Bull. Fac .Agric., Cairo Univ.,Vol. 68:319-331 (2017).

IMPROVING FRUIT QUALITY AND EARLINESS OF MANFALOUTY POMEGRANATE BY USING SOME DORMANCY BREAKING AGENTS.

(Received 13-11-2017)

By
A.T. Abo-El-Ez, T.Kh. El-Boolk* and M. A. Hassan*

Horticulture Department Faculty of Agriculture Sohag University, Sohag, Egypt.
** Department of olive, Horticulture Research Institute, Agricultural Research Center, Giza, Egypt.*

ABSTRACT

The present study was carried out during two successive seasons of 2014 and 2015 on Manfalouty pomegranate trees grown in a private orchard, situated at Arab-Elawamer region, Abnoub city, Assiut Government, Egypt. The trees 9-years-old, were grown in sandy soil at 5 x 5m apart and irrigated by drip irrigation system. The main objective of this investigation was to study the effect of dormancy breaking agent on vegetative growth and flower bud breaking for producing early, high quality and increasing in grain crop of Manfalouty pomegranate cultivar. Considered dormancy breaking agent were mineral winter oil (MO) and Hydrogen cyanamide (H_2CN_2) (H.C.). Winter oil (MO) was as applied one concentration (3 %), while hydrogen cyanamide (H.C.) at three different concentrations (1.5 or 3.0 or 4.5 %) and their combinations. All treatments were added at as foliar sprays three different dates (1st Jan. or 15 Jan. or 1st Feb.). The aim of this study was to formulate a general recommendation to be used by pomegranate growers for enhancing budburst, yield and fruit quality under Assiut governorate climatic conditions. The results showed significant variation in the bud burst percentage, fruit yield, fruits weight, fruit grain weight, fruit juice and total anthothianin percentage in aril and rind. The increase in total soluble solids (TSS) percentage, and Vitamin C content in fruit juice were obtained by application of winter mineral oil plus Hydrogen cyanamide (MO 3 % + H.C. 4.5%) on 1st January. Thus, it can be recommended the application of winter mineral oil plus Hydrogen cyanamide (MO 3 % + H.C. 4.5 %) on 1st January which could be a suitable technology for producing early and high quality of Manfalouty pomegranate fruits under Assiut governorate climatic conditions. This treatment is recommended for Manfalouty pomegranate growers in this area.

Key words: *Manfalouty pomegranate, Hydrogen cyanamide, winter oil, Assiut Government.*

1. INTRODUCTION

Pomegranate is mainly grown in tropical and subtropical areas of the world. High quality fruits can be produced where there is cool winter and worm hot dry summer. (Melgarejo *et al.*, 2009, Ozguuven *et al.*, 2009 and Sawarsan *et al.*, 2011). The optimal temperature for fruit development is about 30-35°C. The tree cannot produce sweet fruits unless the temperature is high for a sufficiently long period. The quality of fruit is adversely affected in humid climate. It is successfully grown in Upper Egypt, especially in Assiut region which occupies the first ranks of area and production (Abdel All, 2007). There is a major problem in the cultivation of most deciduous fruit trees in Egypt, which is the lack of chilling needed to break bud dormancy. Spraying with dormancy breaking agents break the bud dormancy was suggested (Doorenbos, 1953). However, there are two main purposes of using rest breaking agents, improving level of bud breaking and advancing bloom and vegetative bud development (Erez *et al*., 1993). Hydrogen cyanimide and mineral oil are dormancy breaking agents used widely to break bud dormancy (Georg *et al*., 1988 and Haggag *et al.*, 1999).

In view of these facts, an attempt was made to see the response to mineral oil and Hydrogen cyanamide on defoliation and twig bud sprouting in pomegranate. Thus, the main objective of this investigation was to study the effect of some chemicals on the vegetative and flower bud break, to produc early and high quality fruits Manfalouty pomegranate cultivar. Through the application of dormancy breaking chemicals such as mineral oil and Hydrogen cyanamide (H_2CN_2) alone, or in combination with different timing, in order to formulate a general recommendation to be used by pomegranate

growers to enhance bud break, yield and fruit quality under Assiut climatic conditions.

2. MATERIALS AND METHODS

The present study was carried out during two successive seasons of 2014 and 2015 on Manfalouty pomegranate trees grown in a private orchard, situated at Arab-Elawamer region, Abnoub city, Assiut Government, Egypt. The pomegranate trees were propagated by hardwood cuttings. The trees are about 9- years old when this study started, grown in a sandy soil 5 x 5 m apart. The selected trees were uniform in vigour, size and of normal growth. All the chosen pomegranate trees received regular horticultural practices that were carried out in the pomegranate orchards, and irrigated by drip irrigation system. These common practices included pruning, hoeing, pest and fungi control management. Fertilization with farmyard manure, ammonium sulphate (20.6 % N), calcium superphosphate (15.5% P_2O_5) and potassium sulphate (48% K_2O) were added as recommended by the Ministry of Agricultural. Maximum and minimum temperatures and relative humidity for Arab-Elawamer region (Experimental location) during the two experimental seasons (according to Metrology Organization in Cairo) are shown in Table (1).

2.1. Experimental Work

After winter pruning, two dormancy breaking compounds, namely mineral oil (MO) and Hydrogen cyanamide "49% H_2CN_2" were applied alone or in combination at any of the following time, on the first of January, mid- January, on the first of February at dormant bud stage using a hand driven sprayer (atomizer), and irrigation was done after spray. The control treatment was (water plus Tween 20 "1%") on Manfalouty cv. during 2014 and 2015 seasons. The treatments were mineral oil (3%), Hydrogen cyanamide (1.5%, 3% and 4.5%) and mineral oil + Hydrogen cyanamide (combination). Each tree was sprayed completely with about 200 ml of the solution which was sufficient to "drip point" using a hand driven sprayer. Wetting agent Tween 20 (1%) was applied with the spraying solution.

2.2.The treatments

- (T1) Control (water plus Tween 20 "1 %").
- (T2) Spraying by Mineral Oil 3% on 1st Jan.,15th Jan. and the 1st Feb. at dormant bud stage.
- (T3) Spraying by Hydrogen cyanamide 1.5 % on 1st Jan., 15th Jan. and the 1st Feb. at dormant bud stage.
- (T4) Spraying by Hydrogen cyanamide 3 % on 1st Jan., 15th Jan. and the 1st Feb. at dormant bud stage.
- (T5) Spraying by Hydrogen cyanamide 4.5 % on 1st Jan., 15th Jan. and the 1st Feb. at dormant bud stage.

Table (1): Meteorological data (maximum and minimum temperature and relative humidity) for 2014 and 2015 under Assuit climatic conditions.

