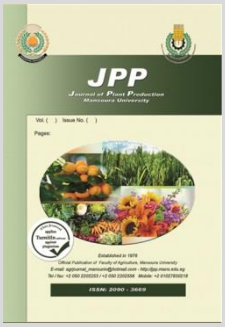
Journal of Plant Production

Journal homepage: www.jpp.mans.edu.eg
Available online at: www.jpp.journals.ekb.eg

Effect of Salicylic Acid and Foliar Spraying with some Microelements on Seed Yield and Quality of some Pea (*Pisum sativum* L.) Cultivars

Abdelmageed, Y. T.[1]; H. E. M. Zaki[1,2*]; M. S. Mohamed[3] and A. K. Elsaied[3]

[1]Hort. Dept. Fac. Agric., Minia University, El-Minia 61517, Egypt.
[2]Applied Biotech. Dept., Univ. of Technology and Applied Sciences, Sur, Sultanate of Oman.
[3]Hort. Res. Inst., Agric. Res. Center, Giza, Egypt.



ABSTRACT

The present study was carried out under field conditions over two successive winter seasons of 2015/2016 and 2016/2017 on clay loam soil at the Experimental Farm at Shandaweel Agriculture Research Station, Sohag Governorate, Egypt. The aim of this research was to investigate effects of salicylic acid application in combination with foliar spraying with different rates of some microelements (Iron, Zinc and Manganese) on green and seed yield of some pea (*Pisum sativum* L.) cultivars. Under field conditions of this study, the interaction among Palmoral cv., 150 ppm of microelements and 300 ppm of salicylic acid concentrations produced the highest production of green pod yield (ton/fed.) and seed yield (kg/fed.) of pea. Furthermore, the application of interaction among Jaguar cv., 150 ppm of microelements and 300 ppm of salicylic acid concentrations gave the highest number of green pods per plant. The interaction among Master B cv., 150 ppm of microelements and 300 ppm of salicylic acid concentrations produced the tallest green pod (cm) and number of green seeds/green pod of pea over both experimental seasons. The highest values of the investigated yield and quality parameters were obtained by the interaction between 150 ppm of microelements and 300 ppm of salicylic acid in the first and second seasons. From results of this experiment, it could be concluded that application of adequate amounts of salicylic acid in combination with foliar application of microelements is one of the most important factors involved in improving yield and quality of pea plants and productivity.

Keywords: Salicylic acid, Microelements, Foliar application, Pea (*Pisum sativum* L.).

INTRODUCTION

Pea (*Pisum sativum* L.) is one of the most important legume vegetable crops grown in Egypt and many countries over the world. It has many nutritional values such as high content of protein, carbohydrates, phosphorus, iron, calcium and vitamins A and B (Watt and Merrill, 1963; Hassan, 1997). Green pea (*Pisum sativum* L.) is one of the main leguminous vegetables grown during the winter season in Egypt for local markets and exportation (Riad *et al*., 2018). In Egypt, green pea production area was 18471 ha with a total production of 184018 tons and an average yield of 9.96 tons ha^{-1} (FAOSTAT, 2014). Increasing the production of peas green pods and dry seeds with high quality is considered an important aim and this aim could be achieved through using salicylic acid and microelements. Peas is one of the most widely consumed legumes in the world and is grown in different regions and environments in many countries. Peas are high in digestible protein, carbohydrates, fats, minerals and vitamins (Marwa *et al*., 2020).

Salicylic acid (SA) naturally occurs in plants in very low quantity. It is a natural product of phenyl propanoid metabolism. Decarboxylation of transcinnamic acid to SA has direct involvement in plant growth, thermogenesis, flower induction and uptake of ions benzoic acid and its subsequent 2-hydroxylation results to SA (Popova *et al*., 2008). (SA) is a ubiquitous phenolic compound occurring in plants in very low amounts and has been reported to regulate the physiological processes in plants such as nutrient uptake, inhibition of ethylene biosynthesis, chlorophyll synthesis, protein synthesis, photosynthesis and transpiration (Raskin 1992, Khan *et al*., 2003). Application of adequate amounts of microelements is one of the most important factors involved in improving plant growth, yield and quality of pea. The nutrition of plants by foliar application is an additional channel of nutrients and a mean of regulating root absorption by such plants (El-Hawary, 1999). The importance of spraying microelements, i.e., Fe, Zn and Mn can be accounted by Their essential role in respiration, their metabolism activation of the enzyme, photosynthesis, chloroplast formation, chlorophyll synthesis and natural hormone biosynthesis (Epstien, 1972). Therefore, the present study was conducted to evaluate effects of salicylic acid and foliar application of some microelements on green and seed yield of pea (*Pisum sativum* L.) some cultivars under field conditions.

MATERIALS AND METHODS

The present study was carried out under field conditions during two successive winter seasons of 2015/2016 and 2016/2017 on clay loam soil at the Experimental Farm at Shandaweel Agriculture Research

* **Corresponding author.**
E-mail address: haitham.zaki@mu.edu.eg
DOI: 10.21608/jpp.2020.112908

Station, Sohag Governorate, Egypt. Surface soil samples (0-30 cm depth) from different parts of the experimental site were collected for soil analyses determination using standard methods by Page *et al*., (1982). The soil of the investigated farm is a good quality soil resulted from fluvial processes (alluvial soil) and dominating in the Nile valley of Egypt and characterized with clay loam soil texture, organic matter of 2.34%, soil pH of 7.76 and EC 0.92 dSm^{-1}. Alluvial soil is well-known as affluent in nutrients, organic matter and provides a good environment for plants growth

1- Experimental design and procedures.

The experimental design was Randomized Complete Block Design in split - split plots arrangements, with three replicates. Cultivars (Master B, Jaguar and Palmoral) were arranged in main plots, the microelements concentrations i.e., zero (control), 50, 100, and 150 ppm were arranged in sub plots While, salicylic acid concentrations i.e., zero (control), 150, and 300 ppm were arranged in sub-sub plots. Each experimental unit was 10.5 m^2 consisting of 5 ridges at 60 cm apart and 3.5 m length. Sowing was done in the 3rd and the 5th of October in the first and second seasons, respectively. Two seeds were sown per hill on the sides of ridge at 10 cm apart. Standard agricultural practices known for commercial pea production other than the applied treatments were followed. Three ridges were chosen for seed yield characteristics and the other two ridges were chosen for green fruit characteristics.

Data were collected from five randomly taken plants from each plot and the following parameters were measured; No. branches per plant, green pod length (cm), green pod diameter (cm), No. green pods/plant, No. green seeds/green pod, green pod weight/plant (g), green pod yield (ton/fed.), seed weight/plant (g), seed yield (kg/fed.) and 100- seeds weight (g).

