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Effect of phosphorus and Aziplex Nutrition on Growth, Yield, Quality and Chemical Constituents of Pea (*Pisum sativum* L.)

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تأثير التغذية بالفوسفور والازيبلكس على النمو والمحصول والجودة والتركيب الكيماوي لنباتات البسلة

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ملخص البحث

أجريت تجربتان حقليتان على صنف البسلة لتل مارفيل بمزرعة كلية الزراعة بمشتهر خلال الموسم الشتوي لعامي ١٩٨٧/٨٦ ، ١٩٨٨/٨٧ وهي ذات أرض طينية صفراء ذات رقم حموضة ٧٫٨ وذلك بهدف دراسة تأثير التسميد الأرضي بالسوبر فوسفات بثلاثة مستويات وهي صفر ، ٣٢ ، ٦٤ كجم فو٢أ٥ / فدان بالتبادل من أربعة تركيزات من السماد الورقي أزيبلكس وهي صفر ، ٠٫٠٥ ، ٠٫١٠ ، ٠٫١٥ ٪ رشا على النباتات ثلاث مرات خلال موسم النمو وكانت النتائج المتحصل عليها على النحو الآتي :

أظهرت النتائج أن زيادة مستوى التسميد الفوسفاتي أو الرش بالازيبلكس أدى الى زيادة الوزن الطازج والجاف للنبات ، محصول النبات ومحصول الفدان من القرون الخضراء ، متوسط وزن القرن ، وزن ١٠٠ بزرة وكذلك نسبة التصافي للبذور الخضراء . وقد أمكن الحصول على أكبر نمو خضري وأعلى محصول من القرون الخضراء وكذلك أفضل جودة للقرون عند تسميد النباتات بمستوى ٦٤ كجم فو٢أ٥ / فدان والرش ثلاث مرات بسماد الأزيبلكس عند تركيز ٠٫١٠٪.

كما أظهرت التحليلات الكيماوية أن محتوى الأوراق من النتروجين والفوسفور والبوتاسيوم والأندولات الكلية وكذلك محتوى البذور من الفوسفور والبوتاسيوم ازداد معنويا بزيادة مستويات التغذية بالفوسفور أو الأزيبلكس أو كلاهما معا وكانت أقصى قيم للنباتات التي سمدت بالمستوى العالي من الفوسفور (٦٤ كجم فو٢أ٥ / فدان) ورشت بالأزيبلكس بتركيز ٠٫١٠ ٪ .

ومن ناحية أخرى فان ارتفاع النبات ، عدد البذور بالقرن ، الكربوهيدرات الكلية بالأوراق أو البذور وكذلك كلوروفيل- أ بالأوراق لم يتأثر بالتسميد الفوسفاتى أو الازيبلكس أو كلاهما معا .

بناء على هذه النتائج فانه يمكن التوصية بتسميد البسلة بمعدل ٦٤ كجم فو٢أ٥ / فدان مع الرش بالأزيبلكس بمعدل ٠,١ ٪ حيث حققت هذه المعاملة أعلى زيادة فى المحصول الكلى للقرون الخضراء بلغت ٤٦,٨ ٪ بالمقارنة بالكنترول وذلك فى موسم النمو الأول .

