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To study the effect of plant growth regulator and chemicals on survival of cuttings in fig (*Ficus carica* L.) Cv.Dinkar.

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Abstract
The present investigation entitled Studies on Effect of Chemicals, Plant Growth Regulator on Growth and Survival of Cuttings in Fig (*Ficus carica* L.) Cv.Dinkar was conducted at section of Horticulture, College of Agriculture, Badnapur, during 2019-20. The experiment was laid out in RBD with fifteen treatments replicated twice. The effectiveness of IBA, SA and PHB concentrations, in which IBA applied as solo and combined with all chemical concentrations, and control were tested for their ability to enhance rooting frequency (%) of Cv.Dinkar of fig cuttings. Among the chemical treatments Auxin concentrations tested ranged from 1000 to 1500 ppm IBA. However 1500 ppm IBA induced significantly greater rooting percentage than the control, but no single auxin, auxin concentration or combination of auxins was clearly superior in every study. IBA application also enhanced the number of roots developed on each cutting.
In Present experimentation, maximum length of longest root (T_{14} 34.49 cm) which is observed with IBA + Polyamine, average root length (26.93 cm), diameter of root (1.85 mm), volume of root (9.39 ml), fresh weight of root (9.53 g), dry weight of root (4.97 g) was noticed in treatment T14 (T2 + Putrescine 3.0 mm). While minimum length of longest root (12.68 cm) in control, average root length (9.13cm) diameter of root (0.77 mm), volume of root (1.85 ml), fresh weight of root (2.02 g), dry weight of root (0.34 g) was recorded in treatment Tl5 (control). In present investigation, maximum root: shoot ratio on fresh weight basis (0.29) was noticed in treatment T1 (Indole Butyric Acid 1000 ppm), however minimum root: shoot ratio on fresh weight basis (0.14) was observed in treatment Tl5 (control), while maximum root: shoot ratio on dry weight basis (0.19) was noticed in treatment T5 (T2 + PHB 1500 ppm), while minimum root: shoot ratio on dry weight basis (0.04) was observed in treatment Tl5 (control).

Keywords: plant growth regulator, chemicals on survival, *Ficus carica* L.) Cv.Dinkar

Introduction
Fig (*Ficus carica* L.) is an important fruit crop grown as subtropical crop, especially in arid and semiarid regions of the world. Fig is a member of the *Moraceae* family. It is unique in a genus embracing perhaps over 1,000 species, mostly giant "rubber trees", and mostly tropical. It is native to the tropical areas of Eastern Asia. Fig is one of the most salt and drought tolerant crop with a deep root system. It is a native to Southern part of Arabian Peninsula, Italy, the Balkan Peninsula and Russia. In India, its commercial production is limited to a few places near Pune and Aurangabad districts of Maharashtra, Bellary and Anantpur districts of Karnataka. in India Puna fig, Daulatabad, Dinkar etc. varieties grown commercially. As far Maharashtra is concerned most of the area of the fig is under Daulatabad and Dinkar varieties. Fig is propagated by asexual propagation, which is very useful for replicating true to type clonal planting material for multiplication of elite plants for plantation purpose, germplasm conservation and introduction of fast growing species. Thus, it is the most important, fast, convenient economic propagation technique to raise superior planting material. In comparison to other methods of asexual propagation in fig, propagation by stem cutting has been the modern commercial nursery practices as a rule. Fig is hard to root hence its cuttings develop roots with great difficulty. Plant growth regulators usually Auxin have an important role in stimulation and initiation of roots to cutting. Auxin induces root formation by breaking root apical dominance induced by cytokinin (Cline, M.G., 2000). Root promoting hormones play important role in the success of rooting of cuttings. It has been reported that root promoting hormones play an important role in the success of rooting of cuttings (Siddiqui and Hussain 2007) [9].

