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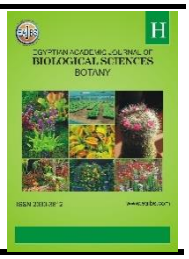

Response of Soybean Plants to Mitigation of Irrigation Water Salinity by Salicylic and Ascorbic Acids

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ABSTRACT

The present study was carried out at Nubaria Region, El- Beheira Governorate, Egypt, during the two summer seasons of 2019 and 2020 to study the effect of foilar application of salicylic (SA) and ascorbic acids (ASA) on yield and quality of soybean *cv.* Giza 111 under drip irrigation. This experiment was laid out in the factorial experiment (two factors) in randomized complete blocks design (RCBD) in three replications. The first factor was salicylic acid (SA) concentrations (water = control, 500, 1000, and 1500 ppm), while the second factor was ascorbic acid (ASA) concentration (water = control, 500, 1000 and 1500 ppm) in both seasons. The obtained results showed that foliar application of salicylic acid (SA) and ascorbic acid (ASA) significantly affected plant height (cm), number of branches/plant, number of pods/plant, 100- seed weight (g , seed yield (kg/fed), straw yield (kg/fed), biological yield (kg/fed), harvest index (%), and oil content (%) in the two seasons, whereas increasing of SA and ASA from 500 up to 1500 ppm increased all the studied characters as compared with the control treatments (water spray) in both seasons. The interaction between the foliar application of SA and ASA concentration was significant on all the studied characters in both seasons, where using 1500 or 1000 ppm SA/fed + 500 or 1000 ppm ASA achieved the highest mean values of all the studied characters in the two cropping seasons in drip water irrigation under the study conditions.

INTRODUCTION

Soybean (*Glycine max* L.) is widely cultivated for its edible bean, which has many uses. Soybean is the most important protein source for animal feeding and human food**.** Among the legumes, soybean is valued for its high protein content (38 – 45 %)**,** also soybean seed contains 18–19 % oil (Livestock's long shadow, 2016).Soybean is a globally important crop that provides protein and oil for a wide array of products. Soybean seed is made up of crudely 40 % protein, 20 % oil, 35 % carbohydrate and 5 % ash (Soares *et al*., 2008).Total cultivated area of soybean in the world in 2018 was about 123.5 million ha which produced about 352.6 million tons, while in Egypt, the cultivated area was about 15000 ha produced approximately 45000 ton from dry seeds (FAO STAT, 2018).

Soybean is very sensitive plant to drought and salinity conditions during vegetative and reproductive growth. Since soybean is classified as dehydration-sensitive species that require

optimum water quantity in the seed germination phase. Seed growth and plant growth (Chen *et al*., 2006). Salt stress effected of major plant processes such as photosynthesis, protein synthesis and lipid metabolism (Parvaiz and Satyawati, 2008).

Salicylic acid (SA) is an endogenous growth regulator of phenolic nature, which contributes in the regulation of physiological processes in plants. SA plays an important role in the defense response to abiotic stresses in many species of plants (Pasala *et al*., 2016). SA increases plant growth and photosynthetic capacity in saline conditions (Noreen *et al*., 2012). Application of salicylic acid significantly increases dry weights of root and top part under saline conditions (Stevens *et al*., 2006). On the other side, Khodary (2004) reported that salicylic acid (SA) could induce salt tolerance in maize plants *via* increasing their photosynthesis performance and carbohydrate metabolism.

Ascorbic acid (ASA) helps as a hydrogen transport agent which complicated in cellular oxidation reduction reactions. Attempts have been made to service active vitamins to overawe the drastic effects of salinity on seed germination, seedling growth and some metabolic mechanisms (Ansari and Khan, 1986; Samiullah and Afridi, 1988). Ascorbic acid plays an important role in improving plant tolerance to abiotic stress (Al-Hakimi and Hamada, 2001; Athar *et al.*, 2008). Effect of ascorbic acid as an exogenous antioxidant increased the total chlorophyll, total of leaf area, number of filled pods and relative water content, while chitosan treatment increased stomatal density. Foliar application of exogenous antioxidants on drought stress presented the important of the role of exogenous antioxidants in reducing the effect of water stress on production and physiological characteristics of soybean (Hasanah *et al.*, 2017). Also, foliar application of ascorbic acid enhanced all studied traits i.e. growth, seed yield characters.The enhancement was gradual with the increasing ASA dose. The linear regression model predicted that when the ASA dose increase by 1.0 mg/L, the seed yield is expected to enhance by 0.06 g/m^2. Enhanced water stress tolerance through adequate ascorbic acid application is a promising strategy to improve the tolerance and productivity of common bean under water stress. Moreover, the response of common bean to water deficit performs to be reliant on ASA dose (Gaafar *et al.*, 2020).

