EFFECT OF TILLAGE, PLANTING DISTANCE AND FOLIAR P AND K NUTRITION ON FABA BEAN PERFORMANCE

ZOHRY[1], A. H. A., A . Y. NEGM[2] AND F. A. ZAHRAN[2]

1 Crop intensification Res. Sec., Field Crop Res. Inst., Agric. Res. Center, Giza, Egypt.

2 Plant Nutrition Debt., Soil, Water and Environment Res. Inst., Agric. Res. Center, Giza, Egypt.

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Abstract

A 2-year field study was conducted at Mallawy Research Station during two successive growing seasons , 1999/2000 and 2000/2001, to investigate the effect of tillage system (tillage and no-tillage) , planting distance (10, 20 and 30 cm) and foliar application of single superphosphate (SSP) and potassium sulphate(KS) at different ratios on faba bean (*cv* Giza 3) production and seed contents of protein , P and K .

The obtained results revealed that conventional tillage induced significant increases in seed yield, seed weight/plant, 100-seed weight and number of pods / plant during the two seasons, while the measured seed contents showed no specific trend. Increasing planting distance gave significant increases in faba bean growth, yield and yield traits as well as seed protein content, being the highest at 30 cm. distance. Foliar application of the mixture of 10 kg KS + 5 kg SSP or 5 kg KS + 10 kg SSP recorded the highest significant increases in faba bean seed yield and its traits, while foliar application of SSP or KS singly showed adverse effects. Seed contents of protein, P and K showed inconsistent results during the two growing seasons.

In the two growing seasons, 100-seed weight as well as seed contents of protein, P and K were significantly affected by the interaction between foliar P and K application and tillage with no specific trend, while faba bean seed yield and its traits generally were affected significantly by the interaction between foliar P and K application and planting distance in the two seasons ; and the interaction between 5 kg KS + 10 kg SSP and 30 cm. planting distance gave the highest values. Seed contents of protein, P and K were also affected significantly by this interaction with no certain trend. The interaction among all the studied factors showed significant effects only on seed protein and K contents with no certain trend either.

It could be stated that planting two plants/hill on both sides of the ridge, 30 cm. between hills with the conventional tillage and foliar application of soaked 5 kg KS + 10 kg SSP /fed could be recommended for growing faba bean under the conditions of Mallawy district.

INTRODUCTION

Economic conditions in modern agriculture demand high crop yields in order to be profitable and consequently match population growth with high demand for food.

There are several factors which cause such high yields. Some of these factors are , to a certain extent , beyond the control of the farmer, but there are many other factors which can be managed. Among these factors are land preparation , seeding density and the proper use of fertilizers , in terms of the quantity and nutrients used, and method of application , which can play an important role in increasing crop production and the quality of food.

No-tillage or minimum tillage can help in erosion control, reduce fuel essential for land preparation , give flexibility in planting and harvesting without waiting for sufficient drying time for tillage (Mc Gregor and Curley , 1975) . Untilled soil also increased land use and reduced labor requirement. However, research is showing that conservation tillage can increase water-use efficiency and decrease soil erosion and then increase crop yields. This kind of management can have considerable effect on crop requirements for certain nutrients, especially nitrogen, phosphorus, potassium and sulphur. Plowing is necessary to mix surface residues and emerging seedlings in clean soil surface. Soil aeration is also important by avoiding soil compaction created by heavy equipment.

While numerous investigators have reported that all yield components of faba bean tended to decrease with increasing plant density per unit area , seed yield per feddan , however , increased with increasing plant density (Amer, 1986; Nigem *et al.*;1988, Selim and El-Seesy,1991; Singh *et al.*,1992, Salwau, 1994 and El-Douby *et al.*, 1996).

