The 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 the application to the field is one of the main issues influencing its nutrient content. The 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 the year 2017 and 2018 at the Organic Agricultural Research Farm of Federal University of Agriculture, Abeokuta, Ogun State. Amendment 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 fronds 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 fronds 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 (RCBD). Data collected were dry matter yield, number of seeds/pod, number of secondary vines, number of days to podding/fruiting, the shelf-life, and yield. Data were subjected to Analysis of Variance (ANOVA) and significant means were separated using Duncan's Multiple Range Test. It was observed that all amendment contributed significantly to dry matter yield, number of seeds/pod, number of secondary vines, reduced the number of days to podding/fruiting, prolong the shelf-life, and increase the yield of *T. occidentalis* above control while the application of PCU at 5.5 t/ha and PPB at 5.4tha^{-1} resulted in the highest. Finding, therefore recommends that, for better yield and yield attributes of *T. occidentalis* in the study area, it must be supplemented with PCU at 5.5tha^{-1} or PPB at 5.4tha^{-1}.

Keywords: Dry matter yield, Fruiting, Podding, Seed, The 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 the 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 the applications such as crop remains, animal manures and green manures have been substitutes because of its effects on soil organic matter content, improve soil fertility and soil physical characteristics, augment microbial activities and ameliorate metal toxicity (Escobar and Hue2008). Organic farming has received recognition in current years as purchasers demand for organically produced food and the sincerity of many growers to maintain or improve the soil (Dimitri and Greene, 2002).

Animal manure is associated with bulkiness, flies, unpleasant odour which can be controlled with the usage of an appropriate housing system. The 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 the application can significantly affect the nutrient content. Three (3) different housing systems were used for this experiment which includes: zinc house, palm frondss house and open space. Zinc house has natural, in-built durability and is easy to maintain. A palm fronds house is light-weight and, if tightly made, remarkably waterproof. The modern investigation established that houses built with palm fronds had lower risks to the environment. Open space is an undeveloped portion of land that is available to everyone. Open space is also a land area with its surface open to the sky.

T. 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 *T. occidentalis* in the 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).

The 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 *T. 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 frondss house and open space and each of the housing system were constructed with space measuring 5m x 6m (30 m^2). Mettler weighing balance was used to weigh 100kg of fresh manure into a 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).

The experimental site was manually cleared and levelled using cutlass and hoes. Initial soil samples (0 - 15 cm layer) were randomly collected at different points with the aid of a soil auger on the experimental site before amendment were applied, these were bulked and subsampled 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 amendment 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 fronds 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 fronds 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 *T. occidentalis* (60 kg Nha^{-1}) (Akanbi *et al.*, 2006). These were laid out in a RCBD with three replicates in both years. They were applied two (2) weeks before planting.

Fluted pumpkin (*T. 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 intervals throughout the experiment. Four plants were cut at the soil level per plot 8 weeks after planting, the fresh weights were taken using a weighing balance. Later, the plants were oven-dried to a 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.

Mature leaveswere first harvested 8 weeks after planting and subsequent harvesting was done at 2 weeks intervals. Fresh weights of harvested leaves were taken using Mettler weighing balance and the weight was recorded, with the cumulative weight taken as yield. The number of secondary vines was done by physical counting. The shelf-life was determined by storing harvested leaves in a 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 podding / 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 taking 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 were subjected to Analysis of Variance (ANOVA) using the Statistical Analysis System (Martin, 2008). Significant means were separated using Duncan's Multiple Range Test (Bautista, *et al.*) at a 5 % level of probability.

III. Results

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

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

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

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

Effect of Poultry Manure and Cow dung from Different Housing Systems and Stacking methods on the shelf-life of *T. occidentalis* in 2017 and 2018

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

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

However, the highest pod weight in year 2017 (Table 1) was observed on *T. occidentalis* plants amended with PPB at 5.4 tha^{-1} which was not statistically higher than the pod weight of *T. 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 higher than the pod weight of every other *T. occidentalis* plants. Whereas, in year 2018, *T. occidentalis* plants amended with PCU at 5.5 tha^{-1} had the highest pod weight which was not statistically higher than the pod weight of *T. 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 *T. occidentalis* plants.

