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Response of hardwood cuttings of Brown Turkey fig to planting time and auxin concentration

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ABSTRACT

Present investigation was conducted on hard wood cuttings of fig cv. Brown Turkey by treating with various Indole -3-butyric acid (IBA) concentrations viz. 500, 1000, 1500, 2500, 3500, 4500 ppm and distilled water (Control). These IBA treated hardwood cuttings of fig were planted at different intervals of time *i.e.* 1st January, 15th January, 1st February and 15th February and data were collected at 30, 60 and 90 days after planting. Fig cuttings treated with IBA 3500 ppm and planted on 1st February showed maximum sprouting percentage (25.07, 57.58 and 76.66, at 30, 60 and 90 DAP, respectively), number of shoots per cutting (5.40 and 5.89 at 60 and 90 DAP, respectively), fresh weight of shoot (26.49 and 51.50g at 60 and 90 DAP, respectively), dry weight of shoot (9.63 and 19.53 g at 60 and 90 DAP, respectively) and maximum number of roots per cutting (25.50, 32.00 and 35.16 at 30, 60 and 90 days after planting respectively), fresh weight of root (0.91, 1.51 and 1.89 g 30, 60 and 90 DAP, respectively) dry weight of root (0.53, 0.64 and 0.70g at 30, 60 and 90 DAP, respectively) and highest survival percentage (70.51 %) was also recorded in same cuttings after 90 days. This was followed by cuttings treated with 4500 ppm IBA planted on 1st February.

Key words: *Ficus carica*, IBA, rooting.

INTRODUCTION

The cultivated fig (*Ficus carica* L.) also known as Anjeer belongs to family Moraceae. Fig originated from West Asia and spread to the Mediterranean region and is now cultivated in different parts of world. It is rich source of nutrients fiber and vitamins (Kaur and Kaur , 6). The fig are consumed fresh as well as in dried and also preserved as candied and canned form. Fig is propagated both through sexual and asexual methods. Propagation of figs by asexual means is widely used to replicate true to type clonal planting material for obtaining elite plants. In India, figs are commercially propagated by hardwood stem cuttings by which vigorous marketable plants can be produced in less than one year. Rooting hormones play an important role in the success of rooting in cuttings. Auxin is considered a key regulator of root growth, gravitropism, and lateral root (LR) formation. Exogenous auxin treatment has typically resulted in inhibited root growth rate (Gaspar *et al*., 3) but at low concentrations auxin can substantially stimulate primary root elongation (Evans *et al*., 2). Biochemical and genetic data show that auxin and ethylene interact in the regulation of root growth (Swarup *et al*., 12). However, the mechanism of their crosstalk during this process is largely unknown. Ethylene stimulates the biosynthesis of auxin that is transported toward the root tip. Subsequently, basipetally transported auxin activates the local auxin response that is regulated by the auxin receptor and inhibits the cell elongation. This mechanism can account for most but not all ethylene effects on the root growth. The optimal auxin type and concentration for rooting of hardwood cuttings varies among species.

The most important problem for cuttings method is the high mortality rate which strongly varies among varieties, time of the year and cultivation practices applied. The time of the year when shoot cuttings are being collected is very crucial for obtaining a high performance of sprouting in the cuttings. The environment which supports and facilitates rooting of cuttings has a profound influence on the success or failure of the establishment of a new plant. Thus performance of cultivars varies with different locations experiencing different environmental conditions. Fig is considered as a minor commercial fruit crop in Jammu and Kashmir and its economic potential of cultivation has been poorly addressed and it is considered as an underutilized fruit species. Fig can be suitable for Jammu especially in dry subtropical areas because it is tolerant to frost. Further there is a good scope of fig cultivation due to late arrival of monsoon rains in this part of India because heavy rains during fruiting and ripening are detrimental. Thus importance of auxin and influence of environmental factors on rooting and survival

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of fig hardwood cutting, necessitates to undertake the study on effect of different cutting date and IBA concentrations on rooting of fig cuttings.

