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Effect of Some Organic Compounds and Cluster Thinning on Quality Characteristics and Powdery Mildew of Flame Seedless

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THE APPLICATION of some organic materials, Jojoba oil, Neem oil and micronized sulfur, sprayed alone or accompanied with cluster thinning was studied on Flame Seedless grapevine. The experiment was conducted in the 2013 season and extended for two successive seasons. It comprised eight treatments to improve berry quality and limiting the powdery mildew progression. Results indicated that spaying with Jojoba oil, Neem oil had a negative effect on the propagation of Powdery Mildew '*Uncinulla necator'*similar to micronized sulfur and they could be a valid alternative control. Jojoba oil plus cluster thinning treatment was the most effective in stimulating all growth characters and increasing significantly the TSS% and anthocyanin but it lowered the yield than the Jojoba oil treatment. Yield compensation was achieved by an increase in cluster weight of about 53%, in response to a reduction of 33%, in cluster numbers. Neem oil had no significant effect on chemical composition but significantly increased yield by 43% by lowering the number of infected berries per cluster.

Keywords: Cluster thinning grapevine, Jojoba oil, Micronized sulfur, Neem oil, Powdery mildew.

The field of the organic production is governed by the relevant law and the implementing provisions such as a production based on natural processes and use of organic and natural materials. Plant management also determines the spatial arrangement of foliage and clusters modifies the microclimate and has a fundamental impact on the regulation of photosynthetic potential, yield and grape composition (Katerji *et al.*, 1994). It was mentioned by Muñoz *et al.* (2002) that high yields reduce the quality of grapes. This is due in part to the fact that excess fruits retard sugar accumulation, as compared with plants with a lower fruit load. However, Freeman and Kliewer (1983) claimed that this condition does not affect the quality of fruits and Bravdo *et al.*, (1985) stated that there was an optimal amount of fruit that a plant can develop without compromising quality.

Thus, applying some processes like cluster thinning will be effective in increasing the TSS accumulation in berries as reported by (Bravdo *et al.*, 1984, Miller *et al.,* 1993 and Naor *et al.,* 2002) but it has a negative effect on the yield. Therefore, there is a need to investigate the use of some organic materials to increase the berry size in red and black grapes. Jojoba oil, Neem oil and sulfur are used to compensate the loss resulting from applying cluster thinning, moreover they showed a great effect on powdery mildew propagation which in turn lowers the amount of yield.

Used materials and their action in the grapevine tissues

Jojoba

Jojoba oil is obtained from jojoba plant '*Simmondsia chinensis Schneid'*, which is a perennial shrub that grows in north western Mexico and parts of California and Arizona. Actually, the oil is a liquefied form of vegetable wax and is found in the seeds of the jojoba plant. This oil contains about 14% toxic saturated erucic acid. It is used in the protection of a great number of plants, practically without limitation. It acts as a fungicide and insecticide. Commercial products contain 97.5% of jojoba oil and have the approval for application in mixtures containing less than 1% of jojoba oil. Thus, the applied product contains around 1% of jojoba oil, and/or 0.14% of unwanted saturated erucic acid which is 10 times less than the allowed percentage (EPA, 2009).

Neem oil

It is the extract obtained from the seeds of tropical tree *Azadirachtaindica A.*jus originating in India. Neem has fungicidae, insect cidae, nematocidal and bactericidal effects (EPA, 2009). Products based on oil fraction of neem are registered for suppressing downy mildew, and it also acts as fungicide for powdery mildew and rusts. Instead of using copper, sulphur, or even systemic treatments, biological neem oil is specially indicated on vineyards against mildew, which attacks grapes plants, not only as a prevention, but also as an effective curative treatment. One of the most important advantages of neem-based pesticides and Neem insecticides is that they do not leave any residue on the plants (Subbalakshmi, *et al.,* 2012).

