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Bio-Stimulant Properties of Some Amino Acids and Seaweed Extracts on Productivity and Berries Quality of Superior Grapevines

Ali, H. A.[1,*]; Hamdy I. M. Ibrahim[1]; Uwakiem M. Kh.[2] and Nermeen Hamdy Abd El-Mageed Othman[1]

[1]Hort. Dept., Fac. of Agric., Minia Univ., Egypt

[2]Viticulture Department, Horticulture Research Institute, Agricultural Research Centre, Cairo, Egypt

[*]**Corresponding author:** ali.sayed1@mu.edu.eg

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Abstract: Grapes cultivated in regions with high temperatures face significant challenges related to multiple aspects of crop quality. The key quality qualities of table grapes cultivated in these regions are shot berries% and chemical composition. Hence, enhancing the quality of berries is a crucial objective for farmers to meet the demands of the market and consumers. So, this study was conducted during two successful growing season of 2021 and 2022 in a private vineyard in Al Hawartah, East El-Nile, Minia Governorate to examined the effects of applying seaweed extract at (0.05, 0.1 and 0.2%) and three amino acids namely; methionine, tryptophan and cystine at (50, 100 and 200 ppm) thrice at vegetative growth, after set, and third at a one-month interval on berry yield, and quality of ten-year-old "Superior seedless" grapevines. The 30 vines chosen for the experiment were carefully picked to have similar levels of growth and were planted in clay soil. Results appeared that using seaweed extract was more effective than the amino acids individually in enhancing the yield and cluster parameters as well as physio-chemical quality of berries especially at 0.2% followed by 0.1% without significant difference between them, while the combined foliar application at 200 ppm amino acids+0.2% seaweed extract was the most treatment in improving the studied parameters and recorded the highest mean values for yield per vine, berry setting%, cluster number and dimensions, berry weight and dimensions, as well as juice %, TSS%, TSS/TA and reducing sugar, while decrease total acidity and shot berry% of grapevine berries, followed by the treatment of 100 ppm amino acids+0.1% seaweed extract, there was no statistically significant disparity observed between these two applications. The best net profit of Superior grapevines was indicated with 100 ppm amino acids+0.1% seaweed extract.

Key words: Superior grapevines, tryptophan, cystine, methionine, amino acids, seaweed extract and fruit quality.

1. Introduction

The grapevine (*Vitis vinifera* L.), is largely acknowledged as the most commercially important crop worldwide and ranks second in terms of significance in Egypt. It is widely recognized as one of the most

esteemed and highly enjoyed fruits worldwide because of its outstanding flavor, appealing taste, and substantial nutritional value. All the grape varieties cultivated in Egypt are European grape cultivars, specifically table grapes (**Mohamed *et al.*, 2019**). The Superior Seedless grapevine is a popular cultivar of table grape that has been successfully grown in Egypt. In the El-Minia region of Egypt, specific challenges exist, such as diminished crop output and a high incidence of shot berries% in grape clusters. These issues have a harmful effect on the marketing of this specific grape type. Several experiments were done to explore alternate methods of addressing these challenges while also protecting the environment from pollution (**Ali *et al.*, 2023**).

The high temperatures in Egypt have negative effects on the color and quality of fruit. Therefore, grape farmers in this region, utilize various methods to improve the quality of their grapes. The techniques utilized in the administration of vineyards have a substantial influence on the caliber of the grape harvest. Organic bio-stimulants have demonstrated potential in promoting plant growth, vitality, crop yield, and quality by augmenting the absorption of vital nutrients (**Sharma *et al.*, 2023**).

