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An evaluation of nursery techniques to improve the growth of *Ziziphus spina-christi* and *Ficus virens* in Bahawalpur, Pakistan

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SUMMARY

The present study was planned to investigate the growth responses of two multipurpose tree species (*Ziziphus spina-christi* and *Ficus virens*) through vegetative propagation methods under various nursery techniques at the nursery of the Department of Forestry, Range and Wildlife Management, The Islamia University of Bahawalpur, Punjab, Pakistan in 2021. Stem cuttings of different sizes (7.5 and 9.5 inches) were taken and applied with or without Indole Butyric Acid (4000ppm) in different seasons, i.e., winter and summer. Results revealed that the peak values of average sprouting percentage, number of leaves and highest average number of roots for *Ziziphus spina-christi* (66%), (18),(15.12) and *Ficus virens* (100%), (20.5), (51.21) were observed in treatments 8 and 16 respectively. On the other hand, maximum average height of *Ziziphus spina-christi* (2.1 inch) and *Ficus virens* (2.56 inch) were noted in treatments 8 and 14 accordingly. Beside, longest average root length of *Ziziphus spina-christi* (3.03 inch) and *Ficus virens* (3.3 inch)were measured in treatments 6 and 16 accordingly. Present inquires outspread the importance of nursery techniques in the determination of healthy planting stocks of both species in different environmental conditions.

Keywords: Different sizes, Environment, Indole butyric acid, Multipurpose, Stem cuttings

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INTRODUCTION

Ziziphus spina-christi, from the Rhamnaceae family, generally called Christ's thorn Jujube, is a deciduous tree and native to subtropical and warm temperate regions of North Africa, Australia, South and East of Asia, South Europe and Middle East (Asgarpanah and Haghighat, 2012). The diameter of the fruit is 1-1.5 cm red and brown. In the middle of the *Ziziphus spina-christi* fruit, there is a hard seed surrounded by a sweet pulp. The fruiting season of *Ziziphus spina-christi* starts in October and ends in April (Saied *et al*., 2007). *Ziziphus spina-christi* is a multipurpose tree,). Leaf powder of *Ziziphus spina-christi* is used against swellings in northern parts of Kordofan, while roots are helpful as anti-purgative (El Ghazali *et*

al., 1997). The bark is used for the treatment of intestinal spasms in White Nile states (El Ghazali *et al*., 1994).

Deciduous tree, *Ficus virens* from the botanical family *Moraceae* is distributed in South Asia and northern parts of Australia, having economic value for medicine, food, and Latex (Lal, 2020). *Ficus virens* can reach up to the height of 35 meters having petiole with 2–4.5 cm length with a yellowish color. *Ficus virens* ranked in the top 10 species from all 90 species present in the world that attract frugivorous (Lee *et al*., 2013). The foliage of *Ficus virens* is eaten as vegetables and pickles. In ancient Egyptian culture, this tree was used as a flock medicine. Different parts of *Ficus virens* are used to treat various diseases i.e. blood diseases, pain, delirium, apoplexy, vertigo, and diabetes.

Application of Indole butyric acid (IBA) on different sized stem cuttings of sub-tropical plants has very progressive effect on sprouting percentage, plant height and root development as compared to non-IBA treated stem cuttings during different seasons (Mehta *et al*., 2018). *Ficus virens* has the potential to breed throws seed as well as from stem cuttings (Yeo and Tan, 2011). In July and August mostly *Ficus* species especially *Ficus virens* can be propagated using stem cutting (Rawat, 2015). *Ziziphus spina-christi* plant needs the attention of researchers to find novel ways of propagation. *Ziziphus spina-christi* can be propagated through stem cuttings but with less potential (Nagla, 2005).

The present study was conducted to check the growth responses of these species through different nursery techniques such as; use of different cutting sizes and the use of growth-promoting hormone (Indole butyric acid) in different seasons. In this way, we can estimate the best nursery technique for the high production of these plants which can be very helpful for the local peoples, nursery owners, foresters, and pharmaceutical industry.