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

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

IV Discussion

The highest agronomic parameters observed in *T. 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*. (2011) 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 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 the soil more productive, it must be supplemented with adequate nutrients. Meanwhile, the close to a neutral level of pH at which PPB was could influence the release of plant nutrients to tested plants. Number of days to podding/fruiting were hastened by the application of PPB at 5.4 tha^{-1} which could be attributed to why PPB mineralized faster when compared with other amendment. *T. 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 sa lower 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 *T. occidentalis* plants was a 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 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 *T. occidentalis* plants in Nigeria is as a result of low fertility of soil. The application of PPB at 5.4 tha^{-1} also increased the leaf yield and the shelf-life of *T. occidentalis* plants which could be probably because palm frondss 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 the shelf-life. This supported the findings of Ubani and Okonkwo (2011) who postulated that *T. occidentalis* leaves can only be kept for 6 days. It was also observed that *T. occidentalis* plants amended with PPB at 5.4 tha^{-1} gave tremendous increase in yield above every other amendment.

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 the soil more productive, it must be supplemented with adequate nutrients.

V Conclusion

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

VI REFERENCES

1. Adjei-Nsiah, S., Leeuwis, C., Giller, K. E., Sakyi-Dawson, O., Cobbina, J., Kuyper, T. W., Abekoe, M. and Van-Der-Werf, W. (2004). Land tenure and differential soil fertility management practices among native and migrant farmers in Wenchi, Ghana. Implication for Interdisciplinary Action Research. *Nigerian Journal of Agricultural Sciences* 52-3/4.

2. Akanbi, W. B., Adebooye, C. O., Togun, A. O., Ogunrinde, J. O. and Adeyeye, S. A. (2006). Growth, Herbage and Seed Yield and Quality of *Telfairia occidentalis* Quality as Influenced by Cassava Peel Compost and Mineral Fertilizer. *World Journal ofAgricultural Sciences*, 3(4): 508-516.
3. Akanni, D. I. and Ojeniyi, S. O. (2008). Residual Effect of Goat and Poultry Manures on Soil Properties, Nutrient Content and Yield of Amaranthus in Southwestern Nigeria. *Research Journal of Agronomy*. 2: 44-46.
4. Aletor, O., Oshodi, A. A., Ipinmoroti, K. (2002). Chemical Composition of Common Leafy Vegetables and Functional Properties of their Leaf Protein Concentrate. Food Chemistry. 78: 63-68.
5. Ayoola, O. T. 2006. Effects of Fertilizer Treatments on Soil Chemical Properties and Crop Yields in a Cassava-based Cropping System. *Journal of Applied Sciences Research.* 2(12): 1112-1116.
6. Ayoola, O. T. and Makinde, E. A. (2009). Maize Growth, Yield and Soil Nutrient Changes with N-Enriched Organic Fertilizers. *Afri. J. Food, Agric. Nutri. & Dev*. 9(1):580-592.
7. Bautista, M. G., Smith, D. W.stainer, R. L. (1997). A Cluster – Based Approach to Means Seperation. Journal of Agricultural, Biological and Environmental Statistics. Vol. 2(2), 179-197.
8. Dimitri, C., and Greene, C. (2002). Recent growth patterns in the U.S. Organic foods market (USDA Econ. Res. Serv., Agr. Info. Bul. 777).
9. Escobar, M. E. O. and Hue, N. V. (2008). Temporal Changes of Selected Chemical Properties in Three Manure Amended Soils of Hawaii. *Bioresource Technology*, 99, 8649-8654.
10. Escobar, M. E. O. and Hue, N. V. (2008). Temporal Changes of Selected Chemical Properties in Three Manure Amended Soils of Hawaii. *Bioresource Technology*, 99, 8649-8654.
11. Farhad, W., Saleem, M. F., Cheema, M. A., and Hammad, H.M. (2009). *The Journal of Animal and Plant Sciences* 19 (3). Pg 122-125.

