

## **Benefits of Calcium Carbonate Sprays on Yield and Fruit Quality of Samany and Zaghloul Date Palm under New Reclaimed Soils**

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### **Abstract:**

The present study was carried out during 2010 and 2011 seasons on "Zaghloul" and "Samany" date palms growing at a private orchard in New Assuit City, Egypt, in order to study the effects of plant protect ant purshade (calcium carbonate) at 0.5%, 1%, 2%, 3% and 5 % on yield, fruit properties and harvesting date of Zaghloul and Samany date palm cultivars growing in new reclaimed soils.

In general, results indicated that spraying Zaghloul and Samany date palm bunches with purshaded caused a significant increase in ultimate fruit retention, bunch weight and consequently total yield, fruit weight, height and pulp thickness as well as fruit moisture content, TSS and sugar contents, while tannins percentages were significantly decreased. The promotion was associated with increasing concentrations. In addition all Purshade treatments delay harvest date in comparison with control treatment.

The superior treatment concerning yield and fruit quality was spraying Purshade at 5 % three times started in Hababouk stage and ending in Khalal stage (15/ May, 15/ June and 15/ July ) which was most suitable for Zaghloul and Samany dates and could be consider as a recommended treatment under conditions of this experiment

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**Keywords:** *nutrients, purshade, stress, calcium, soft cultivars.*

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### **Introduction:**

Date palm is one of the ancient domestic fruit trees in the Middle East countries and their fruits play an important role in the nutritious pattern of many people. In Egypt, many cultivars are grown in different regions according to the diversity of their climatic necessity, particularly average temperature and relative humidity that affect fruit growth and development.

Zaghloul and Samany date cultivars are the most important cultivars of the soft dates in North Egypt. Fruits are consumed at "Khalal" stage (at full color stage). The income from Zaghloul and Samany dates is mainly dependent on fruit quality.

Date palms growing in hot arid regions are generally facing several kinds of environmental stresses which limit tree growth and productivity and negatively affect fruit quality. The average daily maximum temperatures in, leading date growing countries range from 27 to 35°C and date palms can withstand temperatures as high as 50°C. Furthermore, date palms have been known to withstand extreme climatic conditions (Mohamed, 2003). According to replicated field trials and research studies, improvements in plant health associated with Purshade's reduction of solar stress were an important factor in increasing the productivity and the quality of a broad range of crops grown around the world. Particle films have been shown to increase fruit tree productivity in semiarid and subhumid environments by reducing heat stress (Glenn *et al.* 2001).

Purshade reduce all plant stresses by 20-60% and in turn increase marketable yield and improve fruit quality with larger size and better coloring (Bose *et al.*, 2001; Rob-

erts *et al.*, 2002; Radha and Mathew, 2007 and Peter, 2008). Attra (1999) reported that Purshade and other plant protectants protected fruits from all stresses by leaving a protective powdery film on the surfaces of the fruits.

Purshade is the industry's top-performing organic plant protectant for preventing the damaging effects of solar and water stress for use in organic production. The Purshade (62.5% calcium carbonate) has been engineered to reduce solar stress in crops by protecting the foliage and fruit from damaging ultraviolet (UV) and infrared (IR) radiation while still allowing photosynthesis to occur. Engineered with advanced reflectance technology and based on calcium carbonate, a highly reflective mineral, Purshade. When Purshade is used during periods of high light and temperature extremes, crops have the solar protection needed to better reach their full potential and use available water resources more efficiently. Late treated grapevines with plant protectants, during summer periods (warm periods) substantially assist in the reduction of sun damage. Under such high sun intensity and temperature above 90°F a great damage on all plant parts especially clusters was happened (Fosket, 1994; Nakasone and Paul, 1998 and Chadha and Shikhamany, 1999).

The main aim of this study was investigate the effects of Purshade (62.5% calcium carbonate) spraying on palm yield, fruit quality and harvesting date of Zaghloul and Samany date palm cultivars.