MATERIALS AND METHODS

The present study was undertaken at Division of Fruit Science, Faculty of Agriculture Sher-e-Kashmir University of Agricultural Sciences and Technology- Jammu, Chatha in the year 2018-2019.The meteorological data during the course of experimentation are presented in through Fig. 1. Hardwood stem cuttings were taken from five year old plants of fig cv. Brown Turkey. The experiment was laid out in factorial Randomized block design (FRBD), and replicated thrice. A total of 28 treatments were tested in this study and 20 cuttings were utilized in each replication. The cuttings were treated with seven concentrations of IBA (500 ppm, 1000 ppm, 1500 ppm, 2500 ppm, 3500 ppm, 4500 ppm and distilled water as control), and planted at four times (1st January, 15th January, 1st February and 15th February). Quick dip method was used for high concentrations (2500 ppm, 3500 ppm, 4500 ppm) of IBA where cuttings were dipped for 10 min and the slow dip method (24 h) was used in low concentrations (500 ppm, 1000 ppm, 1500 ppm) of IBA. In case of control, the cuttings were immersed in distilled water for 24 h. Polybags were filled with soil, sand and FYM in (1:1:1) without sterilisation. At the time of planting, 1/3 part of cuttings was buried in the rooting media and then light irrigation was provided. The planted cuttings were observed daily under each treatment and the number of days required for sprouting was recorded and their mean was used to calculate the days taken for first sprout to appear. Data on sprouting percentage (%), number of roots, fresh and dry weight of root (g) were recorded 30, 60 and 90 days after planting. Data on number of shoots, fresh and dry weight of shoot (g) were recorded 60 and 90 days after planting. Survival percentage (%) was recorded after 90 days of planting of cuttings. The fresh weight root and shoot (g) were taken with the help of electronic balance and dry weight was taken after drying them in hot air oven at 60˚C for 12 h. All the data were statistically analysed as per the method of Panse and Sukhatme (9).

RESULTS AND DISCUSSION

The result revealed that IBA concentration and time of making cuttings had significant effect on days to first sprouting (Table 1). Among various IBA concentrations 3500 ppm showed minimum mean days taken to first sprouting (15.33) followed by 4500 ppm. Earliness in sprouting due to IBA treatment might be due to the fact that there was better utilization of stored carbohydrates, nitrogen and other factors with the help of growth regulator. Minimum mean days taken to first sprouting (23.04) have been recorded when cuttings were planted on 15th

