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# EVALUATION OF SOME PACKING TYPES ON QUALITY OF RUBY SEEDLESS GRAPE BUNCHES DURING AND AFTER COLD STORAGE

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**ABSTRACT : In 1999 and 2000 seasons mature Ruby Seedless grapevines received some pre-harvest treatments ; i.e., leaf removal around the cluster, two sprays of Plant Guard against rot pathogen and two $CaCl_2$ sprays. After harvesting, the clusters were adopted to one of the flowing six treatments : 1) control (carton boxes (CB) containing $SO_2$ generators), 2) Packing individual cluster in perforated (0.50 of the area) polyethylene (PE) bags contained $SO_2$ gener each and six bags were put in a (CB), 3) as in 2 but with PE bags 0.25% perforated area, 4) wrapping individual clusters in shrinkable PE thin sheet without $SO_2$ gener, each 6 clusters were put in a CB, 5) Packing individual cluster in scaled PE bags without $SO_2$ generator, each 6 bags in a CB, and 6) packing individual cluster in sealed PE bags containing $Ca(OH)_2$ for $CO_2$ absorption, each 6 bags in a CB All CBs were stored under 0°C without humidity control (like most of cold rooms in Egypt) for 1,2,3,4 and 5 months, after each month the naked clusters were kept on the shelf for 3, 6 or 9 days under supermarket conditions.**

**The obtained results revealed the advantage of packing , Ruby Seedless clusters in perforated (0.5 or 0.25% f the bag area) PE bags + $SO_2$ generators . The two packing treatments recorded relatively lowe FWL (%), decay %, berries shattering % and higher berries firmness and attaching force as compared with the control . Packing in sealed PE increased berries firmness and attaching force and decrease pannal test index value during the first three months of cold storage . Clusters packed in perforated PE had longer shelf life than all tested treatments ( 6 days after 3 months and 3 days after 4 months of cold storage ).**

## INTRODUCTION

Grapes are among the most popular fruit in Egypt. The area under vineyards attained about 142,241 feddans* Ruby Seedless grapes is one of the newly cultivars planted in Egypt. The harvesting season of this cultivar was during late September in the clayey soils in Nile valley . Increasing the storage life of ruby Seedless grapes would be the most resonable solution for prolonging its marketting period and for increasing its price. Clod storage would be the most promising solution. Most of cold rooms in Egypt are not humidity controlled, therefore the suitable relative humidity percentage has to be attained through packing treatments. The related studies included trials of wrapping the bunches in perforated polyethylene (PE) before packing in plastic baskets (Berger *et al.*, 1990 in Chile), packing Thompson Seedless bunches in perforted PE bags contained a slow release $SO_2$ genrator ( Soylemezoglu and Agaoglu , 1994 in Turkey), packing Adelo grape bunches in container with a double PE wall and supplied with 50g of potassium metabisulfite (Maestre, 1981 in Spain).

The best packing treatments for Flame Seedless bunches consisted of wrapping in perforated polyethylene and packing in plastic baskets, fungal decay was greatest in berries wrapped in non perforated film (Hegazi *et al.*, 1994) Perforated plastic films reduced weight loss and decay incidence (Castro *et al.*, 1999).

Ge-Yi Qiang *et al.* (1998), in China, noted that $SO_2$ treatment temporarily inhibited pathogen on grape bunches, inhibited respiration rate , reduced abscisic acid content and the release of ethylene , while increased IAA and GA contents which , in turn, inhibited fruit senescence and abscission.

The present work was

* Static of Ministry of Agriculture , 2000

conducted to evaluate some packing types including two types of perforated PE with $SO_2$ generators and shrinkable and sealed PE for replacing the use of $SO_2$ generators as well as $CO_2$ absorbing compound in modified atmosphere sealed PE . The effect of tested treatments on fresh weight losses, berry decay , berries shattering , berries firmness , berries attaching force , juice total soluble solids content and pannel test were considered during the period of cold storage (5 months) and during shelf life of 9 days (20°C and 60-70% RH) after cold storage.

## MATERIALS AND METHODS

This study has been carried out during 1999 and 2000 seasons on Ruby Seedless grape bunches harvested on September 17th from a vineyard at Kafer El-Zayat , Gharbeya Governorate . The vineyard soil was loomy - clay , and the vines were 5-years-old traind according to the cordone system.The vines were irrigated with Nile water using the traditional basin irrigation system , and received the usual horticultural practices regarding winter pruning, fertilization, pests and weeds control. In addition, defoliation had been done around the clusters leaving only the upper leaf on each cluster to prevent the sun burn. Clusters were sprayed twice with 0.5% Plant Guard (PG) [each $1cm^3$ contains $30 \times 10^6$ cells of *Trichoderma harzianum* ] and with 2% $CaCl_2$; the first spray was at pea stage and the second was 48h before harvesting .

Harvesting took place early in the morning, then the clusters were directly taken to post-harvest laboratory in Hort. Dept., Fac. of Agric., Zagazig Univ., where the bunches were divided randomly to six groups to correspond the following six treatments:

1. Control*, packing in 3 kg capacity carton boxes (CB) each having two units of $SO_2$ generator **.

* The same treatments are usually used in grape exportation from Egypt.

**Small paper bags covered partly with shrink PE and contained 1g of sodium metabisulfite

2.Packing individual cluster in perforated (0.25% of area) polyethylene (PE) bags each contained $SO_2$ generator; each 6 bags were put in a (CB).

3.Packing individual cluster in perforated (0.5% of area) PE bags, each contained $SO_2$ generator, each 6 bags were put in a (CB)

4.Wrapping individual cluster in shrinkable PE sheet (very thin layer) without $SO_2$ generator; each 6 clusters were put in a (CB).

5.Packing individual cluster in sealed PE bags 30μ thickness without $SO_2$ generator; each 6 bags were put in a (CB).

6.packing individual cluster in sealed PE bags 30μ thickness containing 5g wetted Ca $(OH)_2$ for $CO_2$ absorption and without $SO_2$ generator; each 6 bags were put in a (CB).

All CBs were stored under 0°C for five months. After each month of cold storage, samples of each treatment were taken out to evaluate storage period effects and to investigate clusters behaviour under conditions of 20°C and 60 -70% RH in an incubator (i.e. , the same as super market conditions ) for 3,6, and 9 days (shelf life of clusters). Evaluation of cold storage and shelf life effects on Ruby Seedless grape bunches was carried out through the following parameters.

1.Fresh weight losses (FWL) (%) : the clusters were weighed before cold storage after each month of cold storage and after each three days period of the shelf life; the fresh weight losses (%) at each period were calculated.

2.Berries decay (%) : the decayed berries on the cluster were separated and counted after each cold storage and shelf life period. The percentage of decayed berries were counted in relation to the total number of berries in each sample.

