Selection of Favorable Exogenous Factors on Adventitious Root Formation in Kollankola (*Pogostemon heyneanus*) cuttings

N. D. N. Priyadarshani, S. Subasinghe and H. K. M. S. Kumarasinghe

Department of Crop Science, Faculty of Agriculture, University of Ruhana, Sri Lankaa

Abstract

Scarcity of good quality planting materials is one of the main problems in development of medicinal plant industry and kollankola (*Pogostemon heyneanus*) is one of the vital medicinal plants facing this problem today. Present study was focused on selection of suitable growing media and cutting types as well as checks the effect of hormone on root formation of this imperative species. For the purpose, survival percentage, percentage of rooted cuttings, number of roots and average root length were determined using two separate experiments. Results revealed that the significantly ($P \leq 0.05$) higher survival percentage, higher rooted cuttings percentage, higher number of roots and higher root length were recorded in sand: compost: coir dust (1:1:1) mixture, while hormone treated semi hardwood cuttings had significantly ($P \leq 0.05$) higher number of roots, higher root length, higher survival percentage and higher rooted cuttings percentage. These findings suggest that hormone treated semi-hardwood stem cuttings planted in sand: compost: coir dust (1:1:1) associated with successful rooting of kollankola. Further, this information will be useful not only in large scale cultivation of kollankola but also ensure the existence of this valued species within the ecosystem.

***Keywords**: Medicinal plant, Planting materials, Semi-hard wood, Survival percentage, Growing media*

INTRODUCTION

Kollankola (*Pogostemon heyneanus*) (Family–Lamiaceae) is one of the valuable plant species with great medicinal and economic importance. Whole plant is used for Ayurvedic preparations in indigenous medicine to treat chronic bronchitis, menstrual trouble, cardiac dropsy, gonorrhea, coughs, asthma, headaches, jaundice, bilious fevers, dropsy and rheumatism (Jayaweera, 1981; Chadha, 1995). Leaves, roots and stem of this plant contain aromatic oil (Jayaweera, 1981) and oil content is very high in leaves comparing other plant parts (Chadha, 1995). Oil is used as valuable raw material for the preparation of perfumes, soap and cosmetics (Chadha, 1995). Moreover, the plant is valuable spice for alcoholic beverages and essential oil production (Seidemann, 2005). This plant also possesses anti insecticidal activities, anti-fungal and bacteriostatic properties (Kukreja *et al.*, 1990; Yang, 1996; Pattnaik *et al.*, 1996) and used for pesticide preparation (Chadha, 1995).In India the plant is often grown as a garden plant (http://www.plantlives.com).

This plant is hardy and can withstand under extreme soil and climatic conditions. In Sri Lanka, it is difficult to find commercial scale cultivations to fulfill annual Kollankola requirement mainly due to non-availability of sufficient amount of quality planting materials. Generally, the plant is propagated through stem cuttings and successfully rooted stem cuttings are essential for better field establishment, subsequent crop growth and yield. Furthermore, it saves the planting materials, labour, time at the initial stage of crop establishment.

Present studies focus on selection of most suitable potting mixture, maturity stage of stem cuttings and effect of hormone application on successful rooting of Kollankola.

MATERIALS AND METHODS

For this purpose, two separate pot experiments were carried out at Medicinal Plant Garden, Faculty of Agriculture, University of Ruhuna.

Experiment I:Selection of suitable potting mixture for successful rooting of *Pogostemon heyneanus* stem cuttings:

Ten different potting mixtures [T_1- sand: top soil: compost (1:1:1), T_2- coir dust, T_3- top soil, T_4- sand, T_5- sand: coir dust (1:1), T_6- sand: top soil (1:1), T_7- top soil: coir dust (1:1), T_8- top soil: compost, T_9- sand: compost: coir dust (1:1:1), T_{10}-sand: compost (1:1)] were used as assigned in different treatments. Black polythene bags of 12×10 cm^2 (gauge 300) were filled using above potting mixtures.

Experiment II: Studies on effect of different cutting types and hormone application on rooting of *Pogostemon heyneanus* stem cuttings :

Three different cutting types namely soft wood cuttings, semi hard wood cuttings and hard wood cuttings were used with and without treating the IBA Hormone (Indole Butric Acid, 3000 ppm). Black polythene bags (gauge 300, 12×10 cm^2) filled with sand: compost: coir dust (1:1:1) potting mixture (most suitable potting mixture from experiment I) were used to plant the treated cuttings.

