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EFFECT OF DIFFERENT LEVELS OF POTASSIUM AND NITROGEN FERTILIZERS ON GROWTH AND YIELD OF SOME SOYBEAN VARIETIES

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ABSTRACT

Two field experiments were carried out in Agricultural Experiments and Research Station, Faculty of Agriculture, Cairo University, Giza Egypt during 2005 and 2006 summer seasons to study the effect of two potassium levels (24 and 48 kg K_2O/fad) and three nitrogen fertilizer levels (15, 30 and 45 kg N/fad) on yield and yield associated traits of four soybean varieties (Giza111, Crawford, Giza 35 and Giza 22). Results indicated that plant height in the first season more than that of the second season, while chlorophyll content, number of pods/plant, weight of pods/plant, seed weight/plant, seed index, harvest index and seed yield/fad in the first season were less than that of the second season . Increasing potassium fertilization levels leads to an increase in all the studied traits for the tested soybean varieties. While, increasing nitrogen fertilization levels lead to increas in plant height, No. of pods/plant, weight of pods/plant, seed weight/plant, seed index and seed yield/fad. Results obtained revealed that there were highly significant differences among genotypes (Giza111, Crawford, Giza 35 and Giza 22) for all the studied characters. Giza 22 gave the highest seed yield/fad, while Crawford gave the lowest one.

INTRODUCTION

Soybean (Glycin max (L.) Merrill) is considered one of the important food and industrial crops on the international level, owing to containing about 30% of cholesterol free oil, and about 40% of protein, which is similar in its nourishing value to the animal protein. The Soy oil is one of the most vegetable oils spread, where is used directly in food, preventing from Blood pressure and Arteriosclerosis, also seeds of Soybean contain the most vitamins that are essential for the body, several countries of the world extract different kinds of foods from Soybean as milk and cheese. The use of Soybean's oil in Egypt had begun from the year 1976, the extraction ratio of oil is about 20.5%, also it is an essential source of protein in the Animal and Poultry feed. Soybean can produce at least twice as much more protein per acre than any other major vegetable or grain crop, 5 to 10 times more protein per acre than land set aside for grazing animals to make milk, and up to 15 times more protein per acre than land set aside for meat production (El-Agroudy *et al.,* 2011).

Currently, Egyptian farmers grow about 23000 faddan with soybean annually which produce about 30 000 ton of seeds (2011) with an average productivity of 1.3 ton/fad. Among the obstacles facing its introduction are the limited cultivated area in Egypt and the competition faces many from the other summer crops such as cotton, rice, and maize. Also, poor Rhizobia nodulation due to unavailability of R. japanicum in the Egyptian soil which alters the leguminous protein-rich plant to be depended completely on soil fertilizers

for providing its height requirement of nitrogen. Special attention should be paid to fertilization due to the contradictory investigation results.

Although it is not a common practice to apply nitrogen (N) fertilizer to soybeans, some researchers speculate that the ability of soybeans to fix atmospheric N is not always adequate for maximum yield. Hence scientists have investigated the effect of N fertilizer on soybean yield and quality. N applications have a positive effect on growth parameters of soybean yield Caliskan *et al*. (2008). Potassium is one of the three major essential nutrient elements required by plants. Unlike nitrogen and phosphorus, potassium does not form bonds with carbon or oxygen, so it never becomes a part of protein and other organic compounds (Hoeft *et al*., 2000). Although K is not a constituent of any plant structures or compounds, it is involved in nearly all processes needed to sustain the plant life. Potassium alone had no significant effect on soybean yield across all rates applied. N., P. and K played an important role in increasing soybean yield. Application of macro and micro nutrients can lead to significantly increased soybean yield Malik *et al*. (2006) and Xiao-hui *et al*. (2009) found differences among genotypes for plant height, chlorophyll content, no. of pods per plant, weight pods per plant, seed yield per plant, seed index, harvest index and seed yield per faddan .

The main objective of this investigation was to study the effect of different levels of potassium and nitrogen fertilizers on growth and yield of some soybean varieties

MATERIALS AND METHODS

Two field experiments were carried out at Agricultural Experiments and Research Station, Faculty of Agriculture, Cairo University, Giza during 2005 and 2006 summer seasons. This investigation aimed to evaluate the effect of different levels of nitrogen and potassium fertilizers on vegetative characters of four soybean, *Glycine max* (L.) varieties (Giza111 “Crawford x Celest”, Crawford “introduced from USA", Giza 35 “Crawford x Celest” and Giza 22 “Forrest x Crawford”).

