



Original Article

Pre-harvest Bagging Material Impacts on Fruit Drop, Bunch Weight and Fruit Quality of 'Sewey' Date Palm (*Phoenix dactylifera* L.)

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ABSTRACT

Bagging is a physical technique commonly used with many crops to both protect the fruits from diseases and pests and to alter the microenvironment in which the fruits develop and its ripening. The influence of bagging material treatments on fruit quality was estimated in the experiment conducted from 2009 to 2010, a private orchard, Egypt. Four treatments of bagging material included control (without bagging, T₁), bagging bunches with newspaper, plastic and paper kraft (T₂, T₃ and T₄) 30 days after of pollination (T₄ and T₅). All the bagging treatments improved fruit quality with respect to fruit set, bunch weight, fresh fruit weight, fruit flesh weight, tannin, fruit firmness, total and reducing sugars contents except fruit dimensions as and vitamin C compared to the control treatment. Among the various bagging treatments, T₃ (plastic) followed T₄ (paper kraft) were earlier ripening fruit 15 days before harvested besides produced the best results in most physical and chemical properties under study condition. Generally bagging with plastic as pre-harvest application treatment could be recommended to improve fruit set, bunch yield and fruit quality of "Sewey" fruit under the current study conditions.

Keywords: Bagging material; Fruit quality, *Phoenix dactylifera*.

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INTRODUCTION

Date palm is an important fruit crop in Egypt where the total production of date fruits amounted to 1,410,000 tons/year (FAO 2012). In Egypt many cultivars are grown in different regions according to the diversity of their climatic necessity average particularly temperature and relative humidity that affect fruit growth and development (Khayyat *et al.*, 2007). Date palm bunch covers offer several advantages and are commonly used in the date palm cultivated areas in order to protect fruits from high humidity, rain, bird attacks and also from damage caused by insects (Gao *et al.*, 2007). Al-Baker (1972) reported that bagging spathes for 30 days after pollination with date fibers, as used in El-Ahsa, Saudi Arabia from ancient times then unbagged for two days before covering again for additional 15 days. Increased fruit set. Also, Nixon and Carpenter (1978) reported that no damage has been observed for using bags. Paper bags increased the fruit set, enhanced maturity slightly increased fruit size

and yield per palm (Stoler, 1972). Bagging with fish nets improved fruit set, yield and fruit dimensions of "Halawy" date palm after pollination in Iraq (Ghalib *et al.*, 1988). Rabeh and Kassem (2003) reported that bagging spathes of Zaghoul and Samani cvs during flowering and fruit setting periods showed a beneficial effect on fruit set, yield and physical and chemical properties. Bunches bagging two weeks after pollination gave high fruit set percentage and palm yield (Rabeh and Kassem, 2003). In addition, such treatment exhibited the highest fruit weight, flesh weight, fruit dimensions, total soluble solid percentage and lowest tannin percentage (Moustafa, 2007). Perumal and Adam (1968) and Chillet and Jannoyer (1996) reported that bagging raised the temperature around bunches and reduced the shooting until harvesting time under temperate conditions. According to Chillet and Jannoyer (1996), microclimate surrounding the bunch could favorably change by bunch covering. It is reported that the bunch weight could be increased by 18-23%, with promoting the appearance of the fruits under Sri Lanka conditions (Anon, 1995). Samson (1980) observed a temperature rise of 1.1-1.6 °C surrounding the bunch increased the bunch weight by 1kg. Daniells and Lindsay (2005) found that the temperatures under the cover can be 2-6°C warmer and during cool times of the year, this can increase fruit length and hasten fruit filling (harvest 4 to 14 days earlier). Therefore, this investigation carried out during the two successive seasons (2009 and 2010) in order to study the effect on bunch material on harvest periods, yield and fruit quality of "Sewey" cultivar.

MATERIALS AND METHODS

Plant Material, Design, Treatments and Measurements

This work was conducted during two successive seasons of 2009 and 2010 on 6 females date palms (*Phoenix dactylifera*, L.) of "Sewey" cultivar grown in sandy soil at a private orchard, El-Wady El-Gadeed governorate, Egypt. Five female palm trees were uniformly selected and were subjected to the same usual horticultural practices and pollinated from the same male palm trees. Number of spathes per palm was adjusted to 12 (3 bunches per bagging treatment) nearly equal size. Sewey bunches subjected to four bagging materials treatments as follows:

- 1- Control (without bagging, T₁).
- 2- Bagging with newspapers, T₂
- 3- Bagging plastic (Polyethylene bags of 30µm thickness, T₃)
- 4- Bagging paper kraft, T₄

The bagging covers were placed like sleeves over the spathes soon after pollination and were tied at the top. The spathes were kept under bagging for one month after pollination. The treatments were arranged in a completely randomized design (CRD) with three bagging materials compared with control (without bagging). All treatments were subjected in each tree (3 replicate/treatments). In order to determine the effect of the different treatments on fruit physical and chemical characteristics, a sample of 30 strands were randomly collected from each bunch/ replicate during both seasons when the fruits for each treatment reached ripening.

