Annals of Plant and Soil Research 25(3): 412-416 (2023)
https://doi.org/10.47815/apsr.2023.10286

Influence of plant growth regulators and natural substances on the root and shoot growth characteristics of grape (*Vitis venifera*) cuttings

***ASTHA, VIJAY BAHADUR, RAJ NARAYAN[1] AND SUMATI NARAYAN[2]**

Department of Horticulture, SHUATS, Prayagraj (U.P.), [1]ICAR – ATARI Zone II, Jodhpur (Rajasthan), [2]SKUAST-Kashmir, Srinagar

Received, June, 2023; Revised accepted, August, 2023

ABSTRACT

An experiment was carried out at Department of Horticulture, Sam Higginbottom University of Agriculture, Sciences and Technology, Prayagraj (Allahabad) during the Kharif season 2021-2022 on grape cuttings cv. Thompson Seedless to assess suitability of growth substancefor efficient root and shoot growth of grape cuttings (Vitis vinifera L.) of Thompson Seedless.The treatments were applied in Randomized Complete Block Design (RCBD) as foliar spray with nine treatments (T_1- Water (Control), T_2- IBA @ 1000 ppm, T_3- IBA @ 750 ppm, T_4- Vermiwash @ 100%, T_5- Vermiwash @ 75%, T_6- Sea weed extract @ 100%, T_7- Sea weed extract @ 75%, T_8- Cow Pit Pat @ 100% and T_9- Cow Pit Pat @ 75%) and replicated thrice. All the treatments were found to be effective in enhancing the root and shoot growth of grape cuttings.However, Vermiwash @ 100% proved to be most effective in terms of average root length(cm),root fresh weight (g), root dry weight (g), average shoot girth (mm), average shoot fresh weight (g) and average shoot dry weight (g).

Key words: CPP, Grape cuttings, IBA, Sea weed, vermicompost

INTRODUCTION

Grape (*Vitis vinifera*) belonging to family *Vitiaceae* is a commercially grown fruit crop of India. It is a temperate crop which has got adapted to sub-tropical climate of peninsular India. Grape is a versatile crop that can adjust to any type of climate. Due to its great benefits, demand for the crop is increasing, becoming increasingly relevant in the fruit industry. The huge percentage of grape production now produced from temperate nations, primarily China, France, and Italy (Food and Agriculture Organization (FAO, 2022). Grapevines are commonly propagated vegetatively, such as through hardwood cuttings (Singh and Chauhan, 2020). Asexual propagation is used because if the plants reproduced by the hardwood start producing fruits ripen early, every year it gives bigger production and high quality of fruits. Cuttings treated with plant hormones are essential in regenerating plants. Grapes are one of India's crucial commercial fruit crops.Thompson Seedlessis one of the most important varieties used for both table and wine grape purposes. Using hardwood cutting, semi-hardwood cutting or softwood cutting, taking cuttings at the appropriate time of the annual growth period of maternal plants, suitable temperature and humidity in environment, using the optimal planting bed, application of plant growth regulators and finding optimal concentrations of these substances, are important factors that should be considered carefully for increasing the rooting in cuttings.Cuttings treated with plant growth regulators are essential in regenerating plants from cuttings. Unfortunately, there are few reports on systematic research on grape propagation from cuttings. As a result, it is felt necessary to research grapevine propagation applying several concentrations of plant regulators for faster proliferation in the nurseries. Vermiwash is a multi-nutrient organic liquid manure decoction obtained from vermicompost unit as drainage. It contains sugars, phenols, amino acids, hormones & plant growth substances like IAA (Auxin), GA_3 (Gibberellic acid), Cytokinin &Humic acids etc. Seaweed is full of growth regulators which can trigger physiological processes (Hamouda *et al.,* 2022). Seaweed acts like phytohormones especially auxin which has an essential role in regulating root development and adventitious rooting process.CPP (Cow Pat Pit) is a biodynamic preparation prepared with locally available materials along with cow dung. It contains high level of Humus along with natural plant

**Corresponding author: sumatinarayan@gmail.com, [2]SKUAST-Kashmir, Srinagar*

hormones like Auxin, Gibberellic acid, Cytokinin etc.The present study was aimed to optimize the hormonal concentrations and natural growth regulators to assess suitable growth substancefor efficient root and shoot growth of grape cuttings (*Vitis vinifera* L.) of Thompson Seedless variety commonly grown in various large of India.

