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EVALUATION OF THE PRODUCTIVITY AND QUALITY OF ONION BULB GROWN IN SANDY SOIL USING SOME SAFE MATERIALS

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ABSTRACT: A field experiment was conducted at a private farm in the El Saleheya El Gadida district of the Ismailia Governorate (Egypt) over the course of two consecutive winter seasons in 2023/2024 and 2024/2025 to assess the growth and productivity of onion plants Cv. Giza 20 under two stimulate (salicylic (SA) and ascorbic acids (AsA) at 100, 150, and 200 ppm for each) in addition to the control treatment (water spraying) under sandy soil conditions and a drip irrigation system.

The results showed that ,foliar spraying with 150 ppm of AsA increased plant height , number of leaves per plant and vitamin C in the bulbs at harvest time, while foliar spraying with 200 ppm of SA enhanced the neck diameter, bulb diameter, and bulbing ratio, the dry weight of the leaves, bulbs, and dry weight of the plant, the concentrations of pigments in leaf tissues, the total absorption of nitrogen, phosphorus and potassium by the onion plant after 135 days of transplanting, which also led to an increase in the exportable and marketable yield, the total yield, the average bulb weight, and the quality of the bulbs, including total soluble solids, dry matter percentage, and the pungency (pyruvic acid) in bulbs.

Key words: Onion, salicylic acid, ascorbic acid, growth and yield

INTRODUCTION

Onion (*Allium cepa* L.) which belongs to family Alliaceae is one of the commercial vegetables and spice crops in Egypt, not only for local consumption but also for exportation. It considered a high cash value crop for Egyptian farmers. This is because the international market demands on the Egyptian dry, fresh and processed onions. The total area devoted for production in 2024 in Egypt, was 333.000 feddan, with an average 15.450 ton/feddan according to **Agriculture Economic Bulletin (2024**), Ministry of Agriculture and reclaimed soil , Cairo, Egypt.

There is a hard direction in these days to produce clean vegetable crops and decrease pollution with high yield and good quality product by reduce the using of chemical fertilizers, especially mineral nitrogen fertilizers which have a bad effect on the human and animal health, as well as most of these fertilizers elements are either fixed in the soil or leached to pollute the environment.

Recently, a great deal of attention has been focused on the use of safe, natural antioxidants such as salicylic and ascorbic acid that have the ability to reduce free radicals and thus form a protective shield around plant cells, thus improving the plant's resistance to environmental conditions and thus increasing productivity **(Alscher *et al*., 1997)**. SA's correct framework may provide protection against several forms of environmental stress. It has a significant role in controlling the growth and development of plants (**Szepesi 2006**). Salicylic acid (SA) is also considered an essential phytohormone that plays a role in biotic stress

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and pathogenesis response. Besides that function, recent studies have shown that SA is also involved in signaling a biotic stress responses **Hara *et al*. (2012**).

In this regard, spraying onion plants with SA had significantly increased plant growth, leaf pigments, productivity and bulb quality (**Abd Elwahed, 2016, Al-Khafagi, *et al*., 2016; Moustafa *et al*., 2016; Ali, 2017, Sathiyamurth, *et al*. 2017; Semida, *et al*., 2017; Nangare, *et al*., 2018; Shelke, *et al*., 2018; Chattoo, *et al*., 2020; Indhumathi *et al*., 2024** and **Pathak *et al*., 2025**).

Water-soluble ascorbic acid reduced oxidative free radicals and plants can defend themselves against stresses thanks to the non-enzymatic compound ascorbic acid (**Shafiq *et al*., 2014**). In addition ascorbic acid is present in all live plant cells, but concentrations are usually highest in the flowers, leaves, and other parts of the plant that are actively growing (**Smirnoff *et al*., 2001**). Often dispersed throughout the cytoplasm of the plant. Furthermore, plants that produce little ascorbate are more susceptible to environmental stressors, which can impair their capacity to develop and expand (**Ahmad *et al*., 2014**).

Treated plants with ascorbic acid (AsA) as foliar spray had significant effect on vegetative growth, yield and its components as well as bulb quality (**Seif El-Yazal 2007; Osman and Tolpa, 2009,** on onion **; Shalaby and El-Ramady, 2014; Ali 2017** on garlic**; Abd El-Nabi *et al*., 2021; Yadav *et al*., 2023** and **Abdel-Wahab *et al*., 2024** on onion).

This work aims to study the effect of foliar spraying with some safe substances such as salicylic and ascorbic acid and their effects on the growth and productivity of onion plants under sandy soil conditions.

MATERIALS AND METHODS

A field experiment was carried out during the two successive winter seasons of 2023/2024 and 2024/2025 at a private Farm in El Saleheya El Gadida district, Ismailia Governorate (Egypt), to evaluation the growth and productivity of onion plants Cv. Giza 20 under spraying with salicylic and ascorbic acid in sandy soil conditions and drip irrigation system. The physical and chemical properties of the experimental soil are presented in Table A

Table 1. The physical and chemical properties of the experimental soil in 2023/2024 and 2024/2025 seasons

Soil property	1st season	2nd season
Physical properties		
Clay (%)	1.91	1.82
Silt (%)	3.69	4.81
Sand (%)	94.4	93.37
Texture	Sandy	Sandy
Chemical properties		
E.C. (mmhos/cm)*	2.19	2.01
pH**	7.98	8.01
Organic matter (%)	0.29	0.32
Available N (ppm)	4.18	4.37
Available P_2O_5 ppm	3.12	3.36
Available K_2O ppm	10.57	10.18

Samples of the soil were obtained from 25 cm soil surface.

