

IDENTIFICATION OF SUITABLE GROWTH REGULATORS TO INDUCE ROOTING IN GRAPE VARIETY CARDINAL

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ABSTRACT

Grape has become a popular fruit crop among the dry zone farmers in the country. Cardinal is a recommended table variety, although its planting material production has been hampered due to the poor rooting nature. Therefore, an experiment was carried out to find out suitable growth regulators to improve the rooting ability. The growth regulators IAA and IBA and 1:1 mixture of IAA and IBA were the three main treatments. Five concentration levels (0, 25, 50, 75 and 100 mg/l) of two growth regulators and the mixture were the five sub treatments. Treatments were replicated five times in split plot design and tested for four seasons. Grape cuttings with 3-4 nodes and 20cm long were dipped in pre-prepared growth regulators as described in treatments for 12 hours. These cuttings were buried in beds of wet coir dust for 14 days. IAA and IBA increased the rooting percentage till the concentration reached up to 75mg/l and declined thereafter. The 1:1 mixture of two growth regulators increased the rooting up to the concentration of 50mg/l. The 1:1 mixture of IAA and IBA is the most suitable growth regulator mixture and its optimum concentration range is 25 to 50mg/l. IAA or IBA also can be used to induce rooting and their optimum concentration range varies from 50 to 75mg/l.

KEYWORDS: Grape, Growth Regulators, Propagation.

INTRODUCTION

Grape (*Vitis vinifera L.*) was introduced to Sri Lanka in Portuguese period and cultivated in Jafna peninsula and the nearby coastal areas. Consequently, it had been spread to other dry zone areas such as Kalpitiya, Anuradapura, and Hambantota and now it has become a popular fruit crop among the dry zone farmers. At present, the total extent of grapes is around 90ha producing approximately 400mt per year. However, the total imports of fresh grapes in 2004 was 3479mt (value – Rs million 316.) which was eight times greater than the annual production (Anon., 2004).

Grape is generally propagated by rooted cuttings. Winkler (1962) defined a stem cutting as a piece of parent plant that would develop into a new plant when placed under favorable conditions for growth. The matured cuttings (brown in color) taken on pruning of vines should be given wet, cool and dark environment to induce callus formation and rooting. In practice, the cuttings are buried in wet coir dust or sand beds which were prepared under shade. After 2-3 weeks, callus and roots are formed.

In general, rooting of stem cuttings varies with the varieties. Stem cuttings of some varieties root so rapidly while the others are difficult to

root under the same conditions favorable for rooting. Among the varieties recommended in Sri Lanka by the Department of Agriculture, variety Israel Blue gives rapid and variety Muscat MI gives moderately high rooting under favorable conditions. It was observed that, the recommended variety Cardinal gives very low percentage of rooting even under the optimum conditions for rooting. Variety Cardinal is a high yielding, good quality table variety and it performs well in the dry zone area. However, its planting material production has been hampered due to the poor rooting nature of the variety. Therefore, still this variety has not been popularized among the grape growers in the country.

According to Singh and Singh (1968), plant growth regulators can be used to increase the percentage of rooted cuttings and increase the number of roots per cutting. Julliard (1954) reported that stem cuttings of grape treated with IAA, produced abundant roots at the base of cuttings. Sarrisora (1964) also found that stem cuttings of seven grape vine varieties treated with Indole Acetic Acid (IAA), Indole Butric Acid (IBA) and Naptyle Acetic Acid (NAA), rooted better than the control. According to Herath *et al.* (1978), IBA can be successfully used as a root-promoting substance in grape variety Semillon. Therefore this experiment was conducted to find out suitable growth regulators which would improve the rooting ability of stem cuttings of this variety Cardinal.

In tropical areas, grape vines are pruned twice a year in mid June (June pruning) and in the end of January (January pruning). In general, it was observed that under normal propagation conditions the planting material production is high in the June pruning. Therefore, this experiment was conducted using cuttings of both pruning seasons to determine whether cuttings taking period has an effect on rooting.

MATERIALS AND METHODS

Experiment was conducted in the green house at Grain Legumes and Oil Crop Research and Development Center (GLOCRDC), Angunakolapelessa, over four seasons from June 2002 to July 2004.

Growth regulators Indole Acetic Acid (IAA), Indole Butric Acid (IBA) and 1:1 mixture of above two growth regulators were considered as the three main treatments. Five concentration levels (0, 25, 50, 75 and 100 mg/l) of above three treatments were the five sub treatments. Treatments were replicated five times in split plot arrangement of Randomize Complete Block design (RCBD) and tested for four seasons.