Micronized sulfur

Sulfur products have been used to manage powdery mildew for centuries but are only effective when applied before disease symptoms appear. Moreover, sulfur is fungicidal over a narrow temperature range and can damage vines if applied at temperatures > 32°C and excessive sulfur usage can have detrimental effects on beneficial arthropod populations (James, *et al*., 2002). Jojoba and Neem oil extracts have effects similar to those of sulfur and, they are reasonably effective as a replacement for sulfur in limiting *Uncinulla necator* propagation. Specifically, sulfur has been linked to respiratory illness (McGourty, 2008)

The goal of this study was to identify optimal combinations of organic compounds and cluster thinning without adversely affecting yield components and fruit composition of 'Flame Seedless' for sustainable grape production. The specific objectives were to determine the effect of cluster thinning and some organic compound on vegetative growth, yield components, fruit composition and powdery mildew propagation.

Materials and Methods

The present work was conducted during two successive seasons 2013 and 2014 in a vineyard located at Cairo-Alexandria Desert Road. Eight years-old Flame Seedless grapevines grown in a sandy soil and trellised by Y- shape system, with line spacing1.75 x 2.75 m were used in this investigation. The vines were pruned during the first week of January leaving 20 fruiting spurs x 3 buds each with a total vine load of 60 buds. Vines were irrigated through drip irrigation system. Seventy two uniform vines were chosen for this study (8treatments x 3 replicates x 3 vines /replicate). The vines were uniform in vigor and received common horticultural practices.

All treatments were applied as a foliar application six times and sprayed at 15 days intervals at different phonological stages of grapevine, starting from shoots having 15-20 cm length, till harvest) cluster thinning treatments were performed after berry set by removing every distal cluster, keeping just one cluster on each shoot as follow:

- Control (C). (Vines were adjusted to 30 clusters per plant after fruit set). **(T1)**
- Micronized Sulfur 250mg/100L.**(T2)**
- Jojoba oil 1.5%.**(T3)**
- Neem oil 1%.**(T4)**
- Cluster thinning (vines were adjusted to 20 clusters per plant after fruit set) **(T5)**.
- Sulfur + cluster thinning.**(T6)**
- Jojoba oil + cluster thinning. **(T7)**
- Neem oil + cluster thinning. **(T8)**

A randomized complete block design was used in this experiment.

Chemical characteristics

Representative random samples of 15 clusters /treatment (5 cluster from each replicate) were collected when clusters reached their full color and total soluble solids reached about 18 – 20, according to Badr and Ramming (1994).

The following determinations were carried out:

- Refractometric total soluble solids (TSS %) and titratable acidity as gram of tartaric acid per 100 ml of juice (A.O.A.C., 1985) and TSS / acid ratio.
- Total anthocyanin in berry skin using spectrocolourimeter at 250 µm according to Yilidz and Dikmen (1990).
- Leaf pigments content (chlorophyll) were measured in the mature leaves of the sixth and seventh positions from the apex by using the

nondestructive Minolta chlorophyll meter model SPAD 502 (SPAD is an acronym for soil plant analysis development (Wood *et al*., 1992).

Morphological measurements

- Leaf area: Samples of leaves were randomly collected from each treatment for leaf area determination at harvest (using leaf area meter, Model CI 203, U.S.A.).
- Shoot length (cm): it was determined by measuring the fruiting shoots.
- Average berry size (cm^3).
- Average berry weight (g).
- Number of berries per cluster.

Yield

- Average cluster weight (kg).
- Number of infected berries.
- Yield per vine (kg).

Data of Powdery mildew

Infection per cluster %

At harvest clusters were collected and the number of infected berries in each cluster were counted and divided by the total number of berries in each treatment to calculate the percentage of infection by the following equation :

$$\text{Infection per cluster\%} = \frac{\textbf{Number of infected berries}}{\textbf{Total no.of berries/cluster}} \times 100$$

Yield after loss (Kg)

It was the actual amount of yield that remained after subtracting the Severity of infection % from the yield per vine.

Yield after loss (Kg)= yield – (yield x Infection per clusters %)

Statistical analysis

Means representing the effect of the tested treatments were compared by the New L.S.D. method at 0.05 according to Snedecor and Cochran (1980).

