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THE EFFECT OF RATES AND TIME OF PHOSPHORUS APPLICATION ON THE YIELD AND QUALITY OF SOME FABA BEAN CULTIVARS *(VICIA FABA L.)* GROWN ON A ALLUVIAL SOIL

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ABSTRACT: *Field experiments were carried out during two successive winter seasons of 2000/2001 and 2001/2002 of Itai El-Baroud Agricultural Research station, Behlera Govevnovate.Two faba bean cultivars,Giza 716 and Giza 843 were evaluated under phosphorus applicatcn at four rates; 0, 100, 200 and 300 Kg calcium superphosphate/fed.and its timing of application once at sowing or twice at sowing and at first irrigation (Mohayah Irrigation) on yield, yield attributes, quality and N, P, K-contents, in seeds of faba bean cultivars. The results could be summrized as follow :*

1-The maximum yields of seed and straw along with yield attributes were produced from plants receiving the highest P fertilizer rate 300 Kg calcium superphosphate15.5% P_2O_5 /fed. .

2-The best time of P application for increasing seed and straw yields (Kg/fed.) and most of its attributes were with P application in two splitted doses at sowing and at first irrigation (Mohayah Irrigaation).

3-The highest values for protein % were obtined from plants receiving the highest P fertilizer rate in two splitted doses and in a single dose.

4- Seeds of plants which treated with calcium superphosphate contained high amounts of N,P and K compared to untreated.

5- Results of simple correlation analysis indicated that the highest significant postive correlation was found between seed yields (Kg/ fed.) and each of N, P and K contents with r- values were 0.767 , 0.949 and 0.948, respectively.Significant and postive correlation was found between protein % and each of N, P and K contents with r- values were 0.84 , 0.63 and 0.70 ,respectively.

Key words: *Faba bean cultivars – Time & Rates – Superphosphate – alluvial soil.*

INTRODUCTION:

Faba bean *(Vicia faba L.)* is considered one of the most essential crops in Egypt for its richness in low price protein. Its growth, as well as other legumes were found to be affected by P application (Ibrahim, 1989) .

Phosphorus has an enhancing impact on plant growth and biological yield through its importance as an energy storage and transfer necessry for metabolic processes. It also raises the efficiency of plants to photosynthesis, enhances the activity of rhizobia and increases the number of branches and pods/ plant, consequently produces more organs Nassar et al., (2000) found that the addition of P fertilization significantly increased both yield and mineral composition of faba bean of both flowering and harvesting stages.

Concerning the suitable P fertilization rate, Comaa (1991) found that seed yield was inereased when fertilized with 30 Kg $P_2 O_5$ / fed. and decreased with higher P rates. Rajkhowa et al., (1992) showed that higher level over 20 Kg $P_2 O_5$ / ha. had no advantages in increasing the yield and its attributes of summer greengran. Mahmoud et al., (1991) found that two doses of phosphorus at sowing and flowering stages produced the maximum No. Of branches / plant, 100 – seed weight, seed yield / plant and seed yield / fed. Likely, P fertilizer in two doses at sowing and pod - filling stage resulted in the highest % of crude protein in seeds of soybean. Dawood and Abou Salama (1994) found that the maximum yields of seed and straw along with yield attributes were produced from plants receiving the highest P fertilizer rate 240 Kg calcium superphosate . Also, found that increasing yield and most of its attributes was obtained with P application in two splitted doses at sowing and at first irrigattion (Mohayah irrigation). Likely , the highest values for protein % were recorded when applying P fertilizer either in two splitted doses at first irrigattion and at flowering stage. El – Far and El – Desoky (1999) on Lupin found that splitting the full dose of fertilization NPK in to equal doses increased the seed content of N, P and K 7.2 , 24.3 and 10.4 % , respectively .

The objective of this study is to determine the effect of rates of P fertilization and its proper time of application on yield and its attributes and quality of faba bean cultivars.

MATERIALS AND METHODS :

A field experiments was carried out on faba bean *(Vicia faba L.)* cultivars Giza 716 and Giza 843 of Itai El- Baroud Agricultural Research Station – Beheira . Egypt(Agricultural Research Center) ,during the two winter seasons, 2000 /2001 and 2001 /2002 .Soil samples were taken before planting from the surface layer (0 – 30 cm.) for physical and chemical analysis which was done according to Black (1982). The results of soil analysis are shown in Table (1).

