New Valley Journal of Agricultural Science
Published by Faculty of Agriculture, New Valley University, Egypt
DOI: 10.21608/NVJAS.2023.210902.1207
Research Article Open Access

Effect of Different Packing Types on Storage and Quality of Saidy Dates

Essam Mohamed Abdelzaher Radwan [*1], Abdel-Fattah mostafa El-Salhy [2], Hajar Mahmoud Saber Hussein [1] and Mohammed Kamal Mohammed Sayed [1]

[1] Horticulture Department, Faculty of Agri. New Valley University, El-Kharga, New Valley, Egypt.
[2] Pomology Department, Faculty of Agriculture. Assiut University, Assiut, Egypt.

*** Corresponding author**
Essam Mohamed Abdelzaher Radwan

Received: 14/05/2023
Revised: 09/06/2023
Accepted: 23/06/2023
Published: 23/06/2023

Abstract

This study was conducted during two successive seasons 2020/2021 and 2021/2022 to study the effect of some packing types on the storability and quality of Saidy dates (*Phoenix dactylifera L.*) fruits during the storage period. The post-harvest treatments were packed with perforated or non-perforated polyethylene layers and aluminum foil. The fruits were stored at cold condition 5±1°C with 85-90% RH. Samples of each treatment were randomly taken every two months for 8 months. The results showed that fruit weight loss %, fruit damage %, total soluble solids % and sugar contents were significantly increased with prolonging the storage period. On other hand, the advanced storage period induced a gradual decrease of fruit weight, flesh% and fruit dimensions. All packing with non-perforated either polyethylene or aluminum foil caused a decrease in fruit weight loss and fruit damage percentage as well as fruit weight, flesh% and fruit dimensions compared to use other packing types. Using non-perforated polyethylene resulted in the least fruit weight loss and fruit damage percentage compared to use other packing types. Using non-perforated polyethylene packing improved the fruit quality during the storage period compared to use perforated polyethylene or either perforated or non-perforated aluminum foil. It could be concluded that using packing with non-perforated polyethylene-maintained fruit freshness without negative effects of fruit quality parameters and seems to be the proper and an ideal packing types to prolong cold storage of Saidy dates without great reduction in fruit quality.

Key words: polyethylene, aluminum foil, packing types, Date palm, storage.

Introduction

Date palm (*Phoenix dactylifera L.*) is considered an old fruit tree in many countries all over the world. Dates are a high-energy food and a fruit that is rich with carbohydrates (60-70% sugar, mainly glucose and fructose) serve as an important food **(Wrigley, 1995).**

The total annual world production of dates amounts to 8.5 million metric tons, countries of the Middle East and North Africa being the largest producers. Egypt is the first top ten date producers (**FAO, 2018)**

Saidy date palm is considered the national date palm variety in new Valley Governorate. It is the most important cultivar of semi-dry dates that is largely required in the local and foreign markets. Cold storage extends fruit shelf life through reducing the respiration rate and ethylene production, inhibiting the biological deterioration rate and reduces the incidence of fruit decay. In general, the optimal storage conditions for mandarins are 5°C and 90-95 RH for 2-6 weeks (**Kader, 2002**).

The cold storage of date palm fruits is an important storage method currently which used to increase the life of fruits in the Rutab stage for as long as possible, which increases the length of time in local markets**.** It decreases the bioactivity of fruits, especially respiration rate and ethylene production, and reduces the growth of pathogens **(Desouki *et al*., 2001 and Mortazavi *et al*., 2010).** Fruits differ in their behavior during storage. They are affected by cultivar type, environmental conditions and agricultural treatments before and after harvest. All these factors are reflected in their effect on the longevity of the fruit in the store **(Benjamin *et al*., 1985; Higazy *et al*., 2002 and Omaima *et al*., 2012).**

Cold storage of date fruits has received more attention in recent years in the major date producing countries. Date industries usually store dates at 3°C for up to a year. It has been gaining popularity as it allows for dates consumption at any time of the year, Cold storage is an essential practice for date's storage. Further research on date fruits quality parameters such as appearance, texture and sensory properties is highly recommended **(Ismail *et al*., 2008; Al-Yahayai and Al-Kharusi, 2012; Aleid, 2013 and Aleid *et al*., 2014).**

Since quality parameters of date fruits are affected by storage, it is very important to understand the effect of storage conditions on the characteristics of date fruits. During handling and storage of date fruits, the packaging is applied to avoid water loss, physical and insect damage. There are various types and dimensions used for the packaging of date fruits. **(Yahia *et al*., 2014).**

