



Effect of PGR and Chemicals on Shelf Life, Bunch and Berry Quality Parameters of Sudhakar Seedless Grapes (*Vitis vinifera* L.)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The experiment was conducted on Sudhakar Seedless vines grafted on 110-R rootstock were selected for this study. The experiment was designed in randomized block design (RBD) having five treatments with four replications were carried out at MRDBS Nashik during 2020-2021. Pre-harvest application of treatments (Chitosan at 10 ppm, Naphthalene acetic acid at 100 ppm, activated Potassium salt @ 2.0 g/ liter, Salicylic acid at 2.0 ml/liter and Potassium Schoenite @ 2.0 g/liter along with untreated vines were applied at veraison stage of berry development. Application of Chitosan @ 10 ppm resulted in to the increase berry size and berry quality along with less Number of rotten berries in physiological loss in weight. Followed by the application of Naphthalene acetic acid at 100 ppm recorded less Number of rotten in this study. However, the lowest physiological loss of weight (%) were recorded with the application of Naphthalene acetic acid. The increasing dose of Naphthalene acetic acid resulted into decrease in pre- harvest berry drop. In grapevines, Application of salicylic acid significantly increase in berry weight, bunch weight, Total

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Soluble Solids /acidity ratio as compare to untreated vines. Biochemical composition of berries was influenced by the application of Activated potassium salt at different concentration. The application of Potassium schoenite in grapevines were found effective for increasing TSS of Sudhakar seedless grapes.

Keywords: Chitosan; naphthalene acetic acid; shelf life; potassium schonite; yield and grapevines.

1. INTRODUCTION

“Grape (*Vitis vinifera* L.) is the most important commercial crop grown in India, especially in Maharashtra. Sudhakar seedless. For this variety the veraison (change of color of the grape berries) after 90 days from pruning and require 25 to 30 days for harvest. The fruit will be ready to harvest between 120 to 125 days after pruning being early maturing variety [1]. But the ripe berries are sensitive to hot climates and, keeping qualities (shelf life). To regulate the market supply and to reduce the losses, pre and post-harvest applications with plant growth regulators, chemicals and wrappers have been useful, in extending the shelf life of grapes during storage, enabling to reduce post-harvest losses” [2]. “Plant hormones (also known as phytohormones) are naturally occurring organic substances that influence growth and development in very low concentrations and whose action may be involved in places remote from their origin [3-5]. Hormones determine the formation of flowers, stems, leaves, the shedding of leaves and the development and ripening of fruit. Plants, unlike animals, lack glands that produce and secrete hormones; instead each cell is capable of producing hormones. The influences on fruit production by the growth regulators are numerous and are employed in a wide range of circumstances varying from tissue culturally propagated plants to enhancing post-harvest storage life through almost all stages of plant life in between. It is not always the effect of single growth regulator but the interaction effect of different hormones in combination for instance; the ratio of cytokinin to auxin determines the fate of callus if it is high it promotes shoot proliferation

while as low cytokinin: auxin ratio enhances root formation” (Jain, 2013) [6,7]. “Application of growth regulators is also reported to increase the yield and quality of grape. Among the plant hormones applied in grapes, GA being growth promoting hormone commands a special place and is being used for different purposes such as to loosen the bunch, increase the berry size and improve the growth, yield and quality of fruits” (Jindal, 1985). The present study was, therefore, undertaken to investigate the effect of growth regulators/ enhancer on the yield and quality characteristics of grape under tropical conditions of India.

2. MATERIALS AND METHODS

2.1 Experimental Site

The experiment was conducted at research and developmental vineyards at MRDBS Nashik during 2020-2021. Seven year-old Sudhakar seedless grafted on Dog ridge rootstock were selected for the study. The vines were planted at a spacing of 2.5 m between rows and 1.2 m between vines within a row. The row orientation was in the direction of North – South. The vines were trained to double cordon Y system. The soil of this region is black having pH 7.75 and EC 0.46 dS/m. However, water used for irrigation had EC 1.8 and pH 8.3. The experiment was designed as Randomized Block Design (RBD) having five treatments and 4 replications for each treatments (2.5 m x 1.2 m). Application of following chemicals done at veraison stage of berry development.

