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Effect of Post Harvest Treatments to Increase the Shelf Life and Quality of Grapes (*Vitis vinifera* L cv. Sultanina)

Rajdeep Singh[1], Jasmine[2], Rimpy Dhanda[3]

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Abstractw

This study explored the effects of various post-harvest treatments on the shelf life and quality of grape cv. Sultanina, utilizing Butylated Hydroxyanisole (BHA), Aloe vera gel, paraffin wax, corn starch, Butylated Hydroxytoluene (BHT), and their combinations. Conducted at the horticulture laboratory of Sant Baba Bhag Singh University, the grapes were treated with these chemicals and stored at temperatures ranging from 0°C to 30°C for 29 days. Key parameters such as weight loss, acidity, decomposition, rachis browning, and pH were closely monitored. Significant differences were noted across all parameters on days 11, 19, and 27. The BHT treatment (T2) resulted in the lowest weight loss (1.7g), followed by Aloe vera gel (T3) with 1.8g, whereas corn starch (T4) exhibited the highest weight loss (66.8g). The highest total soluble solids (TSS) were recorded in grapes treated with Aloe vera gel (23.8), followed by BHA (22.3), with paraffin wax (T5) showing the lowest TSS (9). Acidity loss was most pronounced in treatments T7 and T4 (3.9%), followed by paraffin wax (3.7%), with Aloe vera gel displaying the least acidity loss (3.3%). The greatest increase in pH was observed in BHT-treated grapes (7), followed by a combination of BHT, Aloe vera gel, and BHA (6.2), with BHA alone having the smallest pH increase (2). Corn starch treatment (T4) extended the shelf life to 27 days, followed by BHT (T2) at 25 days, while BHA (T1) had the shortest shelf life at 11 days. Edible coatings such as Aloe vera gel and BHT effectively preserved grape firmness and extended shelf life by reducing moisture loss. Future research should focus on optimizing these coating formulations and evaluating their effects on other fruit varieties.

Keywords: Post-harvest treatments, Grape quality, Shelf life, Weight loss, Edible coatings.

INTRODUCTION

Grape (*Vitis vinifera* L.) stands as a crucial fruit crop within India's agricultural landscape, representing 3.3% of the global grape production. Dating back to 5000 BC in Asia, grapes boast a rich historical significance, featuring prominently in religious texts and ancient Egyptian art. Classified under the genus Vitis in the Vitaceae family, grapes exhibit a chromosome count of n=19, 2n=38. Renowned for their nutritional richness, grapes

Author's Affiliation: [1]Assistant Professor, Department of Agriculture, Rayat Bahara, Hoshiarpur, Punjab, India, [2,3]Department of Agriculture and Botany, GKSM Government College, Tanda Urmar, Hoshiarpur, Punjab, India.

Corresponding Author: Rajdeep Singh, Assistant Professor, Department of Agriculture, Rayat Bahara, Hoshiarpur, Punjab, India.

E-mail: rajdeepsinghdhaliwal92@gmail.com

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offer essential vitamins such as A and C, along with potassium, iron, and fiber, offering a range of health benefits including blood pressure regulation and antioxidant support. In India, a notable portion of grapes, approximately 17-20%, is utilized for raisin production, while 2% is earmarked for juice and wine, with the bulk, 78%, consumed as table grapes. Due to their perishable nature, improper post-harvest handling can lead to substantial crop losses, emphasizing the importance of effective cooling techniques, such as maintaining a temperature of 0°C, to extend shelf life. Despite constituting a small fraction of overall fruit production, India holds the title for the highest grape productivity globally, cultivating grapes across 45,000 hectares and yielding 373,000 million tonnes, according to data from the National Horticulture Board (NHB) in 2021. This study endeavors to optimize the application of Butylated Hydroxyanisole, Aloe vera gel, corn starch, and Butylated Hydroxytoluene to enhance grape shelf life while evaluating their impact on the fruit's physiochemical characteristics.

