EFFECTS OF ROOTING HORMONE AND CUTTING LENGTH ON ROOTING ABILITY, GROWTH PERFORMANCE AND BIOMASS OF TWO IMPORTANT HERBS IN MALAYSIA

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ABSTRACT

Orthosiphon stamineus (misai kucing) and Clinacanthus nutans (belalai gajah) were among the important medicinal plants that rich in antioxidant. As these species has its own demands, farmers have started to cultivate these plants in small scale plantation. Currently, the fertigation system has been introduced in herbal cultivation. Through this system, watering and fertilizer application can be control at precise time and increase nutrient absorption by plants thus wastage of agriculture input could be avoided. These two herbs can be propagated through stem cuttings. However the information on growing the cuttings in fertigation system is still lacking. Therefore, this study was develop to evaluate the effects of rooting hormone application (Treatment 1: 0.1% IBA, Treatment 2: No hormone) and the appropriate cutting length (Length 1: 5 cm, Length 2: 10 cm) on O. stamineus and C. nutans to obtain optimum rooting performance, plant growth and biomass. Cuttings in treatment 2 (no hormone) produced greater root number in C. nutans and O. stamineus at week four of the cuttings. For cutting length, C. nutans with 10 cm length produced vigorous growth compared to 5 cm length. While, cutting length gave no significant difference on the growth of O. stamineus. The hormone treatment and cutting length shows no significant difference on the fresh andry weight of both species harvested at 18 weeks of the experiment. The findings from this study is significance to farmers in the aspect of cost savings due to no rooting hormone were required in growing both herbal plants using the fertigation system. In addition, appropriate cutting length for optimum plants growth were discovered for both species through this study.

Keywords: *Agriculture, asexual reproduction, medicinal plant, plant propagation, stem cutting*

INTRODUCTION

Orthosiphon stamineus and *Clinacanthus nutans* belong to the family of Lamiacea and Acanthacea respectively. They are valuable commercial herbal species in the local and international market. Each of this species has its own medicinal value which associated with plant secondary metabolites. *Orthosiphon stamineus* contains several chemically active constituents, including those belonging to the phenolic group, of which twenty have been identified. Among them are sinensetin, eupatorin and rosmarinic acid (Akowuah et al., 2004). Whereas, the pharmacological studies on *C. nutans* reported anti-Papillomavirus Infectivity, anti-viral activity on varicella-zoster virus, anti-inflammatory activity, anti-herpes Simplex virus type 1 and type 2 activity, anti-oxidant and protective effect against oxidative induced hemolysis (Aslam et al., 2015). Looking at the potential of these two herbal species, it is important to have sustainable supply of the materials to the industry. The propagation method should be established to ensure a high survival rate of the materials.

Lack of agriculture land and increase of fertilizer prices has become the limitation on the cultivation of herbal species in Malaysia. Fertigation system is an intelligent and innovative method to overcome the shortage of agricultural land and optimize the use of fertilizer and water in cropping systems. Among the benefit of fertigation system were complete and efficient provision of nutrients according to the amount required by the crop, no cost of weeding as it does not use soil medium and reduction of labor costs, water and fertilizer (Abdul Wahid et al., 2011). In Malaysia, series of successful application of fertigation system were reported in crops such as chili (Mohd et al., 2016), ginger (Suhaimi et al., 2014) and tomato (Phua et al., 2012). The application of fertigation system could be extend in herbal cultivation to increase the yield and contribute to the national Gross Net Income (GNI).

Orthosiphon stamineus and *Clinacanthus nutans* both can be propagated through cuttings. However, growing the cuttings in a fertigation system has not been studied. It has been reported that rooting success of stem cutting is dependent on presence or absence of hormone and concentration (Kassahun & Mekonnen, 2011; Ibironke, 2016), cutting length (Leakey & Mohammed, 1985; Tchoundjeu & Leakey, 1996) as well as physical and environmental factors (Loach, 1991; Wilson, 1993). To fill the gap, this study was developed to identify the necessity of rooting hormone application and the applicable cutting length for optimum plant growth and biomass of *Orthosiphon stamineus* and *Clinacanthus nutans* grown in a fertigation system.

