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Response of Flame Seedless Grapevines to Foliar Spray with Magnesium Sulphate and Seaweed Extract

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Abstract: In order to preserve the health of vineyards, viticulture is heavily reliant on phytochemicals. Nevertheless, the development of eco-friendly strategies is being driven by green regulations in order to reduce their accumulation in the environment. In this regard, seaweeds have been demonstrated to be one of the marine resources with the greatest potential as plant protective agents, offering an environmentally benign alternative approach to sustainable grapevine production. The present study was conducted in vineyard located at West of the West Desert Road, Al-Qusiya city, Assiut Governorate to assessed the effectiveness of the solo or dual foliar application of magnesium sulphate and/or seaweed extract at various dosage (0.05, 0.1 and 0.2% for each one) on the yield, cluster parameters and berries physio-chemical quality of Flame Seedless grapevines throughout 2023 and 2024 seasons using randomized complete block design in ten treatments with 3 replicates. The results were summarized that applying seaweed extract was more efficacious than magnesium sulphate particularly at 0.2% followed by 0.1%. foliar spraying with 0.2% for both seaweed extract and magnesium sulphate was the most effective treatment on studied traits followed by the concentration of 0.1% for both without significant differences. Therefore, the combination of 0.1% magnesium sulphate + 0.1% seaweed extract has proven to be an effective approach for enhancing the growth, yield, and both physical and chemical quality of Flame seedless grapes in Egypt under sandy soil.

Key words: Magnesium sulphate, Seaweed extract, Berries quality and Flame seedless.

1. Introduction

The grapevine (*Vitis vinifera* L.) is acknowledged as the most economically important crop worldwide and ranks second in Egypt. The predominant grape varieties cultivated in Egypt are table grapes, all of which consist of European grape cultivars (**Mohamed *et al.*, 2019**). The area dedicated to grape cultivation reached 85,240 hectares, producing a total of 1435000 tons (**FAO, 2023**). The Flame seedless grape represents an emerging variety in Egypt that has shown significant development in recent years. A significant area of Flame seedless grapevine is currently being cultivated in the newly reclaimed land along the desert roads in North and Middle Egypt. The Flame Seedless cultivar is recognized as an important commercial and early variety within the Egyptian market. Consequently, it is of considerable significance for both domestic and international markets that engage in exports to European nations. One of the goals of researchers is to improve fruit production to satisfy local consumption needs and support exports to global markets. The improvement can be achieved by incorporating cultural practices, such as fertilization and the protected cultivation of biotic and abiotic stressors (**Novello and de Palma, 2008**). The growth and productivity of grapevines are influenced by fertilization, a vital and limiting factor. A sufficient supply of macro elements is crucial for all plants to perform their normal physiological and biochemical functions (**Aly *et al.* 2020**).

Fertilizers can be administered to crops through foliar spray or soil application; nevertheless, foliar application is uncomplicated, economical, and ecologically friendly (**Toor *et al.* 2020; Adnan *et al.* 2020a; Bilal *et al.* 2020**). Magnesium plays a crucial role in numerous physiological processes in plants. Many developed countries are revising their agricultural policies to reduce or eliminate chemical substances (**Adnan and Anjum, 2021**). Magnesium foliar application is critical for plant physiological and biochemical processes such as protein synthesis, starch metabolism, and energy transfer (Adnan et al., 2020b). Furthermore, magnesium acts as a catalyst in reduction and oxidation events in plant tissues, improving drought tolerance (**Adnan *et al.,* 2021**). According to **Kleczkowski and Igamberdiev (2021**), magnesium is necessary for the activation of enzymes involved in respiration, photosynthesis, and nucleic acid synthesis. The chloroplast complex, which facilitates light absorption, incorporates magnesium as the central atom of the chlorophyll molecule, essential for the photosynthesis of carbon dioxide in plants (**Cakmak and Kirkby 2008**).

