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THE RELATION BETWEEN SOME OF SOYBEAN GENOTYPES AND PLANT DENSITIES UNDER THE DIFFERENT LEVELS OF PHOSPHORUS FERTILIZATION

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ABSTRACT: Two field experiments were conducted in Gemmiza Research Station, Gharbia Governorate during 2005 and 2006 seasons, to study the effect of three levels of phosphorus fertilizer treatments [(15 and 30 kg P_2O_5/fad.),as soil application and phosphoric acid as foliar spray with recommended dose] and three plant densities (15, 20, and 25 plant /m of liner ridge) on some growth parameters, yield and yield components of two promising genotypes (Hagen 30 and Hagin32) and two soybean varieties (Giza 111 and Giza 22).

The results indicated that 30kg P_2O_5 /fed. was the optimum phosphorus rate, that achieved the best data for the most characters under study. Directly proportion was observed between plant densities and the most tested characters with the exception of seed yield/plant and number of pods/plant. Hagen 30 genotype and Giza 111 located first and second order in the most cases.

First and second order interactions had significant impact on all these studied characters as well as seed protein and oil percentage.

INTRODUCTION

Soybean *(Glycine max)* is considered as a main source for food oil that was extracted from it's seeds, which could be grind to become flour that was utilized with wheat flour to produce bread. In Egypt, the cultivated area with soybean crop come up to 38000 feddan which awarded 12.900 ton oil, that amount side by side with the other oil crops was not sufficient to decrease the gab between the production and consumption, so the import and make away with hard currency are the tools for solving this problem that had undesirable effects on national income. Most of modern technique of researches aimed to achieve the available number of plants/ area and aggrandized the values of some growth and yield parameters, Zahou et al (1994) and Shams el Din et al

(1997), reported that increasing soybean plant densities increased plant height and seed yield /fed., on the same line was, seed protein content as recorded by Ali (1993).On the other hand, by exposing the importance of phosphorus for the plants, it could be summarized that, this element has major role in energy transfer,carbohydrate metabolism and photosynthesis activities. Pal et al. (1989), stated that increasing P_2O_5 rates up to 26.4 kg/ha enhanced soybean seed yield by 21% over the control. Seif El- Nasr and Maani (1999), advocated the above results, they also found that number of pods / plant and seed weight / plant were significantly increased with enhancing phosphorus fertilizer up to 45 kg P_2O_5/fad.

This investigation aims to exhibit the influence of plant density and phosphorus fertilization on some growth parameters, yield and it's components of some soybean promising genotypes.

MATERIALS AND METHODS

Two filed experiments were carried out at Gemmiza Res. Station, Gharbia Governorate, during the two seasons 2005 and 2006, to investigate the impact of plant population density and phosphorus fertilization on some growth parameters, yield and yield components for the two promising genotypes (Hagen 30 and Hagen32) as third and forth group, respectively, also the two varieties, (Giza 22and Giza 111) as forth group, they were gained from Food Legume Department, Agric.Res. Center, Giza, Egypt. The applied plant densities were 15, 20, and 25 plant per meter of linear ridge, whereas phosphorus fertilization was experimented at the rates of 15 and 30 kg P_2O_5 as calcium super phosphate (15.5% P2O5/fed.) at sowing time of soybean seeds, meanwhile the third application of phosphorus level as phosphoric acid was sprayed at the rate of 0.1 cm^3/L after 25, 50, and 75 days from sowing date. [200L – fad].

A spilt–spilt design with three applications was used. The main plots were devoted to phosphorus fertilization rates, the sub plots were assigned to plant population densities, while the four genotypes occupied the sub–sub plots. So, this experiment consisted of 36 treatments. The experimental plot area was 5.4m^2 (3mx1.8m).

The previous crop in the experimental site was (*Trifolium alaxandrinum*) in the two successive seasons. A nitrogen fertilizer dose of 15 kg N in the form of Ammonium sulphate (20 % N) was added to soybean plants before the first irrigation. Sowing date was on the 20th of

May in the first season and 17 th of May in the second season.

Soil samples were collected to depth of 0.0 – 150 cm before sowing for mechanical and chemical analysis (A.O.A.C.1970), results are recorded in Table (1).

Table (1). The chemical and mechanical analysis of the experimental site.

