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THE INFLUENCE OFAPPLICATION METHODS OF POTASSIUM FERTILIZATION ON GROWTH, PODS YIELD AND ITS QUALITY OF PEA PLANTS

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ABSTRACT

Two field trails were conducted out during the season of 2006/2007 and 2007/2008 to study the influence of soil dressing of potassium fertilizer at rates of 100, 200 and 300 kgs./fed. as potassium sulphate (48.5 % K_2O) as well as foliar application of liquid potassium contained K_2O 36.5 % and sulphure 26.0 % as twice and/or 3 times) on growth, yield and its quality of pea plant.

The important findings are as follows:

1. All plant growth parameters recorded their highest values when pea plants received 300 kgs. /of potassium sulphate. The increments in fresh and dry weight of whole plant over that plants which supplied 100 kgs/fed. amounted by 34.9 and 56.9 respectively in 1st season and by 48.6 and 49.3 % for the same respective in 2nd season. Also that pea plants which received liquid potassium 3 time by 10 day intervals gained the vigor plant growth.
2. Pea plants which fertilized by the highest rate of K (300 kgs./fed.) recorded an increase in total and early pods yield over than that plants received medium and low potassium level. The enhancement in total pods weight amounted by 10.01, 34.4 % in 1st season and by 16.1 and 31.1 in 2nd one respectively.
3. The best physical quality of pea pods expressed as average number/plant length and diameter recorded their highest significant values when soil was dressed by 300 kgs./fed. Of potassium sulphate. Moreover, foliar application of pea plant by liquid potassium 3 times gained the heaviest total and early pods yield as well as its best physical quality of pods.
4. With increasing potassium fertilizer of soil dressing and/or the numbers of liquid spraying gained an increase in the nutritional values of pea pods as expressed by protein and carbohydrate content as well as N, P and K.

INTRODUCTION

Pea (*Pisum sativum*, L.) plant is one of the most important leguminous crops grown in Egypt, which occupies a great figure in the local consumption and export. However, pea plant are relatively sensitive to environment stresses that many occur in the field compared to most vegetable crops which negatively affect its growth, yield and even the quality of pods. Although the pea plant could be growing in different soils, but the mineral soil content greatly affected the growth of pea plant. Among the mineral elements, potassium which play a major role on the plant growth. Generally mineral fertilizer such as potassium could be added through soil dressing and/or as foliar application. Whereas, the addition as solubility soil application many known and/or unknown factors affected the stability and availability of nutritional element such as the irrigation studies, the soil content of other elements, the microbiological media, as well as other

agricultural practices. So many growers going to addition some minerals through the foliar application beside soil dressing as and/or individually.

Generally potassium, present within plants as the cation K^+, plays an important role in regulation of the osmotic potential of plant cells. Also, activates many enzymes involved in respiration and photosynthesis (Marschner, 1995).

In addition it is known that, potassium is one of the most important elements in the plant nutrition. It plays an important role on promotion of enzymes activity and enhancing the translocation of assimilates. Moreover, it increases root growth, improve drought resistance, builds cellulose, reduce loading and control plant turgidity (Edmond *et al*. 1981).

The effect of potassium fertilizer on vegetable plants were studied by many investigators such as Agwah and Mahmoud, 1994 on tomatoes, Ahmed *et al*. 2004, El-Desuki *et al.* 2006; on beans; El-Bassiouny, 2006 and Aisha *et al*., 2007 and Aisha and H.Ali and Taaleb, A.S. 2008;on onion, , Shokr and Fathy, *et al*., 2009on bean. All of them resulted that decreasing potassium fertilizer gained a reduction in the productivity of plant. However, Roesler and Hanyway, 1981; Kassab and El-Zeinym 2004 and Badawy *et al*. 2004 reported that, the foliar application of potassium resulted a favourable effect on plant growth and its yield. On the contrary, El-Shamma, *et al*. 2000; Ahmed *et al*., 2004, Mamoun and Ahmed, 2006 Aisha *et al*. 2007 and 2008; and reported that soil dressing of potassium fertilizer had a great effect on the plant productivity. The aim of present study is to investigate the effect of adding potassium as soil dressing and/or as foliar spraying on growth, yield and its quality of pea plant.