MATERIALS AND METHODS

The present investigation entitled "influence of plant growth regulators and natural substances on the root and shoot growth characteristics of grape (*Vitis venifera*) cuttings" was carried out during the year 2021-2022 in the Department of Horticulture, Sam Higginbottom University of Agriculture, Sciences and Technology, Prayagraj (Allahabad) during the *Kharif* season (2021-2022).The experimental site was situated at an latitude of $20^0$and 15^0North and longitude of $60^0$and 3^0 East and at an altitude of 98 meters above mean sea level(MSL). The experiment consisted of grapes variety Thompson was laid out in a Randomized Complete Block Design with nine treatments and three replications The nine treatment combinations were,T_1- Water (Control), T_2- IBA @ 1000 ppm, T_3- IBA @ 750 ppm, T_4- Vermiwash @ 100%, T_5- Vermiwash @ 75%, T_6- Sea weed extract @ 100%, T_7- Sea weed extract @ 75%, T_8- Cow Pit Pat @ 100%, T_9- Cow Pit Pat @ 75%. The media was prepared, consisting of 20% sand, 20% cowdung, 50% soil and 10% vermicompost. The grape cuttings were then planted in polybags and different treatment combinations were applied in three replications each. Experimental data was subjected to statistical analysis as per the standard statistical procedure given by Gomez and Gomez (1984). Levels of significance used for 'F' and 'T' tests were P = 0.05 as given by Fisher (1970).

RESULTS AND DISCUSSION

Effect on average root length (cm)

Perusal of the data presented in figure 1 revealed that maximum root length (28.90 cm) was recorded under T_8 (Cow pit pat @ 100%) that was also at par with T_9 (Cow pit pat @ 100%) and T_2 (IBA @ 1000 ppm). The minimum root length (25.73 cm) was recorded under T_1 (Control) followed by T_3 (IBA @ 750 ppm) and T_5 (Vermiwash @ 75%). The synthetic auxins like IBA and vermiwash play an important role in producing more number of shoots and leaves. The increases in root length might be due to better utilization of stored carbohydrates, nitrogen, increased level ofauxins and other factors with the help of growth regulators, theauxin treatments stimulate the hydrolysis of nutritional reserves and their mobilization. This was in concordance with the findings of Lalhruaitluanga *et al.* (2022) and Thuraisingham and Seran, (2019).

Effect on root fresh weight (g)

Critical examination of the data (Figure 1) clarified that maximum root fresh weight (11.78 g) was recorded under T_4 (Vermiwash @ 100%) that was statistically at par with T_2 (11.60 g), T_3 (11.00 g), T_5 (11.18 g), T_8 (11.25 g) and T_9 (11.16 g). The minimum root fresh weight (10.53 g) was recorded under T_1 (Control) followed by T_7 (Seaweed extract @ 75%) and T_6 (Seaweed extract @ 100%).In general, the higher doses of treatments showed greater root fresh weight, than their lower dose of the treatments.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. Due to the application ofvermiwash, which contains various growth substances and auxins that had enhanced 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 Singh *et al.,* (2015), Thuraisingham and Seran (2019) and Kaushik and Shukla (2020).

Effect on root dry weight (g)

The Figure 1 revealed that maximum root dry weight (3.23 g) was recorded under T_4 (Vermiwash @ 100%) followed by T_8 (Cow pit pat @ 100%) and T_2 (IBA @ 1000ppm) with an average root dry weight of 3.05 g and 3.01 g respectively. The minimum root dry weight (2.40 g) was recorded under T_1@ Water (Control) followed by T_7 (Seaweed extract @ 75%) and T_6 (Seaweed extract @ 100%) with an average root

dry weight of 2.53 g and 2.75 g respectively. A glance of data indicated that higher doses of the same treatment caused greater root dry weight compared to their lower dose.The dry weight of the roots is directlyproportional to number of roots in each cutting. The increasein number of roots per cutting might have directly influencedthe dry weight of the roots.The maximum root weight was attributed to the fact thatauxins naturally occurring or exogenously applied are forinitiation and growth of roots. The enhanced root dry weight due to the application of IBA was in agreement with Baurie*t al.,* 2017 and Rolaniya*et al.,* 2018). Thuraisingham and Seran (2019) reported that use of vermiwash has the great potential for increasing rooting as well as shoot growth of peppermint stem cuttings.