Results and Discussion

Chemical characteristics

The following determinations were carried out:

Total soluble solids (TSS %), Titratable acidity % and TSS / acid ratio

There are significant differences among treatments in TSS %, titratable acidity and TSS /acid ratio as shown in Table 1. Spraying with Jojoba oil plus thinning significantly was accompanied with improving quality of the berries in terms of increasing TSS %, and total sugars and reducing total acidity % in relative to the other treatments and the control in both seasons with no significant results between the thinning treatments (T5, T7, T8).Similar results were obtained by Kurtural *et al.* (2006) who found that as the severity of cluster thinning increased, TSS and pH increased linearly. Moreover, Mervat *et al.* (2012) found that jojoba oil was an effective treatment in enhancing the TSS % and TSS/acidity ratio whereas, acidity was decreased in berry juice. These results are in conformity with those obtained by Reynolds *et al.* (2007) who stated that supplementary foliar sprays with Jojoba and canola oils reduced berry and must titratable acidity and increased berry, must and wine pH.

Total anthocyanin in berry skin

It is clear from the obtained data in Table 1 that anthocyanin concentration increased in thinned vines compared with control. The maximum anthocyanin content was gained by Jojoba + thinning treatment, which significantly affected the accumulation of anthocyanin in Flame Seedless berry skin in both seasons, with no significant effect from Neem or sulfur treatments. Increases in anthocyanin content of berries following cluster removal were also reported by Reynolds *et al.,* (1995) in Pinot noir and by Mazza *et al.* (1999) in Cabernet Franc, Merlot, and Pinot noir. Jojoba oil also increased the anthocyanin as it is a phenolic compound rich in phenolics (Zheng and Wang, 2001).

Leaf pigments content (chlorophyll)

It is clear from the data in Table 1 that total chlorophyll content in the leaves was positively affected by the application of jojoba oil extract, micronized sulfur and cluster thinning respectively compared to the Neem oil treatment and the control which showed no significant effect on the chlorophyll content for leaves. The Jojoba oil treatments alone (Mervat *et al.,* 2012) or accompanied by cluster thinning were significantly superior to that of the control in this concern, the maximum values of total chlorophyll were obtained in vines received jojoba oil plus cluster thinning treatment. Jojoba oil is composed almost entirely (~97%) of mono-esters of long-chain fatty acids and alcohols, these fatty acids enter in the composition of thylakoids which are membrane-bound compartments inside of the chloroplasts. Thylakoids are the epicenter for photosynthetic light-reactions and contain the chlorophyll of plants, which is the light-collecting pigment.

The beneficial effect of thinning in increasing total chlorophyll may be due to the increment of nutrients uptake such as nitrogen, magnesium and iron which are involved in chlorophyll formation as mentioned by Harhash and Abd El-Nasser (2000).Followed by the jojoba oil treatments, was micronized sulfur treatments as its deficiency reduced photosynthesis through an effect on chlorophyll content, which decreased linearly with leaf sulfur, and by decreasing the rate of photosynthesis per unit chlorophyll (Terry, 1979).

TABLE 1. Effect of some organic compounds and cluster thinning on the chemical characteristics of Flame Seedless grapevine during the two successive seasons 2013 and 2014.

Treatments	T.S.S %		Acidity %		T.S.S/ acid ratio		Anthocyanin (mg/100g fw)		Total chlorophyll	
	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season
Control (C)	14.0	15.1	0.92	0.89	14.0	15.1	0.92	0.89	37.9	38.4
Micro. sulfur 250mg/100L	15.0	14.9	0.85	0.93	15.0	14.9	0.85	0.93	43.8	43.2
Jojoba oil 1.5%	18.5	18.6	0.64	0.60	18.5	18.6	0.64	0.60	45.8	45.7
Neem oil 1%	14.3	14.7	0.90	0.91	14.3	14.7	0.90	0.91	38.2	38.9
Cluster thinning	17.5	17.8	0.77	0.74	17.5	17.8	0.77	0.74	40.0	41.1
Micro.sulfur+cluster thinning	18.1	18.4	0.71	0.69	18.1	18.4	0.71	0.69	45.1	44.5
Jojoba oil + cluster thinning	19.5	19.8	0.60	0.56	19.5	19.8	0.60	0.56	46.4	46.6
Neem oil + cluster thinning	17.0	17.5	0.78	0.70	17.0	17.5	0.78	0.70	39.7	40.7
New L.S.D at 5%	**0.7**	**0.6**	**0.03**	**0.04**	**0.7**	**0.6**	**0.8**	**0.7**	**0.4**	**0.6**