3. Berries shattering (%) :

was determined by twice light shaking the clusters; the shattered berries were counted for each sample and were expressed as percentages in relation to the initial number of berries before shaking.

4. Berries firmness was determined on 10 berries per cluster using Pushpull dynamometer (Model FD 101) without removing the berry peel. The average firmness of the sample was expressed in (g).

5. Berries attaching force was determined for 10 berries per sample using Puspbull dynamometer(Model FD 101).

6. Juice total soluble solids (TSS) percentage : tweny berries were picked from each sample , the juice was extracted and the TSS (%) was determined using a hand refractometer.

7. Juice active acidity (pH value): was determined using a pH meter ( style Hanna 8514).

8. Pannel test index : each replicate was judged by 5 persons who gave the score as follow : 4 = Excellent taste; 3= very good taste ; 2= good taste; 1= unacceptable taste ;0= very bad taste . The averages of the 5 persons were calculated.

The complete randomized block design with 3 replicates and with factorial arrangement was followed throughout the whole work (Snedecor & Cochran, 1980). The means representing the effect of tested treatments, storage period and their interaction were compared using the NLSD method at 0.05.

## RESULTS AND DISCUSSION

Data from Tables 1 to 9 showed the effect of tested treatments, periods of storage and their interaction on the percentages of fresh weight losses , berries decay , berries shattering , berries firmness (g) , berries attaching force (g), juice TSS, juice pH value and pannel test during the cold storage period and the following shelf life of the Ruby Seedless bunches.

**1.Effect of tested treatments**

**1.1 During cold storage**

The average values representing the effects of tested treatments during cold storage (Tables 1, 5 and 9), generally , indicated reductions in fresh weight losses (FWL) and decay percentages by most of tested treatments in comparison with the control. Berries shattering percentage was high with the control (CB+ $SO_2$ generator), while was particularly low with (0.25 and 0.50% perforated PE bags + $SO_2$ generators), but it was low with sealed PE packing and shrinkable PE in the second season only. Berries attaching force (g) was significantly high with packing in shrinkable PE and sealed PE bags . Berries firmness (g) was significantly high with packing in sealed PE bags as compared with the control. Whereas, juice TSS percentage was decreased by all tested treatments, particularly, (shrinkable PE) and sealed bags) as compared with the control. On the contrary all tested treatments did not affect juice pH values . Also pannel test index was significantly decreased by the treatments (shrinkable PE), (sealed PE bags) and [sealed PE bags + $Ca(OH)_2$].

**1.2 During shelf life**

The fresh weight losses were generally low with the control (CB + $SO_2$ generator) after one , two and three months, but was higher after four months of cold storage periods. Packing in sealed PE caused an increase in FWL during shelf life after one and two months of cold storage.

Berries decay percentage was decreased with the treatments (0.50% perforated . PE bags +$SO_2$ generator) and (0.25% perf. PE bags+$SO_2$ gener.) during shelf life after one , two and four months of cold storage period while the treatment (shrinkable PE sheet) revealed lower decay percentage during shelf life after one month of cold storage only. The other treatments show higher decay percentage .

Berries shattering percentage was relatively low with (0.50 perforated PE bag + $SO_2$ generator) and (0.25 perf. PE bags + $SO_2$ gener.) during shelf life after one , two and three months of cold storage periods. In addition, the treatments of (sealed PE bags) and [sealed PE bags+ Ca $(OH)_2$] encouraged berries shattering in most of the tested samples .

The berries firmness, was relatively higher with (0.25 and 0.50% perforated PE bags + $SO_2$ generator) during shelf life after one , two , three and four months of storage periods. The shrinkable PE sheet and the sealed PE with or without Ca $(OH)_2$ revealed higher berries firmness during shelf life after one and two months after storage .

The attaching force of control berries (CB+$SO_2$ generator) was greatly decreased in shelf samples taken after one , two , three and four months of cold storage. In addition, the treatments of (sealed PE bags) and [sealed PE bags+$Ca(OH)_2$] showed higher values in shelf samples taken after one, two months of cold storage.

The TSS percentage was always high during shelf life of control (CB + $SO_2$ generator) samples taken after one, two , three and four months but without significant differences with all other treatments.

**2. Effect of storage period**

**2.1. During cold storage**

The data from Tables 1,5and 9 obviously show that increasing cold storage period gradually and significantly promoted berries fresh weight losses, berries decay, berries shattering and juice TSS percentages as well as pH value and pannel test index.

On the contrary , berries firmness and berries attaching force were clearly depressed with the advance in cold storage period. This was clear in both considered seasons.

**2.2. During shelf life**

Data from Tables 2,3, 4,

6, 7 and 8 of clusters samples taken after one , two , three, four and five months of cold storage and examined after three , six and nine days of shelf life showed nearly similar trend for fresh weight losses, berries decay , berries shattering and juice TSS percentages. This trend was the gradual increments of values of the four parameters with increasing shelf life . On the contrary , the berries firmness and berries attaching force were obviously depressed after six and none days compared with samples taken after three days of shelf life. This was true in the two tested seasons.

**3.Effect of Interaction (treatments x period)**

**3.1 During cold storage**

The interactions were statistically significant, in most cases. Concerning fresh weight losses, berries decay and berries shattering percentages Tables 1 and 5.

**3.2 During shelf life**

The interaction during the shelf life was significant with fresh weight losses percentage after one month of cold storage in the two tested seasons and took the same trend as mainfactors . The interaction during shelf life was also significant in the two tested seasons with the two parameters (berries shattering percentage and berries attaching force).

Berries shattering percentage revealed an obvious decrease with packing in perforated PE bags + $SO_2$ generators. This may be due to $SO_2$ efficiency in perforated PE bags through reducing ethylene and increasing IAA and GA which inhibit grape senescence and decrease grape abscission (Ge-Yi Qiang *et al.* 1997, Abdel Hamed *et al.* 1999) and (Safaa and El-Hafnawi, 2001).