Many storage technologies are available and being used throughout the world to prolong the market life, maintain a high quality product and add value to dates in order to enhance the market competitiveness and economic value of edible product **(Din *et al*., 2011 and Al-Yahayai and Al- Kharusi, 2012).**

Date fruits are usually stored at low temperatures to prevent color changes, sugar spots, and syrupiness processes, disease incidence, and insect infestation. In addition, cold storage minimizes flavor, textural, and quality losses. Optimal storage temperature depends on cvs and ripening stage of date. To prevent water loss and over-ripening, date fruits at the Khalal stage should be stored at 0°C and 85 to 95% relative humidity (RH). Semi-soft cvs, like Deglet Nour and Halawi, can be stored longer than soft cvs such as Madjool and Barhi **(Siddiq and Greiby, 2013).**

Aluminum foil is an important material in laminates and has wide application in food packaging. Its barrier function against the migration of moisture, oxygen and other gases, and volatile aroma, as well as against the impact of light is generally higher than any plastic laminate material **(Lamberti and Escher, 2007)**.

Polyethylene wrapping of CaCl2 treated apple proved very useful for reducing weight loss and shriveling and retained consumer

acceptability even after 60 days of storage **(Hayat *et al*., 2005).** It was observed in another study that decay incidence in perforated packages did not exceed 10-12% as compared to 20% decay in control. The combination of Modified Atmospheric Packaging (MAP) with effective decay controlling measures can extend the post-harvest life of mango fruit **(Rodov *et al*., 1996).**

Thus, the main goal of this study was to investigate the effect of packing types on saidy date fruits quality attributes during cold storage for 8 months.

Materials and Methods

The present work was carried out on Saidy date palm during 2020/2021 and 2021/2022 seasons. The fruits of date palm were collected in the Routab stage in the two experimental seasons. The fruits were immediately transferred to the laboratory of the Horticulture Department, Faculty of Agriculture, New Valley University. The Picking fruits were sorted to exclude those that were not suitable for marketing, such as the fruits stuck with dust and sand, infected with insects, fungi, or pasty and missing their natural shape, or violating the appropriate degree of maturity, or any damage that makes the fruit unsuitable for packaging and marketing, where only a quantity of equal size and weight is chosen .The chosen fruits were of uniform size and color and free from any visible defects. Fruits were selected with uniform fruit size and divided into nine groups, each containing three replicates 5.0 kg of fruit/repeat in the two experimental seasons as follows:

The nine different treatments were as follows:

1- Packing the fruits in a single layer of non-perforated polyethylene bags (Control, T_1).
2- Packaging the fruits in perforated 2 mm thickness polyethylene layers bags (10 holes, T_2).
3- Packaging the fruits in non-perforated 2mm thickness polyethylene layers bags (T_3).
4- Packaging the fruits in perforated 3 mm thickness polyethylene layers bags (10 holes, T_4).
5- Packaging the fruits in non-perforated 3 mm thickness polyethylene layers bags (T_5).
6- Packaging the fruits in perforated light aluminum foil (10 holes, T_6).
7- Packaging the fruits in non-perforated light aluminum foil (T_7).
8- Packaging the fruits in perforated thick aluminum foil (T_8).
9- Packaging the fruits in non-perforated thick aluminum foil (T_9).

The experimental, starts on 1 September until 1st May under cold storage at 5°C+1°C with (85±90% R.H.) and the following measurements were determined during the two studied seasons.

Physical characteristics

1- Weight Loss %: This percentage is calculated from the following equation:

$$Percentage\ of\ weight\ loss = \frac{WB - WE}{WB}\ x\ 100$$

WB: The weight of fruits at the beginning of storage.

WE: The weight of fruits at the end of storage.

2- Fruit damaged: It was determined by counting the number of decay fruits (pathological or physiological disorders) throughout the eight months and expressed as a percentage of the initial number of fruits per each sample (replicate).
3- Fruit weight, fruit dimensions and percentage of fruit flesh. Samples of fifty fruits were picked at random from each replicate to determine fruit weight, fruit dimensions and percentage of fruit flesh.

