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EFFECT OF DIFFERENT PACKING METHODS ON GRAPES QUALITY

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ABSTRACT

Grape occupies the first rank in the world in terms of cultivated area and in terms of production. Grapes are very perishable commodities. The main of study is the methods of packaging and of special cooling are essential for the delivery of table grapes in optimum conditions. In this study used two kinds of grapes: - 1)Sugraone Seedless:- It is a white seedless, and 2)Flame Seedless:-It is a red seedless.

And used 3 methods of packing: - 1) Grapes bag, 2) LifeSpan (Modified Atmosphere Packing), and 3) LifeSpan and Sulfur Dioxide Pad. Measurements the properties which the quality of grapes depend on its like Total Soluble Solids (T.S.S %), total acidity, weight losses, shatter percentage, brown + rots percentage and diameter .storage grapes at *Maintaining a low temperature is a primary consideration in securing cooling of grapes it's 1±1. However, maintaining a high relative humidity of 95% and above during the storage is very important to minimize moisture loss and keep the stems in good condition and green. From this experiential found that used LifeSpan (Modified Atmosphere Packing) and SO_2 is very suitable to storage white grapes seedless (Sugraone Seedless) until 50 dayss. However, Use LifeSpan (Modified Atmosphere Packing) and SO_2 is unsuitable to storage red grapes seedless (Flame Seedless) until 50 dayss because the color is removal with long storage period. Use LifeSpan (Modified Atmosphere Packing) is suitable to storage red grapes seedless.*

Keyword: - Grape- Modified Atmosphere Packing- Quality

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INTRODUCTION

Grape is one of the most diffuse fruit in the world both as fresh fruit and processed in wine, grape juice, molassa, and raisins. Grape occupies the first rank in the world and second place after the citrus In Egypt. Grape is very delicate and the loss at harvest and during the distribution is very high **(Mencarelli et al., 2005)**

Grape quality depends on numerous factors. The lack of defects such as decay, cracked berries, stem browning, insect damage, grey mould infection caused by *Botrytis cinerea* and berry firmness are the most important elements for consumer acceptance. Gentle handling, careful cluster cleaning, low storage temperature, dipping in ethanol prior to packaging and compounds alternative to SO_2, are proposed to reduce the incidence of degradation. Another relevant aspect to be taken into great account for maintaining the quality of horticultural commodities is the choice of the appropriate packaging system **(Costa, et al. 2011)**

❖ ***Modified Atmosphere Packaging (M.A.P)***

Modified atmosphere packaging (M.A.P) is the removal and/or replacement of the atmosphere surrounding the product before sealing in vapor-barrier materials **(McMillin, 2008)**. The main aim of that the storage life of the product can be extended **(Mir and Beaudry, 2000)**. This technology seems straightforward as it uses permeable films and the respiration rate of the product at a specific temperature to change the concentration of carbon dioxide and oxygen around the product **(Jobling, 2001)**.

There is always a risk/benefit when using M.A.P, particularly when a low oxygen atmosphere is providing the benefit. The greatest extension of shelf life occurs at the lowest possible oxygen concentration before anaerobic respiration is initiated. This point also carries the greatest risk **(Jobling, 2001)**.

❖ ***Cooling system***

In grape postharvest, one of the most important factors affecting product quality is water loss from the stem due to its large surface to mass ratio. The rate of water loss is especially high before and during the cooling phase. The use of adequate pre-cooling techniques, rapidly removing the field and the respiration heats, can reduce the water loss because

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minimizes the exposure of grapes to low vapor pressure conditions **(Mencarelli et al., 2005).** Pre-Cooling must start as soon as possible and SO_2 applied within 12 hours of harvest. **(Crisosto and Smilanick, 1998).** Table grape requires air pre-cooling since most of the varieties is picked in hot season. It could be performed using the following different system as room cooling or conventional system, tunnel cooling and pressure cooling. Packaging type, design and materials dramatically affect the cooling time **(Mencarelli et al., 2005).**

1) Room cooling

The use of existing cold storage rooms is one of the most common systems. The cold air flow across the packed containers and refrigeration capacity have to be increased in order to guarantee the adequate air circulation with respect the normal flow in a cold storage rooms **(fig. 1).** Adequate pre-cooling rate are obtained it is possible to maintain on and around the product the cold air speed close to the value of 0.5 m/s and the refrigeration power inside of the cold storage room should be more than 0.28 kW/t considering a product average density of 0.20 t/m^3**(Mencarelli et al., 2005).**

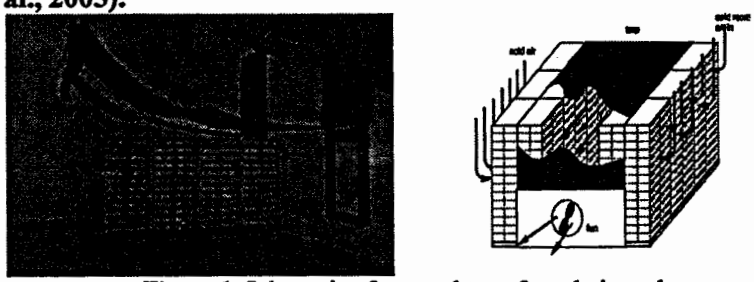

Figure 1. Schematic of a tunnel-type forced-air cooler

2) Forced air cooler

Refrigerated air is used as the cooling medium with this system. It is forced through produce packed in boxes or pallet bins. A number of airflow systems are used, but the tunnel cooler is the most common **(Fig. 1).** Two rows of packages, bins, or palletized product are placed on either side of an air-return channel. A tarp is placed over the product and the channel and a fan removes air from the channel, drawing air through the product. The product is cooled in batches and cooling times range from 1 h for cut flowers to more than 6 h for larger fruit, packed with airflow

restricting materials such as bags or paper wraps ***(Thompson et al., 1998).*** Forced-air cooling causes some moisture loss during cooling. Moisture loss is linearly related to difference between initial and final product temperatures ***(Thompson et al., 2002).***

❖ **Storage**

Recommended storage temperatures for table grapes are -1: 2 °C. The relative humidity should be maintained around 95%. Generally 0°C can be considered the optimum value for storage temperature. In the cold storage rooms uniform air circulation should be provided, but air velocity should be lower than 0.1 m/s in the channels between the pallets in order to minimize the loss of moisture from the stems. The greatest change that takes place in grapes in storage is loss of water. The first noticeable effect is drying and browning of stems and pedicels **(Mencarelli et al., 2005).**

The main objective of this study was study the methods of packaging and of special cooling is essential for the delivery of table grapes in optimum conditions, to storage with high quality for long time.