Table (1) : Physical and chemical analysis of studied soil :

Organic matter %	$CaCO_3$ %	Partical size distribution				Soil Texture
		Coarse sand %	Fine sand %	Silt %	Clay %	
1.34	4.03	11.29	9.78	39.65	39.33	Clayey

PH 1soil:2.5 water suspension	E.C.ds/m, 1soil: 5water extract	Soluble ions and cations meq/L								Available nutrients ppm		
		Cations				Anions				N	P	K
		Ca++	Mg++	Na+	K+	CO3–	HCO3-	Cl-	SO4–			
8.47	0.67	0.67	0.34	0.50	0.26	—	0.56	0.29	0.92	67.5	10.34	410

The layout of the experiments under consideration was split – split plot design with three replications. The whole area was divided into two blocks. At sowing, the first block was planted with cultivar Giza 716 seeds while the other was planted with cultivar Giza 843 ones. Each was subdivided into sub plots; the first was fertilized with superphosphate (15.5% P2O5) in one time full dose applied preplanting, while the second was fertilized with the same fertilizer but the dose was splitted in two equal parts, one preplanting and the other after 21 days of sowing. Phosphatic fertilization rates (O, 100, 200 and 300 kg P_2O_5/fed.) were randomly distributed inside each subplot as sub- sub plots (3 X3.5 m ; 5 rows, 3.5 m along and 0.6 m apart). Basic application of N of the rate of 20 Kg / fed. was applied before the first irrigation directly in form of ammonium nitrate (33.5% N) as an activating dose.

Plant samples were taken at harvesting stage. The following parameters were determined and recoded :

1-Seed, and straw yields at harvesting stage (Kg/ fed.), Number of branches / plant, Number of pods /plant, plant height (cm.). Seed weight (g / plant), and 100 – seed weight (g).

2- Nitrogen, phosphorus and potassium contents (kg / fed. for seeds).

3-The protein content in the seeds was calculated by multiplying the percentage of the total N by a factor of 6.25.

From each plot samples of seeds were dried , ground and wet digested using H_2SO_4 – $HClO_4$ acid mixture. In digested product, nitrogen was determined with micro – kjeldahl apparatus (Chapman and Pratt, 1961) phosphorus was determined colorimetrically according to Watanabe and Olsen (1965). Potassium was determined using flame photometer(Richards, 1954).

4- Available soil phosphorus (ppm) in repesentative surface soil samples taken from all experimental plots at harvesting stage.

All collected data were statistically analyzed according to Gomez and Gomez (1984).

RESULTS AND DISCUSSION:

Concerning the effect of P fertilization rates on yield and yield characteristic data are shown in Tables (2 and 3).Data indicated that, in both growing seasons, increasing the rate of P significantly increased number of both branches and pods per plant, plant height (cm.), seeds / plant, 100 – seed weight, seed and straw yield . Therefore the highest values of yield and yield characteristic were resulted from the higher P rate 300 Kg calcium superphospate / fed.

The increase in seed yield may be attributed to greater uptake and subsequent assimilation of P leading to maximum expression of yield characteristic. Also, may be due to the tallest plants that resulted from the same P rate, which in turn resulted higher yield of faba bean. In this respect, Abdallah (1986), Khalil (1986), Salih & Ali (1986), Gielah & Saffon (1987), El-Zeiny et al. (1990), Rao et al. (1993), Tomar et al. (1993) and Dawood and Salama (1994) came to the same conclusion. Mahmoud et al., (1991) who found that the application of 100 kg calcium superphosphate in a single dose at pod- filling stage gave a significant increase in plant height of soybean in comparison with the other phosphorus treatments.

Moreover, the analysis of variance reveal that the timing of P application had a significant influence on all studied traits. Data also show that the best time of P fertilizer application for increasing the most of yield attributes which resulted in the highest faba bean yield was the P application in two splitted doses at sowing and before first irrigation. These findings are in conformation with those of Mahmoud et al., (1991) However, Setty et al., (1992) found that the seed yield did not differ significantly among number of spray times of the single superphosphate on gram plants *(Cicer arietinum).*

Regarding yield attributes as affected by two faba bean cultivars (Table,2). Results indicated that the two cultivars are significantly differed in plant height, No. of branches / plant and No. of pods / plant but not significantly in seed weight (g / plant) and 100 – seed weight (g) in the two seasons. Table (3) show that the Giza 843 cv. was much higher in seed and straw yield in both seasons than Giza 716 cv.These differences among cultivars might be owe much to the genetical differences which led to the differences in pod characters, yield and its components. Similar findings were obtained by Arisha (1982) on horse bean plant cultivars.