In the two experiments, the commonly known (Hratii) method of sowing was followed, where the soil was pre-irrigated and the seeds were drilled on one side of the ridge, few days later in the moderately moister soil. The soybean seeds were inoculated before sowing with the recommended strain of Rhizobia (*Rhaizobium japanicum*), which provided by the Ministry of Agriculture, Giza.

Each experiment included different treatments, which were compared between three nitrogen levels (15, 30 and 45kg N/fad) and two potassium levels (24 and 48kg K2O/fad).

Mineral fertilizers were applied before first irrigation in the two successive seasons. The other agricultural practices were applied as recommended for the region.

The experimental design used was a split-split plot with four replicats, in which potassium levels were randomly distributed in the main plots, nitrogen levels in sub-plots and soybean varieties in sub-sub plots. The experimental plots consists of 5 ridges of 60 cm apart and 3.5 m long, then the plot size in both experiments was 3x3.5 meters, which equals 1/400 fad. Soybean

varieties were seeded on 26 May in the first season and 24 May in the second seasons. In the first experiment; soybean was preceded by wheat, while in the second one soybean preceded by alfalfa.

Data recorded:

Vegetation characteristics:

1) Plant height in cm.
2) Chlorophyll content.
3) Number of pods per plant.
4) Weight of pods per plant.
5) Seed weight per plant.
6) Seed index (weight of 100 seed)
7) Harvest index (%)
8) Seed yield/fad.

Statistical analysis:

Data were carried out as randomized complete block designe and analyzed to identify significant effects ($P< 0.05$) and the means were compared by the Least Significant differences (LSD) by SAS program (SAS Institute 1988).

RESULTS AND DISCUSSION

Effects of different levels of potassium and nitrogen fertilizers on vegetative and yield characters of four soybean (*Glycine max* (L.)*)* varieties (Giza111, Crawford, Giza 35 and Giza 22) are presented in Tables (1, 2 and 3).

1) Effects of potassium:

Data in Table 1 showed the average of plant height, chlorophyll content, No. of pods/plant, weight of pods/plant, seed yield/plant, seed index, harvest index and seed yield/fad of soybean varieties after treated with potassium 24 and 48 kg K_2O/fad during 2005 and 2006 successive seasons.

Generally, plant height in the first season (2005) was more than those in the second season (2006), whil chlorophyll content, No. of pods/plant, weight of pods/ plant, seed yield/plant, seed index, harvest index and seed yield/ fad in the second season were more than those in the first season.

Table(1): Effect of two levels of potassium on soybean yield and its components in 2005 and 2006 seasons

Potassium levels	plant height (cm)		chlorophyll content		no. of pods/ plant		pods weight/ plant (g)		seed yield/ plant (g)		seed index SI (%)		Harvest index HI (%)		Yield/fad (kg)	
	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006
24 K2o	90.8	86.2	42.76	45.39	72.20	92.23	32.16	38.56	20.55	24.09	16.89	17.60	30.58	32.47	919	1008
48 K2o	92.9	89.7	43.86	45.23	75.49	97.93	32.30	39.85	22.32	25.39	17.25	17.82	31.48	32.40	1000	1124
Mean	91.8	88.0	43.31	45.31	73.85	95.08	32.23	39.21	21.44	24.74	17.06	17.71	31.03	32.43	960	1066
LSD	ns.	ns.	ns.	ns.	2.61	3.70	ns.	1.30	o.9	0.84	ns.	ns.	ns.	ns.	51.40	84.30

Regarding to K fertilizer effect on soybean yield and its components, the obtained results in Table 1 clarify that potassium application caused increasing in all the studied characters in both seasons.

Results showed that there were no significant differences between the two levels of potassium application for plant height, chlorophyll content, seed index and harvest index in the two seasons (2005 and 2006). However, increasing potassium level from 24 to 48 kg/fad had significant effect on number of pods per plant, weight of pods per plant (2006), seed yield per plant and clearly significant effect on yield per fad in both seasons.