The aims of this study were to:

1- study the effect of foliar application of salicylic acid (SA) on yield and yield components of soybean to determine the best concentration, which will increase seed production and quality by avoiding the exposure of the crop to salinity stress,

2- study the effect of ascorbic acid concentrations on yield and yield components of soybean to determine the best concentration to increase the production and quality of seeds, also to avoid the exposure of the crop to salinity stress, and

3- study the interaction effect between salicylic acid and ascorbic acid concentrations on yield and its components of soybean to determine the best concentration, which will increase the production and quality of seeds, and to avoid the exposure of the crop to salinity stress at critical stages of soybean plants.

MATERIALS AND METHODS

The present study was carried out at Nubaria, EL-Beheira Governorate, Egypt, during the two summer seasons of 2019 and 2020 to study the effect of foilar application of salicylic and ascorbic acids on yield and quality of soybean cv. Giza 111 under drip irrigation.

Physical and chemical properties of experimental soil are presented in Table 1 which according method described by Page *et al.* (1982).

This experiment was laid out as factorial experiment (two factors) in randomized complete block design (RCBD) in three replications, the first factor was salicylic acid (SA) concentrations (water = control, 500, 1000 and 1500 ppm), while the second factor was ascorbic acid (ASA) concerntration (water = control, 500, 1000 and 1500 ppm) in both seasons. In both seasons of 2019 and 2020 soybean seeds were sown in 5th April and 1st April, respectively.

Each sub plot included 5 lines. Each line was 3.5 meters long and 70 cm apart. Seeds were sown on two sides of the irrigation line at 20 cm hill apart with two seed per hill. The dry planting method called (Affier) and the rates of seeds was 40 kg seeds/fed.

NPK (50 kg N/fed, 24 P_2O_5/fed and 24 K_2O) were splatted and applied with irrigation water and all the other cultural practices were done according to the recommendation of Ministry of Agriculture and Land Reclamation recommendations in The Nubaria Region, El- Beheira Governorate.

The commercial salicylic acid (SA) and ascorbic acid (ASA) from El Jomhoureya Company – Cairo- Egypt were prepared in concentrations of 500, 1000 and 1500 ppm and sprayed three times during the growing season after 30, 45, and 60 days from seed planting at the same times control was sprayed with tab water only.

At harvest time, plant height (cm), number of branches/plant, number of pods/plant, 100- seed weight (g) , seed yield (kg/fed), straw yield (kg/fed), biological yield (kg/fed), harvest index (%), and seed oil content (%) were recorded in both seasons.

Oil % was determined using soxcelt apparatus using n-hexan, according to AOAC (1995).

Table 1. Physiochemical properties of experimental soil in both seasons.

Properties	Seasons	
	2019	2020
Particle size distribution (%)		
Clay	7.50	7.60
Slit	2.00	2.00
Sand	90.50	90.40
Textural class	Sandy	
$CaCO_3$	3.15	2.45
Organic matter (OM %)	0.89	0.90
pH	7.90	7.85
EC (dS/m)	3.93	3.88
Soluble cations (meq/L)		
Ca++	22.12	21.10
Mg++	4.85	4.61
K+	0.56	0.64
Na+	12.17	12.89
Soluble Anions (meq/L)		
Cl-	11.11	11.42
HCO_3^{--}	2.80	2.78
SO_4^{--}	25.80	25.02
Available nutrient (mg/kg)		
K+	112.10	118.34
P	22.00	21.34
N	41.78	40.09
Fe	5.62	5.45
Zn	3.30	3.50
Mn	3.60	3.45
Cu	1.60	1.55

Table 2. Water irrigation analysis of experimental sites in both seasons

Properties	Seasons	
	2019	2020
P^H	7.30	7.50
EC (dS/m)	3.36	3.38
Soluble cations (meq/L)		
Ca++	8.50	8.10
Mg++	6.00	5.61
K+	0.36	0.34
Na+	18.50	17.89
$CaCO_3$	0.00	0.00
Soluble Anions (meq/L)		
Cl-	14.63	13.42
HCO_3^{--}	3.85	3.70
SO_4^{--}	14.80	15.02
Available nutrient (mg/l)		
K+	14.10	13.34
Fe	0.20	0.25
Zn	0.01	0.02
Mn	0.35	0.45
Cu	0.01	0.02

All collected data were subjected to analysis of variance according to Gomez and Gomez (1984). All statistical analysis was performed using analysis of variance technique by means of CoStat (2005) computer software package.

