J. Plant Production, Mansoura Univ., Vol. 5 (5): 779-792 , 2014

IMPROVING FRUIT QUALITY OF MANFALOTY AND WONDERFULL POMEGRANATES BY USING BAGGING AND SOME SPRAY TREATMENTS WITH GIBBERELLIC ACID, CALCIUM CHLORIDE AND KAOLIN.

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ABSTRACT

This study was carried out during the two successive seasons of 2012 and 2013 on Manfaloty and Wonderful pomegranate trees at5 and 3-years old respectively, the trees were spaced at 4x4 m. grown in a sandy soil. The highest values of yield and its components i.e., fruit weight, fruit number /tree and yield /tree were recorded when Manfaloty and Wonderful pomegranate trees treated with GA_3 at 50 or 100ppm, $CaCl_2$ 4 %, kaolin 2.5 or 5 % and bagging treatment. The lowest percentage of fruit creaking and sunburn were obtained with bagging treatment followed by kaolin 5% and spraying by $CaCl_2$ and GA_3 treatments compared with the control treatment .All treatments caused a highly significant increase in Marketable fruits %. Bagging treatment gave the highest Marketable fruits percentage compared with the control and other treatments. The highest fruit length and diameter obtained by GA_3 50 or 100ppm and $CaCl_2$ 2 or 4% treatment. Furthermore,GA_3, kaolin and bagging treatments improved SSC, total acidity and SSC/acid ratio ,meanwhile the highest anthocyanin content in juice and peel was obtained by bagging and spraying kaolin 5% treatments in both cultivars. Therefore, these treatments could be recommended for improving Manfaloty and Wonderfull pomegranate cvs performance under similar conditions of this study.

Keywords: Pomegranate, bagging, foliar spray, GA_3, kaolin, $CaCl_2$, fruit cracking, sunburn, fruit quality.

INTRODUCTION

Pomegranate (*Punica granatum* L.) is one of the oldest known edible fruits, among the fruit kinds mentioned in the Holy Quran and an important in human medicine and its components have a wide range of clinical applications (Lansky & Newman, 2007). The cultivated area nowadays, acreage is rapidly increasing especially with Wonderfull cultivar under the new reclaimed lands. The total cultivated area is about 26351 feddans. From this area, the fruiting area was about 9746 feddans which produced about 89035 tons (Ministry of Agriculture statistics, 2012). Manfaloty and Wonderfull pomegranate are the most important cultivars in Egypt.

Fruit cracking is a serious problem in pomegranate which hinders its cultivation to a large extent. Cracking varies from 10 to 70% depending upon the prevailing environmental conditions. Various factors are responsible for fruit cracking which include fluctuation in soil moisture regimes, climate, tree nutrition and cultivars (Kumar *et al.*, 2010).It may also occur due to micronutrient deficiency in young fruits, while in mature fruits it might be due

to moisture imbalance or due to extreme variations in day and night temperatures (Abd El-Rhman, 2010). Cracked fruits lose their value for the fresh market and are used for processing only as fruit juice if not affected by fungi. Cracked fruits are susceptible to storage disease and have a shorter storage as well as shelf-life.

Pomegranates are especially sensitive to sunburn because they are terminal-bearing plants, with generally thin branches that bend with the increase in fruit weight as the season progresses (Melgarejo *et al*. ,2004 and Samra & Shalan, 2013). This exposes fruit parts that had developed previously in the shade, and are extremely sensitive to sunburn. Pomegranates are picked in early autumn, therefore the fruits exposed to high temperatures throughout the summer. As a result, the incidence of sunburn damage can be high causing grower losses that may exceed 30% of the harvested fruits (Melgarejo & Martinez, 1992) Controlling irrigation, bagging and spraying pomegranate with GA_3 or kaolin reduced the percentage of fruit cracking ,sunburn (Talaat *et al.*,2009 and Abd El-Rhman,2010) Gibberrellic acid is used widely in various horticultural crops for improving fruit set and also to control cracking of pomegranate fruit (Sepahi, 1986) and litchi (Sharma & Dhillon, 1986) In addition, GA_3 may be influencing cell wall strength or elasticity (Byers *et al.* 1990) The beneficial role of Ca in reducing fruit splitting might be attributed to owing as a cement material plays a vital role in increasing firmness of fruit which reduces water evaporation and increases withstand of the trees to water and drought stresses (Tuckey, 1986).