Statistical analysis

All data of this study were statistically analyzed according to the analysis of variance (ANOVA) for the split plot arrangement as published by Gomez and Gomez (1984), using "MSTAT-C" Computer software package. The treatment means were compared using the Least Significant Differences method as described by Waller and Duncan (1969).

RESULTS AND DISCUSSION

The results of this field study are presented under these main headings:

1- Number of branches/plants, No. green pods/plant and 100-seeds weight (g).

Concerning the effect of interaction between pea cultivars and microelements concentrations on No. branches per plant, No. green pods/plant and 100-seeds weight (g) of pea. Data in Tables (1), (2) and (3) reveal a significant effect between pea cultivars and microelements concentrations in both seasons. The highest values were obtained by the interaction between Jaguar cv. and 150 ppm in the first and second seasons, respectively.

Data in tables (1), (2) and (3) show that the interaction between pea cultivars and salicylic acid concentrations have a significant effect on No. branches / plant, No. green pods/plant and 100-seeds weight (g) of pea. The highest values of No. branches/plant, No. green pods/plant and 100-seeds weight (g) of pea were recorded by the interaction between Jaguar cv. and 300 ppm in the both seasons.

Table 1. Number of branches/plants as affected by pea cultivars, microelements, salicylic acid and their interactions over two seasons.

Seasons		First season				Second season			
		Salicylic acid (C)				Salicylic acid (C)			
Cultivars (A)	Microelements (B)	0 ppm	150 ppm	300 ppm	Mean	0 ppm	150 ppm	300 ppm	Mean
Master B	0 ppm	1.37lm	1.47klm	1.53klm	1.46G	1.43r	1.67pq	1.80nop	1.63G
	50 ppm	1.53klm	1.47klm	1.63jkl	1.54FG	2.00lm	1.70pq	1.80nop	1.83F
	100 ppm	1.73h-l	1.87f-k	1.57klm	1.72EF	1.90mno	2.10kl	1.70pq	1.90F
	150 ppm	2.03e-i	2.10e-h	2.10e-h	2.08CD	1.90mno	2.17jk	2.43hi	2.17DE
	Mean	1.67C	1.73BC	1.71BC	1.70B	1.81G	1.91F	1.93F	1.88C
Jaguar	0 ppm	2.17d-g	2.27b-f	2.60ab	2.34AB	2.13kl	2.50h	2.70ef	2.44C
	50 ppm	2.60ab	2.20c-f	2.37b-e	2.46A	2.90cd	2.47h	2.67fg	2.68B
	100 ppm	2.50a-d	2.57abc	2.30b-e	2.46A	2.80def	3.00bc	2.67fg	2.82B
	150 ppm	2.33b-e	2.57abc	2.80a	2.50A	2.83de	3.07ab	3.17a	3.02A
	Mean	2.45A	2.40A	2.47A	2.44A	2.67B	2.76A	2.80A	2.74A
Palmoral	0 ppm	1.20m	1.47klm	1.67i-l	1.44G	1.37r	1.60q	1.77op	1.58G
	50 ppm	1.67i-l	1.80g-k	1.67i-l	1.71EF	1.93mn	1.93mn	2.10kl	1.99EF
	100 ppm	1.73h-l	2.07e-h	2.00e-j	1.93DE	2.23jk	2.47h	2.30ij	2.33CD
	150 ppm	2.27b-f	2.10e-h	2.17d-g	2.18BC	2.53gh	2.67fg	2.93bcd	2.71B
	Mean	1.72BC	1.86B	1.87B	1.82B	2.02E	2.17D	2.26C	2.15B
Interaction B x C	0 ppm	1.58e	1.73de	1.93cd	1.75D	1.64j	1.92i	2.09h	1.89D
	50 ppm	2.00bc	1.82cd	1.89cd	1.90C	2.28ef	2.03h	2.19g	2.17C
	100 ppm	1.99bc	2.17ab	1.96c	2.04B	2.31e	2.52c	2.22fg	2.35B
	150 ppm	2.21a	2.26a	2.29a	2.25A	2.42d	2.63b	2.84a	2.63A
		1.94A	1.99A	2.02A		2.16C	2.28B	2.34A	

*Means followed by the same letter or letters are not significantly different at the 5% significance level.

Table 2. Number of Green pods/ plants as affected by pea cultivars, microelements, salicylic acid and their interactions over two seasons.

Seasons		First season				Second season			
		Salicylic acid (C)				Salicylic acid (C)			
Cultivars (A)	Microelements (B)	0 ppm	150 ppm	300 ppm	Mean	0 ppm	150 ppm	300 ppm	Mean
Master B	0 ppm	5.33n	5.47n	6.13n	5.64E	5.47t	5.97st	6.43rst	5.96K
	50 ppm	6.40n	5.93n	6.00n	6.11DE	7.13qr	6.00st	6.40rst	6.51J
	100 ppm	6.20n	6.33n	6.20n	6.24DE	7.07qrs	7.83pq	6.90qrs	7.27I
	150 ppm	6.67n	6.67n	6.97n	6.77D	7.50pqr	8.27op	9.17no	8.31H
	Mean	6.15D	6.10D	6.33D	6.19C	6.79E	7.02E	7.23E	7.01C
Jaguar	0 ppm	9.80lm	14.10def	15.40bcd	13.10B	9.23no	13.83fgh	15.00de	12.69E
	50 ppm	16.00bc	10.97i-l	13.43d-g	13.47B	16.40bc	11.93kl	13.50fgh	13.94C
	100 ppm	13.80d-g	17.93a	12.40f-j	14.71A	14.57def	17.63a	12.70h-k	14.97B
	150 ppm	13.40d-g	15.07cde	17.17ab	15.21A	13.70fgh	15.60cd	17.17ab	15.49A
	Mean	13.25B	14.52A	14.60A	14.12A	13.48B	14.75A	14.59A	14.27A
Palmoral	0 ppm	8.93m	10.20klm	10.83j-m	9.99C	8.97o	10.10mn	11.90kl	10.32G
	50 ppm	11.07i-l	10.40klm	11.40h-l	10.96C	13.17g-j	11.07lm	12.37ijk	12.20F
	100 ppm	12.67f-j	13.13e-h	11.87g-k	12.56B	13.40ghi	14.53def	12.13jkl	13.36D
	150 ppm	12.90f-i	13.47d-g	14.03def	13.47B	13.13g-j	14.13efg	15.23de	14.17C
	Mean	11.39C	11.80C	12.03C	11.74B	12.17D	12.46CD	12.91C	12.51B
Interaction B x C	0 ppm	8.02f	9.92de	10.79bcd	9.58D	7.89g	9.97f	11.11de	9.66D
	50 ppm	11.16bc	9.10e	10.28cd	10.18C	12.23bc	9.67f	10.76e	10.89C
	100 ppm	10.89bcd	12.47a	10.16cd	11.17B	11.68cd	13.33a	10.58e	11.83B
	150 ppm	10.99bcd	11.73ab	12.72a	11.82A	11.44d	12.67b	13.86a	12.66A
		10.26B	10.81A	10.99A		10.81B	11.41A	11.58A	

*Means followed by the same letter or letters are not significantly different at the 5% significance level.