Table 1. Effect of some packing types on fresh weight losses , berries firmness and berries attaching forces in bunches of Ruby Seedless grapes during cold storage period (1999 and 2000 seasons).

| Treatments | Fresh weight losses % | | | | | | Berries firmness (g) | | | | | | Berries attaching forces (g) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | one month | Two month | Three month | four month | Five month | Treat av. | one month | Two month | Three month | four month | Five month | Treat av. | one month | Two month | Three month | four month | Five month | Treat av. |
| **First season (1999)** | | | | | | | | | | | | | | | | | | |
| 1.Cont. (CB)+$SO_2$ gener | 7.3 | 10.4 | 16.3 | 25.9 | - | 14.97 | 313 | 300 | 245 | 190 | - | 262.0 | 228 | 219 | 190 | 150 | - | 196.7 |
| 2.PE pags , 0.50% perf+ $SO_2$ gener | 3.2 | 3.8 | 7.8 | 10.3 | - | 6.27 | 318 | 306 | 264 | 208 | - | 274.0 | 239 | 220 | 199 | 166 | - | 206.0 |
| 3.PE bags 0.25% prf +$So_2$ gener | 2.7 | 3.3 | 6.4 | 9.5 | - | 5.47 | 320 | 308 | 278 | 209 | - | 278.7 | 249 | 231 | 207 | 177 | - | 216.0 |
| 4.Shrink PE sheet | 1.9 | 11.6 | 14.7 | - | - | 9.40 | 327 | 301 | 229 | - | - | 285.6 | 308 | 283 | 247 | - | - | 279.3 |
| 5.Sealed PE bags | 1.1 | 8.6 | 10.8 | - | - | 6.83 | 348 | 323 | 300 | - | - | 323.7 | 303 | 298 | 252 | - | - | 284.3 |
| 6.Sealed PE bags+$Ca(OH)_2$ | 0.55 | 2.8 | 6.3 | 14.9 | - | 6.14 | 360 | 313 | 292 | 239 | - | 301.0 | 312 | 280 | 220 | 176 | - | 247.0 |
| Period av. | 2.79 | 6.75 | 10.38 | 15.15 | - | | 331 | 308.5 | 268 | 211.5 | - | | 273.2 | 255.5 | 219.2 | 167.2 | - | |
| NLSD at 0.05 | P=1.336 | | T=1.359 | | T.P=3.774 | | P=37.563 | | T=39.024 | | T.P=40.902 | | P=5[illegible].881 | | T=57.708 | | T.P=57.985 | |
| **Second season (2000)** | | | | | | | | | | | | | | | | | | |
| 1.Cont. (CB)+$SO_2$ gener | 7.3 | 11.5 | 17.1 | 25.4 | 29.1 | 18.08 | 294 | 281 | 227 | 182 | 136 | 224.0 | 219 | 198 | 186 | [illegible] | 137 | 180.2 |
| 2.PE pags , 0.50% perf+ $SO_2$ gener | 1.7 | 4.2 | 7.9 | 10.7 | 11.2 | 7.14 | 307 | 296 | 261 | 200 | 176 | 248.0 | 232 | 219 | 197 | 171 | 151 | 194.0 |
| 3.PE bags 0.25% prf +$So_2$ gener | 1.5 | 5.0 | 7.5 | 9.4 | 11.5 | 6.98 | 315 | 292 | 272 | 212 | 185 | 255.2 | 247 | 226 | 211 | 174 | 152 | 202.0 |
| 4.Shrink PE sheet | 0.4 | 14.6 | - | - | - | 7.50 | 337 | 249 | - | - | - | 293.0 | 306 | 279 | - | - | - | 292.5 |
| 5.Sealed PE bags | 1.5 | 9.6 | - | - | - | 5.55 | 350 | 321 | - | - | - | 335.5 | 304 | 292 | - | - | - | 298.0 |
| 6.Sealed PE bags+$Ca(OH)_2$ | 0.4 | 8.0 | - | - | - | 4.20 | 330 | 285 | - | - | - | 307.5 | 303 | 289 | - | - | - | 296.0 |
| Period av. | 2.13 | 8.82 | 10.83 | 15.17 | 17.27 | | 322.2 | 287.3 | 253.3 | 198 | 165.6 | | 268.5 | 250.5 | 198.0 | 168.7 | 146.6 | |
| NLSD at 0.05 | P=2.076 | | T=1.468 | | T.P=2.368 | | P=86.038 | | T=46.023 | | T.P=NS | | P=99.686 | | T=94.058 | | T.P=79.235 | |

Treatments were terminated after the decay of 50% of fruits .

CB = Carton boxes , gener= generator PE= Polyethylene , perf= perforated

Table 2. Effect of some packing types on fresh weight losses % in bunches of Ruby Seedless grapes during shelf life period (1999 and 2000 seasons).

| Treatments | One month | | | | Two month | | | | Three month | | | | Four month | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 3 days | 6 days | 9 days | treat av. | 3 days | 6 days | 9 days | treat av. | 3 days | 6 days | 9 days | treat av. | 3 days | 6 days | 9 days | treat av. |
| **First season (1999)** | | | | | | | | | | | | | | | | |
| 1.Cont. (CB)+$SO_2$ gener | 3.1 | 7.6 | 9.1 | 6.6 | 2.4 | 5.0 | 6.8 | 4.7 | 0.6 | 5.7 | - | 3.1 | 1.8 | 36.5 | - | 19.1 |
| 2.PE pags , 0.50% perf+ $SO_2$ gener | 3.6 | 8.8 | 9.3 | 7.2 | 3.4 | 7.9 | 9.9 | 7.0 | 0.7 | 5.1 | - | 2.9 | 4.2 | 21.3 | - | 12.7 |
| 3.PE bags 0.25% prf +$So_2$ gener | 3.7 | 8.6 | 11.1 | 7.8 | 2.3 | 8.4 | 10.5 | 7.1 | 7.9 | 20.0 | - | 13.9 | 1.0 | 16.6 | - | 8.8 |
| 4.Shrink PE sheet | 3.5 | 9.7 | 13.0 | 8.7 | 4.5 | 8.2 | 10.7 | 7.8 | 0.4 | 12.8 | - | 6.6 | - | - | - | 9.0 |
| 5.Sealed PE bags | 4.6 | 10.3 | 14.7 | 9.8 | 7.5 | 10.9 | 16.3 | 11.5 | - | - | - | - | - | - | - | - |
| 6.Sealed PE bags+$Ca(OH)_2$ | 6.2 | 13.6 | 20.1 | 13.3 | - | - | - | - | - | - | - | - | - | - | - | - |
| Period av. | 4.1 | 9.7 | 12.8 | | 4.0 | 8.1 | | | 2.4 | 10.9 | | | 2.3 | 24.8 | - | |
| NLSD at 0.05 | P=2.715 | T=2.011 | T.P = 3.107 | | P=3..125 | T=2.913 | T.P = 3.792 | | P=2.935 | T=2.109 | T.P = N.S | | P=3.911 | T=3.741 | T.P = N.S | |
| **Second season (2000)** | | | | | | | | | | | | | | | | |
| 1.Cont. (CB)+$SO_2$ gener | 3.0 | 8.2 | 9.5 | 6.9 | 2.3 | 5.4 | - | 3.8 | 4.9 | 7.7 | - | 6.3 | 5.7 | - | - | 5.7 |
| 2.PE pags , 0.50% perf+ $SO_2$ gener | 3.5 | 9.2 | 9.4 | 7.4 | 3.9 | 7.3 | - | 5.6 | 3.8 | 6.2 | - | 5.0 | 4.5 | - | - | 4.5 |
| 3.PE bags 0.25% prf +$So_2$ gener | 3.4 | 8.5 | 9.2 | 7.0 | 3.5 | 8.5 | - | 6.0 | 5.9 | 21.0 | - | 13.4 | 4.3 | - | - | 4.3 |
| 4.Shrink PE sheet | 3.8 | 9.8 | 11.3 | 8.3 | 4.7 | 8.3 | - | 6.5 | - | - | - | - | - | - | - | - |
| 5.Sealed PE bags | 4.3 | 10.2 | 13.2 | 9.2 | 8.3 | 10.9 | - | 9.6 | - | - | - | - | - | - | - | - |
| 6.Sealed PE bags+$Ca(OH)_2$ | 6.0 | 14.5 | 21.2 | 13.9 | - | - | - | - | - | - | - | - | - | - | - | - |
| Period av. | 4.0 | 10.1 | 12.3 | | 4.5 | 8.1 | | | 4.9 | 11.6 | | | 4.8 | - | - | |
| NLSD at 0.05 | P=1.975 | T=1.014 | T.P = 2.013 | | P=2.223 | T=2.251 | T.P = N.S | | P=3.718 | T=3.912 | T.P = N.S | | P=N.S | T=N.S | T.P = N.S | |