Amino acids, such as tryptophan, cysteine, and methionine, play a vital role in plant metabolism. They function as carriers of organic nitrogen inside the plant's organs and serve as precursors for crucial secondary metabolites in plant cells (**Dinkeloo *et al.*, 2018**). Various research on grapevines have shown that applying amino acids directly to the leaves by foliar spray is essential for enhancing growth, enhancing the nutritional status of the vines, boosting yield, and improving the quality of the berries (**Hussein, 2017; Mohamed, 2017). Maeda and Dudareva (2012)** revealed that tryptophan acid plays a crucial role in promoting plant development and regulating the production of auxin**. Abd-Elkader et al (2020**) found that the use of tryptophan acid through spraying led to improved vegetative development and increased yield. Applying tryptophan to the leaves led to an increase in the overall concentrations of carotenoids and chlorophyll in the plants. Tryptophan plays a vital role in inhibiting premature shedding of flowers and berries. The creation of an enzyme that aids in the synthesis of auxin is crucial for increasing berry set (**Saburi *et al.*, 2014)**. Methionine is a crucial amino acid that plays a role in numerous biological activities. Proteins and carbon metabolism are dependent on it, and its sulfur-bound methyl group stimulates S-adenosylmethionine to generate methane (**Lenhart *et al.*, 2015**). In addition, it is crucial for the production of chlorophyll, cellular energy glucosinolates, polyamines, cell wall synthesis, and several secondary metabolites. Furthermore, DNA methylation is dependent on it (**Mekawy, 2019**). Furthermore, Cysteine is an essential amino acid that possesses an amino group, a thiol group, and a carboxylic acid group as reactive centers. The distinctive arrangement of Cysteine enables it to serve as a potent antioxidant and efficient scavenger for ROS. A thiol side chain provides protection against oxidative damage caused by both biotic and abiotic stressors by promoting efficient oxidation (**Álvarez *et al.*, 2012; Genisel *et al.*, 2015**). The presence of S-adenosylmethionine and/or methionine in plants plays a crucial role in the synthesis of essential phytohormones such as polyamines and ethylene. Consequently, these interactions have a significant impact on the growth and development of plants (**Sauter *et al.*, 2012; Elkelish *et al.*, 2021**).

Seaweed extract is an organic component derived from many marine plant sources and possesses the ability to provide numerous benefits as a plant growth regulator. This extract contains a diverse range of bioactive constituents, such as phytohormones and antioxidants, which have a beneficial effect on the growth and development of plants. Seaweed extract has demonstrated potential as a plant growth regulator by stimulating root growth, enhancing flowering and fruiting, and increasing crop yields (**Prajapati *et al.*, 2023**). Seaweed extracts contain auxins, cytokinins, gibberellins, antioxidants, and trace elements (**Gupta *et al.*, 2021**). It possesses the capacity to enhance a plant's resilience against drought, salinity, and extreme temperatures. When employed as a plant growth regulator, seaweed extract improves the nutritional composition and general quality of crops, making them more attractive to both consumers and producers. One significant advantage of using seaweed extract as a plant growth regulator is its eco-friendly characteristics. Because of its inherent makeup, it does not have any harmful impact on the environment and is entirely benign for human health (**Prajapati *et al.*, 2023**).

The current investigation set out to ascertain the optimal dosage of bio-stimulants, such as various amino acids and seaweed extract, for achieving high-quality yield of Superior Seedless grapevine under the grape growing circumstances of El-Minia Governorate.

2. Materials and Methods

2.1. Experimental and conditions

A study was conducted in a private vineyard in Al Hawartah, East El-Nile, Minia Governorate, during the 2021 and 2022 seasons. The study aimed to examine the effects of applying seaweed extract and amino acids on berry yield, and quality of ten-year-old "Superior seedless" grapevines (Vitis vinifera L.) that were grown on their own roots. The 30 vines chosen for the experiment were carefully picked to have similar levels of growth and were planted in clay soil with a spacing of 3 x 2 m. The grapevines were irrigated using a surface irrigation system supplied by the Nile River. Throughout each experimental season, the vines were exposed to conventional horticulture techniques. The Gable supporting method was used to execute pruning in winter during both seasons, specifically in the first week of January, employing the cane pruning system. Pruning was carried out, leading to the preservation of 84 eyes (6 fruiting canes, each with 12 buds + six replacement spurs x two eyes) on each vine.