Phosphorus and potassium fertilization maintain high productivity and good quality of different crops. Foliar application of P and K is a satisfactory method of supplementary application. Hussein *et al.* (1993) showed that foliar application of 2 % P_2O_5, resulted in the highest faba bean yield components and seed yield as well as seed crude protein percentage. Also spraying common bean plants with potassium sulphate increased seed yield (Hewedy *et al.*, 1994). Seed yield of cowpea was also increased by foliar application of 3% superphosphate and 2 % K-sulphate ; P and K treatments decreased the damaged seeds and increased seed protein content (El-Gizy *et al.*, 1995). Foliar fertilization of lentil and lupine with the supernatant of superphosphate (5 Kg / fed.) or the mixture of SP and KS (10 Kg SP + 5 Kg KS /fed .) induced significant increases in yield and yield components of both the two crops (Zahran *et al.* , 1998).

The present field study was initiated to determine the effect of tillage system, plant density along with foliar P and K fertilization as well as their interactions on faba bean productivity.

MATERIALS AND METHODS

A field trial was carried out at Mallawy Research Station, A.R.C., during the successive growing seasons of 1999/ 2000 and 2000 / 2001 to study the effect of tillage systems , plant density and foliar application of the supernatant of soaked single superphosphate (SSP) and potassium sulfate (KS) alone or in different ratios on yield components, yield and seed chemical composition of the faba bean (variety Giza 3) . The treatments were arranged in a split-split plot design with four replications and the plot size was 10.5 m^2. The main plots were devoted to the conventional tillage and no-tillage systems .The sub-plots were devoted to the hill planting distances, i.e. 10, 20 and 30 cm. with two plants/hill at both sides of all ridges. Each sub-sub-plot consisted of six ridges. Each ridge was 2.8 meter in length and 60 cm. apart from each other. The sub-sub-plots included six treatments of soaked single superphosphate (15% P_2O_5) and/or potassium sulphate (48% K_2O) at the following rates:

(1) Control (without spraying).
(2) 5 Kg potassium sulphate / fed. (KS5).
(3)5 Kg single superphosphate /fed. (SSP5).
(4) (5 Kg KS+ 5 Kg SSP) / fed. (KS5 + SSP5)
(5) (10 Kg KS+ 5 Kg SSP)/fed. (KS10+ SSP5).
(6) (5 Kg KS +10 Kg SSP)/fed. (KS5 + SSP10)

The above-mentioned amounts of SSP and KS as well as their mixtures were soaked in 100 litres water and completed to 400 liters . The plants received 2 sprays of the supernatents at the beginning of both flowering and setting (early pod formation) stages using a wetting agent. The control plots were fertilized with 30 Kg P_2O_5/ fed. as SSP before planting as soil application, while the plots received foliar fertilization (treatments 2-6) were soil fertilized with only 15 P_2O_5 / fed. as SSP before planting . Addition of N fertilizer was also added two weeks after sowing as soil application for all plots at the rate of 15 Kg N/fed. as ammonium nitrate (33.5 % N). At harvest, ten

plants were randomly sampled from each sub-sub plot to determine yield attributes.

Seeds of faba bean were subjected to a chemical analysis to determine protein, phosphorus and potassium contents. Micro-Kjeldahl apparatus method as described by A.O.A.C. (1970), was used to determine nitrogen percentage and then multiplied by 6.25 to obtain protein percentage. Phosphorus was determined colourimeterically according to Jackson (1958), while potassium was determined by flamephotometer (Chapman and Pratt , 1961) . Representative soil samples from the experimental site were taken before starting the experiment in 1999 to determine some chemical properties according to Jackson (1958) and the data are presented in Table 1.

Table 1. Soil chemical analyses of the experimental site.

PH (1:2.5 , soil: water suspension)	7.6
EC mmohs/cm. (1:5, soil : water , extract)	0.31
CaCO3 %	2.91
Available N (ppm) extracted with 1% K-sulfate	80
Available P (ppm) Olsen	9.13
Available K (ppm) extracted with neutral NH_4OAc	550
Texture	Clay loam

The collected data were statistically analyzed according to Snedecor and Cochran (1971).