### **Materials and Methods:**

The experiment was carried out during two successive seasons 2010 and 2011 on 15 years old Zaghloul and Samany date palms growing in sandy soil private orchard in New

Assiut City, Egypt. Eighteen uniform trees in size and vigor as far as possible of each cultivar were selected for this study. The trees were subjected to the usual farm management, for example, artificial pollination (only one source of pollen grains during the two experimental seasons were used to avoid the metaxenic effects), pruning, irrigation, fertilization and manuring. Eight bunches of nearly equal size were left on each palm to maintain leaf / bunch ratio at 8 / 1. The eighteen palms of each cultivar classified into six treatments (three palms/ treatment) then the eight bunches on each palm were treated with one of the following six treatments:-

- T1: Control (sprayed with water)
- T2: Spraying purshade (62.5% calcium carbonate) at 0.5%
- T3: Spraying purshade (62.5% calcium carbonate) at 1%
- T4: Spraying purshade (62.5% calcium carbonate) at 2%
- T5: Spraying purshade (62.5% calcium carbonate) at 3%
- T6: Spraying purshade (62.5% calcium carbonate) at 5%

The eight bunches of each palm (replicate) were sprayed three times started in Hababouk stage and ended in Khalal stage (15 / May, 15 / June and 15 / July). Spraying applied in morning by a hand sprayer using Triton B as a wetting agent. Just before harvest ten female strands per bunch were randomly taken then ultimate fruit retention was estimated using the equation:

$$\text{Fruit retention \%} = \frac{\text{Number of retained fruits per strand}}{\text{Number of total nodes per strand}} \times 100$$

All bunches of Zaghoul and Samany cvs. were harvested at the full fruit color development (red in Zaghoul dates and yellow in Samany dates), bunch weight and total yield

were recorded by hand balance in field.

One- hundred fruits were picked at random from each replicate for determine the physical and chemical properties

#### **Fruit properties:**

1- Fresh fruit weight (g), seed weight (g) and pulp thickness (cm)

2- Fruit height (cm) and diameter (cm) measured by Vernier Caliper

3- Moisture % was determined in about 50 gm chopped flesh sample by drying in oven at 70° c to constant weight.

4- Total soluble solids TSS% were measured by hand refractometer

5- Sugar contents including reducing and total sugars were determined according to Lane and Eynon described in A.O.A.C. 1995

6- Tannins content according to (Winton and Winton 1985)

The treatments were arranged in completely randomized block design with three replicates for each treatment using L.S.D. test to recognize the significance of the differences among various treatment means (Snedecore and Cochran 1990).

#### **Results and Discussion:**

##### **1-Effect of purshade sprays on harvest date, fruit retention percentage, bunch weight and yield per palm:**

Regarding the response of purshade spraying treatments; it is evident from the data presented in Tables (1&2) that all studied treatments resulted in a significant increase in the percentages of retained fruits, bunch weight and consequently total yield compared with control in both cultivars during the two studied seasons.

According to Zaghoul cultivar the purshade at 5% produced the

highest fruit retention percentage, bunch weight and yield per palm compared with other treatments during both seasons the values were 30.82 %, 17.12kg and 132.25 kg and 32.13 %, 18.70 kg and 136.70 kg during 2010 and 2011, respectively. No significant differences were detected in this respect between 0.5 and 1% purshade spraying in both seasons. Also the highest Samany fruit retention percentage, bunch weight and yield per palm (34.12 %, 19.82 kg and 154.25 kg during 2010 and 34.10%, 19.90 and 150 kg during 2011) were obtained under spraying purshaed at 5% during the two experimental seasons, additionally no significant differences were observed in this respect between 1 and 2 % purshade spraying in both seasons.

In the other hand data in Table (3) showed that all purshade treat-

ments caused an observed delay in harvest date of the two cultivars during the two seasons. The harvesting date of Zaghloul cv. was done 12 to 17 and 12 to 18 days later as compared with control, which did early (24 July 2010 and 26 July 2011) in the first and second seasons, respectively. Samany fruits were harvested 15 to 18 and 15 to 20 days later as compared with control, which did early (2 August 2010 and 2011) in the first and second seasons respectively. The same results were announced by Attra (1999). The promoting effect of CaCO<sub>3</sub> (Purshade) on yield and cluster weight of grapes was supported by the results of Kerns and Wright (2000), Glenn *et al.*, (2001), Morsy *et al.*, (2008) and Sarwy *et al.*, (2012) they found that spraying B (Boron) and/or Ca (Calcium) increased bunch weight as compared with the control.

