

Optimizing the productivity of eggplant grown in polybags with the application of buffalo manure tea

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ARTICLE INFO	ABSTRACT
Research Paper Received: December 17, 2024 Revised: February 12, 2025 Accepted: February 24, 2025 Keywords Buffalo manure tea Container gardening Eggplant Organic farming Polybag-growing *Corresponding author Francisco Olermo Esgrina Email: foesgrina@cfcst.edu.ph	By optimizing container gardening practices for solanaceous vegetables like eggplant, urban agriculture and food security initiatives can be significantly advanced. This study examined the productivity of polybag-grown eggplants, focusing on polybag sizes and buffalo manure tea levels. A randomized complete block design (RCBD) was utilized, featuring a 3 × 8 factorial arrangement with 24 treatments and 3 replicates. The experimental results showed that eggplants grown in 40.64 x 40.64 cm polybags demonstrated significantly higher growth and yield. Specifically, these polybags achieved average plant heights of 46.73 cm, a leaf count of 28.39, and a total yield of 2.01 kg per plant. The polybags required at least 6.5 kg of growing media, composed of a 2:2:1 ratio of garden soil, aged rice hull, and vermicompost. These findings offer valuable insights for urban gardeners and agricultural practitioners seeking to enhance eggplant productivity sustainably.

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1. Introduction

Eggplant (*Solanum melongena* Linn) a versatile and nutritious vegetable, thrives in container gardens, making it an ideal choice for urban or small-space gardening (Roll & Wilson, 2020; Kiefer, 2023). Container gardening offers better control over soil quality and moisture levels (Relf, 2020; Harrison, 2021), which are essential for eggplant growth. Container-grown eggplants

benefit from organic nutrients like compost tea or organic fertilizers, which enhance soil quality, promote root health, and improve nutrient uptake (Montgomery & Bikle, 2021; Ye et al., 2023; Hu et al., 2024). Furthermore, eggplants grown without synthetic fertilizers tend to have superior postharvest qualities, including firmer texture, better flavor, richer nutritional content, longer shelf life, and reduced environmental impact (Ebrahimi et al., 2021; Mahamad et al., 2022).

Manure tea application to vegetables enhances growth and yield by supplying essential nutrients such as NPK (Hamaïel et al., 2015; Tuan, 2019; Gad et al., 2023). Its organic matter content improves soil structure, aiding water retention and nutrient availability to plant roots. Beneficial microorganisms in manure tea also enhance soil health and plant resilience against pests and diseases (Schonbeck et al., 2019; Silva & Canellas, 2022). The use of manure tea optimizes crop productivity, reduces reliance on synthetic fertilizers, and supports sustainable agricultural practices (Golabi et al., 2004; Gamage et al., 2023). Specifically, buffalo manure tea (BMT), a liquid organic fertilizer derived from composted buffalo manure, is particularly effective in improving soil fertility and plant health (DAATI, 2011; Leauthaud et al., 2022; Ramírez-Gottfried et al., 2023).

Moreover, despite the benefits, limited studies address the interaction of BMT application levels with container size, particularly for eggplant cultivation. Thus, determining the optimal container size for growing fruit vegetables remains challenging due to gaps in understanding. Fruit vegetables, including eggplant, have specific root structure and growth habit requirements (GCE, 2016; JICA, 2016). Additionally, container size can impact moisture retention, nutrient availability, and microclimate conditions around the plant (NeSmith & Duval, 1998; Llewellyn et al., 2016; Dumroese & Haase, 2018).

Although several studies have explored the effects of manure tea on vegetable growth (Radovich & Arancon, 2011; González-Hernández et al., 2023; Sunaryo et al., 2023), there is still limited standardized guidance on the appropriate concentration and application frequency of manure tea for solanaceous crops like eggplants. Addressing these knowledge gaps through empirical research will provide clearer

guidelines for selecting the best polybag size and manure tea application rate for eggplants. Further, it may provide practical recommendations for urban agricultural practices.

This study aimed to fill these gaps by examining the two-factor effects of polybag size and buffalo manure tea (BMT) application levels on the vegetative, reproductive, and postharvest quality of polybag-grown eggplants in the local environmental conditions of Arakan, Cotabato. It specifically investigated how polybag size influences eggplant growth and yield, the effects of varying BMT levels on eggplant performance, and the interaction between polybag size and manure tea application.