MATERIALS AND METHODS

1) **Materials**

a) Grapes

Two types of grapes *(Vitis vinifera L.)*

1) Sugraone Seedless

It is a white seedless variety with exceptional large berries for an early, seedless variety. It has a good shelf life. The berries have a slight muscat flavour when fully matured.

2) Flame Seedless

It is a red, mid- to late season seedless variety. It normally ripens one week later Sunred Seedless. Flame tends to ripen well on the vine, extending the season for seedless grapes. The bunches are attractive, filled with slightly elongated berries of maroon-red color. Flame has a melting crispy flavour and sweet taste.

b) Packs

1) LifeSpan (Modified Atmosphere Packing)

This bag is designed for 9kg of Seedless Grape-Special for best performance. Store at 0 °C.

Warning: - bag must be opened on removal from cold chain.
Important: - liner must be used as stated in packing information sheet supplied. Information supplied as guidance only. Customer must determine suitability for use. Bag Code: - L612.Batch No.: D161109.

2) Grapes bag

Unfortunately most local authorities will not recycle this but if you return the packaging to our larger stores.

3) Sulfur Dioxide Pad

UVASYS DUAL RELEASE ®(Pack Glossy side away from the grapes)

Sulfur dioxide generator used for the preservation of table grapes. Safe for food contact (Sulfur MRL 10ppm).

Active ingredient: - Sodium Metabisulphite (Cas No. 7681-57-4, E223) 37.55%.

Net quantity per sheet: 356x260 (4.5g) - 460x350 (7.8g) - 530x350 (9.0g).

Inert ingredients: 62.45%.

Disposal: must be made according to official rules.

Patents: RSA 95/7170, India 181228.

Manufactured by: Grapetek (PTY) LTD, Kinghall Avenue, Epping 2, Cape Town, South Africa.

2- Methods of Experimental Procedures

a) First experimental

Storage 2 kinds of grapes seedless one are Sugraone Seedless which whiten colour, and Flame Seedless which red colour. It is storage on 1±1°C and 95% Humidity. Using LifeSpan as a kind of Modified Atmosphere Packing and sulfur dioxide Pad.

b) Second experimental

Storage 2 kinds of grape seedless one are Sugraone Seedless which whitens color, and anther is Flame Seedless which red colour. It is storage on 1±1°C and 95% Humidity. Using LifeSpan as a kind of Modified Atmosphere Packing only.

c) Third experimental

storage 2 kinds of grapes seedless one is Sugraone Seedless which whiten colour, and anther is Flame Seedless which red colour. It is storage on 1±1°C and 95% Humidity. Using grapes bags.

3- Methods of Analyses

a) Chemical Properties

1) Total Soluble Solids (T.S.S %)

A hand refract-meter was used to determine the total soluble solids percentage in fruit juice.

2) Total Acidity

Total acidity was determined in terms of anhydrous malic acid percentage after titration against 0.1 N Sodium hydroxide using Phenolnaphaline as an indicator (A.O.A.C., 1995)

$$\text{Acidity} = \frac{\text{Average Titration}}{\text{the volum of grapes juice}} \times \text{Titration against NaOH} \times \text{Tartaric acid Strength}$$

The volume of grapes juice is 5 ml, Titration against NaOH is 0.1, and Tartaric acid strength is 75.

3) Weight Losses

Weight the bunch of grapes by digital balance.

$$\textit{Weight losses} = \frac{W_0 - W_t}{W_0} \times 100\%$$

Where:-

W_0:- Weight bunch of grapes at zero tome (g).

W_t:- Weight bunch of grapes at (T) time (g).

4) Shatter (%)

Weight the grapes berries which shatter by digital balance.

$$\textit{Shatter} = \frac{S_t}{W_0} \times 100\%$$

W_0:- Weight bunch of grapes at zero tome (g).

S_t:- Weight shatter grapes berries at (T) time (g).

5) Brown + Rots (%)

Weight the grapes berries which have brown and rots by digital balance.

$$\textit{Brown and Rots} = \frac{BR_t}{W_0} \times 100\%$$

Where:-

W_0:- Weight bunch of grapes at zero tome (g).

BR_t: - Weight brown and rots grapes berries at (T) time (g).

6) Diameter

Measuring the diameter of grapes berries by using seizer

RESULTS AND DISCUSSION

I) Sugraone Seedless

1) Effect of chemical and Physical properties during storage period of grape sugeraone was using grapes bags

a) Total Soluble Solids (T.S.S %)

In Fig.2 showed that the Total Soluble Solids (T.S.S %) increased during the storage grapes period. Where it increased from 15.5 to 19.1% after 50 days of storage. The acidity is also increased during the storage grapes period. Where it increased from 0.57 to 1.21 after 50 days of storage.