MATERIALS AND METHODS

Two field experiments were conducted during the two successive winter season of 2006/2007 and 2007/2008 at the experimental stastion of agricultural ministry in El-Baramoon farm (Dakahlia Governorate). The aim of these experiments is to study the effect of soil dressing of potassium sulphate (48.5 % K_2O) at rates of 100, 200, 300 kgs/fed. and the foliar spraying with liquid potassium thio sulphate contained K_2O, 36.5% and sulphur 26 % by application twice and/or three times at rate 1.5 cm/L.

The experiment included 6 treatments which were the combination between addition of potassium as soil dressing at 3 rates 100, 200 and 300 kg/fed. and/or as foliar spraying by liquid potassium at level of 1500 ppm (2 and/or 3 times). A split-plot design with three replicates was used where, the 3 soil dressing rates were occupied the main experimental plots, but the foliar application of liquid potassium was distributed within the sub-plots. Pea seeds were seeded during, the first week of November month in the two successive seasons. The seeds sowing were applied on ridges at 70 cm distance and at 30 cm between plants within each ridge potassium liquid treatments were sprayed starting at 30 days old with 10 days intervals. The normal cultural practices were used for the pea production as the recommendation of ministry of Agriculture. Fertilization of N, Phosphours were added as ammonium sulphate 20.5 N % and calcium super-phosphate (15.5 % P_2O_5).

Table (1) : The Chemical and Physical analysis of the experimental soil during 2006/2007 and 2007/2008 seasons.

Soil properties		2006/2007	2007/2008
Physical properties	Texture	Clay	Clay
	Clay %	61.63	60.25
	Silt %	17.85	18.26
	Fine sand %	19.65	20.54
	Coarse sand %	0.87	0.95
Chemical properties	pH	7.6	7.7
	ECd Sm^{-1}	0.9	0.9
	Organic matter	1.81	1.98
	Total available N ppm	76.6	65.8
	Available P (ppm)	15.4	16.8
	Available K (ppm)	54.2	53.9
	SO_4)ppm)	0.41	0.48
	Cl- (ppm)	0.46	0.48
	Na^+ (ppm)	0.68	0.66
	Ng^{++} (ppm)	0.36	0.38
	Ca^{++} (ppm)	0.48	0.49

Five plants were taken randomly from every experimental plot at 60 days after sowing in both seasons. Plant growth expressed as plant length (cm), number of leaves and shoots per plant, as well as the whole fresh and dry weight of pea plant and its leaves and shoots as g/plant were recorded in representative samples.

At harvesting time, the pods were harvested twice in week and total pods weight as ton/fed., were calculated. The number and weight of pods/plant as gram were recorded. Also, the early pods yield (the total pods weight of the two first harvesting) were recorded as tons/fed.

The chemical constituents :

Samples of green seeds were taken for the chemical determination of the elemental nutrition content. Whereas N, P and K were determined according to the procedure described by Pregl (1945), Troug and Mayer (1939) and Brown and Lilleland (1946) respectively. The protein percentage in dry seeds was accounted by multiplying nitrogen content by 6.25.

Carbohydrates were determined according to Dubois et al. (1956) respectively.

Statistical analysis:

All collected data were subjected to statistical analysis of variance of Gomez and Gomez, 1984.

RESULTS AND DISCUSSION

A. Plant growth :

Tables (2 and 3) presented the pea plant growth charactrs as affected by the treatments of potassium fertilization during the two successive seasons of 2007 and 2008. Whereas, all plant growth elements as expressed by length of plant, average number, fresh and dry weight of leaves and shoots as well as the whole fresh and dry weight of pea plant, all of them recorded their highest vigour when the potassium was added as soil dressing

at the highest rate, i.e. 300 kgs. in the form of potassium sulphate (48.5 % K_2O) per feddan. Also, the obtained results showed that, the values of various plant growth parameters gradually higher with increasing the rate of potassium over 100 kgs./fed. The increments in fresh and dry weight of whole plant when added 300 kgs, /fed. Over then that when added 100 kgs amounted by 34.9 and 56.9 % respectively in 1st season and by 48.6 and 49.3 % for the same respective in 2nd season. The statistical analysis of the recorded results showed that the differences within various rates of soil dressing of potassium were great enough to reach the 5 % level of significant in both experimental seasons.

