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INFLUENCE OF FOLIAR APPLICATION OF ATONIK ON VEGETATIVE GROWTH AND YIELD OF TWO PEA (Pisum sativum L.) CULTIVARS

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ABSTRACT

The study was carried out at Grdarasha field in Erbil from November 4th of 2019 to April 20th, 2020.The purpose of this study was to study different levels of foliar spray of Atonik (0, 0.2, 0.4, 0.6, 0.8, and 1 ml.L^{-1}) affected the growth and yield of two pea cultivars (Utrillo and Nihal). The majority of the parameters investigated yielded significant outcomes. Cultivars had a substantial reaction on some of the tests, according to the findings. Parameters of pea vegetative growth and yield, the Utrillo cultivar produced the best results. Furthermore, Atonik foliar spraying had a considerable impact. The number of leaves and branches has the biggest influence on vegetative parameters (110.74 and 2.69 respectively), according to the findings (1ml.L^{-1}). From 0.2 ml.L^{-1} of Atonik the maximum values of vegetative growth, fresh weight, and total chlorophyll were recorded. Atonik foliar spraying also improved yield parameters significantly. However, at 0.2 ml.L^{-1} of Atonik, the highest numbers of seeds per pod, yield per plant, yield per plot, and yield per hectare (6.00, 0.16 kg, 1.00 kg, and 1.68 tons, respectively) were obtained. Meanwhile, the majority of vegetative development and yield indices, particularly Nihal, exhibited a substantial response to Atonik treatment.

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INTRODUCTION

Pea (*Pisum sativum* L.) area winter season crop that cultivated for edible seed or pods. There are various kind of pea are cultivated for different purpose. Immature seed of green pea are collected as afresh seed for the market (Elzebroek and Wind, 2008).Pea are considering a source of nutrient and fresh pod contain huge value minerals, vitamins and protein (Ali *et al.*, 2016). A popular pea cultivated and consume is (*Pisum sativum* L. var. macrocarpon Ser.) due to persistence a bounded sugar and sweet flavor in edible pods (Myers *et al.*,2001).In addition, the sugar snap pea is devoid of fiber and inner pod and precocious harvested for fresh package market (McGee, 2012). Biostimulants are a new product classification on the market a variety of formulations that have a beneficials impact on a plant's vitality plant growth and development processes, as well as their consequences especially when plant under stress condition. Asahi and Atonic are commercial names of Atonik (Przybysz *et al.*, 2014). Djanaguiraman *et al.*, (2005) Cotton and tomato treatments were proven to be effective in a lab experiment the best recording of germination was with Atonik at 3mg/l seed, enzyme activity and establishment. Abbas *et al.* (2010) investigated the influence of Atonik at (250, 500, and 1000 ml.L^{-1}), vernalization

(50°C for five days),and 6-denzyl adenine(25, 50, 10 ml.L^{-1}) on photosynthetic pigment, growth and blooming parameters of some of *Pisume sativum* L.'s chemical constituents Vernalization alone was the best therapy, alone or in combination with Atonik (1000 ml/l) or 6-denzyl adenine (50 ml/l), has a beneficial effect on root, shoot, fresh and dry weight, and node number. number of leaves on $plant^{-1}$, total chlorophyll, leaf area, relative water content, and blossom are all examples of plants. Kwiatkowski and Juszczak (2011) discovered that foliar spray of sweet basil with a biostimulator (Asahi SL) resulted in the greatest quantitative qualities (plant height, shoot number, yield, and weed control) as well as the best qualitative traits (weed control) (Kocira, 2015). Studied the influence of foliar application by Asahi on bean yield were found appositive effective on yield parameter, which include number of seed and pod were increased. Moreover, control treatment plant gave the lowest yield of seed number in pod and pod number and the seed weight. (Kocira, 2017) stated that once and twice application of Atonik increased yield and quality two bean cultivars (white and red), and the best influence of Atonic were obtained from twice spray. However, the application of Atonik biostimulant had non -significant impact on protein and starch content. When compared to non-treatment plants, foliar spraying with Atonic (0.1 and 0.2 percent) had a substantial impact on all yield parameters such as seed yield, seed number, and 1000-seed weight (Szparaga, 2019). The purpose of this research was to assess Atonik biostimulators and their effects on certain qualitative and quantitative vegetative growth and yield components of two pea cultivars.