Seaweeds are macroalgae that thrive in marine ecosystems and serve various functions in human life. Various types of seaweeds are available, with brown seaweeds being the most commonly utilized for extraction purposes. Seaweed extract is a notable plant bio-stimulant that has diverse applications in horticulture and agriculture. It exhibits effects that are nearly comparable to those of phytohormones. The application of seaweed extract, either independently or in conjunction with other bio-stimulants or nutrients, is being implemented across various growth stages in a wide range of fruit crops, including grapevines (**Rajendra *et al.,* 2024**). A collection of research studies has demonstrated that the application of seaweed extracts is more environmentally sustainable due to their organic composition and cost efficiency (**Ali *et al.,* 2024 a and b**) on grapevines. Significant improvements have been observed in growth, yield, quality, storage, and stress tolerance. The application of seaweed extract at the optimal timing and correct concentration for various fruit crops can enhance the overall growth of the industry (**Rajendra *et al.,* 2024**). Carbohydrates comprise 60.92% of the major constituents, including lichenan, alginates, laminarans, and fucoidans. They facilitate plant growth and activate defense mechanisms in plants against bacterial and fungal infections. Proteins such as isoleucine, histidine, and leucine are found in seaweed extract, alongside lipids including betaine lipids, glycolipids, and non-polar glycerolipids, in addition to a significant quantity of mineral nutrients. Seaweed extract mimics the activity of phytohormones; at low concentrations, it enhances growth, while at higher concentrations, it inhibits growth processes. Brown seaweed extracts contain a variety of secondary metabolites, including polyphenols and phlorotannins, which are generated in response to stress and contribute to cellular defense mechanisms (**Battacharyya *et al.,* 2015**).

This study aims to assess the differences between solo and dual foliar applications of magnesium sulphate and seaweed extract on ‘Flame Seedless’ vines cultivated in sandy soil. In addition to determine the optimal dosage from the two studied materials for vine nutrition in sandy soil conditions to reach the optimal yield and good berries quality.

2. Material and Methods

Two years' field study was executed during 2023 and 2024 on the ten years old Flame seedless grapevines, vineyard located at West of the West Desert Road, Al-Qusiya city, Assiut Governorate, to evaluate the impact of foliar spray with magnesium sulphate and seaweed extract on the growth, leaves chemical content, yield, cluster properties and berries quality of studied grapevines.

Thirty uniform vines were chosen of the same age, growth and size, cultivated at 2 x 3 m in a sandy soil as cleared in Table (A) according to **Wilde *et al.* (1985)**, under drip irrigation system from ground water with electrical conductivity (1000 ppm). Pruning was performed in winter during both seasons using the Spanish Barron system as a trellis for the cane pruning method leaving 6 canes with 12 eyes each plus 6 renewal spurs x 2 eyes/vine with total bud load was 84 buds. All vines underwent the identical cultural management practices suggested by the Ministry of Agriculture.

Table (A). Analysis of the tested soil

<table>
<tr><th rowspan="2">Soil / Years</th><th colspan="4">Particle size distribution (%)</th><th rowspan="2">ECppm (1:2.5 extract)</th><th rowspan="2">pH (1:2.5 extract)</th><th rowspan="2">Organic matter %</th><th rowspan="2">$CaCO_3$ %</th></tr>
<tr><th>Sand</th><th>silt</th><th>Clay</th><th>Texture class</th></tr>
<tr><td rowspan="4">2023/ 2024</td><td>87.36</td><td>4.83</td><td>7.81</td><td>Sandy</td><td>232</td><td>7.83</td><td>0.64</td><td rowspan="4">0.97</td></tr>
<tr><td colspan="7">Soil nutrients</td></tr>
<tr><td>Total N (%)</td><td>Available P (ppm)</td><td>Available K (meq/100)</td><td>Zn (ppm)</td><td>Fe (ppm)</td><td>Mn (ppm)</td><td>Cu (ppm)</td></tr>
<tr><td>0.03</td><td>0.43</td><td>0.26</td><td>3.8</td><td>4.1</td><td>3.6</td><td>2.17</td></tr>
</table>

The foliar application of the ten treatments was organized in a randomized complete block design (RCBD) with three replicates across two seasons. The trees were treated with spray three times: at the onset of vegetative development, after fruit set, and one month subsequent to the second application. Treatments applied as follow:

1. Control (spray with tap water).
2. Magnesium sulphate (0.05%).
3. Magnesium sulphate (0.1%).
4. Magnesium sulphate (0.2%).
5. Seaweed extract (0.05%).
6. Seaweed extract (0.1%).
7. Seaweed extract (0.2%).
8. Magnesium sulphate (0.05%) +Seaweed extract (0.05%).
9. Magnesium sulphate (0.1%) +Seaweed extract (0.1%).
10. Magnesium sulphate (0.2%) +Seaweed extract (0.2%).