Experimental conditions and procedures

For both experiments, double nodal cuttings with two leaves were used as planting materials. Planting end of the cuttings was cut off by keeping 45° angles. They were planted in erect way using single cutting per pot. Pots were arranged in a Completely Randomized Design with five replicates under a shade house. Plants were irrigated daily in the morning and weeding was carried out whenever necessary. Survival percentage, rooted cuttings percentage; number of roots and average root length were measured at five weeks after planting. To determine survival percentage and rooted cuttings percentage, data were subjected to angular transformation and Analysis of Variance (ANOVA) and means were separated by Duncan Multiple Range Test (DMRT) using SAS version 6.12 (SAS Institute, 1998). Error bars represent the standard error.

RESULTS

Experiment I

Different potting mixtures had significant effect on survival percentage, rooting percentage, number of roots and root length. Potting mixture of sand: compost: coir dust (1:1:1) (T_9) showed significantly higher ($P \leq 0.05$) survival percentage, number of roots and root length compared to other treatments. At the five weeks of age, top soil (T_3) and sand: compost: coir dust (1:1:1) (T_9) showed significantly higher ($P \leq 0.05$) rooting percentage of 69.33% and 71% respectively. Also there was no significant difference ($P \geq 0.05$) on rooting percentage of *Pogostemon heyneanus* stem cuttings between these two media. However, rooted cuttings percentage were higher in sand: compost: coir dust (1:1:1) (T_9) potting mixture. At the five weeks of age, potting mixture of sand: top soil (1:1) (T_6) had significantly lowest values in terms of survival percentage (15%), rooting percentage (6.7%), number of roots (3) and root length (1.23 cm) (a, b, c and d of Figure 1).

Experiment II

Similarly, cutting types and hormone had significant effect on survival percentage, rooting percentage, number of roots and root length of *Pogostemon heyneanus* stem cuttings at 5 weeks after planting. Significantly higher ($P \leq 0.05$) survival percentage (84.7%), rooting percentage (83.33%), number of roots (23.3) and root length (6cm) were observed in hormone treated semi hard wood cuttings, while soft wood cuttings without hormone applications had the lowest values for all above parameters tested (Figure 2). Second highest values for survival percentage (74%) and

rooting percentage (74%) were observed in semi hard wood cuttings without hormone application, whereas hard wood cuttings treated with hormone showed highest values for number of roots (18.7) and higher root length (4.5 cm) after hormone treated semi hard wood cuttings. There was no significant effect of hormone on number of roots of soft wood cuttings (Figure 2c). In the same way, average root length of hard wood cuttings was not affected by hormone application (Figure 2d).

DISCUSSION

Single nodal cuttings were used for the both experiments in this study due to scarcity of healthy and vigorous stem cuttings. Similarly, Chadha (1995) reported that the suitability of single node cuttings or split cuttings at the time of planting materials scarcity though their initial rate of growth is comparatively slow. However, he further reported that the long cuttings give higher percentage of rootings than the shorter ones. For both experiments, cuttings were irrigated daily morning to provide sufficient moisture for survival of stem cuttings and cuttings with pots were kept under the shade house. This is comparable with findings of Chadha (1995) that the early stages shade and sufficient moisture are the chief requirements for *Pogostemon heyneanus* stem cuttings.

In this experiment planting end of the cuttings were cut off by keeping 45° angles to provide sufficient surface area for root formation. Experiments carried out in Indonesia have indicated that, un rooted cuttings seldom get established; cuttings planted at an angle give better results (87%) as compared to those planted erect (59%); cuttings from the middle point of the stem give more sprouting than cuttings from the ends; those from 9 months old stems seem to give the best planting success (83-90) as compared to younger and older cuttings (Chadha, 1995).

In the present study, data collection was practiced at five weeks after planting of stem cuttings since field planting of rooted kollankola stem cuttings practiced at 4 to 6 weeks of age. Chadha (1995) reported that at the six weeks age of cuttings ready for transplanting. Kollankola is cultivated either through seeds or cuttings. He also reported that crops raised from seeds show a wide variation in the leaf characters, oil yields and therefore, cuttings are more preferred planting materials.

CONCLUSIONS

Growing media of sand: compost: coir dust (1:1:1) and hormone treated semi hard wood cuttings could be used to obtain significantly higher survival percentage and successfully rooted *Pogostemon heyneanus* stem cuttings for field planting. These findings can be utilized to save planting materials, labour, money as well as provide vigorous and successfully rooted stem cuttings for commercial cultivation the valuable species.

