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Research Article

EFFECT OF IBA CONCENTRATIONS ON SUCCESS OF CUTTINGS OF FIG CV. BROWN TURKEY

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ABSTRACT

In order to study the Effect of IBA concentrations on success of cuttings of fig cv. Brown Turkey an investigation was conducted at the nursery of Department of Horticulture, Khalsa College, Amritsar during 2016-2017. Six treatments were used comprising of IBA (500, 750, 1000 ppm) by slow dip and IBA (2000, 3000, 4000 ppm) by quick dip method along with control. The results of investigation indicated that out of all the treatments IBA (3000 ppm) applied by quick dip proved to be the best in terms of minimum days to first sprouting (13.66), maximum sprouting percentage (77.77%), survival percentage (73.33%), rooting percentage (71.10%), number of roots per cutting (36.99), root length (28.12cm), fresh weight of roots (1.86g), dry weight of roots (0.70g), number of shoots per cutting (5.33), average shoot diameter (0.57cm), shoot length (16.2cm), fresh weight of shoots (52.39g), dry weight of shoots (20.35g), number of leaves (17.08) and total leaf area (299.61cm^2).

INTRODUCTION

The common Fig (*Ficus carica L.*) also known as Anjeer belongs to family Moraceae with over 1400 species classified into 40 genera (Watson and Dallwitz 2004). It is a classical fruit tree of antiquity associated with the beginning of horticulture in Mediterranean basin (Siddiqui and Hussain 2007).Fig is a syconus fruit originated from Western Asia and spread to Mediterranean by humans. The fig producing regions include Turkey, Egypt, Iran, USA and Italy, out of which Turkey is the leading country with a contribution of 28% to the world production on fresh basis and 56% on dried basis. The fig fruit is sweet containing a large number of pits, often used dry. The dried figs have 29% water, 50% sugar, 4% protein, 5.5% nitrogen, 2% fatty material and a substance called Psoralen (Paknahad and Sharafi 2015). The Figs are consumed fresh, dried, preserved, candied and canned. About 90% of the fig, produced in world, are dried. A small portion is sun dried and large quantities are used for jam and alcoholic beverage production (Mars *et al* 2008). Fresh figs are delicious and used as dessert or for jam. In Europe, fig coffee is prepared. It is added in cakes, bread and ice creams. Fig leaves serves as fodder in India. Figs are the richest source of calcium, manganese, magnesium, potassium, fiber and vitamin B_6, B_2, B_1, A and C which can improve physical strength, nerve capability and treatment of neurological diseases. Moreover it is rich in sugar next to dates. Fig is propagated from seeds, cuttings, layers, grafts and by tissue culture techniques. Out of these methods, propagation by means of cuttings is the easiest and cheapest (Singh 2005). In India, figs are commercially propagated by hardwood stem cuttings by which vigorous marketable plants can be produced in less than one year. Under north Indian conditions cuttings are made when plants have shed their leaves in winter season and become dormant. Treatment of cuttings with different growth hormones promote rooting (Dhillon 2013). It has been reported that root promoting hormones play an important role in the success of rooting of cuttings (Siddiqui and Hussain 2007) Growth hormones incuding 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.

MATERIALS AND METHODS

The present investigation Effect of IBA concentrations on success of cuttings of fig cv. Brown Turkey was carried out in the nursery of Department of Horticulture, Khalsa College, Amritsar during the year 2016-2017. Amritsar is located at 31°38′ N latitude and 74°52′E with an elevation of 236m above MSL and represents the sub tropical climate and humid zone of Punjab region. The cuttings were taken from healthy uniform sized branches of fig cv. Brown Turkey, growing in the orchard of Department of Horticulture, Khalsa College, Amritsar. The cuttings were taken from hardwood cuttings arising on fig plants cv. Brown Turkey during the middle of