RESULTS AND DISCUSSION

The results obtained in Table (3) reported that plant height (cm), number of pods/plant, and 100- seed weight (g) of soybean were significantly affected by foliar application of salicylic acid (SA) and ascorbic acid (ASA) in 2019 and 2020 seasons.

Results in this Table (3) reported that the increasing of SA concentration increased plant height (cm), number of pods/plant, 100- seed weight (g) but it did not affect a number of branches/plant of soybean in both seasons, where the highest mean values of plant height (cm), number of pods/plant, 100- seed weight (g) recorded with foliar application of SA up to 1500 ppm, followed by 1000 ppm from SA which had no significant difference between its concentrations, while the lowest values of plant height (cm), number of pods/plant, 100- seed weight (g) of soybean were given with spray water (control) treatment in the first and second seasons. It quiet evdent from the present result that SA has a vital role in soybean growth expressed in terms of the plant under the study conditions. This vital role of SA and its necessity for protoplasm formation, photosynthesis activity, cell division, and meristem activity in plant organs is clearly illustrated. These findings are in agreement with those obtained by Pasala *et al*. (2016), Noreen *et al*. (2012), Stevens *et al*. (2006) and Khodary (2004) they showed the vital role of application of salicylic acid on growth characters.

Table (3), also revealed that increasing ascorbic acid (ASA) concentration from 500 up to 1500 ppm significantly increased plant height (cm), number of branches/plant, number of pods/plant, 100- seed weight (g) followed by 1000 ppm from SA which had significant difference between the higher level in comparison with the control treatment. This increase of these characters may be due to the role of ascorbic acid which plays an important role in improving plant tolerance to abiotic stress (Al-Hakimi and Hamada, 2001; Athar *et al.*, 2008). These results are confirmed with those recorded by Ansari and Khan, 1986; Samiullah and Afridi, 1988 they showed that foliar application of ASA significantly increased the growth and yield of the plant.

Table 3. Plant height (cm), number of branches/plant, number of pods/plant, and 100- seed weight (g) of soybean as affected by salicylic acid (SA), ascorbic acid (ASA) and their interaction in both seasons

Treatment	Plant height (cm)		Number of branches/plant		Number of pods/plant		100- seed weight (g)	
	Seasons							
	2019	2020	2019	2020	2019	2020	2019	2020
Salicylic acid (SA) in ppm								
Spray water	84.8	82.3	3.7	3.6	21.9	21.5	13.0	13.8
500	90.1	87.7	4.0	3.6	30.8	27.8	15.9	17.2
1000	93.7	91.2	4.2	3.7	33.1	30.8	16.8	17.9
1500	100.4	98.9	3.9	3.8	34.1	33.4	19.3	20.1
$LSD_{0.05\ (A)}$	5.1	5.3	ns	ns	1.9	1.4	1.4	1.5
B) Ascorbic acid (ASA) in ppm								
Spray water	82.0	81.4	3.0	2.9	21.9	19.6	13.4	14.5
500	88.0	86.3	3.9	3.7	31.6	29.8	14.3	16.4
1000	95.8	91.8	4.3	3.8	31.8	30.0	16.1	17.1
1500	103.2	100.6	4.5	4.3	34.7	34.2	21.2	21.0
$LSD_{0.05\ (B)}$	5.1	5.3	0.5	0.6	1.9	1.4	1.4	1.5
Interaction								
A x B	*	*	*	*	*	*	*	*

* and ns: significant and not significant difference at 0.05 level of probability.

The interaction between salicylic acid (SA) and ASA was significant on these traits, In this respect, the results in Table (4) revealed that the highest mean values of plant height were recorded with foliar application of 1500 ppm SA + 1000 ppm ASA, while application of 500 ppm SA + 1500 ASA increase number of branches/plant, while the highest number of pods/plant was given by the foliar application of 1500 ppm from SA and ASA. Also, the previous treatments (1500 ppm) gave the highest value of 100- seed weight in the first and the second season. In contrast, control treatments (spray water) gave the lowest ones in both seasons.