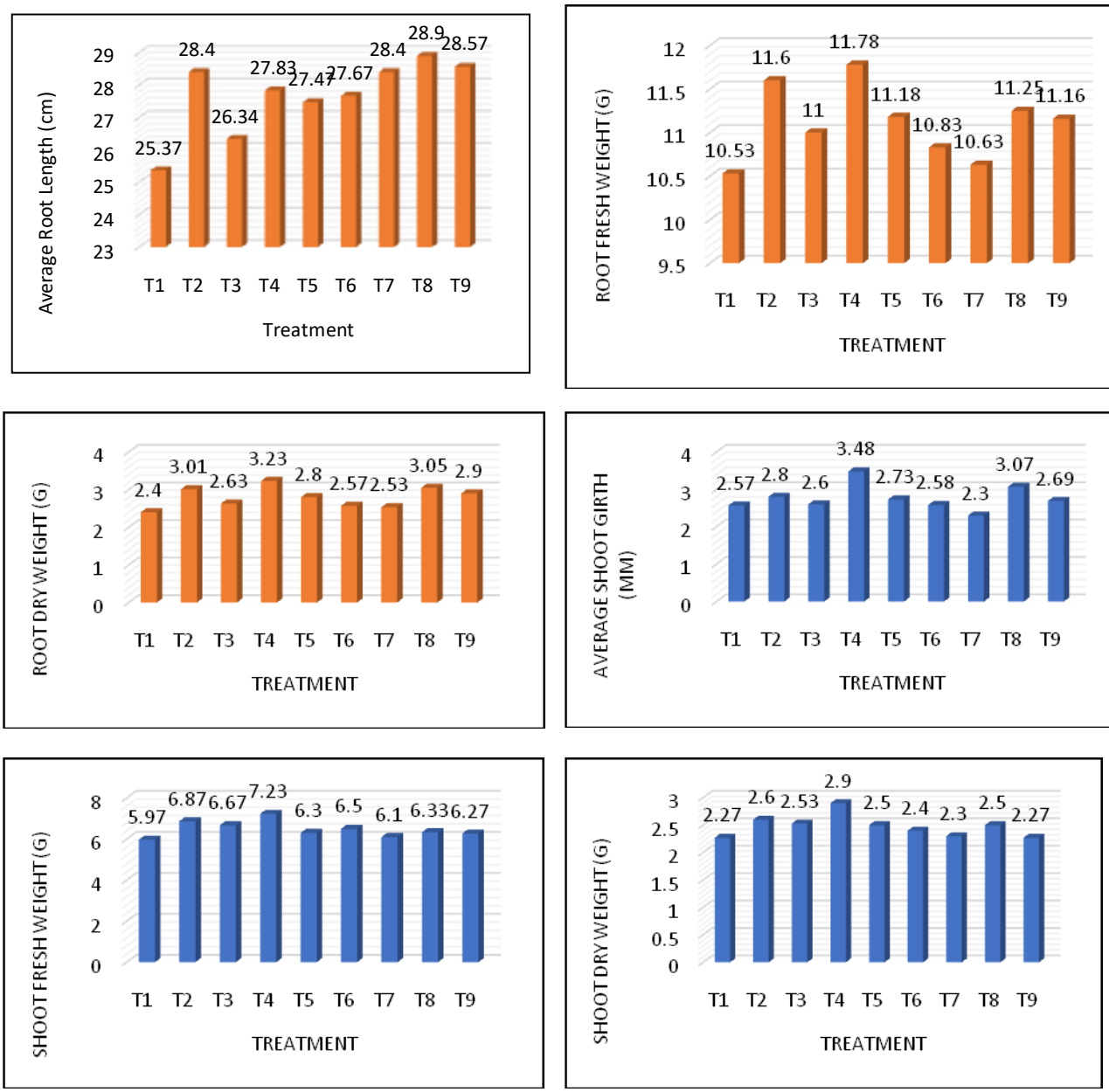

Fig. 1: Overall efficiency ofgrowth regulator (IBA) and various natural substances on days to average root length, root fresh weight (g), root dry weight (g), average shoot girth (mm), average shoot fresh weight (g) and average shoot dry weight (g) in hardwood cuttings of Thompson seedless variety of grape

Effects on average shoot girth (mm)

The perusal of the data in Figure 1 revealed that the maximum shoot girth (3.48 mm) wasrecorded under T_4 (Vermiwash @ 100%) followed by T_8 (Cow pit pat @ 100%) and T_2 (IBA @ 1000ppm). The minimum shoot girth (2.30 mm) was recorded under T_7 (Seaweed extract @ 75%) followed by T_1 (Control) and T_6 (Seaweed extract @ 100%).The same results found by (Waite *et al.,* 2015), it's could be due to auxin's action, which triggered carbohydrate and nitrogen containing material decomposition and translocation, resulting in rapid cell enlargement and in a favorable place of cell division.Similar results with respect to days to first shoot initiation were obtained by Astha *et al.* (2022) and Bhavya *et al.* (2021).

Effects on average shoot fresh weight (g)

Data presented in Figure 1 that maximum shoot fresh weight (7.20 g) wasrecorded under T4 (Vermiwash @ 100%) followed by T2 (IBA @ 1000ppm) and T3 (IBA @ 750ppm). The minimum shoot fresh weight (5.97 g) was recorded under T1 (Control) followed by T7 (Seaweed extract @ 75%) and T9 (Cow pit pat @ 75%). This might have clear from the above result that the increases in the Fresh weight of shoot of cuttings. Application of the auxins like IAA and IBA produced more number of sprouts, leaves, and increased leaf area, leaf chlorophyll content, more starch, total sugar and C/N ratio. It might have resulted in elongation of leaves through cell division and cell elongation as stated by Ghosh *et al.,* (2017) in phalsa. Encouraging effects of vermiwash and Seaweed extract on root as well as shoot growth of stem cuttings (Karthikairaj and Isaiarasu, 2013; Thuraisingham *et al.,* 2019; Rajan and Singh, 2021).