12. Flavel, T. C. and Murphy, D. V. (2006). Carbon and nitrogen mineralization rates after the application of organic amendment to soil. J. Environ. Qual. 35: 183-193 from 21st – 25th Nov. 1999.
13. Golestaneh, S., Ganjali, H. R., Khamari, I., and Mehraban, A. (2013). Morphological Feautures Response of Calendula to the application of Animal Manure (Cow, Chicken and Ostrich Manure). *International Journal of Agriculture Innovations and Research*. Vol. 2(3). ISSN: 2319-1473.
14. Harrison, J. D. and Smith, D. R. (2004). Types of Manure Storage: Process Improvement for Animal Feeding Operations. Agriculture Environmental Management systems.
15. Horsfall, M. J. and Spiff, I. A. (2005). Equilibrium sorption study of AL3+, CO2+ and Ag+ in Aqueous solutions by fluted pumpkin (*Telfairia. occidentalis* Hook. F) waste biomass. *Acta Chim. Slov.*, 52: 174-181.
16. Makinde, E. A. and Ayoola, O. T. 2012. Comparative Growth and Yield of Okra with Cowdung and Poultry Manure. *American-Eurasian Journal of Sustainable Agriculture*, 6 (1): 18-23, ISSN: 1995-0748.
17. Martin, G. (2008). Analysis of Variance. Vol. 117 (1). 115-121.
18. Mugisa T. K. (2002). Integration of Forage Legumes into Per-Urban Maize and Elephant Grass Systems in Kampala-Jinja Milk Shed: MSc. Thesis. Makerere University, Kampala, Unpublished.
19. Mugwe, J., Mugendi, D., Odee, D. and Otieno, J. (2007). Evaluation of the potential of using nitrogen-fixing legumes in smallholder farms of Meru south district. In *Advances in Integrated Soil Fertility Management in Sub-Saharan Africa: Challenges and Opportunities*, 503–510 (Eds A. Bationo, B. Waswa, J. Kihara and J. Kimetu). Netherlands: Springer.
20. Muhereza I. (2005). Socio-economic Evaluation of Cattle Manure The application in Periurban Farming Systems: MSc. Thesis. Makerere University, Kampala. Unpublished.
21. Myint, A. K., Yamakawa, T., Kajihara, Y., Myint, K.K.M. and Zenmyo, T. (2010) Nitrogen Dynamics in a Paddy Field Fertilized with Mineral and Organic Nitrogen Sources. *American-Eurasian Journal of Agricultural and EnvironmentalSciences*, **7**, 221-231.

22. Ndor, E., Dauda, N. S., Abimuku, E. O., Azagaku, D. E. and Anzaku, H. (2012). Effect of Phosphorus Fertilizer and Spacing on Growth, Nodulation Count and Yield of Cowpea (*Vignaunguiculata* (L) *Walp*) in Southern Guinea Savanna Agroecological Zone, Nigeria. *Asian Journal of Agricultural Sciences*.4(4):254-257.
23. Olorunfemi, A. E.,Munavvar, A. S. and Hassaan, A. R. (2014). A Review of the Pharmacological and Biological Activities of the Aerial Parts of *Telfairia occidentalis* Hook. F. (cucurbitaceae). *Tropical Journal of pharmaceutical Research.* 13 (10): 1761 – 1769.
24. Olowokere, F. A., Adesodun, J. K., Owayena, E. J, Ilori, V. O., Adeniji, O. T., Adia, D and Rahman, K. (2014). Soil Chemical Properties and Okra Yield as affected by Sole and Combined The application of Poultry Manure and Cow dung. *Nigerian Journal of Ecology*. 13: 01-11.
25. Oyekunle, O. J. and Oyerele, T. A. (2012). Growth, Yield and Nutritional Compositions of Flutted Pumpkin (Telfaria occidentalis) as Affected by Fertilizer Types in Ogbomoso, South West Nigeria. *Bulleting of Environment, Pharmacology and Life Sciences*. Online ISSN 2277-1808. Vol. 1 (9), 81-88.
26. Salako F. K. (2003). Soil Physical Conditions in Nigerian Savannas and Biomass Production Department of Soil Science and Agricultural Mechanisation, University of Agriculture, Abeokuta, Nigeria Lecture given at the College on Soil Physics. *World Journal of Agricultural Sciences.* 2003; 3 (4): 508-5021.
27. Shamim, G., Khan, M. H., Khanday, B. A. and Sabena, N. (2015). Effect of Sowing Methods and NPK Levels on Growth and Yield of Rainfed Maize (*Zea mays* L.). published online, Doi: 10.1155/2015/198575.
28. Talpur, M. A., Changying, J. I., Junejo, S. A. and Tagar, A. A.. (2013). Impact of Rice on Soil Quality and Fertility. *Balgarian Journal of Agricultural Science*. Vol. 19 (6), 1287 – 1291.
29. Ubani, O. N. and Okonkwo, E. U. (2011). A Review of Shelf-life Extension Studies of Nigerian Indigenous Fresh Fruits and Vegetables in Nigerian Stored Products Research Institute. *African journal of Plant Science*. Vol. 5 (10), pp537-546. ISSN 1996-0824.

30. Uwah, D. F., Eneji, A. E. and Eshiet, U. J. (2011). Organic and Mineral Fertilizers Effects on the Performance of Sweet Maize (Zea mays L. saccharata Strut.) in South Eastern Rainforest Zone of Nigeria. *Int'l J. Agric. Scis*., 3(1):54-61.
31. Watson, C.A., Atkinson, D. Gosling, P. Jackson, L. R. and Rayns, F. W. (2002). Managing Soil Fertility in Organic Farming Systems. *Soil Use and Management* 18: 239-247.

