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The Effect of Organic Waste Compost on the Growth Performance of *Abelmoschus esculentus* (Okra)

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Abstract
This study investigates the effects of various organic waste composts on the growth performance of okra (Abelmoschus esculentus). Composts derived from food waste, yard waste, animal manure, and Black Soldier Fly (BSF) residues were evaluated through a field experiment using 11 treatments, including a control. Plant morphological parameters (e.g., height, leaves, fruit weight) and physiological markers (e.g., chlorophyll a & b, carotenoids, total phenolic content) were measured. Goat manure and BSF frass showed significant improvements in okra growth and soil fertility. Statistical analyses using ANOVA and Duncan's test confirmed the reliability of the results. The findings highlight the potential of composted organic waste as sustainable biofertilizers, enhancing crop productivity while reducing environmental impact.
Keywords: Okra; Organic waste; Compost; Soil fertility; Sustainable agriculture

Introduction

Organic waste constitutes a major portion of municipal and agricultural residues in Malaysia, contributing significantly to environmental degradation when improperly managed (Kadir et al., 2016). Composting offers a sustainable alternative by converting organic waste into nutrient-rich biofertilizer (Kit Wayne Chew et al., 2018). Abelmoschus esculentus (okra), a widely cultivated tropical crop, thrives in poor soils and is suitable for testing organic compost effectiveness (Singh et al., 2014).

Although composting has been applied to various crops, limited data exist on how different compost types influence specific crop growth. This study compares the significance of multiple compost sources, including BSF residues, animal manures, and plant waste, on okra performance. Understanding these effects can promote sustainable farming and improve waste management strategies.

Materials and methods

The study was conducted at Universiti Teknologi Malaysia (UTM), with composting and planting activities taking place at the Faculty of Science and Living Lab. Eleven treatments were used: control (T1), coconut husk (T2), dried leaves (T3), Dyptia (T4), Dyptia Wira (T5), exuviae (T6), goat manure (T7), ostrich manure (T8), horse manure. Compost was produced using a Maeko aerobic biocomposter with Effective Microbes (EM) to speed up decomposition.

Okra seedlings were planted in raised beds and planter boxes filled with compost-amended soil. Each treatment had six replicates. Growth parameters, including plant height, number of leaves, leaf dimensions, fruit count, weight, and flowering time, were recorded. Physiological measurements included chlorophyll a and b, carotenoids, and total phenolic content (TPC) using spectrophotometric methods. Soil NPK, pH, and moisture were assessed using a soil sensor. Data were analyzed via one-way ANOVA and Duncan's Multiple Range Test (DMRT).

Results and discussion

This study evaluated the effect of eleven compost treatments on the growth performance and physiological traits of *Abelmoschus esculentus* (okra). Significant differences ($p < 0.05$) were observed among treatments in both vegetative and reproductive parameters, as well as physiological content, as confirmed by one-way ANOVA and Duncan's Multiple Range Test.

Vegetative Growth Performance

Treatment 6 (Exuviae) yielded the best vegetative development. Okra plants in this group exhibited the greatest plant height, the largest number of leaves, and the widest leaf span. This suggests that black soldier fly (BSF) exuviae, rich in nitrogen and other micronutrients, enhance foliage development and biomass accumulation. In contrast, Treatment 2 (Coconut Husk) recorded the poorest vegetative performance, likely due to poor nutrient composition and low microbial decomposition activity in the husk material (Figure 1).