ABSTRACT

Seeds of pea cv. Little Marvel were sown under the field conditions of the Expermental Farm Station, Fac. Agric. Moshtohor, Zagazig Univ. during the winter seasons of 1986-1987 and 1987-1988. Soil of this experiment was clay loam in texture of pH 7.8. Trials aimed to study the effect of three levels; 0, 32 and 64 kg P_2O_5/Fad. of superphosphate fertilizer as soil application within four concentrations 0, 0.05, 0.10 and 0.15% of the folifertilizer "Aziplex" added as foliar spray 3-times during the growing seasons. Results showed that increasing levels of superphosphate or "Aziplex" considerably increased fresh and dry weight per plant, total yield of green pods per plant and per faddan, average pod weight, weight of 100 seeds and netting % of green seeds. The highest plant growth, green pod yield and pod quality were obtained from plants fertilized with 64 kg P_2O_5/Fad. and sprayed 3 times with Aziplex at 0.1%. Plant analysis showed that N, P, K (mg/plant), total indoles content of leaves as well as P and K content of green seeds were significantly increased by increasing levels of P and/or Aziplex nutrition and reached the maximum in plants fertilized with 64 kg P_2O_5/Fad. and sprayed with Aziplex at 0.1%. On the other hand plant height, number of seeds per pod, totalcarbohydrates (%) of leaves or seeds and chlorophyl-a content of leaves were not considerably affected either by P and/or Aziplex nutrition. Generally, the application of 64 kg P_2O_5/Fad. and 0.10% Aziplex as foliar spray could be recommended for increasing green pod yield of pea by 46.8% as compared with control as shown in the first season.

INTRODUCTION

The favourable response of legume plants to phosphorus nutrition have been mentioned by Peck and Buren (1975), Peck *et al*. (1980) and Midan *et al*. (1981) on snap bean. El-Sawah *et al*. (1985) trials on broad bean grown in clay-loam soil showed that fertilizing plants with 32 kg P_2O_5 and/or 24 kg K_2O/Fad. considerably increased vegetative growth, and fresh pod yield than those received lower P levels or the control. They referred the yield increment to the improvement in average pod weight, weight of 100 seeds and number of pods per plant. However, number of seeds per pod and netting percentage were less affected by P application. Moreover, Midan *et al*.(1982) found that phosphorus nutrition did not increase plant height and green pod yield. On the other hand, El-Neklawy *et al*. (1985) mentioned that P and K application at 64 kg P_2O_5 + 48 kg K_2O/Fad. markedly increased green pods yield, protein and phosphorus content (%) of green seeds. Whereas total carbohydrates content of green seeds was also increased by P-application (Midan *et al*., 1982).

Recently, much interest is focused on micronutrients application to vegetable crops grown in the alluvial soil in Egypt. This interest may be due to the great reduction in the suspended matter of the Nile water after the construction of the High Dam (El-Fouly, 1979) which consequently depressed Fe, Mn, Zn, Cu and Mo content of the Nile water more than 75% (Nabhan, 1966). Added to that; shortage in manuring, the intensive growing of vegetable crops three times yearly and the use of new cultivars with high potential yield. All these reasons and others led us to give more attention to study the response of vegetable crops to micronutrients application especially when soil pH is relatively high. It is reported that a common deficiency of Zn, Cu and Fe was widely observed on vegetable crops grown in new reclamated sandy soils in Egypt (Wallace, 1979). The increase of green pods and dry seed yield of legume plants by micronutrients foliar application have been mentioned by Midan (1981), Gabal <u>et al</u>. (1985) on common bean, Yakout <u>et al</u>. (1981) on soybean and Hassan (1982) on pea. Kamel <u>et al</u>. (1984) found that Aziplex, foliar application at 0.2% weakly, improved plant growth and number of inflorescens per plant. Moreover, spraying pea and common bean plants with Zn or Cu at 50-100 ppm of each, increased total chlorophyll content of leaves (Kanwar and Thakur, 1973 and Hassan, 1982), and P content of soybean foliage (Yakout et al., 1981).

Under conditions of relatively high soil pH of this research, the availability of P and most micronutrients may be depressed. Therefore, determination of the optimum level of superphosphate fertilizer and Aziplex is required for increasing fresh yield of green pods and the quality by mean of proper nutrition of pea plants.