Month	Temperature (°C)						Humidity (%)					
	2014		2015		2016		2014		2015		2016	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Oct.	16.77	30.97	19.36	32.68	17.61	32.52	18.29	56.59	24.55	75.87	20.93	81.52
Nov.	12.00	26.3	12.67	25.18	12.63	26.67	25.13	70.23	31.48	84.17	24.4	83.37
Dec.	8.26	22.68	7.06	20.19	8.26	22.68	27.42	70.97	32.13	88.55	27.42	70.97
Jan.	6.13	22.36	5.23	20.23	6.13	22.36	27.29	83.45	23.94	67.77	27.29	83.45
Feb.	7.25	23.57	7.43	22.44	7.25	23.57	19.57	77.82	19.39	62.21	19.57	77.82
Mar.	12.03	27.48	11.71	26.9	12.03	27.48	15.87	68.84	15.87	58.94	15.89	68.48
April	15.63	32.37	14.17	29.30	17.07	34.73	12.27	61.73	10.67	42.53	9.23	60.97
May	19.48	35.32	19.61	35.32	19.93	35.9	13.74	59.6	12.74	47.00	9.58	51.61
June	21.03	36.27	21.13	36.40	24.43	40.4	17.76	52.83	16.1	61.70	9.60	50.63
July	23.32	38.13	22.77	38.36	23.84	37.6	15.45	55.8	13.35	61.48	16.29	62.32
Aug.	23.07	38.10	24.42	39.90	23.84	36.97	17.00	57.42	15.29	64.42	15.19	60.26
Sept.	21.20	34.33	23.63	38.33	21.43	34.8	16.93	56.83	16.87	60.50	19.07	69.00

*The meteorological data obtained by Meteorology Organization in Cairo.

- (T6) Spraying by Mineral Oil 3% + Hydrogen cyanamide 1.5 % on 1st Jan., 15th Jan. and the 1st of Feb. at dormant bud stage.
- (T7) Spraying by Mineral Oil 3% + Hydrogen cyanamide 3 % of 1st Jan., 15th Jan. and the 1st Feb. at dormant bud stage.
- (T8) Spraying by Mineral Oil 3% + Hydrogen cyanamide 4.5 % on 1st Jan., 15th Jan. and the 1st Feb. at dormant bud stage.

2.3. Experimental Design

Selected pomegranate trees (66 bearing trees) of Manfalouty cv. were set as a randomized complete block design (RCBD) with 7 treatments, and 3 replicates (one tree per replicate), at 3 application time, in addition to 3 trees as a control. The treatments were arranged as main plot, whereas the application times laid out as sub plots.

2.4.Variables measured

2.4.1. Sprouting percentage for bud break

Sprouting percentage for bud break was recorded at each treatment. This stage was estimated by counted the total number of buds sprouted per shoot at the last week of February (beginning of flowering of the best treatment) and the total number of dormant buds per shoot. The percentage of sprouting was calculated as:

Sprouting (%) =

$$\frac{\text{Total number of buds sprouted per shoot}}{\text{Total number of dormant buds per shoot}} \times 100$$

2.4.2. Vegetative growth parameters

2.4.2.1. Shoot length (cm) and leaf number per shoot

In each season, ten one-year-old shoots were tagged randomly at different sides of the tree canopy (replicate) to determine the shoot length and leaf number per shoot at the end of the growing season in July.

2.4.2.2. Leaf area (cm^2)

Samples of approximately 30 mature leaves per treatment were taken from the mid shoot growth (one year-old) from the four sides of the tree to determine average leaf surface area ($cm.^2$) according to the equation described by (Mofeed, 2009).

Leaf area (cm^2) = 0.41 (leaf length x leaf width) + 1.83

2.4.2.3. Blooming characteristics

2.4.2.3.1. Full bloom and blooming periods (days)

Full bloom periods (days) were recorded at each treatment as the number of days from spraying to full bloom (at 75 % anthesis), this stage was estimated by recording time of spraying and full blooming days, then days from spraying to full bloom date was calculated. Blooming periods (days) recorded for each treatment as the number of days from beginning of flowering to full bloom date. This stage was estimated by recorded time of beginning of flowering and full bloom in days, then days from beginning of flowering to full bloom date was calculated.

2.4.2.3.2. Flowering percentage

Flowering percentage was recorded for each treatment. This parameter was estimated by counting the total number of flowers per shoot at full bloom and the total number of bud burst per shoot. The percentage of flowering was calculated as:

Flowering (%) =

$$\frac{\text{Total number of flowers per shoot}}{\text{Total number of buds sprouted per shoot}} \times 100$$

2.5. Fruiting

2.5.1. Fruit set percentage

Ten one-year-old shoots of each-tree (replicate) were selected and tagged at random. the total number of flowers per shoot was counted at full bloom and set fruits was counted two weeks after full bloom stage. The percentage of fruit set (FS %) was calculated as:

FS % =

$$\frac{\text{Number of fruitlets per shoot}}{\text{Total number of flowers per shoot at full bloom}} \times 100$$

The number of dropped fruits were counted every 15 day intervals until harvesting and calculated as percentages (based on fruit set).

2.5.2. Fruit maturity (days)

Fruit maturity (days) was recorded for each treatment. This stage was obtained when the fruits reached the marketable maturity stage (total soluble solids, TSS) reached 14% of the best treatment). In each season, the time of full bloom and harvesting date were recorded in days for each treatment, then days from full bloom to harvesting date were calculated.

2.5.3. Fruit number per tree

In each season, the number of fruits per tree was recorded for each treatment at harvest time.

2.5.4. Fruit yield (Kg/tree)

At harvest time when the fruits reached the marketable maturity stage, fruits were picked of all treated trees on August 9th and 5th in the first and the second season, respectively, fruits were counted and weighed to estimate the number of fruits and yield/tree (kg).

2.5.5. Cracking fruit, sun burn fruit and marketable fruit percentage

In each season, at harvest time the number of cracked fruit, sun burned fruits and marketable fruits per tree were recorded. The percentages were calculated as:

Cracking fruit % =

$$\frac{\text{Number of cracking fruit per tree}}{\text{Total number of fruits per tree}} \times 100$$

Sun burn fruits % =

$$\frac{\text{Number of sun burn fruit per tree}}{\text{Total number of fruits per tree}} \times 100$$

Marketable fruit % =

$$\frac{\text{Number of marketable fruit per tree}}{\text{Total number of fruits per tree}} \times 100$$

2.6. Fruit quality

After fruit harvest, five fruits from each replicate were randomly selected and directly taken to the laboratory of Fruit research of Horticulture Department, Faculty of Agriculture, Sohag University, to evaluate the following fruit physical and chemical characteristics.

2.6.1. Fruit physical characteristics

These included fruit weight (g), fruit peel weight (g), fruit grains weight (g), fruit length and diameter (cm), fruit volume (cm^3), fruit juice (ml) were estimated using conventional methods, and the fruit shape index was calculated.

2.6.2. Fruit weight (g)

It was determined by weighting the fresh fruit samples (5 fruits) and the average fruit weight was recorded in (g.).

2.6.2.1. Fruit peel weight, fruit grain weight (g) and fruit juice (ml)

Selected fruits were peeled by hand in the laboratory, then, the average fruit peel weight (g) and fruit grains weight (g) were recorded, as well as fruit juice (ml).

2.6.3. Fruit chemical content

2.6.3.1. Total anthothyanin percentage in rind and aril

Total anthocyanin (%) content in fruit juice and rind were measured as described by (Hsia *et. al.*, 1965).

2.6.3.2. Total tannins content percentage in rind and aril.

Tannins content was determined in fruit juice aril and rind by the method described by (Winton and Winton, 1945)

2.6.3.3.Total soluble solids(TSS) and acidity (%)

Total soluble solids (TSS %) was measured by a hand refractmeter. Total acidity was determined by titration with NaOH at 0.1 N and phenolphthalein as an indicator, and then expressed as gm citric acid/ 100 ml juice, according to A.O.A.C. (1985).

2.6.3.4. Total soluble solids (TSS)/acid ratio

TSS/acid ratio was estimated mathematically by dividing the value of TSS with titrable acidity.

2.6.3.5. Vitamin C (mg/100 ml juice)

Vitamin-C content (mg) Ascorbic acid/100 ml juice was determined according to the method given in A.O.A.C. (2000).