2. Materials and Methods

2.1. Duration and location of the study

This open-field experiment was conducted from January to April 2024 at the agricultural experimental area of Cotabato Foundation College of Science and Technology, Arakan, Cotabato, Philippines.

2.2. Experimental design, treatments, and field layout

This open-field study employed a factorial arrangement in Randomized Complete Block Design (RCBD), with three polybag sizes (30.48 x 35.56 cm, 35.56 x 35.56 cm, 40.64 x 40.64 cm) as factor A and eight buffalo manure tea levels (0, 0.25, 0.50, 0.75, 1.00, 1.25, 1.50, and 1.75 liters per liter of water) as factor B. The design included 24 treatment combinations, three replicates, and 10 plants per treatment (Table 1). A total of 72 plots (3.0 x 1.25 m) were established, with 0.5 m spacing between plots, covering an area of 625 m² (62.5 x 10 m). Each plot had two rows, with six hills per row, and a planting distance of 20 inches (50 cm) between hills and 30 inches (75 cm) between rows.

Table 1. Summary of this two-factor experimental design

Factor B: Buffalo manure tea levels (liters of BMT per liter of H ₂ O)	Factor A: Polybag sizes (cm)		
	A1 (30.48 x 35.56 cm polybag)	A2 (35.56 x 35.56 cm polybag)	A3 (40.64 x 40.64 cm polybag)
B1 (0 liter)	A1B1 (30.48 x 35.56 cm polybag; 0 L BMT/L H ₂ O)	A2B1 (35.56 x 35.56 cm polybag; 0 L BMT/L H ₂ O)	A3B1 (40.64 x 40.64 cm polybag; 0 liter of BMT/L H ₂ O)
B2 (0.25 liter)	A1B2 (30.48 x 35.56 cm polybag; 0.25 L BMT/L H ₂ O)	A2B2 (35.56 x 35.56 cm polybag; 0.25 L BMT/L H ₂ O)	A3B2 (40.64 x 40.64 cm polybag; 0.25 L BMT/L H ₂ O)
B3 (0.50 liter)	A1B3 (30.48 x 35.56 cm polybag; 0.50 L BMT/L H ₂ O)	A2B3 (35.56 x 35.56 cm polybag; 0.50 L BMT/L H ₂ O)	A3B3 (40.64 x 40.64 cm polybag; 0.50 L BMT/L H ₂ O)
B4 (0.75 liter)	A1B4 (30.48 x 35.56 cm polybag; 0.75 L BMT/L H ₂ O)	A2B4 (35.56 x 35.56 cm polybag; 0.75 L BMT/L H ₂ O)	A3B4 (40.64 x 40.64 cm polybag; 0.75 L BMT/L H ₂ O)
B5 (1.00 liter)	A1B5 (30.48 x 35.56 cm polybag; 1.00 L BMT/L H ₂ O)	A2B5 (35.56 x 35.56 cm polybag; 1.00 L BMT/L H ₂ O)	A3B5 (40.64 x 40.64 cm polybag; 1.00 L BMT/L H ₂ O)
B6 (1.25 liters)	A1B6 (30.48 x 35.56 cm polybag; 1.25 L BMT/L H ₂ O)	A2B6 (35.56 x 35.56 cm polybag; 1.25 L BMT/L H ₂ O)	A3B6 (40.64 x 40.64 cm polybag; 1.25 L BMT/L H ₂ O)
B7 (1.50 liters)	A1B7 (30.48 x 35.56 cm polybag; 1.50 L BMT/L H ₂ O)	A2B7 (35.56 x 35.56 cm polybag; 1.50 L BMT/L H ₂ O)	A3B7 (40.64 x 40.64 cm polybag; 1.50 L BMT/L H ₂ O)
B8 (1.75 liters)	A1B8 (30.48 x 35.56 cm polybag; 1.75 L BMT/L H ₂ O)	A2B8 (35.56 x 35.56 cm polybag; 1.75 L BMT/L H ₂ O)	A3B8 (40.64 x 40.64 cm polybag; 1.75 L BMT/L H ₂ O)
Field layout			
a. Parameter	Specification		
b. Plot dimensions	3.0 x 1.25 m		
c. Total plots	72		
d. Total area	625 m ²		
e. Spacing between plots	0.5 m		
f. Planting distance	50 cm (hills) 75 cm (rows)		
Number of replicates	3		
Number of plants per treatment	10 plants per treatment		
Treatment combinations (factor A x factor B)	3 x 8 = 24 treatment combinations		
Total number of plant population (treatment combination x replication x number of plants per treatment)	24 x 3 x 10 = 720 plants		

