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Lateral Branch Induction of Cordyline (*Cordyline fruticosa*) Shoot Cuttings with Benzyl Amino Purine (BAP)

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Abstract: The Cordyline (*Cordyline fruticosa*) is an important ornamental foliage plant species belongs to Asparagaceae family grown in the tropical and sub-tropical regions of the world. Cordyline has high demand in local and foreign markets as potted and cut foliage plants. Owing to very slow growth rate of cordyline CVs, obtaining leaves with preferred length and quality is difficult. Availability of quality planting material is also a major problem in cordyline cultivation, due to slow growth rate. This study focussed on the possibility of lateral branch induction with Benzyl Amino Purine (BAP) on the decapitated cordyline plants. Cordyline shoots of about 25 cm length were potted in polyethylene bags (6 cm x 15 cm) filled with 1:1 ratio of compost and sand. Shoots were kept for three weeks in the shade before decapitation. Application of different concentrations of BAP as: 25, 50, 75 and 100 ppm were made twice: 1st, three weeks after plant establishment and 2nd, two weeks afterwards as a foliar spray while the control was sprayed with distilled water. The length and the number of lateral branches and also the number of leaves per plant were recorded at fortnight interval starting from two weeks after the last hormone treatment. It was found that the application of BAP at 75 ppm was the most effective in inducing lateral shoots and leaves on cordyline plants. Treatment with 75 ppm BAP has given the highest number of lateral branches; 6−7/tree with 14 −19 leaves compared to the rest of the treatments in both hormonal applications. The length of shoots was also increased markedly due to the application of hormone. The highest length (24.4 and 38.6 cm) was observed in plants treated with 75 ppm BAP. The findings of this study indicated that the application of 75 ppm BAP can be beneficial for lateral shoot induction and growth enhancement of cordyline trees compared to the other treatments.

Keywords: BAP hormone, Cordyline plants, Lateral shoots, Weeks after plant establishment (WAP).

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1. Introduction

Floriculture industry is one of the most economically important sectors in Sri Lanka. Foliage crops have taken an important place among the floriculture crops. Cordyline is one of the most impressive foliage plants and it has plenty of varieties. Various colour combinations and shapes of leaves give attraction to cordyline plants. Flowering occurs for eight to ten weeks (Arkins, 2003) and is heavier every second year. Propagation through cordyline hardwood stem cuttings takes three to five years to get decent-sized plants (Harris, 2001). Plant growth regulators and appropriate soil conditions are two of the important factors affecting the growth of plants. Cytokinin and Auxin are the two plant growth regulators that are associated with plant growth (Fishel, 2009). Cytokinin regulates cell division, retention of chlorophyll, promote light induced formation of chlorophyll, lateral bud development, cell expansion and regulation of source/sink relationship (Mazher *et al.*, 2011). Thus, efficient propagation method could be practiced by using 6−Benzyl Amino Purine (BAP) hormone. BAP is a group of cytokinin that influence cell division and shoot formation. Soad *et al.* (2010) have found that BAP has significant effects on growth parameters of *Codiaeum variegatum* plants in terms of plant height, number of branches and leaves per plant, root length and leaf area as well as fresh and dry weights of stems, leaves and roots compared with the untreated plants. According to Tennekoon *et al*. (2010) the use of Benzyl amino purine (BAP) and Indole acetic acid (IAA) has improved the growth performance and quality of *Chlorophytom comosum*, an ornamental foliage. Liemt, 2003 proved that BAP at 150 mgL^{-1} has given the highest value for the number of branches per plant and stem diameter compared with the other treatments (50 and 100 mgL^{-1}) and control plants (0 mgL^{-1}) and this result may be due to the stimulatory effects of BAP (Soad *et al*., 2010). Mazher *et al*. (2011) have revealed that foliar application of kinetin (synthetic cytokinin) has significantly affected the plant height, number of branches, fresh and dry weight of herbs as well as total carbohydrates, protein and total carotenoids in plants such as *Salvia officinalis, Lavandula officinalis* and *Tagetes minuta*. Asadi *et al*. (2009) have reported that Rose 'Morrasia' cultured on Murashige and skoog (MS) medium in vitro showed the highest number of shoots produced in media with 3 mgL^{-1} BAP without NAA. Thus the present study was conducted to determine the application of different concentrations of Benzyl Amino Purine on the number and lengths of lateral shoots and the number of leaves of cordyline plants and to find out the most effective BAP concentration to obtain the highest number and length of lateral shoots and leaves on cordyline plants.