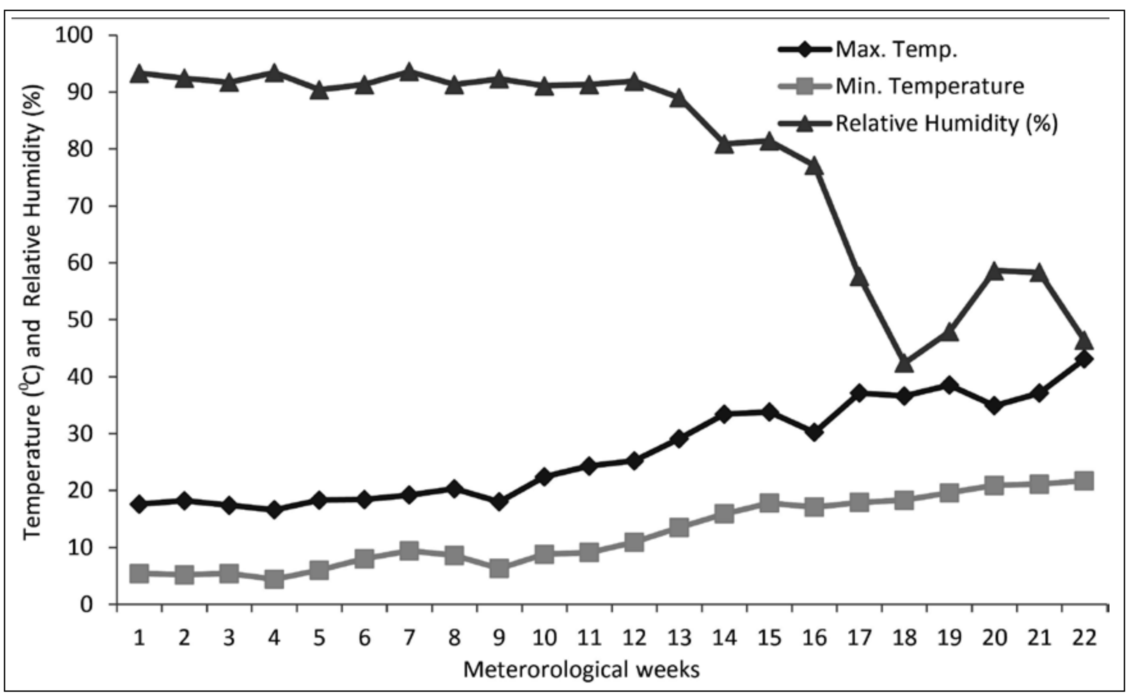


Fig. 1. Meteorological data recorded during the course of experimentation.

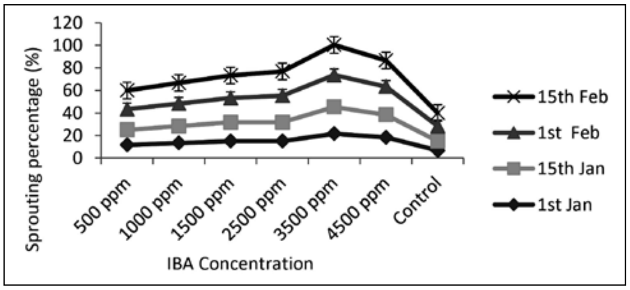
Table 1. Effect of IBA concentrations and planting time on days to first sprouting and survival percentage of fig cuttings.

IBA concentrations (C)	Planting time (T)									
	Days to first sprouting					Survival percentage (%)				
	1st Jan	15th Jan	1st Feb	15th Feb	Mean	1st Jan	15th Jan	1st Feb	15th Feb	Mean
500 ppm	34.00	32.66	30.33	30.00	31.74	43.66	45.00	49.20	42.66	45.13
1000 ppm	33.00	31.66	29.33	29.00	30.74	45.30	46.60	50.60	44.26	46.69
1500 ppm	27.00	26.00	24.00	23.66	25.16	48.53	49.73	53.86	47.53	49.91
2500 ppm	23.00	21.66	19.00	18.66	20.58	56.36	57.60	61.43	55.30	57.67
3500 ppm	17.00	16.00	14.33	14.00	15.33	69.13	70.46	74.43	68.03	70.51
4500 ppm	18.66	16.66	15.33	15.00	16.41	60.86	62.13	66.43	59.66	62.27
Control	35.00	33.33	31.33	31.00	32.66	13.16	14.46	18.26	12.07	14.48
Mean	26.80	25.42	23.37	23.04		48.14	49.42	53.45	47.07	
$CD_{0.05}$ (C)			0.60					0.11		
$CD_{0.05}$(T)			0.45					0.08		
CD0.05 (C × T)			1.20					0.20		