This experiment was included seven treatments as follows:

1.Control (sprayed with water)
2. Salicylic acid (100 ppm)
3. Salicylic acid (150 ppm)
4. Salicylic acid (200 ppm)
5. Ascorbic acid (100 mg/ l)
6. Ascorbic acid (150 mg/ l)
7. Ascorbic acid (200 mg/ l)

These treatments were arranged in a randomized complete block design system in three replicates.

Seeds of onion were sown in nursery on October 20th and 23rd in 2023 and 2024 seasons, respectively and transplanted at 10 cm apart on both sides of the dripper line in December 15th and 17th in both seasons, respectively. All experimental unit area was 10.8 m^2, and it contained three dripper lines with 6 m length and 60 cm in width. One dripper line was used for the samples to measure vegetative growth and the other two lines were used for yield determination.

Seeds of onion was obtained from Onion Dept. Res., Filed Crop Inst. , ARC, Giza. While, the sources of salicylic acid and ascorbic acid were obtained from El- Gomhouria Chemicals Company, Egypt.

Salicylic and ascorbic acid at different concentrations were sprayed by hand sprayer until saturation of leaves three times after 30,60 and 90 days from transplanting applied at 200 liter/feddan. Tween-20 was used as a wetting agent at 0.02% concentration.

Nitrogen, phosphorus and potassium were added in the form of ammonium sulphate (20.5%N), calcium superphophate (15.5% P_2O_5) and potassium sulphate (48% K_2O) at the rate of 100, 60 and 100 kg/fed., respectively. All the amounts of phosphorus fertilizer and one fourth of the amount of N+K mineral fertilizers and 20 ton/fed, compost were added during soil preparation .The rest amount of N and K fertilizers were divided into five portions and added as soil application every two weeks beginning at 30 days after transplanting.

The other normal agricultural treatments for growing onion plant were practiced.

Data recorded:

Ten plants from each plot were randomly taken at 135 days after transplanting and the following data were recorded:

1. Plant growth measurement

a. Morphological characters

- Plant height (cm)
- Number of leaves/ plant
- Neck diameter (cm)
- Bulb diameter (cm)
- Bulbing ratio = Bulb diameter/ neck diameter according to (**Mann, 1952**).

b- Dry weight:

The different parts of onion plant; *i.e.*, bulb and leaves at 135 days after transplanting were oven dried at 70° C till constant weight, and then the following data were recorded:

- Dry weight of bulb/ plant (g)
- Dry weight of leaves / plant (g)
- Total dry weight / plant (bulb + leaves/plant) (g).

2. Leaf Pigments

A disc sample from the fourth outer leaf of onion plant was randomly taken from every experimental unit at 135 days after transplanting in both growing seasons to determine chlorophyll a and b as well as carotenoides according to the method described by **Wettestein (1957).**

Nitrogen, phosphorus and potassium contents

The contents of nitrogen, phosphorus and potassium were assayed in the dry weight from random samples of leaves and bulb at 135 days after transplanting in the both seasons, were finely ground and wet digested for N, P and K determination according to the methods advocated by **Bremner and Mulvaney (1982), Olsen and Sommers (1982)** and **Jackson (1970),** respectively. N, P and K in leaves and bulb uptake and total uptake by plant were calculated **.**

Yield and its components:

Onion plants were harvest when 50% of plant tops were down, left in the field to cure for two week , bulbs in every plot were harvested and graded into four categories according to specification laid down by the Ministry of Economic for onion exportation (1963) as follow

Grade 1: Bulbs with diameter above 5.5cm.

Grade 2: Bulbs with diameter between 4.5-5.4cm. Grade 3: Bulbs with diameter between 3.5-4.4cm. Grade 4: Bulbs with diameter less than 3.5cm Exportable yield = Yield of grade1 and grade 2 Marketable yield = Yields of grades 1, 2 and 3

Total yield = yields of grade 1, 2, 3 and 4.

Average bulb fresh weight (g) will be determined by dividing the total yield per plot by the number of plants per plot.

Bulbs quality at harvest time

Nitrogen, P and K contents: Five bulbs were randomly taken from each treatment and oven dried at 70ºC C till constant weight and determined by the same methods as previously mentioned in the plant chemical composition of onion plants in both seasons.

Dry matter percentage (DM %): It was determined at harvest using 100 g fresh bulbs oven dried at 105ºC till constant weight.

Total soluble solids (T.S.S.): It was determine total soluble solids by Carl Zeis Refractometer.

Ascorbic acid (Vit. C mg/100 mg FW): It was determined in fresh bulbs using 2, 6, Dichlorophenol indophenols dye according to (**A.O.A.C., 2008**).

Pungency, as pyruvic acid: It was determined in fresh bulb tissues according to **(Schwimmer and Westen, 1961).**

Statistical analysis:

Collected data was subjected to proper statistical analysis of variance according to **Snedecor and Cochran (1980)** and the differences among treatments were compared using **Duncans'** multiple range test (**Duncan, 1958**).