Treatments were terminated after the decay of 50% of fruits .
CB = Carton boxes , gener= generator PE= Polyethylene , perf= perforated

Table 3. Effect of some packing types on berries firmness (g) in bunches of Ruby Seedless grapes during shelf life period (1999 and 2000 seasons).

| Treatments | One month | | | | Two month | | | | Three month | | | | Four month | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 3 days | 6 days | 9 days | treat av. | 3 days | 6 days | 9 days | treat av. | 3 days | 6 days | 9 days | treat av. | 3 days | 6 days | 9 days | treat av. |
| **First season (1999)** | | | | | | | | | | | | | | | | |
| 1.Cont. (CB)+$SO_2$ gener | 310 | 295 | 261 | 288 | 290 | 250 | - | 270 | 240 | 200 | - | 220 | 179 | 150 | 131 | 153 |
| 2.PE pags . 0.50% perf+ $SO_2$ gener | 314 | 305 | 262 | 294 | 294 | 217 | - | 255 | 259 | 231 | - | 245 | 195 | 140 | 135 | 157 |
| 3.PE bags 0.25% prf +$So_2$ gener | 317 | 309 | 277 | 301 | 298 | 207 | - | 252 | 271 | 236 | - | 253 | 198 | 132 | 120 | 150 |
| 4.Shrink PE sheet | 325 | 291 | 218 | 278 | 290 | 268 | - | 279 | 221 | - | - | 221 | - | - | - | - |
| 5.Sealed PE bags | 345 | 340 | 340 | 342 | 312 | 238 | - | 275 | - | - | - | - | - | - | - | - |
| 6.Sealed PE bags+$Ca(OH)_2$ | 358 | 278 | 248 | 295 | - | - | - | - | - | - | - | - | - | - | - | - |
| Period av. | 328 | 303 | 268 | | 297 | 236 | - | | 248 | 222 | - | | 191 | 140 | 129 | |
| NLSD at 0.05 | P=23.17 T=13.17 T.P = N.S | | | | P=36.12 T=N.S T.P=N.S | | | | P=21.35 T=N.S T.P = N.S | | | | P=11.21 T=N.S T.P = N.S | | | |
| **Second season (2000)** | | | | | | | | | | | | | | | | |
| 1.Cont. (CB)+$SO_2$ gener | 292 | 285 | 254 | 277 | 264 | 249 | - | 256 | 216 | 191 | - | 203 | 180 | - | - | 180 |
| 2.PE pags . 0.50% perf+ $SO_2$ gener | 301 | 300 | 258 | 286 | 290 | 232 | - | 261 | 243 | 222 | - | 232 | 191 | - | - | 191 |
| 3.PE bags 0.25% prf +$So_2$ gener | 309 | 303 | 281 | 298 | 289 | 234 | - | 261 | 251 | 226 | - | 238 | 199 | - | - | 199 |
| 4.Shrink PE sheet | 329 | 299 | 210 | 279 | 247 | 229 | - | 238 | - | - | - | - | - | - | - | - |
| 5.Sealed PE bags | 339 | 330 | 328 | 232 | 309 | 249 | - | 279 | - | - | - | - | - | - | - | - |
| 6.Sealed PE bags+$Ca(OH)_2$ | 312 | 383 | 251 | 282 | - | - | - | - | - | - | - | - | - | - | - | - |
| Period av. | 314 | 300 | 264 | | 280 | 239 | - | | 237 | 213 | - | | 190 | - | - | |
| NLSD at 0.05 | P=12.35 T=19.716 T.P = N.S | | | | P=32.37 T=19.71 T.P = N.S | | | | P=19.71 T=28.16 T.P = N.S | | | | P=- T=N.S T.P = N.S | | | |

Treatments were terminated after the decay of 50% of fruits .
CB = Carton boxes , gener= generator PE= Polyethylene , perf= perforated

Table 4. Effect of some packing types on berries attaching forces (g) in bunches of Ruby Seedless grapes during shelf life period (1999 and 2000 seasons).

| Treatments | One month | | | | Two month | | | | Three month | | | | Four month | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 3 days | 6 days | 9 days | treat av. | 3 days | 6 days | 9 days | treat av. | 3 days | 6 days | 9 days | treat av. | 3 days | 6 days | 9 days | treat av. |
| **First season (1999)** | | | | | | | | | | | | | | | | |
| 1.Cont. (CB)+$SO_2$ gener | 214 | 183 | 151 | 183 | 198 | 144 | - | 171 | 169 | 140 | - | 154 | 144 | 128 | - | 136 |
| 2.PE pags , 0.50% perf+ $SO_2$ gener | 229 | 201 | 160 | 197 | 201 | 152 | - | 176 | 174 | 139 | - | 156 | 151 | 130 | - | 140 |
| 3.PE bags 0.25% prf +$So_2$ gener | 232 | 222 | 172 | 209 | 210 | 154 | - | 182 | 185 | 130 | - | 157 | 161 | 131 | - | 146 |
| 4.Shrink PE sheet | 252 | 230 | 184 | 222 | 265 | 162 | - | 213 | 156 | - | - | 156 | - | - | - | - |
| 5.Sealed PE bags | 278 | 251 | 195 | 241 | 275 | 165 | - | 220 | - | - | - | - | - | - | - | - |
| 6.Sealed PE bags+$Ca(OH)_2$ | 249 | 240 | 189 | 226 | 269 | - | - | 269 | - | - | - | - | - | - | - | - |
| Period av. | 242 | 221 | 175 | | 236 | 155 | - | - | 171 | 136 | - | | 152 | 130 | - | - |
| NLSD at 0.05 | P=16.75 | T=18.91 | T.P = 21.32 | | P=29.69 | T=23.01 | T.P =N.S | | P=31.02 | T=N.S | T.P = N.S | | P=19.01 | T=N.S | T.P = N.S | |
| **Second season (2000)** | | | | | | | | | | | | | | | | |
| 1.Cont. (CB)+$SO_2$ gener | 212 | 179 | 142 | 178 | 179 | 128 | - | 154 | 162 | 135 | 129 | 142 | 141 | - | - | 141 |
| 2.PE pags . 0.50% perf+ $SO_2$ gener | 230 | 195 | 149 | 191 | 193 | 130 | - | 162 | 171 | 137 | 130 | 146 | 146 | - | - | 146 |
| 3.PE bags 0.25% prf +$So_2$ gener | 235 | 207 | 164 | 202 | 202 | 145 | - | 174 | 179 | 125 | 125 | 143 | 158 | - | - | 158 |
| 4.Shrink PE sheet | 250 | 212 | 173 | 212 | 259 | 140 | - | 200 | - | - | - | - | - | - | - | - |
| 5.Sealed PE bags | 262 | 234 | 185 | 227 | 270 | 145 | - | 208 | - | - | - | - | - | - | - | - |
| 6.Sealed PE bags+$Ca(OH)_2$ | 255 | 228 | 178 | 220 | - | - | - | - | - | - | - | - | - | - | - | - |
| Period av. | 241 | 289 | 165 | | 221 | 138 | - | | 171 | 132 | 128 | | 148 | - | - | |
| NLSD at 0.05 | P=29.16 | T=19.76 | T.P = 19.23 | | P=13.08 | T=19.31 | T.P = N.S | | P=23.14 | T=N.S | T.P = N.S | | | P=- | T=N.S | T.P = - |