Depth (cm)	PH	Ec	Cations				Anions				S A R
			Ca^{++}	Mg^{++}	Na^{+}	K^{+}	Co_3^{--}	Hco_3^{-}	Cl^{-}	$So4^{--}$	
0-15	7.4	1.3	5.9	3.6	0.36	11.0	-	4.0	10.0	6.86	5.1
5-50	7.4	1.8	3.2.	2.3	0.36	12.0	-	3.0	10.0	4.86	5.2
50-150	7.6	2.7	6.2	5.4	0..24	24.0	-	3.5	22.0	10.02	10.0

Depth (cm)	N	P	K	Fe	Mn	Zn	
0-15	21.7	14.6	414	11.7	11.8	2.25	1.69
15-50	17.6	13.0	328	10.0	10.0	2.07	1.58
50-150	15.4	10.8	304	9.3	7.2	1.06	0.88

Depth (cm)	Particle size distribution				Caco3 %	O.M %	textrue class
	clay %	silt %	Finc sand %	coarse sand %			
0-15	58.3	24.3	8.11	3.0	4.5	2.2	Clay
15-50	56.0	26.1	10.2	2.5	3.9	1.5	Clay
50-150	52.9	28.5	12.4	2.1	3.6	0.8	Clay

The studied characters:

Samples of ten individual plants were taken randomly from the middle rows of each plot to estimate the following characters:

1- Growth parameters:
A- Plant height (cm).
B- First pod height (cm).
2- Yield and yield components:-
A- Number of pods / plant
B- Seed yield / plant (g).
C- Seed yield / fad (ton).
D- The percentage of immature to mature seeds / plant (g).

E- Biological yield (ton / fad) was calculated from the weight of all plants (seed + straw).

F- Protein and oil percentage in soybean seed were determined by (IR) Analyzer Infer Red. Both of oil and protein % were estimated for 2006 season only.

The analysis of variance was used for this experiment according to Sndecor and Cochran (1981), the least significant difference (L.S.D) test at 5 % level of significance was used to indicated treatment differences.

RESULTS AND DISCUSSION

1-Growth parameters:

From Tables (2 and 3), it was obvious that plant height was significantly increased as increasing phosphorus fertilizer from 15 kg up to 30 kg P_2O_5/fad., it was enhanced by 3.96% in the first season and 3.60% in the second one, while, spraying soybean plants with phosphoric acid awarded the shortest plants (91.8 and 100.3 cm), in the two growing seasons. As for, the high of the first pod character, fertilized soybean plant with 15 kg P_2O_5/fad, resulted in the highest first pod (21.2 and 20.5 cm). These previous findings may be due to the beneficial effect of phosphorus on the root system efficiency, consequently the physiological activities of the plant. Wang Xuequin et al. (1995) and Surendra et al (1995) achieved the same conclusion. Plant density also increased substantially plant height; there was directly proportion between them. Plant density at the rate of 25 plants per meter of linear ridge awarded the tallest plants, 98.5cm in the first season and 106.5 cm in the second one. Also, the high of the first pod was affected significantly by plant density, 25 plants per meter of linear ridge treatment was the effective one, it gave the highest first pod in the two growing seasons. The superiority of plant height in dense sowing might be explained by the high competition for light among plants as enucleated by Doss and Thurlow (1974) and Wilcox (1974). As revealed in Table (2), Hagen 30 genotype pronounced it's superiority as enduring with the other genotypes and varieties as for the two studied characters, it was followed by Giza 111 in both successive seasons. These differences among the studied cultivars in those parameters could be due to differences exist in their genetical background structures as recorded by Zahou et al. (1994) and Shafshak et al. (1997).

All the created first order interactions had significant impact on those growth characters under study, i.e. treating soybean plants with 30 kg P_2O_5/fad in the presence of 25 plant per meter of linear ridge resulted in the tallest plants, whereas 15 kg P_2O_5/ fad in the presence of the same number per meter of linear ridge gave the highest first pod, in the two growing seasons.

The second order interaction (A x B x C) had also significant influence on the two growth traits under examine, fertilizing Hagen 30 with 30 kg P_2O_5/fad. in the presence of 25 plant per meter of linear ridge gave the tallest plants (110.2 cm) in the first and (116.9 cm) in the second one. Similar results had been observed for the high of the first pod that was affected significantly also with the rate of 15 kg P_2O_5/fad. with the same genotype and plant density.

2- Yield and yield components:

Data tabulated in Tables (4, 5, 6, 7, 8 and 9) revealed that, phosphorus fertilization had significant effect on the all yield and yield components characters under study. Number of pods / plant and biological yield were enhanced as increasing phosphorus rates from 15 up to 30 kg P_2O_5/fad. On the same line, the superiority of seed yield/plant and feddan associated with phosphorus soil application (15 or 30 kg P_2O_5/fad), in both growing seasons. These significant increase may be ought to phosphorus is a constituent of all important nucleoproteins, as well as soybean requires relatively large amount of phosphorus fertilizer for its effect on pod formation, maturity and promoting growth of the root system as explicated Osamn et al (2000).