Kaolin has recently been utilized in the development of hydrophilic particle film technology. This technology uses chemically inter, non – toxic mineral particles coat to plant surfaces(Glenn *et al.* 1999). Kaolin application showed significantly positive effect on protection of fruit against sunburn on Fuji and Honeycrips apple cultivars (Schupp *et al*., 2002) These positive results on Kaolin application was also confirmed with studies of Melgarejo, *et al.,* (2004), Abd El-Rhman, (2010) and Samra & shalan (2013)on pomegranate and Glenn *et al*., 1999 on apple cultivars.

Fruit bagging is one of the most effective techniques to produce high-quality, pollution-free fruits and got more attentions to the fruit producers during the recent decades were obvious. The quality of fruit bagging has been getting better and better. The effect of bagging on appearance quality (brightness, color, size and weight of single fruit), the quality of fruit contents such as total soluble solids, titrable acids, vitamin C, become more apparent procedure. Also, the influence of bagging on fruit maturity period, storage property, protection of plant disease, insect pets ,sunburn and prevention from residual effects of pesticides have also been described (Jing, 2011).

Hence, the objective of this work was to study the effect of some spray treatments with GA_3 , $CaCl_2$, kaolin and bagging on fruit cracking, sunburn and quality of Manfaloty and Wonderful pomegranate cultivars.

MATERIALS AND METHODS

This study was carried out during the two successive seasons of 2012 and 2013 on 5-years old Manfaloty trees and 3-years old Wonderful pomegranate trees ,spaced at 3x4 m. under drip irrigation system grown in sandy soil in a private orchard located at El-Khatatba region, Menofia Governorate, Egypt. The trees were subjected to cultural practices which usually done in this orchard. The experiment was designed as a completely randomized block design within 8 treatments included 3 replicates, each replicate included two trees from each cultivar.

The applied treatments were arranged as follows:

1-Control (sprayed with water only)
2-Fruit bagging
3-Spraying of GA_3 at 50 ppm
4- Spraying of GA_3 at 100 ppm
5- Spraying of $CaCl_2$ at 2%
6- Spraying of $CaCl_2$ at 4%
7-Spraying of kaolin at 2.5%
8- Spraying of kaolin at 5%

Fruit bagging using paper bags 35x30cm, GA_3 and $CaCl_2$ were sprayed at the second week of June, while kaolin was sprayed at three times one at the second week of June, July and August in both seasons.

At harvest time when fruits become fully colored (the first week of October for Manfaloty cv and third week of October for Wonderfull cv) in both seasons fruits per tree in each treatment was counted and fruit yield (kg) per tree was calculated. Also percentage of fruit cracking, sunburn per tree and Marketable fruits were recorded as follow:

$$\text{Fruit cracking\%} = \frac{\text{No.of cracked fruits}}{\text{Total NO.of fruits}} \times 100$$

$$\text{Sunburn \%} = \frac{\text{No.of sunburn fruits}}{\text{Total No.of fruits}} \times 100$$

-Marketable fruits%=Total N. of fruits – (No. of cracked+sunburn fruits) x 100.

Fifteen normal fruits were taken from each treatment arise and transported to the laboratory of. Sakha Horticulture Research Station, Kafr El-Sheikh Governorate for quality determination as follows.

1. Fruit weight (g)
2. Aril weight (g) and percentage.
3. Peel weight (g) and percentage.
4. Fruit length and diameter (cm)
5. Soluble solids content (SSC) percentage in fruit juice was determined by using hand refractometer.
6. Total acidity % was determined according to A.O.A.C.(1995)
7. SSC/acid ratio in fruit juice
8. Vitamin C was determined according to A.O.A.C.(1995)

9. Total anthocyanin in peel and juice of fruit was determined according to Ranganna (1979).

The obtained data were statistically analyzed using the analysis of variance (Snedecor & Cochran, 1980), Treatment means were compared according to Duncan Multiple Range Test at 0.5 level of probability

RESULTS AND DISCUSSION

The obtained results are discussed under the following:

Yield and its components

Regarding to Manfaloty pomegranate cv, data presented in Table (1) reveal that the highest fruits number /tree are obtained by spraying $CaCl_2$ 4% and GA_3 at100 ppm in the first season and second season respectively compared to the lowest one by control in both seasons . Trees sprayed with GA_3 at 50 ppm tended to increase fruit weight compared to the other treatments in both seasons. The trees treated with GA_3 at 50 ppm or 100 ppm, $CaCl_2$ at 2% or 4 % and Kaolin 5 % gave the highest yield / tree without non-significant differences among them in the first season, meanwhile in the second one the $CaCl_2$ 4 % treatment resulted the highest yield compared to the lowest yield obtained by control.

As for the effect of treatments on Wonderful pomegranate cv the same table presented that the highest number of fruit /tree was obtained by GA_3 50 ppm, $CaCl_2$ 2 % and kaolin 5 % treatments without non-significant differences among them compared to the lowest one obtained by control in the first season while the highest fruit number / tree obtained by bagging treatment in the second season. GA_3 at 50 or 100ppm, $CaCl_2$ 4 %, kaolin 2.5 or 5 % and bagging treatment increased average fruit weight without non-significant differences among them over control in the first season. While the trees sprayed with 50 ppm GA_3 gave the highest average fruit weight in the second season. Spraying the trees with 50 ppm GA_3 tended to increase the yield over the other treatments in both seasons. The obtained results are in accordance with those of El-Khawaga(2003), Singh *et al.* (2003), Mohamed (2004) on Manfaloty pomegranate cv. In addition Talaat *et al.* (2009) found that spraying GA_3 at 100 ppm increased fruit number and yield. Furthermore, Melgarejo *et al.* (2004), Abd El-Rhman (2010) and Samra & Shalan (2013) mentiond that bagging or kaolin spraying increased fruit weight and yield (kg) / tree. Generally, increasing fruit yield and its component with spraying GA_3 and $CaCl_2$ may be due to the role of GA_3 and Ca on fruit formation, abscission, cell elongation and fruit retention percentage (Aboutalebi & Beharoznam, 2006). Also, GA_3 may be due to increased concentration of photosynthesis in the shoot (Zoffoli *et al*., 2009).

From these results it is clear that, increasing the yield of Manfaloty trees than Wonderfull due to the different in trees age. Also, Manfaloty trees reached to fruiting age compared to Wonderfull trees which were still at the beginning of fruiting period.

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Fruit cracking and sunburn percentage:

Data in Table (2) indicate that the differences among the treatments were highly significant as for the effect of treatments for two pomegranate cvs in both seasons the lowest percentage of fruit creaking obtained from bagging treatment followed by spraying with $CaCl_2$ and GA_3 treatment compared to the control. On the other hand, the control treatment gave the highest percentage of sunburnt fruits compared to the lowest percentages resulted by bagging treatment followed by kaolin 5 % as for the tow pomegranate cvs in both seasons. In this respect Al- Hmadawi *et al.* (2011), Lal *et al*. (2012) and Abubakar *et al.* (2013) reported that spraying GA_3 reduced fruit cracking in pomegranate fruits .Furthermore Melgarejo *et al.* (2004), Palitha *et al.* (2010) ,Ergun (2012), Hoda & Hoda, (2013) and Samra & Shalan (2013) reveal that bagging or kaolin application significantly reduced the severity of sunburn damage on pomegranate fruits. Generally, decreasing fruit cracking by bagging may be due to the effect of bagging on heat stress of fruit and water content of peel which decrease the transpiration from fruit surface (Glenn & Puterka 2007). In addition, GA_3 influence on fruit cracking indirectly by influencing of permeability or elasticity of the fruit cuticle (Sekse, 2005). Moreover Ca attributed to stabilization of membrane systems and the formation of calcium pectates and cell wall which increase rigidity of the middle portion and cell wall of the fruit (Jackman & Stanly 1995). As for reducing sunburn damage by bagging and kaolin may be attributed to role of these treatments of reflecting radiation, especially UV wavelengths which reaching the surface of fruits (Ergun, 2012).