2.7. Statistical analysis

All data collected were subjected to statistical analysis of variance (ANOVA) and significant difference among means were determined according to (Snedecor and Cochran, 1972). In addition significant difference among means were distinguished according to the Duncan's, multiple test range (Duncan, 1955) whereas, capital and small letters were used for differentiating the values of specific and interaction effects of investigated factors, respectively.

3. RESULTS AND DISCUSSION

The highest significant values of vegetative bud burst were achieved by 1st January x MO 3% + H.C. 4.5% (86.43 and 95.33) in both seasons compared with the control and other treatments. The present results are in harmony with those obtained by Gehan *et al.* (2011) and Sabry *et al.* (2011) who pointed out that Hydrogen cyanamide in association with mineral oil advanced the date of bud break (Table 2).

As for the flowering period (days) data showed that the least period was achieved at the 1st February x MO 3% + H.C. 1.5% (24.00) in the first season and the control (26.00) in the second season compared to the other treatments. Elloumi *et al*. (2013) and Seif El-Yazal *et al.* (2014) revealed that hydrogen cyanamide advanced flowering period in comparison to the untreated control (Table 3).

Data presented in Table (4) illustrate significantly that fruit set percentage was the highest achieved by the interaction treatment at 1st January x MO 3% + H.C. 3% (37.78) and 1st Feb. x H.C. 4.5% (37.78) in the first season compared with the control and other treatments. Seif El-Yazal *et al.* (2014) noticed the efficiency of early bud break induced by Hydrogen cyanamide, and mineral oil in varying degrees. Although Hydrogen cyanamide was distinguished, all dormancy-breaking substances improved fruit-set % as compared to the control.

Table (2): Mean values of Hydrogen cyanamide and mineral oil application alone or in combination with different concentrations and dates on the percentage of vegetative bud burst of Manfalouty pomegranate during 2014 and 2015 seasons.

Spraying dates / Treatments	2014			Mean	2015			Mean
	1st Jan.	15th Jan.	1st Feb.		1st Jan.	15th Jan.	1st Feb.	
Control	68.10f-h	68.10f-h	68.10f-h	68.10E	75.33de	75.33de	75.33de	75.33C
M.O 3%	64.83h	70.20e-h	70.33e-h	68.46E	75.40de	75.60c-e	78.70b-e	76.57BC
H.C. 1.5%	65.90gh	65.83gh	81.10b-d	70.94DE	75.87c-e	76.50c-e	75.60c-e	75.99BC
H.C. 3%	71.73de-h	77.50b-f	77.33b-f	75.52CD	75.70c-e	78.90b-e	82.10b-d	78.90BC
H.C. 4.5%	82.07b-d	79.23b-e	78.57b-f	79.96DC	79.20b-e	72.93e	78.87b-e	77.00BC
MO 3% + H.C. 1.5%	75.57c-g	82.70bc	77.00b-f	78.42BC	78.17b-e	82.60b-d	84.00bc	81.59A-C
MO 3% + H.C. 3%	83.57bc	81.20b-d	85.13bc	83.30AB	81.90b-d	85.00b	81.43b-e	82.78AB
MO 3% + V 4.5%	86.43a	86.57b	83.30bc	88.77A	95.33a	85.43b	83.37b-d	88.04A
Mean	76.03A	76.42A	77.61A	_	79.61A	79.04A	79.93A	_

- MO = mineral oil. - H.C. = Hydrogen cyanamide

Mean separation within treatments, dates of spraying of the pomegranate trees and for their interaction according to L.S.D. at 0.05 level.

Table (3): Mean values of Hydrogen cyanamide and mineral oil application alone or in combination with different concentrations and dates on the flowering period (days) of Manfalouty pomegranate during 2014 and 2015 seasons.

Spraying dates / Treatments	2014				2015			
	1st Jan.	15th Jan.	1st Feb.	Mean	1st Jan.	15th Jan.	1st Feb.	Mean
Control	33.00a-c	33.00a-c	33.00a-c	33.00AB	26.00e	26.00e	26.00e	26.00D
M.O 3%	36.00ab	33.00a-c	36.00a	35.00A	38.00a	36.00ab	33.00a-c	35.67AB
H.C. 1.5%	32.00a-d	29.00c-g	30.00c-f	30.33BC	32.00b-d	38.00a	38.00a	36.00A
H.C. 3%	31.00b-e	29.00c-g	36.00a	32.00AB	27.00de	35.00ab	35.00ab	32.33BC
H.C. 4.5%	27.00e-f	29.00c-g	28.00d-h	28.00CD	28.00c-e	31.00b-e	36.00ab	31.66C
MO 3% + H.C. 1.5%	32.00a-d	26.00f-h	24.00h	27.33CD	32.00b-d	31.00b-e	35.00ab	32.67A-C
MO 3% + H.C. 3%	30.00c-f	27.00e-h	27.00e-h	28.00CD	31.00b-e	31.00b-e	34.00a-d	32.00C
MO 3% + V 4.5%	26.00f-h	29.00c-g	25.00gh	26.67D	31.00b-e	29.00c-e	36.00ab	26.67D
Mean	30.88A	29.38A	29.88A	-	30.63B	32.13B	34.13A	-

- MO = mineral oil. - H.C. = Hydrogen cyanamide

Mean separation within treatments, dates of spraying of the pomegranate trees and for their interaction according to L.S.D. at 0.05 level.

Table (4): Mean values of Hydrogen cyanamide and mineral oil application alone or in combination with different concentrations and dates on fruit set percentage of Manfalouty pomegranate during 2014 and 2015 seasons.

Spraying dates / Treatments	2014				2015			
	1st Jan.	15th Jan.	1st Feb.	Mean	1st Jan.	15th Jan.	1st Feb.	Mean
Control	32.78a-c	32.78a-c	32.78a-c	32.78A	33.13a	33.13a	33.13a	33.13A
M.O 3%	35.55a-c	28.89a-c	27.78a-c	30.74A	33.97a	33.97a	27.78a	32.90A
H.C. 1.5%	31.11a-c	26.11ab	30.00a-c	29.07A	35.55a	35.55a	26.43a	31.59A
H.C. 3%	32.78a-c	32.78a-c	25.00c	30.18A	30.55a	30.55a	35.00a	34.44A
H.C. 4.5%	33.97a-c	32.78b-c	37.78a	34.84A	26.19a	26.19a	31.11a	30.03A
MO 3% + H.C. 1.5%	28.97a-c	30.55b-c	30.55a-c	30.02A	28.97a	28.97a	32.78a	30.24A
MO 3% + H.C. 3%	37.78a	35.55a-c	32.78a-c	35.37A	28.97a	28.97a	28.33a	30.42A
MO 3% + V 4.5%	36.94a-c	28.89a-c	35.00a-c	33.61A	30.16a	30.16a	31.11a	31.00A
Mean	33.73A	31.04A	31.46A	-	30.94A	30.94A	30.71A	-

- MO = mineral oil. - H.C. = Hydrogen cyanamide

Mean separation within treatments, dates of spraying of the pomegranate trees and for their interaction according to L.S.D. at 0.05 level.

Regarding fruit maturity (days), data showed that, there were significant differences between treatments in this respect. The least days in both seasons were recorded for MO 3% + H.C. 4.5% (Table 5). Similar results were obtained by El-Sharkawy and Osman (2009) and Hegazi (2012)

as they found that Hydrogen cyanamide treatments advanced fruit maturity.