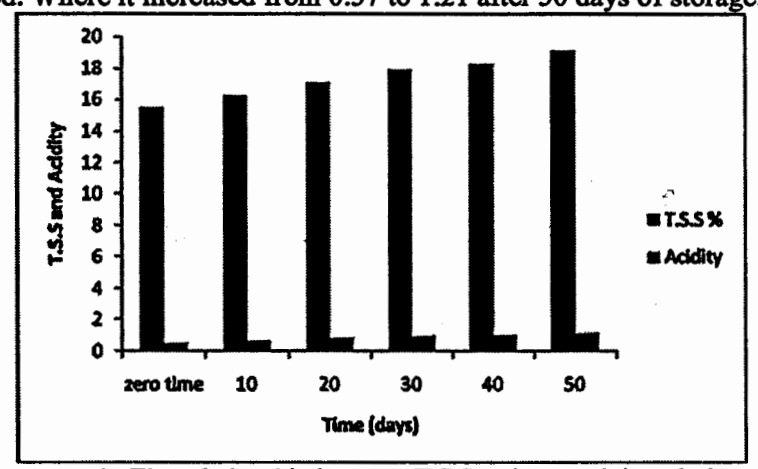

Figure 2:-The relationship between T.S.S, acidity and time during period storage sugarone using grapes bags

b) Sugar: Acid Ratio

In fig. 3 showed that the sugar: acid ratio is decreased from zero time of storage to the end of storage period. Where it decreased from 27.19:1 the best ratio of exportation grapes to 19.32:1 which is unsuitable ratio after 20 days of storage.

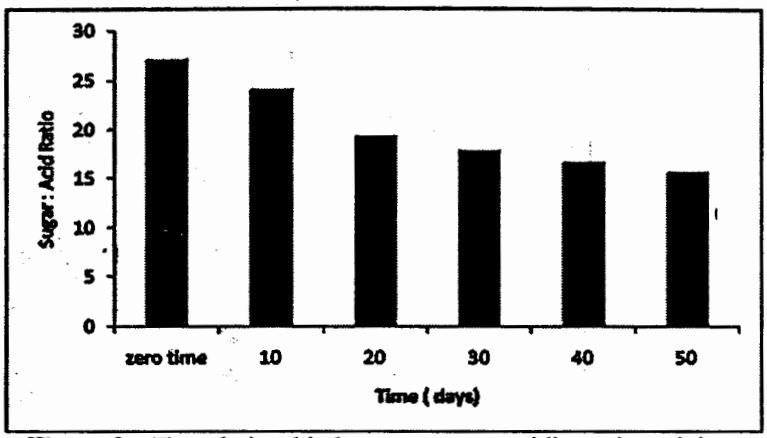

Figure 3:- The relationship between sugar: acidity ratio and time during period storage sugarone using grapes bags

c) The weight

Fig. 4 showed that the weight decreased from 556.5 g at zero time of storage to 389.3 g after 50 days of storage. The weight losses were depending on the water losses from grapes berries and dry the stem after 30 days of the storage.

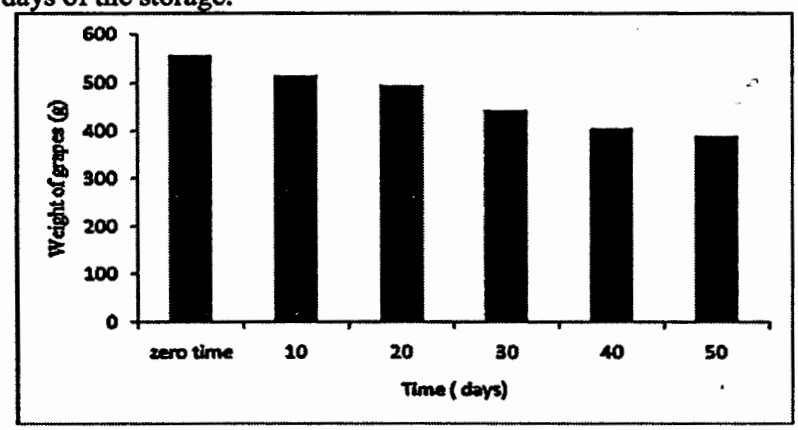

Figure 4:- The relationship between weight of grapes and time during period storage sugarone using grapes bags

d) Grapes berries status

In Fig. 5 showed that the grapes berries start shattering after 20 days during storage with 3.55% and continue until 32.45% after 50 days. But

the brown and rots appear on grapes berries after 10 days with 7.21% and continue until 33.53% after 50 days.

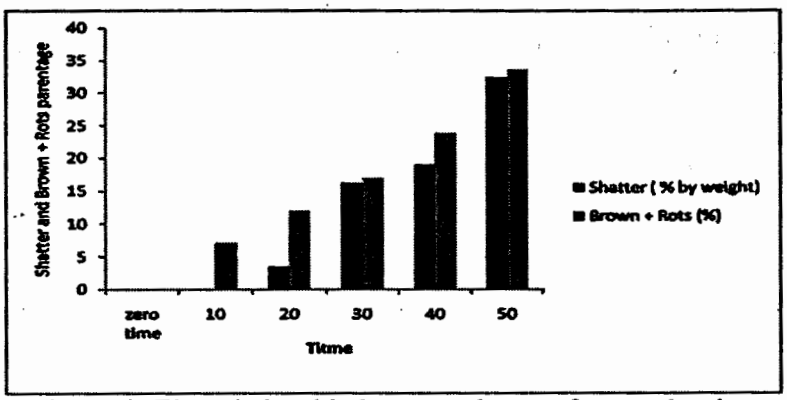

Figure 1:-The relationship between shatter of grapes berries, brown + rots percentage and time during period storage sugarone using grapes bags.

2) **Effect of chemical and Physical properties during storage period of grape sugeraone was using LifeSpan (Modified Atmosphere Packing)**

a) **Total Soluble Solids (T.S.S %)**

In Fig.5 showed that the Total Soluble Solids (T.S.S %) increased during the storage grapes period. Where it increased from 15.5 to 18.8% after 50 days of storage. The acidity is also increased during the storage grapes period. Where it increased from 0.57 to 1.04 after 50 days of storage.