Growth hormones including Indole Butyric Acid promote good rooting. Keeping in view the importance of it, the present study was initiated to produce better and quicker rooting through the use of varying concentrations of Indole Butyric Acid. The availability and mobilization of carbohydrates towards the base of cuttings appear to be a major factor related to rooting of fig cuttings (Aslmoshtaghi and Shahsavar, 2011) [1]. Mancuso (1998) showed a marked seasonal variation in rooting ability of olive cuttings, achieving the highest rooting (80%) in spring-summer and the lowest rooting ability (20-30%) in winter. Moreover high variability in olive rooting has been observed between cultivars, ranging from easy to difficult-to-root cultivars. Adventitious root initiation in olive cuttings can be stimulated by auxins, particularly indol-3-butyric acid (IBA), but in difficult-to-root cultivars, the auxin either fails to promote rooting or promotes it only slightly (Serrano et al., 2002) [8]. Some studies indicate a possible improvement of the auxin stimulation on adventitious root formation when it is conjugated with cofactors such as phenolics (Bartolini et al., 1986) [2], including flavonoides (Curir et al., 1990) [3] and hydrogen peroxide (Sebastiani and Tognetti, 2004; Sebastiani et al., 2002) [7, 6]. Rugini et al. (1990) [5] noticed that 1,4-diaminobutane (putrescine) in combination with IBA promoted early rooting and increased rooting percentage. Keeping in view the importance of propagation through cuttings very less research work has so far been done on propagation of fig by cuttings using plant growth regulator and chemicals.

Materials and methods

Experiment was conducted at Department of Horticulture, College of Agriculture, Badnapur during the year 2019-2020. The average annual precipitation is 722 mm with 30 rainy days. The mean daily maximum temperature varies from 21.4^{0}C in December to 32.9^{0}C in March. The experiment was carried out by planting the cuttings of fig in polythene bags of size (4`` × 6``). The polythene bags were punctured to improve the drainage and filled with garden mixture which was prepared by well mixing of one part of soil, one part of sand, one part of well rotted FYM (1:1:1 proportion of soil, sand and FYM). The cuttings of fig Cv. Dinkar fig used for this research were selected from 5 years old mother plant. Hardwood types of cutting were carefully selected. Pre-treated fig cuttings were planted in polythene bags which were properly filled, labeled with tags and placed as per layout. Hardwood cuttings from one year old shoots of 15-20 cm length and 1.5-2 cm in diameter having 4-5 nodes each were selected. Treatment wise solutions of IBA and other chemicals alone and in combination were prepared. The lower portion of cuttings (1-2 cm) were treated with different concentration of chemicals by quick deep method for 5-10 seconds and allow to dry for 5 minutes in partial shed and then planted in poly bags containing soil + sand + FYM (1:1:1) in a such manner that the 1/3rd portion of the cutting insert in the media and light irrigation was applied gradually in the morning and evening with the help of water cane.

