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Effect of Silicon Foliar Application and Sowing Dates on Faba Bean (*Vicia faba* L.) Productivity under New Valley Conditions –Egypt.

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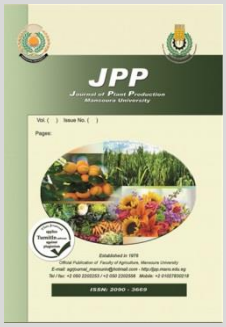

ABSTRACT

Field experiments were conducted at the experimental station farm of Desert Research Center (D.R.C.) at EL-Kharga Oasis, New Valley Governorate, during 2018/ 2019 and 2019/ 2020 growing seasons, to study the effect of sowing dates and silicon foliar application on productivity of faba bean under New Valley conditions. Results revealed that number of pods plant^{-1}, seed yield plant^{-1}, 100 seed weight, harvest index, shelling and seed yield were higher with planting on 15th Oct in both seasons. While, plant height, pod length, straw yield, WUE and seed carbohydrates content were higher with planting on 1st Oct in both seasons. Raising silicon foliar application levels up to 300 ppm led to a significant increase in all studied parameters except, pod length in both seasons. The interaction between sowing dates and silicon foliar application levels had significant effects on all studied characters except, pod length. The highest values of yield and its components were performed when faba bean had sown on 15th Oct with spraying of 300 ppm silicon in the form potassium silicate to obtain the highest possible productivity under New Valley conditions.

Keywords: Faba bean, Sowing date, Silicon, Yield

INTRODUCTION

Faba bean (*Vicia faba* L.,) is considered one of the most important legumes in Egypt. It has become one of the strategic crops that increase the farmer's income because it increases soil fertility, in addition to being an important source of protein as well as the possibility of using it for industrial purposes (Sharaan *et al.*, 2014). Faba bean represent an essential component of the food system of the Egyptian people. Therefore, improving its productivity and quality is an important goal to keep pace with the population increase (Zeidan 2012).

Increasing the productivity of faba bean seed yield, in Egypt, is one of the main Egyptian Government objectives. Since the growing area in Egypt, is limited; so the priority must be given by the Government as well as the Egyptian agricultural institutes towards the improvement of faba bean productivity. The attainment of maximum yield of faba bean from the unit area of land is greatly affected by different cultural practices in addition to environmental conditions. Sowing date is considered to be one of the most important factors, which may affect the timing and duration of the vegetative and reproductive stages, which mainly contribute to seed yield. Herein, Badr *et al.*, 2016 reported that early planting (1st Oct) resulted in a significant yield of faba bean by157 % because of cultivation at this date may be provides the plant with all the necessary the environmental needs in every stage of its growth over the late sowing date (end of December). They concluded that most of these advantages occurred due to the extended period of vegetative growth, which resulted in the improvement of several agronomical characters. Abou El-Yazied 2017 reported that yield increased significantly when planting was in early October, as it doubled compared to planting on January. But, El-Metwally *et al.*, 2018 showed that sowing date on 25th Oct. recorded the highest values of growth characters and total chlorophyll, while, the greatest values of yield and its components were resulted from the sowing date on 25th Nov.

Plant in desert environments exposed to biotic stress (insect and pathological injuries) and abiotic stress (high temperature, soil salinity, soil salinity and drought) that negatively affect growth and yield. In this regard, several researchers have reviewed recent advances on the beneficial roles of silicon on plant growth in adverse environmental conditions and increasing yield and its components for several of crops (Guntzer *et al.*, 2012 and Van *et al.*, 2017). Silicon protects plants from a biotic and biotic stresses (Liang *et al.*, 2017). Silicon relieves the salt stress on plants includes increased competence of antioxidant metabolism for reactive oxygen species (ROS) scavenging, prevention of lignin deposition, optimal ion balances, increased chlorophyll preservation, enhanced polyamine biosynthesis and delayed senescence (Yin *et al.*, 2017). Also, drought stress (Gong *et al.*, 2016), heavy metal toxicity (Shi *et al.*, 2005) and high temperature (Hattori *et al.*, 2015) could be alleviated by silicon.