Measurements

Temperature and relative humidity were recorded in each day during bagging (unpublished data). The percentage of fruit set was determined as previously mentioned by El-Makhtoum (1981).

All bunches of the investigated palms were harvested at Tamr stage (third week of August) and weighted, then the average of bunch weight (kg) was calculated for each treatment. Physical and chemical properties were determined for all treatments. A sample of 60 fruits was randomly taken from each bunch to determine fruit measurements, firmness,

soluble solids content (SSC), tannin, reducing and non-reducing sugars. SSC, firmness, tannin, reducing and non-reducing sugars were determined according to in A.O.A.C. (1995).

Statistical Analysis

One way ANOVA was run using SAS program (SAS Institute Inc., 2000). Means will compare using least significant differences (LSD) at P 0.05 according to Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

Effect of Bunch Bagging Material on Bunch Weight and Some Physical Properties

Fruit Set (%)

Data of Table (1) clearly indicated that different bagging material treatments had increased fruit set % in both seasons than the control. The most effective treatment in such concern was bagging with kraft paper material. The highest fruit percentages were 36.07 and 37.62% by treatment 3 (bagging with plastic) in both seasons, respectively.

Table (1): Effect of bagging material on bunch weight (kg) and some physical properties of "Sewey" date palm fruit during 2009 and 2010 seasons

Treatments	Fruit set (%)		Bunch weight (kg)		Fruit weight (g)		Flesh weight (g)	
	2009	2010	2009	2010	2009	2010	2009	2010
Cont.	19.79 ^c	21.01 ^c	10.23 ^b	10.12 ^b	11.22 ^b	11.10 ^b	10.20 ^a	10.90 ^b
Newspaper	32.62 ^b	30.72 ^b	11.62 ^b	11.97 ^{ab}	12.20 ^b	12.43 ^b	10.47 ^a	10.65 ^b
Plastic	31.25 ^b	33.32 ^b	13.8 ^a	13.45 ^a	14.86 ^a	16.95 ^a	12.26 ^a	15.15 ^a
Kraft paper	36.07 ^a	37.62 ^a	11.41 ^b	11.55 ^{ab}	12.92 ^b	12.60 ^b	10.85 ^a	10.71 ^b

Means followed by a common letter are not significantly different at the 5% level by DMRT

Bunch weight (kg)

As shown in Table (1), bagging material of "Sewey" bunch weight was significantly increased in treatment 3 than control in first season only. The differences among bagging with newspaper, kraft paper and control only were no significant in first season, while among all treatments in second season were not significant. The highest bunch weight (13.8 and 13.45kg) were recorded by treatment 3 (Bagging with plastic) in both seasons, respectively.

Fruit weight (g)

It is clear from Table (1) that all the studies treatments of bagging material not significantly increased the average of "Sewey" dates as compared to that of control treatment during 2009 and 2010 seasons except T₃ and other treatments. The same treatment (Bagging with plastic, T₃) recorded the highest fruit weight (14.86 and 16.95g) during two seasons of study, respectively. While control fruits were the lowest fruit weight (11.22 and 11.10 g) recorded by without bagging treatment (control) in both seasons.

Flesh weight (g)

It is obvious from Table (1) that all bagging material treatments not significantly increased fruit flesh weight than control in both seasons. Bunches which bagged with plastic showed the significantly highest flesh weight of fruit as compared with other studied treatments. The same treatment (Bagging with plastic, T₃) recorded the highest flesh weight (12.26 and 15.15g) during two season of study, respectively.

Fruit dimensions (L/D)

Data given in Table (2) indicated that there were no significant differences between different bagging materials in both seasons; In general, T 2 (bagging with kraft paper) seems to be the most effective treatment under such study.

Table (2): Effect of bagging material on L/D, fruit firmness (Newton) and SSC (%) of "Sewey" date palm fruit during 2009 and 2010 seasons

Treatments	L/D		Fruit firm (Newton)		SSC (%)	
	2009	2010	2009	2010	2009	2010
Cont.	1.50 ^a	1.51 ^a	5205.19 ^a	5052.15 ^a	39.84 ^b	37.50 ^b
Newspaper	1.57 ^a	1.75 ^a	5157.12 ^c	3698.37 ^c	40.80 ^b	40.16 ^b
Plastic	1.57 ^a	1.61 ^a	4417.44 ^d	3659.13 ^d	45.76 ^a	48.96 ^a
Kraft paper	1.58 ^a	1.80 ^a	5354.29 ^a	3825.90 ^b	43.25 ^{ab}	46.40 ^a

Means followed by a common letter are not significantly different at the 5% level by DMRT

Effect of Bagging Material on Some Chemical Properties of Fruit *Fruit firmness (Newton)*

Concerning the effects of different bagging material treatments on fruit firmness in Table 3, showed that the lowest values of fruit firmness (4417.44 and 3722.90 Newton) were found in "Sewey" fruit treated with T₃ (bagging with plastic) in both seasons as compared with other treatments and control. The differences among different bagging material were significant in both seasons at fruit harvest. Control fruits were the highest fruit firmness in both seasons (5205.19 and 5052.15 Newton).