2.3. Sowing and transplanting

Eggplant seeds (var. ‘Dumaguete Long’) from East West Seed Company were sown in trays and transplanted after four weeks when they have

already produced four (4) leaves. The growing media consisted of a 2:2:1 mixture of garden soil, aged rice hull, and vermicompost, with each polybag containing 6.5 kg.

2.4. Preparation of growing media and buffalo manure tea

The planting media in the polybags was modified using a 2:2:1 ratio of ordinary garden soil, aged rice hull, and vermicompost, with each polybag containing 6.5 kg of the mixture. Buffalo manure tea was prepared following the DAATI (2011) guidelines by placing partially dried

buffalo manure in a jute sack, creating a "tea bag." This was submerged in a 200 L plastic drum, weighed down with stones, and covered with a net. Water was added, leaving a 20% air gap, and the mixture was soaked for one week to produce a rich, dark brown manure tea. The chemical test report for the growing media and buffalo manure tea is presented in Table 2.

Table 2. Chemical test results on growing media and buffalo manure tea (analysed at Department of Agriculture, Caraga Region, Regional Soils Laboratory)

Constituents (content)	Oven-dried basis		Methodology
	Growing media	Buffalo manure tea	
Total Nitrogen (N), %	0.54	BDL	<i>Kjeldahl Method</i>
Total Phosphorus (P ₂ O ₅), %	0.38	7.00	<i>Vanadomolybdate Method</i>
Total Potassium (K ₂ O), %	0.28	495.00	<i>Aqua-regia digestion</i>
Moisture Content, %	18.51	-	<i>Gravimetric Method</i>
pH (1:10, sample:water (water by volume))	7.41	7.60	<i>Potentiometric Method</i>
Sodium (Na)*, ppm	368.00	77.00	<i>Aqua-regia digestion</i>
Calcium (Ca)*, ppm	5047.00	68.00	<i>Aqua-regia digestion</i>
Magnesium (Mg)*, ppm	2592.00	44.00	<i>Aqua-regia digestion</i>
Zinc (Zn)*, ppm	12.00	2.00	<i>Aqua-regia digestion</i>
Iron (Fe)*, ppm	57967.00	11.00	<i>Aqua-regia digestion</i>
Copper (Cu)*, ppm	58.00	3.00	<i>Aqua-regia digestion</i>
Manganese (Mn)*, ppm	13268.00	10.00	<i>Aqua-regia digestion</i>
Molybdenum (Mo)*, ppm	72495.00	355.00	<i>Aqua-regia digestion</i>
Lead (Pb)*, ppm	BDL	BDL	<i>Aqua-regia digestion</i>
Chromium (Cr)*, ppm	1297.00	BDL	<i>Aqua-regia digestion</i>
Nickel (Ni)*, ppm	1.00	1.00	<i>Aqua-regia digestion</i>
Cadmium (Cd)*, ppm	BDL	BDL	<i>Aqua-regia digestion</i>

*Remarks: To convert ppm to %: Starting from the decimal point, count four (4) places to the left and affix the decimal point (Example: 10.50 ppm = 0.00105%. BDL = below detection limit. *Microwave-assisted acid digestion and determination by Microwave Plasma-Atomic Emission Spectrometer.*

2.5. Rate and frequency of application of manure tea

This research followed DAATI (2011) guidelines, applying 250 mL of undiluted buffalo

manure tea (BMT) to the growing media one day before transplanting to provide micronutrients and boost microbial activity. After plant establishment, BMT was applied as a foliar spray every 14 days, ensuring full coverage of the eggplant leaves

throughout their growth stages. BMT, in fact, is a liquid organic fertilizer that is effective in improving soil and plant health (Leauthaud et al., 2022; Ramírez-Gottfried et al., 2023).

