Journal of Horticultural Science & Ornamental Plants 13 (2): 134-141, 2021
ISSN 2079-2158

DOI: 10.5829/idosi.jhsop.2021.134.141

Influence of Some Treatments on Suckers' Growth Control of Pomegranate Trees

M. Abou El-Wafa

Olive and Semi-Arid Fruits Zone Research Department,
Horticulture Research Institute, Agriculture Research Centre, Giza, Egypt

Abstract: The present investigation was carried out in a private farm located at Alexandria desert road (Km 64), El-Giza Governorate, Egypt to study the effect of some treatments on suckers' growth control of pomegranate (Wonderful cultivar) trees during 2018 and 2019 seasons. The trees were 5 -years- old and grown in sandy soil under drip irrigation system. The tested treatments were: control (suckering once a year at January), suckering (twice a year at January and June), spraying with NAA at (5, 000, 10, 000, 20, 000 ppm) as well as trunk covering and soil mulching with black plastic. NAA spraying treatments and trunk covering and soil mulching with black plastic were applied on 1st February after suckers' removal (from the crown up to trunk for a distance of 50 cm along the tree trunk). The obtained results showed that, trunk covering and soil mulching with black plastic reduced number of suckers either more or less than 30 cm in length, as well as total number of suckers and weight (g). This result also reflect an increase in length and diameter of fruits(cm), fruit weight (g), yield/tree (kg), juice total soluble solids (%) and juice total soluble sugars (%), as well as, it reduced the infected fruits (%) compared to other treatments. Accordingly, it can be recommended, trunk covering and soil mulching with black plastic on 1st February after suckers removal at a distance of 50 cm along the trunk tree according to our results, which indicate that it is the best treatment on suckers growth control of pomegranate (Wonderful cultivar) trees with improving fruit quality, yield as well as increasing the net profit for the farmer.

Key words: Pomegranate · Wonderful · Suckers · NAA · Mulching

INTRODUCTION

Pomegranate (*Punica granatum* L.) is a shrub that naturally tends to develop multiple trunks and has a bushy appearance, when domesticated, it is grown as a small tree that grows up to 5m. Under natural conditions, it can sometimes grow up to more than 7m; at the other extreme, in severe natural environment, one can find creeping bush varieties [1].

These suckers grow vigorously without branching and when allowed to grow for several years tend to change the tree into unproductive bush. The trees with numerous suckers show a straggling appearance, long weak shoots and bear very little crop. In addition, suckers compete for growth with the rest of the tree, being therefore undesirable formations which behave similarly to weeds [2, 3]. Farmers need to remove this suckers several times during the season. If he let it sucker freely it will put all its nutrients into growing and you will have less fruits. Suckers may compete with new growth in obtaining mineral nutrients and water; consider the main source of insect and pathological diseases, as well as preventing the light to reach all the parts of the tree. The practice of removing the suckers can be made manually twice at the end of the season in winter (January) and in summer (May or June). Suckers can cause problems during vineyard management operations, such as soil tillage, weed removal, mechanical harvest and pest and disease control [4]. The right time for suckering is when they are not yet lignified. Waiting longer causes the suckers to become lignified, harden, which are then more difficult to remove. Suckering in spring also prevents the development of re-sprouting basal buds [5]. Traditionally, suckering was done by hand, however this is costly, stressful and time consuming because it requires constant bending down, getting up and making repetitive motions [6]. Sucker growth can lead to excess vegetation; increase the possibility of attack from pathogens [7].

Corresponding Author: M. Abou El-Wafa, Olive and Semi-Arid Fruits Zone Research Department, Horticulture Research Institute, Agriculture Research Centre, Giza, Egypt.

Many investigators have studied the influence of chemical control of suckers such as (NAA) in controlling suckers growth of many fruits crops. Naphthalene acetic acid (NAA) is a synthetic plant hormone in the auxin family. The hormone NAA does not occur naturally and, like all auxins, is toxic to plants at high concentrations. So, we can use to reduce the number of suckers.