Soluble solids Content (SSC)

Data of Table (3) clearly indicated that differences among bagging material treatments had not significant increased SSC% in fruit in first season than the control only, while there were a significant differences between treatments (T₃ and T₄) and (T₂ and T₁). The most effective treatment in such concern was bagging plastic. The highest SSC percentages were 45.76 and 48.96 % by T₃ (bagging with plastic) in both seasons, respectively.

Total and reducing sugars (%)

Values of total and reducing sugars percentages followed a trend similar to that of soluble solids content percent in both season of study (Table 3). Whereas T₃ (bagging with plastic) showed the significantly highest total sugars%. The highest totals and reducing sugars percentages were 57.76 and 42.48 respectively in the second seasons, while control fruit recorded the lowest values either in total or reducing sugars in both seasons.

Table (3): Effect of bagging material on some chemical properties of "Sewey" date palm fruit during 2009 and 2010 seasons

Treatments	Total sugars (%)		Reducing sugars (%)		Tannin (%)		Vitamin C. (mg/100g flesh weight)	
	2009	2010	2009	2010	2009	2010	2009	2010
Cont.	36.16 ^c	37.76 ^c	24.64 ^c	25.65 ^c	0.45 ^a	0.43 ^a	1.50 ^a	1.50 ^a
Newspaper	48.82 ^b	51.54 ^b	34.09 ^b	35.50 ^b	0.40 ^c	0.38 ^b	1.46 ^a	1.50 ^a
Plastic	56.32 ^a	57.76 ^a	38.40 ^a	42.48 ^a	0.40 ^c	0.38 ^b	1.50 ^a	1.60 ^a
Kraft paper	54.72 ^a	51.54 ^b	40.00 ^a	35.50 ^b	0.43 ^b	0.39 ^b	1.70 ^a	2.00 ^a

Means followed by a common letter are not significantly different at the 5% level by DMRT

Tannin content (%)

Treatments 2 and 3 were significantly decreased tannins content in fruits in second season as compared with other treatments (Table 3). In the second season of study (table3) it is obvious that all the bagging material treatments had reduced significantly tannins content in fruit flesh. Treatment 3 (bagging with plastic) gained the significantly lowest tannins content in fruit. Control fruits recorded (0.45 and 0.43%) the heights tannin content in both seasons.

Vitamin C (mg/100g flesh weight)

It is obvious from Table (3) that all bagging material treatments not significantly increased fruit vitamin C content and control in both seasons The highest vitamin C were 2.00 mg/100g flesh weight in the second season by treatment 4 (bagging with Kraft paper).

DISCUSSION

The practice of pre-harvest bagging has been extensively used in several fruit crops, such as apple (Santos and Wamser 2006; Hao *et al.*, 2011), pear (Feng *et al.*, 2011; Hudina *et al.*, 2012), peach (Jia *et al.*, 2005; Wang *et al.*, 2010), mango (Senghor *et al.*, 2007; Wu *et al.*, 2009), longan (Yang *et al.*, 2009), to improve the commercial value of the fruit, namely, improving fruit coloration (Kim *et al.*, 2010), reducing splitting (Ding *et al.*, 2003), mechanical damage (Amarante *et al.*, 2002) and sunburn (Muchui *et al.*, 2010) of the skin. Pre-harvest bagging also reduces pesticide residues in the fruit (Amarante *et al.*, 2002) and improves insect (Sarker *et al.*, 2009), disease (Wang *et al.*, 2011) and bird damage control (Amarante *et al.*, 2002). Therefore, pre-harvest bagging had been an important technical measure in improving the commercial value and promoting the export of the fruit (Hao *et al.*, 2011). This research showed that all different materials especially plastic and paper kraft were promising application as a pre-harvest technique in Sewey dates through improve fruit setting, fruit yield and fruit quality as compared with control (without bagging) due to microclimate surrounding the bunch and accumulated heat might induce higher respiration rates and CO₂ accumulation within bags might lead to more acetaldehyde production and removal of astringency (Amarante *et al.*, 2002; Awad 2007; Wang *et al.*, 2011; Yang *et al.*, 2009). Muchui *et al.*, 2010 reported that fruit pre-harvest bagging could effectively improve fruit quality such as chemical properties (Fan *et al.*, 1998; Wang *et al.*, 2002), markedly lower pesticide residual (Liu *et al.*, 2003) and avoid eating by birds and insects (Santos and Wamser 2006). So, bagging fruits was one of necessary techniques for producing high quality fruits, which had been universally adopted in some fruit production (Zhai *et al.*, 2006). Furthermore, some countries importing fruit (apple) from China, such as Mexico, Chile, Argentina, require that apple fruits must be bagged.

CONCLUSION

Bagging fruits is one of the major practices that often help in overcoming some problems, such as fruit set dropping, addition it enhances fruit quality of dates and reduces compactness of bunch yield, besides increase adequate quality. Bagging either with plastic or paper kraft as pre-harvest application treatments could be recommended to improve fruit set, bunch yield and fruit quality of "Sewey" fruits under the current study conditions.

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