Effect on average shoots dry weight (g)

The data regarding average shoot dry weight (Figure 1) revealed that the maximum shoot dry weight (2.40 g) was recorded under T_4(Vermiwash @ 100%) followed by T_2(IBA @ 1000ppm) and T_3(IBA @ 750ppm) with average shoot dry weight of 2.6 g and 2.53 g respectively. The minimum shoot dry weight (2.27 g) was recorded under T_1 (Control) followed by T_9 (Cow pit pat @ 75%) and T_7(Seaweed extract @ 75%) with an average shoot dry weight of 2.27 g and 2.30 g respectively. The enhanced shoot growth in terms of shoot dry weight due to the application of IBA obtained in the present study was in agreement with the findings of Yeshiwas *et al.,* (2015). The shoot length due to IBA as well as other organic rooting substances may be attributed to increased photosynthetic efficiency, chlorophyll contents, total soluble sugars, soluble proteins, indole derivatives and catalase activity and decreased level of hydrogen peroxide along with peroxidase activity (Pacholczak *et al.,* 2016).

CONCLUSION

From the results it could be concluded that, vermiwash@100% could be promising for initiation of root and other growth characteristics of grape cuttings and can act as an alternative natural product to the chemical auxin IBA. Application of vermiwash improved all the growth related characteristics of the grape cuttings. This could be due to the growth regulators and mineral constituents present in the vermiwash. Therefore, it can be concluded that application of vermiwash is beneficial for obtaining a better growth in Grape cuttings of Thompson Seedless variety.