Regarding the effect on yield (kg/tree) data in Table (6) revealed that, the highest significant values were achieved by the interaction treatment (1st January x MO 3% + H.C. 4.5%) (33.27 and 36.23) treatments in both seasons compared to the control and other treatments. Gehan *et al.* (2011) and Sabry *et al.* (2011) pointed out that Hydrogen cyanamide in association with mineral oil significantly improved fruit yield.

Data in Table (7) showed that the lowest cracking percentage was obtained by application of 1st January x MO 3% + H.C. 4.5% (4.34 and 4.67) in both growing seasons compared to the control and other treatments. Panwar *et al.* (1994) and Singh (1995) indicated that some of the major physiological disorders which adversely affect the production and quality of pomegranate are fruit cracking.

Percentage of sun bunted fruits was at significantly the lowest values achieved by 1st January x MO 3% + H.C. 4.5% (5.48 and 6.61) for both seasons, respectively. Panwar *et al.* (1994) and Singh (1995) found that some of the major physiological disorders which adversely affect the production and quality of pomegranate are internal breakdown and sun- scorching .

Results in Table (9) illustrated the effects on the fruits weight (g). The results showed that the highest values were obtained at 1st January x MO 3% + H.C. 4.5% (486.07 gm) in the first season and at 1st February x Hydrogen cyanamide 4.5% (442.00 gm) in the second season compared to other treatments. The present results coincided with those obtained by Gehan *et al.* (2011) and Sabry *et al.* (2011). They found that, the combination treatment of Jasmine oil + Hydrogen cyanamide resulted in high fruit quality.

The data presented in Table (10) indicated that, the using of MO 3% + H.C. 4.5 % on 1st January and MO 3% + H.C. 1.5% on 1st January induced significantly the highest fruit grains weight (g) in both growing seasons, compared to other treatments. These findings are in harmony with those obtained by Gehan *et al.* (2011) and Sabry *et al.* (2011). who showed that, the combination treatment of Jasmine oil + Hydrogen cyanamide resulted in high fruit quality.

The fruit juice (ml), was significantly the highest by1st January x MO 3% + H.C. 4.5% and1st January x MO 3% + H.C. 1.5 % (191.00 and 170.93) in both growing seasons, compared to other treatments (Table 11). The results are in line with those obtained by Gehan *et al.* (2011) and Sabry *et al.* (2011) who showed that, the combination treatment of Jasmine oil + Hydrogen cyanamide resulted in high fruit quality (Table 11).

Regarding the total anthothianin percentage in aril, the results indicated that the highest significant values were achieved by 1st January x MO 3% + H.C. 4.5% (0.46 and 0.44 %) in both seasons compared to the control and other treatments. The present results are in harmony with those obtained by Hegazi (2012) and Ahmed *et al.* (2014). Hydrogen cyanamide applied in January or February promotes fruit quality (Table 12).

As for total anthothianin percentage in the rind, the data in (Table 13) indicated that the highest significant values were achieved by 1st January MO 3% + H.C. 4.5% (0.28, 0.26 %) in both season respectively compared with the other treatments. The results are in harmony with those obtained by Gehan *et al.* (2011) and Sabry *et al.* (2011) who showed that, the combination treatment of Jasmine oil + Hydrogen cyanamide resulted in high fruit quality.

Data in Table (14) showed that the lowest significant total tannins in rind were obtained by 1st January x MO 3% + H.C. 4.5% and 1st January x MO 3% (2.67 and 1.70) in both growing seasons compared to the other treatments. The results are in line with those obtained by Gehan *et al.* (2011) and Sabry *et al.* (2011) who showed that, the combination treatment of Jasmine oil + Hydrogen cyanamide resulted in high fruit quality.

Data in Table (15) clearly indicated that the highest values of total soluble solids (TSS %) percentage was achieved by 1st January x MO 3% + H.C. 4.5% (15.07 and 15.00) in both growing seasons, respectively compared to the other treatments. The results are in harmony with those obtained by Gehan *et al.* (2011) and Sabry *et al.* (2011) who showed that, the combination treatment of Jasmine oil + Hydrogen cyanamide resulted in high fruit quality.

Data in Table (16) showed that the lowest significant acidity percentages, were obtained by 1st January x MO 3% + H.C. 4.5% (1.16 and 1.26 %) in both seasons, respectively, compared to the other treatments. These results are in line with those gained by Gehan *et al.* (2011) and Sabry *et al.* (2011) which showed that, the combination treatment of Jasmine oil + Hydrogen cyanamide resulted in high fruit quality.

Table (5): Mean values of Hydrogen cyanamide and Mineral Oil application alone or in combination with different concentrations and dates on fruit maturity (days) of Manfalouty pomegranate during 2014 and 2015 seasons.

Spraying dates / Treatments	2014				2015			
	1st Jan.	15th Jan.	1st Feb.	Mean	1st Jan.	15th Jan.	1st Feb.	Mean
Control	138.00hi	147.00b-d	153.00a	146.00AB	153.00a	153.00a	153.00a	153.00A
M.O 3%	142.00d-g	141.00e-h	151.00ab	144.67AB	137.00e-g	135.00fg	146.00b	139.33B
H.C. 1.5%	139.00gh	146.00c-e	145.00c-f	143.33A-C	142.00b-e	139.00d-f	135.00fg	138.67B
H.C. 3%	139.00f-h	145.00c-e	140.00f-h	141.33BC	136.00fg	147.00b	144.00b-d	142.33B
H.C. 4.5%	143.00d-g	145.00c-f	149.00a-c	145.67A	146.00b	145.00bc	135.00fg	142.00B
MO 3% + H.C. 1.5%	143.00d-g	143.00d-g	143.00d-g	143.00A-C	142.00b-e	140.00c-f	144.00b-d	142.00B
MO 3% + H.C. 3%	139.00g-i	143.00d-g	145.00c-f	142.33A-C	139.00d-f	143.00b-d	139.00d-f	140.33B
MO 3% + V 4.5%	134.00i	145.00c-f	140.00f-h	139.67C	133.00g	142.00b-e	144.00b-d	139.67B
Mean	139.63B	144.38A	145.75A	_	141.00B	143.00A	142.50AB	_

-MO = mineral oil. - H.C. = Hydrogen cyanamide

Mean separation within treatments, dates of spraying of the pomegranate trees and for their interaction according to L.S.D. at 0.05 level.

Table (6): Mean values of Hydrogen cyanamide and mineral oil application alone or in combination with different concentrations and dates on fruit yield (Kg/tree) of Manfalouty pomegranate during 2014and 2015 seasons.

Spraying dates / Treatments	2014				2015			
	1st Jan.	15th Jan.	1st Feb.	Mean	1st Jan.	15th Jan.	1st Feb.	Mean
Control	18.83bc	18.83bc	18.83bc	18.83A	24.13ab	24.13ab	24.13ab	24.13A
M.O 3%	25.77a-c	26.73bc	17.80bc	23.43A	30.30ab	31.27ab	18.33ab	26.63A
H.C. 1.5%	24.50a-c	20.17a-c	21.60a-c	22.09A	31.10ab	19.90ab	23.33ab	24.78A
H.C. 3%	21.27a-c	18.80bc	16.30c	18.79A	25.73ab	22.47ab	18.00b	22.07A
H.C. 4.5%	19.53bc	19.80bc	27.67a-c	22.33A	25.16ab	18.63ab	28.07ab	23.95A
MO 3% + H.C. 1.5%	26.60a-c	26.80a-c	16.37c	23.26A	31.23ab	19.90ab	18.70ab	23.28A
MO 3% + H.C. 3%	30.30ab	24.47a-c	19.07bc	24.61A	27.97ab	31.13ab	18.87ab	25.99A
MO 3% + V 4.5%	33.27a	30.83ab	24.13a-c	29.41A	36.23a	32.60ab	21.57ab	30.13A
Mean	25.01A	23.30AB	20.22B	-	28.98A	25.00AB	21.38B	-

- MO = mineral oil. - H.C. = Hydrogen cyanamide

Mean separation within treatments, dates of spraying of the pomegranate trees and for their interaction according to L.S.D. at 0.05 level.