Morphological measurements

Leaf area (cm²)

Leaf area development is an important characteristic affecting yield and fruit quality of grapevines. Table 2 shows the effect of different treatments on the average leaf area of Flame Seedless. It is obvious from the recorded data that there are significant differences among treatments. The highest values were obtained from the treatment of Jojoba oil + cluster thinning, followed by Jojoba oil alone then the other thinned treatments with no significant difference between the Neem treatment and the control. These results are in harmony with those of Filippetti *et al.* (2007) who found that the ratio between total leaf area and production 1.7 and 2.3 for the control and the thinned cluster respectively. Mervat *et al.* (2012) found that jojoba oil was an effective treatment in improving the vegetative growth parameters and increased the total surface area/vine.

Shoot length (cm)

It is evident from the obtained data in Table 2 that there is a significant stimulation on shoot length with using Jojoba plus thinning and all the other results are linear to those obtained for the leaf area. In an agreement with the present results were those mentioned by El-Saedy *et al.* (2015) who found that the treatment of jojoba oil increased grapevine shoot length in both seasons with 28.5-84.7% compared with the check treatment. Besides, the cluster thinning which also had a positive effect on the shoot length. Sulfur and Neem treatments had no significant effects.

TABLE 2. Effect of some organic compounds and cluster thinning on some traits and berries of Flame Seedless grapevine during the two successive seasons 2013 and 2014.

Treatments	Leaf area (cm^2)		Shoot length (cm)		Average berry weight (g)		Average berry size (cm^3)		Number of berries/cluster	
	1 st Season	2 nd Season	1 st Season	2 nd Season	1 st Season	2 nd Season	1 st Season	2 nd Season	1 st Season	2 nd Season
Control (C).	130.6	129.5	130.6	129.5	2.3	2.4	2.2	2.3	188.6	189.3
Micro. sulfur 250mg/100L	145.3	150.2	145.3	150.2	2.2	2.3	2.0	2.2	198.0	196.4
Jojoba oil 1.5%	181.7	187.8	181.7	187.8	4.6	4.5	4.4	4.2	194.1	195.6
Neem oil 1%	131.9	135.7	131.9	135.7	2.4	2.3	2.2	2.0	186.2	185.4
Cluster thinning	160.4	159.2	160.4	159.2	4.2	4.0	4.0	3.9	186.3	187.4
Micro. sulfur + cluster thinning	166.2	166.0	166.2	166.0	3.7	3.9	3.5	3.6	193.7	189.5
Jojoba oil + cluster thinning	190.3	194.3	190.3	194.3	5.2	4.9	4.9	4.7	189.4	191.7
Neem oil + cluster thinning	158.6	160.5	158.6	160.5	3.9	3.8	3.7	3.5	192.5	189.6
New L.S.D at 5%	**4.3**	**3.2**	**5.5**	**5.0**	**0.1**	**0.1**	**0.2**	**0.1**	**N.S**	**N.S**

Average berries size (cm^3)

Data in Table 2 ensures that jojoba plus thinning, was better than the jojoba or thinning treatments alone. These results are in line with those obtained by Reynolds *et al.* (2007) who stated that supplementary foliar sprays with Jojoba oil increased the berry size. Besides the cluster thinning has been shown to increase berry size as more energy is focused into cell division for fewer berries (Keller, 2010 and Smart & Robinson, 1991). Also El-Saedy *et al.* (2015) mentioned that the size of 100 grape berries was significantly increased with jojoba oil.

