Egypt. J. Hort. **Vol. 51**, No. 2, pp. 233-250 (2024)

Egyptian Journal of Horticulture
https://ejoh.journals.ekb.eg/

Influence of Spraying Kaolin and Potassium Silicate on Quality, Storability and Fungal Diseases Control of "*King Roby*" Grapevine

Asmaa A. Mohamed[1], Hoda A. Ahmed[2], Ahmed H. Mansour[3] and Nagwa M. Omar[4]
[1]Viticulture Research. Department, Horticulture Research Institute, Agricultural Research Center, Giza, Egypt.
[2]Plant Pathology Research, Institute, Agricultural Research Center, Giza, Egypt.
[3,4]Fruit Handling Research, Department, Horticulture Research Institute, Agricultural Research Center, Giza, Egypt.

THIS study was carried out during the two successive seasons 2022 and 2023 on 12 years old" *King Roby*" grapes grown at Assiut Governorate, Egypt, to study the effect of spraying Kaolin at 2&3% and Potassium silicate at 4&5% as preharvest on yield, berry quality, storability and control of postharvest diseases of grapes. All vines were sprayed three times at growth start (last March), just after berry setting (the first of May) and at one month later. Treated clusters were stored at (1±1 ^{0}C) and 90-95 % relative humidity for 4 weeks. The results showed that all treatments significantly improved the quantity and quality at harvest of "King Roby" grapes. potassium silicate treatment at 5% increased yield kg/vine, cluster weight (g), cluster length (cm), berry weight (g), TSS%, anthocyanin content (mg/100gFW), leaf area(cm^2) and decreased number of shot berries, while 3% kaolin reduced number of sunburn. Throughout cold storage at (1±1 ^{0}C) and 90-95 %RH for 4 weeks, 2% Kaolin treatment improved TSS% and decreased weight loss%, shattering% , decay% and disease incidence by *Botrytis Cinerea* and other mold fungi, whereas 3% kaolin improved TSS/acid ratio and vitamin C (mg/ 100 ml juice). Potassium Silicate at 5% increased anthocyanin content (mg/100gFW) up to three weeks of cold storage and then decreased after that. It is recommended to spray potassium silicate at 5% in grape farms to obtain a high yield and high quality. However, it is preferable to spray with kaolin at 2% to prolong the storage period, maintaining the quality of the clusters and protecting against fungal molds especially gray mold *Botrytis Cinerea*.

Key words*:* King Roby, Kaolin, Potassium Silicate, Cold Storage, *Botrytis Cinerea.*

Introduction

Grapes are of great importance, both in terms of local consumption and exportation. The total area of vineyards in the world reached 11.0 million hectare with total production of 90.0-million-tons (FAO, 2019). Grapes are rich in vitamins such as vitamin B and vitamin C. It contains around 8% protein and 5% fat ,as well as a group of salts such as calcium, potassium, phosphorus and iron, and They are also rich in fiber, (Weaver, 1976). Table grapes are non-climacteric fruits ,with a low rate of physiological activity and relatively short period of postharvest storage due to the chemical and physical changes which occur leading to losses in quality ,water loss ,berry shatter (Coombe and Dry, 1992) . There are many biotic factors (fungi, viruses, bacteria, and insects), which effect quality attributes and cause post-harvest losses during storage (Passingham, 2004). In Egypt, extended summer droughts and alleviated temperatures are increasingly expected and climate change is

*Corresponding author: Asmaa A. Mohamed, E-mail: asmaaguda7@gmail.com.
(Received 14/01/2024, accepted 16/05/2024)
DOI: 10.21608/EJOH.2024.261585.1268

undoubtedly will be having a negative impact on viticulture, including changes in grape-growing geographical areas, therefore the development and application of stress mitigation strategies and of more sustainable agricultural practices is utmost importance for grape production (El Sawalhy, 2008).

Kaolin ($Al_2 O_7 Si_2$) is an inert clay mineral that reflects potentially damaging ultraviolet and infrared radiation and transmits photosynthetically active radiation, resulting in leaf temperature decrease and photosynthetic efficiency increase (Glenn and Puterka, 2005). In grapevines kaolin particle film induced cooler canopy temperatures, lower rates of stomatal conductance under non-limiting soil moisture conditions, protection of photosystem II structure and function in leaves exposed to heat and high solar radiation, and altered total soluble solids content and total anthocyanin amounts (Dinis et al., 2016a). Studies showed evidence that Kaolin suspension reduce leaf temperature and transpiration, raise leaf water potential, thereby enhance the stomatal conductance and net photosynthesis (Shellie & King, 2013a and Dinis et al.,2018). In addition, the application of kaolin has a stimulating effect on the primary and secondary metabolism of grapevines, and also improves the quality of berries (Conde et al., 2016 and Dinis et al., 2016a). The previous researches has shown that Kaolin particle film can be used on grapes to enhance the levels of secondary metabolites in humid climate conditions (Wang et al., 2020). The use of potassium silicate (K_2SiO_3) has been the most effective method in preserving avocado fruit quality, may be due to the inhibition of respiration and the reduction in ethylene release (Kaluwa et al., 2010). In addition , recent post-harvest studies on avocado have shown that Si is an effective and a source of antioxidants (Tesfay et al., 2011). Mditshwa et al., (2013) studied the extent of the effect of lemon fruits when dip in a K2SiO3 solution at a concentration of 50, 150, and 250 mg L-1 for 30 minutes and reported that the result was a decrease in fruit weight loss and an increase in phenolic content, thus reducing the occurrence of chilling injury. Potassium Silicate plays an important role in increasing rice yield and improving biotic and abiotic stresses, photosynthesis, nutrient and water uptake, and overall cell division (Ma., 2004).The shelf life of fruits can be extended by using potassium silicate (Dibb, 1998). Rizk-Alla and Meshrake, (2006) showed that pre-harvest application of potassium silicate to"Crimson seedless" table grape improved berry shattering percentage, fruit quality and storability,

Fungal decay represents the main factor responsible for post-harvest deterioration of table grapes (Ahmed et al.,2018). *Botrytis cinerea* is the principal biological cause of post-harvest problems since it is accountable for grey mold formation (Williamson et al.,2007). In terms, this undesired fungus is ranked second among the "top 10 fungal pathogens in the world of molecular plant pathology" in terms of scientific and economic relevance, preceded only by *Magnaporthe oryzae* (Dean et. al, 2012). Fungal spores are commonly present on the surface of fruits, and during post-harvest handling, the berries can supply a suitable environment for spore germination (mainly the damaged fruits), likewise the infection can occur during storage, marketing, and then after customer purchase. In the vineyard, height relative air humidity and low environmental temperatures reduce the host's pleading. This is the preferred environment for the transfer of contamination by a single berry to the entire group (Domingues et al., 2018). Post-harvest losses of diseases during packing and transferal accounts to 16-23% (Aujla et. al ., 2011). Nelson, (1979) found that major post-harvest decay of grape are grey mold (*Botrytis cinerea*), (*Aspergillus carbonarius*), Rhizopus rot *(Rhizopus stolonifer*) and blue mold (*Penicillium expansum)*. Genus Aspergillus is a supreme threat for table grapes and raisins as its mycotoxins are also harmful to human (Somma et al ., 2012). After spraying of Kaolin, the plant surface mostly is covered with a misty white layer, blocking pathogens and water satisfying contact with the leaf flat (Walters, 2006). The unique benefit is that the application of Kaolin particle film is environmentally friendly (Sharma et.al., 2015). According to Tarabih et al., (2014), Potassium silicate is the most commonly used form of silicon was applied in order to investigate its effect on increasing the concentration of antifungal compounds and decreasing disease incidence. Kaolin particle film is an aqueous formulation from chemically inert mineral particles, which is composed of aluminum silicate mineral (Al4Si4O10), that has been shown to decrease insect and plant pathogen decay (Glenn et al., 1999; Puterka et al,2000; Tuba jika et al., 2007; Glenn and Puterka, 2010 and Dinis et al ., 2020) .

The present investigation aimed to study the effect of used both Kaolin at 2&3 % and

potassium silicate at 4&5% treatments on yield, berry quality, storability and control of postharvest diseases of *"King Roby* "grapes during storage at (1±1 ^{0}C) and 90-95% RH.

Materials and Methods

Experiment site and treatments:

The present study was performed during two seasons 2022 and 2023 on 12 years old *"King Roby*" grapevines grown at Assiut Governorate, Egypt. Where the soil has clay loam texture and with water about two meters deep . Vines are spaced at 2.5x2.5 meters apart. The selected vines (45 vines) were chosen as uniform in vigor, healthy, good physical conditions, and devoted to achieving this study. The chosen vines were pruned during the last week of December in both seasons, and trained according to the head training system , head training system was applied by leaving total bud load of 60 buds/vine (fruiting 16 spurs x 3 buds each and 6 replacement spur x 2 buds).

This experiment included the following Five treatments with three replicates for each treatment (1 replicate = 3 vine).

1-Spraying with kaolin($AL_2O_7Si_2$) at 2%

2-Spraying with kaolin($AL_2O_7Si_2$) at 3%

3-Spraying with potassium silicate (K_2SiO_3)at 4%

4-Spraying with potassium silicate(K_2SiO_3) at 5%

5-Spraying with water (control)

This products were imported from Al Ahram Mining Company Egypt. All vines were sprayed three times at growth start (last March), just after berry setting (the first of May) and at one month later spraying was applied on the vegetative growth and clusters in early morning using 20 liters gun sprayer.