Total soluble solids percentage (T.S.S. %):

TSS of the edible pulp was estimated by hand refractometer. Three different readings for each replicate were recorded and the average was calculated **(A.O.A.C., 2000).**

Total and reducing sugars: -

The percentages of total and reducing sugars were determined according to the

volumetric method of Lane and Eynon outlined in **A.O.A.C. (2000).**

Statistical analysis

Randomized complete design with three replicates and with factorial was followed throughout the whole work and the least significant difference test (L.S.D) at 5% level was used to differentiate means according to **Snedecor and Cochran (1980**).

Results

1-The percentage of fruit weight loss and fruits damage:

Data presented in Figure (1, 2) showed the effect of packing with perforated or non-perforated polyethylene layers and aluminum foil on the percentage of weight loss and fruits damage of Saidy dates during the cold storage in 2020/2021 and 2021/2022 seasons. It was obvious that results took similar trend during the two studied seasons.

Data in current figures clear that fruit weight loss and fruits damage percentage were markedly increased with advance of cold storage period. These traits were slightly increased gradually from the beginning of cold storage till the 4th month, then a rapid increase until the 8th month.

Weight loss and damage percentage increased during storage, reaching values of (3.23 & 3.55%) and (6.67 & 6.67%) in control fruits after eight months. The weight loss was significantly increased and attained (6.81, 3.48, 6.33, 3.62, 9.57, 7.43, 9.75 & 7.70%) and (6.22, 3.85, 8.58, 3.93, 9.66, 7.78, 9.61 & 7.43%) due to packing the fruits in perforated 2 mm thickness polyethylene (T_2), non-perforate 2 mm thickness (T_3), perforated 3 mm thickness polyethylene (T_4), non-perforated 3 mm thickness polyethylene (T_5), perforated light aluminum foil (T_6), non-perforated light aluminum foil (T_7), perforated thickness aluminum foil (T_8) and non-perforated thickness aluminum (T_9) during the two studied seasons, respectively. Also, the corresponding values of damage percentage was attained (12.0, 6.76, 10.67, 6.67, 12.0, 13.3, 14.67 & 13.33%) and (10.67, 8.0, 16.0, 8.0, 20.33, 16.0, 18.67 & 14.67), respectively.

In response of packing types, it was apparent that all packing in perforated packages, whether polyethylene or aluminum foil significantly increased the fruit weight loss percentage and undesirable fruit percentage during cold storage compared with control. Using perforated either polyethylene or aluminum foil had the best results, which gave the least percentage of fruit weight loss and fruit damage. In general view, using non-perforated polyethylene gave the least percentage of fruit weight loss and decayed fruits compared to use aluminum foil. No significant differences in weight loss and fruit damage due to use perforated polyethylene layers, as well as perforated aluminum foil. The decrement percentage of weight loss percentage attained (43.95, 49.60 & 47.58) and (68.90, 67.53 & 66.23%), as well as (43.35, 36.91 & 36.05) and (66.58, 62.78 & 62.28%) use non-perforated bags (T_1, T_3, T_5) compared to perforated either polyethylene (T_2) or aluminum foil (T_8) during the two studied seasons, respectively. The corresponding decrement percentage damage fruits values attained (44.42, 44.42 & 44.42%) and (54.53, 54.53 & 54.53%) as well as (37.49, 25.02 & 25.02%) and (64.27, 57.15 & 57.15%) during the two studied seasons, respectively.

The variation in reduction of fruit loss and fruit damage depends on the packing type used where, use perforated polyethylene gave the least percentage of fruit weight loss and induce a least percentage of decayed fruits compared to the other treatments.

The results indicated that using perforated polyethylene bags proved effective in reducing the percentage of weight loss and fruit damage as well as keeping the Saidy date fruits for long period.

