Effects of Chicken Manure, Worm Tea Spray, and their Combination on the Growth of *Clinacanthus nutans*

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ABSTRACT

Organic fertiliser can be essential in cultivating healthy and quality medicinal herbs. This study aims to investigate the effects of organic fertilisers and worm tea application on the growth of *Clinacanthus nutans*. This experiment was assigned in a completely randomised design (CRD) with five replications (r = 5) for 60 days. The treatments consist of T1 (chicken dung), T2 (chicken manure + worm tea spray), T3 (vermicompost), T4 (vermicompost + worm tea spray), T5 (worm tea soil application), and T6 (worm tea soil application + worm tea spray). The measured parameters were plant height, number of leaves, root, stem and leaf fresh weight and dry weight, total biomass, shoot and root biomass, and relative chlorophyll content (SPAD value). The results indicated that the application of chicken manure + worm tea spray (T2) increases total plant biomass, number of leaves, leaf fresh weight, and dry weight, and shoot biomass by 59%, 35%, 141%, 107%, and 80% compared to T4. The results of this study suggest that combining poultry manure and worm tea spray is promising for promoting plant growth and productivity**.**

Keywords: Worm tea, organic fertilizer, vermicompost

INTRODUCTION

Clinacanthus nutans, commonly known as Sabah snake grass or "Belalai gajah" in Malay, is a plant native to Malaysia, Indonesia, and Thailand [1]. This plant is an essential species in the Acanthaceae family and is regarded as one of the primary contributors to medicinal plants in tropical Asia [2]. This plant is a well-known medicinal herb in Malaysia, with a total annual production of 1.34 metric tonnes in 2022. *C. nutans* was used for its phytochemicals and antioxidants, which are therapeutic to cure various ailments and diseases [3]. Pharmacological trials have proved that extracts and pure compounds of *C. nutans* exhibited various biological properties such as anti-inflammatory, antiviral, antioxidant, antimicrobial, antivenom and antidiabetic activities [4]. The leaf is the part that was harvested and processed to make a tea and tablet.

Organic fertilisers can be used as an alternative to chemical fertilisers in sustainable agriculture. This fertiliser is well known for its eco-friendliness and sustainable supply of plant nutrients [5]. In countries such as the United States, India, and China, organic farming practices are adopted in herbal plant production to improve the quality and safety of herbal products. Organic fertilisers offer a cost-effective way to boost the phytochemical content of plants [6]. Vermicompost is a viable alternative to traditional chemical fertilisers. Previous studies have shown that vermicompost can increase the growth and flowering of *Pelargonium zonale* L. and *Calendula officinalis* L. [7]. In addition to vermicompost itself, worm tea is a nutrient-rich extract derived from vermicompost. Worm tea can be applied directly to the soil or as a foliar spray. Compost tea application in the soil can improve plant growth and increase the length of the okra (*Abelmoschus esculentus*) plant [8].

Although *C.nutans* offers significant economic benefits, its availability has declined, preventing commercialisation. While the phytochemical and pharmaceutical aspects of *C.nutans* have been well documented, its agronomic characteristics, such as growth and yield potential, remain relatively unexplored. Sustainable and efficient cultivation practices are essential to ensure a steady supply of *C.nutans* to meet market demand. This study aims to investigate the effects of organic fertilisers and worm tea on the growth and yield of

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C.nutans, analysing the individual and combined impacts of organic fertilisers and worm tea to optimise production.