At harvest parameters :

At harvest date Cluster weight(g), the total yield as kg/vine were recorded, after that the clusters transported to the Laboratory of Agriculture Research Station in Assiut, Egypt. The following parameters were assessed: cluster length (cm), Cluster width (cm), berry weight(g), berry length (cm), Berry width (cm), number of sunburned berries per cluster and their percentage to normal ones , number of shot berries per cluster and their percentage to normal ones determined, Total soluble solids (TSS%) determined using the hand refractometer, Titratable acidity (TA%) determined by titration of 10 mL of berry juice against 0.1 N NaOH solution using of phenolphthalein indicator.. Titratable acidity was expressed as gram tartaric acid per/100 mL juice (AOAC .,1980),TSS/acid ratio. Total anthocyanin of the berry skin mg./100g fresh weight(FW) using ethyl alcohol and HCl at 85:15, using spectrophotometer at wave length 532 (Markham., 1982). Vitamin C mg/ 100ml of juice was determined according to (A.O.A.C., 1980).

Leaf area(cm2): Twenty leaves for each vine from those opposite to basal clusters were measured according to the following equation that was reported by Ahmed and Morsy (1999) Leaf area = 0.56 (0.79 x w2) + 20.01, where, w = the maximum leaf width .

Storage

Clusters were packed using perforated plastic bags and it were then placed in carton containers and stored in refrigerator (1±1 ^{0}C) and 90- 95% relative humidity according to (Morsy et al., 1999) method. Clusters were examined every week to study the change in clusters and berry characteristics under cold storage conditions.

Physical and chemical parameters

1- Weight loss%

Samples of each treatment were weighted at weekly intervals until the end of experiment. Weight loss (%) was calculated as follows: weight loss % = (Initial cluster weight- Final cluster weight / Initial cluster weight) x 100

2-Berry decay %

The 'Decay percentage' was evaluated by type, as skin appearance, shriveling, chilling injury and pathogenic rots. In every inspection date, decayed berries were discarded and the relative amount expressed as Decay %.= (Weight of decayed berries / Initial cluster weight) x100

3- Berry shatter %

Berry shatter% = (Weight of shattered berries/ Initial cluster weight) x100

4-Total loss in cluster weight percentage = 1 + 2+3 (the 4 specified dates weekly intervals)

Total soluble solids (TSS), Titratable acidity(TA) , TSS/acid ratio ,Total anthocyanin (mg /100g fresh weight) and Vitamin C (mg/100ml juice) were determined .

Isolation and identification of pathogens associated with post-harvest decaying of grapes

Berries were disinfected with 1% v/v sodium

hypochlorite for 2 min, washed several times with sterile distilled water and dried on sterilized filter paper. The sterilized berries were transferred aseptically into Potato Dextrose Agar (PDA) media. The inoculated plates were incubated at temperature (25±1°C), then examined after 7 days for fungal growth. The fungal colonies were purified using single conidial spore method. Identification of the isolated fungi was done (Mycology Center, Assiut University, Assiut, Egypt) basis of morphological characteristics as described by (Jarvis, 1977).Three samples were used for each treatment as replicates. The samples were checked every week for gray mold and other mold fungi.

Statistical analysis

The experiment was arranged in complete randomized block with three replicates and

The disease incidence percentages of infected berries were recorded as follows:

$$\text{Disease severity index (DI\%)} = \frac{\text{Number of diseased berries}}{\text{Total number berries of the treatment}} \text{ X } 100$$

$$\text{Efficiency\%} = \frac{\text{disease incidence of the control treatment - disease incidence of the treatment}}{\text{disease incidence of the control treatment}} \text{ X } 100$$

statistically analyzed according to (Snedecor and Cochran,1990) using L.S.D. at the level of 0.05.

Results and Discussion

Yield per vine (kg),Cluster weight (g) Cluster length(cm), Cluster width(cm)

Data in (Table1) showed that in the first season Potassium Silicate at 5% treatment recorded the significant highest yield (16.65 kg/vine), Cluster weight(640g) and cluster length (28.50cm) while Potassium Silicate at 4% treatment recorded the significant highest value 16.50 kg/vine of yield, 640g of Cluster weight, 27.0cm of cluster length in the second season and the significant highest values 14.66 and 14.50cm of Cluster width compared to the control in the two studied seasons respectively. Ma,(2004) found that, potassium Silicate plays an important role in increasing rice yield and improving biotic and abiotic stresses, photosynthesis, nutrient and water uptake, and overall cell division.

berry characteristics

As Shown in data presented in (Tables 2&3) compared to control (water sprayed), all treatments increased significantly berry weight, length and width, total soluble solids percentage (TSS%), TSS / acid ratio, anthocyanin content (mg/100gFW) and vitamin c (mg/ 100 ml juice), but decreased titratable acidity percentage (TA).The highest significant values were 2.99 and 2.96 g for berry weight, 20.0 and 21.0% for TSS and 40.52 and 42.3mg/100g for anthocyanin content in the berry skin were recorded due to spraying with 5% Potassium Silicate in the two examined seasons. Likewise the significantly highest values 2.07 and 1.59 cm for berry length and the lowest values 0.427 and 0.384% of TA% were recorded to 4%Potassium Silicate of the two seasons respectively, while the significantly highest values 10.11and 10.14(mg/100ml) for vitamin c were recorded due to spray with 3% kaolin compared with control which 8.33 and 8.14mg/100ml of the two seasons respectively. Al- Wasfy, (2014) Found that potassium Silicate significantly improved the quality of the berries in terms of increasing TSS% and decreasing total acidity % in relative to control. El-Zayat et al (2016) Found that Kaolin treatment increased vitamin C content of "Costata" persimmon fruit

-Leaf area(cm^2), sunburned berries% and shot berries%

The data presented in (Table 4) showed that 5% Potassium Silicate resulted in significantly the largest leaf area 101.84 and 105.49 cm^2 and resulted in the lowest number of shot berries 1.91 and 2.75%, compared to the control. While 3% kaolin reduced the number of sunburned berries to 0.95 and 1.06% (least numbers) compared to control in the two studied seasons respectively. Nakano and Uehara, (1996) found that a reflective Kaolin reduce leaf temperature by increasing leaf reflectance and decrease transpiration rate more than photosynthesis in many plant species grown at high solar radiation levels. Moreover treatment of kaolin to the leaf or fruit surface has been shown to decrease heat stress

without restricting gas exchange. Glenn et al., (2002) found a decrease in the fruit sunburn of apple by treatment of kaolin at 3, 6 and 12%. Melgarjo et al. (2003) reported that spraying kaolin on a pomegranate trees resulted in a white color which significantly reduced the damage of fruit sunburn. Bedrech and Farag (2015) found that treated grapes with Kaolin ($Al_2O_7Si_2$) at 5% gave the highest yield and improved the physical and chemical characteristics of berries.

Weight loss %

The results in Figure1 demonstrated that the weight loss percentage was gradually increased as storage period elapsed during the two seasons. All treatments had significantly effect on reduction of weight loss % compared with control. It was clearly noticed from the Figure1 that Kaolin 2&3% treatments were more effective in decreasing weight loss percentage than the Potassium Silicate 4&5% treatments and control. Kaolin 2% gave the significant lowest value (8.72 %) in the first season but 3% kaolin gave the best significant value (11.71%) in the second season compared with the control. El-Zayat et al., (2016) found that Kaolin application reduced fruit weight loss during storage which may be due to decreased respiration and slowed metabolism .These results are in harmony to (Ahmed et al., 2007 and Rao-chandra, 2015).

Shattering%

The results (Fig.2) show that during the cold storage, shattering % gradually increased with prolongation of storage time, all treatments had significant effects on reduction of shattering % compared to the control. Kaolin at 2% gave the best significant values 8.72 and 13.24 %compared to the control (17.0 and 20.49 %) in the two research seasons respectively. Shattering may cause by fungal diseases during storage (Sandhu et al.,1990). Kaolin 2% reduced fungal diseases of grapes as it stimulates the expression of various defense genes in the prevention of disease (El-Mehrat et al., 2018).

Decay %

Data in Figure 3 show that all treatments had significant effect on reduction of decay percentage compared to control treatment. Additionally, decay percentage had a positive relationship with storage periods. As storage time increases, decay percentage will increase. Kaolin at 2% showed the significant lowest decay percentage 3.3 and 3.16% compared to control (8.49and6.15%) in both seasons respectively. Babak and Majid Rahmei (2011) found that the used of silicon reduced vase life of carnation as it lowered the ethylene production and silicon formed complexes with organic compounds in the cell wall of epidermal cells, therefore, increased their resistance in degrading enzymes. Mohamed and El hamahmy (2015) found that fruits stored in the cold storage treated with kaolin (2.5%) was found to be more effective in storing it well and for a long time.

Total loss %

It was cleared (Fig.4) that the total loss of cluster weight was due to the reduction in berry weight, shatter and decay. All treatments reduced the total loss percentage during cold storage compared to the control. The significant lowest value 20.74%was splashing with 2% kaolin in the first season. While in the second season, the lowest significant value was 28.57% for total loss was obtained from the Potassium Silicate at 5%, compared to control.