METHODOLOGY

Preparation of stem cuttings

The mother plants of *O. stamineus* and *C. nutans* were collected from Herb and Tree Improvement Branch nursery located in Forest Research Institute Malaysia, Kepong, Malaysia. Healthy and matured stem were select for cutting materials. The leaves on each cutting were trimmed into quarter size to reduce the transpiration rate. The base of each cuttings were dip in commercial rooting hormone (powder form), Seradix 1 with 0.1% IBA as Treatment 1. Cutting without hormone application were set as Treatment 2. For identification of suitable cutting length another experiment was set up. The stems were cut into two set of length i.e. 5 cm and 10 cm. Each of the cutting were treated with powder rooting hormone (Seradix 1). Each of the treatment has three replicate which consist of five cuttings per replicate (per polybag).

All of the cuttings were grown in soilless media in a fertigation system. The cuttings were watered and fertilized once daily at 11.00 am in the morning for five minutes. Commercial AB fertilizer which consists of essential macro and micro element were used and each polybag received approximately 200 ml amount of watered and fertilizer daily.

Data collection

The observation on root production and measurement of root length were made weekly which started on the first week after planting to week 4. The growth performance such as number of shoot, leaf length, and leaf width and stem height were recorded at week 2 to week 8. At week 18 the plants were harvested for biomass analysis. The fresh weight were recorded prior to drying proves. The plants were dried at 45 ◦C for 48 hours. All the data were subjected for Analysis of Variance (ANOVA) using SPSS version 22.

RESULTS AND DISCUSSION

Effects of hormone application and cutting length on number of roots and root length of O. stamineus and C. Nutans

Analyses on rooting data taken for four week after planting showed that there was significant interaction between hormone treatments with number of roots produced in both species at $p < 0.05$ (Table 1). Cuttings untreated with rooting hormone (Treatment 2) produced higher number of roots in both species. However, for root length, only *O. stamineus* treated with 0.1% IBA (Treatment 1) produced longer root length compared to Treatment 2. While others show no significance different on root length production.

For cutting length treatment, the results were vary between the two species (Table 1). Cutting length treatment were significant in number of roots of *O. stamineus* at $p<0.05$. Stem cuttings with 10 cm length produced greater number of roots compared to 5 cm length in *O. stamineus.* While for *C. nutans*, no significant difference was observed on number of roots produced either in 5 cm or 10 cm cutting length. For root length parameter, no significant interaction was found between the cutting length treatments in both species.

Table 1: Effect of hormone application and cutting length on rooting ability of *O. stamineus* and *C. Nutans*

Species	Treatment	Parameters	
		No. of roots	Root length (cm)
Orthisiphon stamineus	Hormone		
	Treatment 1 (0.1% IBA)	5.67±0.26b	3.41±0.22a
	Treatment 2 (No hormone)	6.90±0.42a	2.29±0.17b
	Cutting length		
	5 cm	5.50±0.19b	2.94±0.24a
	10 cm	7.06±0.45a	2.76±0.21a
Clinacanthus nutans	Hormone		
	Treatment 1 (0.1% IBA)	6.76±0.41b	2.17±0.22a
	Treatment 2 (No hormone)	8.25±0.87a	1.57±0.15a
	Cutting length		
	5 cm	7.00±0.74a	1.69±0.20a
	10 cm	8.04±0.60a	2.08±0.97a

*Means followed by different alphabet were significant at p <0.05.

Effects of hormone application and cutting length on growth performance and biomass of O. stamineus and C. Nutans

There was no significant variation on growth performance and biomass of *O. stamineus* in Treatment 1 and Treatment 2 as shown in Table 2. Thus, hormone application does not influence the growth performance of *O. stamineus.* While for *C.nutans*, hormone treatment gave significant values (p<0.05) on shoot length and shoot width. *Clinacanthus nutans* plants in Treatment 2 (no hormone) produced greater shoot length and shoot width compared to Treatment 1 (0.1% IBA). No significant difference was observe in other parameters including the fresh and dry weight of the plants.

Cutting length treatment gave significant variation (p<0.05) on shoot width of *O. stamineus.* Cutting with 10 cm length produced greater shoot width (2.64±0.16) compared to 5 cm cutting length (2.22±0.09). Whereas, no significant difference was observed on stem height, no. of shoots and shoot length of *O. stamineus.* On the other hand, cutting length treatment gave significant effects on the growth performance of *C. nutans.* Cuttings treated with 10 cm cutting length produced greater growth in all parameters as compared to 5 cm cutting length. However, cutting length shows no significant effect on the fresh and dry weight of both species.