2. Materials and Methods

This experiment was conducted at the Royal Botanic Gardens, Peradeniya from October 2015 to February 2016. Polyethylene bags

of 6 cm diameter and 15 cm height were used for this study, the bag were filled with compost and sand at a ratio of 1:1. A length of 25 cm matured and healthy cordyline plant shoots were potted which were collected from the Royal Botanic gardens, Peradeniya, Sri Lanka. Application of different concentrations of BAP (25, 50, 75 and 100 ppm) was done twice (3 WAP and 5 WAP) as a foliar spray while the control was sprayed with distilled water. Solid form of BAP dust was taken and was weighed amounting to 25, 50, 75 and 100 mg. The weighed hormones were put into 4 beakers and a quantity of 3 mL of diluted HCl was poured to dissolve the hormone. The contents of the beaker were stirred and each solution was volumerized to 1,000 mL to obtain 25, 50, 75 and 100 ppm BAP solutions. Three weeks after planting, all the shoots were detopped including the control. Cuts were made at 18 cm above the soil surface. The cut ends were treated with Captan fungicide ($1gL^{-1}$) to prevent fungal infection. The first application of BAP hormone was sprayed 3 weeks after the plant establishment (3 WAP) and the second application (5 WAP) was done 14 days after the first one. The experiment was laid out in the Completely Randomized Design with five treatments and three replications. Each replication consisted of 8 plants. A total number of 120 bags were used for this study. The treatments were as follows:

T_1 – 25 mgL^{-1} BAP was sprayed – 25 ppm concentration

T_2 – 50 mgL^{-1} BAP was sprayed – 50 ppm concentration

T_3 – 75 mgL^{1} BAP was sprayed – 75 ppm concentration

T_4 – 100 mgL^{-1} BAP was sprayed – 100 ppm concentration

T_5 –Distilled water was used as the control

Two weeks after the first hormonal application, the second application (5 WAP) was done and the data on the number and length of lateral shoots and the number of leaves were recorded. The data were statistically analysed and the difference between treatment means was compared using DMRT.

3. Results and Discussions

3.1 Effects of BAP on the number of shoots

There were significant ($P < 0.05$) differences between treatments on the number of lateral shoots of cordyline plants in both hormonal applications (Figure.1). Subjecting shoots to different concentrations of BAP hormone has significantly ($P< 0.05$) increased the number of lateral shoots compared to the control treatment. Significantly highest mean number of lateral shoots (6 and 7) were observed at 75 ppm BAP treatment after the first (3 WAP) and second application (5 WAP) of BAP hormone while the lowest mean number of lateral shoots (2 and 4) was found at 100 p pm BAP hormone concentration.

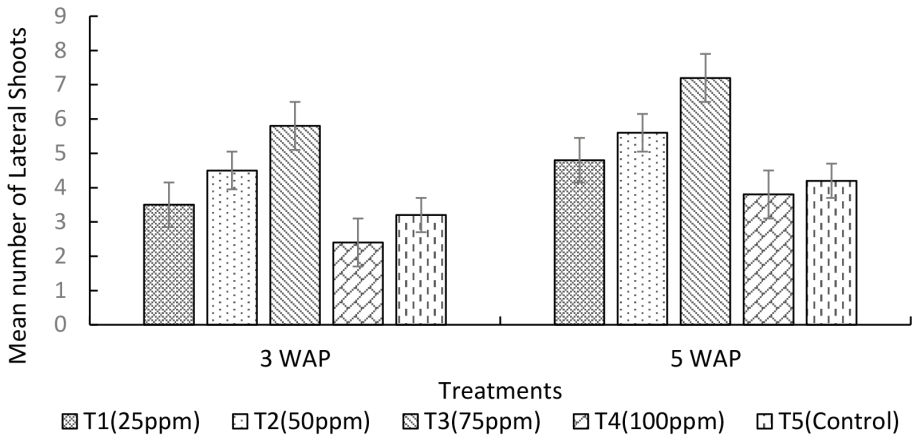

Figure 1: Effects of BAP hormone on the number of lateral shoots of cordyline plants

Mok and Mok (2001) revealed that cytokinin have a major role on plant development, such as the regulation of shoot formation and multiplication and the promotion of cell division and expansion. Benzyl Amino Purine (BAP) is a plant growth regulator which increases branching in floricultural crops when sprayed on containerized plants. Spraying BAP on plants stimulates cell division and increases cell numbers (Schmulling, 2002). Hence, application of BAP has resulted in higher number of lateral shoots. The most effective treatment which has given significantly ($P<0.05$) highest number of lateral shoots was T_3 (75 ppm). Increasing the concentration of BAP increased the number of shoots of plants. Studies of Khaleghi *et al*. (2008) on *Alstroemeria* cv. "Fuego" showed that the greatest number of shoots was obtained from the medium supplemented with 1.5 mgL^{-1} BAP and 0.2 mgL^{-1} NAA. Benedetto *et al*. (2010) found that the application of exogenous cytokinin can improve plant growth at commercial facilities.

There were significant ($P<0.05$) differences between treatments in the length of lateral shoots of cordyline in both hormonal applications (Figure 2). T_3 showed the highest shoot length (24.2 and 38.6 cm) and the lowest length (15.3 cm) observed in T_4 at first hormonal application (3 WAP) and in T_5 (26.4 cm) at second hormonal application (5 WAP). There was a significant ($P< 0.05$) increase in the shoot length of cordyline plants when treated with 75 ppm BAP compared to the rest of the treatments (Figure 2). Based on the biological effects of cytokinin compounds, foliar application of BAP stimulated cell division and increased cell numbers and therefore resulted in increased shoot length of these plants. This increase was in accordance with the results found by Garner *et al*. (1998) which showed that BAP application on tomato plants has increased the shoot length.