The results of the percentage of immature to mature seeds/plant differed according to the growing seasons, in the first one, phosphorus fertilization had no significant impact on that studied character but in the second season, number of immature seeds was significantly declined by 8.43% under the effect of 30 kg P_2O_5, in comparison with applying 15 kg p2o5/fad.

Foliar spray with phosphoric acid did not led to decrease this studied rate, but it increased this rate.

Crude protein and oil percentage were not affected significantly by phosphorus fertilizer application, in 2006 season. It is turn out to be that, seed yield and number of pods / plant and oil percentage were reduced

substantially as increasing plant density from 15 up to 25 plant per meter of linear ridge, on the contrary biological yield, seed yield/fad, immature seeds rate to mature ones and protein percentage were enhanced significantly. In both seasons, decline trend had been observed for seed yield and number of pods and oil percentage, the highest averages for them attributed to 15 plant per meter of linear ridge, whereas increment trend had been achieved for biological yield, seed yield/fad, immature seeds rate to mature ones and protein %, 25 plant per meter of linear ridge was the most effective density that awarded the highest means. The results of yield and yield components exhibited that soybean produces better when it is spaced, so that it's leaves cover the entire soil surface during the seed development period. This provides maximum interaction of solar radiation and maximum conversion of solar energy to store food energy as demonstrated by Taylor (1980).

As for, the significant response for the previous characters due to soybean genotypes and varieties under study. Hagen 30 genotype resulted in the highest averages for number of pods, seed yield/plant and faddan and protein percentage, while this genotype contained the lowest rate of immature seeds to mature once. On the other hand, Giza 22 variety pronounced it's superiority in seed oil percentage, in 2006 season only. In the most yield properties under discussion. , Giza 111 confirmed it's leading and ranked the second as compared with the other varieties. The superiority of Hagen 30 genotype and Giza 111 may be due differences exist in genetical make up, as reported by Hassan et al (2001).

All the first order interaction had significant influence on those studied characters, i-e- treating 15 plant per meter of linear ridge with 30 kg P_2O_5/fad gave the greatest values for number of pods and seed yield/plant, as well as the lowest average of the immature seeds to mature ones. Meanwhile, the highest means for seed yield/ fad and biological yield were belonged to fertilizer 25 plants per meter of linear ridge with 30 kg P2O5 in both growing seasons. The same interaction achieved the highest percentage of protein in seeds during 2006 season. Seed oil percentage was increased significantly as foliar spray with phosphoric acid in the presence of 15 plant per meter of linear ridge as compared with the other treatments, as reveled in Table (9).

Table 2. **Plant height (cm)** of four soybean genotypes as affected by some. phosphorus fertilizer levels and plant densities during 2005and 2006 seasons.

Phosphorus Fertilizer (A)	Plant Density (B) Plant /m	2005 Genotypes (C)				Mean	2006 Genotypes (C)				Mean
		H30	H32	G22	G111		H30	H32	G22	G111	
15 kg P_2O_5	15	92.0	88.5	82.3	90.1	88.4	103.5	96.4	92.1	100.2	98.0
	20	99.2	94.3	85.2	92.6	92.8	110.5	105.8	95.9	103.1	103.8
	25	107.6	98.7	93.7	95.1	98.7	113.7	107.1	97.6	105.4	105.9
Mean		**99.8**	**93.8**	**87.0**	**92.6**	**93.3**	**109.2**	**103.1**	**95.2**	**102.9**	**102.6**
30 kg P_2O_5	15	96.4	91.1	88.6	93.8	92.4	106.3	101.2	94.1	103.8	101.3
	20	103.0	97.6	91.1	95.6	96.8	112.4	109.8	98.0	107.2	106.8
	25	110.2	102.	96.7	98.3	101.9	116.9	111.4	101.2	113.9	110.8
Mean		**103.2**	**97.0**	**92.1**	**95.9**	**97.0**	**111.8**	**107.4**	**97.7**	**108.3**	**106.3**
Phosphoric Acid 49.5 E.M *	15	89.4	85.0	93.8	87.5	88.9	98.3	95.6	100.5	97.3	97.9
	20	92.1	88.4	95.0	90.7	91.5	100.1	98.3	103.0	99.8	100.3
	25	95.4	90.9	100.6	93.1	95.0	102.9	101.1	106.1	100.9	102.7
Mean		**92.3**	**88.1**	**96.4**	**90.4**	**91.8**	**100.4**	**98.3**	**103.2**	**99.3**	**100.3**
Mean of plant densities	15	92.8	88.2	88.2	90.4	89.9	102.7	97.7	95.5	100.4	99.1
	20	98.1	93.4	90.4	92.9	93.7	107.6	104.6	98.9	103.3	103.6
	25	104.4	97.3	97.0	95.5	98.5	111.1	106.5	101.6	106.7	106.5
Mean of genotypes		**98.4**	**92.9**	**91.9**	**92.9**	**94.0**	**107.1**	**102.9**	**98.7**	**103.5**	**103.0**