Application of K fertilizer at the rate of 48 kg/fad increased number of pods per plant from 72.2 to 75.49 in 2005 season and from 92.23 to 97.93 in 2006 season. In the other words number of pods/plant increased by 4.6% in the first season corresponding to5.35% in the second season, respectively.

According to the obtained results in Table 1 weight of pods/plant values were showed no differences between two levels of potassium application in the first season, while there were significantly differences between two levels of potassium application in the second season. One of the reasons possibly due to more favorable environmental condition. These results are in the same line with those obtained by Osborne and Riedelle (2006)

AS seen in Table 1 application of K fertilizer at the rate of 48 kg/fad increased significantly seed yield per plant of soybean during the two seasons. The increase in seed yield per plant was 8.6% in the first season corresponding to 5.4% in the second season, respectively.

Potassium level at 48 kg K_2O/fad yielded significantly higher yield/fad 1000, 1123 kg/fad in 2005 and 2006 seasons compared with the level of 24 kg K_2O/fad which gave 919 and 1008 in the two seasons, respectively. The increase was 8.8% in the first season corresponding 11.4% in the second season, as K rate increased from 24 to 48 kg/fad. These results were in agreement with those reported by Hoeft *et al*.(2000), Iqbal *et al*.(2008) and Ying *et al*.(2011) . Furthermore , the obtained results agree with those obtained by Andrews and Svec (1976) who evaluated seed yield and seed quality of soybean with potassium fertilization (0, 56 or 223 kg / ha). They recorded that seed yield was significantly increased in plants received the highest rate of k fertilizer. In addition, William *et al.* (2008) mentioned that potassium is one of the principal plant nutrients underpinning crop yield production and quality determination. Potassium deficiency can lead to reduction in both the number of leaves produced and the size of individual leaves, consequently in yield and quality production.

On the other hand, Xiaohui *et al.* (2009) indicated that N, P and K played an important role in increasing soybean yield of 5 years continuous soybean cropping. Results indicated that the application of potassium alone had no significant effect on soybean yield across all rates applied. However, when combined with N and P soybean yields increased substantially. Potassium induced yield increases may also result from an enhanced resistance of soybean plants to pests, diseases and lodging. More- over, Xiang *et al*. (2012) found that applying K from 0 to 112.5 kg/ha, pods per plant and harvest index remarkably increased.

2)Effects of nitrogen levels on soybean yield and components of soybean varieties:

The effect of three levels of nitrogen fertilizer (15, 30 and 45 kg N/fad) on soybean yield and yield components (plant height, chlorophyll content, No. of pods/plant, weight of pods/plant, seed yield/plant, seed index, harvest index and seed yield/fad) has been demonstrated in Table 2. during the two successive seasons, 2005 and 2006.

In general, yield and yield components of all the tested soybean varieties increased with increasing application of N fertilizer level from 15 to 30 kg N/fad, while increasing nitrogen fertilization levels from 30 to 45 kg N/fad increased some of yield components (plant height, no. of pods per plant, seed index and seed yield per fad) in both seasons.

Data in Table 2 indicated that application of N fertilizer increased significantly plant height of soybean in the two seasons 2005 and 2006. In spite of N fertilizer level 45 kg/fad had higher plant height (94.8 , 92.5cm) in two seasons compared with the other levels, the results showed insignificant differences between 45 and 30 kg/fad level of N application. These results are confirmed with the findings of Bharati *et al*. (1986)Who found that N application only increased plant height. In addition, Nawar and Abdel-Galil (2008) revealed that increasing nitrogen levels (45, 60, and 75 kg / fad) increased plant height of soybean.

Table(2): Effect of different levels of nitrogen on soybean yield and its components in 2005 and 2006 seasons

Nitrogen	Plant height		chlorophyll		no. of pods/		pods weight/		seed yield/		seed index		Harvest index		Yield/fad	
levels	(cm)		content		plant		plant (g)		plant	(g)	SI (%)		HI (%)		(kg)	
	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006
N1(15kgN/F)	87.9	83.4	41.28	44.72	67.04	91.34	29.61	38.44	19.18	23.81	16.63	17.47	32.01	33.03	825	951
N2(30kgN/F)	92.8	88.0	44.86	46.37	76.02	94.66	34.03	39.57	22.33	25.16	17.09	17.81	30.53	31.87	958	1032
N3(45kgN/F)	94.8	92.5	43.79	44.84	78.49	99.24	33.05	39.62	22.79	25.25	17.47	17.85	30.55	32.40	1097	1214
Mean	91.8	88.0	43.31	45.31	73.85	95.08	32.23	39.21	21.44	24.74	17.06	17.71	31.03	32.43	960	1066
LSD(0.5)	4.10	4.50	2.10	1.44	2.19	5.10	2.70	0.70	1.80	0.80	0.20	0.20	ns.	ns.	63.00	62.40