Silicon enhances the ability of plants to tolerance water stress by increase the ability of leaves to retain water, leaf tissue integrity, stomatal conductance, and xylem construction under high transpiration rates and active photosynthesis (Gao*et al.*, 2016 and Gong *et al.*, 2016). Silicon can diminish the electrolyte leakage from plant leaves and therefore raised photosynthetic activity in plants grown under water stress conditions (Epstein 2011). Matoh *et al*., 2015 found that application of Si led to formation of a silica cuticle layer on epidermal tissue of leaf, which is

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responsible for greater leaf water potential under water deficit conditions. Different studies indicated the positive effect of Si application on growth, yield and quality of many plants (Jarosz, 2014), Mohaghegh *et al.*, 2015, Lu *et al.*, 2016; Sukkaew *et al.*, 2016 and Gorecki and Danielski, 2018.

The objective of the present study was to recognize the suitable combination for sowing dates and foliar application of silicon for maximizing faba bean seed yield and its components under the conditions of New Valley Governorate, Egypt.

MATERIALS AND METHODS

Location of Experiment

Two field experiments were carried out during the two successive winter growing seasons of 2018/ 2019 and 2019/ 2020 in the experimental station farm of Desert Research Center (D.R.C.) at EL-Kharga Oasis, New Valley Governorate. The main objective of this work was to study the effect of four different sowing dates and four silicon foliar levels on yield and its components of faba bean under New Valley conditions. The soil was sandy clay loam with pH 8.91 8.72, organic matter 0.61 and 0.55 %, EC 1356 and 1416 ppm, available nitrogen 52 and 60 ppm, available phosphorus 0.74 and 0.83 ppm and available potassium 45 and 57 ppm in the first and second seasons respectively. The previous crop was cowpea in both seasons.

Treatments and experimental design

Mariout 2 cultivar of faba bean used in this study, Treatments were four sowing dates (1st Oct, 15th Oct, 1st Nov, and 15th Nov) and four levels of silicon in the form of potassium silicate (K_2SiO_3 18 % silicon) as a foliar application (0, 100, 200 and 300 ppm). A strip split plot design, with three replications, was used. The sowing dates were assigned to the vertical strips, while, silicon foliar application were distributed between the horizontal strips. Each experimental unit (10.5 m^2) consisted of five ridges, 60 cm apart and 3.5m long. The distance between plants was 20 cm with three seeds $hill^{-1}$. After two weeks from emergence, seedlings were thinned two plants $hill^{-1}$ to give a theoretical plants population of 46000 plants fed^{-1}.

Agricultural practices

Faba bean seeds were inoculated with Rhizobium (Okadeen). During soil preparation and before each planting date, 5 m^3 of poultry manure mixed with 37.5 kg P_2O_5 were applied. Potassium sulfate (K_2SO_4 48 %) was applied after 45 days of each sowing date at the rate of 50 kg fed^{-1}. Nitrogen fertilizer was added at four equal doses in the form ammonium sulfate (20.5%), the first after four weeks from planting date and the other doses every two weeks as a solution with irrigation. Other cultural practices were applied as per the recommendations. The plants harvested by hand when the 60% of the pods are mature in both growing seasons.

Measurements

At harvest five plants were taken from each experimental unit of each sowing date and the following characters were studied: plant height (cm), number of pods $plant^{-1}$, pod length (cm), seeds weight $plant^{-1}$, 100 seed weight (g), harvest index (%), shelling (%), seed yield (kg/fed.), straw yield (Kg/fed.), water use efficiency (WUE) kg/ m^3, protein in seeds (%) and carbohydrates in seeds (%). Whereas, harvest index was calculated by the following formula: HI: (Seed yield) / (biological yield) X 100. Shelling percentage worked out by using the formula by dividing weight of seeds/ weight of pods x 100. Water use efficiency (WUE) which calculated using the equation of Vites (1965) for seed yield, as follows: WUE = Seed yield kg fed^{-1} /actual consumptive use m^3 fed^{-1}. Protein of seed (%) was determined by using the Kjeldahl method (N %) with a conversion factor of 6.25.