RESULTS AND DISCUSSION

Plant Growth

Morphological characters

Data in Table 1 indicate that spraying onion plants with salicylic acid (SA) and ascorbic acid (AsA) at 100, 150 and 200 ppm of each increased plant height, number of leaves, neck and bulb diameter and bulbing ratio compared to control at 135 days after planting in both seasons.

Table (1). Effect of foliar spray with salicylic acid and ascorbic acid on vegetative growth characters of onion plants after 135 days during 2023/2024 and 2024/2025 seasons

Treatments		Plant height (cm)	Number of leaves/ plant	Neck diameter (cm)	Bulb diameter (cm)	Bulbing ratio
				2023/2024		
Control (water)		49.25 e	6.75 e	1.68 d	3.90 e	2.32 e
SA	**100 ppm**	54.75 d	8.25 d	1.98 b	4.85 d	2.45 de
	150 ppm	61.25 bc	9.00 bc	2.13 a	5.93 b	2.78 bc
	200 ppm	61.50 bc	9.75 a	2.13 a	6.58 a	3.09 a
AsA	**100 ppm**	61.00 c	8.75 cd	1.83 c	4.68 d	2.56 cde
	150 ppm	62.25 b	9.50 ab	2.00 b	5.33 c	2.67 bcd
	200 ppm	64.00 a	9.75 a	2.03 b	5.88 b	2.90 ab
LSD at 0.05 level		**1.12**	**0.50**	**0.08**	0.22	**0.30**
				2024/2025		
Control (water)		51.50 e	7.25f	1.45 c	4.27 f	2.94d
SA	**100 ppm**	56.33 cd	8.75 e	1.74 abc	5.32 d	3.06 cd
	150 ppm	58.00 bc	9.50 d	1.76 ab	5.76 b	3.27 abc
	200 ppm	58.75 b	9.50 d	1.98 a	6.57 a	3.32 a
AsA	**100 ppm**	56.00 d	9.75 c	1.55 bc	4.77 e	3.08 bcd
	150 ppm	67.25 a	10.00 b	1.62 bc	5.14 d	3.17 abc
	200 ppm	67.50 a	11.00 a	1.68 abc	5.52 c	3.29 ab
LSD at 0.05 level		**1.84**	**0.16**	**0.30**	**0.18**	**0.21**

Foliar spray with AsA at 200 ppm increased plant height (64.00 and 67.50 cm) and number of leaves/ plant (9.75 and 11.00) in both seasons, whereas foliar spray with SA at 200 ppm increased neck diameter (2.13 and 1.98 cm), bulb diameter (6.58 and 6.77 cm) and bulbing ratio (3.09 and 3.32) in both seasons.

Bulb diameter for all treatments ranged from 3.90 to 6.58 cm in the 1st season and from 4.27 to 6.57 cm in the 2nd season at 135 days after planting.

The improved growth characteristics may be due to the positive effect of ascorbic acid as a role as an antioxidant enzyme and growth regulator (**El-Kobisy *et al*., 2005**). According to **Abo-Hinna and Merza (2012**), it is crucial for a number of functions, including as photosynthesis, photoprotection, cell wall development and expansion resistance to environmental stressors, and the synthesis of ethylene, gibberellins, anthocyanins, and hydroxyproline. In addition to its crucial function in the ascorbate-glutathione pathway, ascorbic acid's superiority may be explained by its critical role in cell wall growth and cell division (**Farooq *et al*., 2020**).

Salicylic acid is an endogenous plant growth regulator that influences the growth and development of plants by controlling a variety of metabolic and physiological processes (**Raskin, 1992**).

Regarding the AsA effect, studies by **Seif El-Yazal (2007)** and **Osman and Tolba (2009)** demonstrated that, in comparison to the control treatment, treated plants receiving foliar sprays of ascorbic acid (AsA) experienced a notable impact on vegetative growth. Regarding the SA effect, **Moustafa *et al*. (2016)** discovered that, in comparison to other concentrations of 0 and 500 ppm, the greatest concentration of salicylic acid, 1000 ppm, favorably and considerably enhanced the number of leaves /plant and plant height. **Semida *et al*. (2017**) also found comparable results in this regard.

Dry weight

Spraying with SA at 200 ppm significantly increased dry weight of leaves/ plant (5.03 and 5.33 g), bulb dry weight (6.73 and 7.12 g) and total dry weight / plant (11.76 and 12.45 g) at 135 days after planting in both seasons (Table 2).

Average total dry weight / plant of the three concentrations of SA ranged from 10.81 and 11.59 g, whereas average total dry weight /plant of the three concentrations of AsA ranged from 9.09 to 10.43 g in the 1st and 2nd seasons, respectively .

The increases' in total dry weight / plant over the control for SA concentrations were about 2.50 and 2.05g for 100 ppm , 3.09 and 2.66g for 150 ppm and 4.21 and 3.64g for 200 ppm and for AsA concentrations were about 0.51 and 0.65 g for 100 ppm , 1.77 and 1.89 g for 150 ppm and 2.36 and 2.28 g for 200 ppm in the 1st and 2nd seasons, respectively.

Salicylic acid is an endogenous plant growth regulator that influences the vegetative growth and dry weight development of plants by controlling a variety of metabolic and physiological processes (**Raskin, 1992**).