Chlorophyll content was affected by increasing nitrogen levels application from 15 to 30 kg N/fad. Chlorophyll content value reached to 44.86-46.37 in the two seasons with applied of 30 kg N/fad. While increasing nitrogen fertilizer level up to 45 kg/fad caused decreasing in chlorophyll content in 2005 and 2006 seasons. These results are in the same line with the findings of Fayed *et al*.(1986) , Abdel Gawad *et al*. (1989) and Eman (2002) They proved that chlorophyll increased with N application increase.

Results in Table 2 revealed that the application of nitrogen fertilizer at the rates of 15, 30 and 45 kg N/fad increased significantly number of pods per plant during the two seasons. The increase in number of pods/plant was 13.68 and 3.38% in the first season corresponding to 3.64 and 4.84% in the second season, respectively, as N rate increased from 15 kg N/fad up to 30 and 45 kg N/fad . Mandal and Sikder (1999) noticed that soybean pods increased with increasing N rate (0,50 or 100 kg N/ha), while number of pods /plant were greater with N application. In addition, Abd Alla and Omran (2002)compared four soybean gynotypes H15L5, Giza11, Crawford, and Giza

22, for response to nitrogen fertilization 50, 50, and 70 Kg N/ha. They noticed that Giza 22 recorded the highest number of pods per plant. Jain-xin *et al*(2011) stated that application of N increased pods and seeds at any rate.

Data in Table 2 indicated that nitrogen rate had a significant effect on pods weight per plant at 30 kg N/fad in both season, where pods weight per plant increased from 29.61 to 34 03 in the first season and from 38.44 to 39.57 in the second season. While increasing of N rate to 45 kg/fad had insignificant effect on weight of pods per plant in the two seasons. In this regard El -Wahab *et al*. (1984) found that pod weight of soybean increased with increasing of N application. Moreover, Agha *et al*.(2004) recorded that the application of N and inoculation of R. japonicum significantly enhanced grain yield and yield components.

A perusal of Table 2 nitrogen fertilizer significantly affected seed yield/plant. Seed yield/plant was significantly increased with liner increas by N fertilizer application, maximum seed yield per plant were 22.79, 25.25 in 2005 and 2006, respectively, was recorded in 45 kg N/fad does of applied fertilizer. In spite of N fertilizer level 45 kg/fad had higher seed yield/ plant value in two the seasons compared with the other levels, the results indicated insignificant differences between 45 and 30 kg/fad level of N application. Sable and Khuspe (1977) found that application of 30 and 60 kg N/ha to soybeans and / or seed inoculation increased seed yield.

Regarding 100- seed weight (seed index) results showed that nitrogen fertilizer significantly affected 100-seed weight (Table 2). In spite of the results showed maximum seed index 17.47 , 17.85 in the two seasons was recorded in N3 (45 kg N/fad) does applied fertilizer, but there was no significant differences whether applied N2 level (30 kg/fad) or N3 level (45kg/fad) fertilizer. Sable and Khuspe (1977), Tayler *et al*.(2005) revealed that application of N to soybean increased seed index . However, Barker and Sawyer (2005) reported that 100-seed weight is not affected by nitrogen application.

Regarding to nitrogen fertilizer effect on harvest index, data in Table 2 indicated that there were no significant effect among nitrogen levels application for harvest index in the two seasons. In this respect some researches reported that nitrogen applied was not effective on harvest index (Malik *et al*. 2006 and Mehmet OZ 2008). Harvest index values ranged from 30.55% to 33.03% over two years for all treatment combinations.