Total soluble solids (TSS %)

Data in Figure 5 showed that TSS% increase with increasing storage period in both seasons. Although the grapes are non climacteric, probably these increases are due to the water loss in the fruit and the slow ripening process. Ranjbaran et al., (2011) found that the soluble solid content (TSS) increased with prolonging storage in all treated and untreated berries. Compared with other treatments, the highest and significant values (24.33 and 24.4%) were noted in control followed by 2% kaolin (22.97 and 23.13%) in two consecutive seasons respectively. Cao et al.,(2022)found that Kaolin-treated plants increased TSS and decreased TA compared to untreated plants, consistent with previous data testing other grape varieties. Shellie and King (2013a), Bedrech and Farag(2015), Kok and Bal (2018) and Wang et al.,(2020) found that treated grapes with Kaolin (Al2O7Si2) at 5% improved the physical and chemical characteristics of berries.

Titratable Acidity (TA %)

Data in Figure 6 indicated that acidity % decreased with increasing storage period during the two investigation seasons. The treatments of 3% Kaolin and Potassium Silicate 4% and 5% were similar recorded the significant least value (0.324%) of acidity only in second season. Cao

et.al., (2022)found that Kaolin-treated plants decreased TA compared to untreated plants. A reduction in the acid level during storage can be stimulated by increasing membrane permeability, allowing the acids stored in cell vacuoles to be respired and convert into more sugars for certain processes occurring in the cells (Sabir et al., 2010). Tripathi et al. (2013) mentioned that application of Si enhances the growth, yield, and fruit quality.

TSS/acid ratio

Data illustrated in Figure 7 showed that TSS/acid ratio increased with prolonged storage period. This increment may be due to the increasing in TSS percentage and the decreasing in total acidity percentages. Moreover, the results from the aforementioned (Fig.7) showed that the two experimental seasons had a similar trend. The control recorded the highest value (74.08 and 71.66) of TSS/acid ratio followed by 3% Kaolin (66.03and70.48), 4% potassium silicate (65.91and 69.92), 5% potassium silicate (65.8and 69.89) and 2%Kaolin (61.9and 63.2) in two successive seasons respectively.

Total anthocyanin(mg/100g FW)

It can be clearly seen from Figure 8 that all treated and untreated berries reaching to peak value of anthocyanin content (mg/100g) up to three weeks of cold storage and then decreased after that, in both seasons respectively. The treatment of potassium silicate at 5% gave the significantly highest values (41.82 and44.56 mg/100g) FW compared to control which gave least values(33.7and 31.12 mg/100g) in both seasons respectively. Rizk-Alla and Meshrake (2006) found the same results when potassium was applied on "Crimson seedless" cv at pre harvest, it caused an increase in anthocyanin content. Moreover, Potassium Silicate plays a mainly role in improving and increasing plant pigments (Ma 2004).

Vitamin C(mg/100ml juice)

As shown in Figure 9, there were significant differences in Vitamin C content between treatments after 4 weeks of storage. There was a decrease in Vitamin C content which was in parallel with increasing storage period during the two research seasons. The treatment of 3% kaolin induced the significantly highest values (8.33and 8.89mg/100ml) of Vitamin C compared to control which recorded the significant least values (7.02and7.0 mg/100ml) of Vitamin C of all the studied seasons respectively .This results are consistent with El-Zayat et al., (2016) Found that Kaolin treatment increased vitamin C content of "Costata" persimmon fruit.

Disease severity

Tables 5&6 showed the effect of pre-harvest sprays with Kaolin at 2&3% and potassium silicate at 4&5%in controlling the Postharvest infection with grey mold and other mold fungi disease of *King Ruby* grape cv during cold storage (at 1±1 ^{0}C) and 90- 95% RH for 4 weeks during seasons 2022 and 2023. All treatments significantly were effective in reduction development of grey mold and other mold fungi disease of King Ruby grape cv at cold storage in the two studied seasons compared to control. It was clearly noticed from results that 2%Kaolin treatment was more effective in decreasing disease incidence by *Botrytis Cinerea* and other mold fungi than other treatments. The treatment of 2%Kaolin gave the significant lowest values (8.29, 8.75% and 2.00, 2.20%) followed by kaolin3% (9.69 ,10.25% and 2.33 , 2.65%) in the two studied seasons, respectively. 2% Kaolin application showed good protection with a significant decreased of disease index compared to the control. Treated vines which showed less and slower development of disease similar to the protection found on cucumber (Haggag, 2002). Wang et al., (2022) found that Kaolin Particle Film Protects Grapevine cv. Cabernet Sauvignon against Downy Mildew by forming Particle Film at the leaf surface directly acting on sporangia and inducing the pleading of the plant slower pathogen growth in plants that received high dose Kaolin pretreatment. This reduces in infection was due to the lack of assessment to the entrance of the pathogen, because of the deposition of Kaolin. This observation of the infection appeared that the response to Kaolin treatment was low infection and limited disease development.

Conclusion

It is revealed from the present investigation that the application of 5% potassium silicate significant increased the yield kg/vine, cluster weight(g), cluster length(cm), berry weight(g), berry width, TSS%, anthocyanin content(mg/100gm) and leaf area (cm^2) on the contrary decreased number of shot berries .The treatment of 4% potassium silicate increased cluster width(cm), berry length(cm) and decreased TA%, while 3% kaolin reduced number of sunburn berries. Throughout cold storage at (1±1 ^{0}C) and 90-95

% relative humidity, application 0f 2% Kaolin reduced weight loss%, shattering% and decay% and improved TSS%, as decreased disease incidence by *Botrytis Cinerea* and other mold fungi, on the other hand 3% kaolin improved TSS/ acid ratio and vitamin C content, However 5% potassium silicate increased anthocyanin content mg/100g up to three weeks of cold storage and then decreased after that. It is recommended to spray 5% potassium silicate in grape farms to obtain a high yield and high quality. However, it is preferable to spray with kaolin 2% to prolong the storage period and maintaining the quality of the clusters and protecting against fungal molds, especially gray mold Botrytis Cinerea.

TABLE 1. Effect of Kaolin at 2&3% and Potassium Silicate at 4&5% on Yield kg/vine, Cluster weight(g), length(cm) and width(cm) of " King Roby "grapes at harvest time during 2022 & 2023 seasons

Treatment	Yield Kg/vine		Cluster weight (g)		Cluster length (cm)		Cluster width (cm)	
	2022	2023	2022	2023	2022	2023	2022	2023
Kaolin 2%	13.50	13.93	540.0	557.0	22.50	22.83	13.00	12.00
Kaolin 3%	15.30	14.63	612.0	629.0	18.00	25.00	13.66	14.50
Potassium Silicate 4%	15.63	16.50	601.0	640.0	26.66	27.00	14.66	14.50
Potassium Silicate 5%	16.65	16.39	640.0	630.4	28.50	26.00	13.55	14.00
Control	13.08	13.07	510.0	522.8	17.33	19.00	11.33	11.50
LSD at 5% :	1.17	1.36	23.4	30.1	1.16	0.98	1.32	0.50

TABLE 2. Effect of Kaolin at 2&3% and Potassium Silicate at 4&5% on Berry weight (g), length (cm) and width (cm) of " King Roby "grapes at harvest time during 2022 & 2023 seasons

Treatment	Berry weight (g)		Berry length (cm)		Berry width (cm)	
	2022	2023	2022	2023	2022	2023
Kaolin 2%	2.18	1.99	1.68	1.69	1.72	1.60
Kaolin 3%	2.36	2.06	1.87	1.84	1.82	1.72
Potassium Silicate 4%	2.63	2.45	2.07	1.95	1.87	1.71
Potassium Silicate 5%	2.99	2.96	2.03	1.94	1.83	1.76
Control	1.83	1.59	1.67	1.63	1.57	1.43
LSD at 5% :	0.17	0.23	0.19	0.21	0.09	0.20

TABLE 3. Effect of Kaolin at2&3% and Potassium Silicate at 4&5% on TSS (%), Acidity (%), TSS /Acid ratio, Anthocyanin(mg/100gFW) and Vitamin c (mg/100ml) of " King Roby "grapes" at harvest time during 2022 & 2023 seasons

Treatment	TSS (%)		Acidity (%)		TSS /Acid ratio		Anthocyanin (mg/100g FW)		Vitamin c (mg/100ml)	
	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023
Kaolin 2%	19.1	20.33	0.452	0.401	42.43	50.87	33.87	33.4	9.55	9.68
Kaolin 3%	19.8	20.50	0.452	0.427	48.07	38.60	38.60	40.2	10.11	10.14
Potassium Silicate 4%	19.4	20.63	0.427	0.384	45.49	53.89	34.20	35.5	9.11	8.98
PotassiumSilicate5%	20.0	21.00	0.435	0.427	46.06	49.24	40.52	42.3	9.12	9.34
Control	17.8	19.27	0.478	0.461	37.39	41.79	30.00	28.0	8.33	8.14
LSD at 5% :	1.2	0.43	0.024	0.040	2.94	4.66	4.66	0.78	0.125	0.140

TABLE 4. Effect of Kaolin at 2&3% and Potassium Silicate at 4&5% on leaf area, Sunburn and shot berries of " King Roby "grapes at harvest time during 2022 & 2023 seasons