MATERIALS AND METHODS

This experiment was conducted under a shade structure at the Farm Unit in University Technology MARA (UiTM), Perlis Branch, in Northern Peninsular Malaysia (6˚ 45' 29''N, 100˚ 28' 11''E). The average temperature and light intensity under 50% shade were 27 ˚C and 560 µmol m^{-2} s^{-1}, respectively. The stock of *C.nutans* plants was obtained from local farmers in Perlis. The plants are propagated by stem cuttings, each with a length of about 10 cm and three nodes remaining on each stem. Three stem cuttings were planted in a polybag containing one litre of mixed soil with a 3: 2: 1 ratio of topsoil, cow dung, and sand. This experiment was assigned in a completely randomised design (CRD) with five replications (r=5) for 60 days. Treatments consist of T1(chicken dung), T2 (chicken manure+ worm tea spray), T3 (vermicompost), T4 (vermicompost + worm tea spray), T5 (worm tea soil application) and T6 (worm tea soil application + worm tea spray). The measured parameters were plant height, number of leaves, root, leaf and stem fresh weight, plant biomass (shoot, root and stem), and relative chlorophyll content (SPAD value). The plant height and number of leaves were recorded on the 15th day after planting (DAP) and the 60th DAP. The height was measured from the base of the plant at the surface to the top of the youngest newly expanded leaf using a steel ruler. *C.nutans* were harvested 60 days after planting. After harvesting, the plants were washed from any soil particles using tap water and separated into leaves, stems, and roots. All plant parts were separately weighed and recorded for fresh weight. The samples were oven-dried at 60 °C in the oven up to a constant mass and then weighed. The biomass of roots and shoots (stem and leaves) was calculated. The relative chlorophyll content (SPAD value) was measured using a chlorophyll meter, Minolta SPAD-502. Measurement was taken by inserting a leaf and clamping it nicely on the newly matured leaves (third leaf from the top) at 60th DAP. Data were analysed as a complete randomised design (CRD) using SPSS software window version 20. Mean comparisons between treatments are made by analysis of variance (ANOVA) followed by Tukey's HSD test ($p< 0.05$).

RESULTS AND DISCUSSION

Plant height and number of leaves

The growth with the stem and leaves of the application of *C.nutans* as an effect of organic fertilisers and worm tea is shown in Table 1. The height and number of leaves were significantly ($p<0.05$) affected by treatment at 60 days after planting (DAP). The highest plant height was observed in T1 (35.28 cm), followed by T2 (29.70 cm) and T6 (29.50 cm). The lowest plant height was observed in T4 (22.65 cm). Like plant height, the total number of leaves was higher in T2 at 37.26 compared to T4 at 27.52. The taller plant height and the higher number of leaves observed in the treatments with chicken manure (T1 and T2) showed a positive effect of the application of chicken manure on the growth of *C.nutans* cuttings; this coincided with a finding by [9], which states that adding chicken manure can increase plant height and improve nutritional quality. Chicken manure may increase soil nutrient levels, such as nitrogen and phosphorus [10], to help plant growth, as plants need both nutrients to grow healthy and strong. The positive effects of organic fertiliser were as predicted since previous studies also showed that the application of organic fertiliser could increase sugarcane growth [11] and pepper [12].

Fresh weight and dry weight of a plant

Table 2 presents the effects of applying organic fertilisers and worm tea on the root, stem, and leaf fresh weight of *C.nutans* at 60 DAP. The results indicate significant differences among the treatments ($p < 0.05$) for fresh weight. However, the difference between root and stem fresh weights was insignificant ($p>0.05$). Generally, the fresh weight of *C.nutans* was less in the root than in the stem and leaves. Fresh leaf weight in T2 (5.44 g) showed no significant difference ($p>0.05$) to T1 (4.75), but it was significantly higher ($p<0.05$) compared to T3 (2.61 g), T4 (2.26 g), T5 (3.05 g), and T6 (2.82 g). A similar trend has also been recorded for the dry weight (Table 2). These findings align with previous studies that highlight the positive effects of chicken manure application on *Cucumis sativus* production [13]. Chicken dung, in particular, is known for its high nutrient content. The combination of chicken manure and worm tea may have further improved plant growth by providing additional

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nutrients, improving soil structure, and promoting microbial activity [14].