RESULTS AND DISCUSSION

1. Effect of tillage system on growth, yield and seed contents of P, K and protein:

Conventional tillage system induced significant increase in the number of pods, seed weight/plant, 100-seed weight and seed yield over no-tillage system during the two growing seasons, while this was also true for plant height, number of branches/ plant and number of seeds/ pod in the first season only (Table 2). In this respect, Thomas and Frye (1984) demonstrated that, in sustained no-tilled soil, the immediate released phosphorus and potassium accumulated in the very near surface, and the deeper soil layers are gradually deprived from nutrients. Nitrogen mineralization rates tend to be lower in no-till system because the soil is not disturbed and the organic residues remain on the surface where decomposition is lower (Rice and Smith, 1982). All

these factors could explain the favorable effects of conventional tillage on faba bean production. Moreover, plowing proved to be necessary to mix surface residues and improves soil aeration and hence good root-system formation, as well as its effectiveness in weed control, which positively reflected on faba bean production.

The effect of tillage on seed contents of both protein and P was contradictory. While tilled soil showed significant increases in both seed protein and P contents in the second season, the reverse was observed in the first season. Meanwhile, seed-K content of plants grown in untilled soils was significantly higher than those grown in tilled soils (Table 2)

2. Effect of planting distance on growth, yield and seed contents of P, K and protein:

Growth characteristics, yield and yield components of faba bean as well as seed contents of P, K and protein were significantly affected by plant density except plant height in the first season as shown in Table 2. Number of branches and pods/plant, number of seeds/pod, seed weight/plant, 100-seed weight and seed yield, all were significantly increased by widening planting distance during the two growing seasons, while plant height behaved inversely. The increases in yield traits due to increasing planting distance could be attributed mainly to the reduction occurred to the intra specific competition between plants for light intercepted by foliage as well as the availability of nutrients and water absorbed by roots. The reduction in plant height due to increasing planting distance could be explained on the basis of the decreased number of plants per unit area coupled with the less plant to plant competition for light resulted in longer internodes. The increases in seed yield were more pronounced by increasing planting distance from 10 to 20 cm. (by 37.7 and 24.7 % in the first and second seasons, respectively) than from 20 to 30 cm. (20 .0 and 11.6% for the first and the second seasons, respectively). The increases in seed yield could be due to the incident increases in yield attributes by increasing planting distance. Although seed contents of P, K and protein were significantly affected by planting distance, they showed sporadic responses during the two growing seasons as shown in Table 2.

The obtained results with yield traits confirmed those obtained by El-Habbak and El-Naggar (1991) and El-Douby *et al.* (1996). However, El-Douby *et al.* (1996), Nigem

et al. (1988), Selim and El-Seesy (1991) and Singh *et al.* (1992) reported an increase in faba bean seed yield by increasing plant density.

3. Effect of foliar applied P and K on growth, yield and seed contents of P, K and protein:

The obtained data in Table 3 demonstrated significant increases over the control in the yield traits, i.e. number of pods/plant, number of seeds/pod, seed weight/ plant, 100-seed weight due to foliar application of the supernatant of the mixture of 10 kg KS + 5 kg SSP or 5 kg KS + 10 kg SSP / fed. during the two growing seasons .Moreover ,the seed yield was significantly increased due to the three used mixtures, i.e. 5 kg KS + 5 Kg SSP, 10 kg KS + 5 kg SSP or 5 kg KS +10 kg SSP /fed. by 2.1, 6.9 and 11.08 % over the control, respectively, during the first season and 3.1%, 10.9% and 17.7% respectively during the second season. The highest seed yield was achieved by the mixtures with higher SSP rate showing that the 5 kg KS + 10 kg SSP ratio is the most balanced ratio for faba bean foliar application. Such results may indicate the important role of P in energy storage and transfer of metabolite components. The results also show the importance of foliar P and K application at the onset of both flowering and setting because of the key role of these nutrients in increasing the percentage of flowering and setting and hence the seed yield.

On the other hand, foliar application of either SSP or KS singly each at 5 kg/fed. caused significant reduction in seed yield and yield traits and this may be arisen from the imbalanced nutrition of faba bean plants showing the importance of foliar application of both SSP and KS together but avoiding the single application of SSP or KS alone. Seed protein percentage showed inconsistent results; while all foliar treatments gave seeds with more protein than without foliar application in the first year; the reverse was observed in the second year. Contradictory results were also obtained with seed contents of P and K.