Table 3. 100-seed weight (g) as affected by pea cultivars, microelements, salicylic acid and their interactions over two seasons.

Seasons		First season				Second season			
		Salicylic acid (C)				Salicylic acid (C)			
Cultivars (A)	Microelements (B)	0 ppm	150 ppm	300 ppm	Mean	0 ppm	150 ppm	300 ppm	Mean
Master B	0 ppm	14.93r	15.43qr	16.23op	15.53I	15.20t	15.43t	16.37qr	15.67G
	50 ppm	17.37j-n	16.07opq	16.63no	16.69GH	17.20no	16.07rs	16.90opq	16.72F
	100 ppm	17.43i-m	18.07f-j	17.33j-n	17.61EF	17.70lmn	18.90e-h	17.37mno	17.99D
	150 ppm	18.17f-i	18.80ef	20.70b	19.22BC	18.27ijk	19.27de	20.53b	19.36BC
	Mean	16.98F	17.09F	17.73DE	17.26C	17.09F	17.42E	17.79CD	17.43C
Jaguar	0 ppm	16.23op	17.13k-n	17.53h-m	16.97FG	16.50pqr	17.27no	18.33ijk	17.37E
	50 ppm	18.30fgh	16.77mno	17.67h-l	17.59EF	19.17def	16.97op	18.33ijk	18.16D
	100 ppm	18.57efg	19.30de	18.20f-i	18.69CD	19.07efg	19.87c	18.53g-j	19.16C
	150 ppm	19.23de	20.23bc	21.47a	20.31A	19.43cde	20.43b	21.87a	20.58A
	Mean	18.08BC	18.36B	18.72A	18.39A	18.54B	18.63B	19.27A	18.81A
Palmoral	0 ppm	15.57pqr	16.20op	16.77mno	16.18H	15.67st	16.50pqr	16.97op	16.38F
	50 ppm	17.23k-n	17.00lmn	17.20k-n	17.14FG	17.93kl	17.07o	18.43h-k	17.81D
	100 ppm	17.90g-k	18.67efg	18.03f-j	18.20DE	17.90klm	18.67f-i	18.07jkl	18.21D
	150 ppm	19.13e	19.93cd	20.43bc	19.83AB	19.00efg	19.70cd	20.63b	19.78B
	Mean	17.46E	17.95CD	18.11BC	17.84B	17.63DE	17.98C	18.53B	18.04B
Interaction B x C	0 ppm	15.58h	16.26g	16.84ef	16.23D	15.79i	16.40h	17.22f	16.47D
	50 ppm	17.63d	16.61fg	17.17e	17.14C	18.10de	16.70g	17.89e	17.56C
	100 ppm	17.97d	18.68c	17.86d	18.17B	18.22d	19.14c	17.99de	18.45B
	150 ppm	18.84c	19.66b	20.87a	19.79A	18.90c	19.80b	21.01a	19.90A
		17.51C	17.80B	18.18A		17.75C	18.01B	18.53A	

*Means followed by the same letter or letters are not significantly different at the 5% significance level.

The interaction between microelements and salicylic acid concentrations have a significant effect on No. branches/plant, No. green pods/plant and 100-seeds weight (g) in both seasons. The highest values were obtained by the interaction between 150 ppm of microelements and 300 ppm of salicylic acid in the first and second seasons. These results are in the same way for Ali and Mahmoud, 2013. The presented increase in vegetative growth may be due to the beneficial effect of micronutrients and salicylic acid together on absorption and efficiency of plant nutrients as well as high photosynthetic rate in plants (Abd-Elkader, 2016).

For the interactions among pea cultivars, microelements and salicylic acid concentrations, data in the same tables show a significant effect on No. branches / plant, No. green pods/plant and 100-seeds weight (g) in the two experimental seasons. The highest No. branches/plant, No. green pods/plant and 100-seeds weight (g) of pea were recorded by the interaction among Jaguar cv., 150 ppm of microelements and 300 ppm of salicylic acid in the first and second seasons.

2- Green pod length (cm) and green pod diameter:

In relation to the effect of interaction between pea cultivars and microelements concentrations on green pod length (cm) and green pod diameter (cm) of pea. Data in

tables (3) and (4) show a significant effect between them. The highest values of green pod length (cm) were gained by the interaction between Master B cv. and 150 ppm of microelements concentration in both seasons. Meanwhile, the highest values of green pod diameter were recorded by interaction between Palmoral cv. and 150 ppm of microelements concentration in the two experimental seasons.

Data in the same tables show that the interaction between pea cultivars and salicylic acid concentrations have a significant effect on green pod length (cm) and green pod diameter (cm) of pea. The highest values of green pod length (cm) of pea were recorded by the interaction between Master B cv. and 300 ppm and in the first and second seasons. Meanwhile, the highest values of green pod diameter (cm) of pea were recorded by the interaction between palmoral cv. and 300 ppm and in both seasons.

Table 4. Green pod length (cm) as affected by pea cultivars, microelements, salicylic acid and their interactions over two seasons.

Seasons		First season				Second season			
		Salicylic acid (C)				Salicylic acid (C)			
Cultivars (A)	Microelements (B)	0 ppm	150 ppm	300 ppm	Mean	0 ppm	150 ppm	300 ppm	Mean
Master B	0 ppm	8.77de	9.83bc	10.30abc	9.63C	8.77mno	9.53i	10.13fg	9.48D
	50 ppm	10.43ab	9.80c	10.37abc	10.20B	10.57de	9.53i	10.23fg	10.11C
	100 ppm	10.27abc	10.67a	10.17abc	10.37AB	10.67de	11.07c	10.37ef	10.70B
	150 ppm	10.43ab	10.60a	10.70a	10.58A	10.77cd	11.63b	12.10a	11.50A
	Mean	9.97B	10.22AB	10.38A	10.19A	10.19C	10.44B	10.71A	10.45A
Jaguar	0 ppm	8.10f	8.40def	8.57def	8.36EFG	8.20qr	8.50opq	8.97klm	8.56G
	50 ppm	8.63def	8.17ef	8.63def	8.48EF	9.40ij	8.57nop	8.97klm	8.99EF
	100 ppm	8.87d	8.97d	8.17ef	8.67DE	9.43ij	10.00g	8.97klm	9.47D
	150 ppm	8.67def	8.93d	8.93d	8.84D	9.50ij	10.13fg	10.60de	10.8C
	Mean	8.57C	8.62C	8.57C	8.59B	9.13F	9.30DE	9.38D	9.27B
Palmoral	0 ppm	8.03f	8.10f	8.23ef	8.12G	8.03r	8.63m-p	9.17jkl	8.61FG
	50 ppm	8.40def	8.10f	8.23ef	8.24FG	9.63hi	8.40pq	8.77mno	8.93EF
	100 ppm	8.43def	8.57def	8.33def	8.44EFG	9.17jkl	9.63hi	8.90lmn	9.23DE
	150 ppm	8.60def	8.60def	8.63def	8.61DE	9.30ijk	9.57i	9.93gh	9.60D
	Mean	8.37C	8.34C	8.36C	8.36B	9.03F	9.06F	9.19EF	9.04B
Interaction B x C	0 ppm	8.30f	8.78de	9.03bcd	8.70C	8.33g	8.89f	9.42e	8.88D
	50 ppm	9.16abc	8.69e	9.08a-d	8.97BC	9.87d	8.83f	9.32e	9.34C
	100 ppm	9.19abc	9.40a	9.89cde	9.16AB	9.76d	10.23c	9.41e	9.80B
	150 ppm	9.23ab	9.38a	9.42a	9.34A	9.86d	10.44b	10.88a	10.39A
		8.97A	9.06A	9.10A		9.45C	9.60B	9.76A	