L.S.D at 5% level for			
Phosphorus fertilizer	**(A)**	**3.0**	**3.7**
Plant density	**(B)**	**1.5**	**2.6**
Genotypes	**(C)**	**2.2**	**2.1**
Ax B		**1.7**	**4.5**
A x C		**3.8**	**3.7**
B x C		**3.8**	**3.7**
A x B x C		**6.6**	**6.5**

* E.M- effective matter

Table (3). **Height of first pod (cm)** of four soybean genotypes as affected by some, phosphorus fertilizer levels and plant densities during 2005and 2006 seasons.

Phosphorus Fertilizer (A)	Plant Density (B) Plant/m	2005 Genotypes (C)				Mean	2006 Genotypes				Mean
		H30	H32	G22	G111		H30	H32	G22	G111	
15 kg P_2O_5	15	20.10	17.00	15.03	18.40	**17.63**	19.90	16.80	14.80	17.40	**17.22**
	20	24.20	19.10	17.60	23.10	**21.00**	24.00	18.90	16.20	23.00	**20.52**
	25	27.90	23.70	22.10	25.80	**24.87**	25.80	23.10	21.30	25.00	**23.80**
Mean		**24.06**	**19.93**	**18.24**	**22.43**	**21.16**	**23.23**	**19.60**	**17.43**	**21.80**	**20.51**
30 kg P_2O_5	15	16.90	13.00	12.80	15.90	**14.65**	17.60	14.10	13.90	16.60	**15.55**
	20	19.20	16.10	16.00	17.70	**17.25**	19.90	17.60	15.30	18.90	**17.92**
	25	24.86	20.90	19.20	23.00	**21.99**	24.30	22.00	20.00	23.10	**22.35**
Mean		**20.32**	**16.66**	**16.00**	**18.86**	**17.96**	**20.60**	**17.90**	**16.40**	**19.53**	**18.60**
Phosphoric Acid 49.5 E.M	15	15.10	11.10	14.20	13.10	**13.37**	16.20	12.60	13.50	14.00	**14.07**
	20	18.20	12.80	16.10	17.00	**16.02**	17.80	13.10	15.70	16.40	**15.75**
	25	21.00	15.90	20.10	19.80	**19.37**	19.40	14.60	17.00	18.10	**17.27**
Mean		**18.33**	**13.26**	**16.80**	**16.63**	**16.25**	**17.80**	**13.43**	**15.40**	**16.16**	**15.70**
Mean of plant densities	15	17.36	13.70	14.01	15.80	**15.21**	17.90	14.50	14.06	16.00	**15.61**
	20	20.53	16.00	16.56	19.26	**18.09**	20.56	16.53	15.73	19.43	**18.06**
	25	24.82	20.16	20.46	22.86	**22.08**	23.16	19.90	19.43	22.06	**21.14**
Mean of genotypes		**20.90**	**16.62**	**17.01**	**19.31**	**18.46**	**20.54**	**16.97**	**16.41**	**19.16**	**18.27**

L.S.D at 5% level for			
Phosphorus fertilizer (A)		**0.93**	**1.92**
Plant density	**(B)**	**0.93**	**0.98**
Genotypes	**(C)**	**0.95**	**1.01**
Ax B		**1.61**	**1.71**
Ax C		**1.65**	**1.73**
B x C		**1.65**	**1.73**
A x B x C		**2.86**	**3.05**

Table (4). **Number of pods per plant** of four soybean genotypes as affected by some, phosphorus fertilizer levels and plant densities during 2005and 2006 seasons.