Magnesium sulphate was brought from TABARAK Company for fertilization and contain (9.6% Mg and 12.50% S), while the seaweed extract analysis presented in Table (B).

Table (B). Seaweed extract chemical analysis (according to **James, 1994**)

Characters	Value
Moisture%	6.0
O.M%	45-60
Inorganic matter%	45-60
Protein%	6-8
Carbohydrates %	35-50
Aliginic acid%	10-20
Mannitol%	4-7
Total N%	1.0-1.5
P%	0.02-0.09
K%	1.0-1.2
Ca%	0.2-1.5
S%	3-9
Mg%	0.5-0.9
Cu (ppm)	1.0-6.0
Fe (ppm)	50-200
Mn (ppm)	5-12
Zn (ppm)	10-100
B (ppm)	20-100
Mo (ppm)	1-5
Cytokinin %	0.02
IAA %	0.03
ABA%	0.01

The influence of the aforementioned treatments was studied by their impacts on the following parameters:

2.1. Yield and physical attributes of clusters

Nine clusters per vine were taken as representative random samples. The following parameters were determined: Clusters number/vine**,** weight (g), dimensions (length and shoulder in (cm))**,** yield (kg)/vine was assessed in kg for each tree/replicate by multiply the previous parameters**.** Berry setting (%) was computed as the following: packed 5 flower clusters per vine in perforated paper bags before bloom, which are discharged during berry set which computed as follows:

$$\text{Fruit berry Setting\%} = \frac{\text{Number of berries /cluster}}{\text{Total number of flower /cluster}}$$

2.2. Physical characteristics of berries

To get the shot berry proportion, the percentage of berries in each cluster was divided by the total number of berries across all clusters and then multiplied by 100. Berry weight (g), and dimensions (longitudinal and equatorial).

2.3. Chemical characteristics of berries

According to (**A.O.A.C, 2000**): TSS% in berry juice measured with a handheld refractometer. Titrating 5 ml of berry juice against 0.1 N NaOH with phenolphthalein determined the titratable acidity percentage. Lso, TSS/acidity ratio of berry juice was calculated and reducing sugar%.

All data were analyzed using new L.S.D. technique at 5% according to **Mead *et al.* (1993).**

3. Results and Discussion

The results obtained during the course of the experiment was demonstrated by evaluation of magnesium sulphate and seaweed extract at (0.05, 0.1 and 0.2% for each material) via foliar application on yield and cluster properties as well as berries quality across the two years of 2023 and 2024.

3.1. Yield and physical attributes of clusters

Across the 2023 and 2024 growing seasons, Table 1 show the impacts of various dosages (0.05%, 0.1%, and 0.2%) for each one of magnesium sulphate and/or seaweed extract on Flame Seedless grapevine yield and physical characteristics of cluster, such as cluster number per vine, weight, yield in kg per vine, berry setting %, cluster length, and shoulder.

The findings indicated that, in comparison to the control treatment, the application of magnesium sulphate and/or seaweed extract markedly increased the yield and cluster physical attributes of Flame seedless grapevine (Table 1). The administration of the greatest concentration in both treatments resulted an increase in cluster number per vine, weight, yield in kg per vine, berry setting %, cluster length, and shoulder during both trial seasons. The utilization of magnesium sulphate or seaweed extract at concentrations of 0.05%, 0.1%, and 0.2% for each, significantly improved mentioned parameters of Flame seedless grapevines compared to the control treatment throughout two growing seasons. The applying of seaweed extract as a foliar spray proved to be more efficacious than that of magnesium sulphate. The most favorable result in this setting was attained by applying 0.2% SWE to the vines, succeeded by 0.1%, with no notable differences detected between the two treatments in the two seasons. The combination between magnesium sulphate and seaweed extract markedly influenced studied traits throughout both seasons. The most effective interaction treatment was $MgSO_4$ (0.2%) + SWE (0.2%), followed by $MgSO_4$ (0.1%) + SWE (0.1%), as no discernible difference between the two. The highest mean values were (19.4 & 20.2 %), (25.0 & 34.0), (9.5 & 13.1 kg/vine), (379.0 & 386.0 g), (21.1 & 21.3 cm) and (12.9 & 13.1 cm) for cluster number per vine, weight, yield in kg per vine, berry setting %, cluster length, and shoulder with MgSO4 at 0.2% plus SWE at 0.2%, while the most economical treatment yielded (18.2 & 18.9%), (25.0 & 33.0), (9.4 & 12.6 kg/vine), (374.0 & 381.0 g), (20.6 & 20.7 cm) and (12.7 & 13.0 cm) with $MgSO_4$ at 0.1% + SWE at 0.1%. In contrast, the untreated vines had the lowest values of same traits