Table 4. Interaction effect between salicylic acid (SA) and ascorbic acid (ASA) of plant height (cm), number of branches/plant, number of pods/plant, and 100- seed weight (g) for soybean hybrid in both seasons

Treatments		Plant height (cm)		Number of branches/plant		Number of pods/plant		100- seed weight (g)	
Salicylic acid (SA) ppm	Ascorbic acid (ASA) ppm	2019	2020	2019	2020	2019	2020	2019	2020
Spray water	Spray water	74.7	76.7	3.3	3.3	17.3	14.7	10.5	10.2
	500	87.3	83.3	3.3	3.7	22.0	20.7	10.7	14.5
	1000	82.3	76.3	4.0	3.7	25.3	26.0	13.2	14.3
	1500	94.7	93.0	4.0	3.8	23.0	24.7	17.7	16.0
500	Spray water	82.3	84.0	3.0	3.0	26.0	21.7	13.1	15.0
	500	93.3	87.3	4.3	3.0	35.8	32.8	14.4	16.1
	1000	95.0	92.0	4.7	4.0	34.3	31.3	15.2	16.8
	1500	104.3	101.3	4.7	4.6	38.0	37.3	20.7	21.0
1000	Spray water	79.0	74.0	3.0	2.7	21.7	18.7	13.1	14.8
	500	79.3	79.7	4.0	4.3	32.8	29.8	15.1	17.0
	1000	94.0	90.7	4.3	3.0	31.3	28.3	17.0	18.2
	1500	108.0	106.3	4.7	4.3	37.3	34.3	22.0	21.7
1500	Spray water	92.0	91.0	2.7	2.7	22.7	23.3	17.0	18.0
	500	92.0	95.0	4.0	3.7	36.5	35.8	16.9	17.8
	1000	112.0	108.0	4.3	4.3	35.3	34.3	19.0	19.1
	1500	105.7	101.7	4.7	4.3	40.3	40.4	24.3	25.3
$LSD_{0.05\ (A \times B)}$		10.3	10.6	1.0	1.2	3.8	2.7	2.9	3.1

The results in Table (5) revealed that seed yield (kg/fed), straw yield (kg/fed), biological yield (kg/fed), harvest index (%), and seed oil content (%) of soybean were significantly affected by foliar application of salicylic acid (SA) and ascorbic acid (ASA) in 2019 and 2020 seasons.

Results in Table (5) reported that increasing SA concentration from 500 up to 1500 ppm increased seed yield (kg/fed), straw yield (kg/fed), biological yield (kg/fed), and seed oil content (%) while the highest harvest index (%) was given with foliar application of 500 ppm SA/fed of soybean, followed by 1000 ppm from SA.The lowest values of the pervious traits were recorded with spray water (control treatments) in the first and second seasons, respectively. It quiet erdent from the present result that SA has a vital role in soybean growth. This vital role of SA and its necessity for protoplasm formation, photosynthesis activity, cell division, and meristem activity in plant organs is clearly illustrated. These findings are in agreement with those obtained by Pasala *et al*. (2016); Noreen *et al*. (2012); Stevens *et al*. (2006); Khodary (2004) they showed the vital role of application of salicylic acid on growth characters.

Table (5) also showed that increasing ascorbic acid (ASA) concentration significantly increased seed yield (kg/fed), straw yield (kg/fed), biological yield (kg/fed), harvest index (%) as well as seed oil content (%) of soybean in comparison with the control treatment. This increase of these characters may be due to the role of ascorbic acid for improving plant tolerance to abiotic stress (Al-Hakimi and Hamada, 2001; Athar *et al.*, 2008). These results are confirmed with those recorded by Ansari and Khan (1986); Samiullah and Afridi (1988) who showed that foliar application of ASA significantly increased yield of the crop.

Table 5. Seed yield (kg/fed), straw yield (kg/fed), biological yield (kg/fed), harvest index (%), and seed oil content (%) of soybean as affected by salicylic acid (SA), ascorbic acid (ASA) and their interaction in both seasons