Phosphorus Fertilizer (A)	Plant Density (B) Plant/m	2005 Genotypes (C)				Mean	2006 Genotypes (C)				Mean
		H30	H32	G22	G111		H30	H32	G22	G111	
15 kg P_2O_5	15	61.70	47.10	43.10	51.40	**50.82**	75.1	63.1	55.1	66.3	**64.90**
	20	53.30	42.30	40.20	46.90	**45.67**	61.5	54.2	53.1	55.6	**56.10**
	25	41.80	34.23	33.60	39.50	**37.28**	57.6	51.9	48.0	54.1	**52.90**
Mean		**52.26**	**41.21**	**38.96**	**45.93**	**44.59**	**64.73**	**56.40**	**52.06**	**58.66**	**57.96**
30 kg P_2O_5	15	65.40	49.60	45.20	58.30	**54.62**	78.3	67.2	57.9	77.3	**70.19**
	20	55.70	45.76	43.60	48.60	**48.41**	67.8	60.3	54.1	63.4	**61.41**
	25	43.30	38.90	35.80	42.80	**40.20**	59.8	54.9	50.4	55.3	**55.10**
Mean		**54.80**	**44.75**	**41.53**	**49.90**	**47.74**	**68.65**	**60.80**	**54.13**	**65.35**	**62.23**
Phosphoric Acid 49.5 E.M	15	61.00	44.70	41.80	50.60	**49.52**	68.9	61.9	48.9	64.9	**61.09**
	20	44.80	40.10	38.90	43.00	**41.70**	59.7	50.1	43.4	53.7	**51.72**
	25	38.10	33.50	30.80	36.90	**34.82**	55.3	45.3	38.9	48.7	**47.05**
Mean		**47.96**	**39.43**	**37.16**	**43.50**	**42.01**	**61.30**	**52.45**	**43.63**	**55.76**	**53.28**
Mean of plant densities	15	62.70	47.13	43.36	53.43	**51.65**	74.1	64.0	53.8	69.5	**65.39**
	20	51.26	42.72	40.90	46.16	**45.26**	63.0	54.8	50.2	57.5	**56.41**
	25	41.06	35.54	33.40	39.73	**37.43**	57.5	50.7	45.7	52.7	**51.68**
Mean of genotypes		**51.67**	**41.80**	**39.22**	**46.44**	**44.78**	**64.89**	**56.55**	**49.94**	**59.93**	**57.83**

L.S.D at 5% level for			
Phosphorus fertilizer	**(A)**	**3.22**	**2.82**
Plant density	**(B)**	**2.96**	**2.09**
Genotypes	**(C)**	**2.81**	**1.92**
Ax B		**5.12**	**3.63**
Ax C		**4.88**	**3.30**
B x C		**4.88**	**3.30**
A x B x C		**8.45**	**5.78**

Table (5). **Seed yield per plant (g)** of four soybean genotypes as affected by some, phosphorus fertilizer levels and plant densities during 2005and 2006 seasons.

Phosphorus Fertilizer (A)	Plant Density (B) Plant/m	2005 Genotypes (C)				Mean	2006 Genotypes (C)				Mean
		H30	H32	G22	G111		H30	H32	G22	G111	
15 kg P_2O_5	15	17.96	13.20	12.50	15.70	14.84	22.30	19.00	15.80	20.90	19.50
	20	13.80	11.20	10.80	12.60	12.10	18.20	15.10	14.00	16.00	15.82
	25	12.40	10.10	9.60	11.20	10.82	16.20	13.00	12.30	15.00	14.12
Mean		14.72	11.50	10.96	13.16	12.58	18.90	15.70	14.03	17.30	16.48
30 kg P_2O_5	15	19.50	13.20	12.90	17.80	15.85	23.10	20.40	16.10	22.30	20.48
	20	16.50	11.40	11.00	14.10	13.25	20.30	16.30	14.90	18.00	17.37
	25	13.60	10.10	9.90	11.80	11.35	17.00	13.90	12.00	15.40	14.57
Mean		16.53	11.56	11.26	14.56	13.48	20.13	16.86	14.33	18.57	17.47
Phosphoric Acid 49.5 E.M	15	16.73	11.83	11.50	13.53	13.40	21.00	17.70	13.10	18.90	17.67
	20	12.90	11.00	10.40	11.70	11.50	17.20	14.00	11.50	16.60	14.82
	25	13.84	10.94	10.53	12.14	11.86	16.00	12.40	10.30	14.50	13.30
Mean		13.84	10.94	10.53	12.14	11.86	18.06	14.70	11.63	16.66	15.26
Mean of plant densities	15	18.06	12.74	12.30	15.67	14.69	22.13	19.03	15.00	20.71	19.71
	20	14.40	11.20	10.73	12.80	12.28	18.56	15.13	13.46	16.86	16.00
	25	12.63	10.06	9.73	11.40	10.95	16.40	13.10	11.53	14.96	14.00
Mean of genotypes		15.03	11.33	10.92	13.29	12.64	19.03	15.75	13.33	17.51	16.40

L.S.D at 5% level for			
Phosphorus fertilizer	**(A)**	**1.33**	**1.32**
Plant density	**(B)**	**1.24**	**0.91**
Genotypes	**(C)**	**1.27**	**1.08**
Ax B		**2.16**	**1.57**
Ax C		**2.20**	**1.88**
B x C		**2.20**	**1.88**
A x B x C		**3.82**	**3.26**

Table (6). **Seed yield (ton/feddan)** of four soybean genotypes as affected by some, phosphorus fertilizer levels and plant densities during 2005and 2006 seasons.