*Means followed by the same letter or letters are not significantly different at the 5% significance level.

The interaction between microelements and salicylic acid concentrations have a significant effect on green pod length (cm) and green pod diameter (cm) in both seasons. The highest values were obtained by the interaction between 150 ppm of microelements and 300 ppm of salicylic acid concentrations in the first and second seasons.

About the interactions among pea cultivars, microelements and salicylic acid concentrations, data in Tables (3) and (4) show a significant effect on green pod length (cm) and green pod diameter (cm) in the two experimental seasons. The highest green pod length (cm) of pea i.e., (10.70 and 12.10 cm) was obtained by the interaction among Master B cv., 150 ppm of microelements and 300 ppm of salicylic acid in the first and second seasons, respectively. The highest green pod diameter (cm) of pea i.e., (1.13 and 1.22 cm) were obtained by the interaction among Palmoral cv., 150 ppm of microelements and 300 ppm of salicylic acid in the two experimental seasons, respectively.

3- Number of green seeds/green pod.

Concerning the effect of interaction between pea cultivars and microelements concentrations on No. green seeds/green pod of pea, data in Table (5) reveal a significant effect between pea cultivars and microelements concentrations in both seasons. The highest values were obtained by the interaction between Master B cv. and 150 ppm in the first and second seasons, respectively.

Data in the same table show that the interaction between pea cultivars and salicylic acid concentrations have a significant effect on No. green seeds/green pod of pea. The highest values of No. green seeds/green pod of pea were recorded by the interaction between Master B cv. and 150 ppm in the first seasons. The highest No. green seeds/green pod in the second season was recorded by the interaction between Master B cv. and 300 ppm of salicylic acid.

The interaction between microelements and salicylic acid concentrations had a significant effect on No. green seeds/green pod in both seasons. The highest values were recorded by the interaction between 150 ppm of microelements and 300 ppm of salicylic acid in the first and second seasons, respectively. These results are in agreement with those reported by Ali and Mahmoud, 2013

For the interactions among pea cultivars, microelements and salicylic acid concentrations. Data in Table (5) show a significant effect on No. green seeds/green pod in the two experimental seasons. The highest No. green seeds/green pod of pea was obtained by the interaction among Master B cv.,150 ppm of microelements and 300 ppm of salicylic acid in the two studied seasons, respectively.

4- Green pod weight/plant and Green pod yield/fed.

In relation to the effect of interaction between pea cultivars and microelements concentrations on green pod weight per plant (g) of pea, data tabulated in (6), (7) and (8) reveal a significant effect between pea cultivars and microelements concentrations in both seasons. The highest values were obtained by the interaction between Palmoral cv. and 150 ppm in the two successive seasons.

Data in the same tables show that the interaction between pea cultivars and salicylic acid concentrations have a significant effect on green pod weight per plant (g) and green pod yield/fed. of pea. The highest values of green pod weight per plant and green pod yield/fed. of pea were recorded by the interaction between Palmoral cv. and 300 ppm in the first and second seasons, respectively.

The interaction between microelements and salicylic acid concentrations have a significant effect on green pod weight per plant (g) and green pod yield/fed. in both seasons. The highest values were gained by the interaction between 150 ppm of microelements and 300 ppm of salicylic acid in the first and second seasons, respectively. These results are in agreement with those reported by Abd-Elkader, 2016. These yield increments, due to micronutrients and salicylic acid treatments, might be attributed to the increase in vegetative growth characters of pea plants, stimulating of mineral uptake and enhancement of photosynthetic pigments which increased photosynthesis, resulting in assimilation of more carbohydrates accumulation and their translocation to plants, leading to increase in yield potential of plants (Abd-Elkader, 2016).

Table 5. Green pod diameter (cm) as affected by pea cultivars, microelements, salicylic acid and their interactions over two seasons.

Seasons		First season				Second season			
		Salicylic acid (C)				Salicylic acid (C)			
Cultivars (A)	Microelements (B)	0 ppm	150 ppm	300 ppm	Mean	0 ppm	150 ppm	300 ppm	Mean
Master B	0 ppm	0.93h	0.95gh	0.96gh	0.95D	0.94s	0.97r	0.99qr	0.96F
	50 ppm	0.96gh	0.94h	0.95gh	0.95D	1.02op	0.98qr	1.00pq	1.00E
	100 ppm	0.98fgh	0.99fgh	0.95gh	0.97D	1.03no	1.07klm	0.99qr	1.03DE
	150 ppm	0.95gh	0.98fgh	0.99fgh	0.97D	1.03no	1.08jkl	1.13d-g	1.08C
	Mean	0.95C	0.96C	0.96C	0.96B	1.01E	1.02D	1.03D	1.02B
Jaguar	0 ppm	1.03ef	1.04c-f	1.04def	1.04C	1.04mno	1.06lmn	1.08jkl	1.06CD
	50 ppm	1.04c-f	1.04c-f	1.09a-e	1.06BC	1.11e-i	1.05l-o	1.08i-l	1.08C
	100 ppm	1.11ab	1.12ab	1.07a-e	1.10A	1.12efg	1.16cd	1.08jkl	1.12B
	150 ppm	1.08a-e	1.09a-e	1.10abc	1.09A	1.12e-h	1.14e	1.20ab	1.15AB
	Mean	1.07B	1.07AB	1.08AB	1.07A	1.10B	1.10B	1.11B	1.10A
Palmoral	0 ppm	1.01fg	1.07b-e	1.09a-e	1.05BC	0.98qr	1.04mno	1.09h-k	1.04D
	50 ppm	1.09a-e	1.08a-e	1.09a-e	1.09AB	1.10g-j	1.04mno	1.08i-l	1.07C
	100 ppm	1.10a-d	1.10ab	1.09a-e	1.10A	1.12efg	1.17bc	1.11f-j	1.13B
	150 ppm	1.09a-e	1.12ab	1.13a	1.12A	1.13def	1.18bc	1.22a	1.18A
	Mean	1.07B	1.09AB	1.10A	1.09A	1.09C	1.11B	1.13A	1.10A
Interaction B x C	0 ppm	0.99d	1.02cd	1.03c	1.01B	0.98g	1.02f	1.05e	1.02D
	50 ppm	1.03c	1.02cd	1.04abc	1.03B	1.08cd	1.02f	1.06e	1.05C
	100 ppm	1.06ab	1.07ab	1.04bc	1.06A	1.09c	1.13b	1.06de	1.10B
	150 ppm	1.04abc	1.07ab	1.07a	1.06A	1.10c	1.13b	1.18a	1.14A
		1.03A	1.04A	1.05A		1.06B	1.08A	1.09A	