This increase might be due to stimulating dry mass production through enhancement of cell division and cell enlargement, and chlorophyll accumulation which reflected on plant growth of onion plants (**Sathiyamurthy *et al*., 2017**) .In addition, the increase in dry weight can be attributed to the role of ascorbic acid in increasing the secretion of organic acids from the roots to the soil, which leads to increased solubility of most nutrients released slowly in the rhizosphere that plants absorb. Furthermore, ascorbic acid preserves chlorophyll from oxidation as an antioxidant **(Olalekan, 2017**).

These results are in line with those of **Shalaby and El-Ramady (2014) on** onions and **Ali (2017)** on garlic, which demonstrated that, in comparison to the control treatment, AsA foliar spraying produced the best dry weight of different organs/plants.

These findings are consistent with those of **Khadr (2015),** who explained that garlic plants sprayed three times with SA at 50 ppm had the highest dry weights of various organs compared to plants that were not treated. Additionally, **Abd Elwahed (2016)** demonstrated that SA spraying yielded the highest dry weight of onion plants compared to unsprayed plants.

Leaf pigments

Foliar spray with SA at 200 ppm was the best treatment for enhancing the concentrations of chlorophyll a, b, total a+b and carotenoides in leaf tissues of onion followed by foliar spray with SA at 150 ppm and foliar spray with AsA at 200 ppm. (Table3). In general, spraying with SA and AsA at 100, 150 and 200 ppm of each increased leaf pigments in leaf tissues compared to control (spraying with water).

Table (2). Effect of foliar spray with salicylic acid and ascorbic acid on dry weight of different parts of onion after 135 days during 2023/2024 and 2024/2025 seasons

Treatments		Dry weight of leaves / plant (g)	Dry weight of bulb (g)	Total dry weight (leaves bulb)/ plant (g)
			2023/2024	
Control (water)		3.43 d	4.12 g	7.55f
SA	**100 ppm**	4.22 b	5.83 c	10.05 c
	150 ppm	4.27 b	6.37 b	10.64 b
	200 ppm	5.03 a	6.73a	11.76 a
AsA	**100 ppm**	3.59 d	4.47 f	8.06 e
	150 ppm	3.93 c	5.39 e	9.32 d
	200 ppm	4.18 bc	5.73 d	9.91 c
LSD at 0.05 level		**0.28**	**0.08**	**0.43**
			2024/**2025**	
Control (water)		3.82e	4.99 f	8.81 e
SA	**100 ppm**	4.82 bc	6.04 d	10.86 c
	150 ppm	4.87 b	6.60 b	11.47 b
	200 ppm	5.33 a	7.12 a	12.45a
AsA	**100 ppm**	4.10 de	5.40 e	9.50 d
	150 ppm	4.48 cd	6.22 c	10.70 c
	200 ppm	4.57 bc	6.52 b	11.09 bc
LSD at 0.05 level		**0.38**	**0.14**	**0.47**

Table (3). Effect of foliar spray with salicylic acid and ascorbic acid on leaf pigments (mg /g DW) of onion plants after 135 days during 2023/2024 and 2024/2025 seasons

Treatments		**Chlorophyll (a)**	**Chlorophyll (b)**	**Total chlorophyll (a+b)**	**Carotenoides**
			2023/2024		
Control (water)		2.22 e	1.37 d	3.59 e	1.57 e
SA	**100 ppm**	2.64 c	1.63 bc	4.28 c	1.91 bc
	150 ppm	2.85 b	1.76 ab	4.61 b	2.03 ab
	200 ppm	3.13 a	1.88 a	5.02 a	2.10 a
AsA	**100 ppm**	2.43 d	1.49 cd	3.92 d	1.71 d
	150 ppm	2.56 cd	1.58 bcd	4.13 c	1.81 cd
	200 ppm	2.83 b	1.75 ab	4.58 b	1.98 ab
LSD at 0.05 level		**0.14**	**0.24**	**0.18**	**0.13**
			2024/2025		
Control (water)		2.33 d	1.40 c	3.73 d	1.61 d
SA	**100 ppm**	2.74 c	1.86 ab	4.47 c	1.99 bc
	150 ppm	3.12 ab	1.93 a	5.05 ab	2.12 ab
	200 ppm	3.33 a	2.00 a	5.33 a	2.24 a
AsA	**100 ppm**	2.66 c	1.64 bc	4.30 c	1.89 c
	150 ppm	2.83 c	1.75 ab	4.58 c	2.01 bc
	200 ppm	3.06 b	1.90 ab	4.96 b	2.10 ab
LSD at 0.05 level		**0.22**	**0.26**	**0.31**	**0.20**

Results are harmony with **Khadr (2015)** clarified that, spraying garlic plants with salicylic acid at 50 ppm gave the highest concentrations of chlorophyll a, b, total (a+b) and carotenoides in leaf tissues compared to control treatment. In addition **, Al-Khafagi, *et al*. (2016)** came the similar results. In the same time, **Abd El-Nabi *et al*. (2021)** on onion indicated that, the best results for enhancing leaf pigments was recorded when sprayed plants with AsA than control treatment.