MATERAILS AND METHODS

The study was taken at Grdarasha field from November 4th to April 20th 2020, to investigate the impact of foliage spray at various levels on growth development and yield component of pea (1-Utrillo and 2-Nihal), where seeds are produced by star company which originated in Turkey country and the rate of germination is 98%. the seeds were directly sowed in the field on November 4th. Table (1) reveal the chemical and physical characteristic of soil. Table (2) illustrate the environmental condition period the study.

Atonik treatment preparation:

Chemical solution was producedby MFG corporation.The solution consist sodium 5-nitroguaiacolate ($NaC7H6NO_4$), sodium ortho Atonik ($NaC6H4NO_3$) and sodium para Atonik (NaC6H4NO3) were the rate (1g.l^{-1} , 2g.l^{-1} and 3g.$^{l-1}$ respectively).The treatments were prepared by distilled water at concentration (0.0, 0.2, 0.4, 0.6, 0.8 and 1 ml.l^{-1}) for foliar spraying accordance to recent study with modified (Kocira, 2017 and Szparaga, 2019).

Layout of experiment and data analysis

Layout was designed as a Factorial with three replication in randomized complete block design (RCBD Factorial).Layout consisted of 36 experiment units and each experiment unit consist six plants. Moreover, all experiment units were treated by foliar spray according to Atonik concentration. Starting on 18/12/2019 with a 15-day interval for three times and continuing till plant leaves run off. Finally, were the analysis (SPSS) by Duncan's multiple range tests (DMRT) was applied to compare the mean data acquired from the experiment at the 0.05 level.

The data from all experiment units was collected at the end of the investigation. Vegetative parameters include: plant height (cm), leaves number, branches number per plant, and weight of wet and dried of vegetative. Moreover, yield component include; pods number.plant-1, seed number per pod wet weight, wet weight of 100 seed (gm), yield/experiment (kg), yield/ hectare (ton), chlorophyll content % were estimated by handy SPAD 502 regarding to (Incesu, 2015) .

RESULTS AND DISCUSSIONS

Figure (1a) shows that only the number of leaves has a significant effect on both pea cultivars. Nihal had the maximum number of leaves (118.305), and no significant records about plant height and total chlorophyll content. However, both pea cultivars shows non-significant response on weight vegetative growth, It's conceivable because these two cultivars have genetic differences that affect nutrient absorption, photosynthetic activity, and ecological impacts (Jordao *et al.*,1990 and Gaafar and Saker, 2006).

Except plant height and branch number, all vegetative parameter have significant effect foliar treatment had a substantial effect on all vegetative parameters were shown in Table (3). The highest leaves number per plant (110.74) was obtained in Atonik at (1ml.l^{-1}) concentration. However, the highest rate of dry weight was (0.105kg) when the plant treated by Atonik at 0.4 ml.l^{-1}concentration. Furthermore, the greatest data of fresh weight of vegetative and chlorophyll content (0.424 kg and 42.55 SPAD respectively) were founded at concentration 0.2 ml.l-1of Atonik. The data corresponding to (Al-jbury, 2002), could be due to the effect of Salicylic acid which composite phenol or sodium phenolate that cause stimulation development and reduce inhibition plant growth (Shakirova *et al.,* 2003 and Xu *et al.,* 2011). Photosynthesis activity raise and increment in absorption carbon dioxide (CO_2)in plastid due to Atonik biostimulator. hence, biostimulator causes creating a necessary nutrient for new development of cells and increases plant growth (Khan *et al.,* 2003 and Singh and Usha, 2003).

All yield characteristics parameter were responded considerably to Atonik foliar spraying as shown in Figures (2 a and b). Utrillo cultivar had show highest data of 100- seed weight and, yield per plot, yield per hectare and pod dry and wet weight (60.561, 9.343g, 0.677kg, 1.129ton, 1.75g respectively).Furthermore, Nihal cultivar shows the highest value plant yield and pods number (91 and 0.99kg respectively). Similar results were recorded on eggplant by (Taain and Salman, 2018). The variation in yield might be attributed to phenotypic variation between cultivars and interactions with the environment, which influence on plant development hence the production (Mohammed, 2013).