MATERIALS AND METHODS

Two field experiments were carried out under clay-loam soil conditions of the Experimental Farm Station, Faculty of Agric., Moshtohor during the winter seasons of 1986/87 and 1987/88. Data for soil chemical analysis were as follows:

Soil-pH	Avail. N (%)	Soluble-P (ppm)	Soluble micronutrients (ppm) Zn	Mn	Fe	Cu
7.8	0.093	2.58	0.25	0.10	0.22	3.3

Soluble cations (meq/L) Ca	Mg	Na	K	Soluble anions (meq/L) CO_3	HCO_3	Cl	SO_4
8.0	3.0	9.7	0.51	-	3.5	3.5	14

Seeds of Pea (Pisum sativum, L.) local cv. Little Marvel, obtained from the Egyptian Agric. Organization, were sown on October 1st and 8th of 1986 and 1987, respectively in hills at 15 cm apart on both sides of ridges; 60 cm width and 4 m length. After full germination thinning were done leaving only 2 seedlings per hill. Pea plants were supplied with 12 nutritional treatments; 3-levels of P (0, 32 and 64 kg P_2O_5/Fad.) within 4-concentrations of Aziplex (0, 0.05, 0.10 and 0.15%). Phosphorus was added as superphosphate fertilizer (16% P_2O_5) as soil application at two equal portions during soil preparation and prior to flowering time (25 days after sowing). Whereas, micronutrients were added as Aziplex which is a commercial folifertilizer contains; 0.6% Mo, 0.6% B, 3.6% Fe, 1.8% Mn, 0.7% Zn, 0.2% Cu and 0.3% Co. All micronutrients are in the chelated form except B. Peas plants were sprayed with Aziplex on foliage at 3-times; prior to flowering, full blooming and early flat pod stage, i.e. 30, 45 and 60 days after sowing.

Treatments were adopted in a split-plot design with 4-replicates in both seasons. Phosphorus fertilizer survived as main plots however, Aziplex nutrition adopted as sub-plots. Plot area included 5 ridges and reached 12 m^2 (0.6 x 4 x 5 = 12 m^2). All treatments received 45 kg N/Fad. supplied as ammonium nitrate (33.5% N) and added at two equal portions; 20 and 40 days after sowing i.e after thinning and at the beginning of flowering stage. Other cultural practices were done as common in the district.

Data recorded were as follows:

1. Vegetative growth:

At full blooming stage, 10 plants from each plot were taken by random, whereas, plant height (cm), fresh weight and dry weight at 70°C (g/plant) were determined.

2. Chemical composition of plant foliage:

A) The dry matter of plant foliage sampled at flowering stage (45 days after sowing) were used for the following chemical determinations:

Total N, P and K contents in plants were determined according to the methods used by Pregl (1945); Murphy and Riely (1962) as modified by John (1970); Brown and Lilleland (1946) respectively.

Total carbohydrates determined colorimetrically according to the method of Michel *et al*. (1956).

Micronutrients; Zn and Cu content (ppm) were assayed using atomic absorption according to Chapman and Pratt (1961).

B) A random sample of fresh leaves, of 10 plants of each plot were taken at full blooming stage and used for the following determinations:

- Chlorophyll a, b and carotene content were determined in fresh leaves using the method described in A.O.A.C. (1970).
- Indoles were determined colorimetrically in fresh leaves as described by Gordon and Weber (1950) as modified by Fliosson (1969).
- Phenoles were determined in fresh leaves using the method described in the A.O.A.C.(1965).

3. Green pod yield and its components:

A) Yield of green pods harvested from each plot all over the season was determined by weight (kg/plot) and number and then calculated as ton/Fad as well as weight and number of pods per plant.

B) A random sample of one kg pods of each plot was taken at the green mature stage (fresh marketing stage, 80 days after sowing) and then green seeds were extracted and weighed to determine; number of seeds/pod, Netting % and seed index as the weight of 100 green seeds (g).

4. Chemical composition of green seeds:

The total N, P, K and total carbohydrates (% based on dry weight) were determined in the dry matter of green seeds using the same methods described previously for plant foliage analysis.

Statistical Analysis: All data collected were subjected to the statistical analysis of the split-plot design as mentioned by Snedecor and Cochran (1968).