Table (7): Mean values of Hydrogen cyanamide and mineral oil application alone or incombination with different concentrations and dates on fruit cracking percentage of Manfalouty pomegranate during 2014 and 2015 seasons.

Spraying dates / Treatments	2014				2015			
	1st Jan.	15th Jan.	1st Feb.	Mean	1st Jan.	15th Jan.	1st Feb.	Mean
Control	11.87a-d	11.87a-d	11.87a-d	11.87A	13.57a	13.57a	13.57a	13.57A
M.O 3%	11.60a-d	11.93a-d	12.37a-c	11.97A	12.13a-c	13.67a	13.43ab	13.08AB
H.C. 1.5%	11.63a-d	11.53a-d	12.80ab	11.99A	12.83a-c	12.07a-c	12.73a-c	12.54A-C
H.C. 3%	11.40a-d	11.47a-d	11.00a-e	11.29AB	11.80a-d	12.53a-c	11.53a-d	11.96B-D
H.C. 4.5%	8.20ef	11.80a-d	11.53a-d	10.51AB	9.50ef	12.17a-c	12.40a-c	11.36D
MO 3% + H.C. 1.5%	9.83b-f	10.83a-e	13.00a	11.22AB	11.23b-e	12.00a-c	12.13a-c	11.79CD
MO 3% + H.C. 3%	8.93d-f	9.37c-f	10.20a-e	9.50B	9.73d-f	11.77a-d	11.10c-e	10.87DE
MO 3% + V 4.5%	4.34f	10.90a-e	10.23a-e	8.49B	4.67f	11.00c-e	11.23b-e	8.97 E
Control	9.73AB	11.21B	11.63A	_	10.68B	12.35A	12.27A	_

- MO = mineral oil. - H.C. = Hydrogen cyanamide

Mean separation within treatments, dates of spraying of the pomegranate trees and for their interaction according to L.S.D. at 0.05 level.

Table (8): Mean values of Hydrogen cyanamide and mineral oil application alone or in combination with different concentrations and dates on fruit sun burn percentage of Manfalouty pomegranate during 2014 and 2015 seasons.

Spraying dates / Treatments	2014				2015			
	1st Jan.	15th Jan.	1st Feb.	Mean	1st Jan.	15th Jan.	1st Feb.	Mean
Control	21.60a	21.60a	21.60a	21.60A	21.50a	21.50a	21.50a	21.50A
M.O 3%	17.63bc	18.23a-c	18.10a-c	17.99B	18.50a-e	19.80a-c	21.30ab	19.87B
H.C. 1.5%	17.20b-d	17.53b-d	17.47b-d	17.40B	19.73a-c	18.93a-d	19.60a-c	19.42B
H.C. 3%	16.60cd	20.70ab	16.73cd	18.01B	16.80c-f	17.13c-f	18.10a-e	17.34C
H.C. 4.5%	15.47c-e	16.57cd	16.13c-e	16.06B	14.23fg	17.83b-e	19.37a-c	17.14C
MO 3% + H.C. 1.5%	15.80c-e	16.23c-e	17.30b-d	16.44B	15.63d-g	17.10c-f	18.90a-d	17.21C
MO 3% + H.C. 3%	12.67ef	16.50cd	16.20c-e	15.12BC	15.00e-g	17.07c-f	18.70a-d	16.92CD
MO 3% + V 4.5%	5.48f	13.73de	14.40c-e	11.20C	6.61g	16.50c-f	17.13c-f	13.41D
Control	15.31B	17.64A	17.24A	_	16.81C	18.23B	19.33A	_

- MO = mineral oil. - H.C. = Hydrogen cyanamide

Mean separation within treatments, dates of spraying of the pomegranate trees and for their interaction according to L.S.D. at 0.05 level.

Table (9): Mean values of Hydrogen cyanamide and mineral oil application alone or in combination with different concentrations and dates on fruits weight (g) of Manfalouty pomegranate during 2014 and 2015 seasons.

Spraying dates / Treatments	2014				2015			
	1st Jan.	15th Jan.	1st Feb.	Mean	1st Jan.	15st Jan.	1st Feb.	mean
Control	300.23e	300.23e	300.23e	300.23C	264.33d	264.33d	264.33d	264.33D
M.O 3%	362.20c-e	385.07b-e	324.13de	357.13BC	330.33b-d	363.33a-d	335.67b-d	343.11C
H.C. 1.5%	372.00b-e	366.93b-e	333.30de	357.41BC	389.33a-c	377.00abc	358.00a-d	374.78A-C
H.C. 3%	363.83c-e	344.57de	336.33de	348.24BC	354.33a-d	368.00a-d	385.67a-c	369.33A-C
H.C. 4.5%	362.27c-e	382.43b-e	441.33a-c	395.34B	442.00a	419.67abc	391.00a-c	417.56A
MO 3% + H.C. 1.5%	398.07b-d	394.80b-d	348.67de	380.51B	431.33ab	323.00cd	343.00a-d	365.78BC
MO 3% + H.C. 3%	483.87a	335.33de	386.50b-e	401.90AB	356.67a-d	352.67a-d	410.67a-c	373.34A-C
MO 3% + V 4.5%	486.07a	453.53ab	454.07ab	464.56A	422.00a-c	408.67abc	382.33a-c	404.33AB
Control	391.07A	370.36A	365.57A	_	373.79A	359.58A	358.83A	_

- MO = mineral oil. - H.C. = Hydrogen cyanamide

Mean separation within treatments, dates of spraying of the pomegranate trees and for their interaction according to L.S.D. at 0.05 level.

Table (10): Mean values of Hydrogen cyanamide and mineral oil application alone or in combination with different concentrations and dates on fruit grains (g) of Manfalouty pomegranate during 2014and 2015 seasons.

Spraying dates / Treatments	2014				2015			
	1st Jan.	15th Jan.	1st Feb.	Mean	1st Jan.	15th Jan.	1st Feb.	Mean
Control	185.03g	185.03g	185.03g	185.03D	140.00c	140.00c	140.00c	140.00B
M.O 3%	178.87g	225.07b-g	183.30g	195.75CD	172.00bc	186.33bc	217.33ab	191.89A
H.C. 1.5%	218.23c-g	185.40g	203.67e-g	202.43CD	227.00ab	186.33bc	216.33ab	226.55A
H.C. 3%	240.50a-f	195.57fg	214.43d-g	216.83B-D	198.67a-c	195.33a-c	213.33ab	202.44A
H.C. 4.5%	221.30c-g	254.33a-e	275.00ab	250.21AB	237.00ab	229.00ab	211.33a-c	225.78A
MO 3% + H.C. 1.5%	211.87e-g	228.70b-g	217.13c-g	219.23B-D	268.00a	178.67bc	193.00bc	213.22A
MO 3% + H.C. 3%	266.03a-d	185.80g	251.77a-e	234.53A-C	181.33bc	205.00a-c	232.67ab	206.33A
MO 3% + V 4.5%	289.17a	266.97a-c	282.83a	279.66A	204.00a-c	227.00ab	217.67ab	216.22A
Control	226.38A	215.86A	226.65A	_	203.50A	199.71A	205.21A	_

- MO = mineral oil. - H.C. = Hydrogen cyanamide

Mean separation within treatments, dates of spraying of the pomegranate trees and for their interaction according to L.S.D. at 0.05 level.