Treatments were terminated after the decay of 50% of fruits .
CB = Carton boxes , gener= generator PE= Polyethylene , perf= perforated

Table 5. Effect of some packing types on berries decay percentage , berries shattering % and Total soluble solids% (TSS) in bunches of Ruby Seedless grapes during cold storage period (1999 and 2000 seasons).

| Treatments | Berries decay % | | | | | | Berries shattering % | | | | | | Total soluble solids % (TSS) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | one month | Two month | Three month | four month | Five month | Treat av. | one month | Two month | Three month | four month | Five month | Treat av. | one month | Two month | Three month | four month | Five month | Treat av. |
| First season (1999) | | | | | | | | | | | | | | | | | | |
| 1.Cont. (CB)+$SO_2$ gener | 2.9 | 3.4 | 16.0 | 44.0 | - | 16.57 | 1.2 | 7.2 | 10.7 | 16.2 | - | 8.82 | 20.2 | 20.7 | 22.8 | 25.0 | - | 22.17 |
| 2.PE pags , 0.50% perf+ $SO_2$ gener | 0.7 | 1.2 | 1.3 | 36.9 | - | 10.02 | 1.0 | 5.5 | 9.6 | 12.1 | - | 7.05 | 19.5 | 20.0 | 20.5 | 22.5 | - | 20.62 |
| 3.PE bags 0.25% prf +$So_2$ gener | 0.8 | 0.9 | 1.2 | 37.3 | - | 10.05 | 1.6 | 4.3 | 8.7 | 10.0 | - | 6.15 | 19.1 | 20.1 | 20.2 | 22.0 | - | 20.35 |
| 4.Shrink PE sheet | 0.0 | 0.0 | 1.8 | - | - | 0.60 | 1.8 | 7.7 | 15.0 | - | - | 8.17 | 18.2 | 18.8 | 21.4 | - | - | 19.47 |
| 5.Sealed PE bags | 3.4 | 4.1 | 7.0 | - | - | 4.83 | 4.1 | 6.5 | 14.1 | - | - | 8.23 | 18.7 | 20.0 | 21.1 | - | - | 19.93 |
| 6.Sealed PE bags+$Ca(OH)_2$ | 4.4 | 4.9 | 8.2 | 48.0 | - | 16.37 | 9.6 | 11.1 | 13.2 | 15.2 | - | 12.27 | 18.9 | 20.5 | 21.5 | - | - | 20.30 |
| Period av. | 2.0 | 2.42 | 5.91 | 41.55 | - | | 3.21 | 7.05 | 11.88 | 13.37 | - | | 19.10 | 20.02 | 21.25 | 23.17 | - | |
| NLSD at 0.05 | P=5.408 | | T=4.966 | | T.P=5.159 | | P=2.927 | | T=1.874 | | T.P=2.981 | | P=1.137 | | T=1.472 | | T.P=N.S | |
| Second season (2000) | | | | | | | | | | | | | | | | | | |
| 1.Cont. (CB)+$SO_2$ gener | 2.7 | 6.2 | 14.2 | 35.9 | 49.0 | 21.6 | 1.8 | 7.7 | 11.2 | 17.5 | 18.5 | 11.30 | 20.7 | 21.0 | 25.5 | 24.0 | 24.5 | 22.74 |
| 2.PE pags , 0.50% perf+ $SO_2$ gener | 1.1 | 1.9 | 15.3 | 20.2 | 44.1 | 16.52 | 0.9 | 6.1 | 10.4 | 12.4 | 13.3 | 8.62 | 20.0 | 20.3 | 22.1 | 23.0 | 24.0 | 21.88 |
| 3.PE bags 0.25% prf +$So_2$ gener | 0.9 | 1.3 | 10.0 | 17.2 | 35.0 | 12.88 | 0.8 | 7.3 | 9.7 | 11.3 | 12.5 | 8.32 | 19.8 | 21.1 | 22.0 | 22.5 | 23.2 | 21.72 |
| 4.Shrink PE sheet | 2.2 | 13.7 | - | - | - | 7.95 | 1.0 | 8.3 | - | - | - | 4.65 | 18.2 | 19.0 | - | - | - | 18.60 |
| 5.Sealed PE bags | 4.4 | 11.6 | - | - | - | 8.00 | 6.0 | 8.3 | - | - | - | 7.15 | 18.1 | 21.5 | - | - | - | 19.80 |
| 6.Sealed PE bags+$Ca(OH)_2$ | 5.4 | 9.7 | - | - | - | 7.55 | 4.7 | 6.2 | - | - | - | 5.45 | 19.1 | 21.6 | - | - | - | 20.35 |
| Period av. | 2.45 | 7.40 | 13.16 | 24.43 | 42.7 | | 2.53 | 7.32 | 10.43 | 13.67 | 14.77 | | 19.32 | 20.75 | 22.53 | 23.17 | 23.9 | |
| NLSD at 0.05 | P=5.392 | | T=4.291 | | T.P=NS | | P=1.291 | | T=4.144 | | T.P=3.172 | | P=1.636 | | T=0.831 | | T.P=N.S | |

Treatments were terminated after the decay of 50% of fruits .