MATERIALS AND METHOD

Current experiment was performed at the nursery of the Department of Forestry, Range and Wildlife Management, The Islamia University of Bahawalpur, Punjab, Pakistan during 2021. Experiment was conducted in two different seasons' winter (1st January to 3 March 2021) and summer (1st May to 30 June 2021) respectively, with 16 treatments (15 replications in each treatment). Cuttings of *Ziziphus spina-christi* and *Ficus virens* with different sizes (7.5 inch and 9.5 inch), treated with or without Indole Butyric Acid (4000ppm) were used. Data regarding different traits i.e. sprouting percentage, number of leaves, plant height, number of roots and root length was noted after the time interval of 15 days till 2 months. Raw stems of *Ziziphus spina-christi* were collected from Lal Suhanra forest, while raw stems of *Ficus virens* were taken from a mature tree located in Moj Gurh, Cholistan. Five grams of IBA powder was dissolved in 25 ml of Ethanol in a flask. After that, 1.25 liters of distilled water was added to make an IBA solution (4000 ppm). This solution was poured in a 5kg basket and lower ends of stem cuttings were dipped in IBA solution till 16 hours. Similar methodology was also used by Baul *et al.* (2010) to treat the stem cuttings of tropical and sub-tropical plants with IBA solution. One-way analysis of variance (ANOVA) was employed to statistically test the data. Means were compared using Duncan test at ($p < 0.05$). According to Kolmogorov-Smirnov and Levene statistics

tests, normality and homogeneity of variance was tested respectively, using IBM, SPSS Statistics (v22.0) (Table 1).

Table 1: Layout of the experiment.

Treatment 01	Winter + *Ziziphus spina-christi* + Cutting 7.5 inch + No IBA
Treatment 02	Winter + *Ziziphus spina-christi* + Cutting 7.5 inch + IBA
Treatment 03	Winter + *Ziziphus spina-christi* + Cutting 9.5 inch + No IBA
Treatment 04	Winter + Ziziphus spina-christi + Cutting 7.5 inch + IBA
Treatment 05	Summer + *Ziziphus spina-christi* + Cutting 7.5 inch + No IBA
Treatment 06	Summer + *Ziziphus spina-christi* + Cutting 7.5 inch + IBA
Treatment 07	Summer + *Ziziphus spina-christi* + Cutting 9.5 inch + No IBA
Treatment 08	Summer + *Ficus virens* + Cutting 9.5 inch + IBA
Treatment 09	Winter + *Ficus virens* + Cutting 7.5 inch + No IBA
Treatment 10	Winter + *Ficus virens* + Cutting 7.5 inch + IBA
Treatment 11	Winter + *Ficus virens* + Cutting 9.5 inch + No IBA
Treatment 12	Winter + *Ficus virens* + Cutting 7.5 inch + IBA
Treatment 13	Summer + *Ficus virens* + Cutting 7.5 inch + No IBA
Treatment 14	Summer + *Ficus virens* + Cutting 7.5 inch + IBA
Treatment 15	Summer + *Ficus virens* + Cutting 9.5 inch + No IBA
Treatment 16	Summer + *Ficus virens* + Cutting 9.5 inch + IBA

Note: Indole butyric acid (IBA)

RESULTS AND DISCUSSION

AVERAGE SPROUTING PERCENTAGE

For *Ziziphus spina-christi*, the highest value of average sprouting percentage was observed in treatment 8 (66%) followed by treatment 6 (60%), while the minimum values of average sprouting percentage were noted in treatment 1 and 3 (13%) followed by treatment 5 and 7 (26%) respectively. On the other side, for *Ficus virens*, the peak value of average sprouting percentage was measured in treatment 16 (100%) followed by the treatment 14 (93%), while the lowermost average sprouting percentage was observed in treatment 9 (66%) followed by the treatment 11 and 13 (73%) repeatedly (Table 2). Findings of current study, are not matched with the previous findings of research and Sardabi (2005), they checked the sprouting percentage of *Ziziphus spina-christi* stem cuttings in summer season, without application of any growth regulator using a mixture of 50% sand and 50% clay as growth medium. They observed maximum (33%) sprouting percentage. Their results (33% sprouting percentage) were poorer than our findings, where the sprouting percentage of *Ziziphus spina-christi* stem cuttings was noted as (66%) by the application IBA (4000 ppm) in bhal (soil type) with cutting size (9.6 inch) during the summer season. These differences may possible due to the application of growth regulator (IBA 4000 ppm) (Figure 1 and 2). Application of IBA and use of different cutting sizes have pulverized impact on the success and sprouting ratio of stem cuttings of tropical tree species (Mewar and Naithani, 2016). Current findings are

matched with the earlier findings of Shirzad *et al*. (2015) they also measured (100%) sprouting percentage in IBA treated stem cuttings of plants belonging to genus *Ficus*.

