Effect of PGR on Growth and Establishment of Grapes (*Vitis vinifera* L.) cv. Thompson Seedless under Prayagraj Agro Climatic Condition

ABSTRACT

Grapes *(Vitis vinifera*) is one of the important commercial subtropical crops, which is a good source of vitamins and minerals. It is grown throughout the world except the places with extreme temperature and high altitude .So, to find out Effect of PGR on growth and establishment of grapes cv. Thompson Seedless under Prayagraj agro climatic condition; a field experiment was conducted at Horticulture Research Farm, Department of Horticulture, Naini Agriculture Institute, Sam higginbottom University of Agriculture, Technology and Science, Prayagraj, U.P-211007 during the year 2022. The experiment comprised of 10 different treatment of three different plant growth regulator comprising of GA_3, IAA and IBA with different concentration of 50 ppm, 100 ppm and 150 ppm; 100 ppm, 300 ppm and 500 ppm; 1000 ppm, 2000 ppm and 3000 ppm respectively. The main objective of the experiment was to evaluate the root and vegetative growth of grapevines with their success and survival in the Prayagraj agro-climatic zone. From the present investigation, treatment T_9 (IBA @3000 ppm) was found best with least days to emerge from the bud from the grapes cutting (6.4 days) with maximum amount of sprouting percentage (77.7%). It also showed the best root growth parameters with maximum root length 25.1cm @120DAP and maximum number of roots per cutting 49.3 @120DAP. It also showed best vegetative growth parameters with maximum shoot length 13.4cm @120DAP, maximum stem diameter 28.1mm @120DAP, highest number of leaves with 12.5 @120 DAP, maximum leaf area 73.9cm^2, maximum plant height after transplanting 14.9cm and highest survival percentage 88.8% of grapes plant. The T_9 showed the best results with all major parameters when cuttings were treated with different concentrations of plant growth regulators.

Keywords: Grape; cutting; IBA; GA3; IAA; roots; shoots; leaves and survival of plants.

1. INTRODUCTION

Grapes *(Vitis vinifera*) is one of the important commercial subtropical crops, which is a good source of vitamins and minerals. It is grown throughout the world except the places with extreme temperature and high altitude. It is one of the most delicious, nourishing and refreshing fruits of the world and is classified as a protective fruit. Grapes are grown in the world for a very long time .There are a number of varieties that are grown in the world with about 72 million tons of grapes annually. At the time of civilization the grapes production was started. It was started as early as 6500 B.C. as per information of archaeologists. By 4000 B.C., grape growing extended to Asia Minor and grapes production spread throughout Europe by the Romans [1-4].

The grapes is a subtropical fruit belonging to the family Vitaceae made up of about 60-80 species and 12 genera, native to different parts of the world including temperate zone and tropical regions. It is usually a woody vine, climbing by means of tendrils and grows up to a length of 17 meters or more. The leaves are palmate lobed, alternate and always tooth-edged. Botanically, grapes is a berry, with the juicy pulp and seed inside it. It contains minerals such as calcium and phosphorus and is a good

source of Vitamin-A. It also contains glucose and fructose depending upon variety [5-7].

Plant growth regulators or plant bio-regulators are the hormone based-chemicals that help to improve the performance of horticultural crops and fruits crops. There are a lot of plant growth regulators mainly categorized in groups like auxins, gibberellins, cytokinins, abscisic acid, ethylene and growth retardants, etc. These help to influence flowering, fruit set, retention, plant growth and development, ripening, shelf life and fruit quality characters in different tropical and subtropical fruits at different concentrations of PGR's [8-10].

The auxin is a growth regulator for the plant as it helps the plant in cell division and cell expansion. The plant uses a number of cellular mechanisms to regulate auxin levels and response IBA, NAA, etc. are the main examples of auxins. These help plants to grow to a fuller length as it helps in root initiation, stem bending and leaf epinasty. The cuttings are quickly dipped in the solution of auxin-IBA (Indole-3-Butyric Acid) at the time of planting.IAA (Indole-3-acetic acid) is the common plant hormone which regulates various aspects of plant growth and development. It helps in many different ways for cell development as it include cell elongation and cell division. The cuttings were prolong dipped in the IAA-solution before planting [11-14]. Gibberellic acid (GA3) is the plant growth hormone and helps in the development of the plant. It stimulates seed germination, trigger transitions from meristem to shoot growth, vegetative to flowering, etc. This also regulates different mechanisms in the plant development. The cuttings are prolong dipped in the GA3 solution [15,16].