Average berry weight (g)

Berry weight is an important quality parameter for table grapes and affects yield. The mean values of berry weight of Jojoba oil, Neem oil and sulfur, alone or accompanied with cluster thinning treated grapevines displayed in Table 2. From the results of statistical analysis, there were significant differences in berry weights for jojoba treatments, thinning treatments and the other treatments and the control, with a superior effect attributed to using jojoba plus thinning, rather than the other thinning treatments which also increased the berry weight, but with no significant differences between them. Sulfur and Neem treatments alone have no significant effect on the berry weight. These results were similar to those obtained by Weaver and Pool (1973) who stated that cluster thinning has been shown to increase berry weight also Jojoba treatments increased the weight of 100 berries compared with the check treatment and the combination between them resulted in heavier berries than each treatment alone (El-Saedy *et al.*, 2015).

Number of berries per cluster

Numbers of berries per cluster was counted at harvest and results shown in Table 2 indicated that there are no significant differences between treatments in both seasons.

Yield

Cluster weight (Kg)

In the 1st season, data of grapevine clusters (Table, 3) showed that cluster weight was increased by (53%) with jojoba plus thinning, while the increment was only (52.5 %) in the jojoba treatment followed by the thinning treatment (41%) compared to the control and an increase of (52.5%), (50.2%) and (44.1%) in the 2nd season respectively, with no significant differences between the two other thinning treatments nor between the Neem and sulfur treatments in both seasons. Similarly, El-Saedy *et al.* (2015) stated that the highest increase in cluster weight was achieved by jojoba treatment. It was also reported by Bubola *et al.* (2011) that a smaller number of clusters left on the vine resulted in 18-57% greater cluster weight of the remaining grapes of the 'Merlot' variety.

Number of infected berries

Data in Table 3 showed that the number of infected berries per cluster was the least in the Jojoba plus thinning treatment followed by Neem plus thinning which is attributed to modifying the canopy temperatures high temperatures that do not harm the plant can harm the fungus and it is destroyed completely when air temperatures rise above 35°C for 12 hours or more if colonies are directly exposed to UV light (Gubler *et al.* 1999) these conditions are provided by cluster thinning. However, the ability of jojoba oil to remain stable even at high temperatures makes it a widely usable fungicide in nearly all climatic conditions. One of its mechanisms of action is to form a physical barrier between an insect pest and the leaf surface (Copping, 2004). The inhibitory effect of Neem and jojoba oils has been reported earlier by Singh (2008) which are in agreement with the present findings.

Yield per vine (kg)

At harvest time, all clusters on the vines in each treatment were counted and the total cluster fresh weight per vine was recorded. It is evident from the data in Table 3 that foliar application of Jojoba oil was found to be significantly effective in increasing grapevine yield comparing with the Jojoba oil plus thinning treatment. These results agree with Dokoozlian and Hirschfelt, (1995) who found that Cluster thinning generally involves a considerable reduction in yield which potentially improves grape and wine quality and composition. Yield compensation was achieved by an increase in cluster weight of 41%, in response to a reduction of 33%, in cluster numbers, which translated into a yield increase of 12.5 %. In addition, Mervat *et al.* (2012) found that jojoba oil significantly improved yield in both seasons compared with the control. From the above mentioned results, it can be concluded that jojoba oil an important source of nutrients can improve the absorption of water and elements from soil and this is reflected on yield, cluster quality. These results agree with those obtained by Diedhiou *et al.* (2003).The big advantage of using Neem oil is it does not have any side effects over plants. It can cure and improve the immunity of plant's growth and stopping the loss of Nutritional efficiency that can happen to the plant because of Powdery Mildew (Cromwell, 2009).

Powdery mildew

Infection per cluster %

Data in Table 3 and Fig. 1 indicates that the infection per cluster% was the highest in the untreated vines whereas the least was recorded by the seventh treatment (jojoba plus thinning). Jojoba has a lipid composition similar to the epicuticle of plants, the majority (90%) of the waxes are between 38 and 44 carbons long (Johnson and Hinman, 1980), and are thus similar to the esters in plant epicuticles, thus it has been hypothesized that this product might provide control of powdery mildew diseases and consequently interfere with fungal infection. This control appeared to be a prophylactic and/or pre-lesion curative, since only vines continuously covered with the oils remained free from disease (Reynolds, 2005). Similar findings where obtained by Andrew (2005) who found that Jojoba-sprayed (1.0%) displayed 75-100% reductions in powdery mildew disease severity compared to water-sprayed controls.

