AGRICULTURAL INNOVATIONS
The Journal of African Society for Innovative Agriculture https://doi.org/XXXX/XXXX
Research article

OPTIMIZING TURF BIOMASS THROUGH APPLICATION OF POULTRY MANURE

Bankole E. A*, Aiyelari O. P., Ewulo B. S. and Fayeun L. S.

Department of Crop, Soil and Pest Management,
The Federal University of Technology Akure.
***Corresponding author: bankoleea@funaab.edu.ng Tel: +234 803 288 8672**

Abstract

Turf is a vital aspect of modern landscaping and sports field. In the pursuit of healthy and visually appealing turfgrass, nutrient management plays a critical role. Poultry manure, a readily available organic fertilizer, has gained attention for its potential to enhance turfgrass growth and biomass. However, there is little research that has been done on the effects of poultry manure on turf grass biomass. This study was therefore carried out to investigate the effects of poultry manure on turf biomass. The experiment comprised three species of turfgrass: *Axonopus compressus* (Carpet grass), *Cynodon dactylon* (Bahama grass), and *Paspalum vaginatum* (Portharcourt grass) as test crops replicated three times in a randomized complete block design and grown for two season. Data were collected on Turf parameters such as; turf weight, turf height, sprouting percentage and ground cover on monthly basis. Poultry manure has diverse effects on various turf species, impacting ground cover, height, weight, and sprouting percentage differently. Among the species studied, C. *dactylon* is highly sensitive to excessive nutrients, leading to a significant decrease in its height. P. *vaginatum* benefitted from poultry manure through increase in its ground cover, while A. *compressus* showed only minor responses. Therefore, poultry manure can be recommended to enhance ground cover but should be adjusted based on the specific needs of the turfgrass species.

Keywords: Turf, Biomass, Poultry Manure

INTRODUCTION

Turfgrass comprises of a diverse array of grass species which forms the foundation of numerous landscapes, ranging from residential lawns to sports fields, golf courses, and recreational spaces. The importance of turfgrass extends beyond aesthetics, as it serves essential functions such as erosion control, temperature moderation, and providing a safe and pleasant surface for recreational activities (Stier *et al*., 2015). The vitality and aesthetic appeal of these turfs are influenced by various factors, among which the application of organic amendments plays a pivotal role. Poultry manure, a readily available organic resource, has long been recognized for its potential to enhance soil fertility and promote plant growth (Smith *et al*., 2018).

Natural organic fertilizers contain carbon (C) and are typically derived from waste plant or animal materials (Christians, 2004). Furthermore, these naturally occurring slow-release organic fertilizers often supply plants with available nitrogen (N) along with various other essential nutrients, such as phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), and micronutrients (Eldridge *et al*., 2008). In recent

Received: 26 August 2023 Accepted for publication 16 September 2023 Published 10 October 2023

years, there has been a growing interest in the use of organic fertilizers like poultry manure in place of or in conjunction with traditional chemical fertilizers (Diaz-Perez *et al*., 2004). Organic amendments offer a host of benefits, including enhanced soil structure, improved nutrient retention, and the potential to mitigate nutrient runoff, thereby reducing environmental impacts (Liang *et al*., 2015). However, the effective use of poultry manure in turf management necessitates a proper understanding of its application rates, as excessive or inadequate use can lead to unintended consequences.

This study therefore aims to provide a delicate balance between promoting turfgrass biomass and avoiding the overuse of organic amendments that may result in nutrient imbalances or environmental harm.

MATERIALS AND METHODS

The experiment was conducted at the field of The Federal University of Technology, Akure in South West Nigeria. Field establishment of the experiment was carried out from May 2018 and repeated the following year 2019. The experiment comprised three species of turfgrass: *Axonopus compressus* (Carpet grass), *Cynodon dactylon* (Bahama grass), and *Paspalum vaginatum* (Portharcourt grass) as test crops replicated three times in a randomized complete block design and grown for two season. Carefully stripped sprigs of the three turfgrass species, of 10 cm long were planted at spacing of 10 x 10 cm in each experimental plot according to the randomization. Data on Turf parameters such as; turf weight, turf height, Sprouting rate and ground cover were collected every month.