Table (4) shows that Atonik concentration had a favorable effect on pod number per plant, weight of 100 seeds, yield per plant, yield per plot, yield per hectare, and pod dry weight. the highest data of pod number per plant (116.66) was notice from Atonik at 0.4 ml. l^{-1} concentration. Moreover, the greatest value of 100 seed weight(56.025g) when treated Atonik at 1ml.l^{-1}. Furthermore, The treatment that treated Atonik at a concentration of 0. 2ml.l^{-1} had the best yield per plot, yield per plant, and yield per hectare (1.009 kg, 0.681 kg, and 1.681ton, respectively).The best value of single pod dry weight (2.914) was recorded in Atonik at concentration. 6ml.l^{-1}. These findings corroborate with results of (Aksona and Aydın, 2019). Might be due

to Endogenous auxin are increase by exogenous treatment, subsequently increase yield (Djanaguiraman *et al.*, 2005b).

1- Vegetative characteristic parameters:

Obviously in Table (5) illustrated those cultivars and Atonik interaction have significant impact on almost parameter leave, wet and dry weights of plant vegetative and total content of chlorophyll in leaves. The highest value of leaves number (144.080) was noticed in Interaction Utrillo and Atonik (1ml.l^{-1}).Moreover, the greatest data of vegetative wet and dry weight(0.575 and 0.130 kg respectively) were obtained from interaction Utrillo cultivar and foliar application by Atonik at concentration 0.4ml.l^{-1}.Furthermore, the greatest data of total chlorophyll content (48.989) was recorded in experiment unit that consist Utrillo cultivar and treated by Atonik at concentration 0.2ml.l^{-1}.Our findings are consistent with investigated on carrot (Abbas, 2009). Pandita *et al.*, (1982) Atonik substances, like other plant growth regulators, stimulate nutrient absorption by the plant, causing an increase in cell division and leaf number, which has an adverse influence on development and yield characteristics, Wasfi (1990) Growth stimulator might have a positive impact on construction of chlorophyll and prevent breaking in plant.

Cultivars and Atonik interaction have positive impact on most characteristics exclude seed number in pod which shown with the table (6). The highest data of pod number and 100 seed weight (121.00 and 66.400) were obtained from Utrillo cultivar and Atonik application at 0.4 ml.l^{-1}concentration. Furthermore, The interaction cultivar and Atonik at level 0.2 ml.l^{-1} produced the best yield per plot, yield per plant, and yield per hectare (1.198kg, 0.200kg, and 1.997ton respectively). Furthermore, the Utrillo cultivar and foliar spray with Atonik at a concentration of 0.8 ml.l^{-1} yielded the highest pod weight (9.878gm). However, the biggest value of pod dry weight (2.829gm) was obtained from interaction of cultivar and foliar spray at (0.6 ml.l^{-1}) of Atonik. The findings of the study are supported by (AL-Jobori, 2010, Obaid *et al.*, 2011 and Kocira, 2017).Increased yield traits might be owing to the impact of the biostimulators on improving vegetative characteristics, which increment carbohydrate product and translocation to yield (Jawad *et al.*, 2011).

Table (1): Soil analysis chemical and Physical characteristics of investigated location*

Characteristics	Value
pH	7.59
Electro Conductivity (EC)	0.023 daS/m
Nitrogen	1370ppm
Potassium	4400ppm
Phosphorus	5.58ppm
Iron (Fe)	160ppm
Texture of Soil	Silty Clay

* Central Laboratory of Agricultural Engineering sciences college.

Table (2) Ecological data*

Mon.	Temperature c°		Hum. %	Precipitation rain (mm)	Average day length
	Minimum	Maximum			
Nov.	10.73	23.39	35.28	25.27	5.4
Dec.	7.96	16.42	64.37	35.52	6.2
Jan.	5.20	13.14	64.295	38.35	5.8
Feb.	6.05	14.09	61.91	27.23	6.6
Mar.	10.70	20.54	57.75	30.20	6.8
Apr.	13.01	24.80	53.625	0.800	8.6
May	18.84	33.95	32.705	0.960	10.6

* Ministry of Agriculture and water resources in Kurdistan- Iraq.