Treatment	leaf area(cm^2)		sunburn%		shot berries%	
	2022	2023	2022	2023	2022	2023
Kaolin 2%	81.61	79.03	1.83	1.42	5.84	7.03
Kaolin 3%	88.03	81.60	0.95	1.06	6.69	6.08
Potassium Silicate 4%	94.77	100.63	0.98	1.13	2.37	4.12
Potassium Silicate 5%	101.84	105.49	1.95	1.63	1.91	2.75
Control	74.50	77.00	3.11	3.05	14.83	15.59
LSD at 5% :	5.65	4.53	0.58	1.22	2.30	2.22

TABLE 5. Effect of Kaolin at 2&3% and Potassium Silicate at 4&5% on controlling the postharvest infection of gray mold (*Botrytis cinerea*) of " King Roby "grapes during cold storage at (1±1 ^{0}C) and 90- 95% RH during 2022 & 2023 seasons

Disease severity index (DI%)						
Treatment	**1 week**	**2 weeks**	**3 weeks**	**4 weeks**	**Mean**	**Efficacy**
			2022			
Kaolin 2%	10.4	9.3	7.23	6.23	8.29	80.74
Kaolin 3%	11.5	10.0	9.5	7.76	9.69	77.49
Potassium Silicate 4%	16.5	15.5	14.76	13.0	14.94	65.29
Potassium Silicate 5%	14.0	13.2	11.0	10.2	12.10	71.89
Control	47.0	45.0	41.2	39.0	43.05	0.00
Mean	19.88	18.6	16.73	15.24	17.61	73.85
LSD at 5 % : (P): 0.81 (T):0.72 (T*P):1.52						
			2023			
Kaolin 2%	10.4	9.5	8.0	6.6	8.75	80.94
Kaolin 3%	11.75	11.0	10.0	8.25	10.25	76.32
Potassium Silicate 4%	16.7	16.0	16.0	12.7	15.1	65.12
Potassium Silicate 5%	14.5	13.5	13.5	10.0	12.5	71.13
Control	46	45.0	42.2	40.0	43.3	00.00
Mean	19.93	19.0	17.45	15.48	17.98	73.37
LSD at 5% : (P): 0.69 (T):0.63 (T*P): 1.32						

TABLE 6. Effect of Kaolin at 2&3% and Potassium Silicate at 4&5% on controlling the postharvest infection of other mold fungi of " King Roby "grapes during cold storage at (1±1 ^{0}C) and 90- 95% RH during 2022 & 2023 seasons

Disease severity index (DI%)						
Treatment	**1 week**	**2 weeks**	**3 weeks**	**4 weeks**	**Mean**	**Efficacy**
2022						
Kaolin 2%	2.5	2.0	1.95	1.55	2.00	90.07
Kaolin 3%	2.92	2.5	2.0	1.9	2.33	88.53
Potassium Silicate 4%	4.00	3.5	3.00	2.5	3.25	83.87
Potassium Silicate 5%	4.00	3.3	3.1	2.2	3.15	84.36
Control	22.5	20.0	19.1	19.0	20.15	0.00
Mean	7.18	6.26	5.83	5.43	6.17	86.71
LSD at 5 %	(P): 0.51	(T):0.38	(T*P):0.84			
2023						
Kaolin 2%	2.7	2.2	2.0	1.9	2.20	89.26
Kaolin 3%	3.0	2.7	2.7	2.2	2.65	87.07
Potassium Silicate 4%	4.1	4.00	3.7	3.00	3.70	81.95
Potassium Silicate 5%	3.6	3.5	3.0	2.2	3.1	84.87
Control	23.0	20.5	19.5	19	20.5	00.00
Mean	7.30	6.58	6.18	5.66	6.43	85.79
LSD at 5% :	(P): 0.55	(T):0.55	(T*P): 1.09			

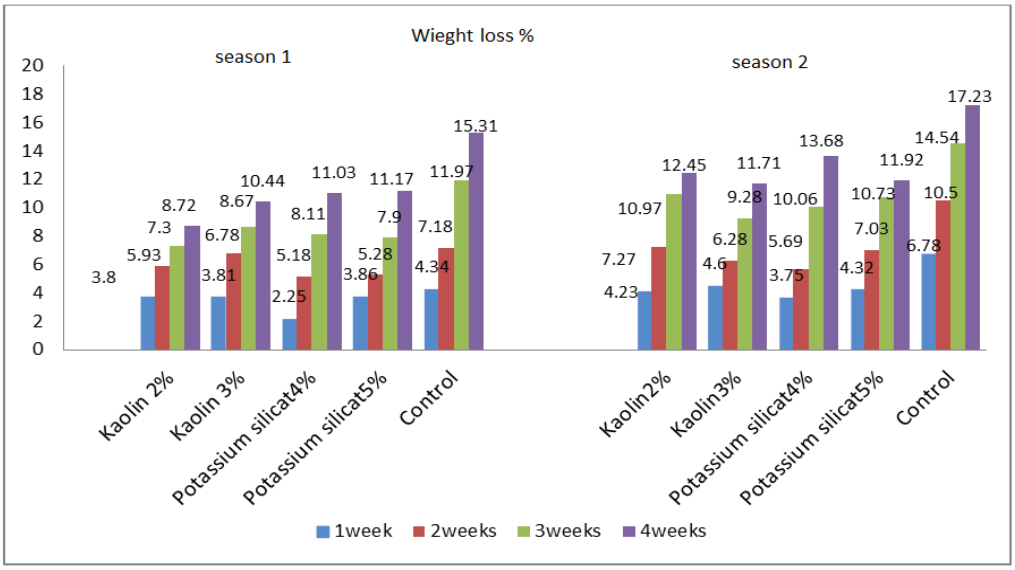


Fig. 1. Effect of Kaolin at 2&3% and Potassium Silicate at 4&5% on weight loss % of " King Roby "grapes during cold storage at (1±1 ^{0}C)) and 90- 95% RH during 2022 & 2023 seasons

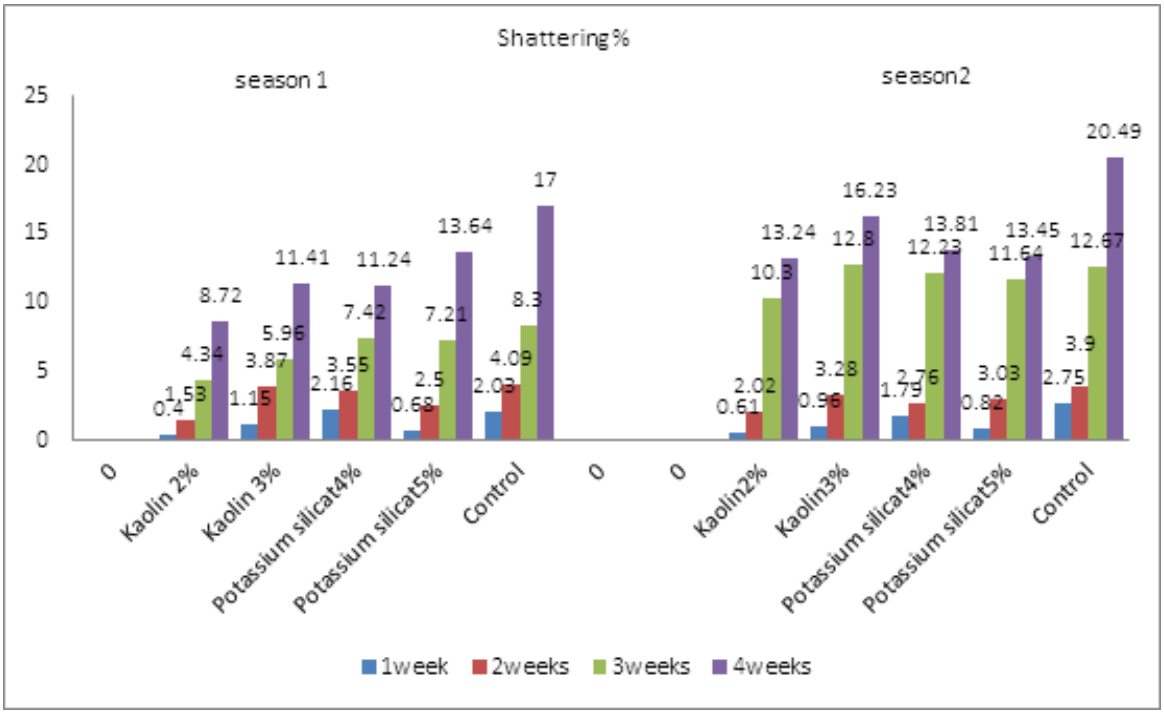


Fig. 2. Effect of Kaolin at 2&3% and Potassium Silicate at 4&5% on shattering % of " King Roby "grapes during cold storage at (1±1 ^{0}C) and 90- 95% RH during 2022 & 2023 seasons