Table (2): Effect of GA_3, $CaCl_2$, kaolin and bagging treatments on percentage of fruit cracking and sunburn of Manfaloty and Wonderfull pomegranate cultivars.

Treatments	Manfaloty				Wonderfull			
	Cracked fruits %		Sunburned fruit %		Cracked fruits %		Sunburned fruit %	
	2012	2013	2012	2013	2012	2013	2012	2013
Control	16.0a	11.9a	32.6a	35.9a	5.5a	4.2a	53.7a	36.3a
Bagging	2.9c	1.7c	0.0f	0.0f	0.7c	0.4b	0.0f	0.0g
GA_3 at 50 ppm	4.0bc	2.6bc	18.7b	17.5c	1.4c	2.6a	26.2b	13.5d
GA_3 at 100 ppm	2.6c	2.9bc	19.1b	26.5b	3.7b	3.3a	25.2bc	16.5c
$CaCl_2$ at 2%	3.2bc	2.4bc	18.8b	15.2d	1.7c	2.7a	24.1c	18.1b
$CaCl_2$ at 4%	3.2bc	2.2bc	14.0c	17.7c	2.3bc	3.2a	21.4d	17.9b
Kaolin 2.5%	4.9b	2.8bc	11.9d	14.4d	2.2bc	3.8a	17.2e	8.9e
Kaolin 5%	4.2bc	3.5b	8.6e	10.8e	1.8c	2.8a	16.6be	6.2f
F . test at 0.05	**	**	**	**	**	**	**	**

Values within each column having different letters showed statistically significant differences (p< 0.05)

Marketable fruits percentage:

Data in Table (3) demonstrate that, all treatments caused a highly significant increase in marketable fruits % compared with the untreated trees (control) for the two cultivars. Furthermore bagging treatment gave the highest marketable percentage since it ranged about (97.09, 98.22 and

99.22, 99.55) compared with the lowest percentage with obtained from the control (48.71, 47.88 and 40.72, 59.38) of Manfaloty and Wonderfull cvs respectively as 2012, 2013 seasons. These findings are agree with those reported by Wen Shuai (2009), Jing *et al*. (2009) ,Xiang *et al.* (2011) and Samra & shalan (2013) on pomegranate fruits. Marketable fruits percentage increased as a result of decreasing fruit disorders (cracking and sunburn) percentages which were affected by all treatments compared with control.

Table (3): Effect of GA_3,$CaCl_2$, kaolin and bagging treatments on percentage of marketable and unmarketable fruits of Manfaloty and Wonderfull pomegranate cultivars.

Treatments	Manfaloty				Wonderfull			
	Marketable fruits %		Unmarketable fruits %		Marketable fruits %		Unmarketable fruits %	
	2012	2013	2012	2013	2012	2013	2012	2013
Control	51.2e	52.1f	48.7a	47.8a	40.7f	59.3f	59.2a	40.6a
Bagging	97.0a	98.2a	2.9e	1.7f	99.2a	99.5a	0.7f	0.4f
GA_3 at 50 ppm	77.2d	79.8d	22.7b	20.1c	72.3e	83.8d	27.6b	16.1c
GA_3 at 100 ppm	78.1d	70.5e	21.8b	29.4b	70.9e	80.1be	29.0b	19.8b
$CaCl_2$ at 2%	77.9d	82.3c	22.0b	17.6d	74.1d	79.0e	25.8c	20.9b
$CaCl_2$ at 4%	82.6c	80.0d	17.3bc	19.9c	76.2c	78.7e	23.7d	21.2b
Kaolin 2.5%	83.1c	82.7c	16.9bc	17.2d	80.4b	87.2c	19.5e	12.7d
Kaolin 5%	87.1b	85.b	12.8d	14.4e	81.5b	90.9b	18.4e	9.1e
F . test at 0.05	**	**	**	**	**	**	**	**

Values within each column having different letters showed statistically significant differences (p< 0.05)

Fruit length and diameter:

Regarding to Manfaloty pomegranate cv data in Table (4) show that, there were non-significant differences among treatments as for fruit diameter in both seasons and for fruit length in the first season. Therefor the highest fruit length was obtained by $CaCl_2$ 4% treatment followed by Kaolin 2.5% and $CaCl_2$ 2% treatment without non-significant differences among them in the second season. In regard to Wonderfull cv the highest fruit length obtained by bagging and GA_3 50 ppm compared to the lowest values recorded by control in both seasons respectively. Meanwhile bagging and $CaCl_2$ 4 % treatment gave the highest fruit diameter compared to control regarding with Wonderfull pomegranate cv. Also, Talaat *et al.* (2009), samra & shalan (2013) on pomegranate and Abo El- Enien (2012) on Navel orange found that spraying $CaCl_2$ or GA_3 improvement fruit length and diameter. This can be attributed to GA_3 wich stimulate cell elongation and membrane permeability to water uptake (Chaudhary *et al.* 2006) .Gibberellins are involved in cell division and cell elongation. They are known to influence fruit size (Zhang &Whiting 2011) Gibberellic acid is also reported to promote growth by increasing plasticity of the cell wall followed by the hydrolysis of starch into sugars which reduces the cell water potential, resulting in the entry of water into the cell and causing elongation (Richard, 2006) . Furthermore, Melgarejio *et al.* (2004) mentioned that kaolin based an effective sunscreen while it gave non-significant differences for fruit diameter compared with untreated ones.

Table (4): Effect of GA_3,$CaCl_2$, kaolin and bagging treatments on fruit length and fruit diameter of Manfaloty and Wonderfull pomegranate cultivars.

Treatments	Manfaloty				Wonderfull			
	Fruit length (cm)		Fruit diameter (cm)		Fruit length (cm)		Fruit diameter (cm)	
	2012	2013	2012	2013	2012	2013	2012	2013
Control	7.2	7.6c	8.2	9.1	7.3c	8.1c	8.5c	9.3
Bagging	7.7	8.4ab	8.8	9.9	8.0a	8.1bc	9.2a	9.7
GA_3 at 50 ppm	7.8	8.4ab	9.0	10.1	8.0a	8.9a	8.6bc	10.0
GA_3 at 100 ppm	7.5	8.3b	8.7	9.6	8.0a	8.5ab	8.9ab	10.1
$CaCl_2$ at 2%	7.8	8.6ab	8.7	10.2	7.7b	8.5ab	8.1d	9.9
$CaCl_2$ at 4%	7.6	8.8a	8.7	10.0	7.8ab	8.2bc	9.2a	9.7
Kaolin 2.5%	7.4	8.7ab	8.4	10.1	7.8ab	8.1bc	8.9ab	9.7
Kaolin 5%	7.3	8.3b	8.5	9.9	8.0a	8.1bc	8.9ab	9.7
F . test at 0.05	Ns	**	Ns	Ns	**	**	**	Ns

Values within each column having different letters showed statistically significant differences (p< 0.05)

SSC %, total acidity and SSC/acid ratio.

It is clear from Table (5) that Manfaloty pomegranate trees sprayed with 50 ppm GA_3 gave the highest parentage of SSC in the fruit juice followed by bagging treatment compared to the other treatments in both seasons. As for acidity and SSC /acid ratio there were no significant differences among treatments in the second season. Trees sprayed with GA_3 at 100 ppm gave the highest acidity followed by kaolin 2.5 or 5 %. Meanwhile the highest SSC/ acid ratio was obtained by $CaCl_2$ 2% or 4 % compared to the lowest percentage obtained by GA_3 100ppm treatment.

With regard to Wonderfull pomegranate cv data in the same table reveal that kaolin 2.5 or 5 % treatments increased SSC % over all treatments in the first seasons followed by bagging and spraying by GA_3 50 ppm. Besides, the GA_3 50 ppm, $CaCl_2$ 2 % and control treatments gave the highest values in this respect compared to other treatments in the second season. All treatments increased acidity without non–significant differences among them compared to $CaCl_2$ 2 % treatment which gave the second rank in this respect in the first season. Meanwhile, bagging treatment gave the highest acidity compared to the lowest values obtained by $CaCl_2$ 2 % treatment in the second season. On the other hand $CaCl_2$ 2 % treatment increased SSC / acid ratio over the other treatments in both seasons. These results are in agreement with those reported by Talaat *et al.* (2009) and Abd El-Rhman (2010) on pomegranate mentioned that spraying GA_3 and kaolin significantly increased soluble solids content (SSC). Furthermore, samra & shalan (2013) and Xiang *et al.* (2011) stated that, bagging application increasing SSC and total acidity. Also, Ramezanian *et al*. (2009) revealed that, SSC increased by preharvest calcium sprays, but it was a slight difference between $CaCl_2$ 2% and 4%. The increase in total SSC in fruits with Ca or GA_3 may be due to the effect of them in improving trees growth which include leaf area, total chlorophyll of the leaves, absorption of water, nutrition and increasing in food synthesized that translocated to fruits Al- Hmadawi *et al*.(2011).