Concerning the interaction effect of P-fertilizer rate x time of P application data in Table (3) revealed that the highest seed yield was produced from plants receiving rate of 300 kg calcium superphosphate in two splitted doses at sowing and at first irrigation followed by treatment receiving 200 kg calcium superphosphate . These results may be due to the fact that these treatments produced to highest yield attributes, e. g., both number of pods and seeds / plant along with 100-seed weight. These findings were supported by highly postive correlation among seed yield (Kg / fed) and each of No. of

Table (2) :The effect of phosphorus rates and its timing of application on some yield attributes of faba bean cultivars

Cultivars	Treatments		Plant height (cm.)		Total no. branches/plant		No. of pods/ plant		Seed weight (g / plant)		100 seed weight (g)	
		Kg supere-phosphat/fed	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Giza 716	One time full dose	Control	102.0	100.5	1.80	1.71	12.22	12.15	30.83	31.37	75.00	76.00
		100	103.3	102.5	1.93	1.90	13.23	12.65	33.59	32.50	76.11	80.56
		200	105.7	104.5	2.23	2.15	14.00	13.70	35.98	36.50	77.08	82.08
		300	114.7	110.0	2.33	2.30	16.67	15.70	37.34	36.50	77.11	83.60
		Mean	106.4	104.6	2.08	2.02	14.03	13.55	34.44	34.22	76.33	80.56
	Two splitted dose	Control	102.0	100.5	1.80	1.71	12.22	12.15	30.83	31.37	75.00	76.00
		100	104.0	103.5	2.27	2.15	13.20	12.30	34.18	33.00	76.52	81.80
		200	105.0	104.5	2.40	2.30	16.67	15.70	37.34	35.00	78.10	85.12
		300	117.7	115.5	2.50	2.25	18.87	18.20	38.19	37.00	78.25	88.92
		Mean	107.2	106.0	2.24	2.10	15.24	14.53	35.14	34.22	76.96	82.96
Giza 843	One time full dose	Control	105.0	104.5	1.40	1.31	10.20	10.00	30.73	31.37	73.00	74.50
		100	107.0	105.5	1.63	1.55	11.27	10.80	31.38	32.00	73.40	78.23
		200	110.0	108.5	1.93	1.90	13.20	12.30	31.82	32.50	73.75	82.70
		300	115.0	114.5	2.37	2.30	16.53	15.80	37.74	35.50	75.17	84.19
		Mean	109.3	108.3	1.83	1.77	12.80	12.23	34.25	33.09	73.83	79.19
	Two splitted dose	Control	105.0	104.5	1.40	1.31	10.20	10.00	30.73	31.37	73.00	74.50
		100	112.0	111.0	1.90	1.80	11.20	10.60	34.01	33.50	73.96	78.94
		200	114.7	115.0	2.03	1.90	15.67	14.90	35.30	34.50	75.83	87.15
		300	128.7	127.0	2.32	2.28	16.87	15.70	38.80	37.50	76.53	88.66
		Mean	115.1	114.4	1.91	1.82	13.48	12.80	34.71	34.22	74.83	82.31
L. S. D. of 5 %												
Cultivars	(C)		2.036	0.242	0.168	0.023	0.885	0.357	ns	ns	ns	ns
Time of P applicetion	(T)		1.172	0.142	0.160	0.101	0.851	0.279	0.390	0.413	0.533	1.903
P rates	(R)		1.560	0.412	0.150	0.092	0.955	0.311	0.716	0.454	1.203	0.881
(C x R)			2.206	0.583	ns	0.363	ns	0.440	ns	0.642	ns	1.246
(C x T)			ns	0.200	ns	ns	ns	ns	0.551	0.585	ns	ns
(T x R)			2.344	0.583	ns	ns	ns	0.440	0.780	ns	ns	1.246
(C x T x R)			ns	0.825	ns	ns	ns	0.622	1.103	0.908	ns	ns