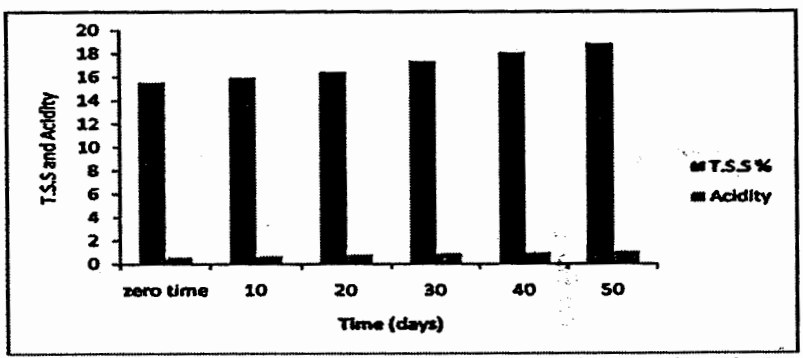

Figure 2:- The relationship between T.S.S, acidity and time during period storage sugarone using grapes LifeSpan (M.A.P.)

b) Sugar: acid ratio

But fig. 6 showed that the sugar: acid ratio is decreased from zero time of storage to the end of storage period. Where it decreased from 27.19:1 the best ratio of exportation grapes to 19.78:1 which is unsuitable ratio after 40 days of storage.

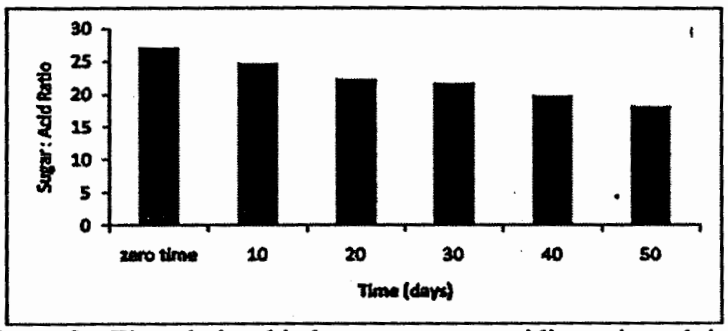

Figure 3:- The relationship between sugar: acidity ratio and time during period storage sugarone using grapes LifeSpan (M.A.P.).

c) The weight

Fig. 7 showed that the weight decreased from 566.1 g at zero time of storage to 421.4 g after 50 days of storage. The weight losses were depending on the water losses from grapes berries and dry the stem. After 40 days of the storage the stem become high dry.

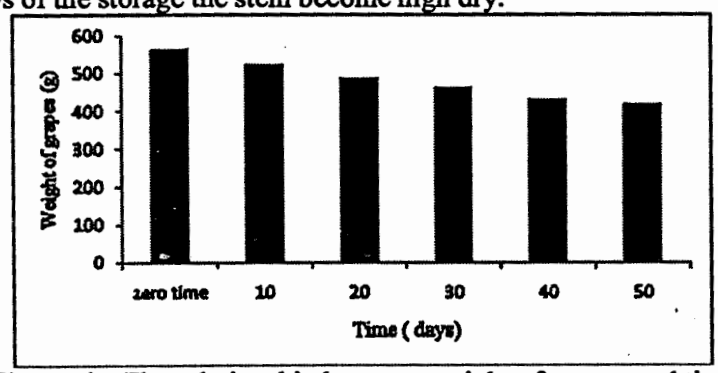

Figure 4:- The relationship between weight of grapes and time during period storage sugarone using grapes LifeSpan (M.A.P.).

d) Grapes berries status

In Fig. 8 showed that the grapes berries started shattering after 30 dayss during storage with 2.16% and continue until 5.44% after 50 dayss. But

the brown and rots appear on grapes berries after 20 dayss with 5.79% and continue until 17.56% after 50 dayss.

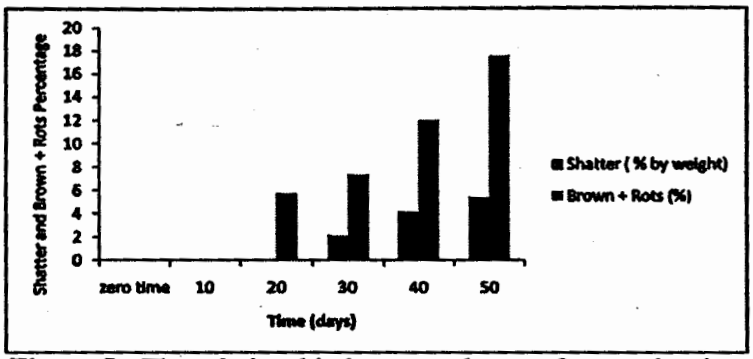

Figure 5:- The relationship between shatter of grapes berries, brown + rots percentage and time during period storage sugarone using grapes LifeSpan (M.A.P.).

Effect of chemical and Physical properties during storage period of grape sugeraone was using LifeSpan (Modified Atmosphere Packing) and Sulfur Dioxide Pad

a) Total Soluble Solids (T.S.S %)

In Fig.9 showed that the Total Soluble Solids (T.S.S %) increased during the storage grapes period. Where it increased from 15.5 to 18.0% after 50 days of storage. The acidity is also increased during the storage grapes period. Where it increased from 0.57 to 0.93 after 50 days of storage.

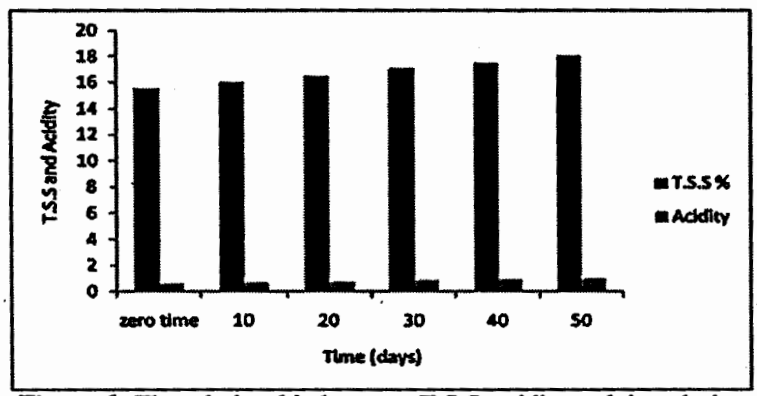

Figure 6:-The relationship between T.S.S, acidity and time during period storage sugarone was using grapes LifeSpan (M.A.P.) and SO_2

b) Sugar: acid ratio

But fig. 10 showed that the sugar: acid ratio is decreased from zero time of storage to the end of storage period. Where it decreased from 27.19:1 the best ratio of exportation grapes to 19.35:1 which is unsuitable ratio after 50 days of storage.