N, P and K content and uptake

Foliar spray with SA at 200 ppm increased N,P and K content in leaves (Table 4), in bulb (Table 5), N, P and K uptake by leaves (Table 6), by bulb (Table 7) and total uptake by plant (Table 8), followed by foliar spray with SA at 150 ppm in both seasons.

The stimulative effect of foliar spray with SA at 200 ppm on N, P and K uptake and total uptake may be due to that this treatment increased dry weight of leaves, bulb and total dry weight (Table 2).

In this regard, **Bardisi, (2004)** found that spraying garlic plants with SA recorded maximum values of N, P and K uptake by leaves and bulb and N, P and K total uptake by plant. Also, **Khadr (2015)** clarified that, spraying garlic plants with salicylic acid at 50 ppm produced the highest values of N, P, K, Ca in leaves and bulb and **Moustafa *et al*. (2016)** showed the similar results.

Yield and Its Components

As for yield of grades 1,2,3 and 4 data in Table 9 indicate that foliar spray with SA at 200 ppm increased yield of grade 1 (7.140 and 7.782 ton) and yield of grade 2 (7.704 and 7.244 ton) followed by spraying with Sa at 150 ppm in both seasons. Spraying with water (control) increased yield of grades 3 and 4 .

Respecting exportable , marketable and total yield and average bulb weight , the obtained results in Table 10 show that , foliar spray with SA at 200 ppm was the best treatment for increasing exportable yield (14.844 and 15.026 ton), marketable yield (15.824 and 15.775 ton) , total yield (16.250 and 16.418 ton), and average bulb weight (116.07 and 117.27 g) in both seasons , followed by SA at 150 ppm .

The percentage of exportable and marketable yield from total yield were about 91.35 and 91.52 % for exportable yield and 97.38 and 96.08 % for marketable yield were recorded by spraying with SA at 200 ppm in both seasons.

The increases in total yield (ton/fed.) for the three concentrations of SA over control were about 0.675 and 0.734 ton for SA at 100 ppm , 2.332 and 3.223 ton for SA at 150 ppm and 3.448 and 4.101 ton for SA at 200 ppm in the 1st and 2nd seasons, respectively.

Onion leaves are storage organ of the food materials and it get translocated into the bulbs at the time of maturity. Hence the number of leaves play a major role in bulb yield (**Sathiyamurth *et al.*, 2017**).

These results are harmony with those obtained with **Moustafa *et al*. (2016**) how found that highest total and marketable bulbs yield were recorded with the highest concentration of salicylic acid 1000 ppm as compared to other concentrations 0 and 500 ppm. Additionally, **Chattoo, *et al*. (2020), Indhumathi *et al*. (2024)** and **Pathak (2025)** indicated that sprayed onion plants with SA scored the highest yield than unsprayed plants. In addition, **Yadav *et al*. (2023) and Abdel-Wahab *et al.* (2024)** on onion showed that sprayed onion plants with AsA gave the best productivity compared to control treatment.

N, P and K content in bulb at harvesting time

Foliar spray with SA at 200 ppm gave the highest values of N,P and K content in bulb , followed by foliar spray with SA at 150 ppm in both seasons (Table 11).

These findings may be related to the synergistic effect of the studied substances on the different biochemical pathways in plant cell. But the highest value of the percentage phosphorus was obtained by foliar spraying of the high levels of ascorbic acid at 450 ppm. The increment in phosphorus content could be explained by **Talaat (2003**) who found that the accumulation of phosphorus by ascorbic acid foliar application may be due to the positive effect of ascorbic acid on uptake minerals and accumulation in fruits.

Bulb quality

Data in Table 12 indicate that spraying with SA at 200 ppm increased TSS (12.24 ad 13.70 (Brix^{o}) , DM % (13.35 and 14.88 %), pungency as pyrovic acid (7.34 and 8.37 µmol/gm FW) in bulb with no significant differences with SA at 150 ppm with respect TSS in the 2nd season and DM% in both seasons . Spraying with AsA at 200 ppm increased Vit C (29.66 and 29.39 mg /100 gFW) with no significant differences with AsA at 150 ppm in both seasons (Table 12).

For all treatments, DM% was ranged from 10.85 to 13.35 % in the 1st season and from 11.41 to 14.38 % in the 2nd season. Whereas TSS ranged from 9.98 to 12.24 Brix^{o} in the 1st season and from 10.90 to 13.70 Brix^{o} in the 2nd season.

As for pungency , for all treatments, pungency were around from 5.69 to 7.34 µmol/gm FW in the 1st season and from 5.43 to 8.37 µmol/gm FW in the 2nd season .

There were positive correlation between DM%, TSS in bulbs and also between DM% and pungency in bulb. There were positive correlation between average bulb weight and DM%.

Salicylic acid's ability to enhance membrane permeability, which promotes the absorption and utilization of mineral nutrients as well as the transport of assimilates, may be the cause of the bulb's increased TSS content following foliar spraying with SA (**Javaheri *et al.*, 2012**). In addition, the improvement of quality parameters of bulb may be attributed to increased carbohydrates production during photosynthesis and consequently more translocation of assimilates towards bulb (**Sathiyamurth *et al.*, 2017**).