NAA inhibited shoot re-growth on the trunk through the inhibition of cell division and enlargement [8]. Higher concentrations of NAA inhibited shoot growth around the trunk [9]. NAA reduced number of suckers, sucker length and suckers weight of Manfalouty pomegranate trees [8]. The related review concerning the effect of the tested treatments on pomegranate trees are somewhat rare, thereupon the review were supported with other species rather than pomegranate in this respect. Many investigators have studied the effect of chemical of sprouted suckers such as 1-Naphthaleneacetic acid (NAA) in controlling suckers growth of several fruits crops, Eynard *et al.* [10]; Reynolds [11] on grapevines; Aly and Shehata [12] on pear and guava and Reynolds *et al.* [13] on berry. Moreover, [14] reported that, NAA treatments gave a reduction in re-growth of suckers number and length of fig and pomegranate trees, generally, 20000 ppm NAA treatment increased the mean number of fruits as well as yield per tree, total sugar percentage of fig trees but reduced TSS percentage slightly in pomegranate trees.

Soil mulching remains among the intelligent cultivation practices for improving the quality of fruits from several crops. It can be organic or plastic [15].

Therefore, the aim of the present experiment was to study the effect of some agricultural practices and Naphthalene acetic acid treatments on sucker's growth control of pomegranate trees (Wonderful cultivar).

MATERIALS AND METHODS

The present study was carried out during 2018 and 2019 seasons on Wonderful pomegranate cultivar trees (*Punica granatum* L.). The experimental trees were uniform, 5 -years- old growing in sandy soil under drip irrigation system in a private farm located at Alexandria desert road, Km 64, El-Giza Governorate, Egypt. Trees were planted at a distance of 5 x3 meters apart and subjected to the same agriculture practices.

The experimental trees were subjected to the following treatments:

- Control (Suckers removal once a year, at January).
- Suckers removal twice a year, at January and June.
- Naphthalene acetic acid spraying at 5, 000 ppm.
- Naphthalene acetic acid spraying at 10, 000 ppm.
- Naphthalene acetic acid spraying at 20, 000 ppm.
- Trunk covering and soil mulching with black plastic.

In treatment (6), the plastic was a black polyethylene film of 120 cm width and a thickness of 50 microns. The tree was covered after suckers removal with black plastic from the crown area up to trunk for a distance of 50 cm along the trunk tree. For trunk covering and soil mulching with black plastic treatment 6, a circle of 25 cm diameter around the base of tree trunk was created to put the plastic. Treatments (3-6) were trunk applied on 1st February after suckers removal during winter pruning. Eighteen trees were selected, 3 trees per each treatment, in both seasons of the study.

Field observations and laboratory measurements were carried out as follows:

Suckers Characteristics: At the end of the experiment (December), number of suckers more than 30 cm, number of suckers less than 30 cm, total number of suckers per each tested tree were counted. The suckers from each treated tree were removed and sucker length (cm.) and weight (g) were recorded.

Fruit Physical Characteristics: A sample of ten fruits was randomly harvested (October) as a replicate for each treatment to determine the following:

- Average fruit length and diameter (cm)
- Percentage of grain weight (edible part) and peel weight (non-edible part) of total fruit weight.
- Total yield/tree (kg), total number fruits/tree and fruit weight (g).
- Infected fruits (%) = (number of infected fruits /total of fruits number /tree) X 100

Infected number of fruits (infected number of fruits with insects + infected number of fruits with diseases).

Fruit Juice Chemical Composition:

- Total soluble solids percentage (TSS %) was determined using hand refractometer.
- Total acidity percentage was determined by titrating 5 ml juice against 0.1 NaOH using phenolphthalene as an indicator. The values of total acidity were expressed in grams of citric acid per 100 ml juice as described in A.O.A.C. [16], then T.S.S/acid ratio was calculated.

- Total soluble sugars, were determined calorimetrically in a sample of 5 ml juice, according to the method described by Dubois *et al.* [17]. The amount of estimated sugars in each sample was calculated in terms of glucose.
- Vitamin (C) content (mg. Ascorbic acid/ 100 ml juice) was measured according to A.O.A. C., [16].
- Total anthocyanin content (%) in fruit juice as described by Hsia *et al.* [18].

Economic Study: Economical study was calculated according to the economic evaluation at the end of the first season. The economic evaluation was done according to the national market prices of all the production inputs and outputs.