Total anthocyanin contents:

Concerning anthocyanin (Juice and peel) data in Table (6) show that, for Manfaloty non-significant differences in juice anthocyanin content in the first season, while the differences were significant in the second one. The highest anthocyanin in Juice was obtained by bagging treatment compared to the lowest one produced by GA_3 at100 ppm treatment. Other treatments gave intermediate values. The bagging treatment gave the highest anthocyanin in peel compared to the lowest values obtained by control and $CaCl_2$ 4 % in the first season, meanwhile in the second one all treatments increased anthocyanin content in peel without non-significant differences among them compared to control. With regard to Wonderfull pomegranate cv, bagging treatment gave the highest juice and peel anthocyanin contents compared to the other treatments. In this respect Arakawa (1991), Jing *et al.* (2009), Xiang *et al.* (2011) and Samra & shalan (2013) mentioned that the bagging pomegranate fruits with paper bags produced higher levels of anthocyanin. Generally, increasing anthocyanin contents by using bagging and kaolin may be due to the role of them for decrease the heat stress of fruit. In addition, Tora *et al.* (2008) presented that light exposure temperature is an important environmental factor that influences anthocyanin synthesis. Low temperature such as 25°C favors the anthocyanin biosynthesis, whereas high temperatures such as 35°C are associated with anthocyanin degradation and inhibition for anthocyanin accumulation. On the other hand, GA_3 at 100 ppm decreased anthocyanin content may be due to the role of GA_3 on delaying the maturation and senescence of fruits (Yilmaz & Özgüven, 2009).

From these results it is noticed that there were marked differences between two cultivars under study when compared to the results of the control, especially in the susceptibility to fruit cracking which was less percentage in Wonderfull cv compared with high percentage produced in Manfaloty. As well as acidity, anthocyanin content and coloring percentage of aril and peel. These differences may be due to genetic traits of the variety. The cracking may occur due to varietal characters and susceptibility (Kumar *et al.* 2009). In india, Malhotra *et al.* (1983) observed the least fruit splitting in Bedana and Dkolka pomegranate cvs. The varietal differences in cracking were attributed to skin structure and epidermal cell size. Yamamura & Nation (1985) stated that, the more cracking resistance cultivars had significantly thicker cell wall and larger cells in subepidermal region than the other cultivars. On the other hand, the sunburn damage percentage of Wonderfull cv was higher in the first season as a result of the fact that the fruits were from young trees (3 years old) where the canopy was not fully developed exposing a high proportion of the fruit to full sun and high daily temperatures.

From this study, it is clear that bagging and spraying with GA_3, $CaCl_2$ and kaolin treatments increased Marketable fruits percentages, improved fruit quality, reduced fruit cracking and sunburn percentages of Manfaloty and Wonderfull pomegranate cultivars. Also, the best results were obtained by bagging, spraying with GA_3 at 50 ppm and kaolin at 5% in both cultivars with fruit yield and quality. Therefore, these treatments could be recommended for improving Manfaloty and Wonderfull pomegranate cvs performance under similar conditions.

Table (6): Effect of GA_3, $CaCl_2$, kaolin and bagging treatments on ascorbic acid and acidity anthocyanin in juice and peel of Manfaloty and Wonderfull pomegranate cultivars.