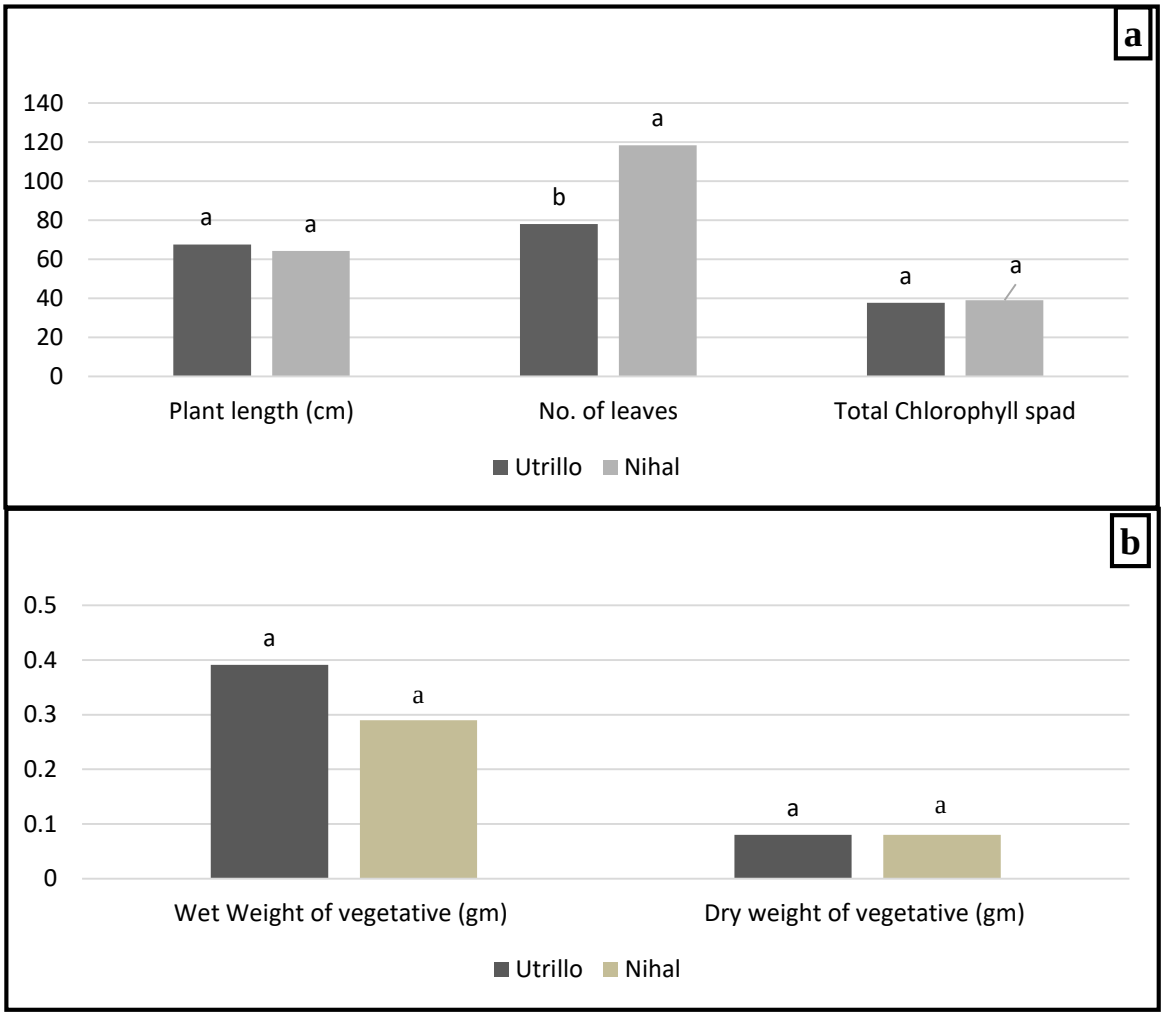