Therefore keeping this knowledge in mind the present experiment was carried out to study the **"Effect of PGR on growth and establishment of grapes (*vitis vinifera* L.) cv. Thompson Seedless under Prayagraj agro climatic condition"** with the following objectives:

1. Effect of PGR on root and vegetative growth of grapevines cv. Thompson seedless.
2. Effect of PGR on survival and success of hardwood cuttings of grapes.

2. MATERIALS AND METHODS

The experiment was conducted at the 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 and vegetative growth 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 GA3 @ 50 ppm, 100 ppm and 150 ppm, IAA @ 100 ppm, 300 ppm and 500 ppm, IBA @ 1000 ppm, 2000 ppm and 3000 ppm and three levels of ppm respectively with growing media of soil, coco peat and FYM in the polythene bags. The cuttings were prolong dipped in IAA and GA_3 for 24hrs before planting them in the polybags. The quick dip was given to the cuttings in IBA for 30sec. at the time of planting. The 90 cuttings were planted with 30 for each growth regulator. The planting was done in the month of September and transplanting was done in the month of February.

The different observations were calculated from seedlings grown from the grapes cutting in the polybags with the effect of different concentrations of PGRs. The rooting parameters and vegetative growth parameters were calculated on the grapes cuttings. The rooting parameters have observation of emergence of buds, sprouting percentage, mortality percentage, root length and number of roots per cutting. The vegetative growth parameters have observation of shoot length, stem diameter, number of leaves per cutting and leaf area. The plant height and survival percentage of grapes were also noted after transplanting of cuttings into the field.

Treatment Details:

Table 1. Different concentrations of PGRs in which cuttings were treated

Treatment	Name of growth regulator	Concentration	Method of treatment
T_0	Control	0 ppm	Prolong Dip
T_1	GA3 (Gibberellic Acid)	50 ppm	Prolong Dip
T_2	GA3	100 ppm	Prolong Dip
T_3	GA3	150 ppm	Prolong Dip

T_4	IAA (Indole Acetic Acid)	100 ppm	Prolong Dip
T_5	IAA	300 ppm	Prolong Dip
T_6	IAA	500 ppm	Prolong Dip
T_7	IBA(Indole Butyric Acid)	1000 ppm	Quick Dip
T_8	IBA	2000 ppm	Quick Dip
T_9	IBA	3000 ppm	Quick Dip

Table 2. Effect of PGR on buds emergence on the grapes cutting.

Treatment No.	Treatments Details	Days of emergence of buds	Sprouting Percentage (%)	Mortality Percentage (%)
T_0	Control	13.5	11.1	88.8
T_1	GA3 (Gibberellic Acid)	11.3	22.2	77.7
T_2	GA3	11.5	44.4	55.5
T_3	GA3	12.0	44.4	55.5
T_4	IAA (Indole Acetic Acid)	13.2	55.5	44.4
T_5	IAA	12.7	44.4	55.5
T_6	IAA	9.0	66.6	33.3
T_7	IBA(Indole Butyric Acid)	7.1	66.6	33.3
T_8	IBA	6.9	66.6	33.3
T_9	IBA	6.4	77.7	22.2
F test		S	S	S
SEm. (±)		0.70	15.53	15.53
CD (5%)		1.47	32.63	32.63

Table 3. Effect of PGR on root and shoot growth on the grapes cutting at 120 DAP

Treatment No.	Treatments Details	Root length (cm)	No. of roots per cuttings	Shoot length (cm)	Stem diameter (mm)
T_0	Control	7.1	14.0	7.8	16.6
T_1	GA3 (Gibberellic Acid)	11.8	17.3	7.8	17.7
T_2	GA3	13.7	21.3	7.8	20.0
T_3	GA3	15.2	24.0	7.9	20.3
T_4	IAA (Indole Acetic Acid)	15.9	26.6	7.9	22.0
T_5	IAA	16.8	34.3	8.0	22.7
T_6	IAA	16.6	34.6	8.9	23.5
T_7	IBA(Indole Butyric Acid)	20.6	39.6	10.7	24.7
T_8	IBA	23.3	45.0	13.0	26.4
T_9	IBA	25.1	49.3	13.4	28.1
F test		S	S	S	S
SEm.(±)		1.04	1.96	0.38	0.80
CD (5%)		2.18	4.11	0.80	1.68

Table 4. Effect of PGR on leaves parameter on the grapes cutting at 120 DAP

Treatment No.	Treatments Details	Number of leaves per cutting	Leaf area (cm^2)
T_0	Control	6.0	13.2
T_1	GA3 (Gibberellic Acid)	6.1	17.7
T_2	GA3	6.2	22.7
T_3	GA3	7.0	32.8
T_4	IAA (Indole Acetic Acid)	7.7	42.7
T_5	IAA	8.3	53.6
T_6	IAA	8.5	62.5
T_7	IBA(Indole Butyric Acid)	9.2	64.9
T_8	IBA	11.2	71.7