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Figures

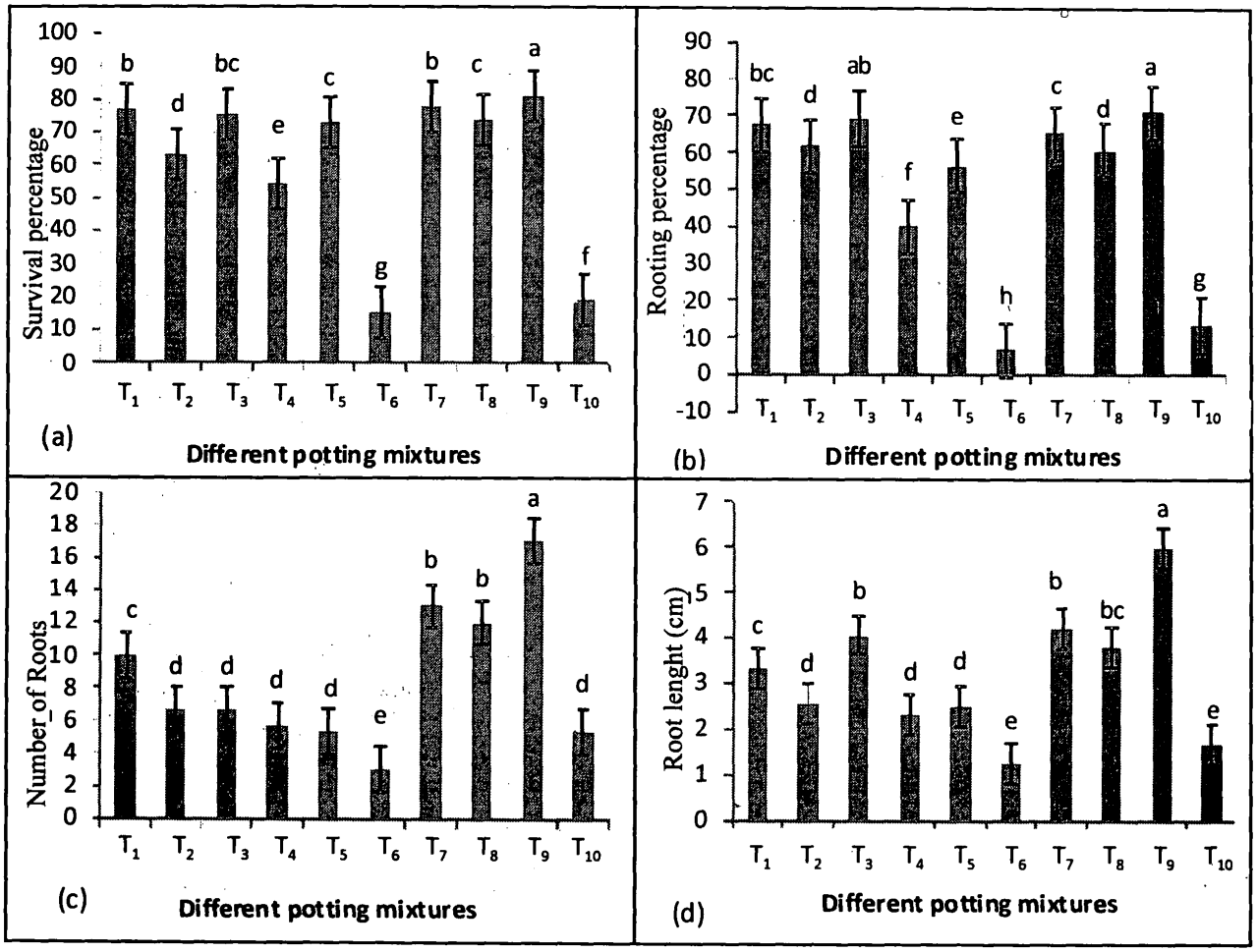

Figure 1: Changes in survival percentage (a), rooting percentage (b), number of roots (c) and root length (d) of *Pogostemon heyneanus* under different potting mixtures at five weeks after planting of single nodal stem cuttings [T_1- sand: top soil: compost (1:1:1), T_2- coir dust, T_3- top soil, T_4- sand, T_5- sand: coir dust (1:1), T_6- sand: top soil (1:1), T_7- top soil: coir dust (1:1), T_8- top soil: compost, T_9- sand: compost: coir dust (1:1:1), T_{10}-sand: compost (1:1)]