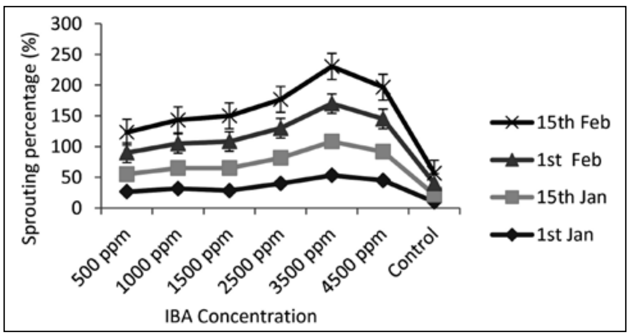
February. Cuttings planted on 15th Feb were earliest to sprout, this can be attributed to effect of duration of light and temperature on days to first sprouting, as by 15th of Feb temperature begins to rise quickly and was supported by meteorological data (Fig. 1) and finding of many researchers who have reported that planting time effects days to first sprouting (Mehta *et al*., 7; Mewar and Naithani, 8). The effect of interaction between IBA concentration and time of making cutting were also found to be significant. Among the treatment combinations minimum numbers of days taken to first sprouting (14.00 days) were observed when fig cuttings were treated with IBA 3500 ppm and planted on 15th February while maximum mean numbers of days taken to sprouting (35.00 days) were recorded in untreated cuttings planted on 1st January. Mean sprouting percentage was also significantly affected by different auxin concentrations and planting dates. Among various IBA concentration 3500 ppm showed highest mean sprouting percentage (25.07, 57.58 and 76.66 % at 30, 60 and 90 DAP, respectively) (Fig. 2). It might be due to the high callus formation in cuttings with optimum dose of IBA resulting highest sprouting percentage. The results are in accordance with the findings of Singh *et al.* (11) who also reported that the application of auxin at optimum concentration causes hydrolysis and translocation of carbohydrates and nitrogenous substances at the base of cuttings and results in accelerated cell division and cell elongation. Significantly the highest mean sprouting percentage (21.47, 42.85 and 58.09 % at 30, 60 and 90 DAP, respectively) was recorded when cuttings were planted on 1st February. Planting of cuttings at suitable time improves the translocation and mobilization of stored carbohydrates which increase the bud sprouting and sprouting percentage. Kahramanoglu and Umar (5) also recorded that pomegranate cuttings collected on 1st February gave highest sprouting percentage (96.50) as compared to cuttings collected on 1st March (87.00). The effect of interaction between IBA concentration and time of making cutting were found to be non-significant. The data on the effect of IBA concentration and planting dates on survival percentage in fig cv. Brown Turkey (Table 1) showed significant differences among all the treatments. Among different IBA treatments, IBA 3500 ppm resulted in highest mean survival percentage (70.51 %) followed by treatment of IBA 4500 ppm (62.27 %). This might be due to the sensitivity of seedling against higher concentration of auxin application at the initial stage. These results are in accordance with Ghosh *et al*.(4) who suggested that when auxin is applied in higher concentration more mortality and less survival percentage of seedlings is observed. Among different time of making cuttings, 1st February planting showed maximum mean survival percentage (53.45 %), followed by 15th January planting (49.42 %). Delayed planting reduced root growth and also restricted soil volume exploited by roots and hence reduced nutrient uptake, hormone synthesis and metabolism in the root system resulting in less survival of cuttings.

The maximum shoots per cutting (5.40 and 5.89 at 60 and 90 DAP, respectively) were observed in cuttings treated with IBA 3500 ppm followed by 4500 ppm. Cuttings planted on 1st February recorded maximum mean number of shoot per cutting (3.59 and 4.26 at 60 and 90 DAP, respectively) (Fig. 3). However, it was at par with 15th February (3.44 and 4.10 at 60 and 90 DAP, respectively). Mehta *et al*. (7)

conducted a similar study in pomegranate cuttings collected at different times of the year and reported that number of shoots per cutting were maximum at mid-January and reduced at the end of January.



30 days after planting



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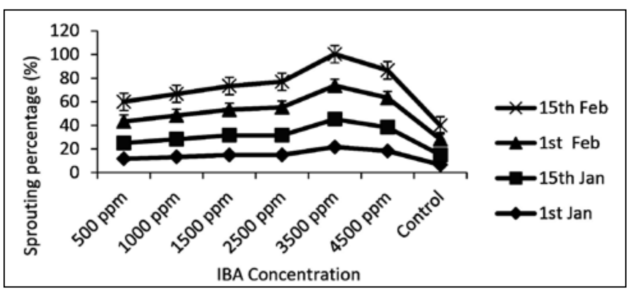
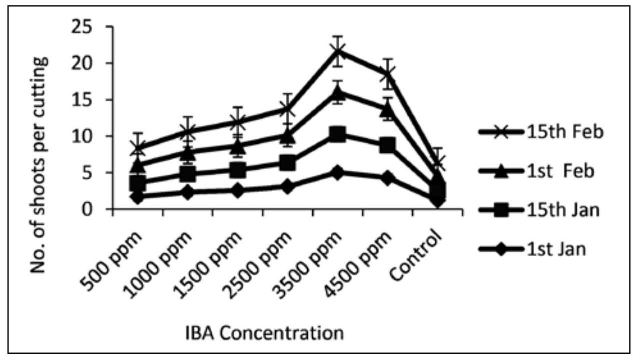


90 days after planting

Fig. 2. Effect of IBA concentration and planting time on sprouting percentage (%) in fig cuttings. Vertical bars indicate ± SE mean.