Table (3) : he effect of phosphorus rates and its timing of application on seed, straw yield and quality of faba bean cultivars

Cultivars		Treatments	Seed yield(Kg / fed)		Straw yield(Kg/fed)		Crude Protein%	
		Kg Supere-phosphat/fed	1st season	2nd season	1st season	2nd season	1st season	2nd season
Giza 716	One time full dose	Control	1419	1338	1813	1622	186	304
		100	1495	1472	1913	1800	327	339
		200	1742	1545	2041	1887	348	367
		300	1813	1628	2265	1987	326	406
		Mean	1617	1496	2009	1824	297	354
	Two splitted dose	Control	1419	1338	1818	1622	186	304
		100	1765	1454	2091	1870	287	332
		200	1842	1594	2159	1950	357	377
		300	1877	1651	2369	2012	285	404
		Mean	1726	1509	2109	1863	279	354
Giza 843	One time full dose	Control	1534	1330	1966	1575	201	279
		100	1703	1496	2262	1786	332	321
		200	1835	1560	2406	1861	335	350
		300	1916	1641	2667	1966	276	365
		Mean	1747	1517	2325	1797	286	329
	Two splitted dose	Control	1534	1330	1966	1575	201	279
		100	1830	1510	2380	1772	245	320
		200	1956	1621	2480	1902	256	353
		300	2072	1650	2741	2004	337	364
		Mean	1848	1528	2392	1813	260	329
L. S. D. of 5 %								
Cultivars	(C)		44.42	Ns	261.73	ns	12.732	18.686
Time of P applicetion	(T)		34.54	34.11	171.24	31.03	20.500	ns
P rates	(R)		64.01	60.39	354.94	47.86	13.953	10.151
(C x R)			ns	ns	ns	ns	19.734	ns
(C x T)			ns	ns	ns	ns	ns	ns
(T x R)			69.09	ns	ns	62.07	19.734	ns
(C x T x R)			ns	ns	ns	ns	27.907	ns

pods / plant , No. of branches / plant and 100-seed weight with r-values were 0.752** ,0.745** and 0.846** (Table, 4).

Table (4) : Correlation coefficients of seed and straw yields with the yield attributes.

	Seed yied (Kg/fed.) r	Straw yield(Kg/fed.) r
Plant height (cm)	0.826	0.875
Total No.branches/ plant	0.745	0.688
No.of pods /plant	0.752	0.717
Seed weight (g / plant)	0.856	0812
100 – Seed weight (g)	0.846	0.785

Therefore, present results emphasize the strong influence of both numbers of pods and 100-seed weight on seed yield / fed. and confirm previous findings of Salem (1982). Sindhu et al., (1985) and El- Murabaa et al., (1987). However, the minimum straw yield and shortest plants were observed at plants received rate of 100 Kg calcium superphosphate regarding to the control. The results indicated that there are a strong relationship between straw yield and plant height (cm), since the significant postive correlation between them (r = 0.875**) was obtained (Table 4).

Data in the former Table (3) show that the highest values for crude protein% were obtained by the application of 200kg calcium superphosphate / fed. for the 1st season but at 300 Kg calcium superphosphate / fed . for the 2 nd season. However, the lowest values were obtained without phosphorous fertilization. Abdallah (1986) and Gielah & saffon (1987) reported that P application increased protein contents. However, Dewood and Abou-Salama (1994) found that the lowest and highest crude protein % were obtained at 120 and 180 Kg calcium superphosphate / fed. respectively.

Concerning the effect of phosphorus application time, the highest significant values for crude protein % were recorded at applying P fertilizer in two doses for the 1st season but at 2nd nonsignificant. Similar findings were reported by Mahmoud et al., (1991) who found that addition of superphosphate in two doses resulted in the highest of crude protein % in seeds of soybean.

Regarding the interaction effect of fertilization rate and time of application, it was noticed that the highest values for crude protein % were recorded for the plant receiving 300 and 200 kg calcium superphosphate ,respectively.

Data presented in Table (5) show that for the two seasons, N,P and K contents in both cultivers of faba bean seeds increased as the phosophorus application rates increased.