- The cost of workers (L.E) = Number of workers/fed x 100 LE
- Total cost = The sum of all costs
- Total income (LE)/fed = ton/fed x price/ton (LE)

According to the fruit quality fruit (data that presented in the results of this research) prices for both the control and NAA spraying at 5, 000 ppm treatments = 2 (L.E)/kg, while the price of kg fruits for the other treatments = 3 (L.E).

- Net profit (LE) = Total income-total cost

Statistical Analysis: All data were tested for treatments effects on analyzed parameters by the one-way analysis of variance (ANOVA) according to Snedecor and Cochran [19]. Duncan's multiple range test [20] was used for the comparison between means of the treatments.

RESULTS AND DISCUSSION

Suckers Characteristics: In Table (1) and Fig. (1), in both studied seasons maximum average numbers of suckers (more than 30 cm, less than 30 cm and total number)/ tree (11, 12 & 10, 14 and 21, 26) were obtained by control (suckers removal once /year, at January). However, the lowest number of suckers (more than 30 cm, less than 30 cm and total number)/ tree were recorded by pruning suckers twice /year and trunk covering and soil mulching with black plastic treatments compared to the other treatments.

Concerning suckers length and weight in general, all treatments decreased sucker's length (cm) and sucker's weight (g) during the two studied seasons compared to untreated ones (Table 2). In this respect, values of sucker's length decreased from 130 and 125 cm (control) to reach 50, 48 cm and 55, 51 cm (pruning suckers twice /year and covering trunk and soil with black plastic treatments) in both seasons, respectively. While, values of sucker's weight decreased from 80 and 88 g (control) to reach 20, 10 g and 29, 34 g (trunk covering and soil mulching with black plastic and pruning suckers twice a year treatments) in both seasons, respectively.

The reducing in suckers' characteristics as a result of mulching treatments may be due to preventing the light to reach the trees trunk or around the tree. So, the suckers can't grow well on stem or around the tree. Also, the use of NAA treatments with higher concentration (20, 000 ppm) may be inhibiting the new growth of suckers. Also, the pruning (suckering, twice a year) treatment reduced the length of suckers, may be due to the fact that this treatment was repeated twice during the growing seasons.

These results are in agreement with those obtained by Takeda *et al.* [9] and Salama and Elsherbeny [8] reported that, NAA treatments reduced number, length and suckers weight of Manfalouty pomegranate trees. The enhancement effect of NAA on sucker growth may be attributed that higher concentrations of NAA inhibited shoot re-growth on the trunk through the inhibition of cell division and enlargement.

Moreover, Aly *et al.* [14] reported that, NAA treatments gave a reduction in re-growth of sucker number and length of fig and pomegranate trees. The positive effect of NAA due to the control of re-growth suckers are in harmony with the findings of Ahmedullah and Wolfe [3] who illustrated that NAA at 1.0 % treatment gave satisfactory control of sucker growth of grapevines. Moreover, Eynard *et al.* [10] and Reynolds [11] reported that, NAA treatments induced successful inhibition of suckers of grapevines. However, Aly and Shehata [12] mentioned that, trunk applied NAA produced reductive effect of sucker growth of pear and guava trees. In addition, Reynolds *et al.* [13] reported that NAA treatments gave reduction in suckers per vine.

The reduction in total fresh weight of suckers as a result of suckering treatments at one, two, three, four and five months could be attributed to its inhibiting effect on growth. This effect may be due to the protrusion of an increase in number of adventitious buds turn of new suckers that their premature removal allowed enhancing accumulation and transportation of mineral nutrients for other parts of the tree [21].

Table 1: Influence of some suckers' growth control treatments on number of suckers /tree during 2018 & 2019 seasons

	Number of suckers more than 30cm		Number of suckers less than 30cm		Total number of suckers	
Treatments	2018	2019	2018	2019	2018	2019
*Control	11.0a	12.0a	10.0a	14.0a	21.0a	26.0a
**Pruning	3.0c	4.0c	7.0c	6.0c	10.0e	10.0c
NAA spraying at 5, 000 ppm	10.0a	8.0b	9.0b	8.0b	19.0b	16.0b
NAA spraying at 10, 000 ppm	8.0b	4.0c	9.0b	6.0c	17.0c	10.0c
NAA spraying at 20, 000 ppm	4.0c	2.0d	9.0b	4.0d	13.0d	6.0d
Trunk covering and soil mulching with black plastic	2.0c	1.0d	3.0d	1.0e	5.0f	2.0e

*Suckers removal once a year, at January.**Suckers removal twice a year, at January and June

Values have the same letter are not significantly different at 5% level using Duncan's Test.