Data pertaining to seed yield/fad in Table 2 depicted that N fertilizer significantly influenced it, seed yield per fad showed significantly positive response by receiving maximum does of fertilizer. Seed yield/fad was significantly increased with liner increase in applied N fertilizer, numerically maximum seed yield/fad 1097 kg ,1214 kg in 2005 and 2006, respectively, was recorded for treatment receiving N3 (45 kg N/fad) fertilizer.The positive effect of N-fertilizer applications to soybean has been observed in some field investigations, Ogburia *et al.* (1999),Tayler *et al*.(2005),Osborne and Ridell (2006) and Boroomandan *et al*.(2009) They indicated that the growth parameters of cultivars responded positively to N fertilizer application, but not in others Olsen *et al.* (1975), Herridge and Brockwell (1988) and Ying *et al*. (1992).

3) Yield and components of soybean genotypes:

Mean values of 2005 and 2006 seasons for plant height, chlorophyll content, No. of pods/plant, pods weight /plant, seed yield/plant, seed index, harvest index and seed yield/fad obtained from some soybean genotypes (Giza111 , Crawford, Giza 35 and Giza 22) are presented in Table 3. Generally, according to the two years results statistically significant differences for all traits were found.

Data in Table 3 showed differences in plant height among the soybean genotypes and years, and it was lower in 2006. Some of reasons were due to the climatic and soil conditions changing year by year. The obtained plant height values showed that the maximum plant height (101.5) in season 2005 and (92.8) in season 2006 was observed in genotype Crawford, while minimum value (82.4) in 2005 and (83.3) in 2006 was recorded in genotype G111. These results are confirmed with the findings of Lee *et al* (1999), Danee *et al*. (2001), Malik *et al* (2006), and Iqbal *et al* (2008) who found highly significant differences among genotypes for all studied characters.

Table(3): Yiela and its components of different soybean genotypes in 2005 and 2006 seasons

SOYBEAN	plant height		chlorophyll		no. of pods/		pods weight/		seed yield/		seed index		Harvest index		Yield/fad	
GENOTYPES	(cm)		content		plant		plant (g)		plant	(g)	SI (%)		HI (%)		(kg)	
	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006
G111	82.4	83.3	39.88	40.37	73.06	92.44	30.34	37.45	20.37	24.51	17.94	18.52	30.55	32.76	934	1014
Crawford	101.5	92.8	43.52	43.12	59.97	80.58	26.15	35.49	17.86	21.48	16.5	17.02	25.48	29.57	824	889
G35	92.3	88.9	45.39	49.5	80.37	100.62	33.52	39.98	21.91	24.74	16.81	17.59	32.30	32.41	992	1145
G22	91.1	86.9	44.44	48.26	82	106.69	38.91	43.91	25.6	28.23	17.01	17.71	35.78	35	1089	1216
Mean	91.8	88.0	43.31	45.31	73.85	95.08	32.23	39.21	21.44	24.74	17.06	17.71	31.03	32.43	960	1066
LSD	3.43	3.31	1.73	1.44	2.21	3.70	1.40	0.90	0.73	0.72	0.30	0.20	1.86	1.12	62.40	48.40

Chlorophyll content values(Table 3) ranged between 39.88 - 45.39, 40.37- 49.5 in 2005 and 2006 seasons respectively. It was showed that there were significant differences among genotypes in both seasons (Table 3). The highest chlorophyll content was obtained from G35 genotype in both seasons. Similar observations were noted by Malik *et al*.(2007) who revealed highly significant difference among genotypes for chlorophyll content, they added that chlorophyll content ranged from 37.30 to 48.47.

Regarding number of pods per plant. Data in Table 3 showed the highest values 82.0, 106.69 in G22 in 2005 and 2006 followed by G35. While G22 had more pods number per plant than G35 cultivar, the obtained results showed no significant differences for number of pods/plant between the two cultivars. The results are contradictory to the findings of Malik *et al*. (2006) who evaluated different cultivars of soybean and found that there were highly significant differences among genotypes for all characters and recorded that increase in number of pods per plant will ultimately increase the grain yield.

Maximum weight of pods per plant (38.91), (43.91) were observed in genotype G22 in 2005 and 2006, while minimum values (26.2), (35.49) were recorded in genotype Crawford (Table 3). These results are confirmed with the findings of Mehasen and Saeed(2005) who found that Giza 22 recorded significantly higher values for pods weight per plant.