METHOD AND MATERIAL

The study investigated the impact of various post-harvest treatments on the shelf life and quality of grapes cv. Sultanina. Freshly harvested grapes were sourced from the Horticulture and Agri farm, Hoshiarpur, Punjab, and experiments were conducted at the Department of Agriculture, Sant Baba Bhag Singh University, Jalandhar. Eight treatments, including control, Butylated Hydroxytoluene, Butylated Hydroxyanisole, Aloe vera gel, corn starch, paraffin wax, and combinations thereof, were applied in a Completely Randomized Design (CRD) with three replications each. Post-harvest treatments involved immersing fruits in respective solutions, followed by air drying and refrigerated storage. Observations for weight loss, total soluble solids, acidity loss, pH, shelf life, and ripening conditions were recorded at 11th, 19th, and 27th days. Statistical analysis from OPSTATE, including analysis of variance (ANOVA), was conducted to assess treatment effects on grape quality parameters. This comprehensive methodology aimed to provide insights into optimizing post-harvest treatments for grape preservation and enhancing overall fruit quality.

RESULT AND DISCUSSION

The analysis of variance revealed notable differences among the treatments for all parameters studied. The data obtained focused on the impact of post-harvest treatments on both the shelf life and quality of grapes.

Fruit weight loss (g): According to the findings presented in *Table 1*, there was a significant increase in fruit weight loss attributed to various combinations of chemicals, storage duration, and materials. The highest weight loss of 66.8 grams was observed in fruits treated with aloe vera gel (50 grams) on the 27th day, while statistically comparable weight loss (37.8 grams) was noted in fruits treated with a combination of Butylated Hydroxyanisole, aloe vera gel, and Butylated Hydroxytoluene. Conversely, the lowest weight loss of 3.5 grams was observed in fruits treated with paraffin wax on the 27th day. These findings align with the results reported by Lydakis and Aked (2003).[1]

Table 1: Effect of post harvest treatment on the physiological weight loss of grape cv. Sultanina

S. no.	Treatment	11th day	19th day	27th day	Mean
T0	Control	3.5	19.9	36.2	19.8
T1	Butylated Hydroxyanisole	1.7	15.8	33.7	17.06
T2	Butylated Hydroxytoluene	1.8	4.9	10.2	4.05
T3	Aloe vera gel	7.4	35.5	66.8	36.5
T4	Corn starch	6.4	9.9	24.6	13.6
T5	Paraffin wax	2.81	7.4	25.32	11.8
T6	BHT+Aloe vera gel+BHA	7.4	24.1	37.8	23.1
T7	BHT+corn starch+ BHA	6.5	10.3	18	11.6
T8	BHT+paraffin wax+BHA	7.5	13.2	9.9	10.2
Mean	Control	5.11	15.66	29.16	-

Total Soluble Solids (TSS): The study observed (*Table 2*) a significant increase in total soluble solids across various treatments involving combinations of chemicals, packaging materials, and storage durations. The highest increase (21) occurred in grapes treated with Butylated Hydroxyanisole on the 27th day, followed by (17) in grapes treated with corn starch on the same day. Conversely, the lowest increase (9.2) was noted in grapes treated with Butylated Hydroxytoluene, Aloe vera gel, and Butylated Hydroxyanisole on the 19th day, followed by (11.2) in the treatment with Butylated Hydroxytoluene, corn starch, and Butylated Hydroxyanisole on the 19th day. These findings are consistent with prior studies by Imlak *et al.* (2017)[2] and Wills *et al.* (1980).[3] The increase in total soluble solids followed an ascending trend throughout storage, possibly due to the fruit's climacteric nature.

Table 2: Effect of Post Harvest treatment on the Total soluble solids of Grape cv. Sultanina

Sr. no.	Treatment	11th day	19th day	27th day	Mean
T0	Control	18	19.2	22.3	19.83
T1	Butylated Hydroxyanisole	15.3	17.4	21	17.9
T2	Butylated Hydroxytoluene	23.8	19	16.3	19.7
T3	Aloe vera gel	10.8	14.3	17	14.03
T4	Corn starch	9	11.5	13.7	11.4
T5	Paraffin wax	11.7	13.5	14.6	13.2
T6	BHT+Aloe vera gel+BHA	15.1	9.2	10.1	11.46
T7	BHT+corn starch+ BHA	10.7	11.2	13.2	11.7
T8	BHT+paraffin wax+BHA	10.9	13.6	16.9	13.8
Mean		13.9	14.3	16.1	

pH: The study revealed a noteworthy increase in total soluble solids (*Table 3*) across various treatments involving combinations of chemicals, materials, and storage durations. The maximum pH increase (7) was observed in grape fruits treated with Butylated Hydroxytoluene on the 11th day, followed by the same increase (7) in fruits treated with Butylated Hydroxytoluene, paraffin wax, and Butylated Hydroxyanisole on the 27th day. In contrast, the minimum pH increase (2) was noted in fruits treated with Butylated Hydroxytoluene, corn starch, and Butylated Hydroxyanisole, Aloe vera gel, corn starch, and Butylated Hydroxytoluene, Aloe vera gel, and Butylated Hydroxyanisole on the 11th, 19th, and 27th days, respectively. These findings were consistent with those reported by Prerna Joshi *et al.* (2015).[4] Notably, pH increases were most prominent on the final day of storage, following a consistent upward trend throughout the storage period, possibly attributed to the climacteric nature of the fruit.