Treatments	Manfaloty				Wonderfull			
	Anthocyanin mg/100ml				Anthocyanin mg/100ml			
	Juice		Peel		Juice		Peel	
	2012	2013	2012	2013	2012	2013	2012	2013
Control	18.4	16.0c	14.8c	15.4b	17.4	17.9c	17.2ab	18.6a
Bagging	19.0	20.2a	18.0a	18.7a	17.8	20.8a	17.9a	19.3a
GA_3 at 50 ppm	18.8	19.6ab	16.7ab	18.4a	17.9	19.0ab	16.9b	18.6a
GA_3 at 100 ppm	18.5	11.2d	16.1bc	17.5a	16.2	18.6bc	17.3ab	16.4c
$CaCl_2$ at 2%	18.6	19.8ab	16.9ab	17.3a	17.3	19.3ab	17.0b	18.6a
$CaCl_2$ at 4%	18.6	16.9bc	16.1bc	17.3a	16.7	19.8ab	16.0c	17.5b
Kaolin 2.5%	18.9	18.7bc	16.5ab	18.5a	17.9	19.2ab	17.3ab	19.0a
Kaolin 5%	18.8	17.4ab	16.7ab	18.7a	17.5	17.8c	17.4ab	19.3a
F . test at 0.05	Ns	**	*	**	Ns	*	**	**

Values within each column having different letters showed statistically significant differences (p< 0.05).

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تحسين جودة الثمار في صنفي الرمان المنفلوطي والوندرفول باستخدام التكييس و بعض معاملات الرش بالجبريللين وكلوريد الكالسيوم والكاولين.

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أجريت هذه الدراسة خلال الموسمين ٢٠١٢م ، ٢٠١٣م على صنفي الرمان المنفلوطي عمر خمس سنوات والوندرفول عمر ثلاث سنوات والمنزرعة على مسافات 4x3في ارض رملية بمنطقة الخطاطبة محافظة المنوفية بهدف دراسة تأثير بعض معاملات التكييس والرش بكل من الجبريللين وكلوريد الكالسيوم والكاولين على المحصول وجودة الثمار لصنفي الرمان تحت الدراسة

ويمكن تلخيص اهم النتائج المتحصل عليها كالتالى:-

ادت جميع المعاملات الى زيادة عدد الثمار /شجرة وكذلك كمية المحصول الكلي / شجرة،كما ادت جميع المعاملات الى خفض كل من نسبة تشقق الثمار وكذلك نسبة الاصابة بلفحة الشمس في كلا الصنفين تحت الدراسة ، حيث اعطت معاملة التكييس بالاكياس الورقية و الرش بحمض الجبريللين بتركيز ٥٠ او ١٠٠ جزء في المليون اقل نسبة تشقق في الثمار والاصابة بلفحة الشمس ثم معاملات الرش بكلوريد الكالسيوم ٢ او ٤ % ثم معاملة الكاولين ٥% بالمقارنة بالكنترول، كما ادت. ادت جميع المعاملات الى زيادة معنوية في نسبة الثمار الصالحة للتسويق في كلا الصنفين تحت الدراسة ، حيث اعطت معاملة التكييس اعلى نسبة للثمار الصالحة للتسويق في كلا الموسمين بالمقارنة بالكنترول وباقي المعاملات. كما اعطت معاملات الرش بحمض الجبريللين ٥٠ و ١٠٠ جزء في المليون وكلوريد الكالسيوم ٢ و ٤% اعلي قيم في طول وقطر الثمرة. كما ادت معاملات التكييس والرش بالجبريللين والكاولين الى زياده معنوية في نسبة المواد الصلبة الذائبة و الحموضه ونسبة المواد الصلبة الذائبة للحموضة . كذلك اعطت معاملات الرش بالجبريللين ٥٠ جزء في المليون والكالولين ٢.٥ و ٥ % اعلى نسبة لحامض الاسكوربيك في كلا الصنفين. من ناحية اخرى اعطت معاملة التكييس اعلى نسبة في محتوى كل من العصير وقشرة الثمره من صبغة الانثوسيانين ثم معاملة الرش بالكاولين بتركيز ٥ % في كلا الصنفين وذلك خلال موسمي الدراسة. من هذه النتائج يتضح اهمية استخدام هذه المعاملات في تحسين خواص الثمار والمحصول في كل من صنفي الرمان المنفلوطي والوندرفول وذلك عند زراعتها في المناطق التي تتشابه ظروفها المناخية مع ظروف المنطقة التي تم اجراء الدراسة بها.

