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Effect of Indole Butyric Acid (IBA) on growth and success rate of hydrangea and fuchsia cuttings

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The research entitled "effect of indole butyric acid (IBA) on growth of hydrangea and fuchsia cuttings" was carried out at National Agriculture Research Council (NARC) Islamabad, during the year, 2020. The experiment was laid out in Complete Randomized Design (CRD) having five treatments (T_1= 0 ppm, T_2= 200 ppm, T_3= 400 ppm, T_4= 600 ppm, T_5= 800 ppm), which was replicated four times. Results unveiled the significant effect of IBA on shoot length, leaves cutting^{-1}, number of flowers, survival percentage while non-significant difference was present in shoot diameter and branches cutting^{-1} of hydrangea. Indole butyric acid increased shoot length, number of flowers, survival percentage and leaves cutting^{-1} of hydrangea plants that was propagated through cuttings. In regards to fuchsia, Indole butyric acid had a significant effect on shoot length, leaves cutting^{-1}, shoot diameter, survival percentage while non-significant effect was observed regarding number of flowers and branches cutting^{-1}. Hence concluded that IBA enhanced shoot length, leaves cutting^{-1}, shoot diameter and survival percentage of cuttings. The growth and flowering of hydrangea was promoted with the application of 800 ppm IBA while 400 ppm concentration of IBA showed superior results for fuchsia**.**

Keywords: Hydrangea, fuchsia, indole butyric acid (IBA), growth, survival

INTRODUCTION

Hydrangeais an ornamental shrub belongs to family Hydrangeaceae, which is native to Japan. This family mainly comprises of woody plants having 17 genera and around 170 species (Mabberley, 1990). It is grown for aesthetic purposes due to its showy flowers (Harrison, 2012). Its flowers come in a wide range of shades i.e. pink, red, purple and white. It has large and coarse leaves that turns into deep red, maroon and burgundy shades in the fall. Many cultivar have been developed which is cultivated for cut flower business but can also be grown in the home gardens as well (Schiappacasse et al. 2014). These plants are commercially propagated by tissue culture, cuttings or through seeds. But seeds grown plants are not true to type and may exhibit variability, which may sometime leads to undesirable characteristics (Hartmann et al, 1997). It has hundreds of varieties yet identified and is mostly cultivated in the southern part of USA (van Gelderenand van Gelderen, 2004). Hydrangea can easily be grown in a container but it produces one or more vigorous branches that exhibit apical dominance, though suppressing lateral growth. Due to which the canopy forms in asymmetrical pattern (Glasgow 1999). Through pruning and plant growth regulator (PGR), branching pattern can be improved. The plants propagated through cuttings are slow to grow along with poor basal branching. Furthermore, huge number of propagules must be required for the commercial production of hydrangea through cuttings. Therefore, these plants are mostly propagated through tissue culture methods (Sebastian and Heuser, 1987).

Fuchsia (*Fuchsia hybrida*) is an important plant of Onagraceae family. The genus Fuchsia comprises of 110 species, including *Fuchsia magellanica* Lam., *Fuchsia denticulate*, *Fuchsia racemosa* and *Fuchsia corimbiflora*. Due to different morphological characteristics among *Fuchsia* Lam. species, taxonomists have recognized 11 sections (Godley et al. 1995). Majority of species are native to South America, but a few belongs to Northern and Central America, Mexico, New Zealand and Tahiti. *Fuchsia triphylla* was the first fuchsia specie that was discovered by a French botanist Charles Plumier on the Caribbean island of Hispaniola (Chisholm, 1911). The height of most fuchsias ranges from 0.2 to 4 m. Leaves are 1 – 25 cm long, arranged in the form of whorls having serrated margins that behaves as evergreen or deciduous, depending upon the species. Most species have decorative flowers having four long, bright red sepals and four short, purple petals that attract insects to pollinate them.

Asexual propagation through stem cuttings could minimize the limitations of seed propagation, such as, seed dormancy and poor viability (Somashekar and Sharma, 2002). Plants propagated through asexual means are true to type (Henrique et al. 2006).

The success of floriculture depends upon the propagation and growth of plants having superior quality in short period of time. Plant growth regulators are mostly used to speed up the propagation process in order to create required plant shape. IBA increases the success rate of grafting roses when powder was applied on scion (Rhizopon Researcher, 1992).Pomegranate cuttings dipped for 10 seconds in different concentration of IBA, enhanced the roots initiation and improved its characteristics (Owais, 2010). Ranpise et al. (2004) observed an improvement in flower diameter and survival percentage of Chrysanthemum with the use of IBA powder during propagation through cuttings.