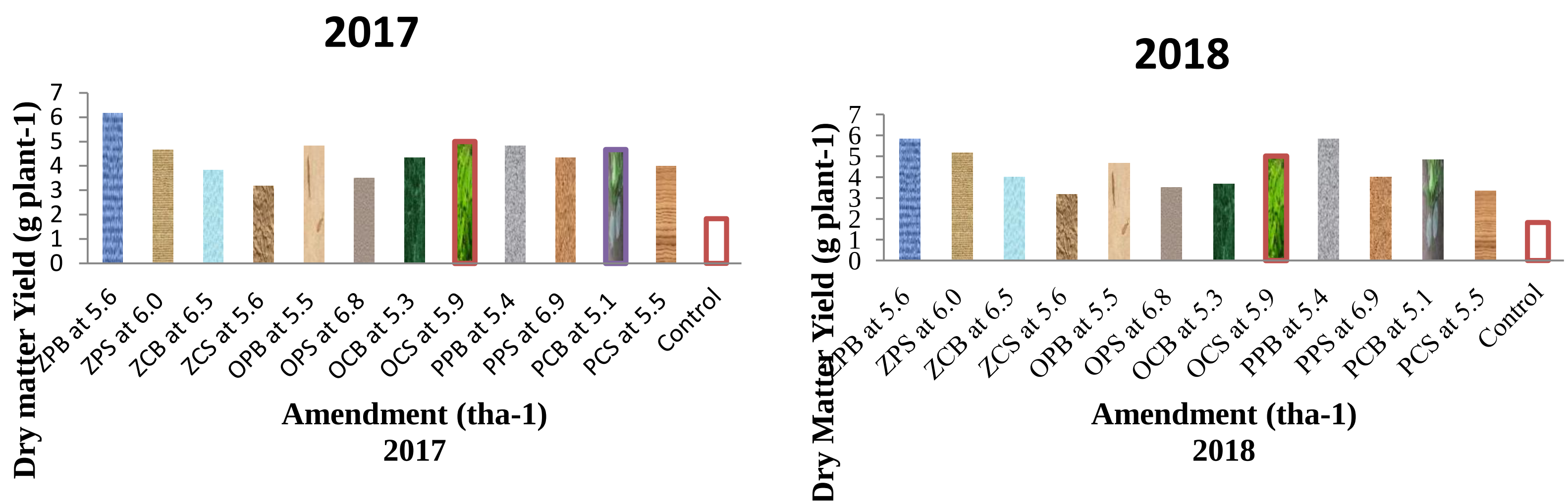

Figure 1: **Poultry Manure and Cow dung from Different Housing Systems and Stacking methods effect on Dry Matter Yield of *T. occidentalis* in Year 2017 and 2018**

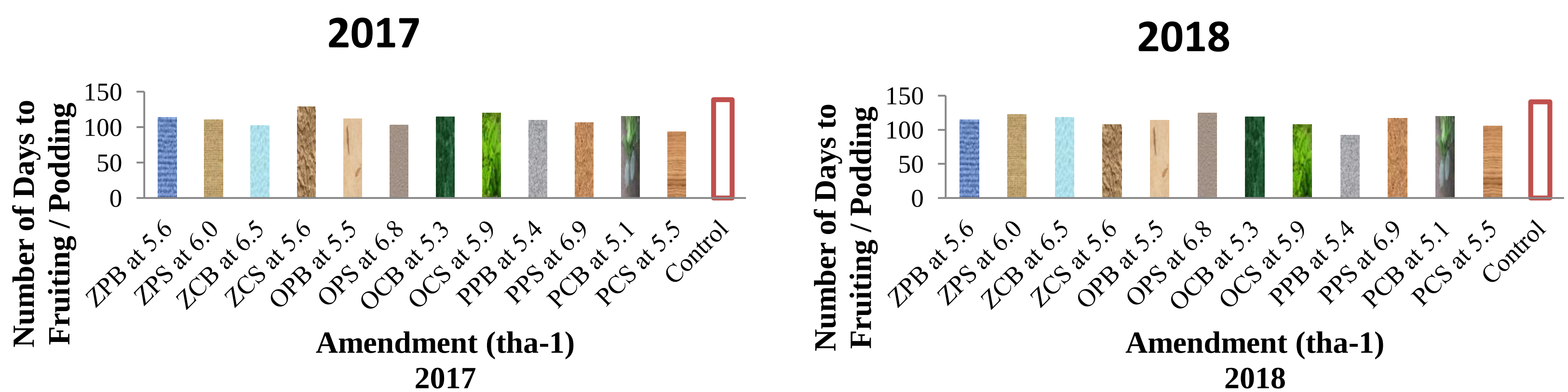

Figure 2: **Poultry Manure and Cow dung from Different Housing Systems and Stacking methods effect on Number of Days to Podding/Fruiting of *T. occidentalis* in Year 2017 and 2018**