The initial examination of the soil's physical and chemical properties as average of two seasons, as outlined by **Wilde *et al.* (1985**), the texture was clayey soil, with EC (294 ppm), pH (7.43), OM% (2.11), CaCO3 (2.31), total N (0.16%) and available P (5.24 ppm), K (496.5 ppm), as well as micro nutrient (ppm) in term to Zn, Fe, Mn and Cu which recorded 2.8, 3.1, 3.9 and 0.10, respectively.

2.2. Examined designs and treatments:

Ten treatments in a fully randomized block design, and each treatment has three replicates individual or combined of the seaweed extract and combination of three amino acids (methionine, cysteine, and tryptophan) as follows:

1- Control (spray with tap water).
2- Amino acid (50 ppm).
3- Amino acid (100 ppm).
4- Amino acid (200 ppm).
5- Seaweed extract (0.05%).
6- Seaweed extract (0.1%).
7- Seaweed extract (0.2%).
8- Amino acid (50 ppm) + seaweed extract (0.05%).
9- Amino acid (100 ppm) + seaweed extract (0.1%).
10- Amino acid (200 ppm) + seaweed extract (0.2%).

The treatments were administered thrice over the season: first during the vegetative stage, second immediately after fruit set, and third at a one-month interval. The application was done using a hand sprayer, ensuring that the vines were sprayed until the run off.

The analysis of the seaweed extract reported in Table (A) is derived from the work of **James (1994).**

Table (A): Seaweed extract analysis

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 following characteristics were determined:

Yield and its components

As usual for commercial harvests, the two seasons' second week of July saw picking as vine yield (kg), berry setting (%), cluster number/vine, cluster/vine as well as cluster weight (g), cluster dimensions (length and shoulder in (cm).

Physical characteristic of the berry

Berry setting%, Berries Physical traits such as berry weight (g) and dimensions (longitudinal and equatorial).

Chemical characteristic of the berry according to (**A.O.A.C, 2000**) as:

Juice %, total soluble solids measured by handheld refractometer, total acidity, TSS/TA ratio of berry juice was calculated and reducing sugar%

2.3. Statistical analysis

To compare the means of the studied treatments according to **Mead *et al.* (1993)** by utilizing the new L.S.D. technique at 5%.

3. Results and Discussion

3.1. Characteristics of the yield and cluster

Results from a foliar spraying experiment in 2021 and 2022 showing the effects of three different amino acid concentrations (methionine, tryptophan, and cysteine) at 50, 100, and 200 ppm, as well as seaweed extract at 0.05, 0.1, and 0.2%, on the yield of "Superior" grapevines compared to untreated vines in terms of berry setting, shoot berries, average cluster weight, clusters number/vine, yield/vine, cluster length and width, and clusters number/vine as presented in Tables (1 and 2).

The data in Table 1 demonstrated that applying thrice sprays of various amino acids and seaweed extract to the vines considerably increased the percentage of berry setting, and yield kg/vine compared to untreated vines. As for number of clusters per vine recorded an increase just in the 2nd season, without significant difference in the 1st one. Nevertheless, based on the statistical analysis, it was shown that the two maximum concentrations of each application treatment did not significantly differ in the berry setting%, number of clusters per vine and yield kg/vine. The highest mentioned traits data was observed during two seasons with SWE foliar application at a concentration of 0.2%, followed by 0.1%. These concentrations resulted in more effective previous parameters in comparison to amino acid concentrations.

The dual application of amino acids and seaweed at different levels resulted a raise in berry setting percentage, number of clusters per vine and yield kg/vine. The highest average values were obtained with the foliar spray of AA (200 ppm) plus SWE (0.2%), with berry setting percentages of (11.6% & 12.7%), number of cluster/vine (23 & 29) and yield/vine (8.7 & 15.1 kg). The lower concentrations of AA (100 ppm) and SWE (0.1%) also showed significant increases in mentioned parameters, there was not much of a distinction between them. The same pattern occurred in the second season.

