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EFFECT OF GROWTH REGULATORS AND BIOFERTILIZERS ON SURVIVAL OF POMEGRANATE (*PUNICA GRANATUM* L.) STEM CUTTINGS

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Abstract

Fifteen treatment combinations consisting of three treatments of biofertilizers *i.e.* Control, Azotobacter in powder form, Phosphorus Solubilizing Bacteria (PSB) in powder form and five treatments of growth regulators *i.e.* Control, 1000 ppm IBA, 2000 ppm IBA, 500 ppm NAA and 1000 ppm NAA were replicated three times in a complete randomized design (CRD Factorial). Presented data indicate that days taken to start sprouting and 50% sprouting, percentage success of cutting, number of leaves per shoot, number of roots per cutting, length of root, diameter of root and dry matter percentage of roots, maximum total number of leaves per cutting and fresh weight of roots were recorded under PSB, which were significantly higher to control and Azotobacter. Number of shoots per cutting and the maximum and minimum number of shoot per cutting were noted under PSB. As regards growth regulators, the earliest sprouting of cutting as well as significantly highest percentage of success, number of leaves per shoot, length of root, diameter of root, fresh weight of roots, dry matter percentage of roots and number of roots per cutting, latest sprouting of cutting as well as lowest roots were observed in IBA 2000 ppm, followed by 1000 ppm IBA. In case of different combinations of biofertilizers and growth regulators, percentage of success of cutting, number of shoots per cutting, number of leaves per shoot, total number of leaves per cutting, diameter of roots, dry matter percentage of roots, number of roots per cutting, length of root and fresh weight of roots were found significantly superior under treatment combination of PSB + 2000 ppm IBA (B_2G_2).

Key words : Pomegranate, cuttings, PGR, biofertilizers.

Introduction

Pomegranate (*Punica granatum* L.) is one of the most important fruit crops of tropical and subtropical regions of the world. Pomegranate being hardy in nature can be planted in neglected and marginal areas in tropical and sub-tropical regions of India. Pomegranate is commercially propagated by cuttings. Multiplication of plants through stem cutting is the most convenient method and by this method a stronger plant can be developed considerably in less time. Propagation through seeds is time consuming method as well as it produces genetically variable and more vigorous plants, which bear late. While propagation of plants through cuttings (vegetative) is easier, less time consuming, true to type and bear early with less vigour. The rooting capability of cuttings varies from cultivar to cultivar, location to location, season to season and age of the branch. The success per cent of pomegranate cuttings depends on many factors such as conditions of the mother plant, part of the tree from where the cuttings are made, time of operation, rainfall, temperature fluctuation, aftercare etc. Besides, different environmental conditions growth regulators also play an important role in rooting and growth of pomegranate cutting. Therefore in order to improve rooting ability and success per cent, one technique has been improved in which synthetic root promoting growth regulator and biofertilizers are used.

Materials and Methods

The investigation was carried out at Department of Horticulture, College of Agriculture, Gwalior (M.P.), India during year 2012. Fifteen treatment combinations consisting of three treatments of biofertilizers *i.e.* Control, Azotobacter in powder form, Phosphorus Solubilizing Bacteria (PSB) in powder form and five treatments of growth regulators *i.e.* Control, 1000 ppm IBA, 2000 ppm IBA, 500 ppm NAA and 1000 ppm NAA were replicated three times in a complete randomized design (CRD Factorial). The cutting were planted for each treatment in each replication in poly bags (6" × 3") containing

rooting media (one cutting in each bag). Two third parts of cuttings (two-third of 25 cm.) was inserted in the media at a slight angle to the vertical.

Results and Discussion

Days taken to start sprouting and days taken to fifty percent sprouting of cuttings were significantly affected by different growth regulators but earliest sprouting of cuttings were noted in IBA 2000 ppm whereas, latest sprouting of cuttings were noted in control. The percentage of success of cuttings were also found significantly higher in IBA 2000 ppm, whereas minimum percentages of success of cutting were recorded in control. This may be due to increased level of auxins resulted in earlier completion of physiological processes in rooting and sprouting of cuttings. Gautherest (1969) confirmed that auxin, natural or artificially applied is a requirement for initiation of adventitious roots on stem cuttings of *Helianthus tuberosus*.