Treatment	Seed yield (kg/fed)		Straw yield (kg/fed)		Biological yield (kg/fed)		Harvest index (%)		Seed oil content (%)	
	Seasons									
	2019	2020	2019	2020	2019	2020	2019	2020	2019	2020
A) Salicylic acid (SA) in ppm										
Spray water	512.8	524.2	888.3	880.2	1401.1	1404.4	36.6	37.3	19.3	18.8
500	585.4	612.7	940.1	939.8	1525.5	1593.9	37.5	41.0	21.0	20.7
1000	632.2	654.1	1051.6	1021.0	1683.8	1633.7	38.4	37.5	21.5	21.2
1500	734.7	761.3	1367.7	1326.3	2102.4	2087.6	34.9	36.5	21.5	22.2
$LSD_{0.05\ (A)}$	67.2	49.9	85.8	74.7	127.1	95.2	3.1	2.3	0.8	1.3
Ascorbic acid (ASA) in ppm										
Spray water	485.6	487.8	978.5	958.6	1464.1	1446.4	33.5	34.0	18.5	18.1
500	638.6	664.8	1067.1	1059.9	1705.7	1727.5	36.6	38.6	20.7	21.2
1000	640.2	667.6	1108.8	1086.0	1749.0	1750.8	37.4	38.8	21.5	21.3
1500	700.7	732.2	1093.2	1062.7	1793.9	1794.9	40.0	41.0	22.7	22.3
$LSD_{0.05\ (B)}$	67.2	49.9	85.8	74.7	127.1	95.2	3.1	2.3	0.8	1.3
A x B	*	*	*	*	*	*	*	*	*	*

*: Significant difference at 0.05 level of probability

The interaction between salicylic acid (SA) and ASA was significant on these traits, In this respect, the results in Table (6) revealed that the highest mean values of seed yield (kg/fed), straw yield (kg/fed), biological yield (kg/fed), as well as seed oil content (%) of soybean were recorded with foliar application of 1500 ppm SA + 1500 ppm ASA.On the other hand, the highest values of harvest index (%) recorded with foliar application of 1000 ppm SA + 1500 ppm of Ascorbic acid (ASA), meanwhile the lowest ones were recorded with the control treatments (spray water) in both seasons**.**

Table 6. The interaction effect between salicylic acid (SA) and ascorbic acid (ASA) of seed yield (kg/fed), straw yield (kg/fed), biological yield (kg/fed), harvest index (%), and seed oil content (%) for soybean hybrid in both seasons

Treatments		Seed yield (kg/fed)		Straw yield (kg/fed)		Biological yield (kg/fed)		Harvest index (%)		Seed oil content (%)	
Salicylic acid (SA) in ppm	Ascorbic acid (ASA) in ppm	2019	2020	2019	2020	2019	2020	2019	2020	2019	2020
Spray water	Spray water	388.0	371.0	835.2	786.3	1223.2	1157.3	31.7	32.1	17.2	17.5
	500	545.3	573.7	844.0	929.8	1389.3	1503.5	39.2	38.2	20.0	18.5
	1000	564.0	585.3	948.7	890.3	1512.7	1475.6	37.3	39.7	19.7	20.0
	1500	553.7	566.7	925.3	914.3	1479.0	1481.0	37.4	38.3	20.5	19.3
500	Spray water	440.3	477.7	906.2	880.7	1346.5	1358.4	32.7	35.2	19.0	17.8
	500	629.2	718.8	966.0	1013.3	1595.2	1732.1	39.4	41.5	21.3	22.1
	1000	627.0	698.0	895.7	959.7	1522.7	1657.7	41.2	42.1	21.3	20.0
	1500	645.0	722.0	992.6	905.3	1637.6	1627.3	39.4	44.4	22.5	22.8
1000	Spray water	536.7	528.7	1032.7	1073.3	1569.4	1602.0	34.2	33.0	18.3	18.3
	500	600.0	588.9	1103.5	1026.3	1703.5	1615.2	35.2	36.5	20.5	21.6
	1000	642.0	568.0	1092.1	1041.0	1734.1	1609.0	37.0	35.3	22.4	21.5
	1500	750.0	765.0	978.0	943.3	1728.0	1708.3	43.4	44.8	23.0	23.3
1500	Spray water	577.3	573.7	1140.0	1094.0	1717.3	1667.7	33.6	34.4	19.0	18.7
	500	779.9	788.9	1355.0	1270.0	2134.9	2058.9	36.5	38.3	21.0	22.7
	1000	727.7	807.7	1477.0	1453.0	2226.4	2260.7	32.7	35.7	22.3	23.7
	1500	854.0	875.0	1498.7	1488.0	2331.0	2363.0	36.6	37.0	24.8	23.7
$LSD_{0.05\ (A\ x\ B)}$		134.4	99.8	171.5	149.4	254.3	190.5	6.2	4.6	1.7	2.5

CONCLUSION:

As a result of the two growing seasons field's study, it was concluded that yield, its components of soybean crop increased with planting soybean cv. Giza 111 with foliar application of salicylic (SA) + ascorbic acid (ASA) at the rate of 1500 ppm at the three times under the study conditions with drip irrigation at Nubaria Governorate, Egypt and the similar Regions.