Table (1). Impact of applying amino acids and seaweed extract on Superior grapevines berry setting, number of cluster/vine and cluster wight in 2021 and 2022 growing seasons

Characteristics / Treatments	Berry setting %		Number of cluster/vine		Yield/vine (kg)	
	2021	2022	2021	2022	2021	2022
Control	8.5	8.8	22	23	7.7	8.2
AA (50 ppm)	9.5	9.7	22	26	7.8	9.8
AA (100 ppm)	10.2	10.3	23	29	8.3	10.7
AA (200 ppm)	10.6	10.7	23	31	8.4	11.6
SWE (0.05%)	10.1	11.3	23	30	8.3	11.2
SWE (0.1%)	10.7	11.9	23	34	8.4	12.9
SWE (0.2%)	11.0	12.3	23	35	8.5	13.4
AA (50 ppm) + SWE (0.05%)	10.6	11.9	23	34	8.5	12.9
AA (100 ppm) + SWE (0.1%)	11.2	12.4	23	37	8.6	14.2
AA (200 ppm) + SWE (0.2%)	11.6	12.7	23	39	8.7	15.1
New LSD at 5%	**0.05**	**0.05**	**N.S**	**3.0**	**0.2**	**1.0**
AA: Amino acids SWE: seaweed extract						

Evidence from Table (2) showed that spraying of three amino acids or seaweed extract, either individually or in conjunction, significantly increased cluster weight, length and shoulders in contrast to the control vines. There was no discernible difference between the two higher rates for either application through the seasons, and the enhancement of cluster weight, length and shoulders were substantially ranked ascendingly with increasing concentrations of both amino acids and seaweed extract. The highest mean values of cluster weight, length and shoulder scored with foliar seaweed extract at 0.2% followed by 0.1% and observed an effective increase than the amino acids.

Cluster dimensions were significantly enhanced with increasing levels of amino acid and seaweed extract dual applications. Nonetheless, the combined usage of three amino acids and seaweed extract yielded much better results than any component alone. During both seasons, the upper values for cluster weight (380.0 & 389.0 g), cluster length (24.3 & 24.6 cm) and cluster shoulder (14.4 & 15.0 cm) were scored on the vines treated with mixture of AA (200 ppm) + SWE (0.2%) followed by the lower concentration AA (100 ppm) + SWE (0.1%) with no discernible disparity between them. The minimum values of cluster dimensions were observed on the check vines.

The application of amino acid bio-stimulants through foliar spraying can lead to higher crop production and cluster features. This improvement can be related to the stimulation of root growth, greater proliferation of root hairs, and improved assimilation of nutrients and increased absorption of water (**Sadak *et al.*, 2023**). Multiple studies have verified that foliar spraying of amino acids has a beneficial effect on plants. This includes an increase in crop productivity by improving photosynthetic efficiency and chlorophyll content, resulting in the accumulation of proteins, polysaccharides, and other nutrients in the edible parts of the plants (**Sadak *et al.*, 2015**). Vines treated with a combination of amino acids and algae extract showed the greatest values for yield per vine and cluster features according to **Sayed (2022**). In the same concern, **Rashid and Al-Atrushy (2023), Zagzog and Qaoud (2023) and Waseel *et al.*, (2024)** they all found a superior yield/vines and cluster parameters of different grapevines varieties were observed due to foliar spray by different amino acids at different concentrations.