When pea plant treated with liquid potassium as foliar application, the results in Tables (2 and 3) showed clearly that, pea plants which supplied 3 times of potassium spraying gained the vigour plant growth if compared by that plants which received two sprayings, whereas, the tallest plants and that which carried the heaviest shoots and leaves were associated with the higher treating application of liquid potassium. These findings were true with the two experiments of 2007 and 2008.

Generally, in spite of the enhancements in plant growth which above mentioned, but the statistically analysis showed that the all plant growth parameters varied significantly only in 2nd experiment, and for fresh and dry weight of leaves, dry weight of shoots and fresh and dry weight of whole plant in 1st experiment.

The promotion effect of potassium on the characteristics of plant growth might be attributed to that potassium is consider the 3rd element of major importance in plant growth by affecting the synthesis of some metabolism parameters in plant tissues such as carbohydrates and protein as well as their translocation within plant tissues (Ahmed *et al*., 2004). In the same direction many researchers reported that, the potassium fertilizer as general plays a great effect on plant growth of tomatoes (Agwah and Mahmoud, 1994), Jew's Mallow (Ahmed *et al.,* 2004), , onion (El-Bassiouny, 2006; Aisha *et al*., 2007 and 2008) Snap Bean (Shakr *et al.,* 2009).

Concerning the method of potassium application the obtained results of previous researches flactuated, whereas, on onion and Kassab and El-Zeiny, 2004 on faba bean plant and Badawy *et al*. 2004, El-Desuki *et al*., 2006 reported that the foliar spraying of K resulted more vegetative growth than soil dressing, the contrary the obtained data of other investigators leaves that soil dressing of potassium gained more plant growth (Ahmed *et al*., 2004; Moamoun and Ahmed, 2006, Aish *et al.,* 2007 and 2008).

The interaction within applying potassium fertilizer as soil dressing and/or foliar application as affected on the plant growth characters as shown in Tables (2 and 3). Whereas, that pea plant which supplied potassium sulphate at rate of 300 kgs. /fed. and sprayed with potassium as foliar application 3 times by 10 days intervals had the no significant best values of growth parameters except total dry weight of whole plant and its leaves during the 1st season. Generally, the no significant response of the most plant growth measurements might be attribute, to the independant effect of each interaction elements.

B. pods yield and its some physical properties:

Response of total and early pods yield of pea plant to the potassium sulphate levels (100, 200 and 300 kgs./fed.) during the season of 2007 and 2008 are shown in Table (4). The application of potassium sulphate at highest rate resulted the heaviest pods yield. With other means, increasing potassium rate over 100 kgs./fed. Gradually and constant increased total and early pods yield.

The pea plant which received the highest potassium level recorded an increase in total pods yield over than that plants, which supplied by meding and low potassium levels, this increment amounted by 10.1, 34.4 % in 1st season and by 15.1 and 31.1 % in 2nd one respectively.

Respect to the early pea pod yield, the highest level of soil dressing of potassium sulphate caused an enhancement at similar total pods yield. These enhancements over medium and low potassium rate application amounted by 8.8 and 17.8 % in 1st season and by 3.9 and 22.3 % in 2nd one. Moreover, the statistical analysis of the obtained data reveals that the differences within various potassium levels concerning total and early pea pods yield were great enough to reach the 5 % level of significance during the two experimental season.

Regarding to the effect of various soil dressing of potassium levels on some physical properties of pea pods, the results presented in Table (4) show that its response completely followed the same pattern of change like that which mentioned above. Generally, the best physical quality of pea pods, expressed as average numbers/plant, as well as average length and diameter of pods recorded their highest significant values when soil dressed by 300 kgs/fed., of potassium sulphate. These findings are in good harmony during the two experiments of 2007 and 2008.