Interest of florists and gardeners regarding absorption of certain chemical compounds by plant tissues in order to induce roots and promote vegetative growth, compel us to design such experiment. The main objectives of this experiment were:

- To investigate the response of IBA on stem cuttings of hydrangea and fuchsia.
- To evaluate mortality rate of stem cuttings when treated with IBA.
- To determine optimum concentration of IBA for hydrangea and fuchsia cuttings to grow better.

MATERIALS AND METHODS

The present experiment was conducted on the field of Floriculture, Department of Horticulture Research Institute, National Agriculture Research Center (NARC) Islamabad during summer, 2020, to study the effect of indole butyric acid (IBA) on cuttings of ornamental plants (hydrangea and fuchsia). The experiment was laid out in completely randomized design (CRD) with five treatments (0, 200,400,600 ppm) which was replicated four times. The basal portion of the cuttings were dipped for 10 minutes in different concentration of IBA solution and then these treated cuttings were planted in 10 inches pots.

Observations were recorded during different stages (vegetative and reproductive)regarding shoot length, shoot diameter, branches cutting^{-1}, leaves cutting^{-1}, number of flowers and survival percentage. Shoot length was measured with the help of measuring tape from point of attachment with the cutting up to the tip, shoot diameter was measured with the help of vernier caliper and branches cutting^{-1} were counted manually after flowering. Leaves cutting^{-1}, number of flowers were counted manually while survival percentage was calculated by dividing survived cuttings by total cuttings planted.

Data was analyzed through statistical computed software named Statistix.8.1. Results depicted significant differences were subjected to least significance difference (LSD) test, used for means comparison to identify the significant components of the treatment (Steel et al. 1997).

RESULTSAND DISCUSSION

HYDRANGEA

The data was statistically analyzed for shoot length, leaves cutting^{-1}, shoot girth, branches cutting^{-1}, number of flowers and survival percentage of hydrangea cuttings and then ANOVA was calculated for the effect of IBA on all the of the above mentioned parameters of hydrangea. Analysis of variance (ANOVA) showed that different concentrations of IBA had significant effect on shoot length and leaves cutting^{-1}. Figure 1 shows that lengthiest shoots (8.0cm) were observed in cuttings treated with 800 ppm IBA, followed by 600 ppm while shortest shoots (3.1 cm) were produced by untreated cuttings. Maximum number of leaves cutting^{-1} (12.25) were recorded in cuttings applied with 600 ppm IBA while minimum leaves cutting^{-1} (4.0) were recorded in untreated cuttings (control).

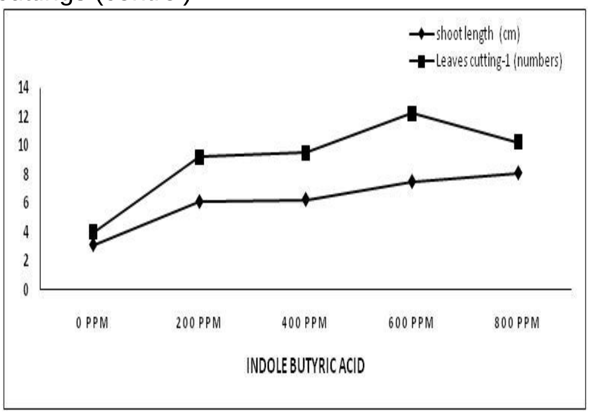

Figure 1: Effect of Indole Butyric Acid (IBA) on shoot length and leaves cutting^{-1} of Hydrangea

Analysis of variance (ANOVA) showed non-significant effect of IBA on shoot girth, branches cutting^{-1} while significant effect on number of flowers. Figure 2 shows that thickest shoots (3.04 mm) were measured in cuttings dipped in 200 ppm IBA solution, followed by 600 ppm IBA while thin stems (2.09mm) were produced by cuttings considered as control (untreated). Regarding branches cutting^{-1}, maximum (2.25) number of branches were recorded in cuttings treated with 600 and 800 ppm IBA during plantation while minimum (1.0) number of branches were recorded untreated cuttings. Maximum number of flowers (1.75) were observed in 800 ppm IBA treatment, whose results are statistically similar to 200, 400 and 600 ppm IBA solution. Least number of flowers was produced by untreated cuttings of hydrangea.

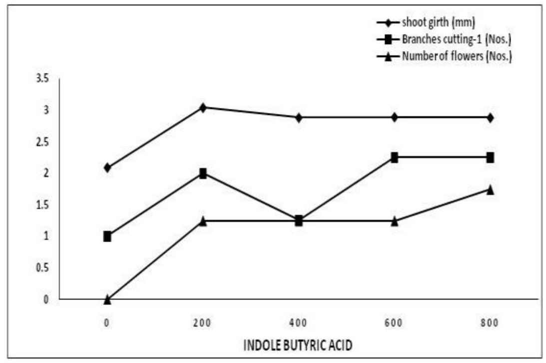

Figure 2: Effect of Indole Butyric Acid (IBA) on shoot girth, branches cutting^{-1} and number of flowers of Hydrangea

Analysis of variance (ANOVA) further showed that IBA had highly significant effect on survival percentage of hydrangea plants propagated through cuttings. Figure 3 shows that maximum survival percentage (68.75 %) was recorded in 800 ppm concentration IBA treated cuttings, followed by 600 ppm while lowest survival percentage (0 %) was observed in untreated plants.