CB = Carton boxes , gener= generator PE= Polyethylene , perf= perforated

Table 6. Effect of some packing types on berries decay percentage in bunches of Ruby Seedless grapes during shelf life period (1999 and 2000 seasons).

| Treatments | One month | | | | Two month | | | | Three month | | | | Four month | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 3 days | 6 days | 9 days | treat av. | 3 days | 6 days | 9 days | treat av. | 3 days | 6 days | 9 days | treat av. | 3 days | 6 days | 9 days | treat av. |
| | | | | | | | | First season (1999) | | | | | | | | |
| 1.Cont. (CB)+$SO_2$ gener | 4.2 | 26.6 | 48.1 | 26.3 | 3.2 | 13.1 | 26.7 | 14.3 | 1.5 | 13.7 | - | 7.6 | 33.3 | 38.1 | 49.1 | 40.1 |
| 2.PE pags , 0.50% perf+ $SO_2$ gener | 3.1 | 6.4 | 13.7 | 7.7 | 2.6 | 6.7 | 20.9 | 10.1 | 1.5 | 12.7 | - | 7.1 | 5.7 | 11.8 | - | 8.7 |
| 3.PE bags 0.25% prf +$So_2$ gener | 3.3 | 5.8 | 10.6 | 6.6 | 2.8 | 5.9 | 14.9 | 7.9 | 2.7 | 21.1 | - | 11.9 | 18.1 | 24.9 | - | 21.5 |
| 4.Shrink PE sheet | 1.5 | 8.0 | 17.2 | 8.9 | 1.5 | 5.4 | 39.4 | 15.4 | 1.4 | 32.2 | - | 16.8 | - | - | - | - |
| 5.Sealed PE bags | 10.7 | 28.8 | 47.1 | 28.9 | 24.6 | 31.2 | 46.4 | 34.1 | - | - | - | - | - | - | - | - |
| 6.Sealed PE bags+$Ca(OH)_2$ | 11.4 | 28.5 | 49.2 | 29.7 | - | - | - | - | - | - | - | - | - | - | - | - |
| Period av. | 5.7 | 17.3 | 31.0 | | 6.9 | 12.5 | | | 1.8 | 19.9 | - | | 19.0 | 21.6 | 49.1 | |
| NLSD at 0.05 | P=10.07 T=12.12 T.P = N.S | | | | P=4.12 T=4.09 T.P =N.S | | | | P=9.68 T=3.12 T.P = N.S | | | | P=5.91 T=17.16 T.P = N.S | | | |
| | | | | | | | | Second season (2000) | | | | | | | | |
| 1.Cont. (CB)+$SO_2$ gener | 7.1 | 21.1 | 47.6 | 25.3 | 7.0 | 16.2 | - | 11.6 | 13.0 | 19.3 | - | 16.1 | 21.3 | - | - | 21.3 |
| 2.PE pags , 0.50% perf+ $SO_2$ gener | 4.6 | 7.2 | 15.6 | 9.1 | 5.1 | 11.9 | - | 8.5 | 8.4 | 12.0 | - | 10.2 | 18.2 | - | - | 18.2 |
| 3.PE bags 0.25% prf +$So_2$ gener | 4.1 | 6.3 | 11.7 | 7.4 | 4.2 | 9.4 | - | 6.8 | 6.1 | 16.1 | - | 11.1 | 15.1 | - | - | 15.1 |
| 4.Shrink PE sheet | 2.5 | 13.4 | 16.3 | 10.7 | 2.7 | 7.1 | - | 4.9 | - | - | - | - | - | - | - | - |
| 5.Sealed PE bags | 16.2 | 22.1 | 48.1 | 28.8 | 18.8 | 37.1 | - | 28.0 | - | - | - | - | - | - | - | - |
| 6.Sealed PE bags+$Ca(OH)_2$ | 13.0 | 23.8 | 49.0 | 28.6 | - | - | - | - | - | - | - | - | - | - | - | - |
| Period av. | 7.9 | 15.7 | 31.3 | | 7.6 | 16.3 | - | | 9.2 | 15.8 | - | | 18.2 | - | - | |
| NLSD at 0.05 | P=6.03 T=11.07 T.P = N.S | | | | P=6.181 T=2.92 T.P = N.S | | | | P=5.76 T=4.01 T.P = N.S | | | | P=- T=N.S T.P = - | | | |

Treatments were terminated after the decay of 50% of fruits .

CB = Carton boxes , gener= generator PE= Polyethylene , perf= perforated

Table 7. Effect of some packing types on berries shattering percentage in bunches of Ruby Seedless grapes during shelf life period (1999 and 2000 seasons).

| Treatments | One month | | | | Two month | | | | Three month | | | | Four month | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 3 days | 6 days | 9 days | treat av. | 3 days | 6 days | 9 days | treat av. | 3 days | 6 days | 9 days | treat av. | 3 days | 6 days | 9 days | treat av. |
| | | | | | | | First season (1999) | | | | | | | | | |
| 1.Cont. (CB)+$SO_2$ gener | 7.4 | 26.6 | 49.7 | 27.9 | 8.3 | 12.4 | 17.4 | 12.7 | 1.1 | 11.0 | - | 6.0 | 4.1 | 5.1 | 6.7 | 5.3 |
| 2.PE pags . 0.50% perf+ $SO_2$ gener | 6.3 | 13.4 | 24.1 | 14.6 | 7.1 | 9.8 | 15.5 | 10.8 | 2.0 | 7.1 | - | 4.5 | 4.5 | 5.9 | - | 5.2 |
| 3.PE bags 0.25% prf +$So_2$ gener | 4.6 | 6.4 | 14.6 | 8.5 | 3.9 | 5.7 | 10.2 | 6.6 | 5.0 | 5.5 | - | 5.2 | 5.2 | 6.8 | - | 6.0 |
| 4.Shrink PE sheet | 1.4 | 4.4 | 48.9 | 18.2 | 4.6 | 9.6 | 24.2 | 12.8 | 11.4 | 21.4 | - | 16.4 | - | - | - | - |
| 5.Sealed PE bags | 19.7 | 37.1 | 43.4 | 33.4 | 22.6 | 41.4 | 49.7 | 37.9 | - | - | - | - | - | - | - | - |
| 6.Sealed PE bags+$Ca(OH)_2$ | 31.1 | 40.2 | 48.9 | 40.1 | - | - | - | - | - | - | - | - | - | - | - | - |
| Period av. | 11.7 | 21.3 | 38.3 | | 9.3 | 15.8 | 23.4 | | 4.9 | 11.2 | - | | 4.6 | 5.9 | 6.7 | |
| NLSD at 0.05 | P=9.03 T=11.23 T.P =10.02 | | | | P=6.01 T=5.98 T.P =11.34 | | | | P=5.12 T=9.21 T.P = 5.93 | | | | P=N.S T=N.S T.P = N.S | | | |
| | | | | | | | Second season (2000) | | | | | | | | | |
| 1.Cont. (CB)+$SO_2$ gener | 7.6 | 25.2 | 48.2 | 27.0 | 8.7 | 14.3 | 24.1 | 15.7 | 2.2 | 12.1 | - | 7.2 | 6.7 | - | - | 6.7 |
| 2.PE pags . 0.50% perf+ $SO_2$ gener | 5.3 | 17.9 | 26.7 | 16.6 | 7.2 | 10.2 | 19.2 | 12.2 | 3.1 | 8.2 | - | 5.7 | 5.9 | - | - | 5.9 |
| 3.PE bags 0.25% prf +$So_2$ gener | 4.7 | 13.9 | 20.2 | 12.9 | 2.6 | 6.9 | 12.8 | 7.4 | 5.1 | 6.1 | - | 5.6 | 6.8 | - | - | 6.8 |
| 4.Shrink PE sheet | 3.5 | 8.7 | 47.9 | 20.0 | 4.2 | 11.3 | 39.6 | 18.4 | - | - | - | - | - | - | - | - |
| 5.Sealed PE bags | 21.1 | 35.6 | 47.6 | 34.8 | 23.0 | 30.2 | 37.5 | 30.2 | - | - | - | - | - | - | - | - |
| 6.Sealed PE bags+$Ca(OH)_2$ | 29.2 | 41.2 | 49.1 | 39.8 | - | - | - | - | - | - | - | - | - | - | - | - |
| Period av. | 11.9 | 23.8 | 40.0 | | 9.1 | 14.6 | 26.6 | | 3.5 | 8.8 | - | | 6.5 | - | - | |
| NLSD at 0.05 | P=11.72 T=10.92 T.P = 11.38 | | | | P=5.02 T=4.02 T.P = 12.65 | | | | P=4.19 T=N.S T.P = N.S | | | | P= T=N.S T.P = - | | | |