Table (11): Mean values of Hydrogen cyanamide and mineral oil application alone or in combination with different concentrations and dates on fruit juice (ml) of Manfalouty pomegranate during 2014and 2015 seasons.

Spraying dates / Treatments	2014				2015			
	1st Jan.	15th Jan.	1st Feb.	Mean	1st Jan.	15th Jan.	1st Feb.	Mean
Control	110.76h	110.76h	110.76h	110.76D	78.09c	78.09c	78.09c	78.09B
M.O 3%	116.91gh	143.04c-h	114.33gh	124.76CD	107.35bc	116.78bc	139.31ab	121.15A
H.C. 1.5%	142.82c-h	115.56gh	127.99e-h	128.79CD	142.67ab	149.24ab	130.80ab	140.90A
H.C. 3%	159.02a-f	124.33e-h	140.06c-h	141.14BC	125.07a-c	125.05a-c	139.49ab	129.87A
H.C. 4.5%	145.53b-h	158.27a-f	174.77a-d	159.52AB	154.22ab	146.56ab	138.12ab	146.30A
MO 3% + H.C. 1.5%	137.87d-h	150.79b-g	151.92b-g	146.86BC	170.93a	115.28bc	124.07a-c	136.76A
MO 3% + H.C. 3%	175.25a-d	119.99f-h	163.16a-e	152.80BC	120.50a-c	133.31ab	146.74ab	133.52A
MO 3% + V 4.5%	191.00a	177.81a-c	183.73ab	184.18A	134.07b	151.67ab	143.66ab	143.13A
Control	147.40A	137.57A	145.84A	_	129.11A	127.00A	130.04A	_

- MO = mineral oil. - H.C. = Hydrogen cyanamide

Mean separation within treatments, dates of spraying of the pomegranate trees and for their interaction according to L.S.D. at 0.05 level.

Table (12): Mean values of Hydrogen cyanamide and mineral oil application alone or in combination with different concentrations and dates on the total anthothianin percentage in aril of Manfalouty pomegranate during 2014 and 2015 seasons.

Spraying dates / Treatments	2014				2015			
	1st Jan.	15th Jan.	1st Feb.	Mean	1st Jan.	15th Jan.	1st Feb.	Mean
Control	0.21e	0.21e	0.21e	0.21D	0.22cd	0.22cd	0.22cd	0.22B
M.O 3%	0.26de	0.30cd	0.26de	0.27BC	0.24cd	0.28cd	0.24cd	0.25B
H.C. 1.5%	0.24de	0.27de	0.24de	0.25CD	0.22cd	0.25cd	0.22cd	0.23B
H.C. 3%	0.25de	0.30c-e	0.27de	0.27BC	0.23cd	0.28cd	0.25cd	0.25B
H.C. 4.5%	0.41ab	0.25de	0.32cd	0.33A	0.42a	0.29cd	0.32bc	0.34A
MO 3% + H.C. 1.5%	0.37bc	0.27de	0.32cd	0.32AB	0.27cd	0.24cd	0.30cd	0.27B
MO 3% + H.C. 3%	0.43ab	0.31cd	0.31cd	0.35A	0.41ab	0.25cd	0.20d	0.29AB
MO 3% + V 4.5%	0.46a	0.32cd	0.32cd	0.37A	0.44a	0.32bd	0.30cd	0.35A
Control	0.33A	0.28B	0.28B	_	0.31A	0.27B	0.26B	_

- MO = mineral oil. - H.C. = Hydrogen cyanamide

Mean separation within treatments, dates of spraying of the pomegranate trees and for their interaction according to L.S.D. at 0.05 level.

Table (13): Mean values of Hydrogen cyanamide and mineral oil application alone or in combination with different concentrations and dates on the total anthothianin percentage in rind of Manfalouty pomegranate during 2014and 2015 seasons.

Spraying dates / Treatments	2014				2015			
	1st Jan.	15th Jan.	1st Feb.	Mean	1st Jan.	15th Jan.	1st Feb.	Mean
Control	0.04^{h}	0.04^{h}	0.04^{h}	0.04^{C}	0.02^{l}	0.02^{l}	0.02^{l}	0.02^{F}
M.O 3%	0.17^{b}	0.06^{gh}	0.13^{bcde}	0.12^{B}	0.13^{e}	0.09^{g}	0.10^{f}	0.11^{C}
H.C. 1.5%	0.15^{bcd}	0.11^{c-g}	0.12^{b-f}	0.13^{B}	0.15^{d}	0.02^{l}	0.11^{f}	0.09^{CD}
H.C. 3%	0.11^{c-g}	0.08^{efgh}	0.10^{d-h}	0.10^{B}	0.05^{j}	0.04^{k}	0.08^{h}	0.06^{E}
H.C. 4.5%	0.15^{bcd}	0.15^{bcd}	0.07^{fgh}	0.12^{B}	0.09^{g}	0.02^{l}	0.11^{f}	0.07^{DE}
MO 3% + H.C. 1.5%	0.14^{bcde}	0.11^{defg}	0.13^{b-f}	0.13^{B}	0.13^{e}	0.13^{e}	0.05^{j}	0.10^{CD}
MO 3% + H.C. 3%	0.23^{a}	0.17^{bc}	0.14^{bcd}	0.18^{A}	0.21^{b}	0.15^{d}	0.20^{c}	0.19^{A}
MO 3% + V 4.5%	0.28^{a}	0.13^{bcde}	0.10^{d-h}	0.17^{A}	0.26^{a}	0.11^{f}	0.06^{i}	0.14^{B}
Control	0.16^{A}	0.11^{B}	0.10^{B}	_	0.13^{A}	0.07^{C}	0.09^{B}	_

- MO = mineral oil. - H.C. = Hydrogen cyanamide

Mean separation within treatments, dates of spraying of the pomegranate trees and for their interaction according to L.S.D. at 0.05 level.

Table (14): Mean values of Hydrogen cyanamide and mineral oil application alone or in combination with different concentrations and dates on the total tannins content percentage in rind of Manfalouty pomegranate during 2014and 2015 growing seasons.

Spraying dates / Treatments	2014				2015			
	1st Jan.	15th Jan.	1st Feb.	Mean	1st Jan.	15th Jan.	1st Feb.	Mean
Control	3.53a	3.53a	3.53a	3.53A	2.97b-g	2.97b-g	2.97b-g	2.97B
M.O 3%	3.04a-c	3.28ab	3.11a-c	3.14B	1.70h	3.09a-f	2.77c-g	2.52B
H.C. 1.5%	3.20a-c	3.12a-c	3.07a-c	3.13B	2.06f-h	3.25a-e	2.47e-h	2.59B
H.C. 3%	3.06a-c	3.32ab	3.07a-c	3.15B	2.67c-h	3.73a-c	2.73c-h	3.04B
H.C. 4.5%	3.03a-c	3.12a-c	3.07a-c	3.07B	1.96gh	3.19a-e	2.61d-h	2.59B
MO 3% + H.C. 1.5%	3.08a-c	3.23ab	2.94bc	3.08B	3.90ab	4.06a	3.66a-d	3.87A
MO 3% + H.C. 3%	2.90bc	3.07a-c	2.98bc	2.98B	3.28a-e	3.04a-f	2.78c-g	3.03B
MO 3% + V 4.5%	2.67c	2.93bc	3.07a-c	2.89B	2.54e-h	2.43e-h	3.04a-f	2.67B
Control	3.06A	3.20A	3.11A	_	2.64B	3.22A	2.88B	_

- MO = mineral oil. - H.C. = Hydrogen cyanamide

Mean separation within treatments, dates of spraying of the pomegranate trees and for their interaction according to L.S.D. at 0.05 level.

