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Effect of Plant Growth Regulators (IIA, IBA, GA_3) on Rooting of Hardwood Cutting of Grape (*Vitis venifera* L.) cv.Thompson Seedless

Manisha Kumari Rolaniya, Mahendra bairwa, Khushbu and S Sarvanan

Abstract
An investigation entitled**, "**Effect of plant growth regulators on rooting of hardwood of grape (*Vitis vinifera*) cv. Thompson seedless" was carried out with 3 regulators (IAA with 100, 300, 500 ppm concentration, IBA with 1000, 2000 and 3000 ppm concentration and GA_3 with 50, 100, 150 ppm concentration) and control treatment. The observations from 10 randomly selected plants from each replication were recorded for quantitative traits viz. First emergence of node, Average number of leaves per cutting, Average number of buds per cutting, Dry weight of shoots, First emergence of root, Average number of roots per cutting, Average root formation zone, Average length of longest root, Average thickness of thickest roots, Dry weight of roots, Fresh weight of roots and Survival percentage of cutting. The results showed that most of the shoot and root characters of cuttings were significantly influenced by the different treatments of growth regulator as compared to control. Results showed that the treatment GA_3 150ppm (T_9) had taken least number of days (9 days) for emergence of first node and IBA-2000 (T_4) had taken minimum number of days for emergence of first node and vice versa for the first emergence of the node. After 90 days after planting, maximum number of leaves (21.6), Average number of buds per cutting (9.93), Average number of roots per cutting (30.54), Average root formation zone (29.74cm), Average length of longest root (28.24 cm) and Average thickness of thickest roots (1.78 mm) were observed in the treatment which was treated with IBA @ 2000ppm followed by 3000ppm IBA. The least values were noted with control. The combination with 2000 ppm IBA was found best for maximum rooting, growth and success of grapes cuttings followed by combination of 3000 ppm IBA under this study.

Keywords: Grape, cutting, IBA, IAA, GA3, maximum number of roots and root length

Introduction

The grape is one of the most delicious, refreshing fruit. Considering the advantages, demands for the crop is increasing day by day and is gaining much importance in the fruit industry. The grape vine is generally propagated by vegetative method such as hard wood cutting. Vegetative propagation is preferred because the plants propagated by this method produce fruits early, give more yield and true to type and quality fruit every year. The treatments of cuttings with plant growth regulators play an important role in regeneration of plants from cuttings. Reports on the systematic investigation on the propagation of grape from cuttings are very scanty. Therefore, it is felt necessary to undertake the study on propagation of grape vines by using different concentration of growth regulators for quicker multiplication in nursery.

Grapes are one of the commercially important fruit crops in India and are cultivated on approximately 60 000 hectares, with an annual production of 1.2 to 1.4 metric tons (MT). It is well known for its delicacy and is a good source of minerals like calcium, phosphorous, iron and vitamins like B and B Grape is cultivated on an area of 7,197 thousand hectares worldwide with an annual production of about 68 million tones, Spain, France, Italy and USA being the leading grape producing countries in the world however, the average productivity is highest (25.80 t/ha) in India producing 2.26 million tones fresh grapes from an area of 87.7 thousand hectare (Anonymous, 2010a). Maharashtra, Tamil Nadu, Karnataka, Punjab and Andhra Pradesh are the major grape growing states of India (Anonymous, 2010b). Grapes are commercially propagated through hardwood cuttings (Weaver, 1976). Cuttings are made from shoots that are one season old and have three to four nodes. They are planted in the media to induce rooting before being transplanted in the field. Dog ridge is one of the commercially important rootstock and is known for its drought tolerance. It is a more vigorous variety and Thompson Seedless grafted onto this rootstock is known to produce more vegetative growth at the cost of reproductive growth, thus reducing the yield per unit area. Another rootstock that is gaining popularity in India is 110 R, which is known for its drought and salt tolerance, apart from improving bud fruitfulness due to its moderate vigour.

St. George is one of the important rootstocks for phylloxera resistance. It is moderately tolerant to drought on lightly textured soil and highly tolerant of moisture stress in deep soils. The rooting ability of rootstocks varies with the species, IBA concentration, and the biochemical composition of the mother vines (Satish *et al*., 2007).

Plant growth regulators are the organic chemical compounds, which modify or regulate physiological processes in an appreciable measure in the plants when used in small concentrations. They are readily absorbed and move rapidly through the tissues when applied to different parts of the plant. They are specific in action. The plant naturally produces plant hormones or phytohormones and they move from the site of production to the site of action. The most commonly employed growth regulators are Indole Butyric Acid (IBA) and Indole Acetic Acid (IAA) and Gibberellic Acid (GA_3) is used for stem elongation (Hartman, 1997).

Auxins were the group of growth regulators to be discovered in the late 1800's by Charles Darwin. Auxins play a major role in stem elongation and apical dominance. One of the most well-known uses of auxin is for the rooting of cutting for plant propogation. Shoot tips of many plant species when dipped or coated with small amount of auxin develop roots more quickly and higher numbers.