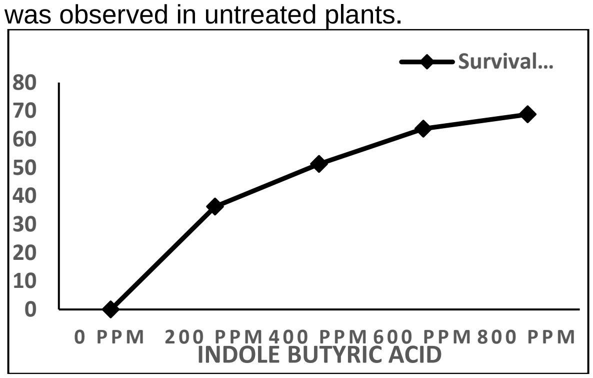

Figure 3: Effect of Indole Butyric Acid (IBA) on survival percentage of Hydrangea

FUCHSIA

The data was statistically analyzed for shoot length, leaves cutting^{-1}, shoot girth, branches cutting^{-1}, number of flowers and survival percentage of fuchsia cuttings and then ANOVA was calculated for the effect of IBA on all the of the above mentioned parameters of fuchsia. Analysis of variance showed that IBA has induced significant difference in shoot length and number of leaves cutting^{-1} of fuchsia cutting Figure 4 shows that maximum (7.45cm) shoot length was observed in 400 ppm IBA treatment, which is statistically similar to 200 ppm, 600 ppm and 800 ppm. Minimum (3.3 cm) shoot length was recorded in control cuttings. As far as number of leaves are concerned, maximum number (12.05) of leaves were found in plants propagated by using 400 ppm concentration IBA, followed by 600 and 800 ppm IBA that were at par with each other by producing

11.75 number of leaves plant^{-1} while minimum (5.1) number of leaves were recorded in untreated cuttings

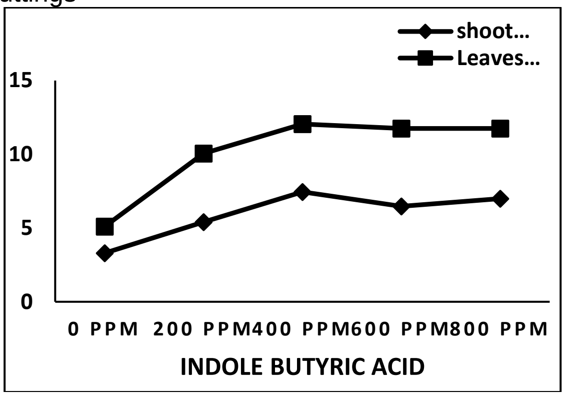

Figure 4: Effect of Indole Butyric Acid (IBA) on shoot length and leaves cutting^{-1} of fuchsia

Data concerning the shoot girth was processed for their statistical analysis and analysis of variance was calculated. Different concentrations of IBA showed significant difference regarding shoot girth while non-significant difference regarding branches plant^{-1} and number of flowers. Figure 5 shows that thickest (6.1 mm) shoots were measured in cuttings dipped in 400 ppm IBA solution, followed by 800 ppm by producing 5.92 mm thick shoots while minimum (4.4) shoot girth was observed in untreated cuttings. Concerning branches cutting^{-1}, maximum (1.75) number of branches were recorded in 600 and 800 IBA treatments while minimum (1.0) number of branches were counted in untreated cuttings. In regards to number of flowers, zero number of flowers were produced my fuchsia cuttings in all the five treatments.

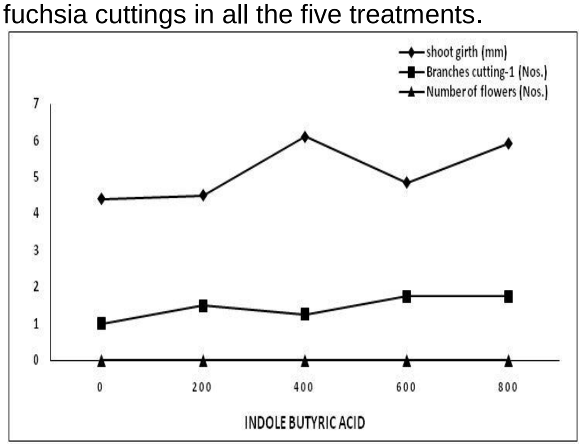

Figure 5: Effect of Indole Butyric Acid (IBA) on shoot girth, branches cutting^{-1} and number of flowers of Fuchsia

Analysis of variance showed that application of IBA had high significant effect on survival percentage of fuchsia cuttings. Figure 6 shows that maximum (75 %) survival percentage was calculated for cuttings treated with 400 ppm IBA solution, followed by 600 ppm while minimum (0 %) survival percentage in untreated cuttings.