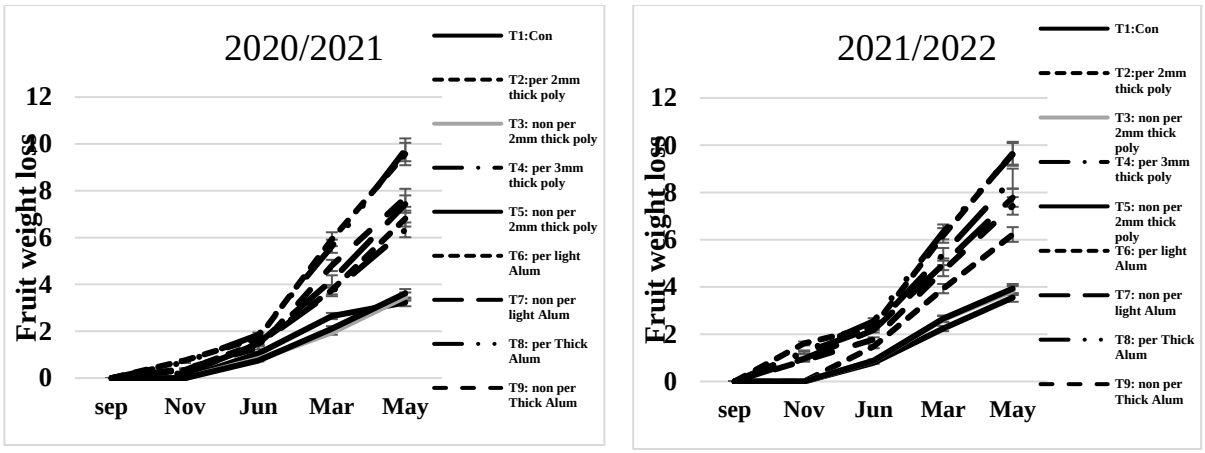

Fig (1): Effect of packing types on fruit weight loss percentage of Saidy dates under cold storage during 2020/2021 and 2021/2022 seasons

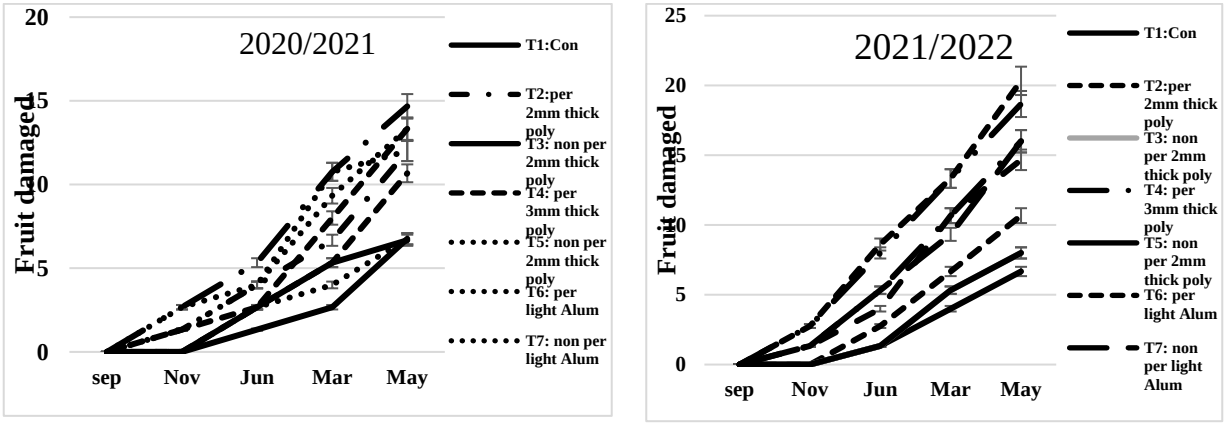

Fig (2): Effect of packing types on fruit damage of Saidy dates under cold storage during 2020/2021 and2021/2022 seasons.

2- Fruit Physical properties:

The data concerning the effect of different cold storage treatments on physical properties of Saidy date fruits during 2020/2021and 2021/2022 seasons are presented in Tables (1, 2, 3 and 4). It was obvious from the data that results took similar trend during the two studied seasons.

In general view, data indicated that physical traits in terms of fruit weight, flesh% and fruit dimensions significantly increased during storage duration increased up to 8th month.

According to the treatment effects, it is clear from the data that all treatments lead to significant effects on physical properties compared to control. Moreover, using perforated polyethylene packing as well as, aluminum foil either perforated or non-perforated significantly decreased, fruit weight, flesh% and fruit dimensions compared to packing in non-perforated polyethylene.

Moreover, the highest values of fruit weight, flesh% and fruit dimensions were recorded on packaging the fruits with non-perforated polyethylene (T_1) at end of storage period compared with other treatments. On other hand, the least values of fruit weight, flesh% and fruit dimensions were recorded on fruits packed in perforated thickness aluminum foil (T_8) with during the two studied seasons.

According to previous results, it could be concluded that using packing with non-perforated polyethylene-maintained fruit freshness seemed to be the proper and ideal treatment to prolong cold storage of Saidy date fruits without great reduction in fruit quality.

Table (1): Effect of packing types on fruit weight (g) of Saidy dates under cold storage during 2020/2021 and 2021/2022 seasons.