Table 1. Effect of organic fertiliser and worm tea application on the plant height and number of leaves of *C. nutans* at 15 and 60 days after transplanting.

Treatments	Plant height		Number of leaves	
	15 DAP	60 DAP	15 DAP	60 DAP
T1	11.88 a	35.28 a	14.64 a	34.94 ab
T2	11.14 a	29.70 b	15.66 a	37.26 a
T3	10.00 a	24.82 bc	15.12 a	30.16 ab
T4	10.96 a	22.65 c	13.94 a	27.52 b
T5	12.16 a	27.34 bc	14.32 a	30.48 ab
T6	10.72 a	29.50 b	15.20 a	33.66 ab

Note: DAP: days after planting. T1 (chicken dung), T2 (chicken manure+ worm tea spray), T3 (vermicompost), T4 (vermicompost + worm tea spray), T5 (Worm tea soil application) and T6 (worm tea soil application + worm tea spray). Value within same column followed by same letter are no significant at 5% level Tukey's HSD, n=5.

Table 2. Effect of organic fertiliser and worm tea application on the fresh weight and dry weight of *C. nutans* at 60 days after planting.

	Fresh weight (g)			Dry weight (g)		
Treatments	Root	Stem	Leaf	Root	Stem	Leaf
T1	2.17 a	4.80 a	4.75 a	0.68 a	1.68 a	1.23 a
T2	2.39 a	5.14 a	5.44 a	0.72 a	1.72 a	1.24 a
T3	2.46 a	3.98 a	2.61 c	0.71 a	1.32 a	0.68 bc
T4	1.84 a	3.21 a	2.26 c	0.67 a	1.04 a	0.60 c
T5	2.63 a	3.82 a	3.05 bc	0.85 a	1.41 a	0.83 bc
T6	2.18 a	4.06 a	2.82 bc	0.66 a	1.46 a	0.86 bc

Note: T1 (chicken dung), T2 (chicken manure+ worm tea spray), T3 (vermicompost), T4 (vermicompost + worm tea spray), T5 (Worm tea soil application) and T6 (worm tea soil application + worm tea spray). Value within same column followed by same letter are no significant at 5% level Tukey's HSD, n=5.

Total biomass and biomass partitioning

Total biomass partitioning and shoot biomass at harvesting (60 DAP) demonstrated significantly ($p<0.05$) higher in T2 than in other treatments, except for T1 (Figure 1). T2 exhibited the highest total biomass of 3.68 g, with a more significant proportion of biomass allocated in the shoot part (2.96 g). Vermicompost-based treatments, T3 and T4 showed significantly lower total biomass than the T1. Chicken manure is an organic fertilizer that contains significant amounts of nitrogen. The application of chicken manure with vermicompost spray is able to enhance the shoot growth of *C. nutans* plant. These results indicate that the chicken manure-based fertiliser plus vermicompost spray improves the shoot growth of *C.nutans*. Shoot biomass was higher in T2 followed by

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T1>T5>T6>T3>T4. The positive effect of chicken manure on shoot growth has also been reported in *Lycopersicum esculentum* [15] and shallot [16].