Significant differences with regard to fresh and dry weight of shoot at different IBA concentrations were recorded (Fig 4 and 5). The maximum mean fresh weight (26.49 and 51.50 g at 60 and 90 DAP, respectively) and dry weight (9.63 and 19.53 g) of shoot was found with IBA 3500 ppm followed by 4500 ppm (24.80 and 50.21 g and 9.16 and 18.41 g at 60 and 90 DAP, respectively). At higher concentration



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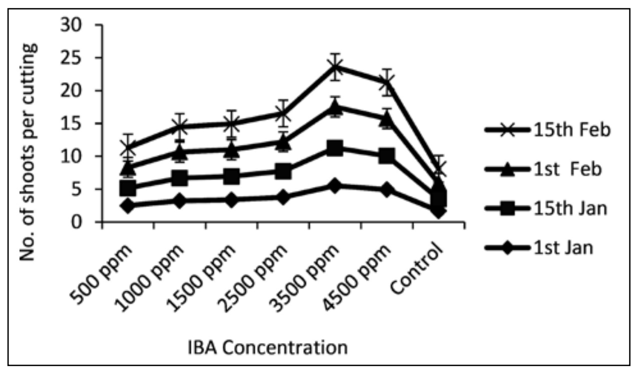

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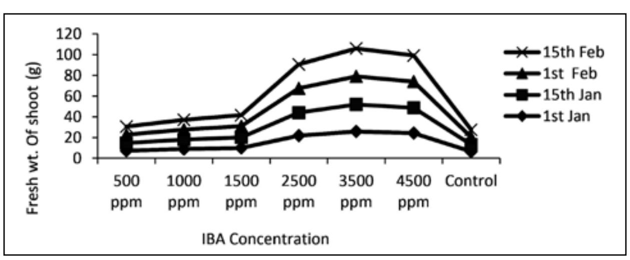
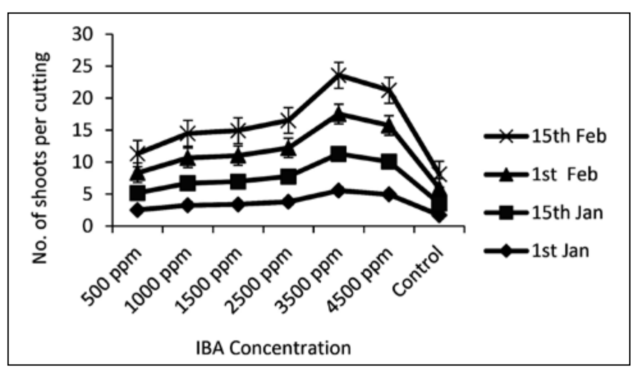
Fig. 3. Effect of IBA concentration and planting time on number of shoots per cutting in fig cuttings. Vertical bars indicate ± SE mean.