Seasons	2020/2021						2021/2022					
Month(A) Treat(B)	Sep.	Nov.	Jun.	Mar.	May	Mean	Sep.	Nov.	Jun.	Mar.	May	Mean
T1	9.86	9.88	9.73	9.60	9.53	9.72	10.15	10.15	10.05	9.92	9.77	10.01
T2	9.92	9.83	9.76	9.53	9.24	9.66	10.31	10.28	10.15	9.89	9.66	10.06
T3	9.89	9.86	9.79	9.68	9.53	9.75	10.24	10.24	10.15	9.96	9.85	10.09
T4	9.82	9.76	9.68	9.46	9.20	9.58	10.29	10.16	10.05	9.73	9.41	9.93
T5	9.90	9.88	9.81	9.68	9.52	9.76	10.20	10.20	10.11	9.92	9.79	10.04
T6	9.71	9.65	9.56	9.13	8.81	9.37	10.16	9.98	9.92	9.53	9.18	9.75
T7	9.74	9.70	9.57	9.33	9.03	9.47	10.23	10.13	10.00	9.72	9.43	9.90
T8	9.95	9.87	9.75	9.39	9.02	9.60	10.30	10.17	10.11	9.65	9.31	9.91
T9	9.80	9.80	9.66	9.33	9.06	9.53	10.18	10.10	10.00	9.70	9.43	9.88
Mean	9.84	9.80	9.70	9.46	9.22		10.23	10.16	10.06	9.78	9.54	
NEW LSD %	A= 0.25		B= 0.18		AB= 0.40		A= 0.26		B= 0.16		AB= 0.36	

T_1: Con T_2: per 2 mm thick poly T_3: non per 2 mm thick poly
T_4: per 3 mm thick poly T_5: non per 2 mm thick poly T_6: per light Alum
T_7: non per light Alum T_8: per Thick Alum T_9: non per Thick Alum

Table (2): Effect of packing types on Flesh % of Saidy dates under cold storage during 2020/2021 and 2021/2022 season.

Seasons	2020/2021						2021/2022					
Month(A) Treat(B)	Sep.	Nov.	Jun.	Mar.	May	Mean	Sep.	Nov.	Jun.	Mar.	May	Mean
T1	85.11	85.00	84.26	83.89	82.25	84.10	84.25	83.92	83.36	81.89	80.76	82.84
T2	84.98	84.46	83.71	83.12	80.18	83.29	84.11	83.63	82.89	82.13	78.75	82.30
T3	85.00	85.00	84.28	82.82	82.00	83.23	84.40	84.11	83.28	82.51	80.52	82.96
T4	85.21	84.93	84.21	82.53	80.86	83.55	84.51	83.96	83.19	81.39	79.41	82.49
T5	85.60	85.48	84.70	83.15	82.57	84.30	84.33	84.05	83.19	81.68	80.60	82.77
T6	84.92	84.11	83.89	81.65	78.85	82.68	84.11	83.18	82.97	80.67	77.13	81.61
T7	85.30	85.21	84.40	81.93	79.58	83.28	84.50	84.25	83.48	81.11	78.71	82.41
T8	86.10	85.53	84.61	80.95	79.11	83.26	84.43	84.31	83.69	79.86	77.13	81.88
T9	85.73	85.60	84.88	80.90	79.83	83.39	84.80	84.58	83.86	79.92	78.18	82.27
Mean	85.33	85.04	84.33	82.14	80.58		84.50	80.11	83.44	81.36	79.14	
NEW LSD %	A= 1.00		B= 0.52		AB= 1.16		A= 1.03		B= 0.46		AB= 1.03	

3- Fruit chemical properties

The data concerning the effect of various cold storage treatments on chemical constituents of saidy date fruits juice during 2020/2021and 2021/2022 seasons are presented in Tables (5, 6 and 7). It was obvious from the data that results followed similar trend during the two studied seasons.

In general view, data indicated that chemical juice quality in terms, total soluble solids and sugars contents significantly increased during storage duration up to 8th month.

According of treatment effects, it is clear from the obtained data that all treatments lead to significant effects on chemical juice properties compared to control. Moreover,

using perforated polyethylene layers and aluminum significantly increased total soluble solids and sugars contents compared to use non-perforated polyethylene.