**Table (1): Effect of calcium carbonate "Purshade" spraying on fruit retention, bunch weight and total yield of Zaghloul date palm during 2010 and 2011 seasons**

Treatments	Fruit retention %		Bunch weight (kg)		Total yield/palm (kg)	
	2010	2011	2010	2011	2010	2011
Control	20.60	21.50	11.25	11.44	92.60	93.00
Spraying Purshade at 0.5%	24.01	24.32	12.35	14.00	94.13	103.90
Spraying Purshade at 1 %	24.32	24.37	12.52	14.23	95.28	104.76
Spraying Purshade at 2 %	26.00	27.40	13.89	15.50	110.45	116.25
Spraying Purshade at 3 %	28.32	29.45	16.20	17.80	126.15	132.00
Spraying Purshade at 5 %	30.82	32.13	17.12	18.70	132.25	136.70
L S D at 5 %	0.80	0.80	0.35	0.43	1.35	1.52

**Table (2): Effect of calcium carbonate "Purshade" spraying on fruit retention, bunch weight and total yield of Samany date palm during 2010 and 2011 seasons**

Treatments	Fruit retention %		Bunch weight (kg)		Total yield/palm (kg)	
	2010	2011	2010	2011	2010	2011
Control	22.32	22.60	14.90	15.10	123.20	127.00
Spraying Purshade at 0.5%	25.14	25.88	16.14	16.22	126.10	129.72
Spraying Purshade at 1 %	27.89	28.00	16.71	16.75	138.52	138.90
Spraying Purshade at 2 %	28.00	28.13	16.85	16.92	139.30	139.30
Spraying Purshade at 3 %	31.50	31.70	17.75	17.82	140.00	140.15
Spraying Purshade at 5 %	34.12	34.10	19.82	19.90	154.25	150.00
L S D at 5 %	0.85	0.80	0.32	0.30	1.35	1.20

**Table (3): Effect of calcium carbonate "Purshade" spraying on date of harvest of Zaghoul and Samany date palms during 2010 and 2011 seasons**

Treatments	Zaghoul		Samany	
	2010	2011	2010	2011
Control	24 / 7	26 / 7	2 / 8	2 / 8
Spraying Purshade at 0.5%	5 / 8	7 / 8	17 / 8	17 / 8
Spraying Purshade at 1%	5 / 8	7 / 8	17 / 8	17 / 8
Spraying Purshade at 2%	8 / 8	12 / 8	17 / 8	22 / 8
Spraying Purshade at 3%	8 / 8	12 / 8	20 / 8	22 / 8
Spraying Purshade at 5%	10 / 8	14 / 8	20 / 8	22 / 8

## 2- Physical fruit properties:

Tables (4&5) showed the effect of five purshad concentrations compared with control (untreated) on some fruit physical properties (weight, height, diameter and pulp thickness) of Zaghoul and Samny dates during 2010 and 2011 seasons. It can be seen from the obtained results that similar tendency was found to be among the two cultivars during the two studied seasons.

Purshade spraying significantly increased fruit weight, height and its pulp thickness compared with control. No significant differences were detected in these traits between, 0.5%, 1% and 2 % values in Zaghoul dates also no significant differences were detected between 1 and 2% concentrations in Samany date palm in the first season and between 2% and 3% treatments during the second season. Additionally, the Purshade at

5% spraying produced the biggest and highest fruits of both cultivars compared with the other treatments.

According to the effect of Purshade spraying on fruit diameter, the differences was slight and not significant among all sprayed treatments in the first and second seasons with the two cultivars.