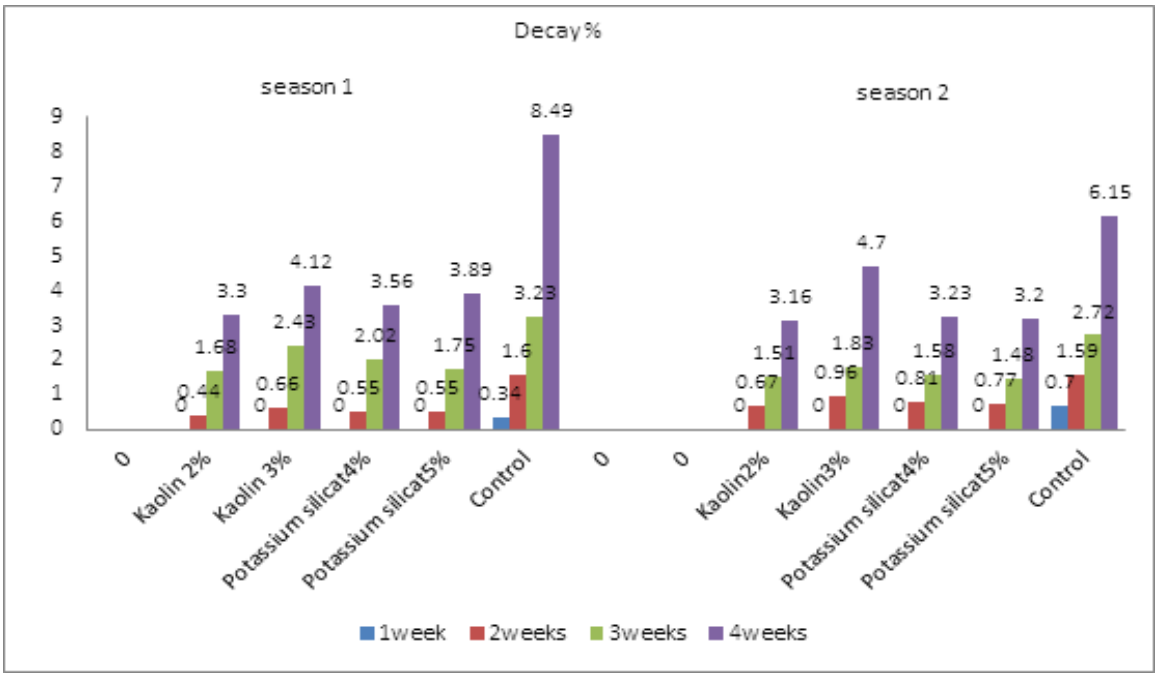


Fig. 3. Effect of Kaolin at 2&3% and Potassium Silicate at 4&5% on decay % of " King Roby "grapes during cold storage at (1±1 0C) and 90- 95% RH during 2022 & 2023 seasons

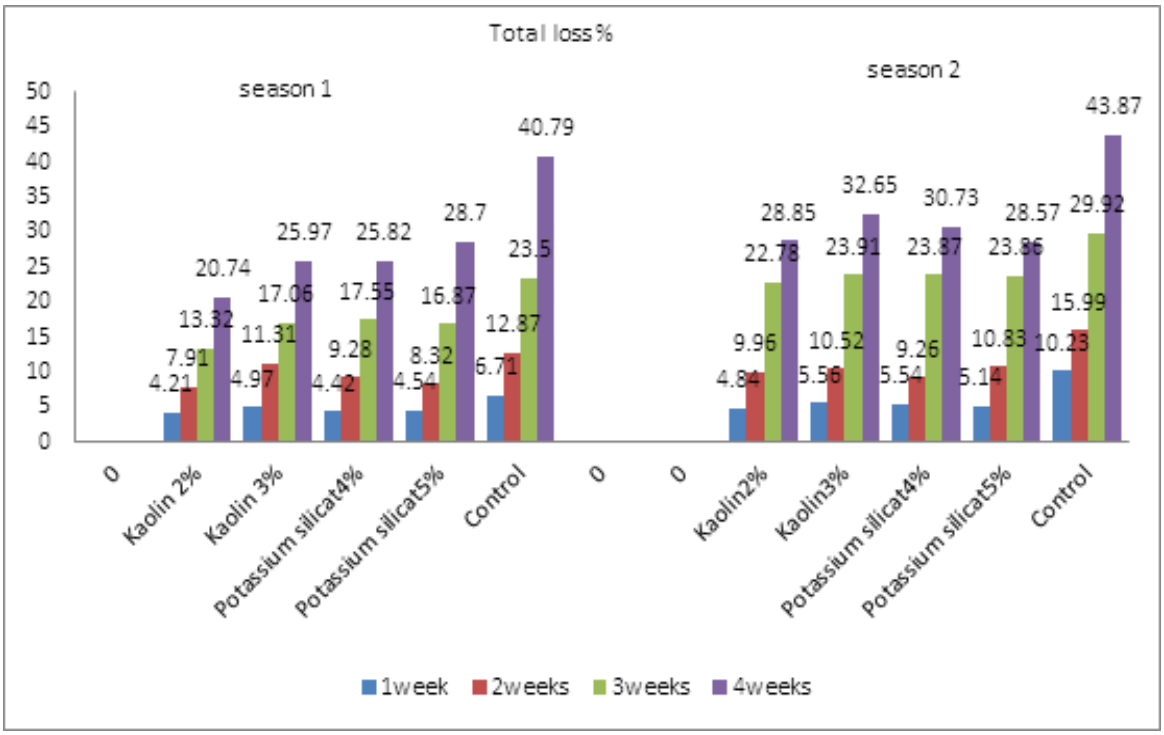


Fig. 4. Effect of Kaolin at 2&3% and Potassium Silicate at 4&5% on total loss % of " King Roby "grapes during cold storage at (1±1 0C) and 90- 95% RH during 2022 & 2023 seasons

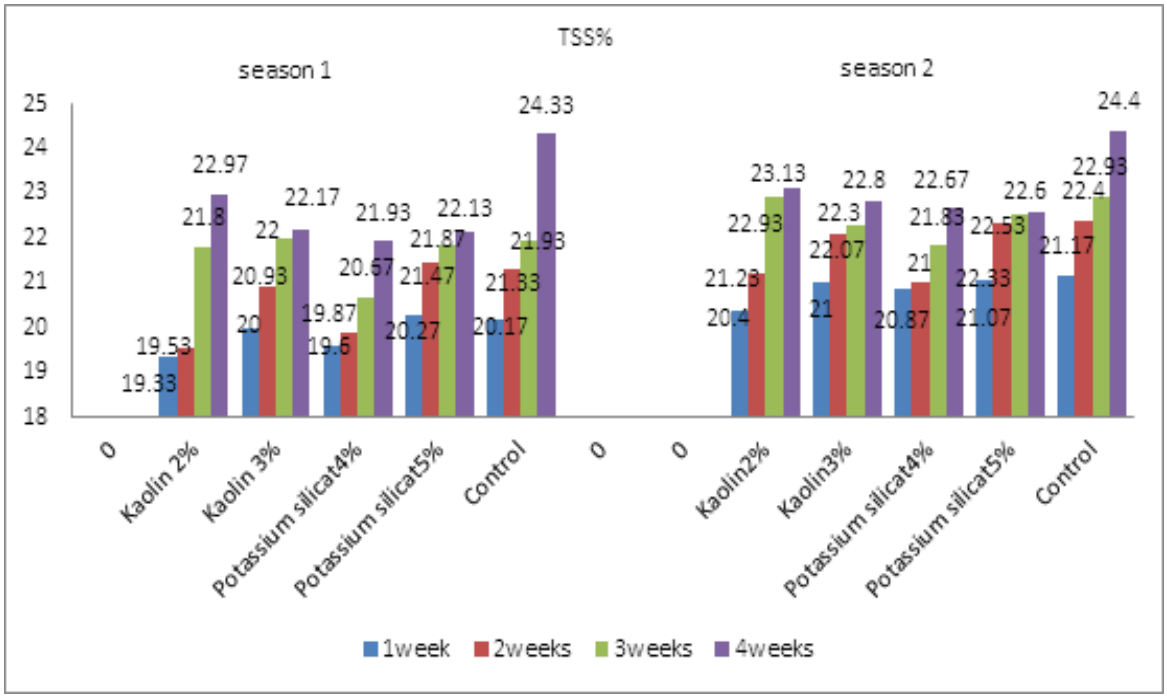


Fig. 5. Effect of Kaolin at 2&3% and Potassium Silicate at 4&5% on TSS % of " King Roby "grapes during cold storage at (1±1 0C) and 90- 95% RH during 2022 & 2023 seasons