The obtained results of yield and cluster parameters may be explained by the seaweed extract impact on the levels of macro- and micronutrients, growth cell division, promoters, carbohydrates, hormones (especially cytokinins), and cluster size and weight, as suggested by **Khan *et al.* (2012**). In addition, it could have increased the natural polyamine concentration at the fruit's highest point. Prior field experiments have shown that the applying of seaweed extract resulted a raise in crop production and its constituent, which aligns with our own research results. According to the findings of **Abo-Zaid *et al.* (2019**), the seaweed extract shown superior effectiveness relative to the control group when it was sprayed four times. Both cluster features and fruit yield would be enhanced by this. The concentration of seaweed extract was increased from 0.05% to 0.2%, resulting in improvements in cluster number, weight, length, and width of grapevines. These findings were observed in experiments conducted on different grapevine kinds by **Sharma *et al.* (2023); Al-Sagheer *et al.* (2023); Ali *et al.*, (2024)** and **Waseel *et al.*, (2024).**

Table (2). Impact of applying amino acids and seaweed extract on Superior grapevines cluster weight, cluster length and cluster shoulder in 2021 and 2022 growing 2022 seasons

Characteristics / Treatments	Cluster weight (g)		Cluster length (cm)		Cluster shoulder (cm)	
	2021	2022	2021	2022	2021	2022
Control	350.0	355.0	20.0	20.05	11.8	12.1
AA (50 ppm)	356.0	363.0	21.1	21.7	12.4	12.8
AA (100 ppm)	362.0	369.0	21.7	22.2	12.9	13.4
AA (200 ppm)	365.0	373.0	22.0	22.6	13.2	13.7
SWE (0.05%)	360.0	372.0	22.3	22.8	13.1	13.6
SWE (0.1%)	366.0	379.0	22.8	23.4	13.7	14.0
SWE (0.2%)	368.0	382.0	23.0	23.8	13.9	14.2
AA (50 ppm) + SWE (0.05%)	370.0	397.0	23.4	23.8	13.7	14.3
AA (100 ppm) + SWE (0.1%)	377.0	385.0	24.0	24.3	14.1	14.8
AA (200 ppm) + SWE (0.2%)	380.0	389.0	24.3	24.6	14.4	15.0
New LSD at 5%	**4.0**	**5.0**	**0.4**	**0.05**	**0.4**	**0.4**
AA: Amino acids SWE: seaweed extract						

3.2. Berry physical characteristic

During 2021 and 2022, compared the impacts of applying various concentrations of amino acids (specifically methionine, tryptophan, and cystine) along with seaweed extract on the morpho-physical parameters of the grapevine variety "Superior" compared to the check vines. The findings are presented in Table 3. The parameters encompass shot berry percentage, mean berry weight, longitudinal and equatorial dimensions of berries.

The percentage of shot berries, mean berry weight, longitudinal and equatorial dimensions of berries are affected by the application of bio-stimulants including amino acids and seaweed extract, both individually and in combination, as seen in Table 3. The plants that were treated with tap water exhibited the highest proportion of shot berries compared to the vines that were sprayed with various amino acids and/or seaweed extract, which recorded the highest mean values of berry weight, longitudinal and equatorial dimensions of berries. Regarding the individual treatments, it was discovered that the vines treated with a 0.2% concentration of SWE followed by a 0.1% concentration of SWE had the lowest percentage of shot berries and highest values of berry weight, longitudinal and equatorial dimensions of berries. However, no significant reduction in the highest two concentrations for both uses showed the highest proportion of mentioned parameters.

Significant variations in the percentage of shoot berries, mean berry weight, longitudinal and equatorial dimensions of berries were detected among the various levels of three amino acids and seaweed extract. The levels of treatments had a noticeable and progressive effect on decreasing the percentage of shot berries and increasing mean berry weight, longitudinal and equatorial dimensions of berries. Applying a combination of 200ppm AA plus 0.2% SWE to the vines did not show any significant difference compared to using a lower concentration. However, this treatment reduces the shot berry% and raise the mean berry weight, longitudinal and equatorial dimensions of berries in contrast to the untreated treatment. These outcomes were consistent across both seasons.

