J. Product. & Dev., 28(4): 213- 228 (2023)

EFFECT OF FOLIAR SPRAY SEAWEED AND AMINO ACID ON GROWTH AND YIELD OF ARRA 15 AND ARRA 20 GRAPEVINES CULTIVARS

El-Sayed, M. Qaoud [1] and Zagzog, O. A. I [2]
1 Hort. Dept., Fac. Agric., Suez Canal Univ., Egypt.
2 Plant Production Department, Faculty of Technology and Development, Zagazig University, Egypt.
e.mail: *s_Qaoud@yahoo.com, zagzog_1000@yahoo.com*

ABSTRACT

This study investigates the impact of seaweed and amino acid treatments on vegetative growth characteristics, leaf mineral contents, and yield of grapevines, focusing on two cultivars, Arra 15 and Arra 20. The experiment spans two growing seasons, and various treatments are applied to the vines. The results demonstrate significant varietal differences in vegetative growth characteristics and leaf mineral contents. Leaf mineral content analysis revealed varietal differences, with Arra 15 having higher nitrogen and phosphorus percentages, and Arra 20 exhibiting higher calcium content. The foliar spray treatments positively influenced leaf mineral content, particularly SW 0.75 + AA 0.25 treatment.

In terms of yield, Arra 15 consistently outperformed Arra 20. All foliar spray treatments significantly increased yield compared to the control, with SW 0.50 + AA 0.25 treatment producing the highest yield in the first season. The interaction between treatments and cultivars influenced yield, with Arra 15 achieving the highest values under specific treatments. The application of seaweed and amino acid treatments positively influences these parameters compared to the control, with specific treatments leading to the highest values. The interaction between cultivars and treatments further influences these characteristics. Additionally, the study assesses the impact on yield, with Arra 15 consistently outperforming Arra 20. The foliar spray treatments significantly enhance yield compared to the control, and specific treatments result in the highest yields per feddan.

The findings of this study contribute to the understanding of the beneficial effects of seaweed and amino acid treatments on grapevine growth and productivity, providing valuable insights for viticulture practices.

Key words: Grape, seaweed, amino acid, vegetative growth characteristics, yield Arra 15, Arra 20.

INTRODUCTION

Globally, grapes are acknowledged as a prominent fruit crop that has seen substantial expansion in cultivation and the development of new varieties in the last twenty years. This is mostly owing to the lucrative financial benefits it offers to producers. Grapes in Egypt rank third in terms of fruit crops, behind citrus and mango. The cultivated area for grapes is estimated to be 187,358 feddans, with a fruiting area of 133,811. In 2020, the country's grape production reached a total of 1,594,782 tons, thereby confirming its significant economic significance (M.A.L.R, 2020). Nevertheless, despite making a significant contribution, Egypt's grape output is rated 32nd globally according to the FAO's 2019 report.

The use of natural plant extracts, which are regarded as safe substances for both people and the environment, offers a novel approach that has the potential to improve grape production and increase its quality (Peter, 1999).Seaweed liquid fertilisers are improving agricultural yield. These fertilisers include growth hormones including Auxins, Gibberellins, Cytokinins, Abscisic acid, Ethylene, Betaine, and Polyamines, as well as trace elements, vitamins, amino acids, antibiotics, and micronutrients (Panda, *et al.*, 2012).

By serving as co-enzymes for plant hormones and enhancing photosynthesis, amino acids boost plant growth and productivity (Kowalczyk and Zielony, 2008). They also chelate micronutrients, helping plants absorb and transport them (Ghasemi et al., 2013). Seaweed may boost grapevine growth and production due to its higher concentration of sulfur-containing chemicals, amino acids, and volatile sulphur components, including methionine and cysteine. These chemicals boost growth hormones, carbs, and organic diets while lowering phenols and ABA (Kubota et al., 1999, and 2000).

Research has demonstrated that numerous sprays of amino acids and seaweed extract work. Saleh *et al*. (2006), Abd El-Wahab (2007), Seleem-Basma and Abd El-Hameed (2008), Wassel (2011), Abd El-Aaal (2012), Mohamed (2013), Carvalho (2019), Ahmed (2022), and Masoud (2023) have shown this.

This experiment will examine how amino acid and seaweed extract foliar sprays impact Arra 15 and 20 grape growth and production.

MATERIALS AND METHODS

This study examined 6-year-old Arra 15 and Arra 20 (*Vitis vinifera* L.) grapevines in 2020 and 2021. A private vineyard at Ismailia Governorate, Egypt, provided the vines. The research examined how seaweed extract and amino acid foliar sprays affected Arra 15 and Arra 20 grapevine yields.

Planting the vines 2 x 3 meters apart in sandy soil under drip watering. Training them to the cone pruning method with the Spanish Baron supporting system ensured equal size and vigor. Adjusted buds had 70 eyes (10 fruit canes x 5 eyes, 10 renewal spurs x 2 eyes). The vineyard followed local customs.

***Treatment and Experimental Design*:**

The Completely Randomized Block research used a factorial experimental design with two factors: cultivars (2) and treatments (10).

We duplicated each treatment three times with one vine. Alga 600 sea weed extract and Amino Total amino acid supply important nutrients. All applications included wetting agent Triton B.

Spraying occurred four times: at growth start after blooming (April), mid-April after berry setting, mid-May, and two weeks later. Spraying till runoff (2 L/vine for three sprayings) using these treatments:

***Controlled water spray*.**

- Sea weed extract (0.25 g/L): SW0.25, 0.50 g/L: SW0.50, 0.75 g/L:
- SW0.75, with 0.25 g/L amino acid. - SW0.25+AA0.25.
- Sea weed extract (0.50 g/L) + amino acid (0.25 g/L) - SW0.50+AA0.25.
- Sea weed extract (0.75 g/L) + amino acid (0.25 g/L - SW0.75+AA0.25.
- SW0.25+AA0.50 = 0.25 g/L sea weed extract + 0.50 g/L amino acid.
- Combining sea weed extract (0.50 g/L) with amino acid (0.50 g/L) yields SW0.50+AA0.50. Using sea weed extract (0.75 g/L) yields SW0.75+AA0.50.