*Means followed by the same letter or letters are not significantly different at the 5% significance level.

Table 6. Number of green seeds/green pod as affected by pea cultivars, microelements, salicylic acid and their interactions over two seasons.

Seasons		First season				Second season			
		Salicylic acid (C)				Salicylic acid (C)			
Cultivars (A)	Microelements (B)	0 ppm	150 ppm	300 ppm	Mean	0 ppm	150 ppm	300 ppm	Mean
Master B	0 ppm	6.67c-h	7.00b-g	7.10a-f	6.92BC	6.50rs	6.93opq	7.30j-n	6.91EF
	50 ppm	7.40abc	6.83b-h	6.90b-h	7.04B	7.73efg	6.83pq	7.00n-q	7.19DE
	100 ppm	7.17a-e	7.27a-d	6.60c-h	7.01BC	7.33j-n	8.23abc	7.17k-p	7.58BC
	150 ppm	7.30a-d	7.63ab	7.90a	7.61A	7.50g-k	7.90def	8.50a	7.97A
	Mean	7.13A	7.18A	7.12A	7.15A	7.27BC	7.47A	7.49A	7.41A
Jaguar	0 ppm	6.43d-h	6.43d-h	6.70c-h	6.52CD	6.27st	6.70qr	7.07l-p	6.68FG
	50 ppm	6.77b-h	6.17gh	6.73c-h	6.56BCD	7.53g-j	6.40rs	6.87pq	6.93EF
	100 ppm	6.83b-h	6.87b-h	6.33e-h	6.68BCD	7.27j-o	7.70e-h	6.70qr	7.22DE
	150 ppm	6.60c-h	6.73c-h	6.87b-h	6.73BCD	7.33j-n	7.67f-i	8.17bcd	7.72AB
	Mean	6.55B	6.66B	6.66B	6.62B	7.10DE	7.12CDE	7.20BCD	7.14A
Palmoral	0 ppm	6.06h	6.47d-h	6.47d-h	6.33D	6.07t	6.50rs	6.90pq	6.49G
	50 ppm	7.10a-f	6.90b-h	6.97b-g	6.99BC	7.27j-o	6.70qr	7.03m-p	7.00DE
	100 ppm	7.20a-e	7.37abc	6.23fgh	6.93BC	7.37i-m	7.40h-l	7.13l-p	7.30CD
	150 ppm	6.93b-h	6.70c-h	6.63c-h	6.76BCD	7.40h-l	8.00cde	8.33ab	7.91A
	Mean	6.82AB	6.86AB	6.57B	6.75AB	7.03E	7.15CDE	7.35AB	7.18A
Interaction B x C	0 ppm	6.39c	6.63bc	6.76abc	6.59B	6.28g	6.71f	7.09e	6.69D
	50 ppm	7.08ab	6.63bc	6.87ab	6.86A	7.51c	6.64f	6.97e	7.04C
	100 ppm	7.07ab	7.17a	6.39c	6.87A	7.32d	7.78b	7.00e	7.37B
	150 ppm	6.94ab	7.02ab	7.13a	7.03A	7.41cd	7.86b	8.33a	7.87A
		6.79A	6.86A	6.87A		7.13C	7.25B	7.35A	

*Means followed by the same letter or letters are not significantly different at the 5% significance level.

Table 7. Green pod weight/plant (g) as affected by pea cultivars, microelements, salicylic acid and their interactions over two seasons.

Seasons		First season				Second season			
		Salicylic acid (C)				Salicylic acid (C)			
Cultivars (A)	Microelements (B)	0 ppm	150 ppm	300 ppm	Mean	0 ppm	150 ppm	300 ppm	Mean
Master B	0 ppm	63.37o	65.73no	66.47mn	65.19D	63.40q	65.23p	67.33mno	65.32G
	50 ppm	66.80lmn	67.07l-n	67.60j-n	67.16CD	69.87hij	67.00no	69.23i-l	68.70F
	100 ppm	67.77i-n	68.17i-n	67.37i-n	67.77CD	71.83efg	74.10bcd	68.00k-n	71.31CD
	150 ppm	69.70g-m	71.93c-h	73.10a-f	71.58AB	70.40ghi	72.87de	74.63bc	72.63B
	Mean	66.91F	68.23EF	68.63DE	67.92B	68.88E	69.80D	69.80D	69.49C
Jaguar	0 ppm	67.07k-n	68.57i-n	68.73h-n	68.12CD	66.30op	69.00i-l	70.47ghi	68.59F
	50 ppm	68.83h-n	67.47j-n	68.83h-n	68.38C	72.00ef	67.47mno	70.20hij	69.89E
	100 ppm	73.40a-e	75.10abc	68.20i-n	72.23AB	73.30cde	75.57ab	69.33ijk	72.73B
	150 ppm	69.97f-l	75.43ab	75.53a	73.64AB	71.87efg	74.80bc	76.63a	74.43A
	Mean	69.82CD	71.64AB	70.33BC	70.59A	70.87C	71.71B	71.66B	71.41B
Palmolar	0 ppm	70.97d-i	69.07g-n	74.10a-d	71.38B	67.77l-o	70.03hij	73.37cde	70.39DE
	50 ppm	75.27ab	68.67h-n	70.20e-k	71.38B	75.10b	68.67j-m	70.97fgh	71.58BC
	100 ppm	72.20b-g	75.07abc	70.50e-j	72.59AB	72.70de	74.63bc	70.17hij	72.05B
	150 ppm	73.07a-f	74.20abc	76.20a	74.49A	73.23cde	74.80bc	76.57a	74.87A
	Mean	72.88A	71.75AB	72.75A	72.46A	72.20AB	72.03B	72.77A	72.33A
Interaction B x C	0 ppm	67.13e	67.79e	69.77cd	68.23C	65.82g	68.09f	70.39d	68.10D
	50 ppm	70.30cd	67.73e	68.88de	68.97C	72.32c	67.71f	70.13d	70.06C
	100 ppm	71.12c	72.78b	68.69de	70.86B	72.61c	74.77b	69.17e	72.18B
	150 ppm	70.91c	73.86ab	74.94a	73.24A	71.83c	74.16b	75.94a	73.98A
		69.87A	70.54A	70.57A		70.65B	71.18A	71.41A	

*Means followed by the same letter or letters are not significantly different at the 5% significance level.