Phosphorus Fertilizer (A)	Plant Density (B) Plant/m	2005 Genotypes (C)				Mean	2006 Genotypes (C)				Mean
		H30	H32	G22	G111		H30	H32	G22	G111	
15 kg P_2O_5	15	1.51	1.34	1.17	1.43	1.36	1.64	1.42	1.32	1.55	1.48
	20	1.85	1.64	1.49	1.72	1.67	2.08	1.76	1.61	1.82	1.81
	25	2.16	1.89	1.80	2.01	1.96	2.19	1.89	1.74	2.06	1.97
Mean		**1.84**	**1.62**	**1.48**	**1.72**	**1.67**	**1.97**	**1.69**	**1.56**	**1.81**	**1.76**
30 kg P_2O_5	15	1.66	1.49	1.34	1.56	1.51	1.71	1.49	1.39	1.610	1.55
	20	1.95	1.66	1.56	1.85	1.75	2.17	1.92	1.69	2.08	1.96
	25	2.19	1.92	1.80	2.09	2.00	2.32	2.05	1.86	2.19	2.10
Mean		**1.93**	**1.69**	**1.57**	**1.83**	**1.76**	**2.09**	**1.82**	**1.65**	**1.96**	**1.87**
Phosphoric Acid 49.5 E.M	15	1.56	1.40	1.15	1.41	1.38	1.61	1.41	1.27	1.50	1.45
	20	1.86	1.55	1.39	1.76	1.64	1.99	1.64	1.54	1.92	1.77
	25	1.95	1.78	1.66	1.87	1.82	2.17	1.85	1.69	2.03	1.94
Mean		**1.79**	**1.57**	**1.40**	**1.68**	**1.61**	**1.92**	**1.63**	**1.50**	**1.82**	**1.72**
Mean of plant densities	15	1.58	1.41	1.22	1.46	1.42	1.65	1.44	1.32	1.55	1.49
	20	1.89	1.61	1.48	1.78	1.69	2.08	1.77	1.61	1.94	1.85
	25	2.10	1.86	1.75	1.99	1.93	2.23	1.93	1.77	2.09	2.00
Mean of genotypes		**1.85**	**1.63**	**1.49**	**1.74**	**1.68**	**1.99**	**1.71**	**1.57**	**1.86**	**1.78**

L.S.D at 5% level for			
Phosphorus fertilizer	**(A)**	**0.10**	**0.11**
Plant density	**(B)**	**0.04**	**0.12**
Genotypes	**(C)**	**0.06**	**0.15**
Ax B		**0.08**	**0.21**
Ax C		**0.12**	**0.26**
B x C		**0.12**	**0.26**
A x B x C		**0.20**	**0.45**

Table(7). **The rate of immature to mature seeds/plant (g)** of four soybean genotypes as affected by some, phosphorus fertilizer levels and plant densities during 2005and 2006 seasons.

Phosphorus Fertilizer (A)	Plant Density (B) Plant/m	2005 Genotypes (C)				Mean	2006 Genotypes (C)				Mean
		H30	H32	G22	G111		H30	H32	G22	G111	
15 kg P_2O_5	15	0.072	0.093	0.102	0.093	0.090	0.062	0.069	0.087	0.068	0.071
	20	0.096	0.107	0.117	0.114	0.109	0.072	0.085	0.093	0.087	0.084
	25	0.100	0.118	0.123	0.120	0.115	0.085	0.095	0.107	0.088	0.094
Mean		0.089	0.106	0.114	0.109	0.105	0.073	0.083	0.096	0.081	0.083
30 kg P_2O_5	15	0.066	0.089	0.099	0.088	0.086	0.058	0.062	0.083	0.064	0.067
	20	0.081	0.106	0.116	0.114	0.104	0.066	0.073	0.089	0.077	0.076
	25	0.096	0.114	0.112	0.118	0.113	0.076	0.088	0.091	0.082	0.084
Mean		0.081	0.103	0.113	0.107	0.101	0.067	0.074	0.087	0.074	0.076
Phosphoric Acid 49.5 E.M	15	0.060	0.097	0.110	0.106	0.093	0.065	0.068	0.092	0.067	0.073
	20	0.093	0.102	0.112	0.110	0.104	0.075	0.080	0.101	0.083	0.085
	25	0.100	0.111	0.123	0.119	0.113	0.081	0.095	0.112	0.089	0.094
Mean		0.084	0.103	0.115	0.112	0.104	0.074	0.081	0.102	0.079	0.084
Mean of plant densities	15	0.066	0.093	0.104	0.096	0.090	0.062	0.066	0.087	0.066	0.070
	20	0.090	0.105	0.115	0.113	0.106	0.071	0.079	0.094	0.082	0.082
	25	0.099	0.114	0.123	0.119	0.114	0.081	0.093	0.103	0.086	0.091
Mean of genotypes		0.085	0.104	0.114	0.109	0.103	0.071	0.079	0.095	0.078	0.081