The evaluation of the two grape cvs.' responses to treatments included the following parameters:

Growth characteristics

At the first week of July, vine growth was measured as follows:

a. Leaf area / vine (cm^2): Five disks were collected from leaves opposite to the first cluster in the shoots of each chosen vine using 1.61cm in diameter and then dried at 70 ºC. Leaf area was calculated according to the formula described by Koller (1972) as follow:-

$$\text{The total area of leaves/plant} = \frac{\text{Dry weight of leaves}}{\text{Dry weight of disks}} \times \text{No. of disks} * \text{disk area.}$$

b. Shoot length (cm).
c. Shoot thick (mm).
d. Number of leaves per shoot.
e. Dormant pruning was weighted at the first of Jan.

Leaf mineral contents:

Percentages of N, P, K and Ca in the petioles of leaf on dry weight basis (Cottenie *et al*., 1982 and Balo *et al*., 1988).

Yield: Vine yield (kg) x Number of vines per Faddan / 1000 = Yield per feddan (tons).

Statistical analysis:

Data analysis using MSTAT-C in a randomised complete block design (RCBD) and mean comparison at 0.05 level (Snedecor and Cochran, 1980; Duncan, 1955).

RESULTS AND DISCUSSION

Impact of seaweed and amino acids on the parameters of vegetative growth:

The analysis of Tables 1-5 indicated that Arra 15 Cv vines exhibited significantly greater values for leaf area, shoot length, and shoot thickness in comparison to Arra 20 Cv vines. In contrast, Arra 20 Cv vines exhibited superior performance in both seasons regarding leaf count per shoot and pruning weight per vine when compared to Arra 15 Cv vines.

Table (1): Effect of seaweed, amino acid and their interaction on average leaf area (cm^2) Arra 15 and 20 grapevine cultivars (2020 & 2021seasons).

Treatments	1st season			2nd season		
	Cultivar		Treat. av.	Cultivar		Treat. av.
	Arra 15	Arra 20		Arra 15	Arra 20	
Control	170.28 d	153.85 f	**162.06 D**	136.10 h	125.64 j	**130.87 H**
SW 0.25 g/L	155.08 f	189.93 b	**172.50 B**	131.07 i	163.30 d	**147.18 D**
SW 0.50 g/L	159.42 e	194.06 a	**176.74 A**	149.76 e	181.91 b	**165.84 A**
SW 0.75 g/L	170.08 d	130.25 i	**150.16 F**	145.96 f	138.26 gh	**142.11 F**
SW 0.25 g/L + AA 0.25 g/L	112.91 k	141.71 h	**127.31 H**	116.28 k	138.07 gh	**127.18 I**
SW 0.50 g/L + AA 0.25 g/L	189.27 b	113.00 k	**151.14 F**	194.86 a	126.50 j	**160.68 B**
SW 0.75 g/L+ AA 0.25 g/L	188.06 b	131.21 i	**159.64 E**	171.16 c	117.38 k	**144.27 E**
SW 0.25 g/L + AA 0.50 g/L	195.81 a	119.99 j	**157.90 E**	197.70 a	117.33 k	**157.52 C**
SW 0.50 g/L + AA 0.50 g/L	162.32 e	173.73 c	**168.03 C**	141.17 g	126.60 j	**133.88 G**
SW 0.75 g/L+ AA 0.50 g/L	145.11 g	147.91 g	**146.51 G**	117.96 k	114.70 k	**116.33 J**
Cultivar av.	**164.83 A**	**149.56 B**		**150.20 A**	**134.97 B**	

Means having same letter(s) within each column did not significantly differ according to Duncan's multiple range test at 5% level. Capital letters are for main effects, while small litters for interaction means SW = seaweed, AA = amino acid

Table (2): Effect of spraying seaweed, amino acid and their interaction on average of shoot length (m) Arra 15 and 20 grapevine cultivars (2020 & 2021 seasons).

Treatments	1st season			2nd season		
	Cultivar		Treat. av.	Cultivar		Treat. av.
	Arra 15	Arra 20		Arra 15	Arra 20	
Control	4.33 ghi	4.05 j	**4.19 E**	5.55 e	4.45 k	**4.70 G**
SW 0.25 g/L	4.33 ghi	4.43 fgh	**4.38 D**	4.70 ij	4.70 ij	**5.00 F**
SW 0.50 g/L	5.00 e	4.50 fgh	**4.75 C**	5.20 f	4.83 hij	**5.02 F**
SW 0.75 g/L	5.30 d	4.10 ij	**4.70 C**	5.70 de	4.67 j	**5.18 E**
SW 0.25 g/L + AA 0.25 g/L	5.50 cd	4.23 ij	**4.86 C**	5.89 c	4.85 hi	**5.37 D**
SW 0.50 g/L + AA 0.25 g/L	5.70 bc	4.50 fgh	**5.10 B**	5.85 cd	4.93 gh	**5.39 D**
SW 0.75 g/L+ AA 0.25 g/L	5.90 ab	4.33 ghi	**5.11 AB**	6.19 b	4.82 hij	**5.51 C**
SW 0.25 g/L + AA 0.50 g/L	5.94 ab	4.64 f	**5.29 A**	6.35 b	5.06 fg	**5.70 B**
SW 0.50 g/L + AA 0.50 g/L	5.80 ab	4.67	**5.24 AB**	6.56 a	5.20 f	**5.88 A**
SW 0.75 g/L+ AA 0.50 g/L	6.00 a	4.54 fg	**5.27 AB**	6.35 b	4.94 gh	**5.65 B**
Cultivar av.	**5.38 A**	**4.40 B**		**5.83 A**	**4.85 B**	

Means having same letter(s) within each column did not significantly differ according to Duncan's multiple range test at 5% level. Capital letters are for main effects, while small litters for interaction means SW = seaweed, AA = amino acid

Table (3): Effect of spraying seaweed, amino acid and their interaction on average leaf number / shoot Arra 15 and 20 grapevine cultivars (2020 & 2021 seasons).