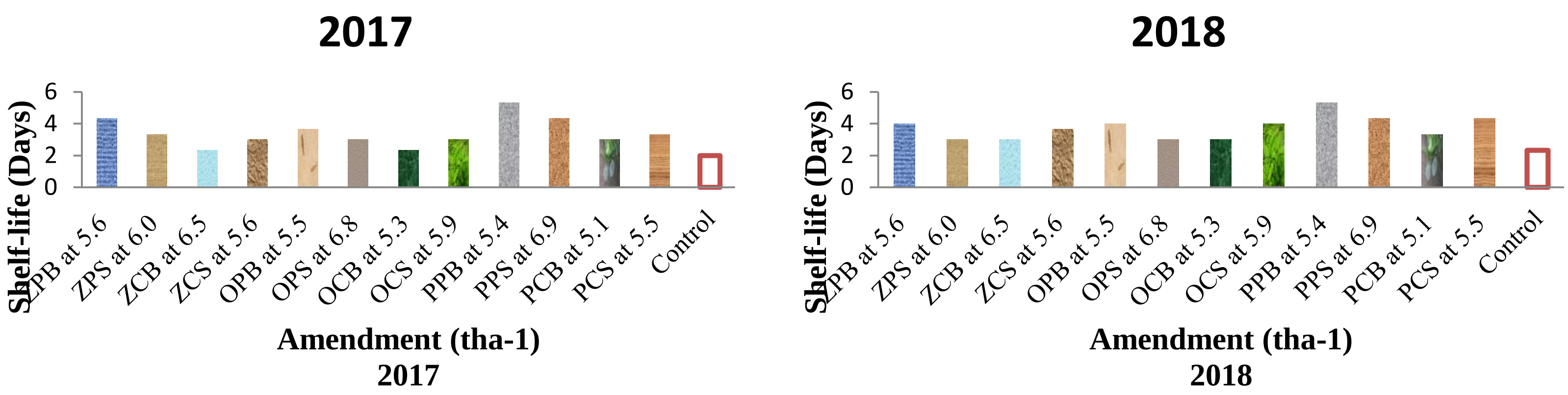

Figure 3: **Poultry Manure and Cow dung from Different Housing Systems and Stacking methods effect on the shelf-life of *T. occidentalis* in Year 2017 and 2018.**

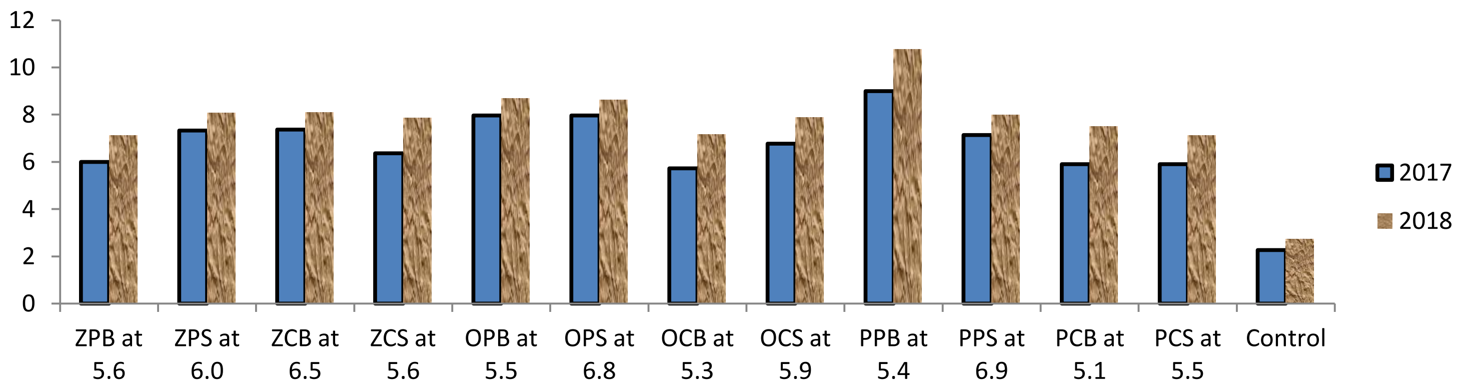

Figure 4: **Poultry Manure and Cowdung from Different Housing Systems and Stacking methods effect on Yield of *T. occidentalis* (Hook F.) in 2017 and 2018**

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

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