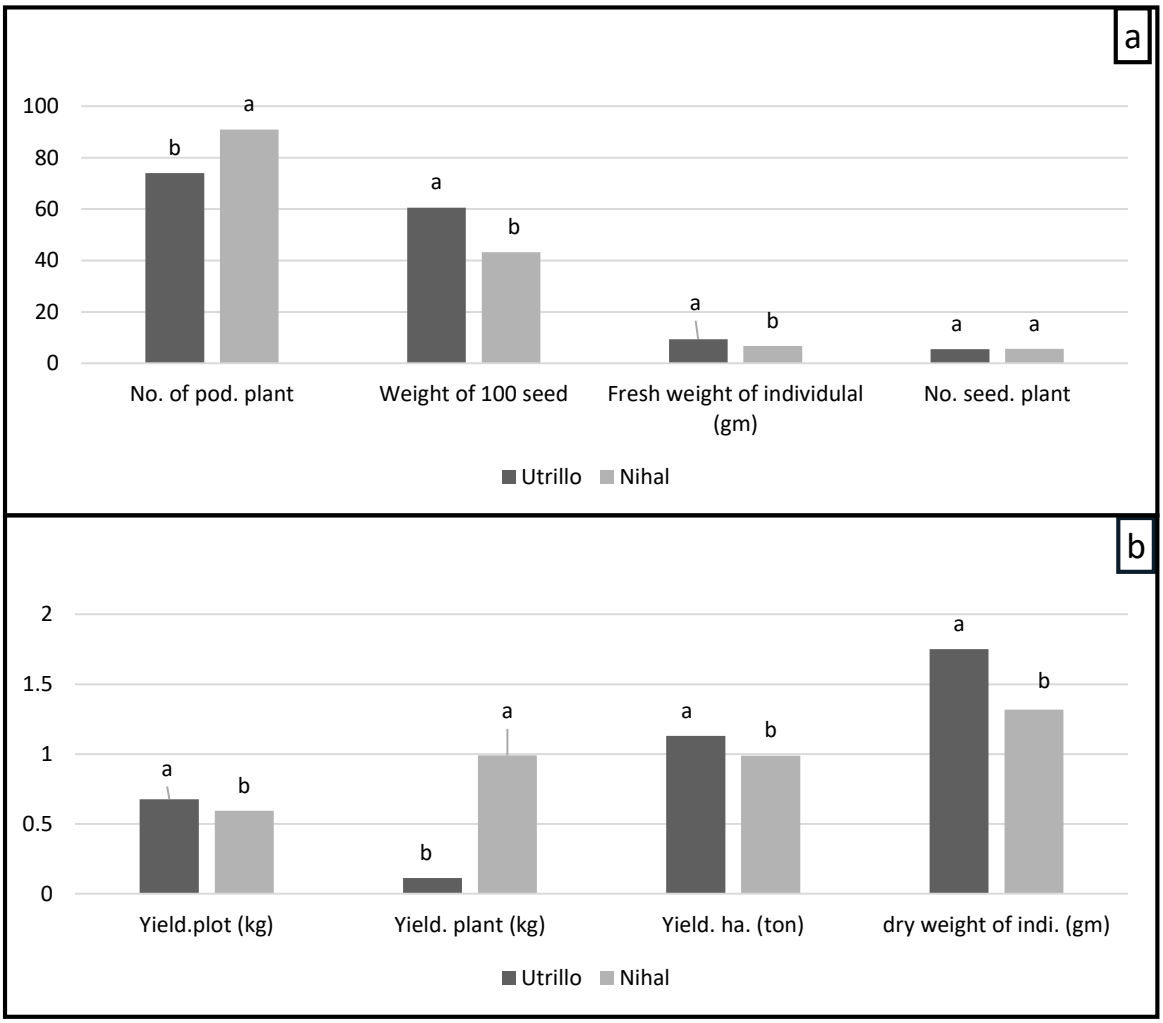