Statistical analysis

The obtained data were subjected to the statistical analysis of the strip split plot design according to Snedecor and Cochran (1990). Treatment means were compared using least significant difference test LSD at 5% probability level.

RESULTS AND DISCUSSION

1.Effect of sowing dates:

Data presented in Table (1 and 2) indicated that planting faba bean at different sowing dates had a significant effect on all studied traits in both seasons. Number of pods $plant^{-1}$, seed yield $plant^{-1}$(g), 100 seed weight (g), harvest index (%), shelling (%) and seed yield (kg/ fed.) were higher when planting on 15th Oct in both seasons. While, plant height (cm), pod length (cm), straw yield (kg/ fed.), water use efficiency (WUE) kg/ m^3 and carbohydrates (%) in seeds were higher when planting on 15th Oct in both seasons. On the other hand, the highest value of the percentage of protein in seeds was on 15th Nov and the lowest on (1st Oct) in both seasons. The results also explained that planting of faba bean on 15th Oct was superior over other sowing dates and met the environmental needs of plant and attributed to the increase in number of pods $plant^{-1}$, 100 seed weight (g) and seed yield $plant^{-1}$(g). It is worthy to conclude that planting of faba bean in this date is a good time in order to explore its yield potential under New Valley conditions. While the late sowing dates (15th Nov) produced the lowest values of all traits in both seasons. The reason for decreasing values of yield and its components when the date of planting is late may be due to high temperature of late planting, which causes reach of leaves to early aging stage and a decrease in its total area, which negatively effects on the net assimilation rate of photosynthesis and dry matter formation.

The increases percentages outcome planting of faba bean on (15th Oct) compared with planting in (15th Nov) with regard to: number of pods $plant^{-1}$were 49.5 and 47.4, seed yield $plant^{-1}$(g) were 48.7 and 46.0, 100 seed weight (g) were 48.4 and 47.8, harvest index (%) were 58.5 and 56.3, shelling (%) were 14.9 and 14.0 and seed yield (kg/ fed.) were 45.8 and 44.0in the first and second seasons, respectively. However, the percentage of increase as a result of planting on (1st Oct) compared with planting in (15th Nov) with regard to: plant height (cm) were 21.1 and 20.8, pod length (cm) were 37.5 and 32.3, straw yield (kg/ fed.) were 56.9 and 54.7, (WUE) kg/ m^3 were 55.6 and 52.6 and carbohydrates (%) in seeds were 22.2 and 17.5 in the first and second seasons, respectively. While, the

percentage increase in seed protein (%) due to cultivation of faba bean on (15th Nov) compared to cultivation on (1st Oct) were 38.3 and 36.65 in the first and second seasons, respectively. In this regard, Zain *et al.,* 2014 reported that faba bean sowing in mid-October gave the highest values of yield and its components due to favorable environmental conditions for seed germination and long growing season upon sowing in early sowing.

Likewise, Turk and Tawaha 2017 pointed out that shortening the growing season when planting at the late date leads to a decrease in the amount of dry matter accumulated and number of pods per plant, which leads to a lack of yield. Similar findings were reported also by (Kawochar *et al.,* 2011, Khalil *et al.,* 2011 and Sharaan *et al.,* 2014). EL-Metwally *et al.,* 2018 found that the highest values of faba bean yield components were obtained when sowing was on 20th Oct. however, the lowest values were recorded at 10th Dec. sowing date. Abou-Taleb 2014 found that yield of faba bean and its components significantly decreased with the late sowing date. This is due to the differences between temperatures of day and night during plant growth stages.