RESULTS AND DISCUSSION

1. Plant growth characteristics:

Data on plant growth (Table,1) show that P and/or Aziplex nutritional treatments had no significant effect on plant height in both seasons. Whereas, fresh and dry weight per plant were significantly increased by increasing levels of P fertilizer and therefore, the maximum plant growth was obtained when plants were fertilized with 64 kg P_2O_5/Fad. as shown in both seasons. This response in pea growth by increasing levels of P application is in agreement with Midan et al. (1981) on common bean, El-Sawah et al. (1985) on broad bean. However, the unsignificant response of plant height to P or Aziplex nutrition may be due to that the cultivar used here (cv. Little Marvel) is a short one with a determinate stem length. Moreover, obtained results agree with those results of Midan et al. (1982) on Pea fertilized with different P-levels.

Concerning the main effect of Aziplex foliar application on plant growth, data clearly show that when plants sprayed with Aziplex at 0.1% or more gave higher fresh and dry weight per plant as compared with those received lower doses or the control, such response was significant only in the first season. Gabal et al. (1985) did not found a considerable increase in vegetative growth of common bean plants sprayed with Zn, Mn,or Cu. However, Kamel et al. (1984) found that Aziplex improved plant growth by using 0.2% of Aziplex weekly.

Table (1): Effect of phosphorus fertilization and Aziplex foliar application on growth characteristics of pea plants during 1986/87 and 1987/89 seasons.

Seasons		1986-87			1987-88		
Treatments							
P_2O_5 kg/fad.	Aziplex %	Plant height (cm)	Fresh weight g/plant	Dry weight g/plant	Plant height (cm)	Fresh weight g/plant	Dry weight g/plant
0	0.00	76.0	80.3	10.6	84.5	87.0	11.8
0	0.05	81.8	84.5	11.4	86.8	89.0	12.3
0	0.10	83.8	91.5	13.0	82.3	87.5	12.2
0	0.15	82.3	91.5	12.9	82.0	91.0	12.9
32	0.00	77.0	89.5	12.2	88.0	90.0	13.2
32	0.05	81.0	101.3	13.5	86.5	92.8	13.3
32	0.10	84.0	105.3	14.4	86.5	91.3	13.2
32	0.15	88.8	114.5	16.9	87.5	92.8	13.8
64	0.00	81.3	112.5	15.5	82.0	95.3	14.3
64	0.05	82.8	110.0	16.4	86.5	103.5	15.1
64	0.10	84.5	115.5	17.9	87.8	107.5	15.5
64	0.15	79.5	112.3	14.9	89.0	105.5	16.1
L.S.D. at 0.05		N.S.	7.4	1.6	N.S.	N.S.	N.S.
0		80.9	86.9	11.9	83.9	88.6	12.3
32		82.7	102.6	14.1	87.1	91.7	13.4
64		82.0	112.5	16.1	86.3	103.1	15.2
L.S.D. at 0.05		N.S.	6.1	1.0	N.S.	10.3	2.2
	0.00	78.1	94.1	12.7	84.8	68.2	13.1
	0.05	81.9	98.5	13.7	86.6	71.3	13.5
	0.10	84.1	104.1	15.1	85.5	71.6	13.5
	0.15	83.5	106.1	14.7	86.2	72.3	14.3
L.S.D. at 0.05		N.S.	4.3	0.9	N.S.	4.0	N.S.

Concerning the interaction effect of P within Aziplex on plant growth significant differences may be detected but only in the first season. Plants supplied with 32 kg P_2O_5/Fad. and sprayed with Aziplex at 0.15% or those received 64 kg P_2O_5/Fad. and sprayed with Aziplex at 0.05 or 0.1% gave higher plant growth as compared with other treatments.

It seems that the favourable role of phosphorus on pea growth here was more pronounced than that of micronutrients application in the form of Aziplex. This result is in agreement with those of Gabal et al. (1984) on common bean who found that Zn, Mn and Cu foliar application depressed growth of common bean plants evaluated at flowering stage. Whereas, increasing levels of P application considerably increased plant growth as mentioned by Houge et al. (1970); Midan et al. (1981) and El-Sawah et al. (1985).