4. Interaction effects:

Data in Table 4 show that among the studied characteristics, seed weight /plant and 100 – seed weight as well as seed contents of both P and K were significantly affected by the interaction between tillage and planting distance. However, these interac-

tion effects were achieved in one season only, being the first season. On the other hand, consistent interaction effects between tillage and foliar P and K fertilization were obtained in the two seasons with 100-seed weight and seed contents of protein, P and K, while these were true for number of seeds/pod and seed yield in the first season only. Effects of P and K being generally in favor of foliar application of 5 kg KS + 10 kg SSP or 10 kg KS + 5 kg SSP under conventional tillage system (Table 5).

Regarding the interaction effects between foliar P and K application and planting distance, the results in Table 6 show clearly that the studied yield traits and seed yield were significantly affected by this interaction during the two seasons except plant height and number of seeds/pod which were significantly affected in the first season only. The interaction between foliar P and K application of 5 kg KS + 10 kg SSP and planting at 30 cm distance gave the highest values for seed yield and yield traits. Seed contents of protein, P and K were also significantly affected by the interaction between foliar P and K application and planting distance; however, no specific trend was observed (Table 7).

The interaction among the studied treatments , i.e. tillage system, foliar P and K application and planting distance indicated that only seed contents of protein and K were significantly affected by this interaction , however , no specific trend was noticed (Table 8). Faba bean seed yield and its components were not significantly affected.

It could be stated that planting two plants / hill on both sides of the ridge , 30 cm. Apart between hills with the conventional tillage system and foliar application of the supernatent of soaked 5 kg KS + 10 kg SSP / fed could be recommended for growing faba bean under the conditions of Mallawy district.

Table 3. Effect of foliar P and K application on growth, yield and yield components of faba bean as well as seed contents of P, K and protein during the growing seasons 1999/2000 and 2000/2001

Characters / Fertilizer treatments	Plant height (cm)	No. branches /Plant	No. pods /Plant	No. seeds /Pod	Seed weight /Plant(g)	100-seed weight (g)	Seed yield (ardab*/fed.)	Protein (%)	P (%)	K (%)
1999 / 2000 Season										
Control	107.83	3.06	19.52	2.89	23.07	57.43	8.96	24.55	0.400	0.914
KS5	107.50	3.09	16.29	2.78	19.89	56.21	8.55	25.75	0.421	0.922
SSP5	108.11	2.85	16.38	2.69	20.06	52.35	8.69	26.02	0.440	0.928
KS5+SSP5	106.11	3.17	19.19	2.79	24.36	58.16	9.15	28.09	0.410	0.938
KS10+SSP5	108.11	2.95	20.26	2.92	25.72	58.81	9.58	27.39	0.411	0.911
KS5+SSP10	107.00	3.11	20.42	2.93	26.87	59.75	10.02	25.58	0.428	0.906
L.S.D(5 %)	1.26	0.09	0.41	0.06	0.45	1.30	0.11	1.19	0.014	0.020
2000 / 2001 Season										
Control	107.61	2.77	19.32	2.46	23.86	68.08	9.37	27.82	0.397	0.979
KS5	107.17	2.38	15.09	2.33	19.82	61.49	7.87	24.63	0.332	0.962
SSP5	107.83	2.57	16.83	2.46	21.09	63.59	8.75	23.52	0.359	0.961
KS5+SSP5	107.83	2.63	19.19	2.52	24.23	68.93	9.66	26.33	0.408	0.960
KS10+SSP5	108.83	2.83	20.88	2.47	26.20	71.32	10.39	25.67	0.420	1.034
KS5+ SSP10	108.83	2.85	22.59	2.62	27.91	72.82	11.03	26.88	0.394	0.954
L.S.D(5 %)	N.S.	0.11	0.37	0.07	0.43	0.90	0.18	0.97	0.015	0.021

*ardab= 160kg

Table 4. Interaction effects between tillage and planting distance on growth characters, yield and yield components of faba bean as well as seed chemical contents during 1999/2000 and 2000/2001 seasons.