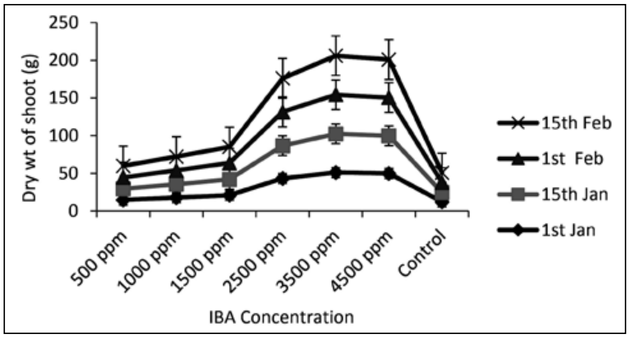


30 days after planting

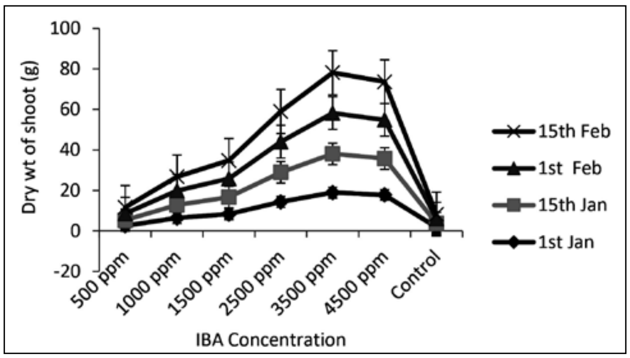


60 days after planting

Fig. 4. Effect of IBA concentration and planting time on fresh weight of shoot (g) in fig cuttings. Vertical bars indicate ± SE mean.



30 days after planting



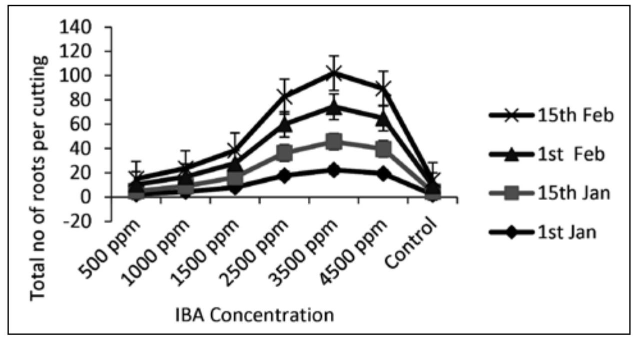
60 days after planting

Fig. 5. Effect of IBA concentration and planting time on dry weight of shoot (g) in fig cuttings. Vertical bars indicate ± SE mean.

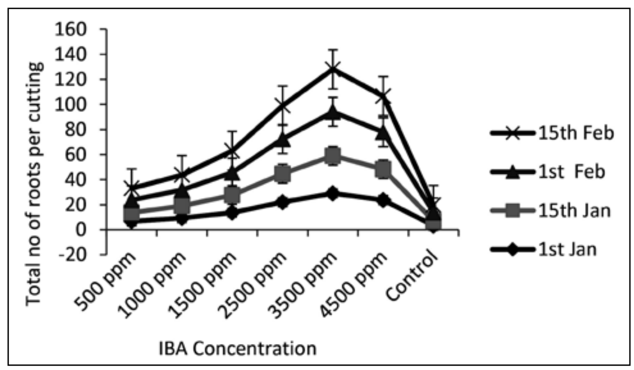
auxin damages the base of the cuttings and has inhibitory effect on the growth parameters of cuttings which results in decrease in fresh and dry weight of shoot. Rani *et al*., (10) also observed that IBA 3000 ppm concentration favoured many shoot parameters in positive direction and at the same time sustained the root length to continue the vigour and vitality in taking up the nutrients as well as moisture from the growing media. Cuttings planted on 1st February recorded maximum mean fresh (15.92 and 30.83 g at 60 and 90 DAP, respectively) and dry (5.58 and 10.86 g at 60 and 90 DAP, respectively) weight of shoot. These results can be attributed to the effect of light, temperature and other environmental factors. The interaction among IBA concentration and time of making cuttings was found to be non-significant.