2. Chemical constituents of plant foliage:

Data given in Table (2) show that N, P and K uptake (mg/plant) were significantly increased by increasing levels of P and/or Aziplex nutrition and the maximum uptake was found in plants fertilized with 64 kg P_2O_5/Fad. and/or sprayed with 0.1% Aziplex as compared with all levels and treatments. This increase in minerals uptake could be referred to the favourable role of P and Aziplex on plant growth as shown in Table (1) and completely agree with Hogue et al. (1970) on tomato supplied with P at rates to provide 100 ppm P; Bishop et al. (1976) on Pea; El-Sawah (1985) using 32 kg P_2O_5 on broad bean and Kamel et al (1988) who found that Aziplex foliar application increased plant growth.

Table (2): Effect of phosphorus fertilization and Aziplex foliar application on chemical composition of pea plant foliage during (1987-1988) season.

P_2O_5 kg/Fad.	Aziplex %	N (mg/plant)	P (mg/plant)	K (mg/plant)	Zn (ppm)	Cu (ppm)	Total phenols	Total Indoles	Total carbo-hydrates%	Chlorophyll a	Chlorophyll b	Carotene
0	0.00	391.4	29.8	257.9	28.8	46.3	433.8	357.5	23.7	79.6	37.6	58.2
0	0.05	422.5	36.5	297.4	29.5	42.3	439.3	342.0	24.7	90.8	39.0	61.3
0	0.10	490.0	46.2	344.9	31.0	50.5	446.3	355.0	25.4	99.8	39.1	61.4
0	0.15	483.2	35.9	351.4	31.3	57.3	466.3	352.5	25.8	98.4	38.4	65.8
32	0.00	532.1	45.6	317.9	30.8	61.5	446.3	307.5	25.6	92.2	41.1	66.2
32	0.05	522.5	39.8	344.6	32.0	61.0	467.5	368.8	25.8	90.1	43.1	66.7
32	0.10	595.6	53.2	407.1	30.3	79.3	675.0	378.8	26.3	90.6	45.4	68.2
32	0.15	771.5	63.0	457.3	37.8	74.5	490.0	417.5	25.7	93.0	49.3	72.5
64	0.00	677.0	57.9	422.9	39.5	61.8	481.3	378.8	25.2	94.0	50.4	73.1
64	0.05	715.3	65.8	519.3	37.0	63.8	515.0	404.3	25.9	94.6	46.7	74.6
64	0.10	839.9	71.5	629.5	45.5	77.0	524.3	416.3	26.0	97.1	52.3	75.9
64	0.15	673.4	60.1	518.4	37.5	69.0	502.5	397.5	25.8	92.6	47.5	74.0
L.S.D. at 0.05		114.0	7.1	59.8	N.S.	N.S.	N.S.	37.9	N.S.	N.S.	N.S.	N.S.
0	-	446.8	37.1	417.2	30.1	49.1	446.4	351.8	24.9	92.1	38.5	61.6
32	-	605.4	50.4	508.9	32.7	69.1	469.7	368.1	25.8	91.5	44.7	68.4
64	-	726.4	63.8	696.7	39.9	67.9	505.8	399.2	25.7	94.6	49.2	74.4
L.S.D. at 0.05		59.4	5.4	39.9	3.3	9.2	15.3	30.5	N.S.	N.S.	3.2	7.6
-	0.00	533.5	44.4	332.9	33.0	56.5	453.8	347.9	24.8	88.6	43.0	65.8
-	0.05	553.4	47.4	387.1	32.8	55.7	473.9	371.7	25.4	91.8	42.9	67.5
-	0.10	641.8	56.9	460.5	35.6	68.9	481.8	383.3	25.9	95.8	45.6	68.5
-	0.15	642.7	53.0	442.4	35.5	66.9	486.3	389.2	25.7	94.7	45.1	70.8
L.S.D. at 0.05		65.8	4.1	34.5	N.S.	12.4	13.2	21.9	N.S.	N.S.	N.S.	N.S.