2.6. Care and maintenance of the experimental plants

Irrigation was conducted twice a day, with plants receiving 500 mL of water per day before flowering, increasing to 1,000 mL per day once flowering began. Weeds and insect pests were controlled manually through handpicking.

2.7. Data collection and monitoring

Growth parameters such as plant height, number of leaves, stem circumference, and leaf area were measured weekly. Yield indicators included fruit diameter, weight, and total yield per plant were gathered during harvest time. Plant height (cm) was measured weekly from the base of the stem to the tip using a ruler; number of leaves was counted weekly for all plants in a treatment group; stem diameter (cm) was measured at the middle part of the plant using a caliper; leaf area (cm²) was determined using the Easy Leaf® digital application; days to fruit setting was recorded from transplanting until the first visible fruit formation; fruit diameter (cm) was measured using a caliper; number of marketable fruits per plant was counted at each harvest; weight (g) of marketable fruits was measured using a digital scale; and the total yield per plant (kg) was calculated by summing the total weight of harvested fruits per plant.

2.8. Harvesting and storing

Sample fruits were collected weekly at harvestable size or commercial maturity, starting at nine weeks (63rd day) after transplanting. Five fruits per treatment, ideally uniform in size and weight, were placed on paper plates and kept at ambient room temperature for less than a day to collect the different data with minimal

statistical errors. Please add how to measure/weight the fruits.

2.9. Statistical data analysis

Data were analyzed using the statistical tool for agricultural research (STAR-2.0.1) through analysis of variance (ANOVA). Significant results from the quantitative treatments were further analyzed using Pairwise Mean Comparison, specifically the least significant difference (LSD).

3. Results and Discussion

The summary of analysis of variance (Table 3), on the one hand, highlighted the significant impact of polybag sizes (factor A) on various growth and reproduction parameters of polybag-grown eggplants. However, the buffalo manure tea levels (factor B) and the interaction between polybag sizes and BMT did not show significant effects on these parameters. Table 4, on the other, presents the significant and highly significant effects of polybag sizes on the plant height, number of leaves, and stem diameter of polybag-grown eggplants across various weeks after transplanting.

Similar studies have demonstrated that larger containers allow for better root expansion, improved water retention, and increased nutrient availability, resulting in enhanced plant growth (NeSmith & Duval, 1998; Bouzo & Favaro, 2015). However, the lack of significant effects from BMT application could be attributed to the nutrient sufficiency of the growing media used (2:2:1 garden soil, aged rice hull, vermicompost), which may have already provided adequate macro- and micronutrients for plant development.

Also, studies on manure tea application in other crops (Gad et al., 2023; Ramírez-Gottfried et al., 2023) suggest that its effects are more pronounced when applied to nutrient-deficient

soils. The neutral pH and relatively low nitrogen content of the BMT used in this study might have further contributed to its limited influence on growth parameters. Future research should explore varying concentrations of BMT or combinations with other organic amendments to assess their cumulative effects on polybag-grown vegetables.

Plant height (cm): Measured weekly for 13 weeks, plant height (Table 4) showed significant variation starting from the third week after transplanting, with steady growth from weeks 2 to 7, followed by slower growth as flowering and fruiting began. BMT application and the interaction between polybag sizes and BMT levels had no significant effect on plant height (5 and 1%, LSD). Only polybag size significantly impacted height (Table 3), with larger polybags (40.64 x 40.64 cm) producing the highest/tallest eggplants. These results align with recommendations from various studies on the advantages of larger container sizes for plant growth (Cotner, 2008; Lerner, 2009; Roll & Wilson, 2020).

Number of leaves: The weekly observations in Table 4 showed significant differences in leaf

number due to polybag size (5 and 1%, LSD), especially from weeks 4 to 13. Eggplants grown in 40.64 x 40.64 cm polybags had the highest leaf counts. Neither BMT levels nor the interaction between BMT and polybag sizes significantly affected leaf production (Table 3). Larger polybags promote better vegetative growth, such as more leaves, likely due to better root growth and moisture retention, even though all polybags contained nearly the same number of growing media (6.5 kg) (NeSmith & Duval, 1998; Bouzo & Favaro, 2015).