Table 1. Treatment details

Treatment details	Dose ml/ha or ppm
Chitosan @ 10 ppm	10.00 ppm
Naphthalene Acetic acid @ 100 ppm	100.00 ppm
Activated Potassium salt @ 2.0 g/ liter	2500 g/ha
Salicylic acid @ 2.0 ml/liter	2000 l/ha
Potassium Schoenite @ 2.0 g/liter	1000 g/ha

2.2 Yield and Yield Components

Yield and berry quality of Sudhakar seedless grapes were recorded at harvest. At harvesting stage parameters such as average bunch weight (g) was calculated from average weight of 15 bunches while yield per vine (kg) was recorded at the time of harvest. Randomly selected berries from bunches were used for berry weight. To measure average berry length and berry diameter, 10 berries were selected randomly from different bunches from a given replication and measured using Digital Vernier Caliper (0–300 mm RSK™) and were expressed in millimeter.

2.3 Biochemical Analysis

Total soluble solids (TSS) were measured using hand refract meter and expressed as degree Brix. Acidity was measured by titrating the sample with 0.1 N sodium hydroxide using phenolphthalein indicator [8]. The total phenol and Tannins content of the berry were determined using the Folin-Ciocalteu method [9] using Catechol, as the standard. Total flavonoid content (TFC) was determined using the aluminum chloride assay described by Samatha et al. [10].

2.4 Physiological Loss in Weight (PLW)

The PLW was calculated on initial weight basis. The physiological loss in weight of bunch was recorded on the basis of initial fresh weight of the fruit and subsequent loss in weight occurred during postharvest storage and expressed as percentage.

$$\text{PLW (\%)} = \frac{\text{Initial weight of fruit} - \text{Final weight of fruit}}{\text{Initial weight of fruit}} * 100$$

Fallen and Rotten Berries (%): Fallen and rotten berry were calculated by using following formulas.

$$\text{Fallen berry (\%)} = \frac{\text{Weight of free berries inside each box}}{\text{Total bunch weight}} * 100$$

$$\text{Rotten berries (\%)} = \frac{\text{Total weight of bunch} - \text{Bunch weight after removing defected berries}}{\text{Total weight of bunch}} * 100$$

2.5 Statistical Analysis

The experiment was conducted in Randomized Block Design consisting of five treatments with

four replications. All calculations were performed using the GLM procedure of SAS System software, (version 9.3.).

3. RESULTS AND DISCUSSION

3.1 Yield and Quality Parameters

Applying the chemicals at different concentration demonstrated a beneficial effect on bunch weight, yield and berry weight in Sudhakar seedless grapes (Table 2). Bunch treated with Chitosan @10 ppm had significantly higher bunch weight (392.56g). Application of Naphthalene acetic Acid at pre veraison stage increases the yield per vine. Result obtained from this study clearly showed that the yield significantly increased by the application of Naphthalene acetic Acid at 100 ppm (14.60kg) followed by the treatment Salicylic acid (13.53 kg). The results confirm the finding of Manish Prajapati and Devi Singh [11] while working on Guava (*Psidium guajava* L.) they reported that combination of different plant growth regulators significantly affected the parameters such as plant height, fresh fruit weight(g), yield/plant (kg) found to be under the treatment (NAPHTHALENEACETIC ACID 200 ppm). There were no significant differences were recorded for berry length, berry diameter and pedicel diameter.

The data recorded on TSS, Acidity was significantly influenced by potassium schonite the treatments. The highest T.S.S. (21.02°Brix) with least Acidity (0.47 %) was obtained with application potassium schonite. While, least TSS. This investigation might be due to the higher concentration of Naphthalene acetic Acid at 100 ppm. The study confirms the finding of Teatota et al. (1972) found that pre-harvest spraying of Naphthalene acetic Acid at different concentration viz. 100 ppm increased the TSS content of guava fruits. Also, Mahmud et al. [12] opined that “the decrease in titratable acidity in papaya during storage probably due to decrease in citric acid and calcium causing inhibition of enzymatic activity leading to delay in the use of organic acid in the enzymatic reaction of respiration. The mean TSS and acid ratio increased with increase in storage period. The maximum TSS and acid ratio was observed in potassium schonite followed by the Salicylic acid 2ml/ lit”.