Results are harmony with those obtained with **Ali (2017), Nangare, *et al*. (2018) , Shelke, *et al.* (2018)** and **Chattoo *et al*. (2020**) showed that maximum bulb quality attributes of onion like dry matter content , soluble solid content and Pyruvic Acid (µmol /g) content were recorded with the treatment consists of foliar spray of salicylic acid at the rate of 250 mg/L . As for AsA effect , **Abd El-Nabi *et al*. (2021**) showed that foliar sprayed with ascorbic acid at rate of 200 mg/ L gave highest significant values of Vit .C in bulb as compared to 0, 100 and 150 mg/l).

Table (4). Effect of foliar spray with salicylic acid and ascorbic acid on N, P and K contents in leaves of onion plants after 135 days during 2023/2024 and 2024/2025 seasons

Treatments		(%)		
		N	P	K
			2023/2024	
Control (water)		2.22 d	0.298 c	2.54 f
SA	100 ppm	2.43 c	0.341 b	2.85 cd
	150 ppm	2.78 a	0.355 ab	3.02 b
	200 ppm	2.91 a	0.377 a	3.14 a
AsA	100 ppm	2.37 c	0.346 b	2.66 e
	150 ppm	2.42 c	0.348 b	2.81 d
	200 ppm	2.61 b	0.359 ab	2.94 bc
LSD at 0.05 level		0.14	0.027	0.09
			2024/2025	
Control (water)		2.27 d	0.301 c	2.61 d
SA	100 ppm	2.38 cd	0.346 ab	2.78 c
	150 ppm	2.71 b	0.358 ab	2.96 ab
	200 ppm	2.93 a	0.371 a	3.09 a
AsA	100 ppm	2.27 d	0.334 b	2.70 cd
	150 ppm	2.34 d	0.341 ab	2.75 cd
	200 ppm	2.56 bc	0.352 ab	2.83 bc
LSD at 0.05 level		0.18	0.030	0.16

Table (5). Effect of foliar spray with salicylic acid and ascorbic acid on N, P and K contents in bulb of onion plants after 135 days during 2023/2024 and 2024/2025 seasons

Treatments		(%)		
		N	P	K
			2023/2024	
Control (water)		1.79 b	0.382 d	1.75 e
SA	100 ppm	1.94 ab	0.395 c	2.10 bc
	150 ppm	2.06 a	0.410 b	2.21 ab
	200 ppm	1.56 cd	0.432 a	2.32 a
AsA	100 ppm	1.77 bc	0.384 d	1.88 de
	150 ppm	1.90 ab	0.391 c	1.96 cd
	200 ppm	1.79 b	0.406 b	2.05 c
LSD at 0.05 level		0.22	0.006	0.14
			2024/2025	
Control (water)		1.51 c	0.371 f	1.63 e
SA	100 ppm	1.77 b	0.394 d	1.88 cd
	150 ppm	1.97 a	0.410 b	2.07 bc
	200 ppm	2.04 a	0.427 a	2.30 a
AsA	100 ppm	1.54 c	0.379 e	1.79 de
	150 ppm	1.65 bc	0.398 cd	1.92 bcd
	200 ppm	1.73 b	0.403 c	2.11 ab
LSD at 0.05 level		0.14	0.005	0.20

Table (6). Effect of foliar spray with salicylic acid and ascorbic acid on N, P and K uptake in leaves of onion plants after 135 days during 2023/2024 and 2024/2025 seasons

Treatments		Mg		
		N	P	K
			2023/2024	
Control (water)		76.15 g	14.39 b	87.12 f
SA	100 ppm	102.55 d	15.16 b	120.27 c
	150 ppm	118.71 b	18.96 a	128.95 b
	200 ppm	146.37 a	12.42 c	157.94 a
AsA	100 ppm	85.08 f	13.68 bc	95.49 e
	150 ppm	95.11 e	15.01 b	110.43 d
	200 ppm	109.10 c	14.39 b	122.89 c
LSD at 0.05 level		3.43	1.62	4.78
			2024/2025	
Control (water)		86.71 g	11.50 f	99.70 f
SA	100 ppm	114.72 d	16.68 bc	134.00 c
	150 ppm	131.98 b	17.43 b	144.15 b
	200 ppm	156.17 a	19.77 a	164.70 a
AsA	100 ppm	93.07 f	13.69 e	110.28 e
	150 ppm	104.83 e	15.28 d	123.20 d
	200 ppm	116.99 c	16.09 cd	129.33 cd
LSD at 0.05 level		2.06	0.86	6.77

Table (7). Effect of foliar spray with salicylic acid and ascorbic acid on N, P and K uptake by bulb of onion plants after 135 days during 2023/2024 and 2024/2025 seasons

Treatments		Mg		
		N	P	K
			2023/2024	
Control (water)		59.60 f	15.73 e	72.10 f
SA	100 ppm	104.36 cd	23.02 cd	122.43 c
	150 ppm	123.58 b	26.15 b	140.78 b
	200 ppm	138.64 a	29.07 a	156.14 a
AsA	100 ppm	69.73 e	17.16 e	84.04 e
	150 ppm	95.40 d	21.07 d	105.64 d
	200 ppm	108.87 c	23.26 c	117.47 c
LSD at 0.05 level		9.29	2.54	8.99
			2024/2025	
Control (water)		75.35 f	18.51 e	81.34 e
SA	100 ppm	106.91 cd	23.79 d	113.55 c
	150 ppm	130.02 b	27.06 b	136.62 b
	200 ppm	145.25 a	30.40 a	163.76 a
AsA	100 ppm	83.16 e	20.46 e	96.66 d
	150 ppm	102.63 d	24.75 cd	119.42 c
	200 ppm	112.80 c	26.27 bc	137.57 b
LSD at 0.05 level		7.04	1.99	14.36