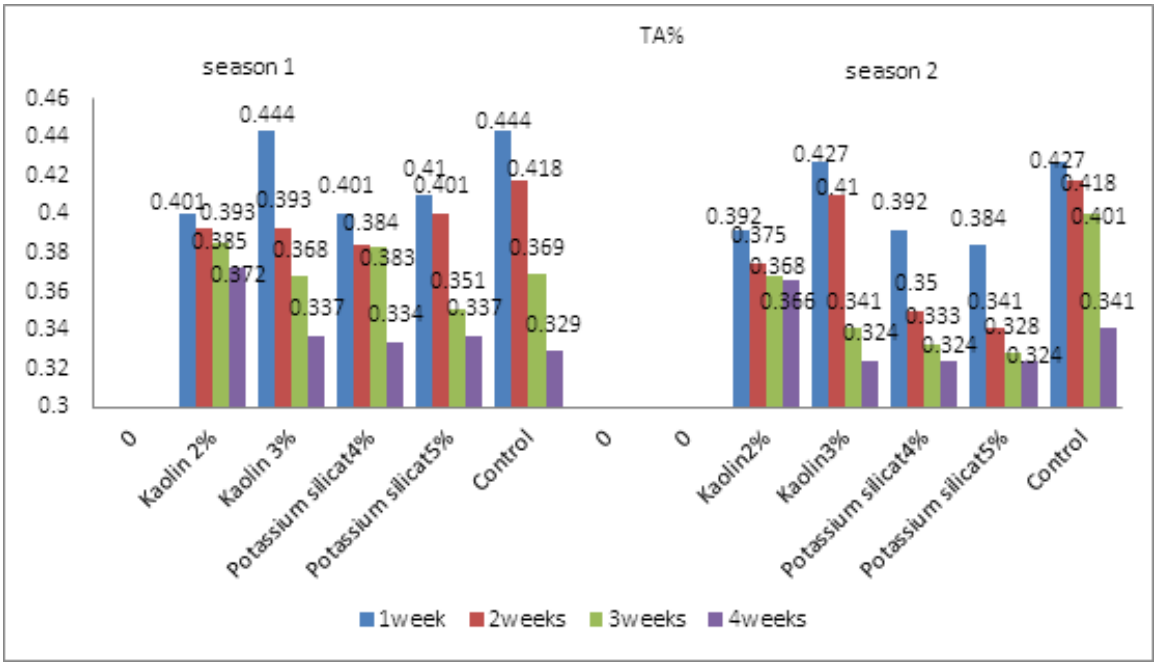


Fig. 6 . Effect of Kaolin at 2&3% and Potassium Silicate at 4&5% on TA % of " King Roby "grapes during cold storage at (1±1 ^{0}C) and 90- 95% RH during 2022 & 2023 seasons

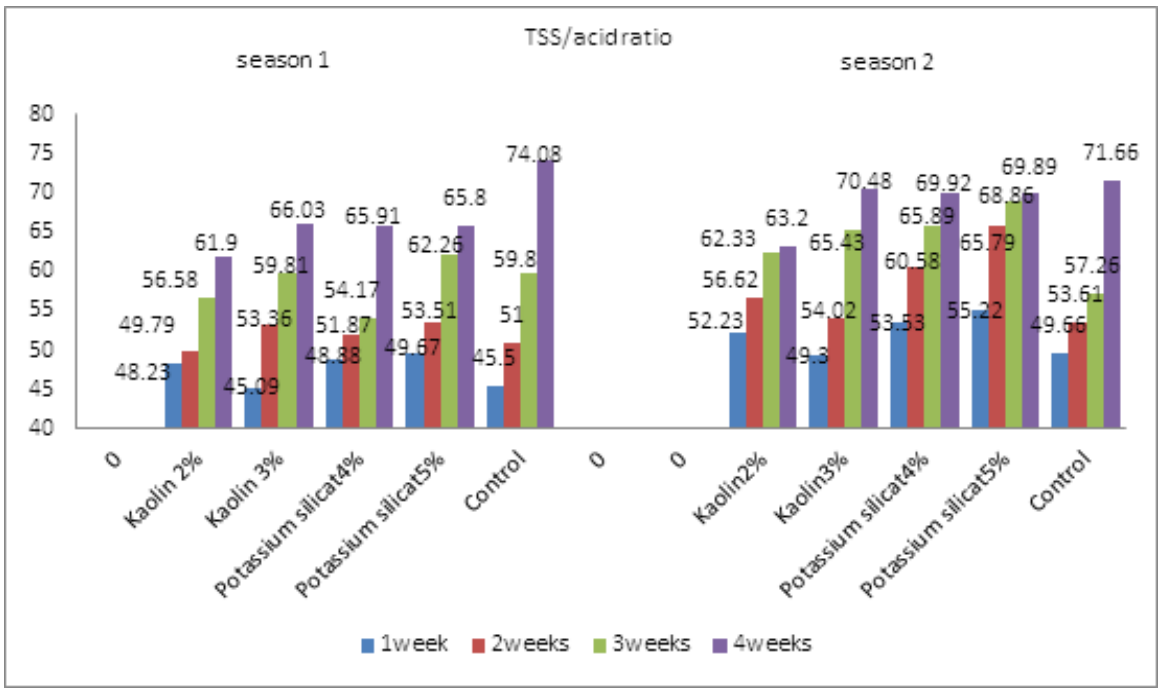


Fig. 7. Effect of Kaolin at 2&3% and Potassium Silicate at 4&5% on TSS/acid ratio of " King Roby "grapes during cold storage at (1±1 0C) and 90- 95% RH during 2022 & 2023 seasons

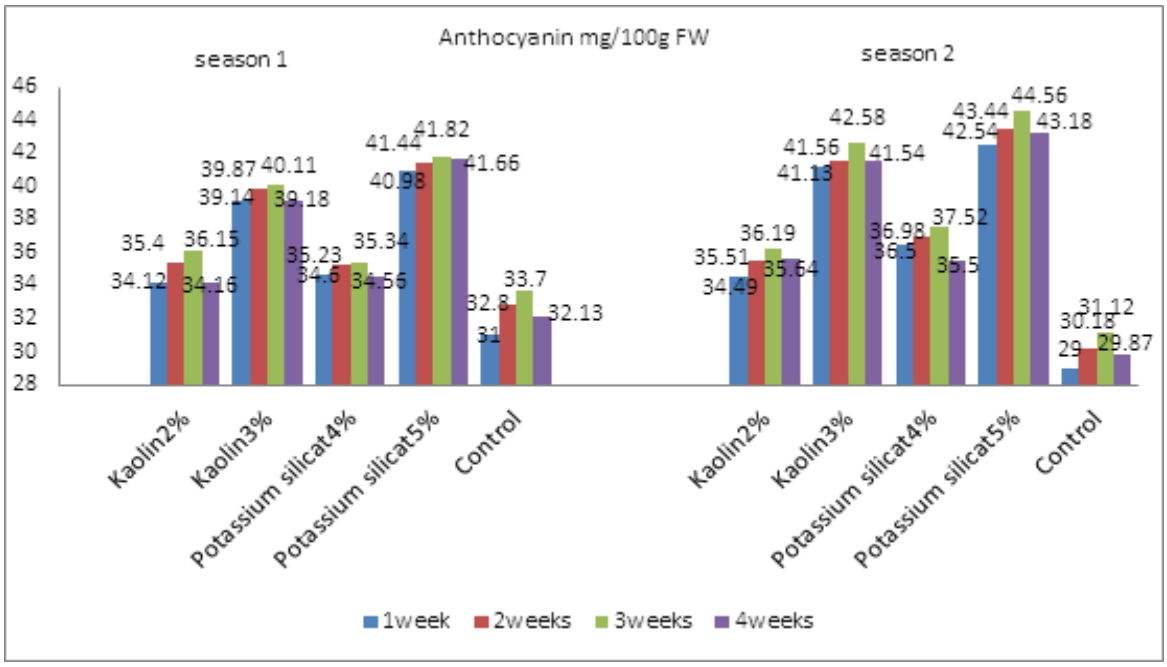


Fig. 8. Effect of Kaolin at 2&3% and Potassium Silicate at 4&5% on Total Anthocyanin(mg/100g FW) of " King Roby "grapes during cold storage at (1±1 ^{0}C) and 90- 95% RH during 2022 & 2023 seasons

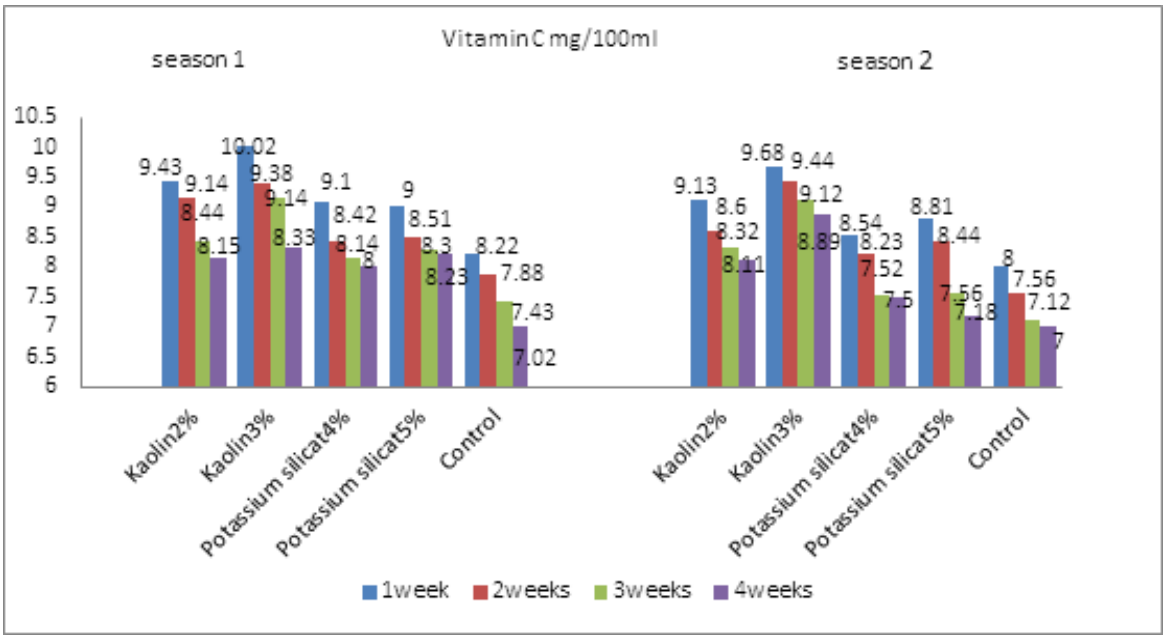
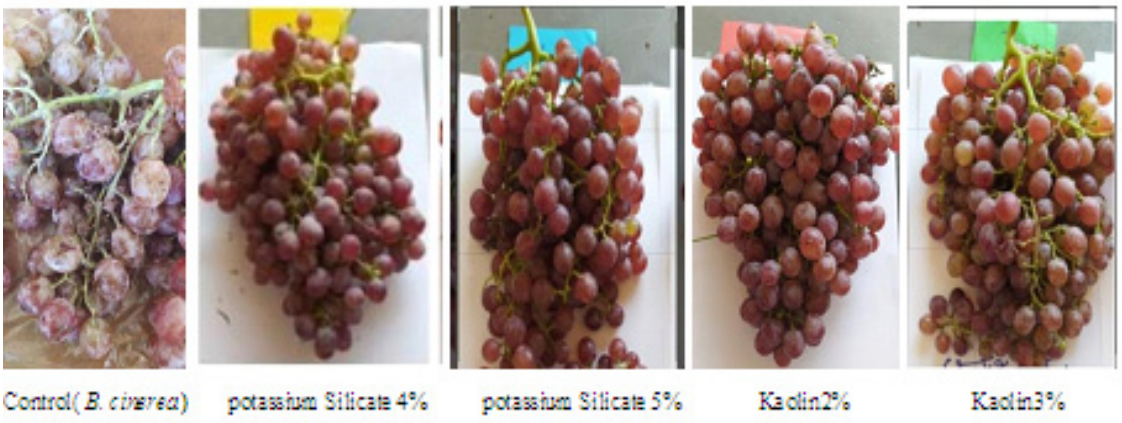