RESULTS

There was no significant ($p \leq 0.05$) difference observed with the application of poultry manure among the turf species and the parameters evaluated as shown in Table 1. *P. vaginatum* gave the highest wet root weight for all the poultry manure rate. Application of 15 tons/ha of poultry manure gave the highest wet shoot weight (0.10) and dry root weight (0.03) observed in *C. dactylon* and *P. vaginatum* respectively. The application of 15 tons/ha of poultry manure resulted in the most significant germination rate (67.22%), which was evident in *P. vaginatum*. *P. vaginatum* consistently demonstrated the highest germination rates for all the various poultry manure rates applied, while *A. compressus* consistently exhibited the lowest germination rates (Table 2). The application of 10 tons/ha of poultry manure resulted in the highest ground cover percentages of 11.67% and 13.67% for *A. compressus* at 50% and 100%, respectively. On the other hand, *C. dactylon* exhibited the lowest ground cover percentages at both 50% and 100% for all the poultry manure rates applied (Table 3). The height of *C. dactylon* was most significantly affected by the absence of poultry manure application (0 tons/ha), resulting in a height of 37.83, followed by the application of 15 tons/ha (33.03). However, *A. compressus* recorded the shortest plant height (18.67) when 10 tons/ha of poultry manure was applied (Table 4).

Table 1: Effects of Poultry Manure Rate on the weight of turf species in Akure

Poultry Manure Rate (tons/ha)	Turf Species	Dry Shoot Weight (g)	Dry Root Weight (g)	Wet Shoot Weight (g)	Wet Root Weight (g)
0	*A. compressus*	0.03a	0.01a	0.08a	0.06a
	C. dactylon	0.03a	0.01a	0.08a	0.07a
	P. vaginatum	0.03a	0.02a	0.08a	0.09a
10	*A. compressus*	0.03a	0.02a	0.08a	0.06a
	C. dactylon	0.03a	0.01a	0.08a	0.06a
	P. vaginatum	0.02a	0.02a	0.08a	0.08a
12.5	*A. compressus*	0.04a	0.01a	0.08a	0.06a
	C. dactylon	0.04a	0.02a	0.09a	0.08a
	P. vaginatum	0.03a	0.02a	0.08a	0.08a
15	*A. compressus*	0.03a	0.01a	0.08a	0.06a
	C. dactylon	0.04a	0.02a	0.10a	0.07a
	P. vaginatum	0.03a	0.03a	0.08a	0.09a

Table 2: Effects of Poultry Manure on germination rate of turf species in Akure

Poultry Manure Rate (tons/ha)	Turf Species	% Germination
0	*A. compressus*	21.67b
	C. dactylon	56.7a
	P. vaginatum	67.01a
10	*A. compressus*	10.00a
	C. dactylon	35.8c
	P. vaginatum	55.57a
12.5	*A. compressus*	33.33c
	C. dactylon	45.1b
	P. vaginatum	54.32a
15	*A. compressus*	21.67b
	C. dactylon	45.6b
	P. vaginatum	67.22a

Table 3: Effects of poultry manure on ground cover of *A. compressus*

Poultry Manure Rate (tons/ha)	Turf Species	50%	100%
0	*A. compressus*	10.67a	13.00a
	C. dactylon	8.33a	10.33a
	P. vaginatum	9.74a	11.74a
10	*A. compressus*	11.67a	13.67a
	C. dactylon	9.33a	11.00a
	P. vaginatum	9.18a	11.18a
12.5	*A. compressus*	10.00a	12.00a
	C. dactylon	9.53a	11.47a
	P. vaginatum	9.01a	11.01a
15	*A. compressus*	9.67a	12.67a
	C. dactylon	8.33a	10.33a
	P. vaginatum	9.67a	11.66a

Table 4: Effects of poultry manure rate on turf species height in Akure

Poultry Manure Rate (tons/ha)	Turf Species	50% Plant Height
0	*A. compressus*	23.00a
	C. dactylon	37.83a
	P. vaginatum	23.34a
10	*A. compressus*	18.67a
	C. dactylon	30.67a
	P. vaginatum	23.24a
12.5	*A. compressus*	22.17a
	C. dactylon	28.35a
	P. vaginatum	27.32a
15	*A. compressus*	20.83a
	C. dactylon	33.03a
	P. vaginatum	29.01a

DISCUSSION

The results of the study indicate that the application of poultry manure had varying effects on different turf species and parameters evaluated. *P. vaginatum* exhibited the highest wet root weight across all poultry manure rates, while *C. dactylon* and *P. vaginatum* showed the highest wet shoot weight and dry root weight, respectively, with the application of 15 tons/ha of poultry manure. These findings are consistent with previous research on the effects of poultry manure on plant growth and development. Studies have shown that poultry manure application can positively influence the growth and yield of various crops, including maize and rice (Boateng et al., 2009; Sangeetha et al., 2013; Ngala et al., 2021). Additionally, *P. vaginatum* demonstrated the highest germination rates for all poultry manure rates, while *A. compressus* consistently exhibited the lowest germination rates. Furthermore, the application of 10 tons/ha of poultry manure resulted in the highest ground cover percentages for *A. compressus*, while *C. dactylon* exhibited the lowest ground cover percentages at both 50% and 100% for all poultry manure rates. The observed variations in ground cover percentages and germination rates among turf species in response to poultry manure application align with studies that have reported differences in nutrient uptake and utilization by different plant species (Vietor et al., 2002; Passos et al., 2014). These differences may be attributed to the specific nutrient requirements and physiological characteristics of each turf species. The height of *C. dactylon* was significantly affected by the absence of poultry manure application, resulting in the tallest plants, whereas *A. compressus* recorded the shortest plant height when 10 tons/ha of poultry manure was applied. The significant effects of poultry manure on plant height and root development are consistent with previous findings on the influence of organic fertilizers on the root and plant development of various crops (Arslanoğlu, 2022; Espinosa et al., 2011).