Figure: (1): a , b response of pea cultivars on vegetative development characteristics.
*The same letters mean that non statistically different according to DMRT.

Table (3): Effect of Atonik concentrations on pea vegetative development characteristics:

Concentration ($ml.l^{-1}$)	Plant height (cm)	Leaves number per plant	Branch number per plant	Wet weight of Veg.	Dry weight of Veg.	%Chlorophyll
0.0	73.858a	96.743b	2.498a	0.287c	0.088b	39.186bc
0.2	64.942a	95.997b	2.694a	0.424a	0.070c	42.553a
0.4	65.775a	108.970ab	2.444a	0.418a	0.105a	37.250c
0.6	58.720a	76.244c	2.528a	0.240c	0.068c	36.878c
0.8	71.247a	100.165ab	2.167a	0.366ab	0.078bc	33.658d
1	61.220a	110.747a	2.500a	0.309bc	0.070c	40.608ab

*(The same letters mean that non statistically different according DMRT at level 0.05).



Figure(2): a, bResponse of Pea cultivars on yield characteristics.
*(The same letters mean that non statistically different according DMRT).

Table (4): Effect of Atonic Levels on Pea Yield Traits

Concentration ($ml.l^{-1}$)	Number ofpod.plant^{-1}	Number seed.pod^{-1}	Wet weight of 100 seed (g)	Yield.plot^{-1} (kg)	Yield. plant^{-1} (kg)	Yield. ha^{-1} (ton)	Fresh weight of pod (g)	Dry weight of pod (g)
0.0	79.500b	5.332 a	52.592a b	0.547c	0.091 c	0.912 c	7.394a	1.242b
0.2	86.167b	6.000 a	51.783a b	1.009a	0.168a	1.681 a	8.617a	1.512b
0.4	116.667 a	5.500 a	53.808a b	0.841b	0.140b	1.402 b	7.544a	1.570b
0.6	69.167b	5.750 a	47.733b	0.381d	0.064d	0.635 d	8.083a	2.194a
0.8	76.000b	5.389 a	49.442b	0.520c	0.087c	0.866 c	8.272a	1.350b
1	69.833b	5.222 a	56.025a	0.513c	0.085c	0.855 c	8.433a	1.340b

*(The same letters mean that non statistically different according DMRT at level 0.05).

Table (5): Interaction influences of *Pisum sativum* L. cultivars and Atonik concentrations on vegetative growth:

Cultivars	Conc. ($ml.l^{-1}$)	Plant height (cm)	Leaves number	Branch number	Fresh weight of Veg. (kg)	Dry weight of Veg. (kg)	Chlorophyl %l
Utrillo	0.0	70.499a	74.993de	2.330a	0.235de	0.070def	37.422cde
	0.2	61.553a	63.500e	2.500a	0.535a	0.055f	48.989a
	0.4	69.997a	83.500de	2.444a	0.575a	0.130a	35.066def
	0.6	60.777a	81.993de	2.222a	0.220d	0.057ef	34.333ef
	0.8	73.887a	86.500d	2.222a	0.430b	0.100bc	32.482f
	1	68.887a	77.415de	2.889a	0.353b	0.070def	38.067cde
Nihal	0.0	77.217a	118.493bc	2.667a	0.340bcd	0.107b	40.950bc
	0.2	68.330a	128.493abc	2.889a	0.313cde	0.085bcd	36.117bcd
	0.4	61.553a	134.440ab	2.444a	0.260cde	0.080cde	39.433def
	0.6	56.663a	70.495de	2.833a	0.260cde	0.080cde	39.422bcd
	0.8	68.607a	113.830c	2.111a	0.302cde	0.057ef	34.833def
	1	53.553a	144.080a	2.111a	0.265cde	0.070def	43.150b

*(The same letters mean that non statistically different according DMRT at level 0.05).

Table (6): Interaction effects of cultivars and Atonik levels on Pea yield characteristics.