Data also show that the highest values of N, P and K contents in seeds were recorded of applying P fertilzer in two splitted doses. Khadr et al.,(1987)

Table (5) : The effect of phosphorus rates and its timing of application on macronutrients content (Kg / fed) in faba bean seeds cultivars

Cultivars	Treatments		N(Kg / fed)		P(Kg / fed)		K(Kg / fed)	
		Kg Supere-phosphat/fed	1st season	2nd season	1st season	2nd season	1st season	2nd season
Giza 716	One time full dose	Control	29.80	48.67	4.42	3.85	9.60	10.04
		100	52.17	54.17	4.88	7.71	13.41	11.75
		200	55.83	58.93	7.21	5.08	15.97	14.41
		300	54.40	55.13	7.21	5.53	16.97	15.95
		Mean	48.05	54.23	5.93	4.79	13.99	13.04
	Two splitted dose	Control	29.80	48.63	4.42	3.81	9.60	9.87
		100	45.87	52.90	6.71	5.09	16.52	11.63
		200	53.60	60.23	7.90	6.22	18.32	15.21
		300	48.83	64.70	7.77	6.77	18.88	18.16
		Mean	44.53	56.62	6.70	5.47	15.83	13.72
Giza 843	One time full dose	Control	32.00	44.53	4.77	3.62	10.46	9.57
		100	53.07	51.30	8.14	5.09	15.27	13.15
		200	51.87	55.97	7.61	5.76	17.89	15.30
		300	44.43	59.77	7.64	6.07	20.25	18.71
		Mean	45.34	52.89	7.04	5.14	15.97	14.81
	Two splitted dose	Control	32.00	44.53	4.77	3.62	10.46	9.57
		100	39.10	51.17	8.47	5.69	12.97	12.59
		200	46.53	57.00	8.89	6.48	17.54	16.01
		300	53.83	58.17	9.33	6.75	19.36	18.49
		Mean	42.87	52.72	7.87	5.64	14.91	14.16
L. S. D. of 5 %								
Cultivars	(C)		ns	ns	0.157	ns	0.298	0.550
Time of P applicetion	(T)		1.667	ns	0.302	0.370	0.619	ns
P ates	(R)		1.291	1.589	0.250	0.247	0.480	0.414
(C x R)			1.826	ns	0.354	0.349	0.480	0.585
(C x T)			0.226	ns	0.041	ns	0.084	ns
(T x R)			1.826	2.248	0.354	0.349	0.683	0.585
(C x T x R)			2.582	2.248	0.500	ns	0.966	0.828

on faba bean grown at three locations in Egypt repoorted that P- application increased P and N uptake.

It could be noticed that there were significant differences among the two cultivars regarding their contents of K in seeds of faba bean in the two seasons as affected by soil phosphorus application . While, opposite results were obtained concerning N- content in seeds. Meanwhile, the maximum value of P content in seeds in both seasons was recorded in Giza 843 cv. compared to another cuultivars.El-Far and El-Desoky(1999) found that plants treated with two splitted doses of the fertilizer took up the highest amounts of N,P and K by Lupin seeds.

Finally, it is worthy to notice that faba bean seed yields (kg/fed) were significantly correlated with the values of N , P and K contents (kg/fed) under application of P rates. The correlation coefficients between seed yield and N, P and K contents were 0.767**, 0.949** and 0.948** respectively Fig (1). The simple regression equations as follows:

Seed yield = 865.3 + 15.1 N
Seed yield = 1053.3 + 91. 3 P
Seed yield =100.8 + 42.7 K

The multiple regression equations were as follows :

Seed yield= 51.08 +4.84 N + 5.06 P –1.50 K ($r^2 = 0.709^{**}$)

In addittion ,the correlation coefficients between protein % and N, P and K contents (Kg /fed) were 0.84**, 0.63* and 0.70** respectively Fig. (2). The simple regression equations as follows:

Protein =34.9+5.0 N
Protein=189.5 + 18.4 P
Protein = 162.7 +9.7 K

The multiple regression equations were as follows :

Protein =984.52–2.99x10^{-3} N+4.96x10^{3} P+2.36 10^{3} K (r^2=0.975**)

Finally data in Table (6) reveald that the soil available P content was further augmented as a result of P-fertilizer rates (Kg / fed.) and splitting phosphorus in two doses. The increses was more pronounced in the treatment 300 kg superphosphate / fed.