3.2 Effects of BAP on the length of lateral shoots

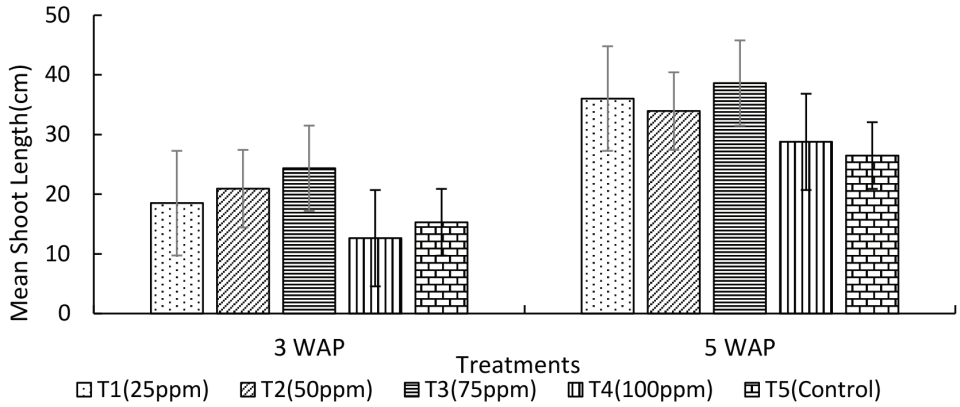

Figure 2: Effects of BAP hormone on the lateral shoot length of cordyline plants

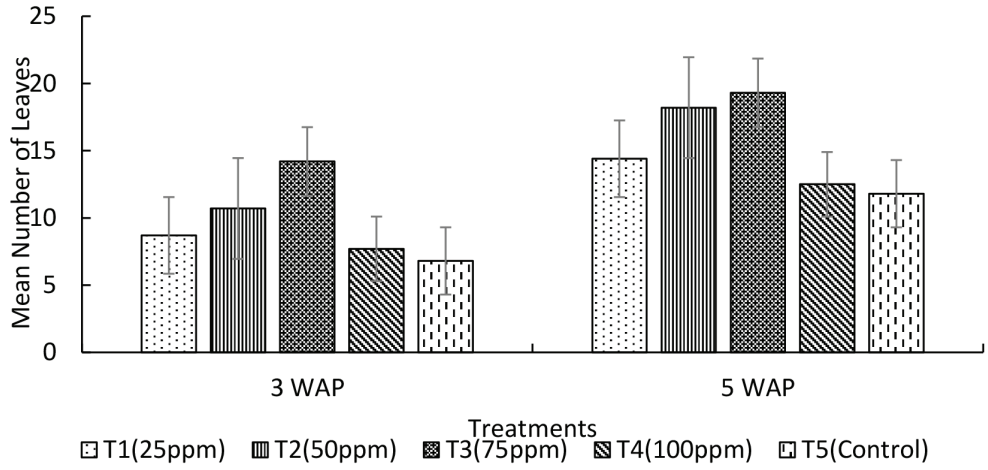

Figure 3: Effects of BAP hormone on the number of leaves of cordyline plants

It was found that there were significant ($P<0.05$) differences between treatments in the number of leaves of cordyline plants at both hormonal applications (Figure 3). Number of leaves on cordyline plants is an important aspect with regard to export market. More number of leaves per plant is the most important in cordyline production. The highest number of leaves (14 and 19) was observed in T_3 (75 ppm) and the lowest number (6 and 11) was found in T_4 (100 ppm) treatment. Tennekoon *et al*. (2010) when did experiments with *Chlorophytum comosom* found that the number of leaves per sucker and number of suckers have increased significantly in 75 mgL^{-1} IAA

in combination with 75 mgL^{-1} BAP in 1:1. While BAP encourages cell division and cell expansion. The success of cell division, elongation and expansion may have led to increase in the length of leaves. Schmulling (2002) stated that increasing the number of leaves is the role of BAP through cell divisions and assimilated transport. Foliar application of BAP stimulated cell division and increased cell numbers and therefore resulted in increased number of leaves. This increase was in accordance with that found by Haratian and Mortazaeinezhad (2015).

4. Conclusions

This study was conducted to increase the production of cordyline plants by hormonal application. Increase in the number of lateral shoots produced from single cutting is the major factor in the propagation of cordyline plants. The highest number and length of shoots were obtained from plants treated with 75 ppm BAP hormone. Hence, 75 ppm BAP hormone was identified as the most effective strength of the hormone to produce highest number and length of cordyline shoots and highest number of leaves on cordyline plants. The results of this study could be useful to commercialize cordyline plant production.

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