Table 2: Effect of hormone application and cutting length on growth performance and biomass of *O. stamineus* and *C. Nutans*

Species	Treatment	Parameters					
		Stem height (cm)	No. of shoots	Shoot length (cm)	Shoot width (cm)	Fresh weight (g)	Dry weight (g)
Orthisiphon stamineus	Hormone						
	Treatment 1 (0.1% IBA)	27.9±2.15a	24.5±2.23a	4.99±0.26a	2.56±0.16a	21.1±4.45a	4.06±0.69a
	Treatment 2 (No hormone)	24.2±2.37a	26.0±2.85a	4.57±0.23a	2.35±0.13a	33.2±10.8a	6.53±2.15a
	Cutting length						
	5 cm	27.6±2.01a	21.7±2.35a	4.63±0.18a	2.22±0.09b	18.6±2.98a	4.19±0.64a
	10 cm	28.2±2.56a	28.2±2.56a	4.90±0.28a	2.64±0.16a	35.7±10.9a	6.39±2.18a
Clinacanthus nutans	Hormone						
	Treatment 1 (0.1% IBA)	10.6±1.22a	12.5±0.91a	5.44±0.31b	1.68±0.12b	9.17±2.37a	1.72±0.47a
	Treatment 2 (No hormone)	13.7±1.00a	11.8±1.15a	6.33±0.26a	2.10±0.12a	11.5±2.88a	1.96±0.53a
	Cutting length						
	5 cm	7.88±0.83b	9.04±0.50b	5.17±0.31b	1.58±0.13b	11.39±2.43a	2.01±0.47a
	10 cm	15.7±0.89a	15.00±0.99a	6.43±0.24a	2.11±0.10a	9.33±2.84a	1.67±0.53a

*Means followed by different alphabet were significant at p <0.05.

Theoretically, the application of rooting hormone helps the rooting ability of the plants as reported in vegetative propagation of some herbal species such as rosemary (Kiuru et al. 2015), stevia (Rakibuzzaman et al., 2018) and roselle (Facknath, 2009). However, in this study both herbal species perform better without the hormone treatment. Low concentration of IBA used in this study may not sufficient to boost the root production. Kamalesh et al. (2021) reported the rooting ability of *O. stamineus* treated with 1500 ppm IBA was on par with the control (no hormone). While greater root number was observed on cuttings treated with 2000 ppm IBA. This shows that greater concentration of exogenous auxin is required to increase the rooting.

Similar trends were observed on the growth performance of *O. stamineus* and *C. nutans* where the IBA treatment does not gave significant effect on the growth parameters and biomass. Kassahun and Mekonnen (2011) shows comparable findings where no

significant effect on the application of rooting homone on leaf number of stevia. The application of 0.3% IBA was not respond well on the propagation ability of bush tea (Araya, 2007). According to Hartmann et al. (1983), plants that roots easily do not respond well to the application of rooting hormone. Hence, application of rooting hormone for the propagation of *O. stamineus* and *C. nutans* is not an important factor.

The effects of cutting length were vary between *O. stamineus* and *C. nutans.* At rooting stages, 10 cm cutting length produced greater root number than 5 cm cutting length in *O. stamineus*. While *C. nutans* does not show any significant effects on the rooting performance. During the growth stages stem height, no of shoots and shoot length of 5 cm cutting length was in line with 10 cm treatment in *O. stamineus*. Thus, both cutting length can be applied on propagation of *O. stamineus.* Whereas, the values of growth parameters were greater with longer cutting length (10 cm) in *C. nutans*. Other studies reported on increasing the cutting length could increase the propagation ability of the plants such as in sage (Mediterranean herb) (Damtew Zigene & Mengesha Kassahun, (2016) and in timber plant *Triplochiton scleroxylon* (Leakey and Mohammed, 1985). This could be related to carbohydrate reserves in long cuttings is higher compared to short ones (Hartmann et al. 1990).

CONCLUSION

Generally it was observed that no hormone application is needed to grow the cuttings of *O. stamineus* and *C. nutans* in the fertigation system. However, cutting length treatment shows significant effect on the rooting ability and growth of the plants. This study recommended to use longer cutting length (10 cm) to propagate both plants as it gave greater roots and growth performances. Findings from this study is essential to the farmers in propagating these two herbal species.

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