Under Egyption soil conditions, phosphorus availability in soil is groverned by many factors (pH, $CaCO_3$, organic matter and clay contents). In spit of the considerable addittion of P to those soils, the level of available phosphorus decreases sharply after a short period from application . Axenova et al., (1969) found that soil P content decreased as plants developed and was not affected by split application of P. (Miller et al., 1990). revealed that under alkaline soil conditions, the available phosphorus in the added fertilizer is rapidly transformed to tricalcium phosphate, thus becomes unavailable to the plants.

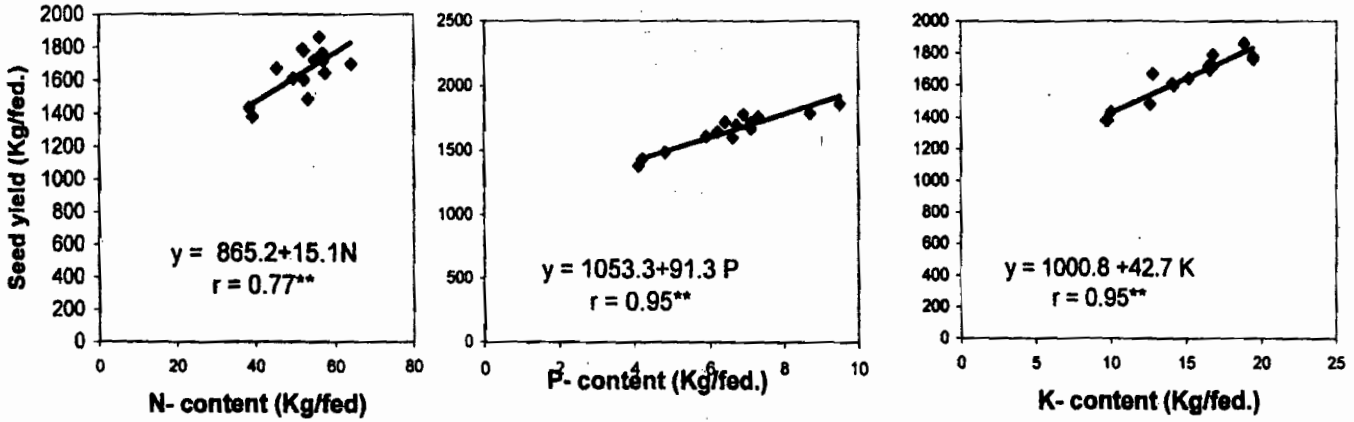

Fig.(1)Statistical correlation between seed yield(Kg/fed)with the content of N, P and K(Kg/fed)of faba bean.

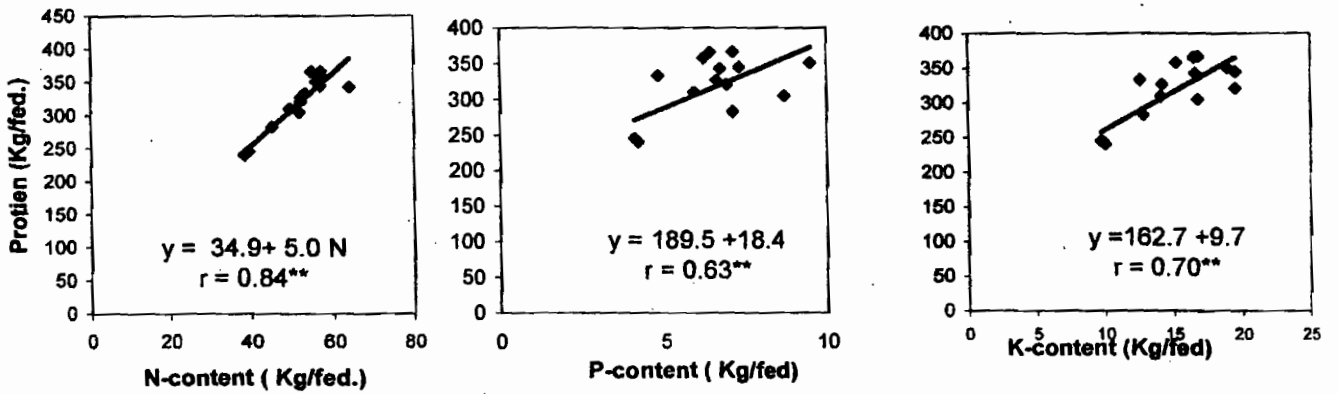

Fig.(2)Statistical correlation between Protien (Kg/fed.) with the content of N,P and K(Kg/fed.) of faba bean.