It could be concluded that, increasing potassium fertilizer as soil dressing up to the level of 300 kgs./fed., of potassium sulphate gained the heaviest yield of total and early pods as well as the best physical quality of pods. These superiority in pods yield and its quality might be attributed to that K as an important nutritional element plays its part in regulating many physiological criteria in the plant which in turn affect the resulted total yield. The following review of literatures of current knowledge about K, many reflect the interest of many workers in studying its mode of action and its role in the production of plant yield. However, one fact must be put in mind is that the provide K to the plant or the soil depends largely on the available reservation of this element in the soil. So, the negative or the positive results may be due to this quantity which stored in the soil.

Generally, the obtained data concerning the effect of potassium fertilizer as soil dressing on the pods yield and its physical quality are in good accordance with that reported by Witty *et al*., 1980 on *Vicia faba*, and El-Shamma 2000 on commen bean, Ahmed *et al*., 2004 on Jew's Mallow, Maamon and Ahmed, 2006 on Fenugreek, El-Bassiouny 2006 and Aisha *et al*., 2008 on onion.

Foliar application of pea plant by liquid potassium 3 times, starting at 30 days old with 10 days as intervals gained the heaviest tonnage of pea pods as total and early if compared with that plants which received twice or one time of foliar application. However, in spite of that superior, but the differences within different application numbers of foliar applicat of liquid potassium were significant only in 1st season for total buds yield and in 2nd season for early pods yield.

Response of the average pods number per pea plant, as well as diameter and length of pods as affected by liquid application of potassium fertilized, the obtained results followed the same pattern of change like that of total and early pods yield in both two experiments.

The interaction treatments had no significant effect on both total or early pods yield during the two experimental seasons. Its means that each two interaction factors act independently.

It could be concluded that, the foliar spraying of pea plant by liquid potassium 3 times gained the heaviest total and early yield as well as the best physical properties of pea pods. The previous studies concerning the behavior of pods yield and its physical quality are in good supporting with the obtained results (El-Habbasha *et al.,* 1996; Badawy *et al*., 2004; Kassab and El-Zeiny, 2004; Shokr *et al*., 2009).

C. Nutritional values of pea pods :

The content of protein N, P, K and total carbohydrates in pea pods tissues significantly responsed by the various rates of potassium sulphate fertilization as soil dressing application. These findings were true completely in 2nd season, but were only for P, K and total carbohydrates contents of 1st season. Generally, it could be showed that, with increasing the addition rate of potassium sulphate above 100 kgs./fed., values of the nutritional elements increased gradually to reach their peaks when 300 kgs./fed. was added. It means the best nutritional values were associated with that plants which received the highest potassium fertilizer rate, but the lowest values obtained with the lowest rate of K fertilizer.

The total soluble solids (T.S.S.) values, followed the same pattern of change like that which mentioned above during two seasons. Whereas, statistically significant differences were recorded with that data for the two experiments.

Table (5) shows regarding to the effect of foliar spraying pea plants by liquid potassium 2 and/or 3 times on the nutritional values of pea pods during the two experimental seasons. However, with increasing number of spraying liquid potassium up 3 times, the values of protein N, P, K and total carbohydrates as well as T.S.S. all of them recorded their superiority than that if spraying two times. Moreover, the statistical analysis reveals that the differences within the two treatments were enough to be significantly for all nutritional elements during the 2nd season, but only for K and total carbohydrates as well as T.S.S. values during the 1st one.

The promotion effect of potassium fertilizer on the nutritional values of pea pods may be due to that potassium is the prevalent cation in plants and involved in maintenance of ionic balance in cells and it bounds ionically to the enzyme pyruvate kinase, which is essential in respiration and carbohydrates metabolism (Edmodn *et al*., 1981). However, the obtained results showed the superior effect of potassium fertilizer on nutritional values of pea pods are in agreement within reported by Agwah and Mahmoud, 1994, Ahmed *et al*., 2004; Badawy *et al*., 2004, Kassab and El-Zeiny, 2004, , El-Bassiony, 2006, El-Desuki *et al*., 2006, Shokr *et al*., 2009, Aisha *et al*., 2008).