Moreover, the highest values of total soluble solids and sugar contents were recorded on packaging the fruits with non-perforated light aluminum (T_6) at end of storage period compared with other treatments. On other hand, the least values of total soluble solids and sugar contents were recorded on fruits that packed on perforated polyethylene (T_1 & T_3) during the two studied seasons.

According to previous results, it could be concluded that using packing with non-perforated polyethylene-maintained fruit freshness seemed to be the proper and ideal treatment to prolong cold storage of Saidy date fruits without great reduction in fruit quality.

Table (3): Effect Storage changes on fruit length of Saidy dates under cold storage during 2020/2021 and 2021/2022 seasons.

Seasons	2020/2021						2021/2022					
Month(A) Treat(B)	Sep.	Nov.	Jun.	Mar.	May	Mean	Sep.	Nov.	Jun.	Mar.	May	Mean
T1	3.88	3.88	3.59	3.51	3.47	3.67	3.84	3.83	3.58	3.49	3.56	3.66
T2	3.87	3.64	3.48	3.39	3.34	3.54	3.85	3.62	3.52	3.41	3.38	3.56
T3	3.82	3.81	3.66	3.61	3.56	3.69	3.81	3.81	3.66	3.61	3.59	3.70
T4	3.90	3.71	3.53	3.46	3.42	3.60	3.88	3.69	3.53	3.47	3.75	3.66
T5	3.82	3.80	3.68	3.62	3.56	3.70	3.79	3.77	3.65	3.62	3.60	3.69
T6	3.80	3.53	3.49	3.40	3.36	3.52	3.77	3.55	3.49	3.47	3.39	3.53
T7	3.77	3.67	3.54	3.47	3.42	3.57	3.74	3.65	3.53	3.62	3.46	3.60
T8	3.80	3.62	3.48	3.42	3.37	3.54	3.78	3.62	3.48	3.42	3.40	3.54
T9	3.79	3.79	3.56	3.49	3.43	3.61	3.77	3.76	3.54	3.48	3.45	3.60
Mean	3.83	3.72	3.56	3.49	3.44		3.80	3.70	3.55	3.51	3.51	
NEW LSD %	A= 0.10		B= 0.06		AB= 0.13		A= 0.10		B= 0.05		AB= 0.12	

Table (4): Effect of packing types on fruit diameter of Saidy dates under cold storage during 2020/2021 and 2021/2022 seasons.

Seasons	2020/2021						2021/2022					
Month(A) Treat(B)	Sep.	Nov.	Jun.	Mar.	May	Mean	Sep.	Nov.	Jun.	Mar.	May	Mean
T1	2.30	2.30	2.16	2.11	2.09	2.19	2.28	2.28	2.15	2.09	2.07	2.17
T2	2.29	2.16	2.09	2.05	2.03	2.12	2.26	2.25	2.06	2.02	1.99	2.12
T3	2.32	2.32	2.21	2.17	2.15	2.23	2.27	2.27	2.17	2.14	2.10	2.18
T4	2.25	2.21	2.13	2.09	2.07	2.15	2.25	2.25	2.11	2.05	2.03	2.14
T5	2.24	2.24	2.20	2.16	2.15	2.20	2.25	2.26	2.16	2.15	2.10	2.19
T6	2.30	2.13	2.08	2.04	2.02	2.11	2.27	2.27	2.10	2.07	1.99	2.14
T7	2.25	2.20	2.12	2.07	2.05	2.14	2.24	2.24	2.08	2.04	2.01	2.12
T8	2.24	2.17	2.08	2.04	2.00	2.11	2.25	2.25	2.06	2.02	2.00	2.12
T9	2.24	2.24	2.15	2.10	2.07	2.16	2.24	2.24	2.13	2.09	2.06	2.15
Mean	2.27	2.22	2.14	2.09	2.07		2.26	2.25	2.11	2.07	2.04	
NEW LSD %	A= 0.05		B= 0.03		AB= 0.07		A= 0.04		B= 0.03		AB= 0.06	

Table (5): Effect of packing types on TSS% of Saidy dates under cold storage during 2020/2021 and 2021/2022 seasons.