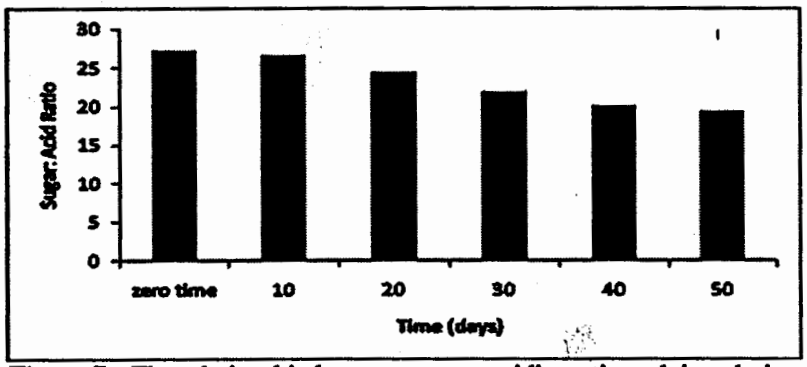

Figure 7:- The relationship between sugar: acidity ratio and time during period storage sugarone was using grapes LifeSpan (M.A.P.) and SO_2

c) The weight

Fig. 11 showed that the weight decreased from 561g at zero time of storage to 455.1 g after 50 days of storage. The weight losses were depending on the water losses from grapes berries and dry the stem. After 50 dayss of the storage the stem become high dry.

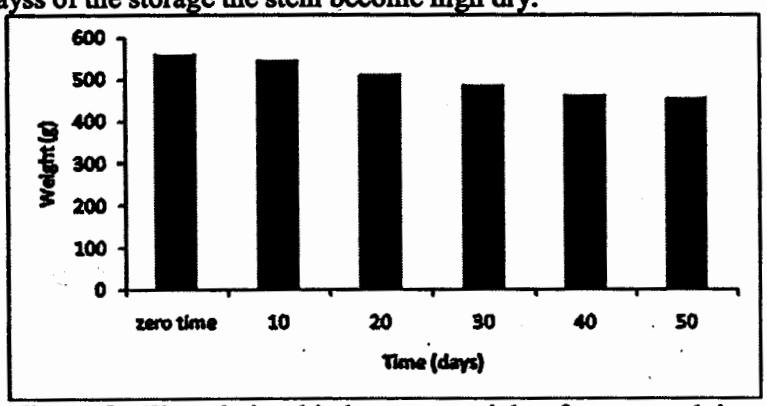

Figure 8:- The relationship between weight of grapes and time during period storage sugarone was using grapes LifeSpan (M.A.P.) and SO_2.

d) Grapes berries status

In fig. 12 showed that the grapes berries started shattering after 30 dayss during storage with 0.55% and continue until 2.14% after 50 dayss. But the brown and rots appear on grapes berries after 30 dayss with 1.65% and continue until 3.42% after 50 days.

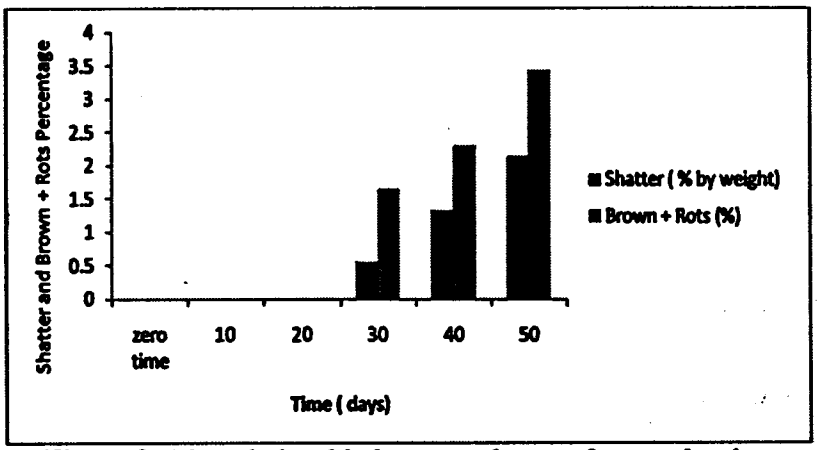

Figure 9:-The relationship between shatter of grapes berries, brown + rots percentage and time during period storage sugarone was using grapes LifeSpan (M.A.P.) and SO_2.

II) Flame Seedless

1) Effect of chemical and Physical properties during storage period of grape Flame was using grapes bags

a) Total Soluble Solids (T.S.S %)

In Fig.13 showed that the Total Soluble Solids (T.S.S %) increased during the storage grapes period. Where it increased from 16 to 19.9% after 50 days of storage. The acidity is also increased during the storage grapes period. Where it increased from 0.56 to 1.14 after 50 days of storage.

