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RESEARCH ARTICLE

EFFECT OF GROWTH REGULATORS AND ORGANIC SUBSTANCES ON ROOTING OF GRAPES (*VITIS VINIFERA* L.) CV.MUSCAT

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ABSTRACT

An experiment was conducted in the Department of Horticulture, Faculty of Agriculture, Annamalai University, Tamilnadu during 2017-2018 to study the "Effect of growth regulators and organic substances on rooting of grapes (*Vitis vinifera* L.) cv.Muscat. Experiment was conducted in Randomized Block Design under shade house condition with ten treatments and three replication for grapes cuttings cv.Muscat. The treatments were three different concentrations of IBA @ 2000 ppm, IBA @ 3000 ppm and IBA @ 4000 ppm and (organic substances) Seaweed extract @1%, seaweed extract @ 2%, seaweed extract @ 3% and Humic acid @ 1%, Humic acid @ 2% and Humic acid @ 3%. The various growth parameters viz., Days required for bud sprouting, length of root (cm), number of roots per cuttings, fresh weight of roots (g), percentage of rooting, length and width of leaf (cm), number of leaves per shoot, fresh weight of leaves (g), leaf area index (cm^2),length of shoot (cm),diameter of shoot (cm), length of internodes (cm) and percentage survival of cuttings were observed, growth regulators and organic substances gives better result in effect on rooting of grapes. percentage survival of cuttings, length of root, number of roots per cuttings, length of shoot (cm), shoot diameter (cm), rooting percentage, fresh weight of root (g) increased in IBA @ 3000 ppm followed by IBA @ 2000 ppm and Humic acid 2%. The rooting was earliest in IBA @ 3000 ppm, and also the days required for bud sprouting was earlier in cuttings treated with IBA @ 3000 ppm, followed by IBA @ 2000 ppm and Humic acid 2%.

INTRODUCTION

Grape (*Vitis vinifera L.*) is one of the most important commercial subtropical vine crop grown in all over the world. Grape belongs to the family Vitaceae with basic chromosome number, 2n = 38. It is native to Western Asia and Europe. Some of the major grape growing countries in the world are Italy, France and USA. In India total area under cultivation of grape is 1,06,000 ha, with a production of 8,81,000 MT and productivity of 8.3MT/ha. (NHB,2016). It is one of the most delicious, refreshing and nourishing fruits of the world and is classified as a protective food. The ripe fruits are supposed to be the best table fruit. The fruit contains a large portion of sugars, minerals and at the same time it is used for making raisin, wines and juices. The berries are a good source of minerals and vitamins B_1, B_2 and C. In India, while 78 percent of grapes produced are used for table purpose, nearly 17-20 percent is used in raisin production, while remaining percent are used for juice and wine. Fresh grape juice exports from India are estimated at 192616.92 tonnes valued at 166647.45 million rupees to markets in 24 countries during 2016-2017.

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Grape cultivation has become one of enterprises of the present time and the area under grapes is fast increasing in North as well as in South India. Commercially grape is cultivated in the states of Maharashtra, Karnataka, Tamilnadu, Punjab, Haryana and Madhya Pradesh. In South India it is grown mainly in Andhra Pradesh, Karnataka and Tamil Nadu. The annual production of Tamilnadu is 2585.3 million tonnes and has the maximum productivity of 29.8 tonnes per hector, (Indian Horticulture Database, 2016). Normally the harvest was done four to five crops in two years (Lester *et al.,* 2007). The popular commercial varieties that are grown in South India are Thompson Seedless, Anab-e-Shahi, Pusa Seedless, Sharad Seedless, Dilkush, Bangalore Blue, Muscat *etc*.Muscat grapes are gaining more popularity as table purpose because of its nutritive value, high total soluble solids, thin skin and desirable taste. In Tamil Nadu, Cumbum is a major grape growing belt for grape production with 4,000 small farmers producing over 90,000 tonnes of Muscat grapes, known locally as PannerDhrakshai and about 10,000 tonnes of Thompson seedless grapes. The unique feature about this area is the grapes are harvested throughout the year while in most grape growing centres elsewhere the season ends with summer. The grapes is a deciduous plant and easily propagated by hardwood cutting. Cuttings which may be a piece of root, stem, leaf a single bud or an eye or a tiny piece of meristem, is considered as a method of vegetative propagation with numerous advantages.