Treatments were terminated after the decay of 50% of fruits .

CB = Carton boxes , gener= generator PE= Polyethylene , perf= perforated

Table 8. Effect of some packing types on total soluble solids percentage (TSS) in bunches of Ruby Seedless grapes during shelf life period (1999 and 2000 seasons).

| Treatments | One month | | | | Two month | | | | Three month | | | | Four month | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 3 days | 6 days | 9 days | treat av. | 3 days | 6 days | 9 days | treat av. | 3 days | 6 days | 9 days | treat av. | 3 days | 6 days | 9 days | treat av. |
| | | | | | | | | First season (1999) | | | | | | | | |
| 1.Cont. (CB)+$SO_2$ gener | 20.5 | 22.0 | 22.3 | 21.6 | 21.2 | 22.0 | 23.1 | 22.1 | 22.9 | 24.1 | - | 23.5 | 25.0 | 26.0 | 27.5 | 26.1 |
| 2.PE pags , 0.50% perf+ $SO_2$ gener | 20.0 | 22.0 | 22.5 | 21.5 | 20.5 | 22.1 | 22.5 | 21.7 | 20.8 | 22.2 | - | 21.5 | 23.0 | 25.0 | - | 24.0 |
| 3.PE bags 0.25% prf +$So_2$ gener | 19.5 | 21.0 | 22.1 | 20.9 | 20.4 | 22.0 | 23.1 | 21.8 | 20.5 | 22.4 | - | 21.4 | 22.6 | 23.5 | - | 23.1 |
| 4.Shrink PE sheet | 18.8 | 20.0 | 21.9 | 20.2 | 19.5 | 21.1 | 22.5 | 21.0 | 21.6 | 22.0 | - | 21.8 | - | - | - | - |
| 5.Sealed PE bags | 19.2 | 21.0 | 21.5 | 20.6 | 20.2 | 21.5 | 22.1 | 21.3 | - | - | - | - | - | - | - | - |
| 6.Sealed PE bags+$Ca(OH)_2$ | 19.3 | 21.1 | 23.0 | 21.1 | - | - | - | - | - | - | - | - | - | - | - | - |
| Period av. | 19.6 | 21.2 | 22.2 | | 20.4 | 21.7 | 22.7 | | 21.4 | 22.7 | - | | 23.5 | 24.8 | 27.5 | |
| NLSD at 0.05 | P=1.05 T=N.S T.P =N.S | | | | P=0.92 T=N.S T.P =N.S | | | | P=1.07 T=N.S T.P =N.S. | | | | P=0.89 T=2.11 T.P = N.S | | | |
| | | | | | | | | Second season (2000) | | | | | | | | |
| 1.Cont. (CB)+$SO_2$ gener | 21.0 | 22.1 | 22.4 | 21.8 | 21.5 | 23.5 | 24.2 | 23.1 | 23.8 | 24.6 | - | 24.2 | 24.2 | - | - | 24.2 |
| 2.PE pags , 0.50% perf+ $SO_2$ gener | 20.2 | 22.1 | 22.3 | 21.5 | 20.6 | 21.7 | 22.3 | 21.5 | 22.5 | 23.1 | - | 22.8 | 23.4 | - | - | 23.4 |
| 3.PE bags 0.25% prf +$So_2$ gener | 20.1 | 21.9 | 22.4 | 21.5 | 21.3 | 21.9 | 22.6 | 21.9 | 22.4 | 23.6 | - | 23.0 | 23.0 | - | - | 23.0 |
| 4.Shrink PE sheet | 19.5 | 22.2 | 23.0 | 21.6 | 19.9 | 21.0 | 22.4 | 21.1 | - | - | - | - | - | - | - | - |
| 5.Sealed PE bags | 18.6 | 21.1 | 22.2 | 20.6 | 21.4 | 22.1 | 22.3 | 21.9 | - | - | - | - | - | - | - | - |
| 6.Sealed PE bags+$Ca(OH)_2$ | 19.3 | 22.0 | 24.0 | 21.8 | - | - | - | - | - | - | - | - | - | - | - | - |
| Period av. | 19.8 | 21.9 | 22.7 | | 20.9 | 22.0 | 22.8 | | 22.9 | 23.8 | - | | 23.5 | - | - | |
| NLSD at 0.05 | P=0.95 T=N.S T.P = N.S | | | | P=0.78 T.= N.S T.P = N.S | | | | P=0.85 T=N.S T.P = N.S | | | | P=- T=N.S T.P = - | | | |

Treatments were terminated after the decay of 50% of fruits .
CB = Carton boxes , gener= generator PE= Polyethylene , perf= perforated

Table 9. Effect of some packing types on activated acidity and pannel test index in bunches of Ruby Seedless grapes during cold storage period (1999 and 2000 seasons).