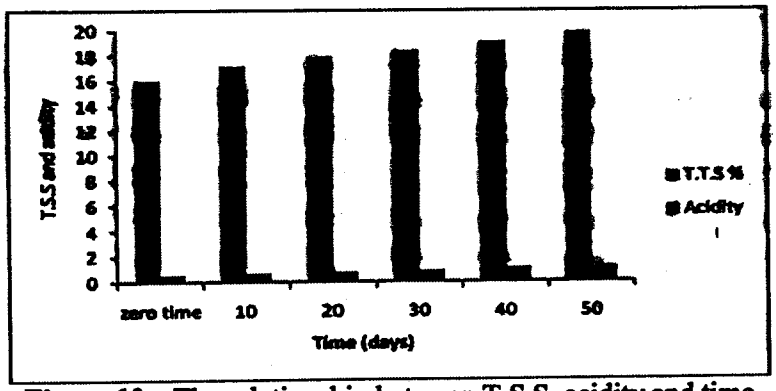

Figure 10:- The relationship between T.S.S, acidity and time during period storage Flame using grapes bags

b) Sugar: acid ratio

But fig. 14showed that the sugar: acid ratio is decreased from zero time of storage to the end of storage period. Where it decreased from 28.83:1 the best ratio of exportation grapes to 20.79:1 which is unsuitable ratio after 30 days of storage.

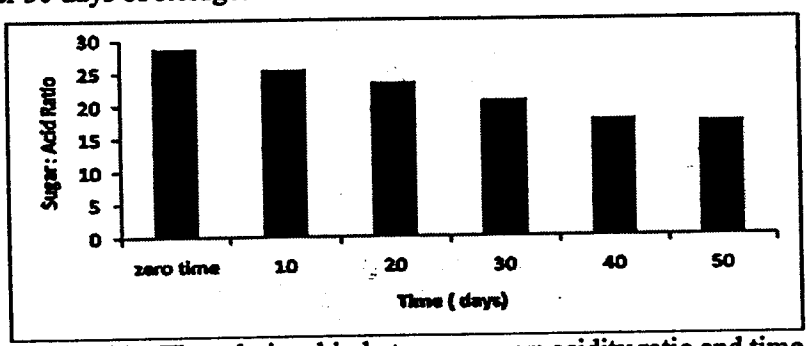

Figure 11:- The relationship between sugar: acidity ratio and time during period storage Flame using grapes bags.

c) The weight

Fig. 15 showed that the weight decreased from 581g at zero time of storage to 391.9g after 50 days of storage. The weight losses were depending on the water losses from grapes berries and dry the stem. After 50 dayss of the storage the stem become high dry.

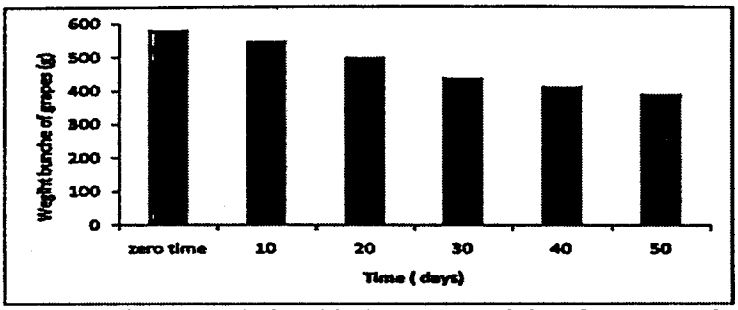

Figure 12:- The relationship between weight of grapes and time during period storage Flame using grapes bags

d) Grapes berries status

In fig.16showed that the grape berries started shattering after 30 days during storage with 0.55% and continue until 2.14% after 50 days. But the brown and rots appear on grapes berries after 30 days with 1.65% and continue until 3.42% after 50 days.

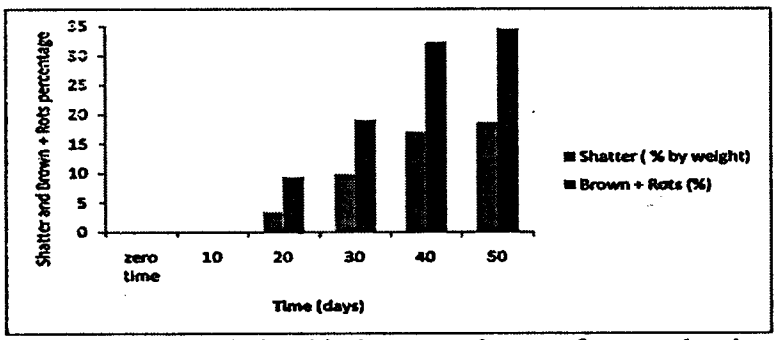

Figure 13:-The relationship between shatter of grapes berries, brown + rots percentage and time during period storage Flame using grapes bags.

2) **Effect of chemical and Physical properties during storage period of grape Flame was using LifeSpan (Modified Atmosphere Packing)**

a) **Total Soluble Solids (T.S.S %)**

In Fig.17 showed that the Total Soluble Solids (T.S.S %) increased during the storage grapes period. Where it increased from 16 to 18.9% after 50 days of storage. The acidity is also increased during the storage

grapes period. Where it increased from 0.56 to 1.04 after 50 days of storage.

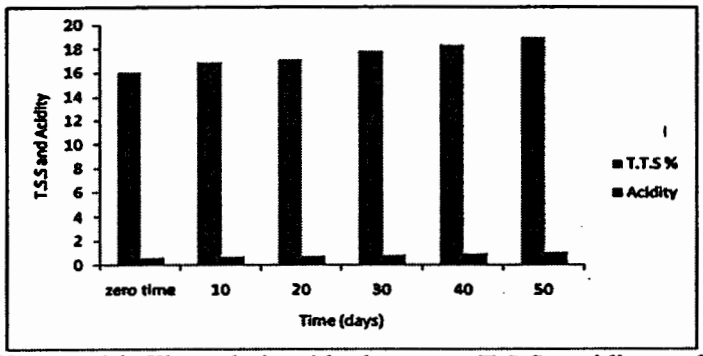

Figure 14:-The relationship between T.S.S, acidity and time during period storage Flame using grapes LifeSpan (M.A.P).

b) Sugar: acid ratio

But fig. 18 showed that the sugar: acid ratio is decreased from zero time of storage to the end of storage period. Where it decreased from 28.83:1 the best ratio of exportation grapes to 20:1 which is unsuitable ratio after 40 days of storage.