Results and Discussion

Effect of chemicals on days to sprouting

Treatment number	Number of cuttings sprouted		Effect of chemicals on number of shooted cuttings (%)	
	30 DAT	45 DAT	60 DAT	90 DAT
T_1 (IBA 1000 ppm)	22.50	28.50	28.50 (95.00)	28.50 (95.00)
T_2 (IBA 1500 ppm)	22.50	28.50	28.50 (95.00)	28.50 (95.00)
T_3 (T_1 + PHB 1500 ppm)	18.50	28.00	28.00 (93.33)	28.00 (93.33)
T_4 (T_1 + PHB 2000 ppm)	19.50	28.00	28.00 (93.33)	28.00 (93.33)
T_5 (T_2 + PHB 1500 ppm)	25.25	29.00	29.00 (96.66)	29.00 (96.66)
T_6 (T_2 + PHB 2000 ppm)	24.00	29.00	29.00 (96.66)	29.00 (96.66)
T_7 (T_1 + SA 2000 ppm)	14.50	24.50	24.50 (81.66)	24.50 (81.66)
T_8 (T_1 + SA 2500 ppm)	16.25	25.00	25.00 (83.33)	25.00 (83.33)
T_9 (T_2 + SA 2000 ppm)	17.00	25.25	25.25 (84.16)	25.25 (84.16)
T_{10} (T_2 + SA 2500 ppm)	17.50	26.00	26.00 (81.25)	26.00 (81.25)
T_{11} (T_1 + PUT. 1.5 mM)	22.21	28.20	28.20 (94.00)	28.20 (94.00)
T_{12} (T_1 + PUT.3.0 mM)	22.70	28.23	28.23 (94.10)	28.23 (94.10)
T_{13} (T_2 + PUT 1.5 mM)	26.75	30.00	30.00 (100.00)	30.00. (100.00)
T_{14} (T_2 + PUT.3.0 mM)	27.80	30.00	30.00 (100.00)	30.00 (100.00)
T_{15} (Control)	12.00	17.00	17.00 (56.66)	17.00 (56.66)
SE±	0.25	0.23	0.23	0.23
CD at 5%	0.73	0.66	0.66	0.66

Observed in treatment T_{14} (30.00) and T_{13} (30.00). Next best treatments were treatment T_5 (29.00), T_6 (29.00), T_1 (28.50), T_2 (28.50). While remaining treatments T_{12}, T_{11}, T_3, T_4, T_{10}, T_9, T_8 and T_7 showed intermediate effect. Significantly minimum number of cuttings sprouted (17.00) was reported in treatment T_{15} (*i.e.* control). While minimum number of cuttings sprouted (4.25) was reported in treatment T_{15} (*i.e.* control). Almost similar trend was reported at 30 days of cutting where maximum number of cuttings sprouted (27.80) was reported in treatment T_{14} (T_2 + Putrescine 3.0 mM). The increase in number of sprouts might be due to the better utilization of stored carbohydrates, nitrogen and other factors with the help of growth regulators (Singh, 2014) [11]. Application of the auxin might have caused hydrolysis and translocation of carbohydrates and nitrogenous substances at the base of cuttings and resulted in accelerated cell division and cell elongation (Singh *et al.* 2009) [10]. Iqbal *et al*, (1999) reported that this might be due to presence of endogenous auxins in cuttings might have brought early breakage of bud dormancy and results in early bud sprouting. Similar result was also found by Srivastava *et al.* (2005) [12] in Kiwi fruit and Kaur *et al.* (2017) [4] in Fig cutting.

Effect of chemicals on number of shooted cuttings (%)

At 60 days of cutting maximum number of shooted cuttings (100.00%) was reported in treatment T_{14} (T_2 + Putrescine 3.0 mM) and T_{13} (100.00%) followed by the treatments T_5 (96.66%), T_6 (96.66%), T_1 (96.66%), and T_2 (96.66%) which were statistically at par with each other. Other treatments like T_{11}, T_{12}, T_3, T_4, T_{10}, T_8, T_9 and T_7 showed intermediate effect. Significantly minimum number of shooted cuttings (56.66%) was reported in control. Almost similar trend was recorded at 90 days of cutting.

The more number of shoot formation with the growth regulators might be due to the vigorous root system which increased the nutrient uptake under the influence of IBA. It might also be due to the more number of roots and vigorous growth of the plant. The result obtained in the present study is in agreement with that reported by Thota *et al.* (2012) [13] in fig.

Conclusion

IBA 1500 ppm + Putrescine 3.0 mM was superior in all shoot observations and as percent success of cuttings over rest of the chemicals, The results of the present study suggest that IBA increases the rooting ability in the easy to root 'Cv.Dinkar' fig cultivar. Putrescine can be a useful substance in increasing fig hard wood cutting succes percentage. Therefore, the idea of using putrescine with IBA also allows for obtaining satisfactory rooting from cuttings known as unfavorable to rooting.

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