Treatments	1st season			2nd season		
	Cultivar		Treat. av.	Cultivar		Treat. av.
	Arra 15	Arra 20		Arra 15	Arra 20	
Control	78.50 gh	85.67 de	**82.08 G**	82.50 i	96.00 d	**89.25 G**
SW 0.25 g/L	76.50 h	85.33 de	**80.92 G**	88.67 fg	90.67 ef	**89.67 G**
SW 0.50 g/L	78.50 gh	96.67 b	**87.58 E**	90.00 efg	96.67 d	**93.33 E**
SW 0.75 g/L	81.00 fg	88.67 d	**84.83 F**	85.00 h	103.00 c	**94.00 E**
SW 0.25 g/L + AA 0.25 g/L	83.50 ef	86.00 de	**84.75 F**	87.50 g	95.33 d	**91.42 F**
SW 0.50 g/L + AA 0.25 g/L	83.00 ef	107.33 a	**95.17AB**	94.50 d	110.33 c	**102.42 C**
SW 0.75 g/L+ AA 0.25 g/L	92.00 c	94.33 bc	**93.17 BC**	97.00 d	104.33 a	**100.67 D**
SW 0.25 g/L + AA 0.50 g/L	85.50 de	108.00 a	**96.75 A**	92.00 e	118.00 a	**105.00 B**
SW 0.50 g/L + AA 0.50 g/L	85.50 de	96.67 b	**91.08 CD**	90.00 efg	120.33 a	**105.17 B**
SW 0.75 g/L+ AA 0.50 g/L	88.00 d	93.33 c	**90.67 D**	97.00 d	118.67 a	**107.83 A**
Cultivar av.	**83.20 B**	**94.20 A**		**90.42 B**	**105.33 A**	

Means having same letter(s) within each column did not significantly differ according to Duncan's multiple range test at 5% level. Capital letters are for main effects, while small litters for interaction means SW = seaweed, AA = amino acid

Table (4): Effect of spraying seaweed, amino acid and their interaction on average of shoot width (mm) Arra 15 and 20 grapevine cultivars (2020 & 2021seasons).

Treatments	1st season			2nd season		
	Cultivar		Treat. av.	Cultivar		Treat. av.
	Arra 15	Arra 20		Arra 15	Arra 20	
Control	6.80 e	5.30 j	**6.05 F**	7.05 f	5.65 jk	**6.35 E**
SW 0.25 g/L	7.16 d	5.36 j	**6.26 E**	7.36 e	5.47 k	**6.41 E**
SW 0.50 g/L	7.33 c	5.60 i	**6.46 D**	7.62 d	5.83 j	**6.73 D**
SW 0.75 g/L	7.58 b	5.33 j	**6.46 D**	7.80 cd	6.03 i	**6.92 C**
SW 0.25 g/L + AA 0.25 g/L	7.39 c	5.80 h	**6.59 C**	7.68 d	6.20 i	**6.94 BC**
SW 0.50 g/L + AA 0.25 g/L	7.84 a	5.97 g	**6.90 B**	7.96 cd	6.17 i	**7.06 B**
SW 0.75 g/L+ AA 0.25 g/L	7.92 a	5.80 h	**6.86 B**	8.22 b	6.77 g	**7.49 A**
SW 0.25 g/L + AA 0.50 g/L	7.94 a	6.40 f	**7.17 A**	8.50 a	6.73 g	**7.62 A**
SW 0.50 g/L + AA 0.50 g/L	7.85 a	5.97 g	**6.91 B**	8.50 a	6.53 h	**7.52 A**
SW 0.75 g/L+ AA 0.50 g/L	7.85 a	6.36 f	**7.11 A**	8.53 a	6.61 gh	**7.57 A**
Cultivar av.	**7.56 A**	**5.79 B**		**7.92 A**	**6.20 B**	

Means having same alphabetical letter(s) within each column did not significantly differ according to Duncan's multiple range test at 5% level. Capital letters are for main effects, while small litters for interaction means SW = seaweed AA = amino acid

Table (5): Effect of spraying seaweed, amino acid and their interaction on average of pruning weight/vine (kg) Arra 15 and 20 grapevine cultivars (2020 & 2021seasons).

Treatments	1st season			2nd season		
	Cultivar		Treat. av.	Cultivar		Treat. av.
	Arra 15	Arra 20		Arra 15	Arra 20	
Control	7.30 k	10.88 f	**9.09 G**	8.35 g	11.85 d	**10.10 E**
SW 0.25 g/L	7.85 ij	11.20 ef	**9.52 EF**	7.95 h	11.76 d	**9.86 F**
SW 0.50 g/L	7.55 jk	11.28 def	**9.41 F**	8.20 gh	11.87 d	**10.03 EF**
SW 0.75 g/L	7.90 ij	11.73 bcd	**9.81 DE**	8.17 gh	12.93 a	**10.55 D**
SW 0.25 g/L + AA 0.25 g/L	7.63 ijk	12.17 ab	**9.90 CD**	8.11 gh	12.82 a	**10.46 D**
SW 0.50 g/L + AA 0.25 g/L	8.05 i	11.88 bc	**9.97 CD**	9.04 f	12.63 abc	**10.83 C**
SW 0.75 g/L+ AA 0.25 g/L	9.36 g	11.56 cde	**10.46 AB**	9.70 e	12.48 bc	**11.09 AB**
SW 0.25 g/L + AA 0.50 g/L	8.87 h	11.46 cde	**10.16 BC**	9.54 e	12.40 c	**10.97 BC**
SW 0.50 g/L + AA 0.50 g/L	8.54 h	12.46 a	**10.50 A**	9.75 e	12.83 a	**11.29 A**
SW 0.75 g/L+ AA 0.50 g/L	8.69 h	12.37 a	**10.53 A**	8.98 f	12.79 ab	**10.88 BC**
Cultivar av.	**8.17 B**	**11.70 A**		**٨.٧٨ B**	**12.44 A**	

Means having same letter(s) within each column did not significantly differ according to Duncan's multiple range test at 5% level. Capital letters are for main effects, while small litters for interaction means SW = seaweed, AA = amino acid

Vegetative growth characteristics responded substantially to interventions involving amino acids and seaweed for vines, according to the data. The treatments SW 0, 50 gave the highest values of leaf area (176.74 and 165.84 cm^2) in the first and second seasons, respectively. Treated vines with SW 25 + AA 0,50 treatment recorded the highest values of shoot length (5.29 m) in the first season and SW 0,50 + AA 0,50 treatment (5.88 m) in the second one. Treated vines with SW 0, 25 + AA 0, 50 treatment gave the highest values of shoot thick (7.17 and 7.62 mm) in the two seasons. Treatment of SW 0, 25 + AA 0, 50 in the first season as will as SW 0, 75 + AA 0, 50 treatment in the second one gave the highest values of leaf number per shoot (96.75 and 107.83 respectively).the highest Pruning weight per vine obtained with SW 0, 50 + AA 0, 50 treatment in the two seasons (10.50 and 11.29 kg respectively) without significant differences with SW 0, 75 + AA 0, 50 treatment in the first season. The untreated trees had the minimum values of vegetative growth characteristics. Similar trend was noticed during both seasons.