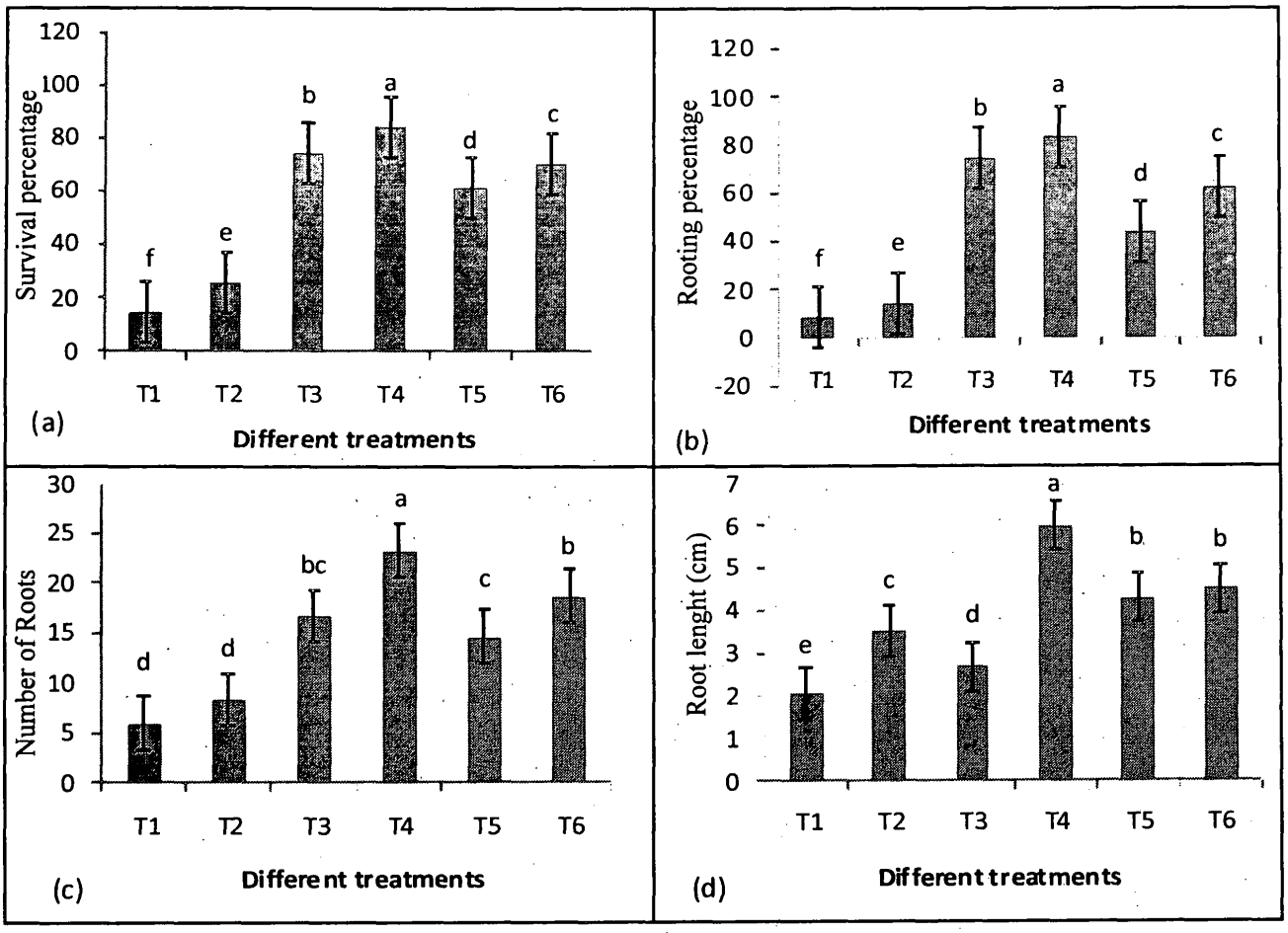

Figure 2: Changes in survival percentage (a), rooting percentage (b), number of roots (c) and root length (d) of *Pogostemon heyneanus* on different cutting types and with or without hormone at five weeks after planting. [T_1- soft wood cuttings without hormone, T_2- soft wood cuttings with hormone, T_3- semi hard wood cuttings without hormone, T_4- semi hard wood cuttings with hormone, T_5- hard wood cuttings without hormone, T_6- hard wood cuttings with hormone]