Table 8. Green pod yield (ton/fed.) as affected by pea cultivars, microelements, salicylic acid and their interactions over two seasons.

Seasons		First season				Second season			
		Salicylic acid (C)				Salicylic acid (C)			
Cultivars (A)	Microelements (B)	0 ppm	150 ppm	300 ppm	Mean	0 ppm	150 ppm	300 ppm	Mean
Master B	0 ppm	1.10p	1.53o	1.90n	1.51G	1.07s	1.57r	1.87q	1.50I
	50 ppm	2.33m	1.90n	2.60l	2.28F	2.23p	1.93q	2.57n	2.24H
	100 ppm	3.20i	3.53h	2.83k	3.19E	3.20k	3.47j	2.73m	3.13E
	150 ppm	3.60h	4.07g	4.50f	4.06D	3.60ij	4.10h	4.57g	4.09D
	Mean	2.56F	2.76E	2.96D	2.76C	2.53G	2.77F	2.93E	2.74C
Jaguar	0 ppm	1.87n	2.33m	2.97jk	2.39F	1.93q	2.43no	3.03l	2.47G
	50 ppm	2.47h	2.30m	3.07ij	2.94E	3.70i	2.33op	3.03l	3.02EF
	100 ppm	3.57h	4.03g	4.43f	4.01D	3.63i	4.07h	4.53g	4.08D
	150 ppm	5.13e	5.77c	6.50b	5.80B	5.17e	5.80c	6.47b	5.81B
	Mean	3.51C	3.61C	4.24B	3.79B	3.61D	3.66D	4.27C	3.84B
Palmoral	0 ppm	2.37m	3.03ijk	3.60h	3.00E	2.37op	3.00l	3.60ij	2.99F
	50 ppm	4.40f	3.47h	3.97g	3.94D	4.43g	3.63i	4.17h	4.08D
	100 ppm	5.00e	5.53d	4.33f	4.96C	4.97f	5.63d	4.43q	5.01C
	150 ppm	5.37d	6.33b	6.83a	6.18A	5.20e	6.37b	6.87a	6.14A
	Mean	4.28B	4.59A	4.68A	4.52A	4.24C	4.66B	4.77A	4.56A
Interaction B x C	0 ppm	1.78k	2.30j	2.82h	2.30D	1.79k	2.33j	2.83h	2.32D
	50 ppm	3.40f	5.56i	3.21g	3.05C	3.46f	2.63i	3.26g	3.12C
	100 ppm	3.92e	4.37d	3.87e	4.05B	3.93e	4.39d	3.90e	4.07B
	150 ppm	4.70c	5.39b	5.94a	5.34A	4.66c	5.42b	5.97a	5.35A
		3.45C	3.65B	3.96A		3.46C	3.69B	3.99A	

*Means followed by the same letter or letters are not significantly different at the 5% significance level.

The interactions among pea cultivars, microelements and salicylic acid concentrations, data in Tables (6), (7) and (8) show a significant effect on green pod weight per plant (g) and green pod yield/fed. in the two experimental seasons. The highest green pod weight per plant (g) of pea was obtained by the interaction among Palmoral cv., 150 ppm of microelements and 300 ppm of salicylic acid in the first season. Also, the highest value in the second season was recorded by the interaction among Jaguar, 150 ppm of microelements and 300 ppm of salicylic acid. The highest values of green pod yield/fed. were recorded by the interaction among Palmoral cv., 150 ppm of microelements and 300 ppm of salicylic acid in both seasons.

5- Seed weight/plant (g) and Seed yield/fed.

Concerning the effect of interaction between pea cultivars and microelements concentrations on seed weight/plant (g) and seed yield/fed. of pea, datain Tables (9) and (10) reveal a significant effect between pea cultivars and microelements concentrations in both seasons. The highest values were obtained by the interaction between Palmoral cv. and 150 ppm in the first and second seasons respectively. Data in the same tables show that the interaction between pea cultivars and salicylic acid concentrations had a significant effect on seed weight/plant (g) and seed yield/fed. of pea. The highest values were recorded by the interaction between Palmoral cv. and 300 ppm in the two experimental seasons.

The interaction between microelements and salicylic acid concentrations have a significant effect on seed weight/plant (g) and seed yield/fed. of pea in both seasons. The highest values were recorded by the interaction between 150 ppm of microelements and 300 ppm of salicylic acid in the first and second seasons, respectively.

These results are in the same way of Ali and Mahmoud, 2013.

About the interactions among pea cultivars, microelements and salicylic acid concentrations, data in

Tables (9) and (10) show a significant effect on seed weight/plant (g) and seed yield/fed. of pea in the two experimental seasons. The highest values were obtained by the interaction among Palmoral cv., 150 ppm of microelements and 300 ppm of salicylic acid in the first and second seasons.

Table 9. Seed weight/plant (g) as affected by pea cultivars, microelements, salicylic acid and their interactions over two seasons.