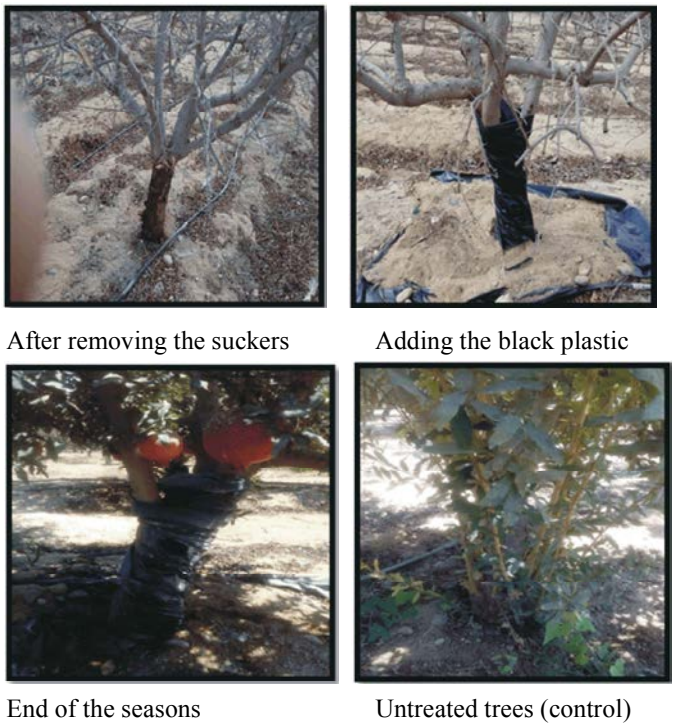

Fig. 1: Trunk covering and soil mulching with black plastic treatment and control

Table 2: Influence of some suckers' growth control treatments on sucker length (cm) and suckers weight (g) during 2018 & 2019 seasons

	Sucker length (cm)		Suckers weight (g)	
Treatments	2018	2019	2018	2019
*Control	130 a	125 a	80 a	88 a
**Pruning	50 d	48 f	29 e	34 c
NAA at 5, 000 ppm	110 b	95 b	70 b	55 b
NAA at 10, 000 ppm	90 c	70 c	58 c	32 c
NAA at 20, 000 ppm	60 d	58 d	40 d	18 d
Trunk covering and soil mulching with black plastic	55 d	51 e	20 f	10 e

*Suckers removal once a year, at January.**Suckers removal twice a year, at January and June

Values have the same letter are not significantly different at 5% level using Duncan's Test.

Fruit Physical Characteristics: In Table (3), the highest significant values of fruit length and diameter (cm) was observed with treatment trunk covering and soil mulching with black plastic during both seasons of the study. On the other hand, the lowest value was obtained with untreated trees (control).

Table 3: Influence of some suckers' growth control treatments on fruit length (cm) and diameter (cm) during 2018 & 2019 seasons

	Fruit length (cm)		Fruit diameter (cm)	
Treatments	2018	2019	2018	2019
*Control	10.75 d	10.40 e	10.00 d	9.80 e
**Pruning	11.50 b	11.00 c	11.00 a	10.30 c
NAA at 5, 000 ppm	11.30 bc	10.80 d	10.50 c	10.00 d
NAA at 10, 000 ppm	11.75 ab	11.30 b	10.75 c	10.20 c
NAA at 20, 000 ppm	11.50 b	11.40 b	11.50 b	10.60 b
Trunk covering and soil mulching with black plastic	12.00 a	11.60 a	11.00 a	10.90 a

*Suckers removal once a year, at January.**Suckers removal twice a year, at January and June

Values have the same letter are not significantly different at 5% level using Duncan's Test.