The results match those of other research conducted by **El-Kenawy (2022), Zagzog and Qaoud (2023), and Waseel *et al.* (2024)** on various types of grapevines. These studies reported that the application of amino acids and/or seaweed extract to the vines resulted in enhance physical characteristics of the berries. The elevated chlorophyll concentration in the leaves is responsible for this improvement, since it improves photosynthesis and the general well-being of the Superior grapevines that were study. Consequently, these enhancements contribute to the enhancement of the berries' physical characteristics.

These ideas align with the research of **Belal *et al.* (2023), Abd El-Moatamed (2024**), and **Ali *et al.* (2024)**. The features of the berries were enhanced by the concentration of seaweed extract treatment. This rise was observed in the root system's ability to absorb essential nutrients, some of which are components of chlorophyll. As a result, there was a considerable rise in the quantity of chlorophyll in contrast to the control treatment. This process enhances photosynthesis and activates plant development, resulting in increased production of hormones (**Hameedawi and Malikshah, 2017**). Seaweed extract contains growth regulators, nutrients, carbs, protein, and vitamins that promote vegetative growth (**Abed El-Hamied, 2014**), which led to a good physical quality.

3.3. Chemical qualities of berries

The chemical quality characteristics of grapevine cv. "Superior" berries, including juice percentage, total soluble solids percentage, total acidity, TSS/acidity ratio, and reducing sugar content, were tabulated in Table 4. These characteristics were measured during the 2021 and 2022 growing seasons, after the grapevines were treated three times with different amino acids (methionine, tryptophan, and cystine) and seaweed extract at various concentrations.

Table (3). Impact of applying amino acids and seaweed extract on Superior grapevines average shot berries, berry weight (g), berry longitudinal and berry equatorial in 2021 and 2022 growing 2022 seasons

Characteristics / Treatments	Shot berries %		Average berry weight (g)		Average berry longitudinal (cm)		Average berry equatorial (cm)	
	2021	2022	2021	2022	2021	2022	2021	2022
Control	8.1	8.0	3.43	3.52	1.94	1.96	1.78	1.80
AA (50 ppm)	7.4	7.2	3.55	3.73	1.99	2.00	1.83	1.85
AA (100 ppm)	6.8	6.5	3.61	3.80	2.02	2.05	1.87	1.89
AA (200 ppm)	6.4	6.0	3.65	3.86	2.03	2.07	1.89	1.92
SWE (0.05%)	6.8	6.5	3.76	3.91	2.04	2.05	1.89	1.90
SWE (0.1%)	6.2	5.9	3.84	3.99	2.09	2.11	1.92	1.94
SWE (0.2%)	5.9	5.4	3.88	4.04	2.11	2.13	1.94	1.97
AA (50 ppm) + SWE (0.05%)	6.9	5.3	3.99	4.10	2.10	2.11	1.95	1.96
AA (100 ppm) + SWE (0.1%)	5.7	4.8	4.08	4.18	2.16	2.17	1.99	2.01
AA (200 ppm) + SWE (0.2%)	5.3	4.3	4.13	4.24	2.18	2.19	2.00	2.03
New LSD at 5%	**0.05**	**0.6**	**0.06**	**0.07**	**0.03**	**0.03**	**0.03**	**0.04**
AA: Amino acids			**SWE: seaweed extract**					

The data presented in Table 4 resulted a considerable rise in the juice percentage, total soluble solids percentage, TSS/acidity ratio, and reducing sugar content and decrease in total acidity of Superior grapevine berries when treated three time with a combination of three amino acids and seaweed extract at different dosages, either alone or in combination, compared to untreated vines.

It can be concluded that all the treatments tested, whether it be a combination of amino acids and/or seaweed extract, significantly raised the juice %, TSS%, TSS/TA and reducing sugar, while decrease total acidity of exceptional grapevine berries in contrast to the control vines. The utilize of seaweed (SWE) was more effective than amino acids (AA) in increasing the juice %, TSS%, TSS/TA and reducing sugar, while decrease total acidity. The treatment that yielded the highest mentioned traits, while decrease total acidity and lowest total acidity was the single treatment of SWE at 0.2%, followed by 0.1%, with no significant difference between them. The two consecutive growing cycles exhibited a comparable progression.