Characters	Plant height (cm.)		No. branches /Plant		No. pods /Plant		No. seeds /Pod		Seed weight /Plant (g)		100-seed weight (g)		seed yield (ardab/fed.)		Protein (%)		P (%)		K (%)	
Distance	Tillage	No Tillage	Tillage	No Tillage	Tillage	No Tillage	Tillage	No Tillage	Tillage	No Tillage	Tillage	No Tillage	Tillage	No Tillage	Tillage	No Tillage	Tillage	No Tillage	Tillage	No Tillage
1999/2000 Season																				
10 cm	115.7	114.9	2.44	2.11	15.10	14.03	2.63	2.53	54.27	52.14	17.43	16.14	7.08	6.56	23.44	25.92	0.418	0.405	0.973	0.953
20 cm	105.7	105.7	3.16	2.88	19.51	18.04	2.93	2.78	59.22	54.58	24.08	22.58	9.57	9.20	25.83	26.77	0.380	0.436	0.778	0.969
30 cm	102.33	101.7	4.04	3.61	23.36	22.68	3.12	3.01	60.98	61.50	31.05	28.70	11.53	11.00	28.22	27.19	0.427	0.443	0.922	0.923
LSD,5%	N.S.		N.S.		N.S.		N.S.		2.39		0.55		N.S.		N.S.		0.023		0.031	
2000/2001 Season																				
10 cm	114.5	113.8	2.23	2.14	16.48	14.40	2.27	2.21	63.63	60.86	18.38	16.60	8.24	7.44	26.33	24.56	0.388	0.364	0.932	0.969
20 cm	106.9	105.9	2.53	2.41	20.52	18.02	2.53	2.47	70.23	66.19	24.87	23.47	10.10	9.46	26.32	24.02	0.415	0.391	0.979	1.013
30 cm	104.1	102.9	3.44	3.27	23.59	20.91	2.69	2.69	73.81	71.51	30.99	28.79	11.34	10.48	27.36	26.26	0.420	0.383	0.956	1.001
LSD,5%	N.S.		N.S.		N.S.		N.S.		N.S.		N.S.		N.S.		N.S.		N.S.		N.S.	

Table 5. Significant interaction effects between tillage and foliar P and K application on some characters of faba bean yield and seed chemical contents during the 1999/2000 and 2000/ 2001 growing seasons.

Characters	No. seeds /Pod		100-seed weight (g)		seed yield (ardab/fed.)		Protein (%)		P (%)		K (%)	
Fertilizers treaments	Tillage	No Tillage	Tillage	No Tillage	Tillage	No Tillage	Tillage	No Tillage	Tillage	No Tillage	Tillage	No Tillage
1999/2000 Season.												
Control	3.23	2.88	57.33	57.53	9.24	8.68	25.34	23.76	0.386	0.414	0.918	0.911
KS5	3.29	2.90	57.79	54.62	8.76	8.35	26.24	25.26	0.416	0.426	0.877	0.967
SSP5	2.98	2.72	53.28	51.42	8.85	8.53	26.64	25.39	0.419	0.460	0.878	0.979
KS5+SSP5	3.28	3.06	59.58	56.74	9.34	8.96	27.03	29.16	0.397	0.423	0.902	0.973
KS10+SSP5	3.16	2.74	60.61	57.00	9.83	9.33	25.93	28.86	0.420	0.402	0.892	0.929
KS5+SSP10	3.36	2.88	60.38	59.12	10.35	9.68	23.8	27.36	0.413	0.444	0.880	0.932
L.S.D (5%)	0.12		1.84		0.15		1.68		0.016		0.028	
2000/2001 Season.												
Control	2.80	2.73	70.29	65.88	9.69	9.05	27.29	28.36	0.440	0.354	1.044	0.913
KS5	2.47	2.29	62.42	60.56	8.40	7.35	23.97	25.30	0.319	0.446	0.856	1.069
SSP5	2.59	2.54	64.16	63.02	9.10	8.39	25.58	21.46	0.361	0.358	0.888	1.033
KS5+SSP5	2.71	2.56	70.72	67.14	9.96	9.36	27.84	24.81	0.403	0.413	0.870	1.050
KS10+SSP5	2.93	2.73	73.03	69.61	10.78	9.99	27.83	23.50	0.447	0.392	1.021	1.048
KS5+SSP10	2.91	2.79	74.72	70.91	11.43	10.62	27.51	26.26	0.477	0.312	1.056	0.852
L.S.D (5%)	N.S.		1.27		N.S.		1.37		0.015		0.029	