Table 4: Influence of some suckers' growth control on fruit (edible part) (%) and fruit (non-edible part) (%) during 2018 & 2019 seasons

	Fruit (edible part) (%)		Fruit (non-edible part) (%)	
Treatments	2018	2019	2018	2019
*Control	52.00 a	51.00 a	48.00 a	49.00 a
**Pruning	53.00 a	52.00 a	47.00 a	48.00 a
NAA at 5, 000 ppm	52.00 a	50.00 a	48.00 a	50.00 a
NAA at 10, 000 ppm	52.00 a	52.00 a	48.00 a	48.00 a
NAA at 20, 000 ppm	53.00 a	52.00 a	47.00 a	48.00 a
Trunk covering and soil mulching with black plastic)	53.00 a	52.00 a	47.00 a	48.00 a

*Suckers removal once a year, at January.**Suckers removal twice a year, at January and June

Values have the same letter are not significantly different at 5% level using Duncan's Test.

Table 5: Influence of some suckers' growth control treatments on fruit weight (g) and fruit yield/tree (Kg.) during 2018 & 2019 seasons

	Fruit weight (g)		Fruit yield/tree (Kg)	
Treatments	2018	2019	2018	2019
*Control	409.0 d	417.2 e	24.13 c	26.28 c
**Pruning	435.0 b	445.3 c	26.10 b	29.39 b
NAA at 5, 000 ppm	415.0 c	422.6 d	24.07 c	27.05 d
NAA at 10, 000 ppm	431.7 b	446.2 c	25.90 b	30.34 b
NAA at 20, 000 ppm	465.0 a	473.5 b	28.83 a	32.67 a
Trunk covering and soil mulching with black plastic	462.2 a	482.6 a	29.58 a	33.78 a

*Suckers removal once a year, at January.**Suckers removal twice a year, at January and June

Values have the same letter are not significantly different at 5% level using Duncan's Test.

Table 6: Influence of some suckers' growth control treatments on number of fruits/tree and infected fruits (%) during 2018 & 2019 seasons

	Number of fruits/tree		Infected fruits (%)	
Treatments	2018	2019	2018	2019
*Control	59.0 a	63.0 a	4.00 a	4.50 a
**Pruning	60.0 a	66.0 a	2.00 b	3.50 b
NAA at 5, 000 ppm	58.0 a	64.0 a	4.00 a	4.60 a
NAA at 10, 000 ppm	60.0 a	68.0 a	2.00 b	2.00 c
NAA at 20, 000 ppm	62.0 a	69.0 a	1.00 c	1.50 c
Trunk covering and soil mulching with black plastic	64.0 a	70.0 a	1.00 c	0.50 d

*Suckers removal once a year, at January.**Suckers removal twice a year, at January and June

Values have the same letter are not significantly different at 5% level using Duncan's Test

Results of the present study (Table, 4) showed that similar trend was found between all treatments. Also, no significant difference between the treatments compared to untreated trees. This was clear in both studied seasons.

As shown in Table (5), generally all treatments significantly increased fruit weight (g) compared to the untreated trees (suckers removal once a year, at January) during both seasons of the study. In this respect, both

covering the tree trunk and soil mulching with black plastic and spraying NAA at higher concentration (20, 000 ppm) treatments surpassed other treatments in increasing fruit weight in the two seasons. Moreover, the aforementioned treatments increased the fruit yield (Kg.) compared to other treatments. Contrarily, the untreated trees and spraying with NAA at lower concentration (5, 000 ppm) treatment expressed the lowest records of fruit weight and yield.

In both seasons of the study, Table (6) reveals insignificant differences among the studied treatments and the control on number of fruits/tree. With regard to the infected fruits (%) as affected by treatments under study, it was noticed that, values ranged from 1.00, 0.50 % (covering the tree trunk and soil mulching with black plastic) and 1.00, 1.50 % (spraying NAA at higher concentration (20, 000 ppm) treatments, respectively in both seasons to reach 4.00, 4.50 % (control) and 4.00, 4.60 % (NAA spraying at 5, 000 ppm) respectively in both seasons.

These results (Tables 5 & 6) could be due to the influence of tested treatments to eliminate or reduce suckers' growth which in turn leads to increase accumulation and transportation of water and elements causing improve fruit growth and yield.

The enhancement in fruit yield parameters (weight and yield) as a result of soil mulching with black plastic treatments may be due to reduces the number of suckers and infected fruits as well as eliminating weeds allows pomegranate tree to receive all the nutrients with no competition.