These results are in harmony with those obtained by Morsy *et al.*, (2008). The improve in fruit physical characteristics of the experimental trees as a result of Purshade spraying could be interpreted on the basis of its capacity in keeping plants 7 degrees F° cooler by reflecting heat. This reduces stress on the plants and enables basic physiological processes to continue in high temperature when they would normally shut down (Adam *et al.*, 1984; Leopold and Kiedermann, 1985; Seagle *et al.*, 1995; Reiley and Shry, 1997).

**Table (4): Effect of calcium carbonate "Purshade" spraying on some physical characteristics of Zaghoul dates during 2010 and 2011 seasons**

Treatment	Fruit weight (g)		Fruit length (cm)		Fruit diameter (cm)		Pulp thickness (cm)	
	2011	2012	2011	2012	2011	2012	2011	2012
Cotrol	18.04	17.34	4.57	4.50	2.45	2.46	0.53	0.50
Spraying Purshade at 0.5%	23.42	22.76	4.97	4.95	2.59	2.54	0.60	0.61
Spraying Purshade at 1 %	23.74	23.14	5.07	4.97	2.61	2.65	0.62	0.63
Spraying Purshade at 2 %	23.89	23.40	5.10	5.11	2.62	2.62	0.63	0.63
Spraying Purshade at 3 %	24.09	24.56	5.26	5.24	2.70	2.67	0.74	0.72
Spraying Purshade at 5 %	25.41	25.52	5.56	5.43	2.74	2.70	0.82	0.80
L S D at 5 %	1.38	0.98	0.20	0.16	N S	N S	0.03	0.03

**Table (5): Effect of calcium carbonate "Purshade" spraying on some physical characteristics of Samany dates during 2010 and 2011 seasons**

Treatments	Fruit weight		Fruit length		Fruit diameter		Pulp thickness	
	2010	2011	2010	2011	2010	2011	2010	2011
Cotrol	17.52	18.20	4.33	4.53	2.75	2.66	0.69	0.71
Spraying Purshade at 0.5%	19.30	20.47	4.57	4.65	2.77	2.72	0.73	0.75
Spraying Purshade at 1 %	20.26	22.23	4.75	4.77	2.93	2.76	0.79	0.81
Spraying Purshade at 2 %	20.73	26.96	4.77	4.98	3.02	2.93	0.80	0.93
Spraying Purshade at 3 %	26.62	27.22	5.57	5.02	3.15	2.97	0.92	0.95
Spraying Purshade at 5 %	27.88	29.79	5.70	5.76	3.17	3.03	1.00	1.06
L S D at 5 %	0.92	0.99	0.11	0.18	N S	N S	0.05	0.03

**3- Chemical fruit characteristics:**

**1- Total soluiable solids (TSS) and sugar contents (total and reducing sugars ) % :**

The data in Tables (6 &7) Indicated that all Purshade spraying treatments significantly increased total soluble solids (TSS), total and reducing sugars in date fruits of Zaghloul and Samany cvs. compared with control. There was a gradual promotion on fruit TSS and sugar content (reducing and total) with increasing concentrations of purshade. The highest TSS and sugar contents of Zaghloul and Samany fruits obtained under spraying purshad at 5 % during the two studied seasons. The increment percentage of TSS (40.67 & 44.21 and 38.14 & 47.17 %), total (38.39 & 43.60 and 42.56 &43.38 %) and reducing sugar (53.02 & 60.39 and 70.23 & 50.08 %) of Zaghloul and Samany dates during the two studied seasons, respectively.

**2- Moisture content :**

It is clear to notice from the data in Tables (8 &9) that spraying Purshade (protect ant compound) treatments significantly increased fruit moisture percentages of the two cultivars in comparison with control which gave the lowest moisture percentages during the two seasons. The increment was associated with in-

creasing concentrations of purshade. This increment may be due to leaving a protective powdery film on the surfaces of the fruits so reducing water loss.

**3- Tannins %:**

As for the soluble tannins in Tables (8&9) all Purshade treatments significantly decreased the soluble tannins of the two investigated cultivars compared with the control. Purshade treatments at 5% and 3% gave the lowest values in the first and second seasons, respectively. No significant differences were found in this respect between all purshade sprayed treatments in both Zaghloul and Samany dates. This was true in both seasons.