Table 6. Effect of interaction between planting distance and foliar P and K application on some growth characters, yield and yield componants of faba bean during the growing season of 1999/2000 and 2000/2001.

Characters	Plant height (cm)			No. branches /Plant			No. pods /Plant			No. seeds /Pod			Seed weight / Plant(g)			100-seed weight (g)			Seed yield (ardab/fed.)		
Distance (cm)	10	20	30	10	20	30	10	20	30	10	20	30	10	20	30	10	20	30	10	20	30
Fertilizer treaments	1999/2000 Season.																				
Control	116.7	104.8	102	2.28	3.1	3.78	16.03	20.15	22.37	2.57	2.97	3.15	53.8	55.4	63.1	16.4	20.9	31.9	6.53	9.48	10.88
KS5	113.5	106.7	102.3	2.37	3.17	3.75	11.98	15.83	19.52	2.50	2.82	3.02	52.9	57.1	58.6	15.1	20.0	24.5	6.16	8.9	10.59
SSP5	115.5	108	100.3	2.20	2.82	3.53	12.90	15.58	21.02	2.48	2.72	2.88	50.7	50.5	55.8	14.9	21.0	24.3	6.49	8.79	10.78
KS5+SSP5	114.7	101.8	101.3	2.35	3.15	4.00	14.90	19.52	23.17	2.63	2.8	2.95	54.9	58.3	61.3	16.7	25.7	30.7	6.83	9.44	11.19
KS10+SSP5	114.2	106.8	101.8	2.18	2.95	3.71	15.82	20.58	24.37	2.68	2.92	3.17	53.9	59.8	62.8	18.6	25.5	33.1	7.17	9.69	11.87
KS5+SSP10	114.8	106.2	103.3	2.27	2.95	3.72	16.13	20.98	24.13	2.62	2.93	3.23	52.9	60.4	65.9	18.9	26.9	34.8	7.72	10.03	12.29
L.S.D (5%)	2.17			0.15			0.71			0.11			2.25			0.78			0.19		
	2000/2001 Season.																				
Control	114.8	105.3	102.7	2.17	2.50	3.63	16.47	19.2	22.3	2.23	2.50	2.63	63.7	68.3	72.2	17.7	22.1	31.8	7.3	9.79	11.02
KS5	112.5	107.3	101.2	1.97	2.30	2.87	11.57	15.27	18.43	2.07	2.30	2.63	56.3	62.2	65.9	15.1	20.3	24.1	6.49	7.89	9.24
SSP5	113.7	106.5	103.3	2.13	2.40	3.17	12.77	16.97	20.77	2.20	2.57	2.67	58.2	65.0	67.6	15.8	22.1	25.4	7.12	8.86	10.26
KS5+SSP5	114.2	106.5	102.8	2.20	2.43	3.27	15.48	19.47	22.63	2.30	2.50	2.70	63.8	68.8	74.2	16.9	26.0	29.7	8.11	9.86	11.03
KS10+SSP5	114.8	106.3	105.3	2.37	2.60	3.35	17.28	21.52	23.87	2.27	2.63	2.63	64.9	71.3	77.7	18.9	26.9	32.8	8.69	10.75	11.73
KS5+SSP10	115	106.3	105.2	2.3	2.60	3.65	19.08	23.2	25.5	2.37	2.50	2.87	66.6	73.6	78.3	20.6	27.6	35.5	9.34	11.53	12.2
L.S.D (5%)	N.S.			0.18			0.64			N.S.			1.55			0.75			0.31		

Table 7. Effect of interaction between planting distance and foliar P and K application on faba bean seed contents of protein ,P and K during the growing seasons 1999/2000 and 2000/2001.