Table (1). Foliar spray with magnesium sulphate and seaweed extract on Flame seedless grapevines yield and cluster physical parameters in 2023 and 2024 growing seasons

Characteristics / Treatments	Berry setting %		No. of cluster/vine		Yield/vine (kg)		Cluster weight (g)		Cluster length (cm)		Cluster shoulder (cm)	
	2023	**2024**	**2023**	**2024**	**2023**	**2024**	**2023**	**2024**	**2023**	**2024**	**2023**	**2024**
Control	12.0	12.5	25.0	25.0	8.5	8.6	340.0	343.0	17.2	17.3	10.9	11.0
$MgSO_4$ (0.05%)	13.8	14.0	25.0	27.0	8.8	9.6	351.0	355.0	18.4	18.3	11.4	11.6
$MgSO_4$ (0.1%)	15.4	15.6	25.0	29.0	9.0	10.6	360.0	363.0	19.2	19.2	11.8	11.9
$MgSO_4$ (0.2%)	16.7	17.0	25.0	30.0	9.1	11.0	366.0	368.0	19.2	19.8	12.0	12.0
SWE (0.05%)	15.3	15.7	25.0	29.0	9.0	10.6	359.0	364.0	19.1	19.2	11.9	12.1
SWE (0.1%)	16.9	17.2	25.0	31.0	9.2	11.5	367.0	372.0	19.8	19.9	12.3	12.5
SWE (0.2%)	18.1	18.5	25.0	32.0	9.3	12.1	372.0	378.0	20.2	20.4	12.4	12.7
$MgSO_4$ (0.05%) + SWE (0.05%)	16.8	17.3	25.0	31.0	9.2	11.6	366.0	373.0	19.9	20.0	12.4	12.5
$MgSO_4$ (0.1%) + SWE (0.1%)	18.2	18.9	25.0	33.0	9.4	12.6	374.0	381.0	20.6	20.7	12.7	13.0
$MgSO_4$ (0.2%) + SWE (0.2%)	19.4	20.2	25.0	34.0	9.5	13.1	379.0	386.0	21.1	21.3	12.9	13.1
New LSD at 0.05	**1.4**	**1.5**	**N.S**	**1.1**	**0.2**	**0.7**	**7.0**	**7.0**	**0.6**	**0.7**	**0.3**	**0.3**

$MgSO_4$: Magnesium sulphate **SWE:** seaweed extract

The positive effect of magnesium application on grapevine productivity is attributed to its role in enhancing plant metabolism, as demonstrated by improvements in both berry yield and quality. Foliar fertilizers, such as magnesium, enhance yield and its components due to the mineral's critical role in the synthesis of organic molecules, including carbohydrates and lipids, which are subsequently transported to the reproductive organs (**Marschner, 2011). Bybordi and Shabanov (2010**) and **Zlámalová *et al.* (2015)** demonstrated that foliar application of Mg significantly increased yields compared to the untreated control. The findings in this context are consistent with the studies conducted by **Farag and Abd El-All (2019), Qaoud and Mohamed (2019), and Eisa *et al.* (2023**).