2.Effect of silicon foliar application:

As for the effect of silicon foliar (potassium silicate) levels on some faba bean traits, data in Table (1 and 2) illustrate that, excess foliar application of silicon levels up to 300 ppm led to a significant increase in all studied traits except, pod length (cm) in both seasons. The highest value of these measurements can be obtained when spraying at a rate of 300 ppm silicon as compared with nil silicon (control) in both seasons. The increase percentages obtained with foliar silicon as 300 ppm compared with the control treatment were 18.0 and 16.7 % in plant height (cm), 42.0 and 39.8 % in number of pods plant^{-1}, 39.1 and 35.0 in seed yield plant^{-1}(g)**,** 37.8 and 36.7% in 100 seed weight (g), 72.2 and 68.5% in harvest index (%), 21.9 and 18.7% in shelling (%), 38.7 and 37.1% in seed yield (kg/ fed.), 40.2 and 34.4% in straw yield (kg/ fed.), 19.0 and 18.1% in (WUE) kg/ m^3, 8.0 and 7.3% in seed protein (%), as well as 49.8 and 48.4 % in seed carbohydrates (%) in the first and second seasons, respectively

Results indicated that foliar application of 300 ppm silicon is quite enough to achieve the highest values of the studied parameters under the current experiment. Where, the good effect of silicon on plants is due to the fact that silicon increases the strength of building cell walls and participates in the activation of many important physiological processes within plant. Several studies indicate that the enhancing effect of silicon is evident under different stress conditions which plants are exposed, so it increases the plant's defense systems against low (Epstein 2011) and high temperatures (Hattori *et al.,* 2015), salinity (Van *et al.,* 2017) and heavy metal toxicity (Shi *et al.,* 2005). Silicon enhances the ability of plants to tolerance water stress by increase the ability of leaves to retain water, leaf tissue integrity, stomatal conductance, and xylem construction under high transpiration rates that leads to greater water use efficiency and active photosynthesis (Gao *et al.,* 2016).

Table 1. Effect of sowing dates, Silicon foliar application and their interactions on yield and quality of faba bean during 2018/ 2019 and 2019/ 2020 growing seasons under New Valley conditions.