Seasons		First season				Second season			
		Salicylic acid (C)				Salicylic acid (C)			
Cultivars (A)	Microelements (B)	0 ppm	150 ppm	300 ppm	Mean	0 ppm	150 ppm	300 ppm	Mean
Master B	0 ppm	10.27v	11.61u	12.75tu	11.54I	10.27w	11.48v	12.86u	11.53J
	50 ppm	13.68st	14.15s	16.00qr	14.61H	13.63t	13.76t	15.83s	14.41I
	100 ppm	17.41op	18.22nop	18.37no	17.99G	17.15r	18.42q	17.58r	17.72G
	150 ppm	20.57kl	25.36h	28.37fg	24.76E	19.37op	25.27jkl	29.23h	24.62E
	Mean	15.48I	17.33H	18.87G	17.23C	15.10I	17.23H	18.87G	17.07C
Jaguar	0 ppm	14.13s	15.67r	17.27op	15.69H	14.20t	15.53s	17.17r	15.63H
	50 ppm	18.79mn	19.69lm	21.68jk	20.05F	18.75pq	18.25q	21.67n	19.56F
	100 ppm	23.34i	25.23h	26.02h	24.86E	23.35m	25.79j	24.68l	24.61E
	150 ppm	27.60g	28.83fg	31.19e	29.21C	27.21i	29.43gh	31.58f	29.41C
	Mean	20.97F	22.35E	24.04D	22.45B	20.88F	22.25E	23.77D	22.30B
Palmoral	0 ppm	17.09pq	19.79lm	22.73ij	19.87F	17.27q	19.47o	22.00n	19.58F
	50 ppm	25.29h	25.70h	28.02fg	26.34D	25.45jk	24.86kl	28.92h	26.41D
	100 ppm	29.16f	31.80e	36.07d	32.35B	29.95g	32.52e	35.17d	32.55B
	150 ppm	38.80c	41.26b	43.40a	41.15A	38.82c	42.03b	43.94a	41.60A
	Mean	27.59C	29.64B	32.56A	29.93A	27.87C	29.72B	32.51A	30.03A
Interaction B x C	0 ppm	13.83k	15.69j	17.58i	15.70D	13.91j	15.49i	17.34h	15.58D
	50 ppm	19.25h	19.85h	21.90g	20.33C	19.27g	18.96g	22.14f	20.12C
	100 ppm	23.30f	25.08e	26.82d	25.07B	23.48e	25.57d	25.81d	24.96B
	150 ppm	28.99c	31.81b	34.32a	31.71A	28.46c	32.24b	34.92a	31.88A
		21.34C	23.11B	25.16A		21.28C	23.07B	25.05A	

*Means followed by the same letter or letters are not significantly different at the 5% significance level.

Table 10. Seed yield (kg/fed.) as affected by pea cultivars, microelements, salicylic acid and their interactions over two seasons.

Seasons		First season				Second season			
		Salicylic acid (C)				Salicylic acid (C)			
Cultivars (A)	Microelements (B)	0 ppm	150 ppm	300 ppm	Mean	0 ppm	150 ppm	300 ppm	Mean
Master B	0 ppm	350.00p	490.00o	590.00mn	476.67I	326.67s	476.67q	583.33p	462.22I
	50 ppm	650.00lm	590.00mn	656.67lm	632.22FG	650.00mno	586.67p	646.67no	627.78G
	100 ppm	753.33jk	876.67fgh	806.67hij	812.22E	750.00l	873.33ij	790.00kl	804.44E
	150 ppm	893.33fgh	953.33f	1056.67f	967.78C	880.00ij	943.33h	1050.00f	957.78C
	Mean	661.67H	727.50G	777.50F	722.22C	651.67H	720.00G	767.50F	713.06C
Jaguar	0 ppm	440.00o	516.67no	603.33mn	520.00HI	430.00r	510.00q	596.67p	512.22H
	50 ppm	666.67klm	526.67no	630.00m	607.78GH	656.67mno	523.33q	616.67op	598.88G
	100 ppm	766.67ij	880.00fgh	1083.33e	910.00CD	746.67l	863.33ij	1003.33g	871.11D
	150 ppm	1500.00d	1716.67c	2133.33b	1783.33B	1476.67e	1736.67d	2173.33b	1795.56B
	Mean	843.33E	910.00D	1112.50B	955.28B	827.50E	908.33D	1097.50B	944.44B
Palmoral	0 ppm	473.33o	603.33mn	670.00klm	582.22GH	493.33q	613.33op	673.33mn	593.33G
	50 ppm	733.33jkl	650.00lm	733.33jkl	705.56F	746.67l	696.67m	746.67l	730.00F
	100 ppm	813.33hij	923.33fg	853.33ghi	863.33DE	833.33jk	936.67h	886.67i	885.56D
	150 ppm	1680.00c	2083.33b	2636.67a	2133.33A	1733.33d	2116.67c	2700.00a	2183.33A
	Mean	925.00D	1065.00C	1223.33A	1071.11A	951.67C	1090.83B	1251.67A	1098.06A
Interaction B x C	0 ppm	421.11i	536.67h	621.11g	526.30D	416.67i	533.33h	617.78g	522.59D
	50 ppm	683.33f	588.89g	673.33f	648.52C	684.44f	602.22g	670.00f	652.22C
	100 ppm	777.78e	893.33d	914.44d	861.85B	776.67e	891.11d	893.33d	853.70B
	150 ppm	1357.78c	1584.44b	1942.22a	1628.15A	1363.33c	1598.89b	1974.44a	1645.56A
		810.00C	900.83B	1037.78A		810.28C	906.39B	1038.89A	

*Means followed by the same letter or letters are not significantly different at the 5% significance level.

Under field conditions and treatments of this research, the following conclusions can be drawn:

1- The interaction among Palmoral cv., 150 ppm of microelements and 300 ppm of salicylic acid concentrations gave the highest production of green pod yield (ton/fed.) and seed yield (kg/fed.) of pea.

2- The application of interaction among Jaguar cv., 150 ppm of microelements and 300 ppm of salicylic acid concentrations had the highest number of green pods per plant.

3- The interaction among Master B cv., 150 ppm of microelements and 300 ppm of salicylic acid concentrations had the tallest green pod (cm) and number of green seeds/green pod of pea over both experimental seasons.

4- The interaction between 150 ppm of microelements and 300 ppm of salicylic acid over both seasons gave the highest values of the investigated yield and quality parameters .

CONCLUSIONS

Pea is considered one of the most important legume vegetable crops grown in Egypt and worldwide as it has many nutritional values. From this study, it could be concluded that the highest significant values of all growth, yield and quality parameters of pea plants were gained by the interaction between 150 ppm of microelements and 300 ppm of salicylic acid in both seasons. Under these treatments, the highest production of green pod yield (ton/fed.) and seed yield (kg/fed.) of pea was attained by

cultivar Palmoral while the highest number of green pods per plant was obtained by the cultivar Jaguar. Under the same treatment, Master B cv., gave the tallest green pod (cm) and number of green seeds/green pod of pea over both experimental seasons. From the results of this study, it could be concluded that adaptability, quality and production of pea (*Pisum sativum* L.) cultivars of Master, Palmoral and Jaguar to the Egyptian environmental conditions are confirmed and increased by using salicylic acid in combination with foliar application of microelements (Iron, Zinc and Manganese).

REFERENCES

Abd-Elkader, D.Y. (2016). Effect of foliar spraying with micronutrients and salicylic acid on growth, yield and quality of garlic plants. Alex. J. Agric. Sci., 61(6): 649-658.

Ali, E.A. and A.M. Mahmoud (2013).Effect of foliar spray by different salicylic acid and zinc concentrations on seed yield and yield components of mungbean in sandy soil. Asian J. of Crop Science, 5(1):33-40.

EI-Hawary, N.A. (1999). Effect of a new macro-micronutrients formulation on the yield production of some field and vegetable crops. J. Agric. Sci. Mansoura Univ., 24 (9): 5175-5186.

