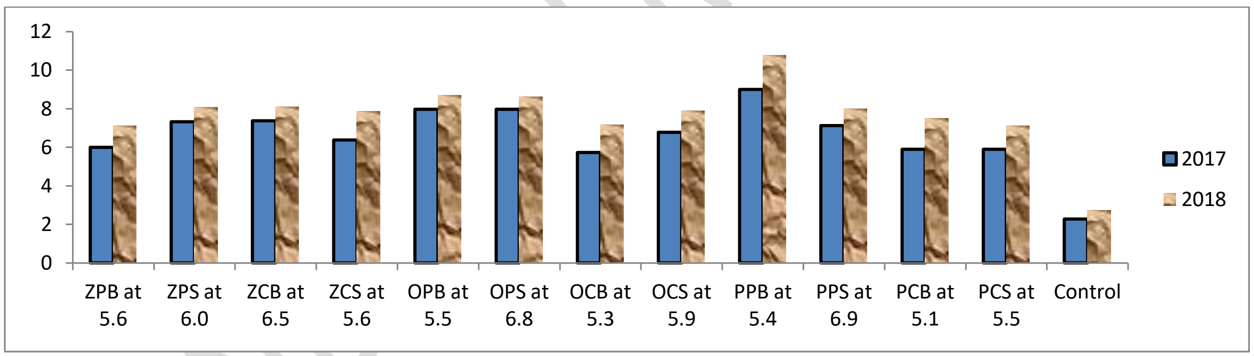

Figure 4: **Effect of Poultry Manure and Cowdung from Different Housing Systems and Method of Packaging on Yield of *Telfairia occidentalis* (Hook F.) in 2017 and 2018**

Table 1: Effect of Poultry Manure and Cow dung from Different Housing Systems and Stacking methods on Number of Pods, Pod Weight and Number of seeds/plot of *Telfairia occidentalis* (Hook F.) in Year 2017 and 2018

Amendments (tha^{-1})	Number of Pods ha^{-1}		Pod Weight (tha^{-1})		Number of Seeds / Pod	
	2017	2018	2017	2018	2017	2018
ZPB at 5.6	2083	2500bc	1.79b	2.67bc	35.00abcd	35.00abcd
ZPU at 6.0	2500	1667cd	2.58ab	2.29bcde	23.33bcd	28.83bcd
ZCB at 6.5	2083	1250d	1.96b	1.09ecde	23.67bcd	35.67abcd
ZCU at 5.6	2083	3333ab	1.54b	4.13ab	26.00abcd	40.33abc
OPB at 5.5	2500	2500bc	2.84ab	2.84bc	52.67a	49.00ab
OPU at 6.8	2083	833d	2.79ab	0.88de	41.67abc	17.00cd
OCB at 5.3	2500	833d	2.83ab	0.95d	33.33abcd	26.00bcd
OCU at 5.9	2500	2917b	2.04b	3.46b	48.67ab	47.33ab
PPB at 5.4	2500	2917b	5.21a	3.75ab	47.33ab	56.33a
PPU at 6.9	2500	1667cd	3.04ab	1.59cde	27.33abcd	34.33abcd
PCB at 5.1	1250	833d	0.96b	0.67e	18.67cd	18.00cd
PCU at 5.5	2500	4167a	3.21ab	5.58a	30.00abcd	38.67abcd
Control	1250	833d	0.46b	0.71e	11.33d	15.00d

Means with the same letter(s) in a column are not significantly different at $P \leq 0.05$

KEY:

ZPB: Poultry Manure Bagged in Zinc House
ZCB: Cowdung Bagged in Zinc House
OPB: Poultry Manure Bagged in Open Space
OCB: Cowdung Bagged in Open Space
PPB: Poultry Manure Bagged in Palm Fronds House
PCB: Cowdung Bagged in Palm Fronds House
ZPU: Poultry Manure Unbagged in Zinc House
ZCU: Cowdung Unbagged in Zinc House
OPU: Poultry Manure Unbagged in Open Space
OCU: Cowdung Unbagged in Open Space
PPU: Poultry Manure Unbagged in Palm Fronds House
PCU: Cowdung Unbagged in Palm Fronds House