Characters	Protein (%)			P (%)			K (%)		
Distance (cm)	10	20	30	10	20	30	10	20	30
Fertilizer treatments	1999/2000 Season.								
Control	21.97	26.47	25.27	0.370	0.402	0.429	0.957	0.820	0.967
KS5	23.22	25.23	28.80	0.450	0.398	0.415	0.972	0.875	0.918
SSP5	24.77	26.37	26.92	0.438	0.442	0.439	0.945	0.933	0.907
KS5+SSP5	25.82	27.38	31.08	0.385	0.388	0.456	0.972	0.913	0.928
KS10+SSP5	27.62	24.62	29.95	0.414	0.387	0.431	0.980	0.847	0.905
KS5+SSP10	24.77	27.75	24.22	0.413	0.432	0.440	0.955	0.852	0.912
L.S.D (5%)	2.06			N.S			0.035		
	2000/2001 Season.								
Control	26.68	28.00	28.78	0.375	0.407	0.409	0.965	0.990	0.982
KS5	24.42	24.45	25.03	0.427	0.383	0.337	0.942	0.988	0.957
SSP5	23.47	21.87	25.22	0.322	0.365	0.391	0.968	0.960	0.953
KS5+SSP5	26.07	24.43	28.48	0.356	0.443	0.426	0.927	0.962	0.992
KS10+SSP5	24.52	25.57	26.92	0.394	0.436	0.429	0.962	1.110	1.032
KS5+SSP10	27.53	26.68	26.43	0.383	0.385	0.415	0.938	0.967	0.957
L.S.D (5%)	1.68			0.026			0.036		

Table 8. Significant interaction effects between tillage planting distance and foliar P and K application on seed chemical contents during the growing seasons 1999/2000 and 2000/2001.

Characters	Protien (%)						Potassium (%)					
	Tillage			No-Tillage			Tillage			No-tillage		
Distance (cm)	10	20	30	10	20	30	10	20	30	10	20	30
Fertilizer treatments	1999/2000 Season.											
Control	22.70	26.50	26.83	21.13	26.43	23.70	0.987	0.747	0.020	0.927	0.893	0.913
KS5	23.57	26.33	28.83	22.87	24.13	28.77	0.930	0.803	0.897	1.013	0.947	0.940
SSP5	26.87	25.43	27.63	22.67	27.30	26.20	0.920	0.840	0.873	0.970	1.027	0.940
KS5+SSP5	22.20	26.70	32.20	29.43	28.07	29.97	0.007	0.790	0.910	0.937	1.037	0.947
KS10+SSP5	24.03	22.97	30.80	31.20	26.27	29.10	0.023	0.740	0.913	0.937	0.953	0.897
KS5+SSP10	21.30	27.07	23.03	28.23	28.43	25.40	0.973	0.747	0.920	0.927	0.957	0.903
L.S.D (5%)	2.91						0.049					
	2000/2001 Season.											
Control	26.43	27.27	28.17	26.93	28.73	29.40	1.033	1.073	1.027	0.897	0.907	0.937
KS5	20.97	24.60	26.33	27.87	24.30	23.73	0.850	0.863	0.853	1.033	1.113	1.060
SSP5	25.33	23.63	27.57	21.40	20.10	22.87	0.900	0.873	0.890	1.037	1.047	1.017
KS5+SSP5	28.70	26.87	27.97	23.43	22.00	29.00	0.900	0.850	0.860	0.953	1.073	1.123
KS10+SSP5	27.50	27.93	28.07	21.53	23.20	25.77	0.883	1.137	1.043	1.040	1.083	1.020
KS5+SSP10	28.87	27.60	26.07	26.20	25.77	26.80	1.023	1.080	1.063	0.853	0.853	0.850
L.S.D (5%)	2.38						0.050					