30 days after planting 60 days after planting

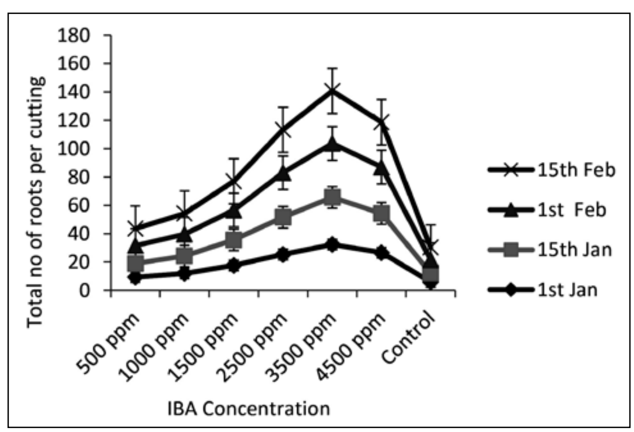
Maximum mean total number of roots per cutting (25.50, 32.00 and 35.16 at 30, 60 and 90 DAP, respectively) were recorded in 3500 ppm IBA treated cuttings followed by 4500 ppm whereas, minimum mean total number of roots per cutting (3.49, 4.91 and 7.58 at 30, 60 and 90 DAP, respectively) were recorded in control (Fig. 6). Number of roots per cutting is intensified by IBA through polysaccharides hydrolysis which provides energy for meristematic tissues and also root primordial for root formation. There was a decrease in mean number of roots at 4500 ppm as compared to 3500 ppm. Researchers believe that high concentrations of auxin can cause damage to the cuttings base. Auxin can be effective in rooting of cuttings in a certain concentration, depending on the crop and cultivar, and will have an inhibition effect at higher concentrations (Cerveny *et*



30 days after planting



60 days after planting

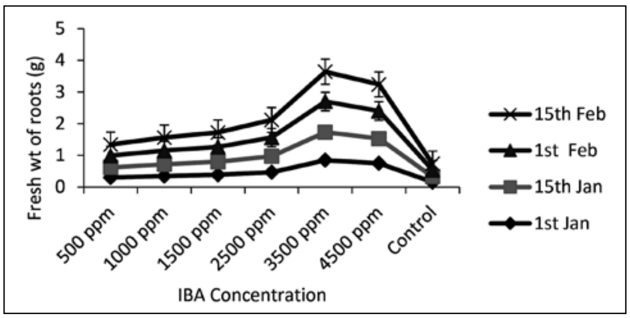


90 days after planting

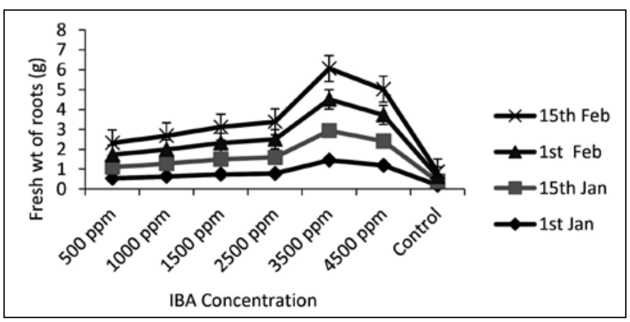
Fig. 6. Effect of IBA concentration and planting time on total number of roots per cutting in fig. Vertical bars indicate ± SE mean.

al.,1). In case of time of making cuttings, maximum mean total number of roots per cuttings (14.99, 19.94 and 22.90 at 30, 60 and 90 DAP, respectively) were recorded in 1st February planting. However, values were at par with 15th February for mean total number of roots per cutting. This may be due to effect of environmental factors, light, air, temperature and soil temperature, seems to be mediating through enzyme activation, mobilization of reserve food materials, stimulation of mitosis in meristematic zones with cell elongation and further differentiation of cambia to form root primordia. The interaction among IBA concentration and time of making cuttings was found to be non-significant.