Similar findings were reported by Hansch and Mendel, (2009), also Sarwy *et al* (2012) indicated that spraying date palm inflorescence with both boric acid and/or calcium nitrate had a significant effect on fruit set, yield and fruit physical and chemical characteristics of Amhat date palm, in addition Bahram *et al* (2013) showed that Calcium amino chelate significantly increased fruit weight, fruit length and TSS.

Finally, it can concluded that spraying bunches of Zaghloul and Samany cvs. using calcium carbonate (purshade) three times started in Ha-

babouk stage and ended in Khalal stage ( 15 /May,15 / June and 15 / July) increased yield and improve fruit quality as well as, delayed harvesting date, consequently it could be

considered as a recommended treatment under the conditions of this experiment of date palms grown under new reclaimed sandy soils.

**Table (6): Effect of calcium carbonate "Purshade" spraying on some chemicals characteristics of Zaghloul dates during 2010 and 2011 seasons**

Treatments	T S S %		Total sugars %		Reducing sugars %	
	2010	2011	2010	2011	2010	2011
Control	26.80	25.54	24.90	24.29	18.88	18.18
Spraying Purshade at 0.5%	29.79	27.65	26.35	25.49	19.77	22.24
Spraying Purshade at 1 %	32.62	30.25	29.40	30.63	24.61	24.18
Spraying Purshade at 2 %	33.38	33.64	31.92	32.02	26.08	25.28
Spraying Purshade at 3 %	35.20	35.44	33.02	33.11	27.14	27.97
Spraying Purshade at 5 %	37.70	36.83	34.46	34.88	28.89	29.16
L S D at 5 %	0.32	0.08	0.62	0.02	0.94	0.24

**Table (7): Effect of calcium carbonate "Purshade" spraying on some chemical characteristics of Samany dates during 2010 and 2011 seasons**

Treatments	T S S %		Total sugars %		Reducing sugars %	
	2010	2011	2010	2011	2010	2011
Control	26.77	25.76	24.13	24.16	18.31	18.65
Spraying Purshade at 0.5%	31.32	30.08	27.07	25.79	22.28	19.33
Spraying Purshade at 1 %	32.75	31.93	30.05	28.38	24.50	22.44
Spraying Purshade at 2 %	34.35	34.60	31.96	32.46	27.51	25.05
Spraying Purshade at 3 %	35.27	35.91	32.99	33.60	28.87	26.17
Spraying Purshade at 5 %	36.98	37.91	34.40	34.64	31.17	27.99
L S D at 5 %	0.29	0.37	1.07	0.34	0.31	0.22

**Table (8): Effect of calcium carbonate "Purshade" spraying on Moisture and Tannins percentages of Zaghloul dates during 2010 and 2011 seasons**

Treatments	Moisture %		Tannins %	
	2010	2011	2010	2011
Control	50.43	51.30	0.245	0.245
Spraying Purshade at 0.5%	52.89	53.44	0.163	0.178
Spraying Purshade at 1 %	57.82	54.87	0.165	0.178
Spraying Purshade at 2 %	58.74	57.39	0.165	0.193
Spraying Purshade at 3 %	59.65	58.32	0.168	0.176
Spraying Purshade at 5 %	61.80	59.93	0.162	0.201
L S D at 5 %	2.15	2.20	0.030	0.030

**Table (9): Effect of calcium carbonate "Purshade" spraying on Moisture and Tannins percentages of Samany dates during 2010 and 2011 seasons**

Treatments	Moisture %		Tannins %	
	2010	2011	2010	2011
Control	52.20	50.42	0.162	0.176
Spraying Purshade at 0.5%	56.35	52.95	0.132	0.134
Spraying Purshade at 1 %	57.45	55.54	0.130	0.132
Spraying Purshade at 2 %	57.78	58.51	0.128	0.132
Spraying Purshade at 3 %	59.70	59.46	0.129	0.129
Spraying Purshade at 5 %	61.24	61.24	0.116	0.132
L S D at 5 %	2.44	2.52	0.020	0.020