The vegetative method of propagation is always preferred over the seed propagation because it provides true to type and early bearing plants producing fruits of uniform quality. Production of any crop is influenced mainly by use of quality planting material. Many new plants can be produced in limited space from few stock plants. It is inexpensive, rapid and simple and doesn't require the special techniques necessary in grafting and budding. But productivity of grapes showed reduction on its own roots due to salinity in soil, chlorides in irrigation water, drought and also nematodes. In order to sustain the grape production under these adverse conditions, use of growth regulators and organic substances is the most effective and convenient means of maintaining optimum development of roots and nutrient supplies according to the specific requirement. The organic inputs are available in Humic acid, Seaweed extract and growth regulators, Indole butyric acid (IBA). Plant growth regulators, Indole butyric acid (IBA) refers to natural or synthetic substances influence the growth and development and its helps to increase the plant growth like, the tip of shoots, roots and side buds. IBA is well known as a rooting hormone, it helps to increase the root growth and development. The callus is a mass of unorganized parenchyma cells which is formed by the cambium layer of plants. The plant growth regulators such as IBA induce the initiation and proliferation of callus and new vascular tissue by promoting cell division and / or cell development (Bonner *et al*., 1952, Rost*et al.,* 1984; Raven *et al.,* 1992). Hence, it is retained that auxin like IBA when used can increase root formation.

Organic substances like Seaweed extract and Humic acid offer an economically attractive and ecologically sound means of reducing external inputs and improving the quality and quantity of internal resources. Organic substances are inputs containing micro-organism which are capable of mobilizing nutritive elements from non usable to usable biological processes. They are less expensive, eco-friendly and sustainable and do not require non renewable source of energy during their production and improve crop growth and quality by producing hormone. They increase sustainability of the soil and make it more productive. This indicates that organic substances can be beneficial for increasing the rooting and growth of cuttings by producing growth regulators (Chen and Aviad, 1990).

MATERIALS AND METHODS

The experiment was conducted during 2017-2018 in Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalainagar. The geographical position of the place is situated at 11º24' North latitude, 79º44' East longitude and at an altitude of ± 5.79 meters above mean sea level in the Cuddalore district of Tamilnadu.The experimental design in this research was randomized block design (RBD) with three replication, with 24 cuttings in each treatment and a total of 240 cuttings were planted in shade house condition. The treatments are T_1 – Indole butyric acid (IBA) @ 2000 ppm,T_2 – Indole butyric acid (IBA) @ 3000 ppm,T_3 – Indole butyric acid (IBA) @ 4000 ppm,T_4 – Humic acid @ 1%,T_5 – Humic acid @ 2%,T_6 – Humic acid @ 3%,T_7 – Seaweed extract @ 1%,T_8 –Seaweed extract @ 2%,T_9 – Seaweed extract @ 3%,T_{10} – Control. The experiment was done during Feb-March. Hardwood stem cuttings of grapes (*Vitis vinifera* L.) were collected from 3 years old plantand 14 cm long stem cuttings and each cutting has 3-4 budds. For rooting media 2:1:1 of (Red soil: Sand: FYM).The basal end of the cuttings dipped in dilute solutions of growth regulators (IBA @ 2000 ppm, 3000ppm, 4000 ppm) and organic substances (Humic acid @ 1%, 2%, 3% and sea weed 1%,2%,3%) by quick deep method for 10 seconds before planting the rooting medium. After the treatment, the cuttings was immediately planted in root trainers and inserted 7.5 cm deep in the rooting media. The number of days required foe sprouting, length of root (cm), number of roots per cuttings, fresh weight of roots (g), length of shoot (cm), length of internodes (cm), percentage survival of cuttings were measured after 45 days. The data recorded were subjected to statistical analysis by using Randomized Block Design (RBD) as described by (Cochran and Cox, 1992).