However, Jojoba oil provided protection against powdery mildew, protecting the grapevines 60% to 100% compared to water control-treated vines. The ability of jojoba oil to remain stable even at high temperatures makes it a widely usable fungicide in nearly all climatic conditions. One of its mechanisms of action is to form a physical barrier between an insect pest and the leaf surface (Copping, 2004).

Powdery mildew growth and also experience reduced coverage of fruiting zone fungicide spray materials, and disease severity has been shown to be inversely proportional (and strongly linear) to the degree of sunlight exposure as defined by CEFA (Austin *et al.,* 2011).

The important role played by the epicuticular wax layer of jojoba in the resistance against fungi is based on the hydrophobic nature of the wax layer (Tewari and Skoropad, 1976), the lipid composition (Marois *et al.,* 1985) as a chemical barrier, and the wax content per unit surface (Rosenquist and Morrison, 1989).

Yield after loss (Kg)

The actual amount of yield remained after discounting the infection per cluster % from the initial yield per vine. Table 3 indicates that the percentage of infection has a great effect on the final amount of yield. It obvious that all treatments decreased the severity of infection except for the control and the Jojoba oil treatment was the most effective in controlling the powdery Mildew.

TABLE 3. Effect of some organic compounds and cluster thinning on yield and Powdery mildew progression in Flame Seedless grapevine during the two successive seasons 2013 and 2014.

Treatments	Cluster weight (g)		No. of infected berries/cluster		Infection/ cluster %		Initial yield/ vine (Kg)		Yield after loss (Kg)	
	1 st Season	2 nd Season	1 st Season	2 nd Season	1 st Season	2 nd Season	1 st Season	2 nd Season	1 st Season	2 nd Season
Control (C).	433.7	442.3	63.1	65.0	33.4	32.5	13.0	13.2	8.6	8.9
Micro. sulfur 250mg/100L	417.1	439.7	19.3	17.6	9.8	9.6	12.5	13.1	11.2	11.8
Jojoba oil 1.5%	893.8	889.0	15.0	15.9	7.7	7.5	26.8	26.6	24.7	24.6
Neem oil 1%	454.0	436.4	17.2	17.8	9.2	9.4	13.6	13.0	12.3	11.7
Cluster thinning	805.3	791.6	22.7	23.4	13.1	13.3	16.1	15.8	13.9	13.6
Sulfur + cluster thinning	796.6	789.0	13.7	14.0	7.0	6.8	15.9	15.7	14.7	14.6
Jojoba oil + cluster thinning	928.6	931.3	8.8	8.9	4.6	4.3	18.5	18.6	17.7	17.8
Neem oil + cluster thinning	799.1	787.4	11.8	11.1	6.1	6.1	15.9	15.7	14.8	14.7
New L.S.D at 5%	**11.6**	**12.3**	**1.2**	**1.1**	**1.0**	**1.3**	**1.2**	**1.2**	**0.1**	**0.2**