Char. / Treatments		Plant height (cm)		Number of pods plant^{-1}		Pod length (cm)		Seed yield plant^{-1} (g)		100 seed weight (g)		Harvest index (%)	
Seasons		**S1**	**S2**	**S1**	**S2**	**S1**	**S2**	**S1**	**S2**	**S1**	**S2**	**S1**	**S2**
Sowing dates													
1 October		132	128	13.4	12.9	9.9	8.6	37.3	35.9	67.6	66.9	42.1	38.5
15 October		127	124	14.5	14.2	9.1	8.8	40.3	38.4	73.9	71.7	49.6	46.9
1 November		117	114	11.3	11.1	8.5	8.1	31.5	30.9	57.3	55.7	37.4	35.8
15 November		109	106	9.7	9.5	7.2	6.5	27.1	26.3	49.8	48.5	31.3	30.0
LSD at 5%		4	3	1.1	1.4	0.5	0.6	1.9	1.3	3.2	2.1	4.5	2.7
Silicon foliar application													
0 (control)		111	108	10.0	9.8	6.7	6.2	28.4	28.3	51.9	50.7	24.5	23.5
100 ppm		117	114	11.5	11.3	7.1	6.9	31.9	31.4	58.0	57.1	28.9	26.4
200 ppm		125	123	13.1	12.5	7.8	7.6	36.4	34.8	66.0	64.0	35.6	33.1
300 ppm		131	126	14.2	13.7	8.3	8.0	39.5	38.2	71.5	69.3	42.2	39.6
LSD at 5%		2	1	0.6	0.5	NS	NS	1.8	2.3	2.0	1.6	2.8	3.3
interaction between sowing dates and Silicon foliar application													
1 Oct.	0	124	121	11.7	11.2	8.3	7.9	32.4	31.1	58.9	57.3	33.3	30.3
	100 ppm	127	124	12.8	12.4	8.5	8.3	35.6	34.5	64.5	65	35.5	32.5
	200 ppm	139	133	13.8	13.1	8.9	8.6	38.3	36.3	69.4	68.5	38.9	35.8
	300 ppm	140	137	15.5	15.0	9.1	8.8	43.0	41.6	73.7	71.7	42.2	39.6
15 Oct.	0	118	113	12.7	12.9	7.9	7.5	35.4	35.9	64.3	63	37.1	34.5
	100 ppm	124	122	13.4	13.2	8.1	7.9	37.1	36.6	67.3	65.9	39.3	36.7
	200 ppm	129	126	15.8	15.3	8.5	8.2	43.9	42.0	75.2	74.6	42.6	40.0
	300 ppm	137	134	16.1	15.4	8.7	8.4	44.8	42.7	77.9	76.1	45.9	43.8
1 Nov.	0	110	106	9.9	10.2	7.6	7.2	27.4	28.2	50.1	48.4	31.0	29.0
	100 ppm	115	111	11.0	10.6	7.8	7.5	30.5	29.4	55.6	53.8	33.2	31.1
	200 ppm	119	118	11.8	11.6	8.2	7.9	32.9	32.1	59.8	56.4	36.5	34.5
	300 ppm	123	120	12.6	12.2	8.4	8.1	35.0	33.9	63.5	64	39.8	38.2
15 Nov.	0	94	91	6.7	6.3	7.0	6.4	18.5	17.4	34.3	32.8	26.4	23.7
	100 ppm	104	99	8.7	9.0	7.2	6.7	24.2	25.0	44.5	43.7	28.6	25.8
	200 ppm	115	112	11.0	10.2	7.5	7.1	30.5	28.3	55.5	53.5	32.0	29.2
	300 ppm	121	119	12.6	12.4	7.8	7.3	35.1	34.5	63.7	61.14	35.3	32.9
LSD at 5%		1	0.6	0.3	0.1	NS	NS	0.6	0.7	1.1	0.8	0.1	0.3

Whereas, S_1: the first season 2018/2019 while S_2: the second season 2019/2020.

Table 2. Effect of sowing dates, Silicon foliar application and their interactions on yield and quality of faba bean during 2018/ 2019 and 2019/ 2020 growing seasons under New Valley conditions.