Table (6): The effect of phosphorus rate and its timing of application on the available phosphorus content in the soil (ppm) after harvesting stage of faba bean (2000 / 2001 and 2001/ 2002 seasons) .

	Calcium super phosphate (kg / fed)		Available phosphorus content in soil (ppm)		
			2000/2001	2001/2002	Mean
Giza 716	One-time	0	9.17	11.51	10.34
		100	10.58	11.68	11.13
		200	11.14	12.24	11.69
		300	12.25	14.00	13.13
	Two-time	0	9.17	11.51	10.34
		100	11.81	12.71	12.26
		200	12.07	12.97	12.52
		300	13.17	14.51	13.84
Giza 843	One-time	0	9.17	11.51	10.34
		100	11.33	13.53	12.43
		200	12.53	14.81	13.67
		300	13.00	15.06	14.03
	Two-time	0	9.17	11.51	10.34
		100	11.36	15.10	13.23
		200	12.25	15.59	13.92
		300	13.78	16.41	15.10

General conclusion, the results of this investigation suggested that the application of fertilizer at 300 Kg /fed. as calcium superphosphate, in two splitted doses at sowing and at first irrigation was benefical to obtain high seed yield, yied attributes, crude proein %, and NPK-content.

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أثر معدلات ومواعيد إضافة السماد الفوسفاتي على الناتج الكمي والنوعي لبعض أصناف الفول البلدي المزروعة فى أرض رسوبية

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الملخص العربي

أجريت تجربتان حقليتان بالمزرعة البحثية لمحطة البحوث الزراعية بآتاى البارود بمحافظة البحيرة خلال موسمي الزراعة ٢٠٠٠/٢٠٠١ ، ٢٠٠١/٢٠٠٢ وتم تقييم صنفين من الفول البلدي (جيزة ٧١٦ ، جيزة ٨٤٣) مع أربعة مستويات من الفوسفور المضاف إلي التربة (صفر، ١٠٠ ، ٢٠٠ ، ٣٠٠ كجم سوبر فوسفات/فدان) وتوقيت إضافته مرة واحدة عند الزراعة أو مرتين عند الزراعة وقبل رية المحاياة علي المحصول ومكوناتة وجودتة وكذلك محتوى النيتروجين والفوسفور والبوتاسيوم في بذور صنفي الفول البلدي وتتلخص النتائج فيما يلي:-

١-أمكن الحصول علي أعلى محصول من البذور والقش كجم /فدان وكذا مكونات المحصول من النباتات المسمدة بأعلى معدل من السماد ٣٠٠ كجم سوبر فوسفات ١٥,٥ % فو٢أ٥/فدان.

٢-كان أفضل وقت أضافة السماد الفوسفاتى للحصول علي زيادة في محصول البذور والقش كجم/فدان ولمعظم مكوناته بإضافة السماد علي دفعتين عند الزراعة وعند الرية الأولى (ريه المحاياه).

٣-حصل علي أعلى قيم للبروتين % من النباتات المسمدة بأعلىمعدل من الفوسفور علي دفعتين عند الزراعة وعند الرية الأولي (ريه المحاياة) أو أضافه السماد مرة واحدة عند الزراعة.

٤-الكمية الممتصة من النيتروجين والفوسفور والبوتاسيوم في البذور إزدادت نتيجة إضافة الفوسفور مقارنة بالكنترول.

٥-أظهرت نتيجة تحليل معامل الأرتباط البسيط وجود ارتباط موجب عالى المعنوية بين محصول البذور كجم /فدان وكل من محتوها من النيتروجين والفسفور والبوتاسيوم وكانت قيم هذا الأرتباط هى: ٠,٧٦٧ ، ٠,٩٤٩ ، ٠,٩٤٨ على الترتيب ؛ كما وجد ارتباط معنوى موجب بين البروتين وكل من محتوى النيتروجين والفسفور والبوتاسيوم وكانت قيم هذا الأرتباط هى: ٠,٨٤ ، ٠,٦٣ ، ٠,٧٠ على الترتيب.