The interaction between cultivars × treatments had significant effect on vegetative growth characteristics. While, the interaction between Arra 15 Cv with SW 0,25, 0,50 and 0,75 + AA 0,50 treatments recorded significantly the highest values of leaf area, shoot length and shoot thick but the interaction between Arra 20 Cv with SW 0,25, 0,50 and 0,75 + AA 0,50 treatments recorded the least values in leaf number / shoot and pruning weight/vine in both seasons.

The results are in harmony with those obtained on grapevines by Seleem- Basma and Abd El- Hameed (2008) , El-Saman (2010), Ahmed, *et al*. (2012) , Abdelaal, *et al*. (2013), Mohamed, *et al*, (2013), Popescu and Popescu (2014), Mohamed (2014), Aly-Samar (2016).

Effect of seaweed and amino acids on leaf mineral contents:

Tables 6 to 9 revealed significant varietal differences in leaf mineral contents, except for potassium (K) percentage, across both seasons. Arra 15 Cv vines exhibited higher leaf nitrogen (N) and phosphorus (P) percentages, while Arra 20 Cv vines showed higher leaf calcium content.

The impact of treatments on leaf mineral content was generally positive compared to the control. The highest leaf nitrogen percentage occurred with SW 0,75 + AA 0,25 treatment (2.71% in the first season and 2.88% in the second season). Leaf phosphorus content was highest with SW 0,25 treatment (0.318% and 0.298% in the two seasons) and lowest with SW 0,50 + AA 0,50 treatment (0.155% and 0.130% in the two seasons).

SW 0,75 + AA 0,25 treatment improved leaf potassium and calcium percentages (2.46% + 2.70% and 0.54% + 0.57%, respectively) compared to

Table (6): Effect of spraying seaweed, amino acid and their interaction on average of nitrogen percentage in leaves Arra 15 and 20 grapevine cultivars (2020 & 2021seasons).

Treatments	1st season			2nd season		
	Cultivar		Treat. av.	Cultivar		Treat. av.
	Arra 15	Arra 20		Arra 15	Arra 20	
Control	2.44 fg	1.90 k	**2.17 F**	2.68 bcd	2.20 g	**2.44 C**
SW 0.25 g/L	2.54 ef	1.97 k	**2.25 EF**	2.73 bc	2.27 fg	**2.50 BC**
SW 0.50 g/L	2.54 ef	2.00 k	**2.27 EF**	2.68 bcd	2.17 g	**2.42 C**
SW 0.75 g/L	2.74 bcd	2.20 hij	**2.47 CD**	2.83 b	2.40 ef	**2.62 B**
SW 0.25 g/L + AA 0.25 g/L	2.79 bc	2.20ij	**2.50 BC**	3.084 a	2.55 cde	**2.82 A**
SW 0.50 g/L + AA 0.25 g/L	2.59 def	2.03 jk	**2.31 E**	3.03 a	2.50 de	**2.77 A**
SW 0.75 g/L+ AA 0.25 g/L	2.99 a	2.43 fg	**2.71 A**	3.03 a	2.53 de	**2.78 A**
SW 0.25 g/L + AA 0.50 g/L	2.69 cde	2.23 hi	**2.46 CD**	3.13 a	2.63 cd	**2.88 A**
SW 0.50 g/L + AA 0.50 g/L	2.64 cde	2.07 ijk	**2.35 DE**	3.03 a	2.50 de	**2.77 A**
SW 0.75 g/L+ AA 0.50 g/L	2.89 ab	2.33 gh	**2.61 AB**	3.034 a	2.50 de	**2.77 A**
Cultivar av.	**2.69 A**	**2.14 B**		**2.93 A**	**2.43 B**	

Means having same letter(s) within each column did not significantly differ according to Duncan's multiple range test at 5% level. Capital letters are for main effects, while small litters for interaction means SW = seaweed , AA = amino acid

Table (7): Effect of spraying seaweed, amino acid spraying and their interaction on average of phosphorus percentage in leaves of Arra 15 and 20 grapevine cultivars (2020 & 2021seasons).

Treatments	1st season			2nd season		
	Cultivar		Treat. av.	Cultivar		Treat. av.
	Arra 15	Arra 20		Arra 15	Arra 20	
Control	0.270 e	0.130 hi	**0.200 E**	0.253 c	0.147 f	**0.200 E**
SW 0.25 g/L	0.397 a	0.240 f	**0.318 A**	0.370 a	0.227 d	**0.298 A**
SW 0.50 g/L	0.357 b	0.123 hi	**0.240 C**	0.370 a	0.150 f	**0.260 B**
SW 0.75 g/L	0.277 e	0.163 g	**0.220 D**	0.253 c	0.123 hi	**0.188 F**
SW 0.25 g/L + AA 0.25 g/L	0.303 d	0.160 g	**0.232 CD**	0.350 b	0.127 hi	**0.238 C**
SW 0.50 g/L + AA 0.25 g/L	0.293 de	0.157 g	**0.225 CD**	0.247 c	0.130 gh	**0.188 F**
SW 0.75 g/L+ AA 0.25 g/L	0.333 cd	0.110 i	**0.222 D**	0.337 b	0.113 i	**0.225 D**
SW 0.25 g/L + AA 0.50 g/L	0.273 e	0.330 c	**0.302 B**	0.207 e	0.370 a	**0.288 A**
SW 0.50 g/L + AA 0.50 g/L	0.147 gh	0.163 g	**0.155 F**	0.143 fg	0.117 hi	**0.130 G**
SW 0.75 g/L+ AA 0.50 g/L	0.270 e	0.127 hi	**0.198 E**	0.253 c	0.143 fg	**0.198 EF**
Cultivar av.	**0.292 A**	**0.170 B**		**0.278 A**	**0.165 B**	

Means having same letter(s) within each column did not significantly differ according to Duncan's multiple range test at 5% level. Capital letters are for main effects, while small litters for interaction means, SW = seaweed, AA = amino acid

Table (8): Effect of spraying seaweed, amino acid spraying and their interaction on average of potassium percentage in leaves of Arra 15 and 20 grapevine cultivars (2020 & 2021seasons).