These results are confirmed by those were obtained by Aly *et al.* [14] and Ahmedullah and Wolfe [3], who reported that 20000 ppm NAA treatment increased the number of fruits as well as yield per tree in fig and pomegranate. Direct or indirect influence of NAA on yield was found by Nauer and Boswell [22] on citrus and fig.

They concluded that the translocation of NAA from cut surface into the rachis of the fruits resulted increasing in fruit set and weight. Also, Stinchcombe and Stott [2] stated that the tendency of olive yield increased as the number and dry weight of suckers decreased probably as a result of the competition between suckers and other growing organs of the trees, particularly the fruits which are important photosynthetic sinks.

NAA treatments gave a high positive effect on yield and fruit quality as compared with hand removal treatment (control) [8]. In addition, Reynolds *et al.* [13], confirmed that NAA treatments increased berry weight.

The enhancement effect of NAA on yield and fruit quality may be attributed to increasing fruit set and or reducing fruit drop as well as increasing weight of the fruit through encouraging cell enlargement during fruit stages [11]. It is necessary to apply removal of suckers to increase fruit yield of pomegranates [23].

Fruit Juice Chemical Composition: As a general trend, all treatments slightly significantly increased total soluble solids (%) compared to untreated trees and trunk sprayed with NAA at 5.000 ppm during the two seasons of the study (Table 7). On the other hand, substantial significantly differences were not observed between tested treatments and untreated trees in acidity percentage in both seasons under investigation.

Compositional analyses in Table (8) reveal that, fruit juice vitamin (C) and total juice anthocyanin (%) didn't reach level of significance (both seasons) between all tested treatments compared to the untreated trees.

Table (9) shows noticeable variations between suckers' growth control treatments and the untreated trees (suckers removal once a year), the highest values of total soluble solids/acid ratio were obtained in treated subjected trees to covering the trunk and mulching soil with black plastic as it recoded (29.06 and 24.25). Reversely, the untreated trees and that were sprayed with NAA at the lower level (5000 ppm) recorded the lowest values (25.37 and 21.15) and (25.44 and 20.25) respectively, during both seasons of the study. Whereas, covering the trunk and mulching soil with black plastic treatment and spraying the trunk with NAA at both concentrations (15.000 and 20000 ppm) increased significantly total sugars (%) of the fruit juice.

Regarding total soluble solids, these results are in agreement with those were obtained by Aly, *et al.* [14] who proved that, NAA increased total sugars % in fig fruits and reduced TSS % slightly in pomegranate. In addition, in pomegranate NAA treatment induced high positive effect on fruit total sugars, total soluble solids and ascorbic acid content [8]. However, Ahmedullah and Wolfe [3] confirmed that NAA lead to reduce acidity and brix in grapevine.

Economic Study: In Table (10), economical comparative study between different treatments clearly proved that, total cost/fed. ranged between (1000 L.E.) in control to reach (6900 L.E.) by treatment NAA spraying at 20, 000 ppm. However, the maximum yield (ton/fed.) and total income /fed were recorded by trunk covering and soil mulching with black plastic. When trunk covering and soil mulching with black plastic were used, which in turn increased the net profit/fed as they recorded (8.28 ton/fed and with a value of 22147.2 L.E).

Table 7: Influence of some suckers' growth control treatments on total soluble solids and acidity (%) during 2018 & 2019 seasons

	Total soluble solids (%)		Acidity (%)	
	2018	2019	2018	2019
*Control	17.00 b	16.50 b	0.67 a	0.78 a
**Pruning	18.50 a	17.30 a	0.67 a	0.75 a
NAA at 5, 000 ppm	17.30 b	16.20 b	0.68 a	0.80 a
NAA at 10, 000 ppm	18.40 a	17.40 a	0.69 a	0.80 a
NAA at 20, 000 ppm	18.30 a	17.60 a	0.66 a	0.79 a
Trunk covering and soil mulching with black plastic	18.60 a	17.70 a	0.64 a	0.73 a

*Suckers removal once a year, at January.**Suckers removal twice a year, at January and June

Values have the same letter are not significantly different at 5% level using Duncan's Test.