Table (1): Effect of GA_3,$CaCl_2$, kaolin and bagging treatments on number of fruit /tree, average of fruit weight of Manfaloty and Wonderfull pomegranate cultivars.

Treatments	Manfaloty						Wonderfull					
	No .of fruit/tree		Average fruit weight(g)		Yield (kg)/tree		No .of fruit/tree		Average fruit weight(g)		Yield (kg)/tree	
	2012	2013	2012	2013	2012	2013	2012	2013	2012	2013	2012	2013
Control	51.1h	40.8f	269.4b	365.0d	13.7c	14.9d	25.0d	31.5e	304.5b	376.0c	7.6c	11.8c
Bagging	61.1g	44.3e	329.4ab	476.0b	20.2b	20.9c	32.8ab	44.0a	355.2a	420.4bc	11.7ab	18.4a
GA_3 at 50 ppm	66.8d	44.5e	372.8a	488.00a	21.6a	21.7bc	38.8a	31.5e	348.6a	496.0a	13.5a	15.6a
GA_3 at 100 ppm	65.8a	53.1a	332.0ab	442.5c	21.9a	23.5ab	31.3c	34.0d	354.5a	464.0ab	11.2b	15.8b
$CaCl_2$ at 2%	65.0e	50.0c	328.7ab	479.8ab	21.4a	20.6c	38.5a	36.6c	306.6b	438.3ab	11.8ab	16.0ab
$CaCl_2$ at 4%	72.8b	44.8e	314.2ab	482.0ab	22.6a	24.0a	32.3bc	37.6c	356.6a	413.6bc	11.5ab	15.3b
Kaolin 2.5%	61.6f	46.5d	283.9b	473.0b	17.5b	21.2c	37.5a	41.8b	352.5a	392.5bc	12.9ab	16.4ab
Kaolin 5%	70.6c	51.5b	306.8b	444.3c	21.6a	20.6c	37.8a	41.0b	343.0a	420.2bc	13.3ab	17.2ab
F . test at 0.05	**	**	**	**	**	**	**	**	*	*	**	**

Values within each column having different letters showed statistically significant differences (p< 0.05)

Table (5): Effect of GA_3, $CaCl_2$, kaolin and bagging treatments on SSC%, acidity and SSC/ acid ratio of Manfaloty and Wonderfull pomegranate cultivars.

Treatments	Manfaloty						Wonderfull					
	SSC %		Acidity %		SSC / Acid ratio		SSC %		Acidity %		SSC/ Acid ratio	
	2012	2013	2012	2013	2012	2013	2012	2013	2012	2013	2012	2013
Control	15.7	14.9c	1.08b	1.10	15.0ab	14.2	14.9b	16.5a	1.30a	1.17b	11.4bc	14.1b
Bagging	16.3	16.3ab	1.09b	0.96	14.8ab	17.4	15.8ab	15.7ab	1.43a	1.48a	11.0c	10.6c
GA_3 at 50 ppm	16.0	16.9a	1.06b	0.89	15.1ab	19.6	15.8ab	16.7a	1.30a	1.21ab	12.1bc	14.0b
GA_3 at 100 ppm	15.9	15.2c	1.41a	1.09	10.9c	14.0	15.6ab	14.7b	1.44a	1.11bc	10.8c	13.1bc
$CaCl_2$ at 2%	15.7	15.3bc	0.97b	0.74	16.4a	20.8	15.1b	16.6a	0.70b	0.88c	19.2a	19.1a
$CaCl_2$ at 4%	16.5	14.6c	0.98b	1.17	16.9a	12.5	15.6ab	15.6ab	1.18a	1.34ab	13.8bc	11.9bc
Kaolin 2.5%	16.3	14.6c	1.26ab	0.91	12.9bc	16.1	16.7a	15.6ab	1.35a	1.10bc	12.4bc	14.2b
Kaolin 5%	15.1	15.0c	1.16ab	0.82	13.5ab	19.1	16.5a	15.7ab	1.11a	1.14bc	15.4ab	14.0b
F . test at 0.05	Ns	**	*	Ns	*	Ns	*	*	*	*	*	**

Values within each column having different letters showed statistically significant differences (p< 0.05)