Regardless to P-application, increasing levels of Aziplex from 0.1 up to 0.15% did not result any considerable increase in N, P and K uptake. This result was also true when P was added at the highest level of 64 kg P_2O_5/Fad.This may be explained by the considerable differences in vegetative growth of plants fertilized with 64 kg P_2O_5/Fad. and sprayed with 0.1% or 0.15% of Aziplex.

Concerning Zn and Cu content of plant foliage data in Table(2) show that the effect of interaction between P and Aziplex was not Signficant. However, Zn and Cu contents of plant foliage were increased as a result of increasing levels of P fertilizer from 0 up to 64 kg P_2O_5/Fad. Regardless to P-levels, Aziplex foliar application increased Cu content of pea foliage, reached the maximum values in plants sprayed with 0.1% or the highest concent. of Aziplex. Although the same trend was noticed for Zn content of foliage but variances failed to reach the level of significance. This result agree with the theory of cation-anion balance of Kirkby and Mengel (1967) who stated that plants took up high anions (HPO_4^{--}) should also take up high cations to keep that balance in plant tissues.

It was also clear from Table (2) that there were no interaction effects between P and Aziplex nutrition on total phenols, total carbohydrates and photosynthetic pigments content of plant foliage or leaves. Meanwhile, chlorophyll-a and total carbohydrates content were not considerably affected either by P and/or Aziplex treatments. Chlorophyll-b and carotene content of leaves were mainly responsed to raising levels of P application whereas, plants supplied with 64 kg P_2O_5/Fad. had the highest values as compared with those received lower levels of P-fertilizer.

Concerning total indoles and total phenoles it was increased by increasing levels of P-application reached the maximum in plants fertlilzed with 64 kg P_2O_5/Fad. Regardless to P-levels, all levels of Aziplex significantly increased total indoles and phenoles than the control with no significant differences due to the concentration of Aziplex foliar application.

3. Green pod yield and its components:

Concerning the main effect of phosphorus on green pod yield of pea data (Table, 3) showed that increasing levels of P-fertilizer from 0, 32 up to 64 kg P_2O_5/Fad. significantly increased green pod yield per plant as well as per faddan as shown in both seasons. This increase in pod yield may be referred to the increase in plant growth and average pod weight of plants fertilized with P as compared with those of the control. Moreover, number of pods per plant seemed to be increased by P-application but only in the second season.. However, increasing levels of P-fertilizer from 32 up to 64 kg P_2O_5/Fad. did not result in any significant increase in number of pods per plant, in both seasons. These results are in harmony with those of Bishop et al. (1976) and Browning and George (1981) who found that N, P and K application increased seed yield of many legume crops including peas.

Table (3): Effect of phosphorus fertilization and Aziplex foliar application on green pod yield of pea during (1986-1987) and (1987-1988) seasons.

Seasons / Treatments: P_2O_5 (kg/fad.)	Aziplex %	1986-1987 No. of pods/plant	1986-1987 Pod yield/plant (g)	1986-1987 Pod yield/Fad. (Ton)	1987-1988 No. of pods/plant	1987-1988 Pod yield/plant (g)	1987-1988 Pod yield/Fad. (Ton)
0	0.00	5.2	20.6	3.259	4.9	22.7	3.596
0	0.05	5.2	22.1	3.498	5.0	23.2	3.667
0	0.10	5.3	22.9	3.630	5.1	24.7	3.916
0	0.15	5.8	26.0	4.125	5.4	26.1	4.126
32	0.00	5.3	25.0	3.960	5.3	25.3	4.003
32	0.05	5.2	26.8	4.249	5.4	26.8	4.242
32	0.10	5.3	25.1	3.968	5.2	25.9	4.095
32	0.15	5.7	27.8	4.406	6.1	30.4	4.811
64	0.00	5.4	24.4	3.993	5.5	27.2	4.312
64	0.05	5.5	24.7	4.191	5.5	28.7	4.312
64	0.10	5.8	30.2	4.785	6.0	31.2	4.943
64	0.15	5.7	29.2	4.628	5.9	30.5	4.827
L.S.D. at 0.05		N.S.	2.1	0.399	0.3	N.S.	N.S.
0	-	5.4	22.9	3.628	5.1	24.2	3.826
32	-	5.4	26.2	4.146	5.5	27.1	4.287
64	-	5.6	27.1	4.399	5.7	29.4	4.635
L.S.D. at 0.05		N.S.	1.7	0.122	0.3	1.9	0.337
-	0.00	5.3	23.3	3.737	5.2	25.1	3.970
-	0.05	5.3	24.5	3.979	5.3	26.2	4.122
-	0.10	5.5	26.1	4.128	5.4	27.3	4.318
-	0.15	5.7	27.7	4.386	5.8	24.0	4.588
L.S.D. at 0.05		N.S.	1.2	0.231	0.2	1.2	0.210