Epstien, E. (1972). Mineral nutrition of plants. Principles and perspectives. John Wiley and Sons, New York.

Gomez, K.N. and A.A. Gomez (1984). Statistical procedures for agricultural research. John Wiley and Sons, New York, 2nd ed., 68p.

Hassan, A.A. (1997). Vegetable fruits. Al-Dar Al-Arabia Publications and distribution, Cairo, Egypt, pp: 241.

Khan, W.; B. Prithiviraj and D.L. Smith (2003). Photosynthetic responses of corn and soybean to foliar application of salicylates. J. Plant Physiol; 160: 485-492.

Marwa, M. A.; A.F. El-Shafie, O.M. Dewedar, J.M. Molina-Martinez and R. Ragab (2020). Predicting the water requirement, soil moisture distribution, yield, water productivity of peas and impact of climate change using saltmed model. Plant Archives Vol. 20 supplement 1, 3673-3689.

Page, A. L., Miller, R. H. and Keeney, D. R. (1982). Methods of soil analysis; 2. Chemical and microbiological properties, 2. Aufl. 1184 S., American Soc. of Agronomy.

Popova, L.; L. Maslenkova; R. Yordanova; A. Krantev; G. Szalai and T. Janda (2008). Salicylic acid protects photosynthesis against cadmium toxicity in pea plants. General and Applied Plant Physiology (Special issue). 34 (3-4): 133-144.

Raskin, I. (1992). Role of salicylic acid in plants. Annu. Rev. Plant Physiol. Plant Mol. Biol., 43: 439-463.

Riad, G. S.; S. M. Youssef, Nashwa A.I. Abu El-Azm and Enas M. Ahmed (2018). Amending Sandy Soil with Biochar or/and Superabsorbent Polymer Mitigates the Adverse Effects of Drought Stress on Green Pea. Egypt. J. Hort. 45(1):169-183.

Waller, R.A. and D.B. Duncan (1969). A Bayes Rule for the Sym- metric Multiple Comparison Problem. J. the American Statistical Association, 64, 1484-1503; Corrigendum (1972), 67: 253-255.

Watt, B. and Merrill, A.L., (1963). Composition of foods: raw, processed, prepared. Washington, DC: Consumer and Food Economics Research Division / Agricultural Research Service, 198 (Agriculture Handbook, 8).

تأثير حامض السلسليك والرش ببعض العناصر الصغرى على المحصول الطازج والبذري والجودة لبعض أصناف البسلة

يسري تمام عبد المجيد[1] ، هيثم إلهام محمد زكي[2,1] ، محسن شحاتة محمد[3] و أحمد خلف السيد[3]

[1]قسم البساتين – كلية الزراعة – جامعة المنيا

[2]قسم التقنية الحيوية التطبيقية-جامعة التقنية والعلوم التطبيقية بصور-سلطنة عمان

[3]مركز البحوث الزراعية – معهد بحوث البساتين – الجيزة

أجريت هذه الدراسة الحقلية بمزرعة محطة البحوث الزراعية بشندويل بمحافظة سوهاج – مصر، وذلك خلال الموسم الشتوي لموسمي 2016/2015 و2017/2016 م وذلك لدراسة تأثير كل من حامض السلسليك والعناصر الصغرى على المحصول الطازج والبذري لبعض أصناف البسلة ،وقد تم استخدام 3 اصناف بسلة هي (ماستر بي، جاجوار، بالمورال) مع 3 تركيزات من حامض السلسيلك هي (صفر، 150، 300 جزء في المليون) وكذلك 4 تركيزات من العناصر الصغرى (الحديد، الزنك، المنجنيز) وكانت التركيزات كالتالي (صفر، 50، 100، 150 جزء في المليون) وكان تصميم التجربة المستخدم هو تصميم القطاعات الكاملة العشوائية RCBD في قطع منشقة مرتين. وتم دراسة عدد من الصفات كالتالي (عدد الأفرع على النبات، طول القرن الأخضر (سم)، سمك القرن الأخضر (سم)، عدد القرون الخضراء على النبات، وزن القرون الخضراء على النبات (جم)، محصول الفدان من القرون الخضراء (طن/فدان)، وزن بذور النبات (جم)، محصول الفدان الكلي من البذور (كجم/فدان)، وزن 100 بذرة (جم). ويمكن تلخيص النتائج المتحصل عليها كما يلى: -1- أظهر التفاعل ما بين الصنف بالمورال والتركيز 150 جزء في المليون من العناصر الصغرى أعلى النتائج في الصفات التالية: سمك القرن الأخضر (سم)، وزن القرون الخضراء للنبات (جم)، وزن محصول القرون الخضراء للفدان (طن)، وزن البذور الجافة للنبات (جم)، وزن البذور الجافة للفدان (كجم) خلال موسمي الدراسة.2- أعطى التفاعل ما بين صنف بالمورال وتركيز 300 جزء في المليون من حامض السلسليك أفضل القيم في الصفات الآتية: سمك القرن الأخضر (سم)، وزن القرون الخضراء للنبات (جم)، وزن محصول القرون الخضراء للفدان (طن/فدان)، وزن البذور الجافة للنبات (جم)، وزن البذور الجافة للفدان (كجم)/فدان) خلال موسمي الدراسة.3- حقق التفاعل ما بين تركيز 150 جزء في المليون من العناصر الصغرى وتركيز 300 جزء في المليون من حامض السلسليك أفضل النتائج في كل الصفات المدروسة.4- حقق التفاعل ما بين الصنف بالمورال وتركيز 150 جزء في المليون من العناصر الصغرى وتركيز 300 جزء في المليون من حامض السلسليك أفضل النتائج في الصفات الآتية: طول النبات (سم)، سمك القرن الأخضر (سم)، وزن المحصول الأخضر للفدان (طن)، محصول البذور الجافة للنبات (جم)، محصول البذور للفدان (كجم) في كلا موسمي الزراعة. الاستنتاج: في ضوء النتائج المتحصل عليها وتحت نفس ظروف التجربة يمكن استنتاج أن التفاعل ما بين الصنف بالمورال وتركيز 150 جزء في المليون من العناصر الصغرى و تركيز 300 جزء في المليون من حامض السلسليك حقق أعلى إنتاجية من المحصول الأخضر والبذري للبسلة بالإضافة الى أن التفاعل ما بين الصنف جاجوار و وتركيز 150 جزء في المليون من العناصر الصغري و تركيز 300 جزء في المليون من حامض السلسليك أعطى أعلى عدد قرون خضراء للنبات كما أعطى التفاعل ما بين صنف ماستر بي وتركيز 150 جزء في المليون من العناصر الصغري و تركيز 300 جزء في المليون من حامض السلسليك أطول قرن أخضر وأعلى عدد بذور خضراء للقرن الأخضر في كلا موسمي الزراعة.