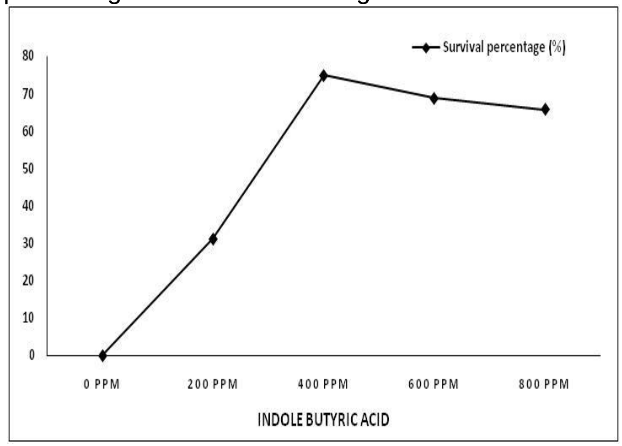

Figure 6: Effect of Indole Butyric Acid (IBA) on survival percentage of Fuchsia

DISCUSSION

Hydrangea

Data presented in the graph indicates that increasing concentration of IBA induces good impact height. Ullah et al. (2013) also observed that IBA increases plant height in marigold. The fact behind this is that IBA inhibits primary root elongation but promotes lateral roots growth, due to which more nutrients were absorbed and hence shoot length increases. Results for number of leaves plant^{-1} are in lined with the findings of Pathak et al. (2002), who observed that the cuttings of chrysanthemum when treated with IBA produced maximum number of leaves. Okafor et al. (2020) also observed significant increase in number of leaves by exogenous application of IBA on some medicinal plants. Branches cutting^{-1} were also improved through exogenous application of IBA, the results are in conformity with Pathak et al. (2002), who observed that the cuttings of chrysanthemum when treated with IBA produced more number of branches. This reason behind this significant improvement is that Indole butyric acid increases root length and root diameter as reported by Shahab et al. (2013), due to which plants takes more nutrients from the soil and used it in growth and development. Highest survival percentage was calculated in IBA treated cuttings. Similar results were recorded by Shahab *et al.* (2013), who reported that optimum concentration of IBA enhanced survival percentage in alstonia plants.

Fuchsia

The results showed that the application of proper level of IBA through which the plants acquired well developed structure and height. Data showed in graph that increasing concentration of IBA show good responses in increasing plant height. Kaur (2015) also recorded maximum shoot length in peach cuttings when treated with adequate concentration of IBA. Similar results were recorded by Zia et al. (2013), observed that indole butyric acid increases plant height in marigold. Regarding number of leaves plant^{-1}, it is evident from the results that maximum number of leaves plant^{-1} were produced by cuttings that were treated with 400 ppm IBA solution, and minimum number of leaves were recorded in control. This increase in number of leaves might be due to production of more number of roots and branches cutting^{-1}. Similar results were recorded by Pathak et al. (2002) who observed that the cuttings of chrysanthemum when treated with IBA produced more number of branches. Similar results were recorded by Shahab et al. (2013), who reported that increasing concentration of IBA resulted in highest survival percentage of alstonia cuttings.

CONCLUSION

Keeping in view the findings of present research work; it can be concluded that;

Indole butyric acid shows significant effect on plant height, number of leaves, number of flower and survival percentage of hydrangea. Application of IBA at the rate of 800 ppm shows the best result followed by 600 ppm.

Indole butyric acid shows significant effect on plant height, number of leaves, stem diameter, survival percentage of fuchsia while shows non-significant result for number of flowers and number of branches. Application of IBA at the rate of 400 ppm shows the best result followed by 800 ppm and 600 ppm.

Recommendations

In light of above conclusion; it can be recommended that;

Indole butyric acid (IBA) at the concentration of 800 ppm is recommended for significant growth and highest survival rate of hydrangea.

Indole butyric acid (IBA) at the concentration of 400 ppm is recommended for significant growth of fuchsia plant

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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AUTHOR CONTRIBUTION

WB, AG, and MKA contributed equally to this work. JK and IU conceptualized and analyzed the manuscript. AG and IU wrote the initial manuscript. SNZ, MZA and AUR helped design the methodology. FN, AM and JK revised the manuscript and polished the expression of English. All of the authors have read and approved the final manuscript.

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