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January. The shoots selected for preparation of cuttings were healthy and disease free. The cuttings of 20 cm length having 3-6 buds were taken with preferably pencil thickness. A slanting cut was given at the upper side and a round cut was given at the lower end of the cutting. Six treatments of IBA (500, 750, 1000 ppm) by slow dip and IBA (2000, 3000, 4000 ppm) by quick dip method were used along with control. For preparation of stock solution one gram of growth regulator was weighed and dissolved in absolute ethyl alcohol and the final volume was made to 100 ml using distilled water (1 per cent concentration). From the stock solution the desired concentration was made with the help of following formula:

$$\frac{\text{Ratio of stock solution}}{\text{Ratio of distilled water}} = \frac{\text{Concentration required}}{\text{Concentration of stock solution – concentration required}}$$

1000 ml growth regulator solution of appropriate concentration was taken in beaker and a unit of 15 cuttings was placed in each approximately $1\frac{1}{2}$ inch of the basal ends of cuttings dipped in solution for 2 minutes in quick dip while in slow dip treatment, the time was extended up to 24 hrs. In case of control, the cuttings were immersed in distilled water for the same period of time. The various observations regarding sprouting percentage, survival percentage, root, shoot and leaf formation were recorded. Field observations were statistically analysed by Randomized Block Design.

RESULTS AND DISCUSSION

It was clearly indicated that the treatment of cuttings greatly influenced the days to first sprouting in fig. Increase in the concentration of IBA significantly decreased the days to first sprouting of cuttings upto a certain limit. IBA 3000 ppm (T_5) recorded minimum number of days (13.66) for sprouting followed by T_6 (IBA 4000 ppm) and T_4 (IBA 2000 ppm) when applied as quick dip generating 14.66 and 18.33 days respectively. IBA when applied as slow dip also influenced the days for sprouting by taking more days (29.66, 29.00, 28.66) with IBA (500, 750 and 1000 ppm) as compared to quick dip. Earliness in sprouting might be due to the fact that there was better utilization of stored carbohydrates, nitrogen and other factors with help of growth regulators (Chandramouli 2001). Similar findings were reported by Thota (2012) in fig cv. Poona. Rafael (2005) and Adelson (2009) in olive also reported the same.

The maximum percentage of sprouting (77.77 %) was observed in T_5 (IBA 3000 ppm) under quick dip treatment while the least (19.99%) was recorded in T_{10} (Control). Under slow dip, T_2 (IBA 750 ppm) resulted in more sprouting (57.77%) as compared to other concentrations. Evidence suggests that auxin increased rooting percentages, shortened the rooting period and ensured improved uniformity in plants (Hartmann *et al* 2011). The increase in number of sprouts and sprout might be due to the better utilization of stored carbohydrates, nitrogen and other factors with the help of growth regulators (Sinha *et al* 2014). Application of the auxin might have caused hydrolysis and translocation of carbohydrates and nitrogeneous substances at the base of cuttings and resulted in accelerated cell division and cell elongation (Singh *et al* 2015). It also has been found to enhance the histological features like formation of callus and tissue and differentiation of vascular tissue. The research findings of Kurd *et al* (2010), Thota (2012) are also in line with the present findings.

Maximum survival (73.33%) was recorded in T_5 (IBA 3000 ppm). Minimum survival percentage (17.66%) was recorded from the cuttings under control. The superiority of treated cuttings regarding the survival can be attributed to better start and root growth. The better start might have facilitated absorption of nutrients and moisture from soil and better growth developed capacity to withstand for a longer period (Ram *et al* 2005). Several workers in different crops have reported the improvement in survival of cuttings with the aid of growth regulators. Iqbal *et al* (1999), Kaur (2016) in Pomegranate cv. Ganesh, Thota (2012) and Kishorbhai (2014) in fig also reported the same.

Highest rooting (71.10%) was gained from T_5 (IBA 3000 ppm) while the least (39.99) in T_{10} (cont further increased the content of physiologically produced sugar, provided energy for meristematic tissues and thereby for root primordial for roots formation. The results are in conformity with Kurd *et al* (2010), and Rafael (2005) in olive. Reddy *et al* (2008) also reported the same in the rooting of hardwood and semi hardwood cuttings of fig.