During the two research seasons, there was a significant correlation observed between the treatments including amino acids and seaweed extract. Applying a solution containing 200 ppm AA combined with 0.2% SWE resulted in the greatest juice %, TSS%, TSS/TA and reducing sugar, while decrease total acidity and lowest total acidity content in both seasons, with values of (77.5 & 78.3%), (20.0 & 21.0%), (37.04 &38.89), (18.3 & 18.5%) and (0.540 & 0.546%), respectively. This was followed by a solution containing 100 ppm AA combined with 0.1% SWE, which generated juice percentages of (77.3 & 78.0%), TSS% of (19.9 & 20.8%), TSS/TA of (35.79 & 37.68), reducing sugar of (18.1 & 18.2%) and total acidity of (0.556 & 0.552%). However, there was no statistically significant disparity observed between these two applications. Conversely, the vines that were not treated had the lowest average value of juice %, TSS%, TSS/TA and reducing sugar, while highest of total acidity in both seasons.

Amino acids are essential constituents in the protein process synthesis. Also, play a crucial role in improving crop yield, fruit characteristics, and the trees overall growth and development. **Ahmed (2022), Rashid and Al-Atrushy (2023), and Waseel *et al.* (2024)** have reported that applying amino

acids externally can enhance the quality of grapes from various grapevines. All of them went online as documented in the current study.

Seaweed extract contains specific enzymes that facilitate the synthesis of amino acids, proteins, certain phytohormones, and carbohydrates (**Khan *et al.*, 2012; Petoumenou & Patris, 2021**). This is associated with an elevation in the TSS% and reducing sugar content of grape juice, also a reduction in the total acidity percentage. Investigators, **Belal *et al.* (2023); Abd El-Moatamed (2024); Ali *et al.*, (2024) and Waseel *et al.*, (2024**) there is consensus on the efficacy of using seaweed extract spray to improve the chemical quality of several grapevine varieties, including measurements such as TSS, total acidity, TSS/TA ratio, sugar content, and juice percentage.

Table (4). Impact of applying amino acids and seaweed extract on Superior grapevines juice %, TSS%, total acidity, T.S.S/acidity and reducing sugar% in 2021 and 2022 growing 2022 seasons.

Characteristics / Treatments	Juice %		TSS%		Total acidity%		TSS/acidity ratio		Reducing sugar%	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Control	74.9	75.2	17.5	17.7	0.660	0.652	26.52	27.15	15.0	15.8
AA (50 ppm)	75.3	75.7	17.9	18.2	0.641	0.632	27.93	28.80	16.3	16.5
AA (100 ppm)	75.6	76.1	18.2	18.6	0.622	0.616	29.26	30.19	16.7	17.0
AA (200 ppm)	75.8	76.4	18.4	18.8	0.616	0.603	29.87	31.18	17.0	17.2
SWE (0.05%)	76.2	76.5	18.8	19.5	0.600	0.605	31.33	32.23	16.9	17.2
SWE (0.1%)	76.6	76.9	19.3	19.8	0.580	0.588	33.28	33.67	17.4	17.7
SWE (0.2%)	76.7	77.2	19.4	19.9	0.565	0.563	34.34	35.35	17.6	18.0
AA (50 ppm) + SWE (0.05%)	77.0	77.5	19.5	20.4	0.575	0.570	33.91	35.79	17.6	17.8
AA (100 ppm) + SWE (0.1%)	77.3	78.0	19.9	20.8	0.556	0.552	35.79	37.68	18.1	18.2
AA (200 ppm) + SWE (0.2%)	77.5	78.3	20.0	21.0	0.540	0.546	37.04	38.89	18.3	18.5
New LSD at 5%	**0.3**	**0.4**	**0.3**	**0.3**	**0.017**	**0.016**	**1.26**	**1.29**	**0.4**	**0.4**
AA: Amino acids			**SWE: seaweed extract**							

4. Conclusion

Based on our investigation conducted under identical study conditions of Minia Governorate, it can be concluded that applying 100 ppm amino acid plus 0.1% seaweed extract to the leaves three times - first during the vegetative stage, second immediately after fruit set, and third at a one-month interval - in Superior vineyards resulted in the most cost-effective and highest quality berries for Superior grapevines.