Table 8: Influence of some suckers' growth control treatments on fruit juice vitamin (C) as mg ascorbic and total juice anthocyanin (%) during 2018 & 2019 seasons

	Vitamin (C) mg ascorbic acid/100 ml juice		Total juice anthocyanin (%)	
Treatments	2018	2019	2018	2019
*Control	13.46 a	14.20 a	0.28 a	0.32 a
**Pruning	13.35 a	14.15 a	0.23 a	0.26 a
NAA at 5, 000 ppm	12.20 a	14.00 a	0.27 a	0.29 a
NAA at 10, 000 ppm	12.47 a	14.22 a	0.22 a	0.25 a
NAA at 20, 000 ppm	13.81 a	14.25 a	0.24 a	0.27 a
Trunk covering and soil mulching with black plastic	13.49 a	14.27 a	0.29 a	0.31 a

*Suckers removal once a year, at January.**Suckers removal twice a year, at January and June

Values have the same letter are not significantly different at 5% level using Duncan's Test.

Table 9: Influence of some suckers' growth control treatments on fruit juice total soluble solids /acid ratio and total sugars (%) during 2018 & 2019 seasons

	TSS/acid ratio		Total sugars (%)	
Treatments	2018	2019	2018	2019
*Control	25.37 c	21.15 d	14.13 b	13.66 b
**Pruning	27.61 b	23.07 b	14.25 b	13.72 b
NAA at 5, 000 ppm	25.44 c	20.25 e	14.22 b	13.79 b
NAA at 10, 000 ppm	26.67 b	21.75 d	15.58 a	14.80 a
NAA at 20, 000 ppm	27.73 b	22.28 c	15.60 a	14.86 a
Trunk covering and soil mulching with black plastic	29.06 a	24.25 a	15.67 a	15.00 a

*Suckers removal once a year, at January.**Suckers removal twice a year, at January and June

Values have the same letter are not significantly different at 5% level using Duncan's Test.

Table 10: Economical comparative study for some treatments on suckers' growth control per fed. of pomegranate during 2018 season

Treatments	Number of workers	Cost of workers (L.E)	Cost of chemical (L.E)	Total Cost (L.E)	Yield/fed (Ton)	Total income (L.E)	Net profit (LE)
*Control	10	1000	-	1000	6.76	13512.80	12512.8
**Pruning	20	2000	-	2000	7.31	21924.00	19924.0
NAA spraying at 5, 000 ppm	13	1300	1400	2700	6.74	13479.20	10779.2
NAA spraying at 10, 000 ppm	13	1300	2800	4100	7.25	21756.00	17656.0
NAA spraying at 20, 000 ppm	13	1300	5600	6900	8.07	24217.20	17317.2
Trunk covering and soil mulching with black plastic	13	1300	1400	2700	8.28	24847.20	22147.2

*Suckers removal once a year, at January. **Suckers removal twice a year, at January and June.

Values have the same letter are not significantly different at 5% level using Duncan's Test.

CONCLUSION

Generally, the best results of this study with regard to the control suckers growth of Wonderful pomegranate were obtained by pruning suckers twice /year and covering trunk and soil with black plastic treatments. In this respect, sucker's characteristics (total number/tree, length and weight) were reduced. Accordingly the fruit physical, chemical characteristics and yield of pomegranate increased significantly.

According to the obtained results we can recommend to According to the obtained results we can recommend to apply trunk covering and soil mulching with black plastic in January after removing the suckers at a distance

of 50 cm from the crown area to the control suckers of Wonderful pomegranate especially on large farms, with improving fruit quality and yield as well as increasing the net profit for farmer.