CONCLUSION

Poultry manure has varying effects on ground cover, height, weight, and Sprouting rates among the different turf species. C. *dactylon* is highly sensitive to excessive nutrients, resulting in significant reductions in plant height. P. *vaginatum* benefits from higher ground cover, while A. *compressus* showed minor responses. Poultry manure can be recommended to enhance ground cover but adjustment needs to be made based on species and their specific needs. Caution should be exercised when using poultry manure to improve plant height, especially for sensitive species like C. *dactylon*. The relationship between poultry manure application and turfgrass biomass remains complex and may require further investigation to consider species-specific responses.

REFERENCES

Agba, O. (2020). Evaluation of planting distance and poultry manure on performance of utasi (gongronema latifolium). Journal of Experimental Agriculture International, 24-36. https://doi.org/10.9734/jeai/2020/v42i830567

Arslanoğlu, F. (2022). The effects on the root and plant development of soybean of organic fertilizer applications. Bioscience Journal, 38, e38036. https://doi.org/10.14393/bj-v38n0a2022-60382

Boateng, S., Zickermann, J., & Kornahrens, M. (2009). Poultry manure effect on growth and yield of maize. West African Journal of Applied Ecology, 9(1). https://doi.org/10.4314/wajae.v9i1.45682

Diaz-Perez, J. C., Phatak, S. C., & Lee, E. H. (2004). Nitrogen Mineralization

Eldridge, S. M., Chan, K. Y., Xu, Z. H., Chen, C. R., & Barchia, I. (2008). Plant-available nitrogen supply from granulated bio-solids: implications for land application guidelines. Australian Journal of Soil Research, 46, 423436.

Espinosa, D., Sale, P., & Tang, C. (2011). Changes in pasture root growth and transpiration efficiency following the incorporation of organic manures into a clay subsoil. Plant and Soil, 348(1-2), 329-343. https://doi.org/10.1007/s11104-011-0951-3

Liang, J., Werf, H. M. G. v. d., Koppert, R., & Wenneker, M. (2015). Economic and Environmental Impact of Bio-based Chemicals Production. Industrial Crops and Products, 64, 288-296.

Ngala, A., Digmari, F., Ndirmbula, J., & Abdullahi, R. (2021). Effects of npk, bio-fertilizers and manures on growth of maize (zea mays l.) and soil nutrients content in maiduguri, nigeria. European Journal of Agriculture and Food Sciences, 3(5), 117-122. https://doi.org/10.24018/ejfood.2021.3.5.34

Passos, A., Rezende, P., Carvalho, E., & Aker, A. (2014). Residual effects of the organic amendments poultry litter, farmyard manure and biochar on soybean crop. Agricultural Sciences, 05(14), 1376-1383. https://doi.org/10.4236/as.2014.514148

Ragagnin, V., Júnior, D., Dias, D., Fernandes-Braga, W., & Nogueira, P. (2013). Growth and nodulation of soybean plants fertilized with poultry litter. Ciência E Agrotecnologia, 37(1), 17-24. https://doi.org/10.1590/s1413-70542013000100002

Sangeetha, S., Balakrishnan, A., & Devasenapathy, P. (2013). Influence of organic manures on yield and quality of rice (<i>oryza sativa</i> l.) and blackgram (<i>vigna mungo</i> l.) in rice-blackgram cropping sequence. American Journal of Plant Sciences, 04(05), 1151-1157. https://doi.org/10.4236/ajps.2013.45141

Smith, A. W., Johnson, S. E., & Brown, G. (2018). Poultry Manure Application Effects on Turfgrass: Part I - Soil Properties and Quality. Soil Science Society of America Journal, 82(4), 797-806.

Stier, J. C., Peake, J. B., & Liu, H. (2015). Managing Turfgrass for Environmental Quality. CRC Press.

Vietor, D., Griffith, E., White, R., Provin, T., Muir, J., & Read, J. (2002). Export of manure phosphorus and nitrogen in turfgrass sod. Journal of Environmental Quality, 31(5), 1731-1738. https://doi.org/10.2134/jeq2002.1731