Table (15): Mean values of Hydrogen cyanamide and mineral oil application alone or in combination with different concentrations and dates on the total soluble solids (TSS) percentage of Manfalouty pomegranate during 2014and 2015 seasons.

Spraying dates / Treatments	2014				2015			
	1st Jan.	15th Jan.	1st Feb.	Mean	1st Jan.	15th Jan.	1st Feb.	Mean
Control	12.70j	12.70j	12.70j	12.70E	11.87m	11.87m	11.87m	11.87F
M.O 3%	13.90gh	13.57i	13.77hi	13.75D	12.87k	12.67l	12.57l	12.70E
H.C. 1.5%	14.13c-g	13.77hi	13.60i	13.83CD	13.13j	13.03jk	12.90k	13.02DE
H.C. 3%	14.20c-f	14.07e-g	13.97fgh	14.08BC	13.40hi	13.33i	13.03jk	13.25D
H.C. 4.5%	14.40bc	14.13c-g	14.33b-e	14.29AB	13.87e	13.67fg	13.53gh	13.69C
MO 3% + H.C. 1.5%	14.37bcd	14.27c-e	14.17c-g	14.27AB	14.18cd	13.93e	13.67fg	13.93BC
MO 3% + H.C. 3%	14.57b	14.23c-f	14.10d-g	14.30AB	14.37b	14.13d	13.80ef	14.10AB
MO 3% + V 4.5%	15.07a	14.27c-e	14.27c-e	14.54A	15.00a	14.33bc	14.00de	14.44A
Control	14.17A	13.88B	13.86B	_	13.59A	13.37B	13.17C	_

- MO = mineral oil. - H.C. = Hydrogen cyanamide

Mean separation within treatments, dates of spraying of the pomegranate trees and for their interaction according to L.S.D. at 0.05 level.

Table (16): Mean values of Hydrogen cyanamide and mineral oil application alone or in combination with different concentrations and dates on acidity percentage of Manfalouty pomegranate during 2014 and 2015 seasons.

Spraying dates / Treatments	2014				2015			
	1st Jan.	15th Jan.	1st Feb.	Mean	1st Jan.	15th Jan.	1st Feb.	Mean
Control	2.03a	2.03a	2.03a	2.03A	1.81a	1.81a	1.81a	1.81A
M.O 3%	1.67b-e	1.69b-e	1.68b-e	1.68B-D	1.44c-e	1.44cd	1.55b	1.48B
H.C. 1.5%	1.73bc	1.77b	1.78b	1.76B	1.41c-f	1.42c-f	1.48bc	1.44BC
H.C. 3%	1.66b-e	1.71b-d	1.72bc	1.70BC	1.37d-g	1.43c-e	1.44c-e	1.41B-D
H.C. 4.5%	1.55ef	1.55ef	1.57d-f	1.56D	1.31g-i	1.38d-g	1.44c-e	1.38C-E
MO 3% + H.C. 1.5%	1.57d-f	1.61c-f	1.61c-f	1.60CD	1.27hi	1.36d-f	1.40c-f	1.34DE
MO 3% + H.C. 3%	1.33h	1.37gh	1.48fg	1.39E	1.27hi	1.31g-i	1.35e-h	1.31E
MO 3% + V 4.5%	1.16i	1.27hi	1.33h	1.25F	1.26i	1.31g-i	1.34f-i	1.30E
Control	1.59B	1.63AB	1.65A	_	1.39C	1.43B	1.48A	_

- MO = mineral oil. - H.C. = Hydrogen cyanamide

Mean separation within treatments, dates of spraying of the pomegranate trees and for their interaction according to L.S.D. at 0.05 level.

Data in Table (17) as regard to the Vitamin C percentage data showed that the highest significant values were achieved by 1st January x MO3% + H.C. 4.5 % (20.20 and 18.90 %) in both growing seasons, respectively compared to the other treatments. The results are in harmony with those obtained by Naderi (2014) who indicated that the highest amount of vitamin C belonged to the

Table (17): Mean values of Hydrogen cyanamide and mineral oil application alone or in combination with different concentrations and dates on Vitamin C (mg/100 ml juice) of Manfalouty pomegranate during 2014and 2015 growing seasons.

Spraying dates / Treatments	2014				2015			
	1st Jan.	15th Jan.	1st Feb.	Mean	1st Jan.	15th Jan.	1st Feb.	Mean
Control	11.32i	11.32i	11.32i	11.32E	8.40e-h	8.40e-h	8.40e-h	8.40D
M.O 3%	12.43hi	12.65g-i	12.21hi	12.43DE	13.13bc	11.55b-e	7.35h	10.68BC
H.C. 1.5%	12.88fghi	12.88f-i	12.21hi	12.66DE	12.81bc	7.88f-h	7.46gh	9.38CD
H.C. 3%	14.21c-h	13.76d-i	13.10e-i	13.69CD	13.65b	8.19f-h	8.93d-h	10.26B-D
H.C. 4.5%	16.20b-d	16.43b-d	15.76b-e	16.13AB	10.19c-h	10.29c-h	8.40e-h	9.63CD
MO 3% + H.C. 1.5%	15.99b-d	15.32b-g	14.65c-h	15.32BC	10.92b-f	7.98f-h	8.40e-h	9.10CD
MO 3% + H.C. 3%	17.76ab	16.43b-d	15.54b-f	16.58AB	18.06a	8.51e-h	9.98c-h	12.18AB
MO 3% + V 4.5%	20.20a	17.98ab	16.65bc	18.28A	18.90a	10.71b-g	11.76b-d	13.79A
Control	15.12A	14.60AB	13.93B	_	13.26A	9.19B	8.83B	_

- MO = mineral oil. - H.C. = Hydrogen cyanamide

Mean separation within treatments, dates of spraying of the pomegranate trees and for their interaction according to L.S.D. at 0.05 level.

combination treatment of Volk oil + Hydrogen cyanamide. Gehan *et al.* (2011) and Sabry *et al.* (2011) added that, the combination treatment of Jasmine oil + Hydrogen cyanamide resulted in high fruit quality.

Conclusion

This study suggested that treatment with mineral oil plus Hydrogen cyanamide "Hydrogen cyanamide " (MO 3% + H.C. 4.5%) treated on the 1st of January is considerd as useful technology for producing early and high quality Manfalouty pomegranate under Assiut climatic conditions.

4. REFERENCES

Abdel All E. H. A. (2007). Effect of fruit thinning and spraying with some chelated elements and calcium on yield and fruit quality of Manfalouty pomegranate. Thesis M. Sc., Fac. of Agric., Minia Univ., Egypt.

A.O.A.C. (1985). Associate of Official Analytical Chemists. Official Methods of Analysis 14th ed., washington DC., USA.

A.O.A.C. (2000). Associate of Official Analytical Chemists. Official Methods of Analysis 7th ed. Washington D.C., USA.