Table (8). Effect of foliar spray with salicylic acid and ascorbic acid on total uptake of N, P and K by onion plants after 135 days during 2023/2024 and 2024/2025 seasons

Treatments		Mg		
		N	P	K
			2023/2024	
Control (water)		135.75 d	25.96 f	159.22 e
SA	100 ppm	206.91 c	37.42 cd	242.70 c
	150 ppm	242.29 b	41.32 b	269.73 b
	200 ppm	285.01 a	48.03 a	314.08 a
AsA	100 ppm	154.81 d	29.58 e	179.53 e
	150 ppm	190.51 c	34.75 d	216.07 d
	200 ppm	217.97 bc	38.27 bc	240.36 cd
LSD at 0.05 level		27.66	3.42	26.25
			2024/2025	
Control (water)		162.06 e	30.01 e	181.04d
SA	100 ppm	221.63 cd	40.48 c	247.55 c
	150 ppm	262.00 b	44.49 b	280.77 b
	200 ppm	301.42 a	50.17 a	328.46 a
AsA	100 ppm	176.23 e	34.16 d	206.94 d
	150 ppm	207.46 d	40.04 c	242.62 c
	200 ppm	229.79 c	42.37 bc	266.90 bc
LSD at 0.05 level		19.23	2.37	28.60

Table (9). Effect of foliar spray with salicylic acid and ascorbic acid on yield of different grades of onion plants during 2023/2024 and 2024/2025 seasons

Treatments		Grade (ton/fed.)			
		Grade 1	Grade 2	Grade 3	Grade 4
		2023/2024			
Control (water)		3.020 f	4.896 f	2.855 a	2.031 a
SA	100 ppm	5.073 d	5.635 e	1.886 b	0.886 b
	150 ppm	6.393 b	7.036 b	1.215 d	0.490 c
	200 ppm	7.140 a	7.704 a	0.980 e	0.426 c
AsA	100 ppm	4.257 e	6.319 d	1.921 b	0.946 b
	150 ppm	5.306 cd	6.424cd	1.425 c	0.463 c
	200 ppm	5.829 bc	6.837 bc	1.136 d	0.429 c
LSD at 0.05 level		**0.655**	**0.427**	**0.144**	**0.154**
		2024/2025			
Control (water)		3.078 f	5.395 d	2.040 a	1.804a
SA	100 ppm	4.935 d	6.208 c	1.194 b	0.714 bc
	150 ppm	6.948 b	6.871 ab	0.952 c	0.771 bc
	200 ppm	7.782 a	7.244 a	0.749 d	0.643 c
AsA	100 ppm	4.144 e	5.791 cd	1.975 a	0.877 b
	150 ppm	6.061 c	6.178 c	1.172 b	0.711 c
	200 ppm	6.393 bc	6.703 b	1.090 b	0.647 c
LSD at 0.05 level		**0.664**	**0.472**	**0.115**	**0.163**

Table (10). Effect of foliar spray with salicylic acid and ascorbic acid on yield and its components of onion plants during 2023/2024 and 2024/2025 seasons

Treatments		Exportable yield		Marketable yield		Total yield (ton /fed.)	Bulb weight (g)
		ton /fed.	(%) in total yield	ton /fed.	(%) in total yield		
		2024/2025 season					
Control (water)		7.916 e	61.83	10.771 e	84.14	12.802 d	91.44f
SA	100 ppm	10.708 d	79.44	12.594 d	93.43	13.480 cd	94.29 e
	150 ppm	13.429 b	88.73	14.644 b	96.76	15.134 b	108.10 b
	200 ppm	14.844 a	91.35	15.824 a	97.38	16.250 a	116.07 a
AsA	100 ppm	10.576 d	78.67	12.497 d	92.96	13.443 cd	96.02 de
	150 ppm	11.730 c	86.14	13.155 cd	96.60	13.618 cd	97.27 d
	200 ppm	12.666 bc	89.00	13.802 bc	96.99	14.231 bc	101.65 c
LSD at 0.05 level		**0.960**	--	**1.105**	--	**0.995**	**2.59**
		2024/2025 season					
Control (water)		8.473 g	68.79	10.513 f	85.35	12.317 d	87.98f
SA	100 ppm	11.143 e	85.38	12.337 de	94.53	13.051 d	93.22 e
	150 ppm	13.819 b	88.91	14.771 ab	95.04	15.542 ab	111.01 b
	200 ppm	15.026 a	91.52	15.775 a	96.08	16.418 a	117.27 a
AsA	100 ppm	9.935 f	77.70	11.910 e	93.14	12.787 d	91.34 e
	150 ppm	12.239 d	86.67	13.411 cd	94.97	14.122 c	100.87 d
	200 ppm	13.096 c	88.29	14.186 bc	95.64	14.833 bc	105.95 c
LSD at 0.05 level		**0.689**	---	**1.190**	---	**0.885**	**2.16**