Materials and Methods

The experiment was conducted during kharif (rainy) season 2016 at Horticulture research farm, Department of Horticulture, Naini Agricultural Institute, SHUATS Allahabad, (U.P.) India. The objective was to find out the best effect of plant growth regulators on rooting of hardwood of grape (*Vitis vinifera*) cv. Thompson seedless. The design applied for statistical analysis was carried out with randomized block design having three factors with three levels of IAA @ 100, 300 and 500 ppm, IBA @ 1000, 2000 and 3000 ppm and three levels of GA_3 @ 50, 100 and 150 ppm respectively.

Treatment details

Table 1: Shows the growth regulators used along with the concentration applied to Grape hardwood cuttings

Name of Growth Regulator	Concentration	Treatment	Method of Treatment
Control	0 ppm	T_0	Prolong dip
IAA (Indole Acetic Acid)	100 ppm	T_1	Prolong dip
IAA	300 ppm	T_2	Prolong dip
IAA	500 ppm	T_3	Prolong dip
IBA (Indole Butyric Acid)	1000 ppm	T_4	Quick dip
IBA	2000 ppm	T_5	Quick dip
IBA	3000 ppm	T_6	Quick dip
GA_3 (Gibbrellic Acid)	50 ppm	T_7	Prolong dip
GA_3	100 ppm	T_8	Prolong dip
GA_3	150 ppm	T_9	Prolong dip

Result and Discussion

The observations on 10 randomly selected plants from each regulators in each replication were recorded for all quantitative traits viz. First emergence of node on which concentration or plant growth regulator, Average number of leaves per cutting, Average number of buds per cutting, Dry weight of shoots, First emergence of root on which concentration or plant growth regulator, Average number of roots per cutting, Average root formation zone, Average length of longest root, Average thickness of thickest roots, Dry weight of roots, Fresh weight of roots and Survival percentage of cutting.

The experimental as carried out in a single factor Randomized Block Design. The cuttings were treated with growth regulators like IAA, IBA, and GA_3. Each growth regulators had 3 level of concentration viz., 100ppm, 300ppm, 500ppm in IAA; 1000ppm, 2000ppm, 3000ppm in IBA; 50ppm, 100ppm, and 150ppm in GA_3. The cuttings treated with IBA were with quick dip while the other regulators (IAA and GA_3) and control were treated by prolong dip method. The observations were taken at an interval of 15 days.

Of the three growth regulators used, IBA @ 2000ppm responded maximum no. of roots/cutting. In terms of number of Leaves/cutting, GA_3 treatment had little effect in the shoot proliferation but IBA at concentration of 2000ppm gave a better result followed by 3000ppm and 1000ppm IBA. The grape cuttings treated with 2000ppm gave better result in root formation zone, Average length of longest root, Average thickness of thickest roots, and Dry weight of roots, Fresh weight of roots and Survival percentage of cutting. Higher concentration of GA_3 @ 150ppm also gave better results. These findings are closely related with Alia *et al*. (2000), Borah and Das (2000) in fig, Patil *et al*. (2001) in grape, Rawat *et al*. (2004) in grape and Akhtar *et al.* (2015) in rose.

Conclusion

In this study, affect of 10 different treatments of three (IBA, IAA and GA3) plant growth regulators in various combinations was observed on the growth of cuttings of grape (*Vitis vinifera*) cv. Thompson seedless. In the present investigation, most of the shoot and root characters of cuttings were significantly influenced by the different treatments of growth regulator as compared to control. But the treatment of 2000 ppm IBA was found best for maximum rooting, growth and success of grapes cuttings followed by treatment 3000 ppm IBA under this study.

Table 2: Effect of plant Growth regulators on Shoot Zone of Hardwood Cutting of Grape

S.No.	First emergence of node	Average no of leaves/cutting						Average no. of Buds/ cutting						Dry weight of shoots
		15 DAP	30 DAP	45 DAP	60 DAP	75 DAP	90 DAP	15 DAP	30 DAP	45 DAP	60 DAP	75 DAP	90 DAP	
T_0	19.33	2.01	2.80	1.65	8.17	9.07	9.07	0.00	0.70	2.20	5.60	6.53	7.53	1.65
T_1	20.33	1.32	3.40	0.60	9.37	9.37	9.60	0.20	0.73	2.50	5.70	6.40	7.40	0.60
T_2	17.67	0.68	3.68	0.68	10.73	10.90	10.90	0.27	0.87	2.70	6.10	6.70	7.70	0.68
T_3	16.00	3.01	3.71	0.78	5.03	5.20	15.37	0.33	0.97	2.90	6.60	7.07	8.07	0.78