Seasons	2020/2021						2021/2022					
Month(A) Treat(B)	Sep.	Nov.	Jun.	Mar.	May	Mean	Sep.	Nov.	Jun.	Mar.	May	Mean
T1	67.35	68.11	69.11	71.58	73.58	69.95	70.33	70.76	71.18	73.32	74.12	71.10
T2	67.90	68.70	69.77	72.85	76.35	71.12	70.26	70.41	72.10	74.32	74.95	72.66
T3	68.50	69.18	69.85	72.18	74.75	70.89	68.95	69.13	70.83	74.30	76.38	71.92
T4	68.00	68.06	70.11	73.35	76.61	71.23	69.27	69.4	71.08	73.82	76.80	72.45
T5	66.53	67.42	68.45	70.13	73.08	69.12	77.56	69.37	71.15	73.14	75.36	71.56
T6	68.50	69.38	70.50	72.65	77.11	71.63	70.00	70.68	71.95	75.35	77.53	73.10
T7	68.00	68.70	69.95	72.65	76.50	71.16	69.50	70.81	71.48	73.81	76.88	72.50
T8	66.85	67.83	68.98	73.11	77.6	70.87	69.83	70.58	71.85	74.16	75.70	72.42
T9	68.50	68.80	70.63	72.84	76.33	71.42	70.30	70.88	72.51	74.25	76.93	72.75
Mean	67.80	68.57	69.71	72.38	75.78		69.36	70.25	72.57	74.34	75.43	
NEW LSD %	A=1.53		B= 0.46		AB= 1.03		A= 1.58		B= 0.48		AB= 1.06	

Table (6): Effect of packing types on Total sugar of Saidy dates under cold storage during 2020/2021 and 2021/2022 seasons.

Seasons	2020/2021						2021/2022					
Month(A) Treat(B)	Sep.	Nov.	Jun.	Mar.	May	Mean	Sep.	Nov.	Jun.	Mar.	May	Mean
T1	56.81	57.66	58.51	60.59	62.05	59.11	58.78	59.68	60.54	62.67	64.04	61.14
T2	57.3	58.2	59.2	61.69	64.65	60.17	59.92	60.59	61.67	63.67	66.5	62.48
T3	57.58	58.55	59.11	61.08	63.06	59.91	59.76	60.28	61.11	63.06	64.85	61.80
T4	57.51	57.66	59.38	61.95	64.85	60.26	59.98	60.02	61.44	64.4	66.43	62.45
T5	57.51	58.43	59.41	60.93	63.08	59.43	59.59	60.41	61.32	63	64.48	61.75
T6	58.96	59.91	60.86	62.58	65.92	61.65	60.28	61.22	62.25	64.08	66.26	62.81
T7	58.09	59.75	59.87	62.24	65.26	61.21	59.81	60.49	61.63	64.04	65.91	62.38
T8	56.78	57.61	58.65	62.18	65.71	60.18	59.05	59.94	61.01	64.53	66.39	62.18
T9	57.08	58.76	60.35	62.37	65.18	60.92	60.33	60.8	62.45	64.12	66.05	62.75
Mean	57.51	58.46	59.44	61.23	64.37		59.72	60.38	61.49	63.73	65.66	
NEW LSD %	A= 1.45		B= 0.63		AB= 1.39		A= 1.33		B= 0.65		AB= 1.44	

Table (7): Effect of packing types on reducing sugar of Saidy dates under cold storage during 2020/2021 and 2021/2022 season.

Seasons	2020/2021						2021/2022					
Month(A) Treat(B)	Sep.	Nov.	Jun.	Mar.	May	Mean	Sep.	Nov.	Jun.	Mar.	May	Mean
T1	47.01	47.82	49.05	50.23	51.50	49.10	48.21	49.01	50.27	51.51	52.78	50.35
T2	47.68	48.3	49.19	51.08	53.63	49.95	49.87	49.87	50.68	52.72	55.19	51.58
T3	47.46	48.11	48.65	50.15	51.30	49.25	48.95	49.48	50.15	51.68	53.5	50.76
T4	47.69	47.7	49.66	51.30	53.59	49.98	49.31	49.3	51.51	52.89	54.22	51.60
T5	46.92	47.51	49.13	49.86	52.58	49.18	48.66	49.2	51.05	51.73	53.48	50.85
T6	49.21	49.72	51.28	52.18	54.82	51.39	49.47	50.04	51.75	52.57	55.16	51.88
T7	48.63	48.99	50.55	52.01	54.38	50.84	49.35	50.12	51.24	53	55.19	51.75
T8	48.17	47.72	48.66	51.63	54.51	50.15	48.58	49.81	50.15	53	65.06	51.49
T9	48.45	48.76	50.55	51.48	53.8	50.63	49.59	49.06	52.03	53.21	55.08	51.81
Mean	47.83	48.2	49.5	51.01	53.33		49.04	49.54	50.98	52.48	54.63	
NEW LSD %	A= 1.48		B= 0.91		AB= 2.01		A= 1.25		B= 0.66		AB= 1.47	