Cuttings were taken from 3 year old vines at pruning and selected cuttings of 6-8 mm diameter were trimmed to length of 20 cm,

containing 3-4 nodes. In the upper end of the cutting made a straight across cut 1 cm above the node and in the bottom, made a slant cut (45°) just below the node. All the cuttings were dipped in fungicide solution Homai (active ingredient Thiophanate Methyl 50% and Thiram 30 %) to avoid fungal contaminations. Prepared the growth regulators in different concentration levels (0, 25, 50, 75 and 100 mg/l) and basal parts of cuttings were dipped in these solutions separately (25 cuttings per one concentration level) and kept for 12 hours. After that bundled cuttings (5 cuttings in each bundle) were labeled and then buried in wet coir dust medium for curing. These coir dust beds were also pretreated with fungicide Homai and watered well at three days interval.

The experiment was completed after 14 days and recorded the rooting percentage and total root length of grape cuttings. Data were statistically analyzed in split plot design and differences between the treatments were tested by ANOVA and followed by mean separation using SAS software package. T-test was used for mean separation in the analysis of pruning time (month).

RESULTS AND DISCUSSION

According to Tables 1 and 2, both growth regulators and their concentrations showed significant increase on the rooting percentage and the total root length. The interaction between two factors was also significant. Therefore, the effect of each growth regulator is considered under each level of concentration.

When considering the growth regulators IAA and IBA separately, with the increase of concentration levels from 0 to 75 mg/l, rooting percentage and total root length increased up to the maximum. However, beyond that level both rooting percentage and total root length decreased (Tables 1 and 2). As shown in Figure 1 in all four seasons, the growth regulator IBA reacted more effectively on rooting of grape cuttings than IAA.

With the 1:1 mixture of IAA and IBA, rooting percentage and total root length reached the maximum at concentration level of 50 mg/l and beyond that, rooting decreased. This pattern was common in all the four seasons.

The maximum rooting percentage varied with the pruning time in which cuttings were collected for planting material production. Cuttings taken from the June pruning recorded significantly greater rooting percentage and total root length over the cuttings taken in January (Table 3).

Table 1. The effect of growth regulators and their concentration levels on percentage rooting of grape cuttings (variety Cardinal) at GLOCRDC Angunakolapelessa from June 2002 to July 2004.

Main treatments	Sub treatments	Rooting Percentage*			
		June pruning		January pruning	
Growth regulators	Levels mg/l	2003	2004	2003	2004
IAA	00	25.0 d	17.3 d	12.7 d	9.3 e
	25	34.7 c	30.0 c	24.3 c	16.7 d
	50	43.0 bc	41.7 b	34.3 a	30.0 b
	75	57.3 a	57.0 a	40.3 a	40.3 a
	100	48.0 a	40.0 b	32.0 b	22.3 c
CV %		11.1	5.7	12.6	11.0
IBA	00	24.7 c	16.7 e	12.3 d	12.3 c
	25	50.3 b	34.3 d	28.0 c	27.6 b
	50	63.0 a	56.0 b	39.0 b	41.0 b
	75	71.0 a	69.0 a	43.0 a	49.3 a
	100	52.7 b	48.0 c	27.0 c	28.7 b
CV %		7.8	7.8	5.7	9.6
IAA + IBA	00	27.0 d	19.6 c	10.3 e	11.3 e
	25	61.0 b	56.0 b	36.7 c	37.0 c
	50	88.1 a	83.0 a	52.7 a	57.0 a
	75	79.0 b	65.3 b	43.3 b	52.0 b
	100	48.6 c	56.0 b	28.3 d	22.3 d
CV %		4.8	10.4	10.3	10.6

*Means followed by the same letter under each main treatment in each column are not significantly different at $p = 0.05$

Although Harmon (1942) and Weaver (1956) stated that growth regulators had not induced rooting in grape cuttings, this experiment shows that the growth regulators IAA or IBA or the mixture of two can be effectively used to accelerate rooting in this variety Cardinal. Results of the experiments carried out by Sarrisora (1964) for seven grape varieties and Herath *et al* (1978) for variety Semillon also supported the findings of the present experiment.

The most common and practical method of raising planting material is by rooted cuttings. Rooting is one of the most important factors which directly affect planting material production. In practice, a direct relationship between the rooting percentage and the number of plants produced was observed. Therefore, it is important to use growth regulators to enhance root initiation in cuttings which can increase the planting material production rapidly.

In tropical areas grape vine pruning is carried out twice a year. Vine pruning is presently practiced in mid January and mid June. Usually, cuttings for propagation can be obtained at both of these prunings.

GROWTH REGULATORS TO INDUCE ROOTING IN GRAPE 171

Table 2. The effect of growth regulators and their concentration levels on total root length of grape cuttings (variety Cardinal) at GLOCRDC Angunakolapelessa from June 2002 to July 2004.