The highest number of primary roots (36.99) were recorded in T_5 (IBA 3000 ppm) under quick dip. It was observed that T_{10} (Control) had minimum number of roots (9.22) per cutting. This pertains to the fact that the auxins promoted cell division and their elongation led to differentiation of cambial initials into root primordia and in the mobilization of reserve food material to sites of root initiation there by giving higher number of roots per cutting (Sharma 1999). These findings are in agreement with the research work of Tripathi and Shukla (2004) in pomegranate, Reddy *et al* (2008) in fig, Diwaker and Katiyar (2013) in kagzi lime, Shukla *et al* (2010) in peach, Kumar *et al* (2004) in lime and Ram *et al* (2005) in pomegranate cvs. Ganesh and Kandhari.

The maximum fresh weight (1.86) was recorded in T_5 (3000 ppm IBA) and minimum (0.30g) with control. Maximum fresh weight of roots was attributed to the fact that auxins naturally occurring or exogenously applied are for initiation and growth of roots.). The present findings are in line with the research study of Chalfun *et al* (2003) in fig cv. Roxo de valinhos, Kaur (2016) in pomegranate cv. Ganesh and Deb *et al* (2009) in lemon cuttings.

The maximum dry weight (0.70g) was recorded in T_5 (3000 ppm IBA) followed by T_3 (IBA 1000 ppm) applied as slow dip with (0.68 g). Increase in dry weight of roots might be due to the fact that the increase in the root number and length of roots resulted in higher accumulation of dry matter. The present results are in accordance with findings of Deb *et al* (2009) in lemon cuttings and Thota (2012) in fig cv. Poona.

The maximum number of shoots (5.33) were registered from the cuttings treated with IBA 3000 ppm (T_5) followed by T_6 IBA 4000 ppm (4.55) under quick dip. 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. Theresearch findings of Khajehpour *et al* (2014) in olive, Thota (2012) in fig.

The maximum shoot length (16.2 cm) observed in T_5 (IBA 3000 ppm) applied by quick dip followed by T_8 and T_6 with 14.7 cm, 14.1 cm while minimum shoot length was observed under controlled conditions. This might be due to the fact that IBA led to best aerial growth. The emergence of longest shoots on cuttings might be attributed to the well developed root system in such cuttings which might have tended to promote shoot growth by ensuring adequate mobilization of water and nutrients from the soil or substrate to the growing apices. Consequently, there was a faster growth rate of the newly emerged shoots (Pratima and Rana 2011). Earliness in sprouting, increase in number of sprouts and sprout length might be due to better utilization of stored carbohydrates, nitrogen and other factors with the help of growth regulators (Swathi 2013). These results are in line with the findings of Kaur (2016) in pomegranate cv. Ganesh and Khajehpour *et al* (2014) in olive and Kishorbhai (2014) in fig.

Maximum fresh weight (52.39g) was depicted by T_5 (IBA 3000 ppm) followed by T_6 and T_4 with fresh weight of 51.48g and 44.93g respectively while the minimum fresh weight (14.52g) was recorded under control. This might be attributed to the fact that auxins increased the permeability of cell for moisture, nutrients and resulted in the enlargement of cell causing more growth of plant parts. They increased the number of shoots resulting in higher fresh and dry weight of shoots. Similar results are confirmed by Kishorbhai (2014) in fig.

The highest dry weight of shoots (20.35g) was found in T_5 (IBA 3000 ppm) while the least (2.32g) was observed from T_{10} (control). This was in accordance with the number of shoots and fresh weight of shoots. Results are in conformity with Sandhu and singh (1986) in sweet lime. These results may be attributed to the fact that auxins activated the shoot growth which might have resulted in the elongation of stems and leaves through cell division accounting for higher dry weight of shoots. The dry weight was related with number of sprouts, diameter and length of sprout per cutting. The findings of Thota (2012) in lemon cuttings and Kishorbhai (2014) in fig are in support with the present investigation.

It is evident from the results that the maximum number of leaves per plant (17.08) were observed under T_5 (IBA 3000 ppm) with quick dip followed by T_6 (15.97) with IBA (4000 ppm) while the minimum were obtained in T_7 (500 ppm) under slow dip. The least number of leaves (8.43) were reported under control. Increase in leaf number might be due to the vigorous rooting induced by the growth regulators enabling the cuttings to absorb more nutrients and thereby producing more leaves as reported by Stancato *et al* (2003). The highest number of leaves were associated with number of sprouts as well as length of sprouts of cuttings, which in turn, was dependent on hydrolysis of reserve food materials, proper shoot and root balance. Similar findings have also been reported by Kepinski and Leyser (2005) who found that an increase in number of leaves was due to the auxin treatment which increased the development of primary shoots and their number.