IBA 2000 ppm produced the maximum number of shoots per cutting, but the minimum number of shoots per cutting was observed in control. Total number of leaves per shoot and per cutting was also found significantly higher in IBA 2000 ppm, while the lowest number of leaves per shoot was noted in control. Although, growth regulators significantly influenced the number of shoots per cutting and maximum number of shoots per cutting it was observed the maximum in IBA 2000 ppm. This may be due to vigorous root system which increased nutrients uptake under this treatment. Kumawat *et al.* (2010) found 1500 ppm of IBA concentration was the superior in Graps cuttings. Singh and Pande (1986) found positive effect in number of shoots per cutting and number of leaves per shoots, with 1500 ppm IBA in hard wood stem cuttings of sweet lime (*Citrus limettiodes*). Similarly, Kale and Bhujbal (1971) reported that 1500 ppm concentration of IBA was the superior in respect of the rooting of cuttings, primary roots, length of shoot and number of the leaves in Bougainvillea cuttings.

As regards root characters like number of roots per cutting, diameter and fresh weight of roots were found maximum in IBA 2000 ppm. Whereas, minimum number of roots, diameter of roots and fresh weight of roots were observed in control. The longest root was noted in IBA 2000 ppm, while the shortest root was observed in control in this experiment. Similarly, growth regulators were found significant for dry matter percentage of roots and minimum dry matter percentage of root was also observed in IBA 2000 ppm and control, respectively. This may be due to higher accumulation of photosynthates, metabolites and nutrients under this treatment. Dhua *et al.* (1980) suggested that IBA at 3000 ppm in combination with ferulic acid at 2000 ppm gives maximum rooting success. Barde *et al.* (2010) also observed better rooting percentage with 2000 ppm IBA. The same trend was also observed for fresh weight and dry matter percentage of roots, while maximum length of root was noted with 1500 ppm IBA. Singh and Singh (1964) reported that IBA at 2000 ppm gave maximum rooting and success with Sweet lime and Lemon cuttings.

Poor performance of cuttings as regards the percentage of success and number of leaves per shoot and per cuttings were found under control. These results may be attributed to the fact that growth attributes in term of root and shoot growth parameters affected by exogenous application of required growth regulators. This is depicted in lowest physiological activity for triggering root initiation and development and finally all other growth parameter of cuttings were seriously affect. This may be due low activity of growth substance and low physiological activity.

Effect of biofertilizers

The result of present investigation clearly exhibits that the earliest sprouting (days taken to start sprouting and 50% sprouting) of cuttings was observed under PSB. This may be due to increase level of plant growth regulators in the cutting under PSB. Thus, increased level of auxins (PGR's) resulted in earlier completion of physiological processes involved in rooting and sprouting of cutting. Slankis (1973) also reported that biofertilizer increased the level of plant growth regulators in the plants. The percentages of success of the cutting were found significantly higher under PSB. Similar results were found in pomegranate cuttings by Barde *et al.* (2010). But, more number of shoots per cutting was recorded under both PSB and Azotobacter in powder form. Significantly more number of leaves per shoot, total number of leaves per cutting was observed with the application of PSB. Dry matter percentage of leaves and roots were also found significantly higher under PSB. Similar findings were also reported by Sharma and Bhutani (1998). They found that the inoculation of *Azotobactor chrocooccum* produced the larger plants, higher leaf area, greater biomass and higher chlorophyll content in apple seedling. Rao and Dass (1989) also reported that *Azotobactor chrocooccum* increased plant height and dry weight of plants of *Ziziphus mauritiana* cv. Seb and Gola and rooted cuttings of pomegranate cv. Jalore seedless. Godara (1993) observed significant increase in plant height, trunk girth and total biomass of peach seedlings when inoculated with biofertilizers.