L.S.D at 5% level for			
Phosphorus fertilizer	**(A)**	**N.S**	**0.004**
Plant density	**(B)**	**0.006**	**0.004**
Genotypes	**(C)**	**0.007**	**0.005**
Ax B		**0.011**	**0.008**
A x C		**0.012**	**0.008**
B x C		**0.012**	**0.008**
A x B x C		**0.021**	**0.015**

Table (8). **Biological yield (ton/feddan)** of four soybean genotypes as affected by some, phosphorus fertilizer levels and plant densities during 2005and 2006 seasons.

Phosphorus Fertilizer (A)	Plant Density (B) Plant/m	2005 Genotypes (C)				Mean	2006 Genotypes (C)				Mean
		H30	H32	G22	G111		H30	H32	G22	G111	
15 kg P_2O_5	15	4.97	4.53	4.30	4.66	4.61	5.36	5.24	4.88	5.28	5.19
	20	6.03	5.58	5.48	5.78	5.72	6.80	6.48	5.92	6.70	6.47
	25	7.04	6.47	6.23	6.46	6.55	7.16	6.98	6.41	7.06	6.90
Mean		6.01	5.53	5.34	5.63	5.63	6.44	6.23	5.74	6.35	6.19
30 kg P_2O_5	15	5.68	5.29	4.97	5.52	5.37	5.86	5.72	5.54	5.84	5.74
	20	6.66	5.91	5.97	6.53	6.22	6.88	6.58	6.05	6.76	6.57
	25	7.50	6.85	6.70	2.24	7.07	7.45	7.02	6.60	7.11	7.05
Mean		6.61	6.02	5.82	6.43	6.22	6.73	6.44	6.04	6.57	6.45
Phosphoric Acid 49.5 E.M	15	5.38	4.91	4.41	5.16	4.96	5.53	5.17	4.82	5.45	5.24
	20	6.44	5.50	5.40	6.31	5.91	6.72	5.73	5.60	6.50	6.14
	25	6.86	6.37	6.23	6.79	6.56	7.07	6.59	6.45	6.89	6.75
Mean		6.23	5.59	5.34	6.09	5.81	6.44	5.83	5.62	6.28	6.04
Mean of plant densities	15	5.34	4.91	4.56	5.11	4.98	5.58	5.38	5.08	5.52	5.39
	20	6.38	5.66	5.55	6.20	5.95	6.80	6.26	5.81	6.65	6.39
	25	7.14	6.56	6.39	6.83	6.73	7.23	6.86	6.48	7.02	6.90
Mean of genotypes		6.29	5.71	5.50	6.05	5.89	6.54	6.17	5.81	6.40	6.23

L.S.D at 5% level for			
Phosphorus fertilizer	**(A)**	**0.22**	**0.23**
Plant density	**(B)**	**0.08**	**0.18**
Genotypes	**(C)**	**0.14**	**0.20**
Ax B		**0.14**	**0.31**
Ax C		**0.23**	**0.35**
B x C		**0.23**	**0.35**
A x B x C		**0.40**	**0.61**

Table (9).. **Seed crude protein and oil percentage** of four soybean genotypes as affected by some, phosphorus fertilizer levels and plant densities during 2006 season.