It was found That plants of pea which received both potassium fertilizer as soil dressing at 3 rates and sprayed by liquid potassium at 2 application methods had no significant response in all nutritional features in two seasons except the content K in 1st season and protein in 2nd seasons. These results indicate that each factor of the interaction treatments might be act independently.

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تأثرطرق التسميد البوتاسى على النمو والمحصول وجودتة لنبات البسلة

عبـــدالمعطى محمـــد شـــاهين ، فـــاتن ســـمير عبـــدالعال ، احمـــد عبـــدالنبى احمـــد و فاطمة احمد رزق
قسم بحوث الخضر – المركز القومى للبحوث – الدقى - القاهرة

اجريت تجربتان فى محطة التجارب الخاصة بوزارة الزراعة بالبرامون (محافظة الدقهلية) فـى موسـمى ٢٠٠٧/٢٠٠٦ و ٢٠٠٧ /٢٠٠٨ لدراسـة تـأثير اضـافة السـماد البوتاسـى (الاضـافة الارضية بمعدل ١٠٠ ، ٢٠٠ ، ٣٠٠ ك/فدان من سلفات البوتاسيوم والذى يحتوى علـى ٤٨,٥ % اكسيد بوتاسيوم) ، الرش علـى المجموع الخضـرى بالبوتاسيوم السـائل بمعدل ١٥٠٠ جزء /مليون مرتين ، ٣ مرات) علـى النمو والمحصـول وجودة المحصـول النـاتج لنبـات البسـلة **وتضمنت اهم النتائج مايلى :**

١- ادى الاضافة الارضية لسماد البوتاسى فى صورة سلفات البوتاسيوم بمعدل ٣٠٠ ك/ف الـى الحصـول علـى افضـل نمـو لنبـات البسـلة ممثلـة فـى طـول النبـات وعـدد الاوراق والفـروع والـوزن الغض والجـاف للنبـات والاجـزاء المختلفـة .والتسـميد بالبوتاسـيوم السـائل ٣ مـرات بفاصل زمنى ١٠ ايام اعطى نموا خضريا افضل من الرش مرتين .

٢- اعلى محصول كلى اومبكر من قرون البسلة سجل عندما اضيف السماد البوتاسى الارضـى بمعدل ٣٠٠ ك/فدان ، حيث قدرت الزيـادة فـى المحصـول الكلـي بحـولي ١٠,١, ٣٤,٤ % في الموسم الاول مقارنه باضافه ٢٠٠كجم/فدان او ١٠٠ كجم/للفدان على الترتيب ، وكانت هذه الزيادة حوالى ١٦,١ ، ٣١,١ % فى الموسم الثانى بنفس التسلسل السابق .

٣- التسـميد الارضـى للبوتاسـيوم فـى صـورة سـلفات البوتاسـيوم بمعـدل ٣٠٠ ك/فـدان والـرش بالبوتاسيوم السائل (١٥٠٠ جزء /مليون) بمعدل ٣ مرات ادى الـى زيـادة فـى صـفات النمـو الخضرى والمحصول الكلى والمحصول المبكر .

٤- اضافة سماد البوتاسيوم ارضـى بمعدل ٣٠٠ ك/فدان فـى صـورة سلفات البوتاسـيوم اعطـى افضل القيم بالنسبة للصفات الطبيعية (عدد القرون/نبات ، قطر وطول القرن) وكذلك افضـل محصـول مـن البـروتين الكلـى والكربوهيـدرات الكليـة ، ومحتـوى النتـروجين ، الفوسـفور والبوتاسيوم , واوضحت النتائج ايضا ان الرش بالسمادالبوتاسى السائل ٣ مرات افضل من الرش مرتين من حيث الصفات الطبيعية والكيميائية لقرون البسلة .

٥- اوضحت النتائج ان افضل صفات الجـودة الظاهريـة والكيميائيـة لقـرون البسـلة سـجلت حينمـا اضيف سلفات الوبتاسيوم ارضى بمعدل ٣٠٠ ك/فدان والرش بالبوتاسيوم السائل ٣ مرات.