Treatments	1st season			2nd season		
	Cultivar		Treat. av.	Cultivar		Treat. av.
	Arra 15	Arra 20		Arra 15	Arra 20	
Control	1.80 i	1.79 i	**1.79 G**	2.09 fg	2.07 gh	**2.08 F**
SW 0.25 g/L	2.01 g	2.02 fg	**2.01 E**	2.16 e	2.15 ef	**2.15 E**
SW 0.50 g/L	2.01 g	2.03 fg	**2.02 E**	2.17 e	2.17 e	**2.17 E**
SW 0.75 g/L	2.24 bcd	2.22 cd	**2.23 BC**	2.46 d	2.44 d	**2.45 CD**
SW 0.25 g/L + AA 0.25 g/L	2.06 efg	2.08 ef	**2.07 D**	2.18e	2.16 e	**2.17 E**
SW 0.50 g/L + AA 0.25 g/L	2.08ef	2.09 e	**2.08 D**	2.47 b	2.45 d	**2.46 C**
SW 0.75 g/L+ AA 0.25 g/L	2.45 a	2.48 a	**2.46 A**	2.71 a	2.70 a	**2.70 A**
SW 0.25 g/L + AA 0.50 g/L	2.19 d	2.21 cd	**2.20 C**	2.42 d	2.40 d	**2.41 D**
SW 0.50 g/L + AA 0.50 g/L	2.25 bc	2.28 b	**2.26 B**	2.63 b	2.55 c	**2.60 B**
SW 0.75 g/L+ AA 0.50 g/L	1.86 h	1.88 h	**1.87 F**	2.02 h	2.04gh	**2.03 G**
Cultivar av.	**2.09 A**	**2.11 A**		**2.33 A**	**2.31 A**	

Means having same letter(s) within each column did not significantly differ according to Duncan's multiple range test at 5% level. Capital letters are for main effects, while small litters for interaction means SW = seaweed, AA = amino acid

Table (9): Effect of spraying seaweed, amino acid spraying and their interaction on average of calcium percentage in leaves of Arra 15 and 20 grapevine cultivars (2020 & 2021seasons).

Treatments	1st season			2nd season		
	Cultivar		Treat. av.	Cultivar		Treat. av.
	Arra 15	Arra 20		Arra 15	Arra 20	
Control	0.49gh	0.51 fg	**0.50 E**	0.50 h	0.52 gh	**0.51 D**
SW 0.25 g/L	0.45j	0.47 ig	**0.46 F**	0.53 fg	0.54 c-f	**0.53 C**
SW 0.50 g/L	0.52 c-f	0.52 ef	**0.52 D**	0.52 fg	0.54 def	**0.53 C**
SW 0.75 g/L	0.52 c-f	0.54 b-e	**0.53 CD**	0.52 fg	0.54 def	**0.53 C**
SW 0.25 g/L + AA 0.25 g/L	0.53 cde	0.54 bc	**0.53 BC**	0.54 c-f	0.56 ab	**0.55 B**
SW 0.50 g/L + AA 0.25 g/L	0.54 bcd	0.56 a	**0.55 A**	0.55 b-e	0.57 ab	**0.56 AB**
SW 0.75 g/L+ AA 0.25 g/L	0.54 bcd	0.55 ab	**0.54 AB**	0.56 ab	0.58 a	**0.57 A**
SW 0.25 g/L + AA 0.50 g/L	0.52 def	0.53 cde	**0.52CD**	0.55bcd	0.56 bc	**0.55 B**
SW 0.50 g/L + AA 0.50 g/L	0.45 j	0.47 ij	**0.46 F**	0.55 b-e	0.57 ab	**0.56 AB**
SW 0.75 g/L+ AA 0.50 g/L	0.48 hi	0.50 gh	**0.49 E**	0.51 gh	0.53 efg	**0.52 CD**
Cultivar av.	**0.50 B**	**0.52 A**		**0.53B**	**0.55 A**	

Means having same alphabetical letter(s) within each column did not significantly differ according to Duncan's multiple range test at 5% level. Capital letters are for main effects, while small litters for interaction means SW = seaweed, AA = amino acid

SW 0,25 treatment in the first season and control treatment in the second season. Untreated vines had the minimum values in both seasons.

The interaction between cultivars and treatments significantly influenced leaf nitrogen and phosphorus percentages. Arra 15 Cv × SW 0,75 + AA 0,25 treatment resulted in the highest leaf nitrogen percentage in the first season, and SW 0,25 + AA 0,50 treatment had the highest values in the second season. Arra 20 Cv consistently exhibited lower values. Leaf potassium content was highest with SW 0,75 + AA 0,25 treatment in both seasons, while Arra 15 Cv × SW 0,50 + AA 0,25 treatment recorded the highest leaf calcium percentage in the first season, and SW 0,75 + AA 0,25 treatment had the highest values in the second season.

These findings align with previous studies on grapevines by Amin (2007), El-Saman (2010), Ahmed *et al*. (2011), Gad El-Kareem and Abd El-Rahman (2013), Mohamed et al. (2013), Mohamed (2014), and Carvalho *et al.* (2019).

Effect of seaweed and amino acids on yield:

Table 10 illustrates the impact of seaweed and amino acid spraying on yield per feddan during the 2020 and 2021 growing seasons. Arra 15 Cv consistently outperformed Arra 20 Cv in yield per feddan, with values of 9.55 and 9.62 tons/feddan in the first season, and 8.89 and 9.26 tons/feddan in the second season, respectively.