Phosphorus Fertilizer (A)	Plant Density (B) Plant/m	Seed protein percentage % Genotypes (C)				Mean	Seed oil percentage % Genotypes (C)				Mean
		H30	H32	G22	G111		H30	H32	G22	G111	
15 kg P_2O_5	15	40.5	39.4	39.2	39.7	**39.7**	19.6	20.0	20.1	19.8	**19.8**
	20	41.2	40.1	39.7	40.7	**40.4**	18.9	19.5	19.7	19.2	**19.3**
	25	42.1	40.9	40.6	41.6	**41.3**	18.0	19.5	19.3	18.4	**18.6**
Mean		**41.2**	**40.1**	**39.8**	**40.6**	**40.4**	**18.8**	**19.5**	**19.7**	**19.2**	**19.2**
30 kg P_2O_5	15	40.9	39.6	39.0	40.1	**39.9**	19.4	19.8	20.4	19.6	**19.8**
	20	41.5	40.2	40.0	40.7	**40.6**	19.1	19.5	20.1	19.2	**19.4**
	25	24.3	41.5	41.0	41.8	**41.6**	18.9	19.2	19.5	19.0	**19.1**
Mean		**41.5**	**40.4**	**40.0**	**40.8**	**40.7**	**19.1**	**19.5**	**20.0**	**19.2**	**19.4**
Phosphoric Acid 49.5 E.M	15	39.6	39.1	38.3	39.4	**39.1**	19.7	20.1	20.5	20.3	**20.1**
	20	41.1	40.0	39.0	40.5	**40.1**	19.3	19.7	20.0	19.5	**19.6**
	25	41.5	40.6	40.3	41.2	**40.9**	18.9	19.3	19.6	19.2	**19.3**
Mean		**40.7**	**39.9**	**39.2**	**40.3**	**40.0**	**19.3**	**19.7**	**20.0**	**19.6**	**19.6**
Mean of plant densities	15	40.3	39.3	38.8	39.7	**39.5**	19.5	19.9	20.3	19.9	**19.9**
	20	41.2	40.1	39.5	40.6	**40.3**	19.1	19.5	19.9	19.3	**19.4**
	25	41.9	41.0	40.6	41.5	**41.2**	18.6	19.2	19.4	18.6	**19.0**
Mean of genotypes		**41.4**	**40.1**	**39.6**	**40.6**	**40.4**	**19.0**	**19.6**	**19.9**	**19.3**	**19.4**

L.S.D at 5% level for			
Phosphorus fertilizer	**(A)**	**N.S**	**N.S**
Plant density	**(B)**	**0.7**	**0.7**
Genotypes	**(C)**	**0.6**	**N.S**
Ax B		**1.3**	**0.3**
Ax C		**1.1**	**0.5**
B x C		**1.1**	**0.5**
A x B x C		**2.0**	**0.9**

From Tables (4, 5, 6, 7, 8), it was concluded that the second order interaction (A x B x C) had significant influence on all the studied yield characters. Application of 30 kg P_2O_5/fad to 15 plants per meter of linear ridge of Hagen 30 genotype detected the maximum average for number of pods and seed yield/plant, in the same time this treatment achieved the lowest rate of immature seeds. The greatest yield of biological and seed/fad associated with Hagen 30 genotype that was fertilizer with 30 kg P_2O_5/fad, in the presence of 25 plant per meter of linear ridge, in both growing seasons. Spraying Giza 22 genotype with phosphoric acid, in the presence of 15 plant per meter of linear ridge awarded the highest seed oil percentage, as tabulated in Table(9)

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الملخص العربى

العلاقة بين بعض أصناف فول الصويا والكثافات تحت مستويات مختلفة من التسميد الفوسفاتى

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اجريت تجربتان بمحطة بحوث الجميزة – محافظة الغربية خلال عامى ٢٠٠٥و٢٠٠٦ بهدف دراسة تاثير كل من التسميد الفوسفاتى بمعدلات ١٥، ٣٠ كجم/فدان(سماد سوبر فوسفات الكالسيوم احادى١٥,٥%) كتسميد أرضى والرش بالمعدل الموصى بة من حمض الفوسفوريك بمعدل ٠,١ سم^{3}حمض/١ لتر ماء نقى) بالإضافة إلى استخدام ثلاثة مستويات من الكثافة النباتية (١٥، ٢٠، ٢٥نبات/م طولى) على بعض صفات النمو والمحصول ومكوناتة لإثنين من الهجن المبشرة (هجين٣٠، هجين٣٢) وصنفين من نباتات فول الصويا (جيزة١١١، جيزة٢٢).

ولقد أظهرت النتائج ان تسميد نباتات فول الصويا بالمعدل ٣٠كجم بو٢أ٥/فدان هو الأفضل لمعظم الصفات تحت الدراسة وان هناك تناسب طردى فيما بين زيادة الكثافة النباتية وبين قيم معظم الصفات محل الدراسة فيما عدا محصول البذرة/ نبات وعدد القرون/ نبات. وإحتل كلاً من هجين ٣٠، جيزة ١١١ المرتبة الأولى والثانية فى معظم الصفات .

واثبتت النتائج ان الصفات جميعها بما فيها النسبة المئوية للبروتين والزيت بالبذرة تأثرت بالتفاعل سواء كان من الدرجة الأولى او الثانية خلال موسمى الدراسة.