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خواص المحفزات الحيوية لبعض الأحماض الأمينية ومستخلص الأعشاب البحرية على إنتاجية وجودة ثمار صنف العنب سوبريور

على حسن على[1]، حمدي إبراهيم محمود[1]، ماهر خيري يواقيم[2] ونرمين حمدي عبد المجيد عثمان[1]

١- قسم البساتين – كلية الزراعة – جامعة المنيا – مصر
٢- قسم العنب – معهد بحوث البساتين – مركز البحوث الزراعية – القاهرة – مصر

الملخص العربي

تواجه مزارع العنب في المناطق ذات درجات الحرارة المرتفعة مشاكل في الإنتاجية وأفضل صفات عنب المائدة تتمثل في انخفاض فرط الحبات ومحتواها الكيميائي ومن ثم فإن تحسين جودة الثمار يعتبر هدفاً بالغ الأهمية للمزارعين لتلبية متطلبات السوق والمستهلكين لذلك أجريت هذه الدراسة خلال موسمين تجريبين ناجحين ٢٠٢١ و ٢٠٢٢ في مزرعة عنب خاصة بمنطقة الحوارته شرق النيل بمحافظة المنيا. لدراسة تأثير الرش الورقي بمستخلص الأعشاب البحرية بتركيزات (٠,٠٥، ٠,١، ٠,٢%) ومزيج من ثلاث أحماض أمينيه هي المثيونين، التربتوفان والسيستين بتركيزات (٥٠، ١٠٠، ٢٠٠ جزء في المليون) ثلاث مرات خلال مرحلة النمو الخضري والثانية بعد العقد مباشرة والثالثة بعد شهر من عقد الثمار على محصول وجوده ثمار عنب السوبريور. تم اختيار ٣٠ كرمه ذات صفات متقاربه مزروعة في تربه طينيه. وأظهرت النتائج تحت الدراسة إلى أن الرش باستخدام مستخلص الأعشاب البحرية كان أكثر فعالية من الرش بالأحماض الأمينية وخاصة عند تركيز ٠,٢% يليه ٠,١% دون وجود فرق معنوي بينهما كمعاملات فرديه. و لكن الرش المشترك بين ٢٠٠ جزء في المليون أحماض أمينيه + ٠,٢% مستخلص أعشاب بحريه كان الأكثر تفوقا في تسجيل أعلى القيم للمعاملات تحت الدراسة مثل نسبة العقد، عدد العناقيد / الكرمة، وزن العنقود، طول العنقود، عرض العنقود، المحصول / الكرمة بالكجم، وزن ، طول و قطر الحبات بالسم ، النسبة المئوية للعصير، النسبة المئوية للمواد الصلبة الكلية، نسبة المواد الصلبة الكلية/ الحموضة الكلية ، المحتوى السكريات المختزلة و أقل نسبة فرط للحبات و نسبة الحموضة يليه الرش بمعدل بين ١٠٠ جزء في المليون أحماض أمينيه + ٠,١% مستخلص أعشاب بحريه دون ملاحظة أي فرق معنوي بين التركيزين. ولذلك ينصح اقتصاديا والحصول على أفضل ربح عند الرش بمعدل ١٠٠ جزء في المليون أحماض أمينيه + ٠,١% مستخلص أعشاب بحريه.

الكلمات المفتاحية: عنب سبريور، تربتوفان، سستين، مثيونين، أحماض أمينيه، مستخلص أعشاب بحريه وجودة الثمار