All foliar spray treatments significantly increased yield compared to the control in both growing seasons. SW 0.50 + AA 0.25 treatment resulted in the highest yield per feddan (9.79 tons/feddan) in the first season. In the second season, SW 0.50, SW 0.25 + AA 0.25, and SW 0.75 + AA 0.50 treatments yielded the highest values (9.92, 9.91, and 9.89 tons/feddan, respectively), with no significant differences among them.

The interaction between treatments and cultivars revealed the highest yield per feddan under SW 0.25 + AA 0.25 and SW 0.50 + AA 0.25 treatments with Arra 15 Cv (10.10 and 10.12 tons/feddan, respectively) in the first season. In the second season, SW 0.75 + AA 0.50 treatment with Arra 15 Cv resulted in the highest yield per feddan (10.20 tons/feddan). Control treatment with Arra 15 Cv recorded the lowest values (8.59 and 8.37 tons/feddan) in both seasons.

These findings align with previous studies on grapevines conducted by Seleem-Basma and Abd El-Hameed (2008), El-Saman (2010), Kok et al. (2010), Wassel *et al.* (2011), Datir *et al*. (2012), Mohamed (2014), Carvalho *et al.* (2019), Ahmed (2022), and Masoud *et al*. (2023).

Table (10): Effect of spraying seaweed, amino acid and their interaction on average of yield per feddan (ton) Arra 15 and 20 grapevine cultivars (2020 & 2021 seasons).

Treatments	1st season			2nd season		
	Cultivar		Treat. av.	Cultivar		Treat. av.
	Arra 15	Arra 20		Arra 15	Arra 20	
Control	9.14 de	8.59 g	**8.87 D**	8.98 jk	8.37 m	**8.68 G**
SW 0.25 g/L	9.13 de	8.73 fg	**8.93 CD**	9.35 h	8.72 l	**9.04 F**
SW 0.50 g/L	9.37 cd	8.64 g	**9.00 CD**	10.01 b	9.82 d	**9.92 A**
SW 0.75 g/L	9.52 c	9.37 cd	**9.44 B**	9.93 bc	9.68 e	**9.81 B**
SW 0.25 g/L + AA 0.25 g/L	10.10 a	8.83 fg	**9.46 B**	9.98 b	9.85 cd	**9.91 A**
SW 0.50 g/L + AA 0.25 g/L	10.12 a	9.46 c	**9.79 A**	9.77 de	9.46 g	**9.61 C**
SW 0.75 g/L+ AA 0.25 g/L	9.81 b	8.88 efg	**9.35 B**	9.69 e	9.04 j	**9.37 D**
SW 0.25 g/L + AA 0.50 g/L	9.52 c	8.66 g	**9.09 CD**	9.36 h	8.93 k	**9.14 E**
SW 0.50 g/L + AA 0.50 g/L	8.98 ef	8.78 fg	**8.88 D**	8.89 k	9.18 i	**9.04 F**
SW 0.75 g/L+ AA 0.50 g/L	9.81 b	9.00 ef	**9.40 B**	10.20 a	9.58 f	**9.89 A**
Cultivar av.	**9.55 A**	**8.89 B**		**9.62 A**	**9.26 B**	

Means having same alphabetical letter(s) within each column did not significantly differ according to Duncan's multiple range test at 5% level. Capital letters are for main effects, while small litters for interaction means SW = seaweed AA = amino acid

Generally, Arra 15 Cv vines exhibited superiority in certain tested attributes, while Arra 20 Cv vines demonstrated higher significance in other parameters, emphasizing the impact of varietal differences rooted in genetic composition. The genetic makeup of grape cultivars plays a pivotal role in their response to environmental factors, influencing developmental processes and their ability to harness available growth factors (Zuo *et al.,* 2007).

The foliar application of seaweed and amino acids had a pronounced positive effect on various aspects of vegetative growth, leaf mineral contents, cluster properties, and ultimately increased yield per feddan. The observed improvements in growth and fruiting could be attributed to the essential role of seaweed and amino acids in enhancing plant tolerance to both biotic and abiotic stresses.

Plant responses to stresses, particularly heat stress, are intricate and often intertwined with other stress factors, such as drought (McKersie and Lesheim, 2013). The complexity of plant responses involves changes at the transcriptome, cellular, and physiological levels. Moreover, the presence of abiotic stress can impact susceptibility to biotic pests or pathogens, and vice versa. Biotic stress, arising from living organisms like fungi, bacteria, viruses, and pests, presents an additional challenge to global agricultural productivity (Newton *et al.,* 2011).

Amino acids, as organic nitrogenous compounds, play a crucial role in protein synthesis and various metabolic pathways, promoting plant growth (Coruzzi and Last, 2000; Davies, 1982). They have been reported to enhance drought tolerance by maintaining water balance, photosynthetic efficiency, and xylem vessel structure under stress conditions (Hattori *et al.,* 2005).

Similarly, seaweed extracts, rich in diverse compounds such as polysaccharides, fatty acids, vitamins, phytohormones, and minerals, have shown positive effects on plant tolerance to abiotic stresses, including heat tolerance (Zhang and Ervin, 2008). Seaweed-based biostimulants have been recognized for their role in improving plant growth, fruit quality, and stress tolerance. They contribute to seed germination, root and shoot elongation, nutrient uptake, resistance to environmental stresses, and remediation of soil pollutants (Babgohari *et al.,* 2015; Nabti *et al.,* 2017). The application of seaweed extracts has demonstrated positive impacts on the nutritional value of fruits, enhancing the accumulation of minerals, antioxidants, and essential amino acids (Frioni *et al.,* 2018; Stasio *et al.,* 2018; Carvalho *et al.,* 2019).

In conclusion, the positive outcomes observed in this study align with previous research on grapevines and underscore the potential of seaweed and amino acids in improving viticultural practices, enhancing stress tolerance, and contributing to sustainable agricultural systems. Understanding the mechanisms by which these biostimulants act on plants will be essential for further advancements in their application.

REFERENCES

Abdelaal, A. M. K; Ahmed, F. F. and Abd El-aal, E. E. H. (2013): The stimulative effects of using some nutrients and antioxidants on growth, nutritional status and yield of Thompson seedless grapes. Hort. Sci. J. Suez Canal Univ. Vol. 1: 322-329.