Ahmed F. F., Ibrahim H. I. M., Abada M. A. M. and Osman M.M.M. (2014). Using plant extracts and chemical rest breakages for breaking bud dormancy and improving productivity of superior grapevines growing under hot climates. World Rural Observ, 6(3):8-18.

Doorenbos J. (1953). Review of literature on dormancy in buds of woody plants. Land Bhoogesh. Wagenin, 53: 1-23.

Duncan B.D. (1955). Multiple test range and multiple F tests. Biometries.11-142.

Elloumi O., Ghrab M., Kessentini H. and Mimoun M.B. (2013). Chilling accumulation effects on performance of pistachio trees cv. Mateur in dry and warm area climate. Sci. Hort., 159:80-87.

El-Sharkawy S. M. M. and Osman I. M. S. (2009). Effect of foliar applications of some growth regulators on flowering, fruit production and quality of Wichita and Western Schley pecan cultivars. Egypt. J. Hort., 36(1):29-46.

Erez A., Rignwald S. and Yablowitz Z. (1993). New means to break bud rest and advance bloom in apple and peach. ISHS, Sym. on (TZFTS) Cairo, Egypt, Abst, p: 33.

Gehan H. S., Hanaa A. E. and Ansam S. A. (2011). A study on using jasmine oil as a breaking bud dormancy for flame seedless grapevines. Report and Opinion, 3(2):48-56.

Georg A.R., Nissen R.J. and Baker J.A. (1988). Effect of hydrogen cyanamide in manipulating budburst and advancing fruit maturity of table grapes in Southeastern Queensland's. Aust. J. Exp. Agric., 28: 533-538.

Haggag M. N., Ezz T. M. and El-Kobbia A.M. (1999). Bud break, yield, fruit quality and enzyme activity of Banati pomegranate trees in relation to Hydrogen cyanamide spray. Alexandria J. Agric. Res., 44(2):175-184.

Hegazi A. A. (2012). Effects of Some Dormancy Breaking Agents on Flowering, Fruiting and Fruit Characteristics of 'Canino'

Apricot Cultivar. World J. Agric. Sci., 8 (2): 169-173.

Hsia C. L., Luh B. S. and Chickester C.O. (1965). Anthocyanin in freestone peaches. J. food sci., 30, 5-12.

Melgarejo P., Martínez J. J., Hernández F., Martínez R., Legua P., Oncina R. and Martínez-Murcia A. (2009). Cultivar identification using 18S–28S rDNA intergenic spacer-RFLP in pomegranate (*Punica granatum* L.). Sci. Hortic., 120 (4): 500-503.

Mofeed A.S. (2009). Effect of conversion to organic farming on yield, fruits and oil quality of olive. Ph. D. Thesis Faculty of Agriculture, Ain Shams University, Egypt.

Naderi A. (2014). The study of different treatments effect on the amount of vitamin C in overcoming the grapevine buds dormancy. Indian J. Fund. Appl.Life Sci., 4(2):474-479.

Ozguven A.I., Yilmaz M., Yilmaz C. and Rehber, Y. (2009). The adaptation of different pomegranate cultivars to the ecological conditions of Northern Cyprus. Acta hort. 818, March 2009: International Sympoium on pomegranate and Minor Mediterranean Fruits, Northern Cyprus.

Panwar S., Desai U. T. and Choudhary S. M. (1994). Effect of pruning on physiological disorder in pomegranate. Ann. Arid Zone, 33: 83-84.

Sabry G. H., El-Helw H. A. and Abd El-Rahman A. S. (2011). A study on using Jasmine Oil as a breaking bud dormancy for Flame seedless grapevines. Report and Opinion, 3(2):48-56.

Sawarsan M. R., El-Bolok K. T. and Abou-Taleb S. A. (2011). A comparative study on some pomegranate cultivars under the ecological conditions of Souhag Governorate, Agric. Res., J. Suez Canal University, 11 (12): 101-106.

Seif El-Yazal M. A., Seif El-Yazal S.A. and Rady M. M. (2014). Exogenous dormancy-breaking substances positively change endogenous phytohormones and amino acids during dormancy release in 'Anna' apple trees. Plant Growth Regul., 72:211–220.

Singh S. (1995). Pomegranate. *In*: Commercial Fruits, pp. 225-233. Kalyani Publisher, Ludhiana. Indian.

Snedecor G.W. and Cochran W.G. (1972). Statistical Methods. 7*th* Ed. The Iowa State Univ., Press Ames, Iowa, U.S.A., p.593.

Winton A. H. and Winton K.B. (1945). Analysis of food. Wiley, New York, USA., p 572.

تحسين جودة ثمار الرمان المنفلوطى والتبكير باستخدام بعض الوسائل الكاسرة للسكون

علاء ثابت ابو العز – طارق خلف البلك* – محمد على حسن*

قسم البساتين – كلية الزراعة - جامعه سوهاج - مصر.
* قسم بحوث الزيتون – معهد بحوث البساتين – مركز البحوث الزراعية – الجيزة - مصر.

ملخص

أجريت هذه الدراسة خلال الموسمين المتعاقبين 2014 و 2015 علي أشجار صنف الرمان المنفلوطى المنزرعة في مزرعة خاصة، والواقعة في منطقه عرب العوامر في مدينة أبنوب - محافظة أسيوط - مصر. وكانت أشجار الرمان عمرها 9 سنوات ومنزرعة في تربة رملية على أبعاد غرس 5 × 5 وتروى بنظام الري بالتنقيط.

كان الهدف الأساسي من هذا البحث هو دراسة تأثير بعض المواد الكاسرة للسكون على النمو الخضري وتفتح البراعم الزهرية وذلك بهدف التبكير وتحسين جودة الثمار وزيادة محصول الرمان المنفلوطي.

وقد تم استخدام الزيت المعدني الشتوي وسينامید الهيدروجين كمواد كاسرة للسكون، وأتم إضافة الزيت المعدني الشتوي بتركيز 3 % وسينامید الهيدروجين بثلاث تركيزات هي (1.5، 3.0 و 4.5 %) والخلط بينهم، وقد استخدمت هذه المعاملات في ثلاث مواعيد مختلفة رشا في (أول ومنتصف يناير، وأول فبراير).

والغرض من هذه الدراسة هو الحصول على توصية عامة لمزارعي الرمان لكسر سكون البراعم والحصول على محصول مبكر وزيادة المحصول وتحسين جودة ثمار الرمان تحت الظروف المناخية لمحافظة أسيوط.

وقد أظهرت النتائج اختلافات معنوية في نسبة تفتح البراعم ومحصول الثمار ووزن الثمار ووزن الحبات والعصير ونسبة صبغة الأنثوسيانين في الحبات والقشرة.

هذا وقد كان الرش بالزيت المعدني الشتوي بتركيز 3 % وسينامید الهيدروجين بتركيز 4.5 % في أول يناير أفضل المعاملات للحصول على أعلى القيم في المواد الصلبة الذائبة الكلية وفيتامين سى (C).

وعليه يمكن التوصية بإضافة الزيت المعدني الشتوي تركيز 3 % + سينامید الهيدروجين بتركيز 4.5 % في الأول من يناير والتي تعتبر الطريقة المناسبة لإنتاج محصول مبكر وعالي الجودة من ثمار الرمان صنف المنفلوطي النامي تحت الظروف المناخية لمحافظة اسيوط ويوصى بهذه المعاملة لمزارعي الرمان المنفلوطي تحت الظروف المناخية لهذه المنطقة.