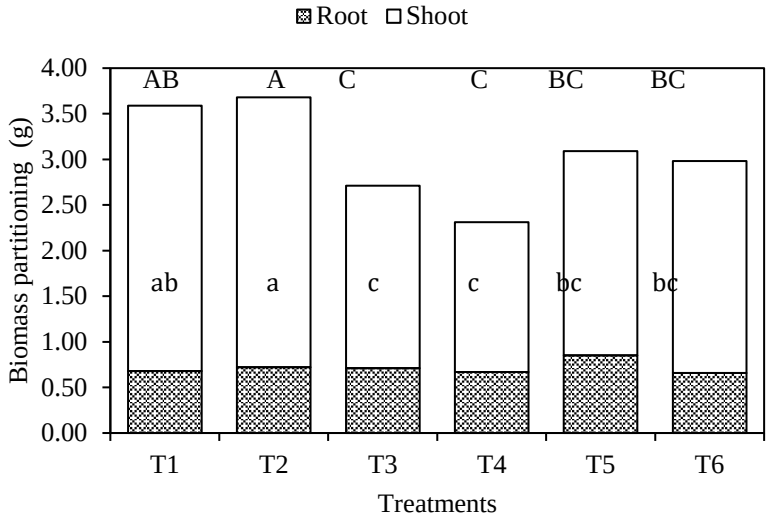

Figure 1. Total plant biomass (whole histrogram) and biomass partitioning between shoots, (upper bars) and root parts (bottom bars) of *C.nutans* as effect of organic fertiliser and worm tea application at 60 days after planting. T1 (chicken dung), T2 (chicken manure + worm tea spray), T3 (vermicompost), T4 (vermicompost + worm tea spray), T5 (worm tea soil application) and T6 (worm tea soil application + worm tea spray). Means followed by the same letters are not statistically different for $p < 0.05$ (Tukey's HSD test), n=5. Capital letters refer to significance for whole plant biomass, small letters refer to significance of shoot biomass. Letters for root biomass were omitted as the effect of treatments was not significant.

Relative chlorophyll content

The results obtained for the relative chlorophyll content (SPAD value) at 60 DAP show no significant differences ($p>0.05$) between different types of fertiliser treatment (Figure 2). Chlorophyll is a crucial pigment involved in photosynthesis, and higher chlorophyll levels are generally associated with increased plant photosynthetic capacity. The relative chlorophyll content is between 27.88 and 30.3 of the SPAD value. This result is similar to the finding of [17] in Gynura pseudochina, where the application of fertilisers does not influence the chlorophyll content. Vermicompost is a nitrogen-containing fertiliser, similar to chicken dung [18]. In chlorophyll molecules, nitrogen is a component of the porphyrin ring [19]. A sufficient amount of nitrogen is supplied to the plant, producing enough chlorophyll for photosynthesis.

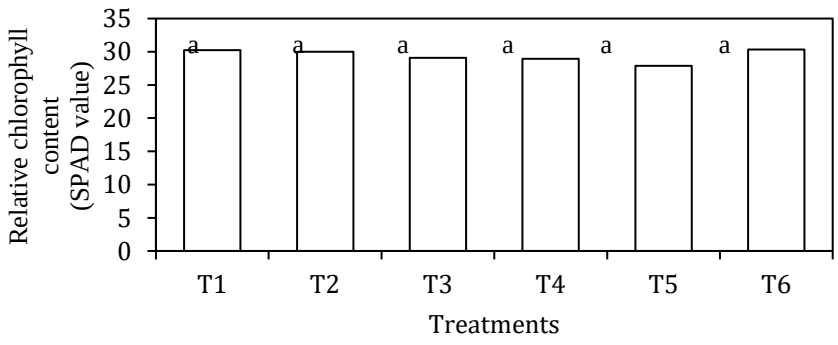

Figure 2. Relative chlorophyll content (SPAD value) of *C.nutans* as affected by different organic fertilizer and worm tea application. T1 (chicken dung), T2 (chicken manure+ worm tea spray), T3 (vermicompost), T4 (vermicompost + worm tea spray), T5 (worm tea soil application) and T6 (worm tea soil application + worm tea spray). Means followed by the same letters are not statistically different for $p < 0.05$ (Tukey's HSD test), n=5.

CONCLUSION

Based on the findings of this study, the application of chicken manure and worm tea spray significantly enhanced the growth and development of *C.nutans* plants. The application of chicken manure and worm tea spray resulted in a substantial increase in total fresh plant weight, primarily driven by an increase in the number of leaves and leaf fresh weight. The total biomass of the plants was also significantly higher. These results suggest that combining chicken manure and worm tea spray is promising for promoting plant growth and productivity.

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