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ARABIC SUMMARY

استجابة نباتات فول الصويا لتخفيف ملوحة مياة الري بحامضي السالسيلك والاسكوربيك

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فول الصويا يتبع العائلة البقولية ويزرع للحصول على البذور لاستخدامها في استخراج الزيت كما يستخدم في الطعام ولتصنيع الأدوية. يعتبر فول الصويا من المحاصيل الغذائية والصناعية الهامة على المستوى العالمي. ويتميّز عن بقية الأنواع الأخرى مع البقول بأنه يحتوي على جميع الأحماض الأمينية الأساسية الثمانية الضرورية لجسم الإنسان لصنع البروتين. هذا يجعله مصدرا ممتازا للبروتين الكامل وخصوصا للنباتيين.

أجريت هذه الدراسة فى مزرعة بمنطقة النوبارية – محافظة البحيرة خلال الموسم الصيفى لعامى 2019 و 2020 و ذلك لدراسة تأثير السالسيلك والاسكوربيك على محصول البذور وجودتها لصنف فول الصويا "جيزة 111" تحت ظروف الري بالتنقيط.

ووزعت المعاملات عشوائياً كتجربة عاملية ذات عاملين في تصميم القطاعات الكاملة العشوائية RCBD فى ثلاث مكررات مع التوزيع العشوائى للمعاملات التجريبية وهى:

العامل الاول : 4 تركيزات من السالسيلك : (الرش بالماء (الكنترول) ، 500 ، 1000 ، 1500 جزء في المليون ppm).

العامل الثاني : 4 تركيزات من حامض الأسكوربيك : (الرش بالماء (الكنترول) ، 500 ، 1000 ، 1500 جزء في المليون ppm).

على أن يكون الرش ثلاثة مرات عند 30 ، 45 ، 60 يوم من الزراعة.والمعاملات الزراعية الأخري أجريت كتوصيات وزراة الزراعة واستصلاح الأراضي لمحصول فول الصويا في النوبارية.

وأظهرت النتائج أن:

- الرش الورقي بحمض السالسيلك وحمض الاسكوربيك أثر معنوياً على كل من ارتفاع النبات (سم) وعدد الأفرع للنبات وعدد القرون للنبات ووزن 100 بذرة (جم) و محصول البذور (كجم/فدان) ومحصول العرش (كجم/فدان) والمحصول البيولوجي ودليل الحصاد (%) ومحتوى البذور من الزيت (%) تحت ظروف مياه الري الملحية باستخدام نظام الري بالتنقيط خلال موسمي الزراعة.
- زيادة معدل الرش الورقي لحامض السالسيلك من 500 الى 1500 جزء في المليون حققت زيادة معنوية في معظم الصفات المدروسة تحت ظروف التجربة. وسجل الرش بمعدل 1500 جزء في المليون اعلى متوسط قيم للصفات تحت الدراسة ومتبوعاً بمعدل 1000 جزء في المليون حيث لا يوجد بينها وبين المعدل الأعلى 1500 جزء في المليون خلال موسمي الدراسة.
- حقق زيادة معدل الرش الورقي لحامض الاسكوربيك من 500 الى 1500 جزء في المليون زيادة معنوية في معظم الصفات المدروسة تحت ظروف التجربة حيث حقق معدل 1000 جزء في المليون أعلى متوسطات القيم خلال موسمي الدراسة.
- التداخل بين عاملي الدراسة كان له تأثير معنوياً حيث وجد أن أفضل معدل للرش الورقي لحامض السالسليك هو 1500 أو 1000 جزء في المليون مع 500 أو 1000 جزء في المليون من حمض الاسكوربيك حيث حققت هذه المعدلات أعلى القيم لجميع صفات الدراسة خلال موسمي الزراعة.

التوصية:

توصى الدراسة بزراعة فول الصويا صنف (جيزة 111) مع الرش الورقي بمعدلات 1000 جزء في المليون من حامضي السالسليك والأسكوربيك حيث أن هذه المعدلات حققت أعلى محصول بذور ومكوناته وأعلى نسبة زيت في البذور (%) تحت ظروف مياه الري الملحية خلال نظام الري بالتنقيط وخلال موسمي الدراسة وتحت ظروف منطقة النوبارية – محافظة البحيرة – مصر وظروف المناطق المماثلة لها.