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## التأثيرات المفيدة لرش كربونات الكالسيوم على المحصول وجودة الثمار لصنفى نخيل البلح الزغلول والسمانى المنزرعة فى اراضى حديثة الاستصلاح محمد احمد بدران

قسم بحوث الفاكهة الاستوائية معهد بحوث البساتين مركز البحوث الزراعية

### الملخص:

اجريت هذه الدراسة خلال الموسمين التجريبيين ٢٠١٠ و ٢٠١١ على اشجار نخيل البلح المنزرعة فى اراضى حديثة الاستصلاح بمنطقة اسيوط الجديدة بمحافظة اسيوط لدراسة تأثير الرش بمركب البورشاد (كربونات كالسيوم) كعامل حماية وذلك بتركيزات ٠,٥ % ١ % ٢ % ٣ % و ٥% على محصول وصفات الثمار وايضا مواعيد النضج وذلك لصنفى الزغلول والسمانى وقد تم رش المعاملات ثلاث مرات بداية من طور الحبابوك حتى بداية الخلال ( فى اشهر مايو ويونيه ويوليو) وتم تقدير العقد النهائى (البستانى) عند جمع المحصول وايضا تم تسجيل وزن السباطة وكذا المحصول الكلى.

تم اخذ عينة مكونة من ١٠٠ ثمرة بطريقة عشوائية من كل مكررة وذلك لتقدير بعض الصفات الطبيعية والكيميائية.

### اولا: الصفات الطبيعية:

وزن وابعاد (الطول والقطر) الثمرة وكذلك ايضا سمك اللحم.

### ثانيا: الصفات الكيميائية:

نسبة المواد الصلبة الذائبة والمحتوى من السكريات المختزلة والكلية بجانب المحتوى من التانينات والرطوبة.

وكانت أهم النتائج المتحصل عليها:

### المحصول:

- ادى الرش بمركب البورشاد بجميع تركيزاته الى زيادة معنوية فى نسبة الثمار المتبقية ووزن السباطة وبالتالي المحصول الكلى وذلك مقارنة بالكنترول للصنفين خلال موسمى الدراسة وسجلت معاملة الرش ٥ % اعلى القيم للصفات السابقة فى صنف الزغلول بينما كانت اعلى القيم فى صنف السمانى للمعاملة ٥ % فى الموسم الاول والمعاملة ٣ % فى الموسم الثانى.

- ادى استخدام المركب بتركيزاته المختلفة الى تاخير مواعيد النضج بواقع ١٢-١٨ يوم فى صنف الزغلول وبواقع ١٥ - ٢٠ يوم لصنف السمانى.

### الصفات الطبيعية:

سبب الرش بمركب البورشاد بجميع تركيزاته زيادة معنوية فى وزن وطول الثمرة و سمك اللحم مقارنة بالكنترول وذلك لكلا الصنفين خلال موسمى الدراسة كما لوحظ عدم وجود فروق معنوية بين بعض التركيزات لكلا الصنفين.

### الصفات الكيميائية:

ادى الرش بمركب البورشاد بجميع تركيزاته الى زيادة معنوية فى نسبة المواد الصلبة الذائبة والمحتوى من السكريات الكلية والذائبة والرطوبة وذلك مقارنة بالكنترول لكلا الصنفين وقد لوحظ زيادة مضطردة لكل الصفات السابقة بزيادة التركيز المستخدم من البورشاد.

أدى استخدام البورشاد بتركيزاته المختلفة الى نقصا معنويا فى صفة التانينات مقارنة بالكنترول وذلك فى كلا الصنفين الزغلول والسمانى.

من نتائج الدراسة يمكن التوصية برش مركب البورشاد بتركيز ٥ % ثلاث مرات فى اشهر مايو ويونيه ويوليو حيث يودى ذلك الى زيادة المحصول مع صفات جودة عالية لثمار

صنفى الزغلول والسمانى المنزرعة فى اراضى حديثة الاستصلاح اضافة الى تاخير موعد النضج مما يسهم فى تحسين العائد الاقتصادى نتيجة لتنظيم مواعيد جمع المحصول.