Stem diameter (cm): Polybag size significantly affected stem diameter (Table 4), with highly significant differences observed in all weeks except week 9 (5 and 1%, LSD). The interaction between BMT levels and polybag sizes, as well as the individual effect of BMT, had no impact on stem diameter.

The r coefficient (Table 3): Eggplants grown in 35.56 x 35.56 cm or 40.64 x 40.64 cm polybags showed similar stem diameters, suggesting that both sizes supported comparable stem growth. Smaller polybags, however, may limit vegetative growth and root development (Bouzo & Favaro, 2015; UT, 2015).

Table 3. Summary of analysis of variance of the polybag sizes (factor A), buffalo manure tea (BMT) levels (factor B) and their interactions on growth and reproductive parameters of polybag-grown eggplant in Arakan, Cotabato, Philippines

Parameters	Polybag sizes (A)	Levels of BMT (B)	Interaction (A x B)
Average plant height (cm)	** LSD	ns	ns
Average number of leaves	** LSD	ns	ns
Average stem diameter (cm)	** LSD	ns	ns
Leaf area (cm ²)	** LSD	ns	ns
Days to fruit setting	* LSD	ns	ns
Fruit diameter (cm)	* LSD	ns	ns
Number of marketable fruits	** LSD	ns	ns
Weight of marketable fruits (g)	** LSD	ns	ns
Total yield / plant (kg)	** LSD	ns	ns

** : highly significant @ 1%; * : significant @ 5%; ns : not significant; LSD : least significant difference test.

Table 4. Significant and highly significant effects of polybag sizes on the plant height (cm); number of leaves; and stem diameter (cm) of polybag-grown eggplants in Arakan, Cotabato, Philippines

Weeks after transplanting														
Plant height (cm)		1 ^{ns}	2 ^{**}	3 ^{**}	4 ^{**}	5 ^{**}	6 ^{**}	7 ^{**}	8 ^{**}	9 [*]	10 ^{**}	11 ^{**}	12 ^{**}	13 ^{**}
Polybag sizes ^{1/}		1.99	3.72 ^b	6.29 ^b	12.10 ^b	19.45 ^b	24.13 ^b	32.67 ^b	33.88 ^b	36.22 ^b	38.77 ^b	40.39 ^b	42.63 ^b	44.49 ^b
A ₁ (30.48 x 35.56 cm)		1.96	4.19 ^a	7.56 ^a	14.10 ^a	22.11 ^a	26.51 ^a	35.29 ^a	36.48 ^a	38.72 ^a	41.34 ^a	42.89 ^a	44.85 ^a	46.73 ^a
A ₂ (35.56 x 35.56 cm)		1.88	4.04 ^{ab}	7.40 ^a	14.09 ^a	21.04 ^a	25.67 ^a	34.24 ^a	36.08 ^a	38.31 ^a	40.88 ^a	42.87 ^a	45.01 ^a	46.64 ^a
A ₃ (40.64 x 40.64 cm)		20.31	14.74	14.81	13.01	9.13	7.49	6.71	6.22	6.34	6.06	6.00	5.97	5.64
CV (%)														
Number of leaves (Leaves)														
Polybag sizes ^{1/}		1 ^{**}	2 ^{ns}	3 ^{ns}	4 ^{**}	5 ^{**}	6 ^{**}	7 ^{**}	8 ^{**}	9 [*]	10 ^{**}	11 ^{**}	12 ^{**}	13 ^{**}
A ₁ (30.48 x 35.56 cm)		5.38 ^b	6.70	6.23	9.18 ^b	10.00 ^b	9.51 ^b	14.99 ^b	19.51 ^b	20.85 ^c	24.22 ^b	27.27 ^b	24.77 ^c	23.10 ^b
A ₂ (35.56 x 35.56 cm)		5.85 ^a	6.92	6.58	9.37 ^{ab}	10.50 ^a	9.92 ^a	15.42 ^a	20.13 ^a	22.15 ^b	24.78 ^b	28.57 ^b	26.98 ^b	23.51 ^b
A ₃ (40.64 x 40.64 cm)		5.65 ^{ab}	6.65	6.54	9.46 ^a	10.57 ^a	9.85 ^a	15.33 ^a	20.46 ^a	25.33 ^a	29.93 ^a	34.43 ^a	32.54 ^a	28.39 ^a
CV (%)		8.34	8.28	8.08	4.15	4.32	6.03	3.09	3.03	9.29	12.44	10.46	13.37	13.39
Stem diameter (cm)														
Polybag sizes ^{1/}		1 ^{**}	2 ^{**}	3 ^{**}	4 ^{**}	5 ^{**}	6 ^{**}	7 ^{**}	8 ^{**}	9 [*]	10 ^{**}	11 ^{**}	12 ^{**}	13 ^{**}
A ₁ (30.48 x 35.56 cm)		0.23 ^b	0.37 ^b	0.57 ^b	0.82 ^b	0.91 ^b	0.93 ^b	0.95 ^b	0.99 ^b	1.02 ^b	1.04 ^b	1.06 ^b	1.10 ^b	1.13 ^b
A ₂ (35.56 x 35.56 cm)		0.30 ^a	0.48 ^a	0.68 ^a	0.87 ^a	0.93 ^b	0.95 ^b	0.97 ^b	1.02 ^a	1.06 ^a	1.09 ^a	1.11 ^a	1.14 ^a	1.16 ^a
A ₃ (40.64 x 40.64 cm)		0.29 ^a	0.46 ^a	0.65 ^a	0.89 ^a	0.95 ^a	0.97 ^a	0.99 ^a	1.04 ^a	1.07 ^a	1.10 ^a	1.13 ^a	1.16 ^a	1.18 ^a
CV (%)		14.29	13.54	12.17	4.52	3.35	3.46	3.97	5.34	6.00	6.06	5.54	4.58	4.54