RESULTS AND DISCUSSION

A perusal of Table 1 indicated that the days required for rooting was influenced significantly by of planting and growth regulators (IBA) followed by organic substances (Humic acid) (T_2) (10.52) and ($T_{1)}$ (10.93) followed by (T_5) (12.02) . The sprouting was occurred very late in (T_{10}) (14.02), when cuttings were planted on mid june followed by mid march. The increases in number of sprouts might be due to better utilization of stored carbohydrates, nitrogen, increased level of auxins and other factors with the help of growth regulators, the auxin treatments stimulate the hydrolysis of nutritional reserves and their mobilization of sprouting. This was in concordance with the findings of Chandramouli (2001) in stevia, Muhammad *et al*., (2003) in grapes,Singh *et al*., (2015) in lemon.The maximum length of root (cm) was observed (T_2) (6.90) and (T_1) (6.43)followed by (T_5) (6.23). The root length was lower in (T_{10}) (4.33). Due to the due to the application of auxin had been enhance the histological features like formation of callus, enhanced hydrolysis of carbohydrates, synthesis of new proteins, cell enlargement and cell division and differentiation of vascular tissues. These results are also accordance with the findings of Misra and Jaiswal (1993) in Karonda, Kumar *et al*., (2004) in Sweet lime, Shukla *et al*., (2010) in Peach, Singh *et al*., (2015) in Phalsa. The number of roots per cuttings was synchronized due to more diameter of roots in these treatments (Table 2), (T_2) (14.60) and(T_1) (13.10)followed by (T_5) (12.90) . The minimum number of roots per cuttings was seen in ($T_{10)}$ (4.48). The increasing number of roots was probably due to the effect of auxin, auxin promoted cell division and cell elongation and the differentiation of cambial root primordial in the mobilization of reserve food material to sites of root initiation thus produced higher number of roots per cutting. The increasing number of roots was probably due to hormonal effect and it is found that IBA increases number of roots in *prunus laurocerasus* (Ribeiro *et al*., 2010). He also found higher number of roots with IBA indicated that auxin application could provoke at earlier and faster root growth. The present study was in concordance with the findings of Ram *et al*., (2005) in Pomegranate, Diwaker and Katiyar (2013) in Kagzi lime. The maximum average fresh weight of roots (gm) per cuttings was recorded under mid of February. The higher fresh weight of root was recorded in (T_2) (12.05) and ($T_{1)}$ (11.63) followed by (T_5) (10.88).The lowest value was recorded in (T_{10}) (8.60). The fresh weight of the roots is directly proportional to number of roots in each cutting. The increase in number of roots per cutting might have directly influenced the fresh weight of the roots.

Table 1. Effect of growth regulators and organic substance on days required for sprouting and length of root (cm) in grapes (*Vitis vinifera* L.) cv. Muscat

Days required for sprouting			Length of root (cm)	
T_1 - IBA @ 2000 ppm	10.93		T_1 - IBA @ 2000 ppm	6.43
T_2 - IBA @ 3000 ppm	10.52		T_2 -IBA @ 3000 ppm	6.90
T_3 - IBA @ 4000 ppm	11.75		T_3 - IBA @ 4000 ppm	6.03
T_4 -Humic acid @ 1%	11.26		T_4 -Humic acid @ 1%	5.50
T_5 - Humic acid @ 2%	12.02		T_5 - Humic acid @ 2%	6.23
T_6 - Humic acid @ 3%		11.05	T_6 - Humic acid @ 3%	6.22
T_7 – Seaweed extract @ 1%	12.35		T_7 - Seaweed extract @ 1%	6.00
T_8 – Seaweed extract @ 2%	12.49		T_8 – Seaweed extract @ 2%	5.40
T_9 - Seaweed extract @ 3%	12.76		T_9 - Seaweed extract @ 3%	4.90
T_{10} – Control	14.02		T_{10} – Control	4.33
Mean	3.5		Mean	2.57
SE (d)	0.22		SE (d)	0.16
CD at 0.05%	0.38		CD at 0.05%	0.28

Table-2 Effect of growth regulators and organic substances on Number of roots per cuttings and Fresh weight of roots (g) in grapes (Vitis vinifera L.) cv.Muscat