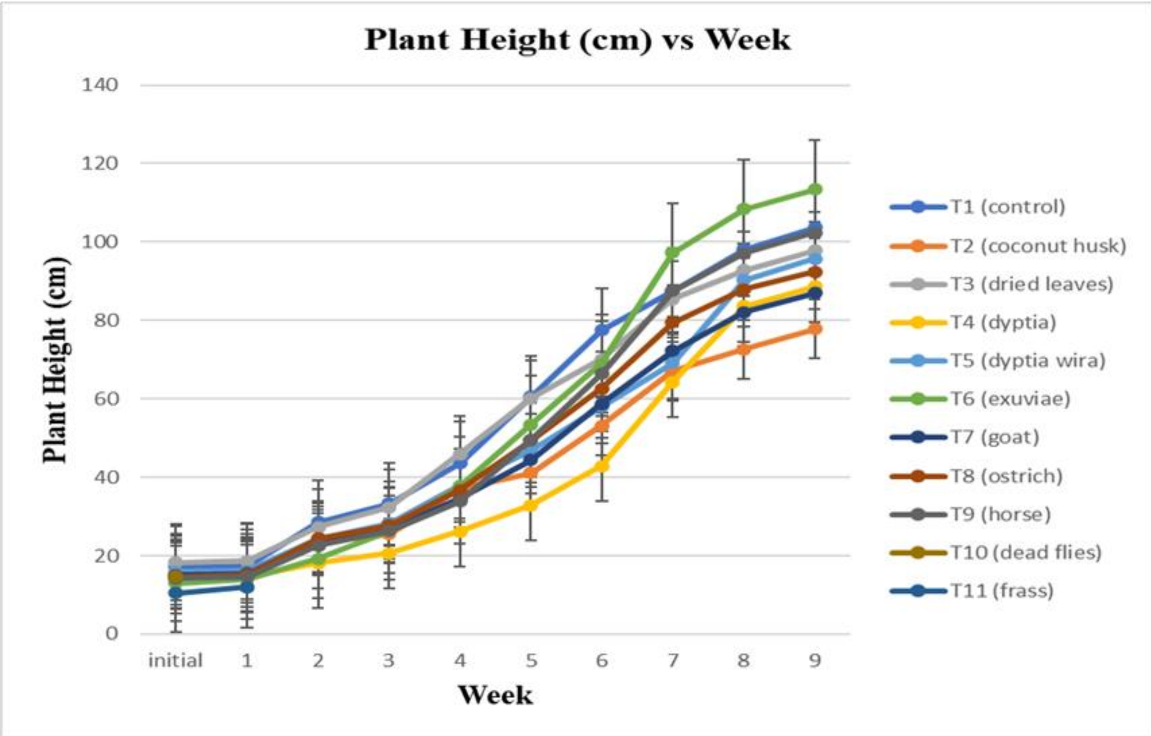

Figure 1 Graph of plant height for 9 weeks

Reproductive Growth Performance

The highest fruit yield was recorded in Treatment 8 (Ostrich Manure), with plants producing the greatest number and weight of okra pods throughout the study period. This may be attributed to the balanced nutrient release and high phosphorus content in ostrich manure, which supports flowering and fruiting. While Treatment 6 (Exuviae) also contributed to good reproductive outcomes, its impact was most prominent in vegetative traits. Meanwhile, coconut husk again showed the weakest results, with minimal fruit formation and reduced overall productivity (Figure 2).

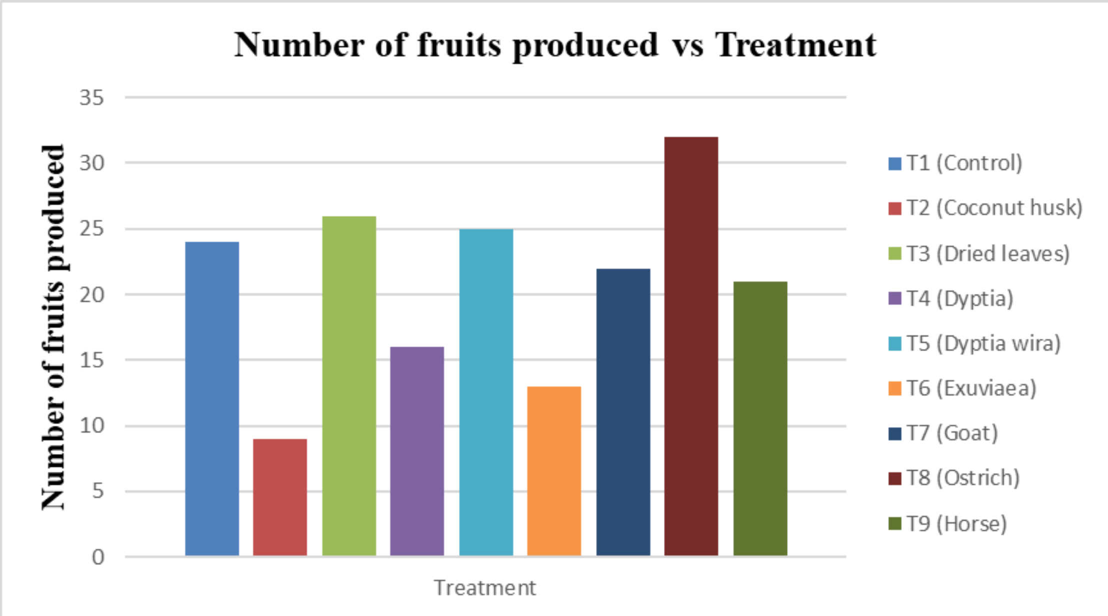

Figure 2 Graph of fruit produced for 9 weeks

Physiological Traits

Photosynthetic pigment analysis showed that okra leaves from the Exuviae and Ostrich Manure treatments had significantly higher chlorophyll a and b and carotenoid content compared to other groups (Table 1). This suggests enhanced photosynthetic efficiency and stress tolerance.