*: means in the same column with common letter manuscript do not significantly differ at 5%, LSD; **: means in the same column with common letter manuscript do not significantly differ at 1%, LSD; n.s.: not significant.

Leaf area (cm²): Significant differences (Table 5) in the leaf area of the crops were caused by the varying polybag sizes used in the study (1% level, LSD Test), but not by the individual effect of manure tea nor by the interaction of polybag sizes and levels of manure tea. The results in Table 5 agree with what authors (Bouzo & Favaro, 2015; Oagile et al., 2016) have posited about the enhanced growth and development of solanaceous crops like eggplant.

Number of days to fruit setting: The interaction between polybag sizes and BMT levels, as well as the individual effect of BMT, did not significantly affect (Table 5) the number of days to fruit setting. The interaction effect ranged from 43.67 to 47.33 days, while the individual effect of BMT ranged from 44.78 to 46.89 days. Only polybag size had a significant impact (Table 3) on fruit setting (5% level, LSD Test), with eggplants in larger polybags being the first to produce buds that developed into fruits. Plants with more leaves, branches, and a sturdier, taller structure are more likely to bear flowers and fruits earlier. Fruit setting is influenced by the availability of macro- and micronutrients, and trace elements (Tisdale et al., 1993), which are present in the manure tea and growing media, albeit in smaller quantities (DARSL, 2020a; 2020b).

Fruit diameter (cm): Polybag size significantly affected (Table 5) fruit diameter (5% level, LSD Test), while the application of BMT and the interaction between polybag sizes and BMT had no significant impact (Table 3). The interaction effect ranged from 2.70 to 3.05 cm, and the individual effect of BMT ranged from 2.77 to 2.95 cm. The fruits in this experiment were relatively smaller compared to field-grown eggplants (Daunay, 2016; Zaro et al., 2016). Photosynthesis, a key plant process where food

is produced and stored in fruits, shoots, stems, and leaves (Johnson, 2016; Simkin et al., 2019), was likely limited by restricted root growth, shoot expansion, and nutrient and moisture availability in the polybags, affecting fruit size and other related parameters.

Number of marketable fruits: The use of different polybag sizes significantly affected (Table 5) the number of marketable fruits (1% level, LSD Test), while the individual effect of BMT application and the interaction between polybag sizes and BMT did not have a significant impact (Table 3). The number of marketable fruits ranged from 22.89 to 28.22 for polybag sizes, and from 20 to 32.67 for the interaction effect. These results suggest that larger polybags support the expansion of vegetative parts, leading to more marketable fruits. However, the low nitrogen content in organic substances, as reflected in the manure tea and growing media (DA, 2020a; 2020b), limits the ability of eggplants to produce fruits that match the appearance of those grown with synthetic fertilizers in conventional field farming.