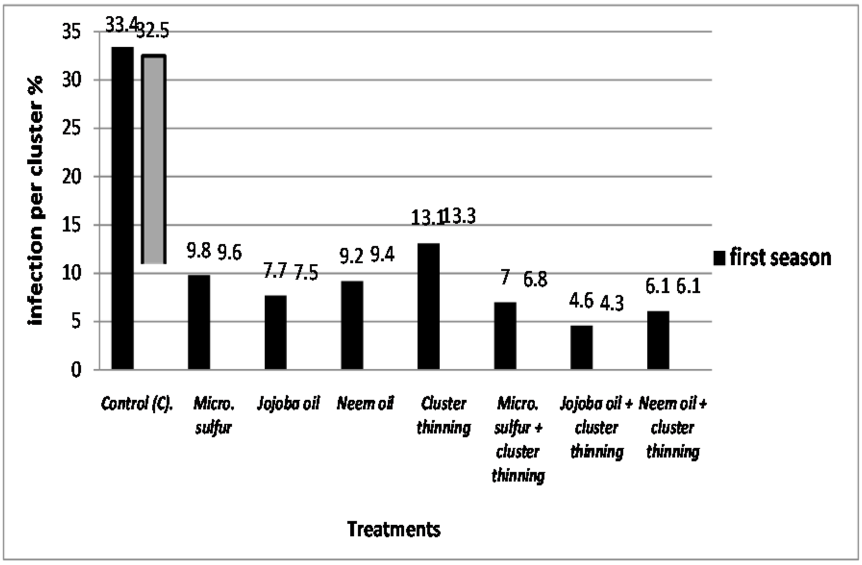

Fig. 1. Infection per cluster % as affected by different treatments in both seasons 2013-2014.

Conclusion

Jojoba oil accompanied by cluster thinning was an effective treatment in increasing cluster weight by about (928.6 g), as well as enhancing the physical and chemical characteristics of berries, TSS % (19.5%), TSS/acidity ratio whereas, acidity % (0.6%) was decreased in berry juice and improved vegetative growth parameters and increased the total surface area of leaves /vine, more than the other treatments and the control. Regardless to the yield per vine (18.6 Kg) was less than the Jojoba oil treatment (26.8 Kg) by (30.5%) only, but provided an increment of (43%) than the control. Both Jojoba and Neem oil treatments have an inhibitory effect on the powdery mildew propagation similar to micronized sulfur, and they can be a valid alternative to viticulture management techniques of early maturing table grapes.

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تـأثير إستخدام بعض المـواد العضـوية وخـف العناقيـد علـى صـفات الجودة والبياض الدقيقى للعنب صنف الفليم سيدلس

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تم دراسة تأثير بعض المواد العضوية علـى صـفات الجودة والبياض الدقيقى للعنب صـنف الفليم سيدلس. و قد تـم الـرش علـى العناقيـد بزيـت الجوجوبـا وزيـت النـيم بالإضافة الى الكبريت الميكرونى منفرداً أو مع خف للعناقيد.

وقـد أجريـت هـذه التجربـة خـلال الموسـمين ٢٠١٣-٢٠١٤ بمزرعـة بمدينـة السـادات، وكانـت عمرالكرمـات ثمـانى سـنوات ناميـة فـى تربـة رمليـة علـى مسـافة 1.75 x 2.75 متر، وتروى بنظـام الرى بـالتنقيط ، الكرمـات مربـاة بنظـام التـدعيم "واى". وتم تثبيت عـــدد العناقيد الى ٣٠ عنقود للكرمة أما معـاملات الخـف علـى ٢٠ عنقـود للكرمـــة واشـتملت التجربـة علـى ثمانيـة معامـــلات هـى الكبريـت الميكرونـى ٢٥٠ ملليجرام/لتـر - زيـت الجوجوبـا ١.٥٪ - زيـت النـيم ١٪ - خـف العناقيد - الكبريت الميكرونى + خف العناقيد - زيت الجوجوبـا + خف العناقيد - زيت النيم + خف العناقيد.

وأظهرت النتائج المتحصل عليها أن المعاملة بالجوجوبا والنيم لهم تـأثير سلبى علـى انتشـار البيـاض الـدقيقى مماثـل للـرش بالكبريـت الميكرونـى. وكانـت معاملـة الجوجوبا مع الخف الافضل من حيث مساحة سطح الورقة ، و حجم ووزن الحبات و طـول الفـرع وزن العنقـود والانثوسيانين والنسـبة المئويـة للسـكريات الكليـة وأقـل نسـبة للحموضـة .أمـا بالنسـبة لـوزن المحصـول علـى الكرمـة فقد سـجلت المعاملـة المنفردة للجوجوبا اعلى القيم.

ولم يكن لمعاملة النيم أى تأثير على الصـفات النوعيـة و الكميائيـة للحبـات ولكـن كانـت أفضـل مـن الكنتـرول حيـث عملـت علـى زيـادة المحصـول بنسـبة ٤٣ ٪ عـن طريق تقليل عدد الحبات المصابة بالبياض الدقيقى.