Char. / Treatments		Shelling (%)		Seed yield (kg/ fed.)		Straw yield (kg/ fed.)		Water use efficiency WUE kg/ m^3		Protein (%)		Carbohy-drates(%)	
Seasons		**S_1**	**S_2**	**S_1**	**S_2**	**S_1**	**S_2**	**S_1**	**S_2**	**S_1**	**S_2**	**S_1**	**S_2**
Sowing dates													
1 October		73.8	77.6	1721	1696	2810	2704	0.823	0.780	20.1	19.4	44.6	41.0
15 October		78.7	75.5	1868	1833	2621	2573	0.747	0.721	23.0	22.5	42.3	41.7
1 November		71.3	71.5	1453	1429	2256	2115	0.556	0.530	25.9	25.1	39.1	37.8
15 November		68.5	66.2	1281	1273	1791	1748	0.529	0.511	27.8	26.5	36.5	34.9
LSD at 5%		1.4	1.6	23	31	44	61	0.015	0.018	1.7	1.4	1.8	1.2
Silicon foliar application													
0 (control)		59.3	57.9	1314	1292	1836	1783	0.357	0.349	23.5	23.4	32.9	31.8
100 ppm		62.3	60.8	1480	1461	2114	2022	0.375	0.384	24.5	23.9	40.8	39.4
200 ppm		65.6	63.5	1687	1662	2393	2280	0.402	0.396	25.0	24.5	45.6	45.1
300 ppm		72.3	68.7	1823	1771	2574	2396	0.425	0.412	25.8	25.1	49.3	47.2
LSD at 5%		1.8	2.1	37	42	51	67	0.013	0.011	0.4	0.3	2.0	2.3
interaction between sowing dates and Silicon foliar application													
	0	66.6	64.4	1497	1462	2323	2323	0.590	0.576	19.5	18.8	38.8	37.1
1	100 ppm	68.1	67.2	1650	1627	2462	2462	0.599	0.593	19.9	19.2	42.7	41.2
Oct.	200 ppm	70.7	69.6	1773	1751	2602	2602	0.613	0.599	20.3	19.6	45.1	44.1
	300 ppm	73.1	71.2	1962	1945	2692	2692	0.624	0.607	20.6	20.0	47.0	45.5
	0	69.0	65.7	1637	1611	2229	2229	0.552	0.535	22.4	21.7	37.6	36.5
15	100 ppm	70.5	68.2	1722	1703	2368	2368	0.561	0.553	22.8	22.1	41.6	40.6
Oct.	200 ppm	72.2	69.5	2031	2007	2507	2507	0.575	0.559	23.0	22.8	44.0	43.4
	300 ppm	75.5	72.1	2082	2049	2598	2598	0.586	0.567	23.7	23.2	45.8	44.8
	0	65.3	63.7	1251	1234	2046	2046	0.457	0.440	24.6	25.8	36.0	34.5
1	100 ppm	67.8	66.2	1417	1394	2185	2185	0.466	0.457	25.8	24.5	40.0	38.6
Nov.	200 ppm	68.5	67.5	1525	1501	2325	2325	0.479	0.463	26.4	26.1	42.4	41.5
	300 ppm	71.8	70.1	1619	1588	2415	2415	0.491	0.471	26.9	26.7	44.2	42.9
	0	63.9	60.6	869	860	1814	1814	0.443	0.428	27.6	27.4	34.4	33.1
15	100 ppm	65.4	63.0	1131	1120	1953	1953	0.452	0.445	29.5	28.7	38.7	37.2
Nov.	200 ppm	67.1	64.4	1418	1387	2092	2092	0.466	0.451	30.2	29.6	41.1	40.0
	300 ppm	70.4	67.3	1627	1605	2183	2183	0.477	0.459	31.8	30.3	42.9	41.4
LSD at 5%		1.1	0.8	11	1 7	16	21	0.009	0.005	0.2	0.3	0.1	0.2

Whereas, S_1: the first season 2018/2019 while S_2: the second season 2019/2020.

Silicon can diminish the electrolyte leakage from plant leaves and therefore raised photosynthetic activity in plants grown under water stress conditions (Epstein 2011). Yin *et al.,* 2017 found that addition of silicon leads to the formation of silica in the epidermal tissues of the leaves, which is responsible for increasing the leaves' water retention under conditions of water shortage. Pati *et al.,* 2017 found that foliar application of silicon increased 100 seed weight of faba bean by 120 %, seed yield by 65 %, number of pods plant^{-1} by 42 % and protein by 23 % as compared with control, they concluded that the significant effect of using foliar application of silicone on yield and its components on faba bean may be due to alleviate the damage of both drought and heat stresses.

4. Effect of the interaction between sowing dates and silicon foliar application levels:

Results in Table (1 and 2) indicated that the interaction between sowing dates and silicon foliar application levels had a significant effect on all studied characters except, pod length (cm) don't affected significantly by the interaction between the two studied factors in both seasons. The highest values of studied traits in concerning the number of pods plant^{-1},seed yield plant^{-1}(g)**,** 100 seed weight (g), harvest index (%), shelling (%), seed yield (kg/ fed.) and seed carbohydrates percentage were obtained when faba bean had sown on 15th Oct and spraying of plants by silicon at the rate of 300 ppm in both seasons. However, the highest values in concerning plant height (cm), pod length (cm), straw yield (kg/ fed.) and WUE (kg/ m^3) were obtained when faba bean had sown on 1st Oct and spraying of plants by silicon at the rate of 300 ppm in both seasons. On the other side, the highest values of seed protein (%) were obtained when faba bean had sown on 15th Oct and spraying of plants by silicon at the rate of 300 ppm in both seasons. Therefore, this study recommends the cultivation of faba bean on 15th Oct with spraying of 300 ppm silicon in the form potassium silicate to obtain the highest possible productivity under New Valley conditions.