Regardless to P-levels, Aziplex foliar application significantly improved green pod yield per plant as well as per faddan than the control, as shown in both seasons. Increasing levels of Aziplex from 0.05 up to 0.10% did not result in any significant increment in pod yield, however, spraying plants with 0.15% Aziplex significantly increased fresh pod yield per plant as well as per faddan.

Moreover, the effect of interaction between P and Aziplex nutrition on pod yield, showed significant differences but only in the first season (Table,3). Treatments which showed the most favourable effect on green pod yield per plant and per faddan were 32 kg P_2O_5 + 0.15% Aziplex and 64 kg P_2O_5Fad. + 0.10 or 0.15% Aziplex as compared with other treatments. This increase in green pod yield ranged from 35.19 to 46.80% over than the control. The same trend was also noticed in the second season, however variances failed to reach the level of significancy. This result is completely agree with those of Bishop et al. (1976); Midan et al. (1982); El-Neklawy et al. (1985) and El-Sawah et al. (1985) who reported a favourable role of P on fresh and dry seed yield of legume plants. Moreover obtained data showed that spraying the folifertilizer Aziplex without adding P-fertilizer failed to increase the number or weight of green pods per plant or per faddan except whe when plant received the highest level of Aziplex (0.15%) i.e., the role of micronutrients application in the form of Aziplex on plant growth and pod yield was more pronounced in plants received the medium or high level of P-fertilizer. This result is in harmony with those of Hassan (1982); Gabal *et al*. (1984) and Kamel *et al*. (1984). Under the conditions of this work, no deficiency symptoms for micronutrients or P were noticed visually. So, the use of the folifertilizer mixture Aziplex may correct the hidden deficiency expected or at least increase the levels of micronutrients in plant foliage (Table, 2) up more than the adequate level which consequently improved fresh pod yield and its quality.

4. Quality of green pods:

Data on quality of fresh pods (Table, 4) showed that Aziplex and/or superphosphate application increased average pod weight, weight of 100 seeds and netting % of green pods as shown in the first season and the best results were obtained when plants fertilized with 64 kg P_2O_5/fad. and/or sprayed with 0.10% Aziplex. Whereas, number of seeds per pod was not considerably affected by any nutritional treatment, in both seasons. This result may be due to that number of seeds per pod is a genetical character, less affected by environmental factors especially when temperature is favourable for fruit set. However increment in weight of 100 seeds and netting percentage did not reach level of significancy either by P or Aziplex nutrition in second season.

5. Chemical constituents of green seeds:

Data in Table (5) showed that P and K content of green seeds were increased by increasing levels of P and/or Aziplex nutrition. The maximum content was found in plants supplied with high-P 64 kg P_2O_5/Fad. and/or sprayed with Aziplex at 0.10%. Moreover, P-application significantly increased total-N

Table (4): Effect of phosphorus and Aziplex nutrition on quality of green pods of pea during (1986-1987) and (1987-1988) seasons.