Weight (g) of marketable fruits: Polybag size significantly affected (Table 5) the weight of marketable fruits (1% level, LSD Test), but neither the interaction between polybag sizes and BMT levels nor the individual effect of BMT significantly influenced (Table 3) fruit weight. The interaction effect ranged from 13.62 to 28.10 g, while the individual BMT effect ranged from 17.78 to 22.29 g. These results suggest that larger polybags enable the plants to produce more and heavier fruits. Fruit weight is closely linked to moisture content, with eggplant fruits typically containing 92% water (Siemonsma & Piluek, 1994). However, the limited root growth due to polybag size restricted the plants' ability to access

moisture and nutrients, and despite frequent watering, the hot and dry conditions (January to April) led to the drying of the growing media and increased evapotranspiration (NeSmith & Duval, 1998; Bouzo & Favaro, 2015).

Total yield/plant (kg): The only significant factor (Table 5) affecting the total yield of polybag-grown eggplants was polybag size (1% level, LSD Test). The interaction between polybag sizes and BMT levels, as well as the individual effect of BMT, did not show a significant difference (Table 3), with yield ranging from 1.17 to 2.28 kg for polybag sizes and 1.50 to

1.87 kg for BMT levels. These results align with studies by Bouzo & Favaro (2015), which showed that larger containers resulted in higher total yields. However, the yields in this study were much lower compared to conventionally field-planted crops, likely due to limited root growth, restricted nutrient absorption, and exposure to drying conditions caused by wind and heat (NeSmith & Duval, 1998). Additionally, the BMT and growing media lacked essential nutrients, affecting the plants' vegetative and reproductive functions, further reducing yield of eggplant (DA, 2020a; 2020b).

Table 5. Highly significant and significant effects of polybag sizes on the growth parameters of polybag-grown eggplant applied with different levels of buffalo manure tea in Arakan, Cotabato, Philippines

Polybag sizes	Leaf area (cm ²)**	Days to fruit setting (days)*	Fruit diameter (cm)*	No. of marketable fruits (fruits)**	Weight of marketable fruits (g)**	Total yield/plant (kg)**
A1 (30.48 x 35.56 cm)	68.21 ^b	46.42 ^a	2.77 ^b	21.46 ^c	15.94 ^c	1.34 ^c
A2 (35.56 x 35.56 cm)	70.88 ^b	45.62 ^{ab}	2.87 ^{ab}	25.08 ^b	19.67 ^b	1.64 ^b
A3 (40.64 x 40.64 cm)	76.25 ^a	45.29 ^b	2.92 ^a	30.79 ^a	24.04 ^a	2.01 ^a
CV (%)	8.21	3.31	6.27	18.53	22.63	19.02

** : means with the same letter do not significantly differ, 1% LSD; * : means with the same letter do not significantly differ, 5% LSD.

4. Conclusions

The results of this study underscore the substantial effect of polybag sizes on the growth and yield parameters of polybag-grown eggplants. Especially, the results suggest that a minimum size of 40.36 x 40.36 cm polybags, with 6.5 kg of growing media that is composed of 2:2:1 garden soil, aged rice hull, and vermicompost,

is optimal for promoting the vegetative growth and reproductive development of eggplants, particularly in urban or backyard gardening settings. However, BMT application did not have a significant effect on plant performance. This suggests that nutrient availability from the growing media was sufficient, rendering additional organic fertilization unnecessary

under the experimental conditions. These findings contribute to best practices in container gardening by emphasizing the importance of selecting appropriate polybag sizes. Future studies may investigate the effects of higher BMT concentrations, alternative organic inputs, or nutrient-deficient growing media conditions to determine more specific recommendations for organic fertilization in polybag cultivation.

Conflict of interest

The authors declare that there are no conflicts of interest.

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Authors contribution

The corresponding author, FOEsgrina, conceptualized, conducted the experiments, analyzed the results, wrote the manuscript, and prepared the article for publication. The co-author, AABaladjay, provided the technical and intellectual support for the study.

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