قام بتحكيم البحث

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Table (2): Effect of the application of potassium fertilizers soil dressing and / or foliar spraying on the growth characters of pea plant during 2006 / 2007 season.

Treatments		Plant length	Number of		Fresh weight (g)			Dry weight (g)		
soil dressing (Kgs. /fed.)	Foliar	(cm)	Leaves	Branches	Leaves	Shoots	Total	Leaves	Shoots	Total
100	Twice	62.47	15.93	2.20	19.9	5.79	25.69	6.41	3.25	9.66
	3Times	64.17	23.83	2.50	24.27	7.08	31.35	7.81	4.23	12.03
Mean		63.32	19.88	2.35	22.1	6.43	28.53	7.11	3.70	10.81
200	Twice	66.70	23.97	2.73	27.42	8.28	35.70	9.27	5.10	14.37
	3Times	68.63	24.77	2.85	28.31	8.75	36.06	10.67	5.65.	16.32
Mean		67.76	24.37	2.79	27.80	8.51	35.31	9.97	8.37	15.34
300	Twice	73.23	27.0	2.88	28.80	9.30	37.10	10.91	5.80	16.71
	3Times	80.10	27.3	3.0	29.50	9.50	39.01	11.07	6.30	17.37
Mean		76.67	27.22	2.94	29.10	9.40	39.50	10.99	5.79	16.96
Mean	Twice	67.46	22.3	2.60	25.40	7.78	33.18	8.86	4.66	13.52
	3Times	70.96	25.34	2.70	27.30	8.44	35.74	9.84	5.39	15.23
L. S. D. at 5%	K - Levels	4.64	3.21	.015	0.81	0.73	1.54	1.38	0.47	1.85
	Foliar	N.S	N.S	N.S	1.93	N.S	1.39	0.39	0.32	0.71
	Interactions	N.S	N.S	N.S	N.S	N.S	N.S	0.68	N.S	0.68

Table (3): Effect of the application of potassium fertilizers soil dressing and / or foliar spraying on the growth characters of pea plant during 2007 / 2008 season.

Treatments		Plant length (cm)	Number of		Fresh weight (g)			Dry weight (g)		
Soil dressing (Kgs. /fed.)	Foliar		Leaves	Branches	Leaves	Shoots	Total	Leaves	Shoots	Total
100	Twice	56.77	16.40	2.17	16.40	6.12	22.52	8.20	2.47	10.67
	3Times	64.37	19.60	2.92	19.67	7.78	27.45	9.48	2.78	12.26
Mean		60.57	18.03	2.54	18.03	6.95	24.98	8.84	2.63	11.97
200	Twice	65.10	19.90	3.10	19.90	8.41	24.31	10.90	3.06	13.96
	3Times	69.80	24.80	3.60	24.80	10.17	34.97	12.47	3.63	16.10
Mean		67.45	22.37	3.45	22.37	9.23	31.6	11.68	3.35	15.03
300	Twice	70.7	26.10	3.80	24.90	10.83	35.37	13.03	3.78	16.81
	3Times	72.7	27.30	3.90	27.30	11.16	38.46	13.62	3.83	17.45
Mean		71.70	26.72	3.82	26.13	11.0	37.13	13.33	3.80	17.13
Mean	Twice	64.18	20.81	3.02	20.40	8.45	28.85	10.71	3.1	13.81
	3Times	68.90	23.90	3.51	23.90	9.70	33.60	11.85	3.41	15.26
L. S. D. at 5%	K - Levels	1.11	2.65	0.2	1.04	0.40	1.44	.0.57	0.17	0.74
	Foliar	2.96	2.06	0.32	2.74	0.51	3.25	0.78	0.20	0.98
	Interactions	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

Table (4): Effect of the application of potassium fertilizers soil dressing and / or foliar spraying on the pods yield of pea plant during 2006 / 2007 and 2007 / 2008 seasons.