Table (11). Effect of foliar spray with salicylic acid and ascorbic acid on bulb nutrients at harvesting time of onion plants during 2023/2024 and 2024/2025 seasons

Treatments		Mineral contents (%)		
		N	P	K
		2023/2024 season		
Control (water)		1.41 d	0.387 d	1.11f
SA	100 ppm	1.59 c	0.394 d	1.38 c
	150 ppm	1.74 ab	0.439 b	1.52 b
	200 ppm	1.85 a	0.467 a	1.71 a
AsA	100 ppm	1.51 cd	0.405 cd	1.25 e
	150 ppm	1.65 bc	0.427 bc	1.27 de
	200 ppm	1.62 bc	0.438 b	1.33 cd
LSD at 0.05 level		**0.14**	**0.026**	**0.07**
		2024/2025 season		
Control (water)		1.39 d	0.390 d	1.09 f
SA	100 ppm	1.62 c	0.399 d	1.32 cd
	150 ppm	1.77 ab	0.442 b	1.48 b
	200 ppm	1.88 a	0.475 a	1.68 a
AsA	100 ppm	1.55 c	0.411 cd	1.16 e
	150 ppm	1.67 bc	0.431 bc	1.26 d
	200 ppm	1.79 ab	0.452 ab	1.35 c
LSD at 0.05 level		**0.12**	**0.028**	**0.06**

Table (12). Effect of foliar spray with salicylic acid and ascorbic acid on bulb quality at harvesting time of onion plants during 2023/2024 and 2024/2025 seasons

Treatments		TSS (Brix^{o})	DM (%)	Vit C(mg/100 g FW)	Pungency as pyruvic acid µmol/gm FW
			2023/2024 season		
Control (water)		9.98 e	10.85 e	22.95 d	5.69 f
SA	100 ppm	10.98 cd	12.42 c	25.06 c	6.84 c
	150 ppm	11.70 b	13.29 a	25.42 c	7.10 b
	200 ppm	12.24 a	13.35 a	25.99 c	7.34 a
AsA	100 ppm	10.08 e	10.95 e	27.79 b	5.96 e
	150 ppm	10.77 d	12.07 d	28.71 ab	6.57 d
	200 ppm	11.25 bc	12.88 b	29.66 a	6.64 cd
LSD at 0.05 level		**0.45**	**0.28**	**1.41**	**0.22**
			2024/2025 season		
Control (water)		10.90 d	11.91 e	23.08 d	5.43d
SA	100 ppm	12.25 b	13.36 c	25.45 c	7.56 c
	150 ppm	13.60 a	14.83 a	26.19 c	8.01 b
	200 ppm	13.70 a	14.88 a	27.34 bc	8.37 a
AsA	100 ppm	11.40 c	12.35 d	26.82 c	7.53 c
	150 ppm	12.60 b	13.73 b	29.23 ab	7.73 bc
	200 ppm	12.58 b	13.67 b	29.39 a	7.88 b
LSD at 0.05 level		**0.47**	**0.24**	**2.00**	**0.28**

Conclusion

Under the same conditions, it could be said that applying 200 ppm of AsA to the plant resulted in a considerable increase in plant height and number of leaves per plant at 135 days after planting and vitamin C in the bulbs at harvest time. Conversely, the optimum treatment for improving the onion plant's the total dry weight of the plant, overall uptake of N, P, and K, its exportable and marketable yield, its total yield, and its bulb quality, including TSS, DM%, and pungency as pyrovic acid in the bulb was to spray it with SA at 200 ppm.

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تقييم إنتاجية وجودة أبصال البصل النامى فى التربه الرملية بإستخدام بعض المواد الآمنة

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أجريت تجربة حقلية في مزرعة خاصة بمنطقة الصالحية الجديدة بمحافظة الإسماعيلية (مصر) خلال موسمى شتاء 2024/2023 و2025/2024 لتقييم نمو وإنتاجية نباتات البصل صنف جيزة 20 تحت محفزين (حمض الساليسيليك وحمض الأسكوربيك بتركيز 100 و150 و200 جزء في المليون لكل منهما) بالإضافة إلى معاملة المقارنه (الرش بالماء) تحت ظروف الارض الرملية وباستخدام نظام الري بالتنقيط.

أظهرت النتائج الرش الورقى بحمض الأسكوربيك بتركيز 200 جزء في المليون إلى زيادة فى إرتفاع النبات وعدد الأوراق / نبات بعد 135 يومًا من الشتل وكذلك محتوى الأبصال من فيتامين ج عند الحصاد، في حين أدى الرش الورقي بحمض الساليسيلك بتركيز 200 جزء في المليون إلى زياده قطركل من العنق والبصلة ونسبة التبصيل، الوزن الجاف للاوراق و للأبصال والوزن الجاف للنبات، وزيادة تركيزات الصبغات في أنسجة الأوراق، وامتصاص نبات البصل الكلي للنيتروجين والفوسفور والبوتاسيوم بعد 135 يومًا من الشتل كما ادت ايضا لزياده المحصول القابل للتصدير والتسويق، والمحصول الكلى ، ومتوسط وزن البصله ، وجودة الأبصال، متمثله فى تركيز المواد الصلبة الذائبة ونسبة المادة الجافة، والحرافه (حمض البيروفيك) في الأبصال.

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