AVERAGE PLANT HEIGHT

Application of IBA significantly increased the plant height in stem cuttings of both species. For *Ziziphus spina-christi*, a peak final average of plant height was observed in treatment 8 (2.1 inches) followed by the treatment 6 (2 inches), while minimum value was noted in treatment 1 (1 inch) followed by the treatment 3 (1.15 inches) accordingly. In the case of *Ficus virens*, a maximum final average of plant height was observed in treatment 14 (2.56 inches) followed by the treatment 16 (2.55 inch), while the minimum final average was noted in treatment 9 (1.8 inches) followed by the treatment 13 (1.92 inches) repeatedly (Table 2). Similar trend was also observed by Naji *et al*. (2015) in stem cuttings of some tropical and sub-tropical plants treated with growth regulators. According to their results significant increase in plant height was observed in stem cuttings applied with growth regulator hormone as compared to stem cuttings not treated with any growth regulating agent.

AVERAGE NUMBER OF LEAVES

Data indicated that the highest final average numbers of leaves for *Ziziphus spina-christi* were observed in treatment 8 (18) followed by the treatment 6 (16.5), while the lowest final average of number of leaves was noted in treatment 1 (7.5) followed by the treatment 3 (8.5) accordingly. In the case of *Ficus virens*, the maximum final average number of leaves was noted in treatment 16 (20.5) followed by the treatment 14 (18.3), while the lowest final average of number of leaves was observed in treatment 9 (9.9) followed by the treatment 11 (11) repeatedly (Table 2). Similar findings were also reported by Ullah *et al*. (2013) they also observed significant increase in average number of leaves in some wild plants found in tropical and sub-tropical dry forests. According to them they observed 44 leaves per plant in IBA treated plants, while 27 leaves were noted in control. Same trend was also observed in IBA and non-IBA treated stem cuttings.

AVERAGE NUMBER OF ROOTS

Significant increase in root number was observed in treatments applied with IBA as compared to rest of the treatments. For *Ziziphus spina-christi*, the peak value of average number of roots were observed in treatment 6 (17.12) followed by the treatment 8 (15.12), while the bottommost values of average number of roots were noted in treatment 3 (6.1) followed by the treatment 1 (7.5) repetidly. In the case *of Ficus virens*, the maximum average number of roots were observed in treatment 16 (51.21) followed by the treatment 14 (48.57), while the minimum average number of roots were seen in treatment 9 (20.3) followed by the treatment 11 (21.46) accordingly (Table: 2). Previous findings of Babaie et al. (2014) also revealed the signifcant increase in arverage number of roots in IBA treated stem cuttings of wild species of genus *Ficus*. They observed maximum average number of roots (16) in IBA treated cuttings and minimum (6) roots were noted in non-IBA treated cuttings.

AVERAGE ROOT LENGTH

Treatments under IBA treatment showed significant increase in root length as compared to treatments not applied with IBA. For *Ziziphus spina-christi*, the highest average of root length was measured in treatment 6 (3.03 Inch) followed by the treatment 4 and 8 (2.91 inch) and (2.9 inch) respectively, while the minimum number of roots was noted in treatment 1 (1.45 Inch) followed by the treatment 3 (1.5 inch) accordingly. On the other side, for *Ficus virens,* the maximum average of root length was observed in treatment 16 (3.3 inch) followed by the treatment 12 (3.1 inch), while the lowest average value was noted in treatment 9 (2.19 inch) followed by the treatment 13 (2.3 inch) respectively (Table: 2). Significant increase in root length was also perversely noted by Salmi *et al*. (2016) in IBA treated stem cuttings of some plants belonging to genus *Ficus*. According to their previous findings peak value of average root length (12.14 cm) was observed in treatment applied with IBA, while minimum average root length (3.8 cm) was noted in treatment not applied with any growth regulator.