Number of roots per cuttings		Fresh weight of roots (g)		
T_1 - IBA @ 2000 ppm	13.10	T_1 - IBA @ 2000 ppm		11.63
T_2 -IBA @ 3000 ppm	14.60	T_2 -IBA @ 3000 ppm		12.05
T_3 - IBA @ 4000 ppm	10.80	T_3 - IBA @ 4000 ppm	10.69	
T_4 -Humic acid @ 1%	7.00	T_4 -Humic acid @ 1%	9.78	
T_5 - Humic acid @ 2%	12.90	T_5 - Humic acid @ 2%		10.88
T_6 - Humic acid @ 3%	11.69	T_6 - Humic acid @ 3%		10.85
T_7 - Seaweed extract @ 1%	7.03	T_7 - Seaweed extract @ 1%	10.42	
T_8 - Seaweed extract @ 2%	6.50	T_8 – Seaweed extract @ 2%	9.57	
T_9 - Seaweedextract @ 3%	5.83	T_9 - Seaweed extract @ 3%		9.31
T_{10} – Control	4.48	T_{10} – Control		8.60
Mean	9.1	Mean	3.45	
SE (d)	0.57	SE (d)	0.22	
CD at 0.05%	1.12	CD at 0.05%	0.38	

Table-3. Effect of growth regulators and organic substances on Length of internodes and Percentage survival of cuttings in grapes (Vitis vinifera L.) cv. Muscat

Length of internodes		Percentage survival of cuttings	
T_1 - IBA @ 2000 ppm	7.42	T_1 - IBA @ 2000 ppm	92.20
T_2 -IBA @ 3000 ppm	7.67	T_2 -IBA @ 3000 ppm	94.61
T_3 - IBA @ 4000 ppm	6.82	T_3 - IBA @ 4000 ppm	88.75
T_4 -Humic acid@ 1%	5.92	T_4 -Humic acid @ 1%	85.25
T_5 - Humic acid@ 2%	7.15	T_5 - Humic acid @ 2%	90.50
T_6 - Humic acid @3%	6.95	T_6 - Humic acid @ 3%	90.00
T_7 - Seaweed extract @ 1%	5.91	T_7 – Seaweed extract @ 1%	86.50
T_8 - Seaweed extract @ 2%	5.57	T_8 - Seaweed extract @ 2%	83.26
T_9 - Seaweed extract @ 3%	5.20	T_9 – Seaweed extract @ 3%	80.27
T_{10} – Control	4.84	T_{10} – Control	72.51
Mean	3.32	Mean	21.09
SE (d)	0.13	SE (d)	1.35
CD at 0.05%	0.24	CD at 0.05%	2.34

The maximum root weight was attributed to the fact that auxins naturally occurring or exogenously applied are for initiation and growth of roots. Low auxin activity and its slow degradation by auxin destroying enzyme lead to the growth and vigour of roots. This was in concordance with the finding of Farooqui *etal*., (1994) in Rose (*Rosa damascene*), Carvalho *et al*., (1995) in *Stevia rebaudiana*, Singh and Tomar (2015) in Phalsa. The length of internodes (cm) was also observed in February. The higher length of internodes was observed (Table 3) (T_2) (7.67) and (T_1) (7.42)followed by (T_5) (7.15) . The lower length of internodes was observed in (T_{10}) (4.84) . The increased vigor of the cuttings is attributed to more vigorous growth, due to the formation of callus internodal length might be due to the availability of high amount of storage which helped the grow vigorously. The internodal length plays an important role in reserving the food material required for further growth after planting.

This research was similar with the findings of Sivaci*et al*., (2006) in apple and Somkumar*et al*., (2009) in grapes. The highest value for percentage survival of cuttings was observed in (T_2) (94.61) and (T_1) (92.20) followed by (T_5) (90.50). The lowest value was observed in (T_{10}) (72.51). This might be due to the increased length, maximum number of primary roots and early sprouting resulted in more thickness of the roots, perhaps the ability of regenerating further new fibrous roots from main roots, which probably absorb more nutrients and water from the soil under low transpiration losses.. The effect of auxin might be slow translocation property or slow destruction of auxin by auxin destroying enzyme system as reported by Debnath and Maiti*et al*., (1990). This was in line with the findings of Ram *et al*., (2005) in Pomegranate, Shukla *et al*., (2010) in Peach, Diwaker and Katiyar (2013) also reported in Kagzi lime, Singh *et al*., (2015) in Phalsa.

Conclusion

Using of growth regulators IBA @ 3000 ppm was found beneficial effect on days required, length of of root (cm), fresh weight of roots (g), percentage of rooting, length of internodes and percentage survival of cuttings in Grapes (Vitis vinifera L.) cv.Muscat.

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