Table 1: Chlorophyll a and b content of okra leaves under different compost treatments

Treatment	Chlorophyll a	Chlorophyll b
Control	1.47601	1.093513333
Coconut husk	2.089316667	2.393156667
Dried leaves	0.227963333	0.274136667
Diptia	4.21594	2.276553333
Diptia Wira	0.21978667	0.254826667
Exuviae	7.41199	3.756903333
Goat manure	2.61429333	1.38888
Ostrich manure	2.16273667	1.261076667
Horse manure	3.13731933	1.54531

In addition, Total Phenolic Content (TPC) was markedly higher in plants from these treatments, indicating greater antioxidant activity, which may contribute to improved plant resilience (Table 2).

Table 2: Carotenoid content and total phenolic content of okra leaves under different compost treatments.

Treatment	Carotenoid	Total Phenolic Content
Control	1.501206667	15.88266667
Coconut husk	1.367856667	31.00266667
Dried leaves	1.059423333	21.12266667
Diptia	1.994616667	43.92266667
Diptia Wira	1.279028333	51.336
Exuviae	2.501059	37.42933333
Goat manure	1.734394333	25.776
Ostrich manure	1.559272733	14.90666667
Horse manure	1.231741	29.76

Statistical Analysis Using ANOVA

One-way ANOVA revealed statistically significant differences ($p < 0.05$) among the eleven compost treatments in terms of plant height, number of leaves, and leaf width of Abelmoschus esculentus. Duncan's Multiple Range Test (DMRT) further clarified these differences by grouping treatments based on statistical similarity.

Treatment 6 (Exuviae) demonstrated the highest overall vegetative performance, with the tallest average plant height (115.4 cm) and broadest leaves. It was consistently grouped under 'a', indicating a statistically significant advantage over most other treatments. This suggests that black soldier fly exuviae provide a rich source of nutrients that enhance vegetative development.

Treatment 11 (Frass) and Treatment 8 (Ostrich Manure) also performed well, grouped as 'ab', showing they were not significantly different from the top performer in most traits. Treatment 10 (Died Flies) also maintained 'ab' status in leaf number. In contrast, Treatment 2 (Coconut Husk) consistently fell into group 'e' across all traits, indicating significantly lower performance in height, leaf number, and leaf width. This confirms its unsuitability as a standalone compost source.

Table 3: Mean values and DMRT groupings for okra vegetative growth under different compost treatments

Treatment	Plant Height	Group
Control	77.4	d
Coconut husk	65.3	e
Dried leaves	83.6	cd
Diptia	87.9	bc
Diptia Wira	90.2	bc
Exuviae	115.4	a
Goat manure	103.2	b
Ostrich manure	98.5	ab
Horse manure	95.3	b

Table 4: Mean values and DMRT groupings for okra vegetative growth under different compost treatments

Treatment	Number of leaves	Group
Control	11.2	d
Coconut husk	9.5	e
Dried leaves	11.9	cd
Diptia	12.3	c
Diptia Wira	12.5	c
Exuviae	14.5	a
Goat manure	13.4	b
Ostrich manure	13.7	b
Horse manure	12.8	bc

Table 5: Mean values and DMRT groupings for okra vegetative growth under different compost treatments

Treatment	Leaf width	Group
Control	10.7	d
Coconut husk	9.6	e
Dried leaves	11.2	cd
Diptia	11.8	c
Diptia Wira	12.0	c
Exuviae	14.3	a
Goat manure	12.7	b
Ostrich manure	13.2	ab
Horse manure	12.5	bc

Conclusion

Organic waste composts significantly enhance okra plant growth and physiological quality. Treatments with goat manure and BSF frass consistently outperformed others in both morphological and physiological aspects. These results demonstrate the potential of organic waste composts as sustainable, eco-friendly alternatives to synthetic fertilizers in okra cultivation.

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