REFERENCES

1. Levin, G.M., 2006. Pomegranate Roads: a Soviet Botanist's Exile from Eden (1st Edn), Floreant Press, Forestville, California, pp: 15-183.
2. Stinchcombe, G.R. and K.J. Stott, 1980. "The Effect of Autome Applications of Glyphosate on Fruit, Trees Sucker Control and on Parent Trees Damage". Proceedings British Crop Prolectill Conference, Weeds, pp: 303-310.
3. Ahmedullah, M. and W.H. Wolfe, 1982. Control of sucker growth on *Vitis vinifera* L. cultivar Sauvignon blank with naphthalene acetic acid. Amer. J. Enol. Viticult., 33: 198-200.
4. Byrne, M.E. and G.S. Howell, 1978. Initial response of Baco noir grapevines to pruning severity, sucker removal and weed control. Am. J. Enol. Vitis., 29: 192-198.
5. Fregoni, M. and X. Chapter, 1999. La potaturadellavite. In Viticoltura di Qualità; Edizionil 'Informatore Agrario: Verona, Italy, pp: 377-492.
6. Kang, F., H. Wang, F.J. Pierce, Q. Zhang and S. Wang, 2012. Sucker detection of grapevines for targeted spray using optical Sensors. Trans. ASABE 55: 2007-2014.
7. Dolci, M., F. Galeotti, P. Curir, L. Schellino and G. Gay, 2004. New 2-naphthyloxyacetates for trunk sucker growth control on grapevine (*Vitis vinifera* L.). Plant Growth Regul., 44: 47-52.
8. Salama, A. and R.A. Elsherbeny, 2016. Influence of growth regulators treatments on suckers growth control, yield and fruit quality of pomegranate trees cv. Manfalouty and their economics effect. IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS). 9(1) Ver. I (Jan. 2016): 73-82.
9. Takeda, F., V. Drane and S.S. Mary, 1982. Inhibiting sprouting in muscadine grapes. Proc. Fla. State Hort. Soc., 95: 127-128.
10. Eynard, I., G. Gay, R. VaIlania, P. Occelli, R. Botta, M. Dolci and A. Martini, 1986. "Control of Sucker Growth on *Vitis vinifera* cv. Merlot with NAA Derivatives". Vitis, 25: 169-177.
11. Reynolds, A.G., 1988. "Effectiveness of NAA and Paclobutrazol for Control of Re-growth of Trunk Suckers on 'Okanagan Riesling;' Grapevines. " 1. Amer. Soc. Hort. Sci., 113: 484-488.
12. Aly, M.A. and M.M. Shehata, 1990. Chemical control of sucker on Top worked Le Cont pear and guava Stump with naphthalene acetic acid. Fayoum J. Agri. Res. & Dev., 4(1): 118-124.
13. Reynolds, A.G., A.C. Cottrell, D.A. Wardle and A.P. Gaune, 1991. NAA and paclobutrazol control grapevine suckers: Vine performance and fruit tissue residues. Hort., Science, 26(10): 1286-1287.
14. Aly, M.A., M.A. Bacha and F.E. Farahat, 1999. Effect of some growth bioregulators on controlling of suckers, fruit characteristics and yield of Fig and Pomegranate trees J. King Saud Univ., Vol. II, Agric. Sci., 2: 157-169.
15. Mal, B., B.C. Banik, S.N. Ghosh and P.K. Maity, 2006. Studies on the effect of mulching in pomegranate cv. Ganesh. Proceedings of the national symposium on production, utilization and export of underutilized fruits with commercial potentialities, Kalyani, Nadia, West Bengal, India, 22-24 November, pp: 162-167.
16. Association of Official Agricultural Chemists (A.O.A.C.), 1985. "Official Methods of Analysis", 15th ed. Published by A.O.A.C. Washington, D.C., USA.
17. Dubois, M., K.A. Gilles, J.K. Hamilton, P.A. Rebers and F. Smith, 1956. Colorimetric method for determination of sugars and related substances. Anual. Chem., 28: 350-356.
18. Hsia, C.L., B.S. Luh and C.O. Chichester, 1965. Anthocyanin in freestone peaches. J. Food Sci., 30: 5-12.
19. Snedecor, G.W. and W.G. Cochran, 1980. "Statistical Methods", 7th ed. Iowa State Univ. U.S.A., pp: 593.
20. Duncan, D.B., 1955. Multiple range and multiple F. Tests Biometrics, 11: 1-24.
21. Abdel-Galil, H.A., 2008. Effects of suckering on vegetative growth, yield and fruits quality of Manfalouty pomegranate under Assiut environments. Assiut J. Agric. Sci., 39(3).
22. Nauer, E.M. and S.B. Boswell, 1977. Effect of NAA on Shoot Growth Of Top worked Fig Trees. Hort., Sci., 12: 250-251.
23. Sekhi, Y.S., 2017. Effect of Decapitation and Suckers Removal on Growth and Yield Traits of Pomegranate *Punica granatum* L. Cv. Salimi. J. Plant Production, Mansoura Univ., 8(10): 979-981.