Table 1 : Effect of Growth Regulators, Biofertilizers and their combination on Survival of Pomegranate stem cuttings.

Treatments	Growth regulators						Biofertilizers				
	Control	IBA 1000 ppm	IBA 2000 ppm	NAA 500 ppm	NAA 1000 ppm	CD at 5% level	Control	Azotobactor	PSB	CD at 5% level	Interaction at 5% level
Days taken to start sprouting	13.00	9.00	8.33	9.40	9.05	0.22	11.69	9.84	7.86	0.37	NS
Days taken to 50% sprouting	27.99	19.21	17.99	20.33	19.33	0.28	22.86	20.93	19.06	0.18	0.88
Percentage of success of cutting	60.93	77.60	79.00	74.53	78.20	0.36	71.5	74.7	75.96	0.28	0.63
No. of shoots per cutting	1.13	2.50	2.83	2.17	2.63	0.03	2.02	2.24	2.5	0.02	0.06
No. of leaves per shoot	11.30	11.83	13.43	12.13	13.10	0.05	11.68	12.83	13.72	0.04	0.09
Total no. of leaves per cutting	13.87	34.70	37.77	29.97	32.00	0.47	24.92	28.86	35.26	0.37	0.82
Survival percent	63.11	80.33	80.84	76.24	79.75	0.45	73.68	76.48	78.00	0.35	0.77
No. of roots per cutting	6.23	10.03	10.08	9.90	10.03	0.08	8.94	9.46	9.80	0.64	0.14
Length of roots (cm)	8.03	10.23	11.33	10.83	10.9	0.06	9.68	10.36	10.76	0.05	0.11
Diameter of roots (mm)	0.88	1.15	1.23	1.13	1.15	0.008	0.96	1.16	1.22	0.007	0.015
Fresh weight of roots (g)	1.33	1.86	2.30	2.10	2.02	0.021	1.59	1.94	2.23	0.016	0.037
Dry matter of roots (%)	38.92	42.52	44.2	42.45	43.53	0.11	40.64	42.66	43.68	0.09	0.19

In this experiment, the performance of various root characters of cuttings was found significantly better under PSB than Azotobacter and control. Significantly more number of roots per cutting, longest root and maximum diameter of root were found with PSB than Azotobacter and control. The same trend was also observed for fresh weight and dry matter percentage of roots. Nageswari *et al.* (1999) reported the maximum percentage of rooting with higher number and length of roots per cutting with the application of phosphobacteria at the time of planting of cinnamon cuttings.

Higher percentage of success of cuttings was found under PSB. This may be due to increased level of growth promoting substances, available P_2O_5 and other nutrients with the application of PSB. Since, PSB increase available phosphorus in the nutrient medium through bacterial involvement. Phosphorous is very much important for root initiation through increased cell division and energy transfer as a ADP and ATP, which results better and earliest root and shoot initiation and growth (Salisburry and Ross, 1989). Nageswari *et al.* (1999) also reported maximum percentage of success in cinnamon cutting under PSB.

The maximum number of leaves per shoot and total no of leaves per cutting was also found under PSB. This may be due to more uptake and utilization of phosphorus, nitrogen and other nutrients by the cuttings under this treatment. Better rooting in respect to more number of roots per cutting, length of roots, diameter of roots, fresh weight and dry matter percentage of roots were also found under PSB. This may be due to increased synthesis of growth promoting substances as well as availability of more phosphorus under this treatment which enhanced the rooting in cuttings. Wange and Ranawade (1997) also reported the maximum rooting in grapes cutting treated with biofertilizers.

Combined Effect of biofertilizers and growth regulators

In the present investigation, most of the root and shoot parameters as well as success of cuttings were appreciably increased under the interaction of PSB and IBA (2000) ppm (G_2B_2). This can be attributed due to increased level of growth promoting substance, available P_2O_5 and other nutrients with the application of PSB due to synergistic effect of both biofertilizer and growth regulators in various ways. Nageswari *et al.* (1999) also reported maximum percentage of success in cinnamon cutting under PSB.

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