Fig. 9. Effect of Kaolin at 2&3% and Potassium Silicate at 4&5% on Vitamin C(mg/100ml) of " King Roby "grapes during cold storage at (1±1 ^{0}C) and 90- 95% RH during 2022 & 2023 seasons



Picture 1. Fungal spores on the surface of berries after 4weeks of cold storage at (1±1 ^{0}C) and 90- 95% RH

Acknowledgment

The authors thanks all staff of Assiut research station, Agricultural research center.

Funding statements

The authors received no external funding for this work.

Conflicts of interest

The authors declare that they have no conflicts of interest during this study.

References

Ahmed, F.F. and Morsy ,M.H.(1999) A new method for measuring leaf area in different fruit crops. *Minia J. of Agric. Res. & Develop.*, **19(6)**, 97-105.

Ahmed, S., Mohammed, A., Zahid, H., Raheel, A. and Thompson, A. (2007) Effect of fruit size and treatments in the shelf life and quality of ripe banana fruit. *Sarhad. J. Agric.*, **23** (1), 46 - 54.

Ahmed, S., Roberto, S., Domingues, A.,Shahab, M., Junior, O., Sumida, C., and Souza, R. (2018) Effects of Different Sulfur Dioxide Pads on Botrytis Mold in 'Italia' Table Grapes under Cold Storage. *Horticulturae,* **4**(29),7-15

Al- Wasfy, (2014) The Synergistic Effects of Using Silicon with Some Vitamins on Growth and Fruiting of Flame Seedless Grapevines. *Stem Cell*, **5**(1),8- 12.

AOAC, (1980) *Official Method of Analysis*, 14th ed., *Association of Official Analytical Chemist, Washington*, DC., USA.

Aujla, K.M., Shah, N.A., Ishaq, M. and Fraooq, A. (2011) Postharvest losses and marketing of grapes in Pakistan. *Sarhad Journal,* **27**(2), 485-490.

Babak, J. and Rahemi, M. (2011) Carnation flowers senescence as influenced by nickel, cobalt and silicon. J. *Biol. Environ. Sci*., **5**(15), 147-152.

Bedrech, S. A. and Farag, S.G. (2015)Usage of some sunscreens to protect the Thompson Seedless and Crimson Seedless grapevines growing in hot climates from sunburn *Nature and Science*, **13**(12),22-31

Cao, X.., Wang, Y., Wang,.Z ., Tian, X., Han,X ., Wu, D., Yao, F., Hui, M., Li, H. and Wang, H. (2022) Effects of kaolin particle film coatings on the water-saving efficiency and fruit quality of Cabernet Sauvignon (Vitis vinifera L.) grape plants in the Ningxia region of China Horticulture, *Environment, and Biotechnology,* 1358022-00498-4

Conde, A., Pimentel, D., Neves, A., Dinis, L.T., Bernardo,S., Correia, C.M. and et al. (2016) Kaolin Foliar Application Has a Stimulatory Effect on Phenyl propanoid and Flavonoid Pathways in Grape Berries. Front. *Plant Sci*., **7**, 1150,1 - 14.

Coombe, B.G. and Dry, R.R. (1992) Viticulture Vol. 2 practices VIII, pp. 376.

Dean, R., Van Kan, A., Pretorius, Z.., Hammond-Kosack, K., Pietro, A., Spanu, D., Rudd, J., Dickman, M., Kahmann, R. and Ellis, J. (2012**)** The Top 10 fungal pathogens in molecular plant pathology.Mol. *Plant Pathol*., **13**(6)414–430.

Dibb, D.W. (1998) Potassium for agriculture adapted and reprinted from better crops with plant food. published by potash & phosphate Institute.1 (3) 17 -27.

Dinis, T., Bernardo, S., Conde, A., Pimentel, D., Ferreira ,H.and Felix, L. (2016a) Kaolin exogenous application boost antioxidant capacity and phenolic content in berries and leaves of grapevine under summer stress .J .*Plant Physiol.,* **191**(6)45–53.

Dinis, T., Malheiro, C., Luzio, A., Fraga, H., Ferreira, H. and Goncalves, I. (2018) Improvement of grapevine physiology and yield under summer stress by kaolin-foliar application ,water relations, photosynthesis andoxidativdamage. *Photosynthetica,* **56**(3)10.17.

Dinis, T., Bernardo, S., Matos, C., Malheiro, A., Flores, R. and Alves, (2020) Overview of Kaolin Outcomes from Vine to Wine, Cerceal White Variety Case Study. *Agronomy Basel,* **10** (1)14-22.

Domingues ,A., Roberto, S., Ahmed , S.,Shahab , M., José Chaves Junior, O., Sumida, C.and de Souza, R.**(** 2018**)** Postharvest Techniques to Prevent the Incidence of Botrytis Mold of 'BRS Vitoria' Seedless Grape under ColdStorage. *Horticulturae*, **4**(7) 17-23.

El-Mehrat ,H.G., Yoness, H. H. and Abdelrhman, F. A. (2018) Effect of potassium silicate spray with packaging on storability and control postharvest diseases of grapevine fruits .*Menoufia J. Plant Prod.,* **3,**189 – 207.

El-Sawalhy, H.A., Abou El-Azayem, M.G. and Zaghloul, E.A. (2008). Analysis of Egyptian grapes market shares in the world markets. American-Eurasian j. Agric. And Environ. Sci., 3, 656-662

El-Zayat, M., Taha, H., Shakweer, and El-Hadidy,M. (2016**)** Effect of some natural stimulations on fruit set ,yield and fruit quality of costata persimmon at harvest and after cold. *Fac .Agric., Cairo Univ.* **67(4)**, 27- 58.

FAO, (2019) Food and Agriculture Organization of the United Nations, *Production Year Book, Rome.* **66**.

Glenn, D.M.,. Prado, E., Erez, A., McFerson,J. and Puterka, G.J.(2002) A reflective processed-kaolin particle film affects fruit temperature, radiation reflection and solar injury in apple. *J. Am. Soc. Hort. Sci*., **127**, 188-193.

Glenn, D.M. and Puterka, G.J. (2005) Particle films, A new technology for agriculture. *HortRev*., **31**,1–44.

Glenn, D. M. and Puterka, G. J. (2010) Particle Films, A New Technology of Agriculture, *Horticult. Rev*., **31**, 123-127.

Glenn, M.,Puterka, Vanderzwe, J., Byers,T.E. and Feldhake, C.(1999) Hydrophobic particle films ,A new paradigm for suppression of arthropod pests and plant diseases.J.Econom.Entomol.92,759–771.

Haggag, W.M. (2002) Control of Downy Mildew on protected cucumberplants withfilmformingantitranspirants. *OnLine J. Biol. Sci*., **2**,403–407.

Jarvis, W. R. (1977) Botryotinia and Botrytis species, Taxonomy, Physiology and Pathogenicity, Mono grape h 15,Research Branch, *Canada Department of Agriculture, Ottawa*.

Kaluwa, K.., Bertling, I., Bower, J.P.and Tesfay, S.Z. (2010) Silicon application effects on Hass avocado fruit physiology. *Journal of South African Avocado Growers Association* **33(2)**,44-47.

Kok, D. and Bal ,E. (2018) Leaf removal treatments combined with kaolin particle film technique from different directions of grapevine's canopy affect the composition of phytochemicals of cv. Muscat Hamburg (V. vinifera L.). *Erwerbs-Obstbau* **60**(1),39–45.

Ma, J.F. (2004) Role of silicon in enhancing the resistance of plants of biotic and abiotic stresses. *Soil Sci. Plant Nutr*., **50**(6),11-18

Markham, K..P. (1982) Techniques of flavonoids identification, Academic Press, *London, p*. **144**.