Cultivar	Conc. (ml.l^{-1})	Number ofpod. Plant^{-1}	Number of seed. pod^{-1}	F.Wt of 100 seeds (g)	Yield/plot (kg)	Yield/plant $^{-1}$ (kg)	Yield/ha (ton)	Fresh weight. of pod (g)	Dry weight of pod (g)
Utrillo	0.0	52.000e	5.220a	62.850a	0.469c	0.078c	0.782c	9.811a	1.566bc
	0.2	103.00abc	5.889a	57.867abc	1.198a	0.200a	1.997a	9.650a	1.540bc
	0.4	121.000a	5.556a	66.400a	1.150a	0.192a	1.917a	7.765abc	1.716b
	0.6	59.333de	5.167a	53.067bcd	0.248d	0.041d	0.413d	9.088ab	2.829a
	0.8	60.667de	5.556a	61.083ab	0.529c	0.088c	0.882c	9.878a	1.500bc
	1	48.000e	5.556a	62.100a	0.470c	0.078c	0.783c	9.867a	1.348bcd
Nihal	0.0	107.00ab	5.444a	42.333def	0.625c	0.104c	1.042c	4.977c	0.918d
	0.2	69.333cde	6.111a	42.700def	0.820b	0.137b	1.366b	7.584abc	1.484bc
	0.4	112.333ab	5.444a	41.217ef	0.532c	0.089c	0.887c	7.322abc	1.425bc
	0.6	79.00bcde	6.333a	42.400ef	0.515c	0.086c	0.858c	7.078abc	1.558bc
	0.8	91.333abcd	5.222a	37.800f	0.510c	0.085c	0.850c	6.667bc	1.200cd
	1	91.667abcd	4.889a	49.950cde	0.556c	0.093c	0.927c	7.00abc	1.332bcd

*(The same letters mean that non statistically different according DMRT at level 0.05).

CONCLUSION

Based on the results were gathered from data analysis can be surmise:
Utrillo cultivar overcome Nihal cultivar in mostly yield characteristics. However, highest value of vegetative development and yield characteristics were recorded from of Atonik at a concentration (0.2ml.l^{-1}). Moreover, combination of the Utrillo cultivar and foliar spray with Atonik had a good effect on the majority of vegetative development and reproductive parameters.

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CONFLICT TO INTEREST

There are no conflicts of interest declared by the authors.

تأثير الرش الورقي بمادة الأتونيك على النمو الخضري وحاصل صنفين من البازلاء (*Pisum sativum* L.)

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الخلاصة

نفذت الدراسة في حقل كرده ره شة في اربيل من(4 تشرين الثاني 2019 الى 20 نيسان 2020). الغرض من الدراســة لمعرفة تأثير مســتويات مختلفة من الرش الورقي ب اتونيك (0.0 , 0.2, 0.4 , 0.8 مع 1.0 مل \ لتر$^{-1}$) على النمو الخضري والحاصل لصنفين من البزاليا (Utrillo و Nihal).اغلب النتائج ظهر بشكل معنوي. الاصــناف كانت لها فروقات معنوية لبعض الصــفات وفقاً للنتائج. مؤشــرات البزاليا للنمو الخضــري والحاصل لصنف Utrillo حققت نتائج مثلى, كما أن الرش الورقي بالاتونيك كان لها تأثير معنوي على صفات النمو الخضري مثل عدد الاوراق وعدد الافرع (110.74 و2.69 على التوالي) سجلت عند معاملته بتركيز (1 مل. لتر$^{-1}$).في حين اعلى القيم من النمو الخضــري والوزن الطري والكلوروفيل الكلي ســجلت عندما رشت بالرش الورقي بالاتونيك عند معاملته بتركيز (0.2 مل.لتر$^{-1}$). بالإضافة الى ان المعاملة (0.2 مل.لتر$^{-1}$) اعطت اعلى عدد من البذور لكل قرنة والحاصــل لكل نبات والحاصــل لكل لوح والحاصــل لكل هكتار(6.00 بــذور.قرنــة$^{-1}$, 0.16 كغم .نبــات$^{-1}$,1.00كغم.لوح$^{-1}$ مع 1.68طن.هكتــار$^{-1}$ بــالتوالي). وفي نفس الوقــت الصنف Nihal أظهرت استجابة معنوية و اعطت النتائج القياسية من النمو الخضري والحاصل عند معاملته بالاتونيك.

الكلمات الدالة: الأتونيك، البزاليا، النمو الخضرى، الحاصل، الكلورفيل الكلي

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