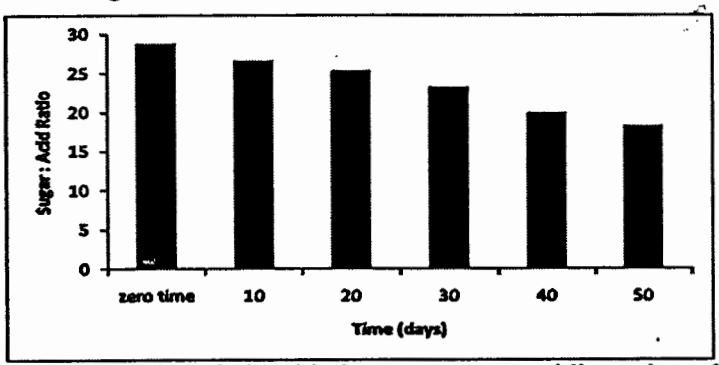

Figure 15:-The relationship between sugar: acidity ratio and time during period storage Flame using grapes LifeSpan (M.A.P.).

c) The weight

Fig. 19 showed that the weight decreased from 581g at zero time of storage to 391.9g after 50 days of storage. The weight losses were

depending on the water losses from grapes berries and dry the stem. After 50 dayss of the storage the stem become mostly dehydrated.

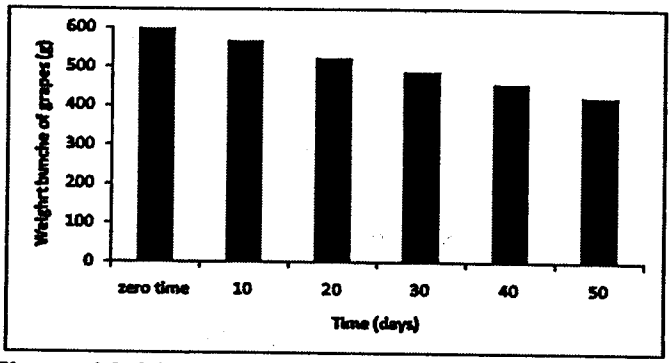

Figure 16:-The relationship between weight of grapes and time during period storage Flame using grapes LifeSpan (M.A.P.).

d) Grapes berries status

In fig. 20 showed that the grapes berries started shattering after 30 dayss during storage with 2.88% and continue until 6.17% after 50 dayss. But the brown and rots appear on grapes berries after 30 dayss with 8.49% and continue until 29.35% after 50 dayss.

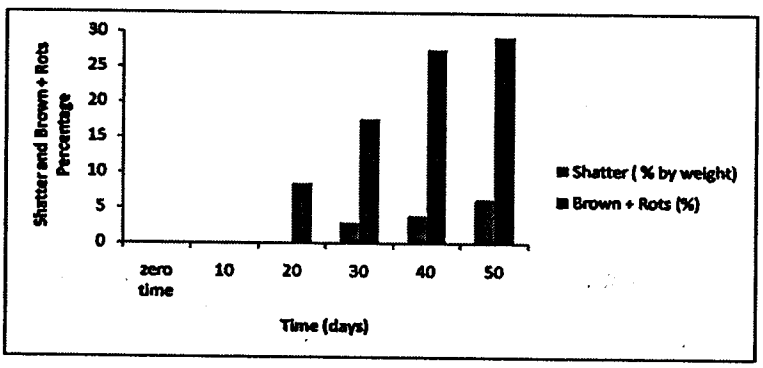

Figure 17:-The relationship between shatter of grapes berries, brown + rots percentage and time during period storage Flame using grapes LifeSpan (M.A.P.).

3) Effect of chemical and Physical properties during storage period of grape Flame was using LifeSpan (Modified Atmosphere Packing) and Sulfur Dioxide Pad

a) Total Soluble Solids (T.S.S %)

In Fig.21 showed that the Total Soluble Solids (T.S.S %) increased during the storage grapes period. Where it increased from 16 to 18.7% after 50 days of storage. The acidity is also increased during the storage grapes period. Where it increased from 0.56 to 0.98 after 50 days of storage.

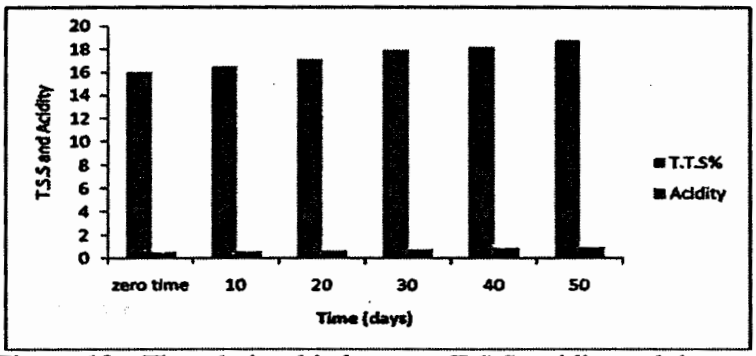

Figure 18:- The relationship between T.S.S, acidity and time during period storage Flame using grapes LifeSpan (M.A.P.) and SO_2.

b) Sugar: acid ratio

But fig. 22 showed that the sugar: acid ratio is decreased from zero time of storage to the end of storage period. Where it decreased from 28.83:1 the best ratio of exportation grapes 20.56:1 which is unsuitable ratio after 40 days of storage.

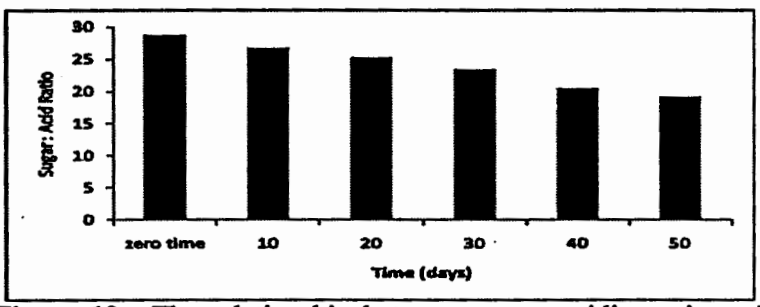

Figure 19:- The relationship between sugar: acidity ratio and time during period storage Flame using grapes LifeSpan (M.A.P.) and SO_2

c) The weight

Fig. 23 showed that the weight decreased from 576g at zero time of storage to 451.9g after 50 days of storage. The weight losses were depending on the water losses from grapes berries and dry the stem. After 50 dayss of the storage the stem become high dry.