REFERENCES

Astha, Bahadur, V., Mishra, S. Narayan, S. and Amir, M. (2022) Effect of growth regulator (IBA) and various natural substances on shoot growth of grape cuttings (*Vitis vinifera* L.). *Journal of Community Mobilization and Development*, 17 (3):

Bauri, F.K., Dey, K., Ghosh, A., Chakraborti, K. and Misra, D.K. (2017) Effects of indole butyric acid on rooting in cuttings of Burmese grape, *Baccaureasapida*. *Food and Nutrition, Journal*, **2**: 151.

Bhavya, K., Sumalatha, N., Archana, T. and Lakshmi, K.V. (2021) A review vermiwash: A plant growth booster and a disease suppressor. *The Pharma Innovation Journal*, SP-10(11): 2959-2962

Fisher R. A. (1970) Statistical Methods for Research Workers. Edinburgh: Oliver & Boyd.

Food and Agriculture Organization. FAOSTAT database, (2022) Retrieved February 1, 2022, from https://www. fao.org/faostat/en/#data/QCL.

Ghosh, A., Dey, K., Mani, A., Bauri, F. K and Mishra, D. K. (2017) Efficacy of different levels of IBA and NAA on rooting of Phalsa (*Grewia asiatica* L.) cuttings. *International Journal of Chemical Studies***5**(6): 567-571.

Gomez K. A. and Gomez A. A. (1984) Statistical Procedures for Agricultural Research. 2nd Edition, John Wiley and Sons, New York, 680.

Hamouda, M.M., Saad-Allah, K.M.and Gad, D. (2022) Potential of seaweed extract on growth, physiological, cytological and biochemical parameters of wheat (*Triticum aestivum* L.) seedlings. Journal of Soil Science and Plant Nutrition, **22**: 1818–1831.

Karthikairaj K., and Isaiarasu. L. (2013) Effect of vermiwash on the growth of mulberry cuttings. *World Journal of Agricultural Sciences.***9**: 69-72.

Khushbu and Sarvanan, S. (2018) Effect of plant growth regulators (IIA, IBA, GA_3) on rooting of hardwood cutting of grape (*Vitis venifera* L.) cv. Thompson Seedless.*International Journal of Chemical Studies***7**: 354-361.

Kaushik, S. and Shukla, N. (2020) A review on effect of IBA and NAA and their combination on the rooting of stem cuttings of different ornamental crops. Journal of Pharmacognosy and Phytochemistry, **9** (3): 1881-1885.

Lalhruaitluanga, Bahadur, V., Prasad, V.M. and Kumar, S. (2022) Effects of plant growth regulators (IBA) and soil media on success, growth and survival of stem cutting of Assam Lemon (*Citrus lemon* (L) Burm). *International Journal of Plant & Soil Science*, 34 (23): 288-298.

Pacholczak, A., Nowakowska, K., Pietkiewicz, S. (2016) The effects of synthetic auxin and a seaweed-based biostimulator onphysiological aspects of rhizogenesis in ninebark Stem cuttings. *Not Bot HortiAgrobio*, **44**(1):85-91.

Rajan, R.P and Singh, G. (2021) A review on the use of organic rooting substances for propagation of horticulture crops. *Plant Archives*, 21: 685-692.

Singh, K.K and Y.K.Tomar. (2015) Effect of planting time andindolebutyric acid levels on rooting of woody cuttings of Phalsa (*Grewia asiatica* L.). *HortFlora Research Spectrum*, **4**(1).39-43.

Singh, K.K. and Chauhan, J.S. (2020) A review on vegetative propagation of grape (*Vitis vinifera* L.) through cutting. *Global Journal of Bioscience and Biotechnology*, **9** (2): 50-55.

Thuraisingham, V. and Seran, T. H. (2019) Response of Rooting Attributes of Peppermint (*Mentha piperita L*.) Stem Cuttings to Natural Rooting Stimulators. International Journal of Crop Science and Technology, 5 (1): 20-27.

Yeshiwas, T., Alemayehu, M. and Alemayehu, G. (2015) Effects of Indole Butyric Acid (IBA) and Stem Cuttings on Growth of Stenting-Propagated Rose in Bahir Dar, Ethiopia. *World Journal of Agricultural Sciences***11** (4): 191-197.