T_4	20.67	1.32	6.64	1.08	13.47	15.33	21.67	0.83	1.67	3.63	7.20	7.70	8.70	1.08
T_5	17.33	3.67	12.69	3.02	21.00	21.53	5.20	1.07	2.13	4.40	8.13	9.30	9.93	3.02
T_6	20.00	1.32	2.91	2.38	10.00	10.50	12.00	0.93	1.83	4.00	7.67	8.67	9.23	2.38
T_7	14.67	1.31	2.43	0.93	2.77	3.73	8.90	0.60	0.93	2.90	6.63	7.07	8.07	0.93
T_8	12.00	0.20	0.38	1.01	4.40	8.40	6.40	0.60	1.07	3.17	6.83	7.37	8.37	1.01
T_9	9.00	0.69	3.71	1.06	4.60	4.80	4.87	0.70	1.47	3.47	7.20	7.70	8.70	1.06
	0.17	0.00	0.00	0.00	0.59	0.04	0.05	0.01	0.01	0.1	0.1	0.1	0.1	0.00
S.E.	0.41	0.02	0.03	0.01	0.77	0.20	0.23	0.07	0.11	0.10	0.10	0.10	0.10	0.01
C.D.	0.87	0.05	0.06	0.03	1.61	0.43	0.49	0.16	0.23	0.22	0.21	0.22	0.21	0.03

Table 3: Effect of Plant Growth Regulators on Root Zone of Hardwood Cutting of Grape

S.No.	First emergence of roots	Average no. of roots/cuttings						Average root formation zone					
		15 DAP	30 DAP	45 DAP	60 DAP	75 DAP	90 DAP	15 DAP	30 DAP	45 DAP	60 DAP	75 DAP	90 DAP
T_0	21.00	5.01	6.13	11.06	12.87	14.77	15.87	4.18	6.18	7.90	9.90	9.95	10.05
T_1	18.00	3.78	8.78	10.25	12.25	14.26	15.26	3.35	5.35	7.35	9.35	9.85	9.97
T_2	16.67	4.68	9.68	11.57	13.57	15.22	16.22	3.57	6.97	8.97	10.97	11.17	11.77
T_3	15.00	5.01	10.35	13.11	15.11	17.20	18.20	4.00	7.80	10.80	12.80	13.86	14.14
T_4	14.00	7.67	13.31	20.64	22.64	25.64	27.64	7.77	14.27	18.27	20.27	21.27	22.27
T_5	9.00	8.75	14.72	21.20	24.08	27.40	30.54	9.76	16.16	21.64	25.65	26.74	29.74
T_6	11.33	8.32	14.31	21.05	23.75	26.75	28.75	8.23	15.28	19.28	22.28	23.18	24.88
T_7	23.00	6.31	12.58	16.58	18.43	21.43	21.83	4.87	9.87	12.87	14.87	15.87	16.16
T_8	22.00	7.20	13.14	17.14	19.14	22.47	22.97	5.86	10.86	13.86	15.73	16.73	17.43
T_9	20.00	7.67	13.64	18.64	20.64	23.64	23.97	6.26	11.56	15.56	17.56	18.56	19.56
	0.50	0.01	0.02	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S.E.	0.71	0.03	0.14	0.05	0.16	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02
C.D.	1.49	0.05	0.29	0.11	0.33	0.05	0.05	0.03	0.03	0.03	0.03	0.04	0.04

Cont….

Average length of the longest root						Average diameter of the thickest root						Dry weight of roots	Fresh weight of roots
15 DAP	30 DAP	45 DAP	60 DAP	75 DAP	90 DAP	15 DAP	30 DAP	45 DAP	60 DAP	75 DAP	90 DAP		
3.58	5.20	7.68	8.28	8.85	8.95	1.09	1.33	1.33	1.34	1.35	1.35	0.03	0.05
2.65	4.75	7.01	7.97	8.14	8.34	1.07	1.31	1.32	1.32	1.33	1.33	0.12	0.16
2.95	5.50	8.06	10.49	11.13	11.49	1.11	1.37	1.37	1.38	1.38	1.38	0.15	0.18
3.17	6.87	9.32	11.03	11.73	12.13	1.13	1.42	1.42	1.42	1.43	1.43	0.17	0.22
5.48	13.44	19.08	23.44	24.44	25.44	1.26	1.60	1.60	1.60	1.62	1.61	0.34	0.37
7.30	15.65	22.08	26.05	27.96	28.24	1.35	1.70	1.72	1.75	1.75	1.78	0.36	0.61
6.65	14.14	20.80	23.99	25.16	26.16	1.30	1.65	1.66	1.66	1.67	1.67	0.34	0.41
3.10	8.16	14.21	14.90	15.19	16.02	1.14	1.47	1.48	1.49	1.49	1.49	0.20	0.26
3.89	9.22	14.22	16.11	16.71	17.71	1.17	1.50	1.50	1.50	1.51	1.51	0.23	0.30
4.98	10.73	15.46	17.66	17.96	18.96	1.23	1.55	1.55	1.56	1.56	1.56	0.24	0.32
0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.02	0.02	0.30	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00
0.04	0.04	0.63	0.03	0.05	0.05	0.02	0.02	0.02	0.01	0.02	0.01	0.01	0.00

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