The results regarding yield and cluster parameters can be attributed to the influence of seaweed extract on cell division, carbohydrates, macro- and micronutrient levels, growth promoters, hormones (notably cytokinins), and the size and weight of clusters, as indicated by **Khan *et al.* (2012).** Furthermore, it may have elevated the natural polyamine concentration at the apex of the fruit. Previous field experiments have demonstrated that the application of seaweed extract led to an increase in crop production and its components, consistent with our research findings. **Abo-Zaid *et al.* (2019**) found that the seaweed extract demonstrated greater effectiveness compared to the control group when applied four times. This would enhance both cluster features and fruit yield. Increasing the concentration of seaweed extract from 0.05% to 0.2% led to enhancements in the number of clusters, as well as the cluster weight, length, and width of grapevines. Experiments conducted on various grapevine varieties revealed these findings, as reported by **Sharma *et al.* (2023), Al-Sagheer *et al.* (2023), Ali *et al.* (2024b), and Waseel *et al.* (2024**).

3.2. Berry physical characteristics

Table (2) presented the results of a foliar spraying experiment conducted in 2023 and 2024. The experiment examined the effects of magnesium sulphate and seaweed extract at concentrations of 0.05, 0.1, and 0.2% on the physical characteristics of berries in "Flame Seedless" grapevines in comparison to untreated vines. The results were analyzed in terms of shot berries%, average berry weight, longitudinal, and equatorial.

The data from Table 2 demonstrated that average berry weight, longitudinal, and equatorial of 'Flame seedless' grapevines was increased, while shot berries was decreased in the two seasons under the study when magnesium sulphate and seaweed extract were sprayed at varying quantities compared to the control condition. Furthermore, adding seaweed extract at 0.2% significantly increased the average berry weight, longitudinal, and equatorial and decreased the shot berries% than the other individual treatments of magnesium sulphate or seaweed extract. Whereas, seaweed extract at 0.1% produced a lower average berry weight, longitudinal, and equatorial near to the highest dosage and high shot berries% without a discernible change between the two treatments. Concerning the effect of interaction between the magnesium sulphate and seaweed extract concentrations, data in the same table reveal that all treatments caused an increase in aforementioned traits and decrease in shot berries% than the control, and magnesium sulphate and seaweed extract at (0.2% for both) gave the higher parameters and lowest shot berries% values than those at 0.1 or 0.05 for both.

The application of magnesium enhanced the physical qualities of berries due to its essential role in the structure of chlorophyll molecules, thereby promoting chlorophyll production (**Papadakis *et al.* 2023**). **Farag and Abd El-All (2019), Qaoud and Mohamed (2019), Eisa *et al.* (2023), and El-Katawy *et al.* (2024)** reported that the application of magnesium in various forms resulted in improved physical berry quality across different grapevine varieties.

The concepts presented are consistent with the findings of **Belal *et al.* (2023), Abd El-Moatamed (2024), and Ali *et al.* (2024b).** The concentration of seaweed extract treatment enhanced the features of the berries. The increase was noted in the root system's capacity to uptake essential nutrients, including certain components of chlorophyll. Consequently, there was a significant increase in chlorophyll levels compared to the control treatment. This process improves photosynthesis and stimulates plant growth, leading to heightened hormone production (**Hameedawi and Malikshah, 2017**). Seaweed extract comprises growth regulators, carbohydrates, proteins, nutrients, and vitamins that enhance vegetative growth (**Abed El-Hamied, 2014)**, resulting in improved physical quality.

Table (2). Foliar spray with magnesium sulphate and seaweed extract on Flame seedless grapevines average shot berries, berry weight (g), berry longitudinal and berry equatorial in 2023 and 2024 growing 2024 seasons