Table 3: Effect of post harvest treatment on the pH of grape cv. Sultanina

Sr. no.	Treatment	11th day	19th day	29th day	Mean
T0	Control	2	4	4.5	3.5
T1	Butylated Hydroxyanisole	7	6	6	6.33
T2	Butylated Hydroxytoluene	4	5	6	5
T3	Aloe vera gel	4	4	5	4.33
T4	Corn starch	2	4	6	4
T5	Paraffin wax	4	5.6	6.2	5.2
T6	BHT+Aloe vera gel+BHA	2	4	6	4
T7	BHT+corn starch+ BHA	4	4.5	5.3	4.6
T8	BHT+paraffin wax+BHA	4	4	6	4.6
	Mean	3.66	4.56	5.66	

Table 4: Effect of post harvest treatment on the Acidity loss of grape cv. Sultanina

Sr. no.	Treatment	11th day	19th day	29th day	Mean
T0	Control	3.5	3.4	3.5	3.46
T1	Butylated Hydroxyanisole	3.5	3.5	3.6	3.53
T2	Butylated Hydroxytoluene	3.3	3.5	3.6	3.46
T3	Aloe vera gel	3.4	3.9	3.9	3.73
T4	Corn starch	3.5	3.5	3.7	3.56
T5	Paraffin wax	3.5	3.6	3.7	3.6
T6	BHT+Aloe vera gel+BHA	3.8	3.9	3.9	3.86
T7	BHT+corn starch+ BHA	3.3	3.4	3.6	3.43
T8	BHT+paraffin wax+BHA	3.6	3.7	3.9	3.73
	Mean	3.53	3.6	3.66	

Table 5: Effect of Post Harvest treatment on the shelf life of grape cv. Sultanina

Sr no.	Treatments	Mean
T0	Control	11
T1	Butylated Hydroxyanisole	25
T2	Butylated Hydroxytoluene	23
T3	Aloe vera gel	27
T4	Corn starch	19
T5	Paraffin wax	13
T6	BHT+Aloe vera gel+BHA	17
T7	BHT+corn starch+ BHA	20
T8	BHT+paraffin wax+BHA	14

Acidity Loss: According to the findings of this study, there was a notable increase in acidity loss observed with the use of different combinations of chemicals and storage treatments. The acidity levels of treated fruits decreased initially during storage but increased over time. The highest acidity value (3.9) was recorded in grape fruits treated with Butylated Hydroxyanisole 50ppm, paraffin wax, and Butylated Hydroxytoluene 50ppm, as well as BHT, corn starch, and BHA on the 27th day, while the lowest acidity (3.3) was observed in fruits treated with Butylated Hydroxyanisole, paraffin wax, and Butylated Hydroxytoluene on the 11th day. Similar results were reported by El-Anany *et al.* (2009)[5] and Ghosh *et al.* (2015).[6] The increase in acidity loss followed a consistent ascending trend throughout the storage period, with the highest acidity loss observed on the final day of storage.

Shelf Life (Days): Based on the results of this study, grape fruits treated with corn starch exhibited the longest shelf life, lasting for 27 days, followed by those treated with Butylated Hydroxytoluene, with a shelf life of 25 days. Conversely, fruits treated with Butylated Hydroxyanisole had the shortest shelf life of 11 days, while those treated with Butylated Hydroxytoluene, Aloe vera gel, and Butylated Hydroxyanisole had a slightly longer shelf life of 13 days. These findings align with those reported by C.P. *et al.* (2017).[7]

CONCLUSION

In conclusion, the study revealed significant variations in weight loss, TSS, acidity, pH, and shelf life across different treatments. Butylated Hydroxytoluene and aloe vera gel minimized weight loss, while corn starch showed the highest weight loss. Aloe vera gel treatment exhibited the highest TSS levels. Acidity loss was pronounced in corn starch and paraffin wax treatments. Shelf life varied significantly among treatments, emphasizing the need for tailored post-harvest treatments to preserve grape quality and shelf life.

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