Abd El-Aaal, E. E. H. A. (2012): The synergistic effects of using some nutrients as well as antioxidant substances on growth, nutritional status and productivity of Thompson seedless grapevines grown under Sohag region. Ph. D. Thesis Fac. of Agric. Sohag Univ., Egypt.

Abd El-Wahab, A. M.(2007). Effect of some sodium azide and algae extract treatments an vegetative growth, yield and Berries quality of early superior grapevine Cv. M.Sc. Thesis Fac. of Agric., Minia Univ. Egypt.

Ahmed A. S. (2022). Evaluation of Foliar Spray with Some Amino Acids in Comparison to Some Antioxidants on Vegetative Growth and Cluster Quality of Red Globe Grape Cultivar. New Valley J. of Agri. Sci. 2 (6): 410-422.

Ahmed, F. F., Abdelaal, A. M. K. and Abd El-aal, E. E. H. A. (2012): Promoting productivity of Thompson seedless grapevines by application of some antioxidants and nutrients. Minia J. Agric. Res. & Develop. (32)3: 527-542.

Ahmed, F. F.; Abdelaal, A. M. K.; Abdelaziz, F. H. and El- Kady- Hanaan, E. M. (2011): Productivity of Thompson seedless grapevines as influenced by application of some antioxidants and nutrient treatments. Minia J. Agric Res. & develop. 31(2): 219- 232.

Amin, M. M. A. (2007): Response of Red Roomy grapevines to application of amino acids and some micronutrients. M.Sc. Thesis Fac. Agric. Minia Univ. Egypt.

Amin, A.A., Fatma, A.E., Gharib, M., El-Awadi, M. & Rashad, S.M. (2011). Physiological response of onion plants to foliar application of putrescine and glutamine. *Scientia Horticulture*, *129*: 353-360.

Aly- Samar, S. H. (2016): Influence of reducing mineral nitrogen fertilizer partially by using plant compost enriched with Spirulina platensis algae on fruiting of Flame seedless grapevines. M. Sc. Thesis Fac. of Agric. Minia Univ. Egypt.

Babgohari Z., P. Rathor and B. Prithiviraj (2015). Seaweed extracts as biostimulants in horticulture. Scientia Horti. 196, 30: 39-48.

Balo, E.; Prilesszky, G.; Happ, I.; Kaholami, M, and Vega. L.(1988): Soil improvement and the use of leaf analysisfor forecasting nutrient requirements of grapes. PotashReview (Subject 9, 2nd suite, No. 61: 1-5).

Carvalho R. P., M. Pasqual, H. R. O. Silveira, P. C.Melo, D. F. A. Bispo, R. R. Laredo and L. A. S. Lima (2019). BNiágara Rosada table grape cultivated with seaweed extracts: physiological, nutritional, and yielding behavior. J. Appli. Phyc. (https://doi.org/10.1007/s10811-018-1724-7).

Coruzzi, G. and R. Last (2000). Amino acids. in biochemistry and molecular biology of plants. b. buchanan w. gruissem r. jones (eds.). Amer. Soc. Plant Biol., Rockville, MD, USA. 358-410.

Cottenie,A.; Verloo, M.; Velghe, M. and Camerlynck, R. (1982): Chemical Analysis of Plant and Soil. Ghent,Belgium, Laboratory of Analytical and Agro-chemistry. State Univ. pp. 200-210.

Davies, D. D. (1982): Physiological aspects protein tumour Encycl. Plant physiol. New series (nucleic acids and proteins, structure, biochemistry and physiology of proteins). Springer Verla, Berlin, New York, pp. 190- 228.

Datir, R. B.; B. J. Apparao and S. L. Laware. (2012). Application of amino acids chelated micronutrients for enhancing growth and productivity in chili. J .Plant Sci. Feed. 2 (7):100-105.

Duncan BD (1955) Multiple ranges and multiple F-test. Biometrics 11: 1-42

El-Saman, A. Y. E. (2010): Response of Flame seedless grapevines growing under El-Mataana conditions to spraying seaweed extract. M.Sc. Thesis Fac. of Agric. Minia Univ. Egypt.

Frioni T, P. Sabbatini, S. Tombesi, J. Norrie, S. Poni, M. Gatti and A. Palliotti (2018). Effects of a biostimulant derived from the brown seaweed Ascophyllum nodosum on ripening dynamics and fruit quality of grapevines. Scientia Hort. 232, 17: 97-106.

Gad El- Kareem, M. R. and Abd El- Rahman, M. M. A. (2013): Response of Ruby seedless grapevines to foliar application of seaweed extract, salicylic acid and Roselle extract. Hort. Sci. J. of Suez Canal Univ. vol. (1): 299-

Ghasemi, S., Khoshgftarmanesh, A., Hadadzadeh, H. & Afyuni, M. (2013). Synthesis, characterization and theoretical and experimental investigations (11)–amino acid complexes as ecofriendly plant growth promoters and highly bioavailable sources of zinc. *J. Plant Growth Regul. 32*: 315-323.

Hattori, T. I. S.; H. Araki, S. Mortia, M. Luxova and A. Lux (2005). Application of silicon enhanced drought tolerance in Sorghum bicolor. Physio. Plantarum, 123:459-466.

M.A.L.R. (2020). Ministry of Agriculture and Land Reclamation Publishes. Economic Affairs Sector.

Kok D., E. Bal, S. Celik, C. Ozer and A. Karauz (2010). The influences of different seaweed doses on table quality characteristics of Cv. Trakya Ilkeren (*Vitis vinifera* L.). Bulgarian J. of Agri. Sci., 16 (4) 2010, 429-435.

Koller, H. R. (1972). Leaf area-Leaf weight relationship in the soybean canopy. Crop Sci. 12: 180-183.

Kowalczyk, K. & Zielon, T. (2008). Effect of Aminoplant and Asahi on yield and quality of lettuce grown on Rockwool. Book of Abstracts of the Conference of bio stimulators in modern agriculture, Warsaw, Poland, 40.