<i>Main treatments</i>	<i>Sub treatments</i>	<i>Total root length (mm)*</i>			
<i>Growth regulators</i>	<i>Levels mg/l</i>	<i>June pruning</i>		<i>January pruning</i>	
		<i>2003</i>	<i>2004</i>	<i>2003</i>	<i>2004</i>
IAA	00	143 b	137 c	38.3 d	37 d
	25	149 b	149 c	74.7 c	82 c
	50	264 ab	262 b	133 b	143 b
	75	295 a	312 a	181 a	191 a
	100	270 ab	266 b	70 c	73 c
CV %		31.6	8.5	13.7	8.4
IBA	00	139 c	143 c	31.0 d	35 d
	25	487 ab	497 a	92.0 c	96 c
	50	513 ab	516 a	157.7 b	162 b
	75	606 a	530 a	233.7 a	242 a
	100	449 b	382 b	111.3 c	121 c
CV %		16.7	5.0	10.8	10.6
IAA + IBA	00	140 d	145 d	34.0 e	32 e
	25	658 bc	652 b	152.0 c	150 c
	50	753 a	712 a	309.6 a	312 a
	75	662 b	610 c	271.3 b	274 b
	100	589 c	590 c	125.7 d	133 d
CV %		6.9	3.5	4.9	4.5

*Means followed by the same letter under each main treatment in each column are not significantly different at $p = 0.05$

Table 3. Effect of cuttings taking period on rooting percentage and total root length of grape variety Cardinal over four seasons at GLOCRDC Angunakolapelessa from June 2002 to July 2004.

<i>Observations</i>	<i>Rooting percentage*</i>	<i>Total root length (mm)*</i>
<i>2003 June pruning</i>	50.06 a	407.8 a
<i>January pruning</i>	30.94 b	134.3 b
<i>2004 June pruning</i>	45.84 a	393.5 a
<i>January pruning</i>	26.34 b	146.3 b

*In each year, column values followed by same letters are not significantly different at $p = 0.05$

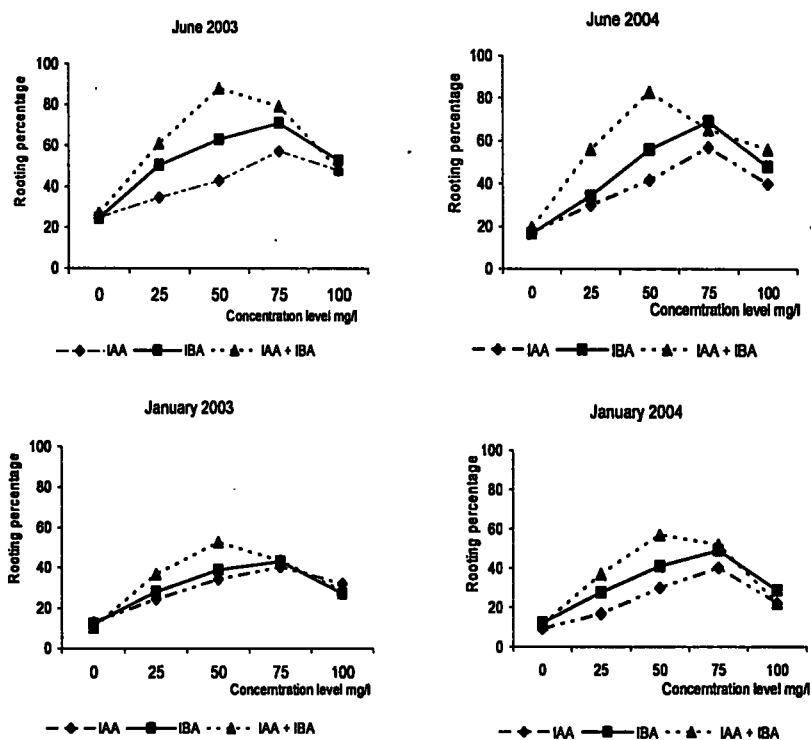


Figure 1. The effect of growth regulators and their concentration levels on rooting percentage of grape cuttings (variety cardinal) in different seasons at GLOCRDC Angunakolapelessa from June 2002 to July 2004.

According to the results of this experiment, rooting percentage of grape cuttings varies with the pruning time in which cuttings are taken. In general, the rooting of cuttings taken from January pruning is low and accordingly, the planting material production is also low in this season. This may be due to poor growth and low food reserves due to heavy defoliation caused by fungal diseases during the *maha* rainy period. Also in the *maha* season, the prevailing cloudy conditions may hamper the photosynthesis process to reserve less food in stems compared to the *yala* season. Even treating with the growth regulators, the rooting percentage was low compared to the cuttings taken in June.

CONCLUSIONS

Growth regulators of IAA or IBA can be used to induce rooting of grape cuttings in variety cardinal. Concentration range of 50 – 75 mg/l can be used to obtain sufficient rooting. The 1:1 mixture of IAA and IBA was identified as the best combination for propagation of grape variety cardinal.

The identified optimum concentration range for the above mixture was 25 - 50 mg/l.

There is a seasonal effect on rooting of grape cuttings. The rooting of grape cuttings taken at January pruning was low, even with the use of growth regulators compared to cuttings taken in January. Accordingly, possibility for the planting material production of grape is high in June.

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