The results of the study showed that the maximum leaf area (299.61 cm^2) had been achieved in T_5 (IBA 3000 ppm) followed by T_6 (205.66 cm^2) with IBA 4000 ppm applied as quick dip while the least (81.44 cm^2) was noted under T_{10} (control). The number of green leaves is the most important growth character that has direct impact on total leaf area. Since, number of green leaves were significantly influenced by variation in dosages of plant growth regulators and consequently the total leaf area also showed variations. The increase in total leaf area is related with the growth. It might be due to the fact that the plants with the vigorous growth gave more leaf area and vice versa. Plants with more roots increased nutrient uptake and increased growth with more leaf area. The research study of Kishorbhai (2014) in fig, Devi *et al* (2016) in Phalsa and Kaur (2016) in Pomegranate cv. Ganesh are in support with the present findings.

Table 1 Effect of IBA on sprouting, survival and rooting of fig cuttings cv. Brown Turkey

Treatments	Days to first sprouting	Sprouting (%)	Survival (%)	Rooting (%)	Number of roots per cutting
T_1 (IBA 500 ppm) Slow dip	29.66	51.10%	48.88%	46.66%	12.99
T_2 (IBA 750 ppm) Slow dip	29.00	57.77%	53.33%	55.55%	15.55
T_3 (IBA 1000 ppm) Slow dip	28.66	53.33%	51.10%	64.44%	18.77
T_4 (IBA 2000 ppm) Quick dip	18.33	59.99%	57.77%	66.66%	31.10
T_5 (IBA 3000 ppm) Quick dip	13.66	77.77%	73.33%	71.10%	36.99
T_6 (IBA 4000 ppm) Quick dip	14.66	68.88%	64.44%	68.88%	33.44
T_7 Control	31.33	19.99	17.66	39.99	9.22
Mean	23.61	55.55	52.35	59.04	22.58
CD(0.05%)	2.95	8.96	9.95	10.87	2.60

Table 2 Effect of IBA on root and shoot parameters of fig cuttings cv. Brown Turkey

Treatments	Root length (cm)	Freshweight of roots (g)	Dry weight of roots (g)	Number of shoots per cutting	Shoot length (cm)
T_1 (IBA 500 ppm) Slow dip	7.85	0.69	0.09	1.77	9.6
T_2 (IBA 750 ppm) Slow dip	12.74	0.88	0.12	1.99	10.5
T_3 (IBA 1000 ppm) Slow dip	14.52	0.97	0.68	2.33	11.0
T_4 (IBA 2000 ppm) Quick dip	20.75	1.16	0.36	3.33	9.8
T_5 (IBA 3000 ppm) Quick dip	28.12	1.86	0.70	5.33	16.2
T_6 (IBA 4000 ppm) Quick dip	23.16	1.65	0.54	4.59	14.1
T_7 Control	11.18	0.30	0.15	1.77	9.1
Mean	16.90	1.07	0.37	3.01	11.47
CD(0.05%)	2.57	0.34	0.09	0.83	1.46

Table 3 Effect of IBA on shoot and leaf parameters of fig cuttings cv. Brown Turkey

Treatments	Fresh weight of shoots (g)	Dry weight of shoots (g)	Number of leaves	Total Leaf area (cm^2)
T_1 (IBA 500 ppm) Slow dip	15.39	3.12	10.20	118.23
T_2 (IBA 750 ppm) Slow dip	22.94	8.19	13.33	149.87
T_3 (IBA 1000 ppm) Slow dip	18.58	5.17	11.53	136.06
T_4 (IBA 2000 ppm) Quick dip	44.93	14.03	9.22	180.41
T_5 (IBA 3000 ppm) Quick dip	52.39	20.35	17.08	299.61
T_6 (IBA 4000 ppm) Quick dip	51.48	19.66	15.97	205.66
T_7 Control	14.52	2.32	8.43	81.44
Mean	31.46	10.40	12.25	167.35
CD(0.05%)	2.73	1.29	1.93	13.44

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