Seasons		1986 - 1987				1987 - 1988			
Treatments: P_2O_5 (kg/fad.)	Aziplex %	Average pod wt. (g)	No. of seeds/ pod.	Weight of 100 seeds (g)	Netting %	Average pod wt. (g)	No. of seeds/ pod	Weight of 100 seeds (g)	Netting %
0	0.00	4.2	4.65	43.3	44.0	4.5	4.90	44.5	46.1
0	0.05	4.3	4.75	44.9	46.0	4.7	5.03	46.6	46.8
0	0.10	4.3	4.80	45.6	45.8	4.9	5.20	46.2	46.7
0	0.15	4.5	4.98	45.9	45.3	4.8	5.13	47.2	47.2
32	0.00	4.8	4.88	46.5	45.8	4.8	4.98	45.2	46.8
32	0.05	5.2	5.08	46.8	47.0	5.0	4.93	44.8	47.3
32	0.10	4.7	4.85	45.7	48.0	5.0	4.83	46.3	47.5
32	0.15	5.1	5.15	47.7	48.3	5.0	5.05	45.0	47.1
64	0.00	4.5	5.10	46.7	48.0	4.9	5.10	45.6	47.1
64	0.05	4.5	5.25	45.8	47.5	5.2	5.10	46.1	46.6
64	0.10	5.3	5.48	49.1	48.5	5.2	5.03	45.8	47.4
64	0.15	5.2	5.35	47.7	46.3	5.4	5.08	46.0	47.1
L.S.D. at 0.05		0.4	N.S.	1.7	1.6	N.S.	N.S.	N.S.	N.S.
0	-	4.3	4.79	44.9	45.3	4.7	5.06	46.1	46.7
32	-	4.9	4.98	46.7	47.3	4.9	4.94	45.3	47.2
64	-	4.9	5.29	47.3	47.6	5.2	5.08	45.8	47.0
L.S.D. at 0.05		0.1	N.S.	N.S.	1.3	0.3	N.S.	N.S.	N.S.
-	0.00	4.5	4.87	45.5	45.9	4.7	4.99	45.1	46.6
-	0.05	[illegible]	5.03	45.8	46.8	4.9	5.02	45.8	46.9
-	0.10	4.8	5.04	46.8	47.4	5.0	5.32	46.1	47.2
-	0.15	4.9	5.16	47.1	45.6	5.1	5.18	46.1	47.1
L.S.D. at 0.05		0.2	N.S.	0.9	0.9	N.S.	N.S.	N.S.	N.S.

Table (5): Effect of phosphorus fertilization and Aziplex foliar application on chemical composition of green seeds of pea (based on dry wt.) during 1987-1988 season.

Season		1987-1988			
Treatments		N	P	K	Total carbohydrates %
P_2O_5 (kg/fad.)	Aziplex %	mg/100 g D. Wt.			%
0	0.00	4730	294	2360	30.3
0	0.05	4780	330	2280	31.5
0	0.10	4830	360	2430	32.5
0	0.15	4630	293	2580	34.2
32	0.00	4950	295	2540	34.8
32	0.05	5040	301	2500	35.1
32	0.10	5180	374	2590	30.7
32	0.15	5570	385	2590	33.2
64	0.00	5140	374	2600	33.0
64	0.05	5400	386	2570	32.8
64	0.10	5730	401	2610	34.1
64	0.15	5390	410	2620	34.9
L.S.D. at 0.05		n.s.	37	115	n.s.
0	-	4739	319	2412	32.1
32	-	5185	338	2555	33.4
64	-	5463	392	2600	33.7
L.S.D. at 0.05		370	23	88	n.s.
-	0.00	4942	321	2500	32.7
-	0.05	5075	339	2450	33.1
-	0.10	5242	378	2543	32.4
-	0.15	5285	362	2596	34.1
L.S.D. at 0.05		n.s.	21	66	n.s.

content of green seeds however, total-carbohydrates content was not considerably affected by any of the studied treatments. These results agree with that of El-Niklawy et al. (1985) who found that P application increased P and protein content of pea seeds. On the other hand, these results disagree with Midan et al. (1982) who found that P application decreased P and increased total carbohydrates content of green pea seeds. It was clear that they treated pea plants with both of GA_3 and P and that may explain the opposite trend.

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