| Treatments | Activited acidity pH | | | | | | Pannel test index * | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | one month | Two month | Three month | four month | Five month | Treat av. | one month | Two month | Three month | four month | Five month | Treat av. |
| **First season (1999)** | | | | | | | | | | | | |
| 1.Cont. (CB)+$SO_2$ gener | 3.53 | 3.72 | 3.92 | 4.18 | - | 3.84 | 3.2 | 3.4 | 3.5 | 3.2 | - | 3.32 |
| 2.PE pags ,.0.50% perf+ $SO_2$ gener | 3.45 | 3.74 | 4.01 | 4.31 | - | 3.88 | 3.1 | 3.2 | 3.4 | 3.1 | - | 3.20 |
| 3.PE bags 0.25% prf +$So_2$ gener | 3.43 | 3.66 | 3.99 | 4.19 | - | 3.82 | 2.8 | 2.9 | 3.0 | 3.0 | - | 2.92 |
| 4.Shrink PE sheet | 3.40 | 3.65 | 4.06 | - | - | 3.70 | 2.5 | 2.7 | 2.5 | - | - | 2.57 |
| 5.Sealed PE bags | 3.28 | 3.70 | 4.08 | - | - | 3.69 | 2.5 | 2.6 | 2.1 | - | - | 2.40 |
| 6.Sealed PE bags+$Ca(OH)_2$ | 3.31 | 3.73 | 4.02 | 4.35 | - | 3.85 | 2.4 | 2.7 | 2.6 | 1.9 | - | 2.40 |
| Period av. | 3.40 | 3.70 | 4.01 | 4.26 | - | | 2.75 | 2.91 | 2.85 | 2.80 | - | |
| NLSD at 0.05 | | P=0.249 | T=N.S | | T.P=N.S | | P=N.S | | T=0.327 | | T.P=N.S | |
| **Second season (2000)** | | | | | | | | | | | | |
| 1.Cont. (CB)+$SO_2$ gener | 3.58 | 3.76 | 3.88 | 4.28 | 4.65 | 4.03 | 3.4 | 3.5 | 3.5 | 3.1 | 3.0 | 3.30 |
| 2.PE pags , 0.50% perf+ $SO_2$ gener | 3.61 | 3.77 | 4.15 | 4.40 | 4.71 | 4.13 | 3.3 | 3.5 | 3.6 | 3.2 | 3.1 | 3.34 |
| 3.PE bags 0.25% prf +$So_2$ gener | 3.55 | 3.69 | 4.14 | 4.46 | 4.54 | 4.08 | 3.3 | 3.4 | 3.5 | 3.2 | 3.0 | 3.28 |
| 4.Shrink PE sheet | 3.43 | 3.65 | - | - | - | 3.54 | 2.9 | 2.9 | - | - | - | 2.9 |
| 5.Sealed PE bags | 3.31 | 3.77 | - | - | - | 3.54 | 2.6 | 2.7 | - | - | - | 2.65 |
| 6.Sealed PE bags+$Ca(OH)_2$ | 3.28 | 3.69 | - | - | - | 3.49 | 2.7 | 2.9 | - | - | - | 2.8 |
| Period av. | 3.46 | 3.72 | 4.06 | 4.38 | 4.63 | | 3.03 | 3.15 | 3.53 | 3.17 | 3.03 | |
| NLSD at 0.05 | | P=0.229 | T=N.S | | T.P=N.S | | P=N.S | | T=0.353 | | T.P=N.S | |

Treatments were terminated after the decay of 50% of fruits . CB = Carton boxes , gener= generator
PE= Polyethylene , perf= perforated *4= Excellent, 3= very good , 2= good , 1= unaceptable , 0 = very bad

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# تقييم بعض طرز التعبئة وتأثيرها على جوده عناقيد العنب صنف روبى سيدلس خلال وبعد فترة التخزين المبرد

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أجريت هذه التجربة فى عامى ١٩٩٩ ، ٢٠٠٠ حيث تلقت الكروم المثمرة من الصنف روبى سيدلس بعض معاملات قبل الحصاد ( التوريق حول العناقيد + رشتين لمستحضر بلانت جارد المضاد لمسببات أعفان الثمار + رشتين بمركب كلوريد الكالسيوم ) . وبعد القطف مباشرة تلقت العناقيد أحد المعاملات الستة الأتية : ١- المقارنه : تعبئة العناقيد فى صناديق سعه ٣ كجم وفى كل صندوق كيس صغير يحتوى مركب يولد غاز ثانى أكسيد الكبريت ببطء ، ٢- تعبئة كل عنقود فى كيس بولى أيثلين مثقب (٥ر ٪ من مساحة الكيس ) وبكل كيس عبوه صغيرة بها مولد ثانى أكسيد الكبريت ، كل ٦ أكياس فى صندوق كرتون ، ٣- مثل السابق + لكن المساحة المثقبة فى الكيس تبلغ ٢٥ر٪ ، ٤- لف كل عنقود في رقائق من البولى أيثيلين الرقيق جداً والقابل للانكماش وبدون مولد لغاز ثانى أكسيد الكبريت ، كل ٦ أكياس فى صندوق كرتون ، ٥ - تعبئة كل عنقود فى كيس من البولي أيثيلين المحكم الاغلاق وبدون مولد لغاز ثاني أكسيد الكبريت ، كل ٦ أكياس فى صندوق كرتون ، ٦- تعبئة كل عنقود فى كيس من البولى أيثيلين محكم الاغلاق يحوى هيدروكسيد الكالسيوم لامتصاص غاز ثانى أكسيد الكربون ، كل ٦ أكياس فى صندوق كرتون . وقد خزنت كل المعاملات تحت حرارة صفر درجة مئوية لمده ١ ، ٢ ، ٣ ، ٤ ، ٥ أشهر وبعد كل شهر تركت الصناديق على الرف تحت ظروف السوبر ماركت لمدة ٣ ، ٦ و٩ أيام .

وتظهر النتائج فائدة تعبئة عناقيد العنب صنف روبى سيدلس فى أكياس بولى أيثيلين مثقبة (٥ر. ، ٢٥٪ من مساحة الكيس ) تحتوى مولد غاز ثانى أكسيد الكبريت وقد أسهمت المعاملتان فى خفض النسبة المئوية للفقد فى الوزن الطازج ، والنسبة المئوية لتلف الحبات ، والنسبة المئوية للفرط من العنقود ، كما ازادت كل من صلابة الحبات وقوة التصاق الحبات بالعنقود وذلك عن عناقيد المقارنه وباقى المعاملات ، وأدت التعبئة فى أكياس محكمة الاغلاق إلى زيادة صلابة الحبات وقوة التصاق الحبات وقللت من درجة طعم الثمار فى خلال الاشهر الثلاثة الأولى من التخزين المبرد ، أما العناقيد المعبأة فى أكياس البولى أيثيلين المثقبة فكان لها عمراً أطول بعد الجمع عن كل طرز التعبئة الأخرى ( سته أيام بعد ثلاثة أشهر وثلاثة أيام بعد أربعة اشهر من التخزين المبرد ).