Treatments \ Characteristics	Shot berries %		Average berry weight (g)		Average berry longitudinal (cm)		Average berry equatorial (cm)	
	2023	2024	2023	2024	2023	2024	2023	2024
Control	8.9	9.0	3.41	3.49	1.70	1.74	1.46	1.50
$MgSO_4$ (0.05%)	8.0	8.2	3.50	3.56	1.76	1.81	1.51	1.56
$MgSO_4$ (0.1%)	7.3	7.5	3.59	3.64	1.84	1.86	1.56	1.60
$MgSO_4$ (0.2%)	6.8	7.0	3.65	3.70	1.87	1.88	1.58	1.62
SWE (0.05%)	7.2	7.4	3.58	3.65	1.81	1.87	1.58	1.60
SWE (0.1%)	6.6	6.8	3.65	3.73	1.87	1.92	1.61	1.65
SWE (0.2%)	6.2	6.2	3.70	3.78	1.89	1.95	1.62	1.66
$MgSO_4$ (0.05%) + SWE (0.05%)	6.5	6.7	3.66	3.72	1.85	1.93	1.62	1.65
$MgSO_4$ (0.1%) + SWE (0.1%)	5.8	6.0	3.74	3.80	1.89	1.97	1.65	1.69
$MgSO_4$ (0.2%) + SWE (0.2%)	5.3	5.5	3.80	3.86	1.92	1.99	1.67	1.71
New LSD at 0.05	**0.6**	**0.6**	**0.07**	**0.07**	**0.04**	**0.04**	**0.03**	**0.03**

$MgSO_4$: Magnesium sulphate **SWE:** seaweed extract

3.3. Berry chemical characteristics

Data presented in Table 3 showed the effect of magnesium sulphate and seaweed extract on berry chemical characteristics of Flame Seedless grapevines including (TSS%, total acidity, TSS/total acidity and reducing sugar%) during 2023 and 2024 seasons.

It is obvious from Table 3, that during the two seasons under study, the data showed a similar tendency. Such data indicated that foliar spraying with magnesium sulphate and seaweed extract at different concentrations thrice on the vines significantly increased TSS%, TSS/total acidity, reducing sugar% and decreased total acidity% in berries compared untreated ones. Foliar spray with seaweed extract on the vines enhanced TSS% about 10.05 and 9.42%, TSS/TA about 34.48 & 33.97%, reducing sugar about 11.74 & 10.67% and reduction in total acidity about 18.34 & 18.24% at 0.2% compared to the control during both seasons. The addition of SWE was more superior that $MgSO_4$. Concerning the effect of dual application of $MgSO_4$ and SWE, the data in the same Table revealed that foliar spraying Flame seedless vines at several concentrations considerably raised the TSS%, TSS/total acidity, reducing sugar% and decreased total acidity of the berries compared to the untreated vines. The highest mean value of TSS, TSS/total acidity, reducing sugar% and lowest total acidity recorded with 0.2% for both $MgSO_4$ and SWE followed by 0.1% without significant difference between them. On the contrary was the untreated plants.

Malakouti (2006) demonstrated that the application of magnesium solution improved the translocation of photosynthetically generated substances from the leaf to the grape fruit. Moreover, **Bybordi and Shabanov (2010)** found that increased magnesium application led to higher leaf chlorophyll content, hence improving photosynthesis and significantly increasing total soluble solids percentages. Moreover, magnesium plays a crucial role in cellular division and glucose metabolism (**Ilyas *et al.* 2014**). In this regard, **Mostafa *et al.* (2017), Farag and Abd El-All (2019), Qaoud and Mohamed (2019), and Eisa *et al.* (2023)** all demonstrated enhanced chemical parameters in several grapevine varieties resulting from foliar sprays of magnesium at varying doses.

Seaweed extract comprises certain enzymes that promote the production of proteins, amino acids, certain phytohormones, and carbohydrates (**Khan *et al.*, 2012; Petoumenou and Patris, 2021**). This correlates with an increase in TSS% and reducing sugar concentration in grape juice, as well as a decrease in total acidity percentage. Researchers, including **Belal *et al.* (2023), Abd El-Moatamed (2024), Ali *et al.* (2024b), and Waseel *et al.* (2024),** concur on the effectiveness of seaweed extract spray in enhancing the chemical quality of various grapevine cultivars, as evidenced by metrics such as total soluble solids, total acidity, TSS/TA ratio, and sugar concentration in juice.