Treatments		Yield (ton/fed.)		Pods			Yield (ton/fed.)		Pods		
Soil dressing (Kgs. /fed.)	Foliar	Early	Total	No./plant	Length	Diameter	Early	Total	No./plant	Length	Diameter
		First season, 2006 / 2007					Second season, 2007 / 2008				
100	Twice	1.53	5.13	27.7	8.3	1.26	1.40	4.53	22.2	9.57	1.27
	3Times	1.6	6.50	28.37	9.13	1.33	1.64	4.73	23.93	10.1	1.3
Mean		1.57	5.82	28.0	8.78	1.29	1.52	4.69	23.07	9.83	1.28
200	Twice	1.66	6.93	28.81	9.63	1.35	1.73	5.13	25.4	10.7	1.39
	3Times	1.74	7.27	29.33	1027	1.50	1.85	5.33	28.53	10.93	1.41
Mean		1.7	7.1	29.1	9.95	1.42	1.79	5.23	26.97	10.85	1.40
300	Twice	1.82	7.57	30.47	10.53	1.59	1.81	5.93	29.23	11.1	1.43
	3Times	1.89	7.67	30.57	11.2	1.60	1.91	6.21	29.47	11.6	1.47
Mean		1.85	7.82	30.52	10.87	1.60	1.86	6.07	29.35	11.35	1.45
Mean	Twice	1.66	6.54	29.01	9.5	1.39	1.64	5.19	25.6	10.47	1.36
	3Times	1.74	7.14	29.42	10.5	1.47	1.8	5.42	27.31	10.87	1.39
L. S. D. at 5%	K - Levels	0.07	1.05	.034	0.52	0.09	0.17	0.55	.0.47	0.30	0.06
	Foliar	N.S	0.48	N.S	.0.53	0.04	0.07	N.S	N.S	0.20	N.S
	Interactions	N.S	N.S	N.S	N.S	0.06	N.S	N.S	N.S	N.S	N.S

Table (5): Effect of the application of potassium fertilizers soil dressing and / or foliar spraying on some nutritional values of pea pods during 2006 / 2007 and 2007 / 2008 seasons.

Treatments		Protein	%			Carbohydrate	TSS	protein	%			Carbohydrate	TSS
Soil dressing (Kgs./fed.)	Foliar		N	P	K				N	P	K		
		First season, 2006 / 2007						Second season, 2007 / 2008					
100	Twice	19.58	2.70	0.37	1.54	14.63	8.80	15.70	2.51	0.37	1.44	13.4	9.00
	3Times	20.9	2.87	0.38	1.57	14.87	9.03	15.80	2.55	0.39	1.49	13.80	9.17
Mean		17.4	2.78	0.38	1.56	14.75	8.92	15.80	2.53	0.38	1.46	13.60	9.09
200	Twice	18.75	3.00	0.40	1.64	15.37	9.60	16.43	2.62	0.39	1.57	14.37	9.37
	3Times	19.58	3.11	0.41	1.68	15.60	9.90	18.17	2.82	0.40	1.72	14.67	9.60
Mean		19.17	3.07	0.40	1.66	15.48	9.75	17.30	2.72	0.40	1.65	14.50	9.48
300	Twice	20.0	3.20	0.42	1.75	15.80	10.13	18.70	3.03	0.44	1.82	15.47	10.40
	3Times	21.6	3.47	0.42	1.83	15.87	10.60	20.654	3.30	0.46	1.88	15.77	10.70
Mean		20.83	3.33	0.42	1.79	15.83	10.37	19.60	3.17	0.45	1.85	15.62	10.55
Mean	Twice	18.54	2.96	0.39	1.64	15.26	9.51	16.90	2.72	0.39	1.60	14.40	9.58
	3Times	19.72	3.15	0.40	1.69	15.44	9.84	18.20	2.88	0.41	1.69	14.70	9.82
L. S. D. at 5%	K	N.S	N.S	0.02	0.02	0.23	0.31	0.54	0.04	0.02	0.02	0.37	0.22
	2,3	N.S	N.S	N.S	0.01	0.15	0.17	0.25	0.09	0.01	0.04	0.35	0.16
	Interactions	N.S	N.S	N.S	0.01	N.S	N.S	0.42	N.S	N.S	N.S	N.S	N.S

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