Kubota, N.; Matthew, M.A.; Takahugl, T. and Kliewer, W.M. (2000): Effect of garlic preparations, calcium and hydrogen cyanamides on bud break of grapevines grown in greenhouse. American J. of Enology and Viticulture (51): 409-414.

Kubota, N.; Yamane, Y.; Toriu, K.; Kawasu, K. and Higuchi, T. (1999): Identification of active substances in garlic responsible for breaking bud dormancy in grapevines. J. Jap. Soc. Hortic. Sci., 68: 1111-1117.

McKersie, B. D.; Lesheim, Y. (2013). Stress and Stress Coping in Cultivated Plants; Springer: Berlin, Germany.

Masoud Alaa A.B.; Aiman K.A. Mohamed; Iman A. Abou Zaid and Mohamed H. Abd El-Hakim (2023). Effect of Foliar Application with Some Certain Natural and Chemical Compounds on Yield and Cluster Weight of Ruby Seedless Grape Cultivar. Assiut J. Agric. Sci. 54 (1) :198-212.

Mohamed A. R. M. A., Abdel-Aziz F. H., Mohamed M. A.Gobara A. (2013). Effect on foliar application of Sida Compound fertilizer on growth, yield, and fruit chemical composition of ‘Early Superior’ grapevine. J. of Horti. Res. 21(2): 53–57. DOI10.2478/johr-2013-0021.

Mohamed, T. M. M. (2014): Relation of fruiting in Superior grapevines with spraying salicylic acids and boron. M. Sc. Thesis Fac. of Agric. Minia Univ. Egypt.

Nabti E., B. Jha and A. Hartmann (2017). Impact of seaweeds on agricultural crop production as biofertilizer. Int. J. Environ. Sci. Technol., 14:1119–1134.

Newton AC, Johnson SN and Gregory PJ. (2011). Implications of climate change for diseases, crop yields and food security. Euphytica. 179:3-18.

Panda D, Pramanik K. and Nayak B. R. (2012). Use of seaweed extracts as plant growth regulators for sustainable agriculture. Inter. J. of Bio-resource and Stress Management 3(3): 404-411.

Peter, K.V. (1999). Information on turmeric and ginger. Indian species, 6 (2, 3): 12-14.

Popescu G. C. and Popescu M. (2014). Effect of the brown alga ascophyllum nodosum as biofertilizer on vegetative growth in grapevine (*Vitis vinifera* L.). Current Trends in Natural Sci. 3:61 – 67.

Saleh, M. M. S., El-Ashry, S. and Gomaa, A. M. (2006). Performance of thompson seedless grapevine as influenced by organic fertilizer, humic acid and biofertilizer under sandy soil conditions. Res. J. Agri.and Biolo. Sci., 2(6): 467-471.

Seleem - Basma, M and Abd El- Hameed, H. M. (2008): Effect of the stimulant aminoquelant- Ca on yield and berries quality of Thompson seedless grapevines. Minia. J. of Agric. Res. & Develop. (28) 1:13 - 21.

Snedecor, G., and Cochran, W. G. (1980). Statical methods. Iowa State Univ. Press, Ames, IA.

Stasio E. D., M. James V. Oosten, S. Silletti., G. Raimondi, E. dell'Aversana., P. Carillo and A. Maggio (2018). Ascophyllum nodosum-based algal extracts act as enhancers of growth, fruit quality, and adaptation to stress in salinized tomato plants. J. Appli. Phyc. 30:2675–2686.

Wassel, A. M. M.; Ahmed, F. F.; El- Mamlouk, E. A. H. and Fekry, W. M. E. (2011): Reliefing clusters looseness and shot berries in Red Roomy grapevines by using some antioxidants. Minia J. of Agric. Res. & Develop. (31) 2:205- 217.

Zhang X and E. H. Ervin (2008) Impact of seaweed extract-based cytokinins and zeatin riboside on creeping bentgrass heat tolerance. Crop Sci 48:364–370.

Zuo Y., L. Ren, F. Zhang and R. F. Jiang. (2007). Bicarbonate concentration as affected by soil water content controls iron nutrition of peanut plants in a calcareous soil. Plant Phys. and Bio. , 45: 357-364.

تأثير الرش الورقى بمستخلص الطحالب البحرية والأحماض الأمينية على نمو وإثمار العنب صنفى آرا ١٥ وآرا ٢٠

السيد مصطفى حسن على قاعود* - أسامة أحمد إبراهيم زقزوق**
*قسم البساتين – كلية الزراعة بالإسماعيلية -جامعة قناة السويس- مصر
** قسم الإنتاج النياتى – كلية التكنولوجيا والتنمية -جامعة الزقازيق- مصر

أجريت هذه الدراسة خلال موسمي ٢٠٢٠ و٢٠٢١ على العنب صنفي آرا ١٥ و٢٠ في تربة رملية تحت نظام الري بالتنقيط في مزرعة تبارك، محافظة الإسماعيلية، مصر. صُممت التجربة كتجربة عاملية فى قطاعات كاملة العشوائية فى ثلاث مكررات لتقييم تأثير الرش الورقي من المعاملات المختلفة بمستويات من الاحماض الامينية ومستخلص الطحالب البحرية على المحصول والجودة والمحتوي الكيماوي لأوراق أصناف العنب آرا ١٥ و٢٠. تم الرش الورقي للكرمات أربع مرات عند بداية النمو بعد الإزهار (الأول من أبريل)، وبعد العقد مباشرة (منتصف أبريل) ثم بعد شهر واحد (منتصف مايو) ثم بعد أسبوعين (آخر مايو).

أوضحت النتائج أن الرش الورقى لكرمات العنب آرا ١٥ و٢٠ بمستخلص الطحالب البحرية والأحماض الأمينية أدى ألى تحسين صفات النمو وكذلك زيادة محصول الفدان للكرمات. بالمقارنة بمعاملة المقارنة.

التوصية: من نتائج هذا البحث ، نوصى برش كرمات العنب بمستخلص الطحالب البحرية والأحماض الأمينية ٤ مرات فى بداية النموأول أبريل ، وبعد عقد الثمار وسط أبريل ، وبعد شهر وسط مايو، ثم بعد اسبوعين آخر مايو، لتحسين صفات النمو الخضرى وزيادة محصول الثمار للفدان.