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تأثيرالرش بالسيليكون ومواعيد الزراعه على إنتاجية الفول البلدى تحت ظروف الوادى الجديد - مصر

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أجريت تجربتان حقليتان بالمحطة البحثية بالخارجة التابعة لمركز بحوث الصحراء بمحافظة الوادي الجديد خلال موسمي 2018 /2019 و /2020 2019 لدراسة تأثير مواعيد الزراعة (1 أكتوبر، 15 أكتوبر، 1 نوفمبر،15 نوفمبر) والرش بالسيليكون بتركيزات (0. 100 ، 200 و 300 جزء في المليون) فى صورة سليكات بوتاسيوم تحت ظروف الوادي الجديد. أظهرت النتائج أن إستخدام مواعيد الزراعة المختلفة مع الفول البلدى كان له تأثيرمعنوي على جميع الصفات تحت الدراسة في كلا الموسمين.عدد القرون/ نبات , محصول البذور/ نبات، وزن الألف بذرة ، دليل الحصاد ، نسبة التفريط و محصول البذور كانت أعلى عند الزراعة في (15 أكتوبر) في كلا الموسمين. بينما كان إرتفاع النبات، طول القرن، محصول القش، كفاءة إستخدام الماء (WUE) ونسبة الكربوهيدرات في البذور أعلى عند الزراعة في (1أكتوبر) في كلا الموسمين. من ناحية أخرى، كانت أعلى قيمة لنسبة البروتين في البذورعند الزراعة فى (15 نوفمبر) وأقلها عند الزراعة فى (1 أكتوبر) في كلا الموسمين. وعلى ذلك فإن الزراعة فى الموعد المتأخر (15 نوفمبر) أعطى أقل القيم لجميع الصفات تحت الدراسة فى كلا الموسمين. أوضحت النتائج أن زيادة معدل الرش بالسليكون حتى 300 جزء في المليون أدى إلى زيادة معنوية في جميع الصفات تحت الدراسة بإستثناء طول القرن، في كلا الموسمين. وكانت أعلى القيم لجميع الصفات التى تم الحصول عليها عند الرش بمعدل 300 جزءفي المليون من السليكون مقارنة بمعاملة الكنترول (الرش بالماء فقط) في كلا الموسمين. كان للتفاعل بين مواعيد زراعة الفول البلدى ومعدلات الرش بالسليكون تأثيراً معنويا على جميع الصفات تحت الدراسة بإستثناء طول القرن الذي لم يتأثرمعنويا بالتفاعل بين عاملي الدراسة في كلا الموسمين. أعلى القيم للصفات عدد القرون/ نبات، محصول البذور/ نبات، وزن الألف بذرة، دليل الحصاد، نسبة التفريط، محصول البذور ونسبة الكربوهيدرات في البذور تم الحصول عليها بزرعة نباتات الفول البلدى في 15 أكتوبر وعند الرش بالسيلكون بمعدل 300 جزء في المليون في كلا الموسمين. بينما تم الحصول على أعلى القيم في ما يتعلق بإرتفاع النبات، طول القرن، محصول القش، وكفاءة استخدام الماء (WUE) عند الزراعة في 1 أكتوبر والرش بالسيلكون بمعدل 300 جزءفي المليون في كلا الموسمين. على الجانب الآخر تم الحصول على أعلى نسبة للبروتين فى البذورعند الزراعة في 15 أكتوبر ورش بالسيليكون بمعدل 300 جزء في المليون في كلا الموسمين. لذلك، توصي الدراسة بزراعة الفول البلدى في 15 أكتوبر ورش السيليكون بمعدل 300 جزء في المليون فى صورة سيليكات البوتاسيوم للحصول على أعلى إنتاجية ممكنة تحت ظروف الوادي الجديد.