Maximum mean fresh weight (0.91, 1.51 and 1.89 g at 30, 60 and 90 DAP, respectively) and mean dry weight (0.53, 0.64 and 0.70 g at 30, 60 and 90 DAP, respectively) of roots was recorded in IBA 3500 ppm treated cuttings (Fig. 7 and 8). However, cuttings planted on 1st February recorded maximum mean fresh weight (0.55, 0.88 and 1.10 g at 30, 60 and 90 DAP, respectively) and dry weight (0.25, 0.33 and 0.38 g at 30, 60 and 90 DAP, respectively) of roots. Similar findings were observed by Thota *et al*. (13) in fig who reported that cuttings treated with 3000 ppm showed increase in fresh and dry weight of root and Kaur and Kaur (6) have also reported that IBA results



30 days after planting



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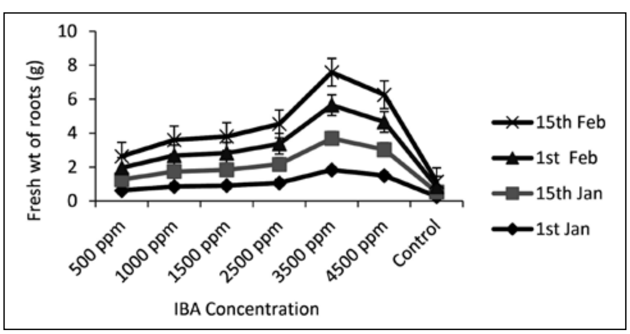
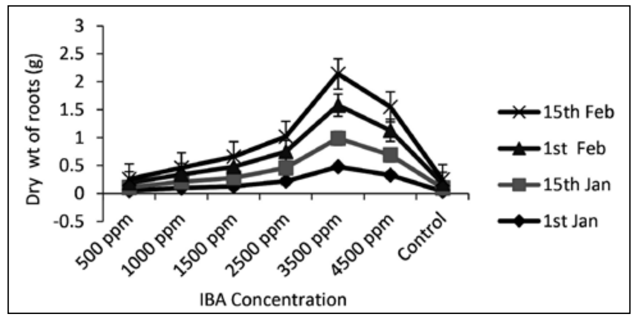
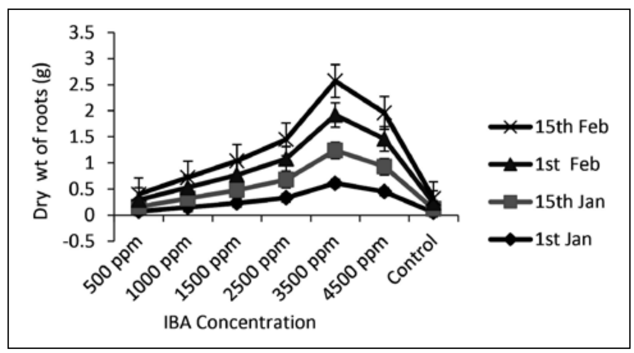


90 days after planting

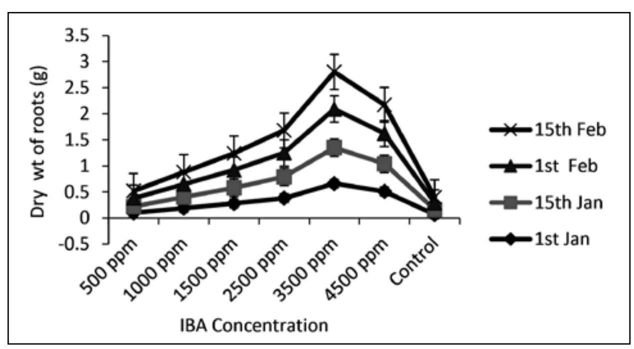
Fig. 7. Effect of IBA concentration and planting time on fresh weight of root (g) in fig cuttings. Vertical bars indicate ± SE mean.



30 days after planting



60 days after planting



90 days after planting

Fig. 8. Effect of IBA concentration and planting time on dry weight of root (g) in fig cuttings. Vertical bars indicate ± SE mean.

into increase in dry weight of root due to the increase in root number and length of roots and increased accumulation of dry matter. The interaction among IBA concentration and time of making cuttings was found to be non-significant.

From the present investigations it can be concluded that fig cuttings planted under climatic conditions of Jammu on 1st February and treated with IBA 3500ppm for 10 minutes gave best results in terms of days to sprouting, sprouting percentage, number of shoots per cutting, fresh and dry weight of shoot, number of roots per cutting, fresh and weight of root and survival percentage.

DECLARATION

The authors declare no conflict of interest.

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