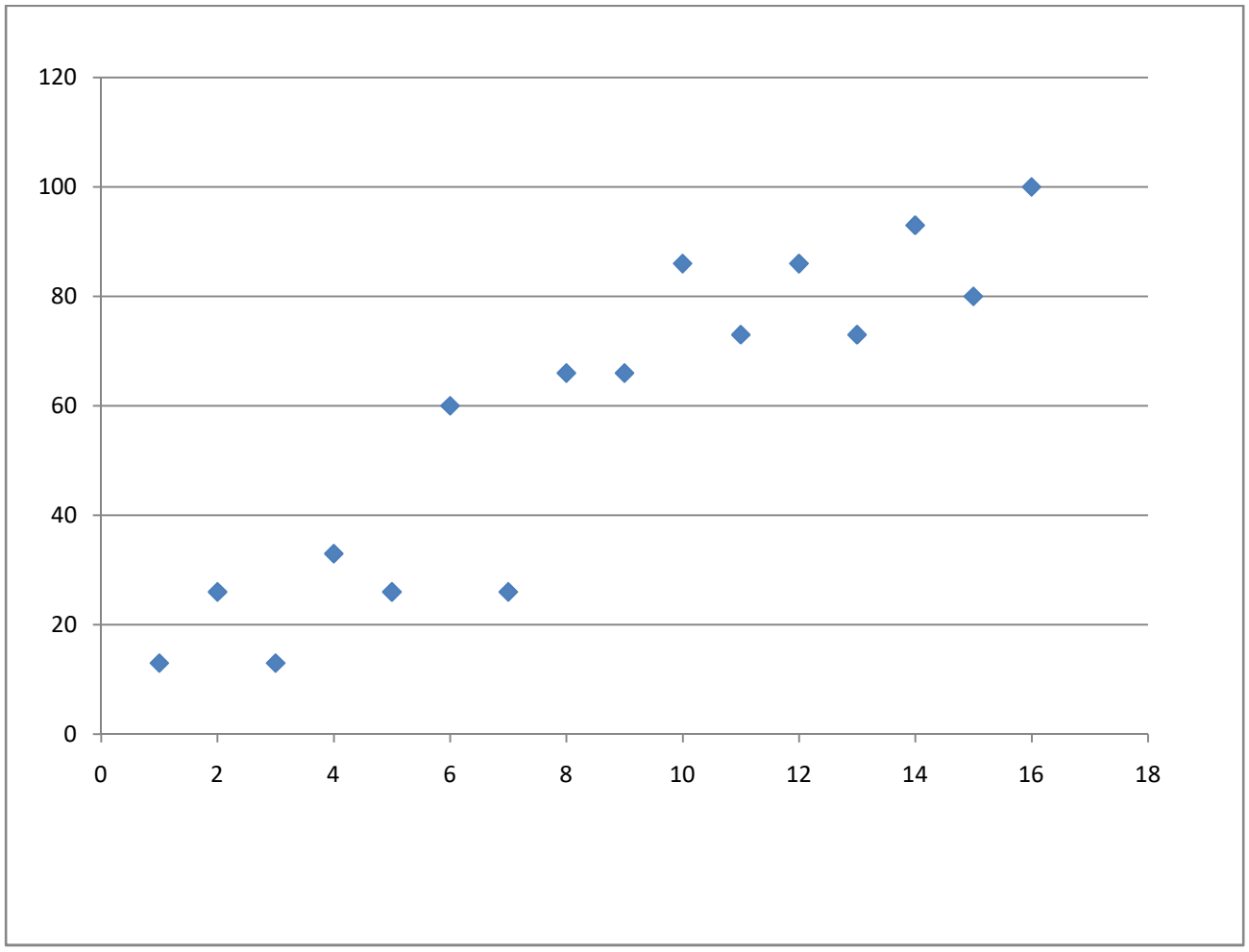

Figure 1: Average sprouting percentage among treatments Numbers (0 to 120) on X-axis represents sprouting percentage, while treatments are arranged on Y-axis.

Figure 2: Growth of stem cuttings, *Ziziphus spina-christi* (left) and *Ficus virens* (right).

Table 2: Values of experimental parameters.

Number of Treatment	Maximum average sprouting percentage	Maximum average plant height(inch)	Maximum average number of leaves	Maximum average number of roots	Maximum average root length (inch)
Treatment 01	13	1	7.5	7.5	1.45
Treatment 02	26	1.45	11.75	11.5	2.7
Treatment 03	13	1.15	8.5	6.1	1.5
Treatment 04	33	1.6	13.6	13.5	2.91
Treatment 05	26	1.32	10.5	9.25	1.7
Treatment 06	60	2	16.5	17	3.03
Treatment 07	26	1.4	11.75	10	2.06
Treatment 08	66	2.1	18	15.12	2.9
Treatment 09	66	1.8	9.9	20.3	2.19
Treatment 10	86	2.4	14.5	35.23	3.03
Treatment 11	73	1.94	11	21.46	2.4
Treatment 12	86	2.52	15.71	41.07	3.1
Treatment 13	73	1.92	12	23.27	2.3
Treatment 14	93	2.56	18.3	48.57	3.02
Treatment 15	80	1.98	13.6	23.61	2.4
Treatment 16	100	2.55	20.5	51.21	3.3

CONCLUSION AND RECOMMENDATION

Results concluded that the overall growth responses of both studied species were found excellent in summer season while using large cuttings (9.5 inch) against Indole Butyric Acid (4000ppm). Present inquires also outspread the importance of nursery techniques in the determination of healthy planting stocks of both species, because different species shows variation in growth patterns due to their changed growth requirements during different seasons in desert conditions. So, treatment number 6 and 8 for *Ziziphus spina-christi*, and treatment number 14 and treatment 16 for *Ficus virens* are recommended to propagate these plants through stem cuttings.

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