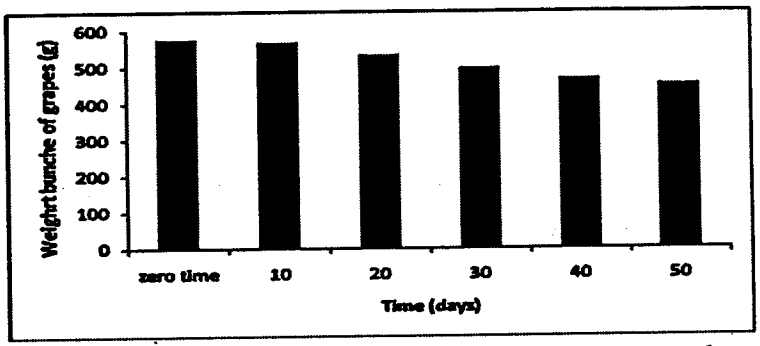

Figure 20:- The relationship between weight of grapes and time during period storage Flame using grapes LifeSpan (M.A.P.) and SO_2

d) Grapes berries status

In fig. 24 showed that the grapes berries started shattering after 30 dayss during storage with 1.78% and continue until 4.15% after 50 dayss. But the brown and rots appear on grapes berries after 30 dayss with 11.61% and continue until 35.33% after 50 dayss.

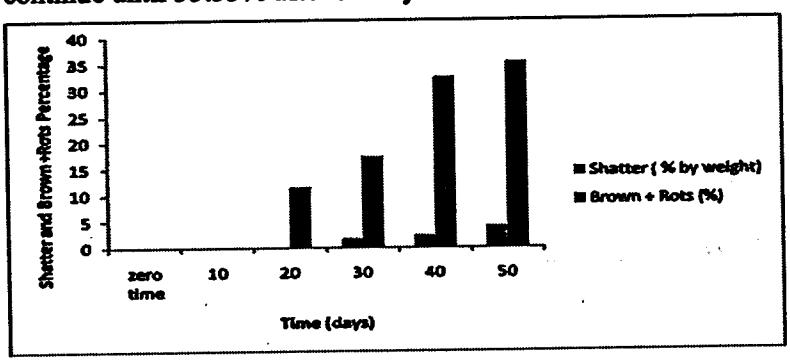

Figure 21:- The relationship between shatter of grapes berries, brown + rots percentage and time during period storage Flame using grapes LifeSpan (M.A.P.) and SO_2

CONCLUSION

Use LifeSpan (Modified Atmosphere Packing) and SO_2 is very suitable to storage white grapes seedless (**Sugraone Seedless**) until 50 dayss. However, Use LifeSpan (Modified Atmosphere Packing) and SO_2 is unsuitable to storage red grapes seedless (**Flame Seedless**) until 50 dayss because the color is removal with long storage period. Use LifeSpan (Modified Atmosphere Packing) is suitable to storage red grapes seedless.

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الملخص العربى

تاثير طرق التعبئة المختلفة على جوده العنب

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يحتل العنب المرتبة الأولي في العالم من حيث المساحة المنزرعة ومن حيث الإنتاج وفي مصر يحتل العنب المرتبة الثانية بعد الموالح. وللعنب آفاق واسعة للتصدير ويمكن له ان يقفز بمعدل الصادرات الزراعية بشرط التعرف علي كيفية إنتاج عنب صالح للتصدير في الوقت المناسب وبجودة مناسبة. ونظرا لان العنب من المحاصيل الحساسه للتلف السريع لذلك فإيراعى التعبئة فى عبوات مناسبة مع التخزين المبرد فى ظروف مثلى حتى يحتفظ بجودته للاطول فترة. فالحفظ على درجة حرارة منخفضة هي الاعتبار الأساسي في تبريد العنب. وكذلك الحفظ على رطوبة عالية نسبيا من ٩٥ ٪ وما فوق خلال التخزين مهم جدا لتقليل الخسائر والحفاظ على رطوبة ينبع في حالة جيدة والخضراء. ويوجد العديد من التقنيات المستخدمة فى تعبئه العنب للحفظ مده طويله بحاله جيده.

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و فى هذه الدراسه تم استخدام نوعين من العنب صنف ابيض اللون (Sugaraone) وصنف ملون احمر (Flame) . وكذلك تم استخدم ٣ انواع من طرق التعبئة وهى١) اكياس تعبئه العنب المعتاد استخدامها و٢) اكياس اللايف اسبان (lifespan) كاحدى انواع التعبئة فى الجو الهوائي المعدل و٣) اخرى تم استخدام شيتات من ثانى اكسيد الكبريت. وتم قياس مجموعه من العوامل التى تحدد عليها جوده العنب وهى قطر الحبة ، نسبة المواد الذائبه ، نسبه الحموضة، نسبه الفقد فى الوزن، نسبه الفرط وكذلك نسبه الاعفان وتلون الثمار باللون البنى. ومن خلال هذه التجربه تبين ان استخدام lifespan مع شيتات ثانى اكسيد الكبريت ادت الى حفظ الاطناف البيضاء من العنب الى فترة تصل الى ٥٠ يوم بجوده متوسطة . بينما استخدام lifespan مع شيتات ثانى اكسيد الكبريت مع الاصناف الملونه ادى الى ازاله اللون بعد ٤٥ يوم من الحفظ . وبالتالى فان استخدام lifespan فقط مع الاصناف الملونه مناسب يؤدى الى حفظها الى فترة تصل الى ٤٠ يوم بجوده متوسطة.