Table 2. Effect of PGR and other chemicals on bunch and berry quality parameters of Sudhakar seedless grapes

Treatment	Bunch Weight (g)	Berry Weight (g)	Berry diameter (mm)	Berry length (mm)	Pedicle diameter (mm)	Skin Thickness (mm)	TSS (°Brix)	Acidity (%)	Yield/ vine kg /Vine
T1	392.56	3.50	17.10	18.09	1.11	18.67	19.56	0.56	13.01
T2	320.14	4.12	18.05	19.43	1.28	29.00	18.21	0.66	14.60
T3	300.95	3.09	16.12	17.16	1.04	17.00	19.60	0.60	12.86
T4	377.68	3.96	17.73	18.86	1.21	20.67	18.60	0.66	13.53
T5	352.05	3.67	16.82	17.75	1.16	19.33	21.02	0.47	13.49
SEm (±)	5.04	0.03	0.23	0.35	0.03	2.16	0.24	0.03	0.23
C.D @ 0.5 %	16.70	0.09	0.78	1.16	0.09	7.14	0.81	0.09	0.76

Table 3. Effect of PGR and other chemicals on biochemical parameters of Sudhakar seedless grapes

Treatment	Phenol (mg/g) fresh.wt.	Tannin (mg/g) fresh.wt.	Flavonoids (mg/g) fresh.wt.
T ₁	1.72	2.08	54.77
T ₂	3.66	3.78	80.54
T ₃	1.61	1.87	49.57
T ₄	1.21	1.54	50.91
T ₅ Control	2.93	3.04	62.05
SEm (±)	0.17	0.26	1.66
C.D @ 0.5 %	0.56	0.88	5.52

Table 4. Effect of PGR and other chemicals on Shelf life of Sudhakar seedless Grapes at 7th Day after storage

Treatment	PLW (%)	Fallen Berry (%)	Rotten Berry (%)
T ₁	9.42	2.25	2.15
T ₂	7.21	2.89	3.15
T ₃	8.10	2.10	3.84
T ₄	7.56	1.52	8.50
T ₅ Control	10.58	4.75	10.13
SEm (±)	0.59	0.84	1.41
C.D @ 0.5 %	1.50	1.84	3.08

3.2 Biochemical Parameters

The data recorded on biochemical changes of Sudhakar seedless vines were presented in Table 3. The result obtained from the study revealed that the application of PGR at different concentration does not affect the phenolic properties of berry. This result might be just due to the time of application of NAPHTHALENEACETIC ACID and its chemical properties. NAPHTHALENEACETIC ACID is applied to increase the shelf life of grapes at pre veraison stage. The result in hand confirm the finding of Artes- Hernandez et al. [13] reported that “white Superior Seedless table grapes stored for 7 days at 0 °C, followed by 4 days at 8 °C under modified atmosphere packaging, did not change their total phenolic content. Further slight decreases were seen during their subsequent shelf- life”.

3.3 Physiological Loss in Weight (PLW)

The data on physiological loss in weight (PLW) of grape bunches as influenced by the pre-harvest treatment with growth regulators are presented in Table 4. Among the treatments highest PLW was observed in control at (10.58 per cent). PLW was less in NAPHTHALENEACETIC ACID @ 100 ppm at (7.23 percent). Data revealed that reduced PLW %, fallen berries %, rotten berries % were observed with application of Chitosan. Findings confirm with the report of Ranjeet and Gupta [14] that pre harvest spray of NAPHTHALENEACETIC ACID @ 100 reduced the physiological loss in weight in perlette grapes. The results obtained in this investigation might be due to the application of NAPHTHALENEACETIC ACID at pre harvest reduces water loss in berries after post-harvest storage. These studies confirm the findings of Dass et al. [15]; Beerh et al. [16] reported that the use of growth regulators as pre-harvest

sprays improves the quality of grapes and also the shelf life. In Cheema Sahebi, a pre-harvest spray of NAPHTHALENEACETIC ACID @ 50 and @ 100 ppm significantly reduced the post-harvest berry shattering.

4. CONCLUSION

From the present study, it was concluded that the application of Chitosan at 10 ppm increases berry weight, bunch weight and yield per vine. In addition, the application of Naphthalene acetic Acid at 100 ppm concentration at pre veraison stage significantly reduced the berry drop and increases the shelf life of Sudhakar seedless grapes which represent serious problem in this variety.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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