Discussion

Handling and storage is an important method for fruit production and its quality. Fresh weight loss and fruit decay percentage were increased by extending storage duration. The loss of water from fruits during storage is a substantial problem due to shrinkage and weight loss, thus, the fruits could be damaged and loss its quality **(Ben-Yehoshua, 2005).** The fruit weight decreases due to its respiratory process, the transference of humidity and some processes of evaporation of moisture inside the fruits **(Hassan *et al*., 2014).**

Total soluble solids and sugar contents in date fruits increased gradually with the increase of storage time. This significant increase in TSS and sugar contents could be due to the degradation in insoluble compounds present in date fruit **(Al-Kahtani *et al*., 1998; Afoakwa and Sefa-Dedeh, 2001 and Azelmat *et al*., 2005)**.

Physicochemical characteristics of stored date fruits, such as Total Soluble Solids (TSS), fruit weight, length and width, were measured. The results showed that cold storage and packing type could significantly affect physical and chemical quality of date fruits. Significant differences in fruit weight, flesh % and fruit dimension was observed. Physical attributes such as fruit weight, length and width were significantly reduced due to storage period. There was significant effect of package type on TSS and water activity of dates.

Dates fruit stored at low temperature had high soluble solids and total carbohydrates values in comparing with stored dates in canning at room temperature **(Wahid *et al*., 2005 and Aleid *et al*., 2014).**

Conclusion

Generally, from the above-mentioned results, it could be concluded that the most effective treatments in maintaining quality properties of Saidy date fruits after eight months were packing with non-perforated polyethylene.

Conflicts of Interest/ Competing interest

All authors declare that they have no conflicts of interest.

Data availability statement:

All data sets collected and analyzed during the current study are available from the corresponding author on reasonable request.

List of Abbreviations

L.S. D	Least significant difference
MAP	Modified Atmospheric Packaging
RH	Relative humidity
T.S.S.	Total soluble solids

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تأثير بعض أنواع التعبئة علي تخزين وجودة ثمار البلح الصعيدي

عصام محمد عبد الظاهر رضوان [1]، عبد الفتاح مصطفي الصالحي [2]، هاجر محمود صابر حسين [1]، محمد كمال محمد سيد [1]

*قسم البساتين – كلية الزراعة - جامعة الوادي الجديد
**قسم الفاكهة – كلية الزراعة – جامعة أسيوط

أجريت هذه الدراسة خلال موسمي 2021/2020، 2022/2021 لدراسة تأثير بعض أنواع التعبئة علي ثمار نخيل البلح الصعيدي تحت التخزين البارد وذلك بمعمل كلية الزراعة جامعة الوادى الجديد حيث تم دراسة تأثير التعبئة بالبولي إيثلين والألومنيوم فويل المثقب والغير مثقب علي خصائص ثمار نخيل البلح الصعيدي.

وقد أظهرت النتائج

- حدثت زيادة تدريجية جوهرية في نسبة فقد الوزن ونسبة التالف مع نقص جوهري في وزن وأبعاد الثمرة ونسبة لحمها وارتبطت هذه الزيادة أو النقص بزيادة فترة التخزين.
- أدي استخدام التعبئة بالبولي إيثلين والألومنيوم فويل المثقب إلي زيادة في فقد الوزن ونسبة التالف للثمار والمواد الصلبة الذائبة الكلية والسكريات الكلية والمختزلة مقارنة بالكنترول (التعبئة في البولي إيثلين الغير مثقب).
- سبب إستخدام التعبئة بالبولي إيثلين والألومنيوم فويل المثقب نقص في وزن الثمار ونسبة اللحم وأبعاد الثمارمقارنة بالكنترول.
- أظهرت النتائج تفوق إستخدام البولي إيثلين الغير المثقب مقارنة بالألومنيوم فويل المثقب والغير مثقب خلال فترة التخزين البارد.

من نتائج هذه الدراسة يمكن التوصية بأهمية استخدام البولي إيثلين الغير مثقب وذلك في تعبئة ثمار نخيل البلح الصعيدي لتحسين خصائص الثمار وإطالة فترة التخزين.

الكلمات الدالة: البولي إيثلين – الألومنيوم فويل -أنواع التعبئة – نخيل البلح – التخزين.