Mditshwa, A., Bower, J.P., Bertling, I., Mathaba, N., Tesfay, S.Z. (2013) The potential of postharvest silicon dips to regulate phenolics in citrus peel as a method to mitigate chilling injury in lemons. *African Journal of Biotechnology* **12**,1482-1489.

Melgarejo,P.,Martinez,J.J.,Hernandez,F.,MartinezFont ,R.,Barrows,P.,andErez,A.(2003) Kaolin treatment to reduce pomegranate sunburn .*Sci. Hortic.* **100**(5)349-353.

Mohamed, S.M. and Elhamahmy, M.A.(2015) Impact of Kaolin particle film coating and UV-C treatments on storability and quality of Washington navel orange during long-period cold storage . *Zagazig J. Agric. Res., Vol*. **42** (5), 1- 16.

Morsy, A. A., Abd-Alla, M. A. and Abd-El-Kareem, F.(1999) Evaluation of chitosan as asubstitute of fungicides for postharvest disease control, Strawberry decay. *Egypt J. Phytopathol.*, **27**(2), 109-116.

Nakano, A. and Uehara,Y. (1996) The effect of kaolin clay on cuticle transpiration in tomato.*Acta Hort.* **440**, 233–238.

Nelson, K.E. (1979) Harvesting and handling California table grapes for market. *UCANR Publications*. **1913**(7) 266-281.

Passingham, J.V. (2004) On the growing of grapevines in the tropics. Acta Hort. VII Inter. Symposium on Temperate Zone Fruits in the Tropics and Sub Tropic, **65**, 3944.

Puterka, G. J., Glenn, D. M., Sekutowski, D. G., Unruh, T. R., and Jones, S. K. (2000) Progress toward liquid formulations of particle films for insect and diseasecontrolinpear.*Environ.Entomol*.**29**,329–339.

Ranjbaran, E., Sarikhani, H., Wakana, A.,and Bakhshi, D. (2011) Effect of salicylic acid on storage life and postharvest quality of grape (Vitis vinifera L cv Bidaneh Sefid). *Journal of Faculty of Agriculture, Kyushu University* **56**(2),263-269.

Rao-Chandra, G. (2015) Engineering for storage of fruits and vegetables cold storage. *Academic Press* (p.p. 26 - 28).

Rizk-Alla, M.S. and Meshrake, A.M. (2006) Effect of preharvest application of GA3, Potassium green and glucose on fruit quality and storability of "Crimson seedless". *Egypt J. Appl. Sci.*, **21**, 210 -238.

Sabir, A., Kafkas,E. and Tangolar,S. (2010) Distribution of major sugars, acids and total phenols in juice of five grapevine (Vitis spp.) cultivars at different stages of berry development. *Spanish Journal of Agricultural Research* (In press).

Sandhu, S.S., Dhillon, P.S., Bindra, A.S. (1990) Effect of package and storage conditions on the keeping quality of Perlette grapes. *Vitis*, **29**,97-107.

Sharma, R.R., Reddy, S.V. and Datta, S.C. (2015) Particle films and their applications in horticultural crops. *Appl. Clay Sci.,* 116(10) 54–68.

Shellie, K.C. and King, B.A. (2013a) Kaolin Particle Film and Water Deficit Influence Malbec Leaf and Berry Temperature, Pigments, and Photosynthesis. *Am.J.Enol.Viticult*., **64**, 223 -230.

Snedecor, G. W. and Cochran ,W. G. (1990) *Statistical Methods*, 7th ed. Oxford and J. B. H. publishing Com.

Somma, S.T., Perron, EGI, L.O. and Gri Eco, A.F. (2012) Diversity of black Aspergilli and mycotoxin risks in grape, wine and dried vine fruits. *Phytopathologia Mediterranea,* **51**, 1, 131−147.

Tarabih, M.E., El-Eryan.E.E. and El-Metwally,M.A. (2014) Physiological and pathological impacts of potassium silicate on storability of Anna apple. *Amer. Jour. of Plant Physiology,* **9** (2),52-67

Tesfay, S.Z., Bertling, I.and Bower, J.P .(2011) Effects of postharvest potassium silicate application on phenolics and other antioxidant systems aligned to avocado fruit quality Postharvest *Biology and Technology* **60**,92-99.

Tripathi, D.K., Mishra, S., Chauhan, D.K., Tiwari, S.Pand Kumar, C. (2013) Typological and frequency based study of opaline silica (phytolith) deposition in two common Indian sorghum. Proceedings of the National Academy of Sciences, India Sec B 83(1),97-104.

Tubajika, K.M., Civerolo, E.L., Puterka, G.J., Hashim, J.M., and Luvisi, D.A. (2007) The effects of kaolin, harpin, and imidacloprid on development of Pierce'sdiseaseingrape.*CropProtect*, **26**(9),7- 17.

Walters, D.R. (2006) Disguising the leaf surface, the use of leaf coatings for plant disease control. *Eur. J. Plant Pathol.,* **114**, 255–260.

Wang, Y., Xue, T., Han, X., Guan, L., and Li, H.(2020) Kaolin Particle Film Acts Grapevine Berry Quality in cv. Meiliin Humid Climate Conditions. *HortScience,* **55** ,1987–2000.

Wang, Y., Han, Y., Han, X., Wang, Z., Xue, T., Ye, Q.,and Li, H. (2022) Kaolin particle film protects grapevine cv. Cabernet Sauvignon against downy mildew by forming particle film at the leaf surface, directly acting on sporangia and inducing the defense of the plant. *Frontiers in Plant Science*, **3**(2), 88 -103.

Weaver, R.J. (1976) *Grape Growing*. Univ. of Calif., Davis, pp. 160-174.

Williamson, B., Tudzynski, B., Tudzynski, P. and Van Kan, J. **(**2007**)** Botrytis cinerea: The cause of grey mould disease. *Mol. Plant Pathol.,* **8**, 561–580.

تأثير الرش بالكاولين وسيليكات البوتاسيوم لتحسين جوده عنب " الكينج روبي "ومقاومة الامراض الفطرية خلال التخزين البارد

اسماء احمد محمد[١] ، هدي عبد الفتاح مصطفي[٢] ، احمد حسن منصور[١] و نجوي محمد عمر[١]
[١] معهد بحوث البساتين – مركز البحوث الزراعية – الجيزة – مصر.
[٢] معهد بحوث امراض النبات – مركز البحوث الزراعية – الجيزة – مصر.

المستخلص

اجريت هذة الدراسة خلال موسمي ٢٠٢٢-٢٠٢٣ علي العنب الكينج روبي في محافظة اسيوط-مصر حيث تم رش الكرمات بالكاولين بتركيز ٢ و٣٪ وسليكات البوتاسيوم بتركيز ٤ و٥٪ وتم الرش في ثلاث مواعيد الاولي عند بداية النمو الثانيه عند بداية العقد الثالثه بعد الثانية بشهر وذلك بغرض زيادة المحصول وتحسين الجودة عند الحصاد وايضا لتحسين جودة الثمار ومقاومة الامراض الفطرية خلال التخزين علي درجة 1±1 (^{0}C) ورطوبة نسبية من ٩٠-٩٥٪ .ثم اجريت التحليلات الفزيائية والكيميائية والميكروبية عند الحصاد وخلال فترات التخزين علي البارد

النتائج

اوضحت النتائج ان أن الرش باستخدام ٥٪ سيليكات البوتاسيوم أدى إلى زيادة معنوية في المحصول كجم/كرمة و وزن العنقود(جم)و طول العنقود(سم)و وزن الحبة(جم)و عرض الحبة والنسبة المئوية للمواد الصلبة الذائبة ومحتوى الأنثوسيانين (ملجم/١٠٠جم). ومساحة الورقة (سم) بينما خفضت من عدد الحبات shot berries في حين أدى ٤٪ سيليكات البوتاسيوم إلى زيادة عرض العنقود (سم) وطول الحبة (سم) وانخفاض النسبة المئوية للحموضة الكلية بينما قلل الكاولين ٣٪ من عدد الحبات المصابة بحروق الشمس(sunburn) . التخزين البارد عند (1±1 ^{0}C) ورطوبة نسبية ٩٠-٩٥٪، أدى الرش بالمعاملة 2% كاولين إلى تقليلا لنسبة المئوية للفقد في الوزن ونسبة الفرط(shattring٪) والنسبة المئوية لتلف الحبات(Decay)و والنسبة المئوية للمواد الصلبة الذائبة كما انخفض معدل الإصابة بفطر Botrytis Cinerea وفطريات العفن الأخرى. من ناحية أخرى، أدى الكاولين ٣٪ إلى تحسين نسبة المواد الصلبة الذائبة إلى الحموضة ومحتوى فيتامين C، بينما أدى سيليكات البوتاسيوم ٥٪ إلى زيادة محتوى الأنثوسيانين ملجم/١٠٠ جم حتى ثلاثة أسابيع من التخزين البارد ثم حدث انخفاض في الاسبوع الرابع من التخزين البارد.

التوصية

يوصى برش سيليكات البوتاسيوم بنسبة ٥٪ في مزارع العنب للحصول على محصول عالي وذو جودة عالية اما اذا كان الغرض هو اطالة فترة التخزين مع الحفاظ علي جودة العنقود والحماية من الاعفان الفطرية وخاصة العفن الرماديBotrytis Cinerea يفضل الرش ب كاولين ٢٪ .