Table (3). Foliar spray with magnesium sulphate and seaweed extract on Flame seedless grapevines juice %, T.S.S%, total acidity, T.S.S/acidity and reducing sugar% in 2023 and 2024 growing 2024 seasons

Characteristics / Treatments	TSS%		Total acidity%		TSS/acidity ratio		Reducing sugar%	
	2023	2024	2023	2024	2023	2024	2023	2024
Control	18.9	19.1	0.725	0.729	26.1	26.2	15.3	15.5
$MgSO_4$ (0.05%)	19.5	19.6	0.685	0.688	28.5	28.5	15.8	16.0
$MgSO_4$ (0.1%)	19.9	20.0	0.652	0.653	30.5	30.6	16.3	16.4
$MgSO_4$ (0.2%)	20.1	20.3	0.627	0.625	32.1	32.5	16.5	16.6
SWE (0.05%)	20.0	20.1	0.650	0.651	30.8	30.9	16.4	16.4
SWE (0.1%)	20.5	20.6	0.620	0.621	33.1	33.2	17.0	16.9
SWE (0.2%)	20.8	20.9	0.592	0.596	35.1	35.1	17.1	17.1
$MgSO_4$ (0.05%) + SWE (0.05%)	20.4	20.6	0.620	0.620	32.9	33.2	16.8	16.9
$MgSO_4$ (0.1%) + SWE (0.1%)	20.9	21.0	0.585	0.590	35.7	35.6	17.2	17.3
$MgSO_4$ (0.2%) + SWE (0.2%)	21.2	21.3	0.556	0.561	38.1	38.0	17.4	17.5
New LSD at 0.05	**0.4**	**0.4**	**0.030**	**0.030**	**2.5**	**2.5**	**0.3**	**0.3**

$MgSO_4$: Magnesium sulphate **SWE:** seaweed extract

4. Conclusion

The combination of magnesium sulphate and seaweed extract has proven to be an effective approach for enhancing the growth, yield, and both physical and chemical quality of Flame seedless grapes in Egypt under sandy soil. Therefore, it is possible to infer that the most advantageous economic outcomes in terms of yield and berry quality were achieved by spraying Flame Seedless grapevines cultivated in the Assiut region with a mixture of 0.1% for both magnesium sulphate and seaweed extract three times at the onset of vegetative growth, post-fruit set, and one month thereafter.

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إستجابة كرمات عنب الفليم سيدلس للرش الورقى بسلفات الماغنسيوم و مستخلص الأعشاب البحرية

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تعتمد مزارع الكروم بشكل كبير على الأسمده المعدنيه و من أجل الحفاظ علي مزارع الكروم يجب تطوير إستراتيجيات صديقة للبيئة، و قد ثبت أن مستخلص الأعشاب البحرية له إمكانيات كبيره كعوامل وقائية للنبات مما يوفر نهج بديل لإنتاج عنب نظيف و مستدام. لذلك أجريت الدراسه الحالية بمزرعة خاصة تقع غرب الطريق الصحراوى الغربى بالقوصية – محافظة أسيوط، لتقييم فاعلية الرش الورقى بصوره فرديه أو مجتمعه لسلفات الماغنسيوم و / أو مستخلص الأعشاب البحرية بتركيزات مختلفه (٠,٠٥، ٠,١ و ٠,٢% لكل منهما) على المحصول و صفات العناقيد و الصفات الفيزيائية و الكيميائية للحبات فى كرمات عنب فليم سيدلس خلال عامى ٢٠٢٣ و ٢٠٢٤ بإستخدام تصميم القطاعات العشوائيه لعشر معاملات فى ٣ مكررات. أوضحت التجربه أن الرش الورقى بمستخلص الأعشاب البحريه كان الأفضل من سلفات الماغنسيوم و خاصة عند تركيز ٠,٢% يليه ٠,١%، ووجد أن الرش بإستخدام تركيز ٠,٢% لكل من سلفات الماغنسيوم و مستخلص الأعشاب البحريه كان الأكثر تفوقا فى الحصول على أفضل الصفات يليه الرش بالتركيز الأقل ٠,١% لكل منهما بدون ملاحظة أى فرق معنوي بين التركيزين. لذلك، خلال التجربه أثبت أن المعاملات المشتركه بين ٠,١% سلفات ماغنسيوم + ٠,١% مستخلص أعشاب بحرية يعتبر نهج إقتصادى فعال و قوى لتعزيز النمو و الإنتاجية و الجوده الفيزيائية و الكيميائية للعنب فليم سيدلس تحت ظروف الاراضى الرمليه فى مصر.

الكلمات المفتاحيه: سلفات الماغنسيوم، مستخلص أعشاب بحرية، صفات الجوده، عنب فليم سيدلس