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T_9	IBA	12.5	73.9
F test		S	S
SEm.(±)		0.42	2.16
CD (5%)		0.87	4.54

Table 5. Effect of PGR on survival and plant height on the grapes cutting after transplanting

Treatment No.	Treatments Details	Plant height (cm)	Survival percentage (%)
T_0	Control	7.0	22.2
T_1	GA3 (Gibberellic Acid)	7.5	44.4
T_2	GA3	8.8	44.4
T_3	GA3	8.9	44.4
T_4	IAA (Indole Acetic Acid)	10.1	44.4
T_5	IAA	11.7	55.5
T_6	IAA	12.1	55.5
T_7	IBA(Indole Butyric Acid)	12.9	55.5
T_8	IBA	14.0	77.7
T_9	IBA	14.9	88.8
F test		S	S
SEm.(±)		0.41	12.93
CD (5%)		0.86	27.16

The experiment was carried out in a single factor Randomized Block Design. The cuttings were treated with growth regulators like GA_3, IAA and IBA. Each growth regulators had 3 different level of concentrations viz., 50 ppm, 100 ppm, 150 ppm in GA_3; 100 ppm, 300 ppm, 500 ppm in IAA and 1000 ppm, 2000 ppm, 3000 ppm in IBA. The cuttings were grown in the growth media consisting of soil, FYM and coco peat. The cuttings treated with IBA were quick dipped in the solution whereas the cuttings were prolonged dipped in the GA_3 and IAA solution. The observations were calculated at different days intervals i.e.30, 60 and 120 DAP.

3. RESULTS AND DISCUSSION

The cuttings with IBA@3000 PPM showed the best results of different parameters on the grapes cutting. The early bud emergence with high sprouting percentage were observed in the cuttings with IBA@3000 ppm. The role of high IBA concentration in the activation of dominant bud through the enhanced activity of hydrolytic enzymes, acting upon stored food in the cuttings. The root length and number of roots per cutting were noted best with the effect of IBA on the grapes cutting. These findings were closely related to the findings of Upadhyay and Badyal [17] in pomegranate and Stancato et al. [18] in cactus and Singh et al [19] in pomegranate.

The shoot length and stem diameter were also observed best in the IBA treated cuttings. This may be due to increased synthesis and accumulation of growth promoting substances as well as availability of more nutrients under this treatment, which enhance the rooting in cuttings. In terms of number of leaves per cutting, GA_3 treated cuttings had a little effect in the shoot proliferation but IBA showed best results with IBA @3000ppm followed by 2000 ppm and 1000 ppm of IBA. These findings were closely related to the findings of Singh et al [19] in pomegranate, Kaur et al. [20] in fig, Ali et al. [21] in fig, Rolaniya et al.[22] in grapes and Kumar et al. [23] in pomegranate.

The plant heights were observed in the grapes plant after transplanting them into the field and the IBA treated plants showed a good growth as compared to the other plant growth regulators. This might be attributed to higher amounts of growth-promoting chemicals and accessible nutrients because of using different plant growth regulators. The growth and establishment of grapes plant were maximum in the IBA treated plants followed by IAA and GA_3.These findings are closely related with Patil et al. [1] in grape, Jadhav et al. [24] in Rangpur lime, Burman et al. [2] in grapes, Narula et al. [25] in plum and Rolaniya et al. [22].

4. CONCLUSION

Early Proof

On the basis of result of the experiment in hardwood cutting of grapes cv.Thompson Seedless, the following conclusions may be made-

1. Among the different plant growth regulators,IBA responded well to the sprouting of buds in the cutting.
2. The root and shoot parameters were well recorded in the IBA treated cuttings.
3. The application of IBA was best recorded on the leaves characteristics of the grapes plant.
4. The application of IBA gave maximum growth and establishment of grapes plants in the field.

5. SUGGESTION FOR FURTHER WORK

Since the results of present investigation belong to one year of experiments for reaching to any definite conclusion and recommendation,it need further conduction of the same experiment for at least three successive years in different environments.Following studies are also suggested to be undertaken in future:

1. In order to confirm the validity of results the experiment must be repeated over years,location and different seasons with more accuracy.
2. The experiment should be tried on a large number of species and varieties of fruit crops propagated by cutting.
3. Non auxinic chemicals (like p-hydroxy benzoic acid-PHB, ferulic acid, etc.) combination with growth regulators should be tried.
4. This experiment should also be conducted to see the effect of environmental conditions.
5. Further investigations may be carried out to improve the *in-vitro* rooting in grapes.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Grey Proof

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