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تأثير الخدمة ومسافات الزراعة والرش بالفوسفور والبوتاسيوم على انتاجية محصول الفول البلدى

عبد الحفيظ أحمد زهرى[1] ، عبد الواحد يوسف نجم[2] ، فهمى عبد المنعم زهران[2]

١ قسم بحوث *التكشيف المحصولى* - معهد بحوث *المحاصيل الحقلية* - مركز *البحوث الزراعية* - *الجيزة*

٢ قسم بحوث *تغذية النبات* - معهد بحوث *الأراضي والمياه والبيئة* - مركز *البحوث الزراعية* - *الجيزة*

أقيمت تجربة حقلية فى محطة البحوث الزراعية بملوى أثناء موسمي الزراعة ١٩٩٩/٢٠٠٠ ، ٢٠٠٠/٢٠٠١ لدراسة تأثير الخدمة (حرث ، بدون حرث) ، مسافات الزراعة (١٠، ٢٠، ٣٠ سم) والرش بمنقوع السوبر فوسفات وكبريتات البوتاسيوم كل على حده أو مخلوط منهما بنسب مختلفة والتفاعلات بين هذه المعاملات على إنتاجية محصول الفول البلدى ومحتوى البذور من البروتين والفوسفور والبوتاسيوم .

أوضحت النتائج المتحصل عليها أن الحرث التقليدي احدث زيادة معنوية في محصول البذور ووزن البذور /نبات و وزن ١٠٠ بذرة و عدد القرون /نبات وذلك أثناء موسمي الزراعة ،بينما لم تظهر محتويات البذور التى تم تقديرها اتجاها معينا ، كذلك فان زيادة مسافات الزراعة أعطت زيادة معنوية فى نمو نباتات الفول البلدى ومحصول البذور و مكوناته بالإضافة إلى محتوى البذور من البروتين حيث أعطت الزراعة على ٣٠ سم أعلى القيم فى معظم الاحوال . بالاضافة الى ذلك فان الرش بمنقوع ١٠ كجم كبريتات بوتاسيوم + ٥ كجم سوبر فوسفات أو ٥ كجم كبريتات بوتاسيوم +١٠ كجم سوبر فوسفات أعطى أكبر زيادة فى محصول البذور و مكوناته ، بينما احدث الرش بمنقوع الأسمدة كل على حدي أثرا عكسيا. أظهرت مكونات البذور من البروتين والفوسفور والبوتاسيوم نتائج غير مؤكدة نتيجة الرش بالأسمدة أثناء موسمي الزراعة .

تأثر معنويا وزن ١٠٠ بذرة ومحتويات البذور من البروتين و الفوسفور و البوتاسيوم بالتفاعل بين الرش بالأسمدة وبين عملية الحرث فى كلا الموسمين ، بينما تأثر معنويا محصول البذور و مكوناته بالتفاعل بين الرش بالأسمدة وبين مسافات الزراعة ، وأعطى التفاعل بين الرش بالأسمدة عند ٥ كجم كبريتات بوتاسيوم + ١٠ كجم سوبر فوسفات /ف مع الزراعة على ٣٠ سم أعلى القيم .كما تأثرت معنويا محتويات البذور من البروتين والفوسفور والبوتاسيوم بهذا التفاعل . وأعطى التفاعل بين العوامل تحت الدراسة أثرا معنويا فقط على محتوى البذور من البروتين والبوتاسيوم . بينما لم يتأثر محصول البذور و مكوناته .

هذا ويمكن التوصية بزراعة الفول البلدى (الصنف جيزة ٣) على مسافة ٣٠ سم بين الجور ونباتين بالجورة وعلى جانبي الخط بعد حرث الأرض قبل الزراعة والرش بمنقوع ٥ كجم كبريتات بوتاسيوم + ١٠ كجم سوبر فوسفات /ف تحت ظروف منطقة ملوى بمحافظة ألمنيا .