The range of 17.86 – 25.6 g was recorded for seed yield per plant in season 2005, while in 2006 the range of seed yield per plant was 21.48 – 28.23 g. According to the results in Table 3 G22 have higher seed yield per plant than the other genotypes. The results are supported by the findings of Zayed (2007)

As seen in Table 3 100-seed weight (seed index) values ranged from16.5-17.94 ,17.02-18.52 in 2005 and 2006 seasons respectively.100-seed weight showed that there were differences among the genotypes in the two seasons. The highest 100-seed weight values were obtained from G111 followed by G22 in 2005 and 2006. Differences observed for 100-seed weight among the soybean varieties were probably related to genetic variation and ambient conditions. The obtained 100-seed weight values were similar to those reported by Malik *et al*. (2006)

As shown in Table 3 harvest index values showed highly significant differences among genotypes. Harvest index ranged between 25.48- 35.78 among different genotypes in the first season and between 29.57- 35.0 in the second one. According to the results the highest harvest index value was obtained by, G22 followed by G35 in two seasons. While the lowest value was obtained by Crawford genotype. The obtained results corroborates with the findings of Pedersen and Lauer (2004) who reported that the harvest index varied among soybean genotypes.

According to Table 3, yield per fad (Y/F) values were ranged between 824-1089 kg/fad, and between 889 -1216 kg/fed in 2005 and 2006 respectively. Yield per fad showed differences among soybean genotypes and year, it was lower in 2005. Some of the reasons were climatic and soil condition changing year by year. According to results, G22 and G35 have higher seed yield than other genotypes. These two soybean genotypes can be recommended for Egyptian farmers. Ruhul Amin *et al*. (2009) Found that seed yield varied significantly among varieties of soybean. The obtained results agree with those obtained by Danee *et al*.(2001), Malik *et al* (2006), and Iqbal *et al* (2008)who found highly significant differences among genotypes for all the studied characters(chlorophyll content,plant height, number of pods per plant,100-seed weight and grain yield).Furthermore, Mehasen and Saeed(2005) found that Giza 22 recorded significantly higher values for weight pods per plant, seed weight per plant,100-seed weight, and seed yield per faddan compared with G111.

REFERENCES

Abd-Alla, A .A. and Omran, M. M. (2002): Response of four soybean genotypes to nitrogen fertilization levels and plant population. Annals Agric. Sc., Moshtohor; 40(1): 93-105.

Abdel Gawad,.A.A; Ashour, N.I; Saad, A.O.M; Aboshetta, A.M and Ahmed, M.K.A (1989) The insignificant importance of late nitrogen fertilization on the yield of soybean (Glycine max L.) in Egypt. : Annals of Agric. Sci Cairo 1989; 33(1): 249-260 .

Agha, S. K.; Oad, F. C. and Buriro, U. A. (2004): Yield and yield components of inoculated and un-inoculated soybean under varing nitrogen levels. Asian J. of Plant Sci(2004) 3 (3): 370 – 371.

Andrews, A.K and L.V. Svec (1976): Pod and leaf photosynthesis and disease incidence in soybean (Glycine max (L.) Merr.) with potassium fertilization. Communications in Soil Sci and Plant Analysis. 1976; 7(4): 345-363

Barker DW, Sawyer JE (2005). Nitrogen application to soybean at early reproductive development. Agro J. 97: 615-619.

Bharati, M.P; Whigham, D.K and Voss, R.D. (1986): Soybean response to till age and nitrogen, phosphorus, and potassium fertilization. Agron J. 1986; 78(6): 947-950

Boroomandan, P. ; M. Khoramivafa ;Y.Haghi and A.Ebrahimi(2009): The effect of Nitrogen starter fertilizer and plant density on yield, yield components and oil and protein content of soybean (Glycine max (L.) Merr). Pakistan J. of Bi Sci (2009) Vol. :12 Issue : 4 Page No. 378 – 382 .

Caliskan , S; Ozkaya,I; Caliskan, M. E; Arslan, M (2008)The effect of nitrogen and iron fertilization on growth ,yield and fertilizer use efficiency of soybean in a Mediterranean type soil . Field Crop Res Volume 108 Issue 2, 23 Aug 2008 : 126 – 132 .

Danee, M.; Ahmadi, MR. and Grami, A. (2001): Cluster analysis of varieties Iranian soybean collection and computing the re-lative discriminate functions. Iranian J. of Agric Scences. 2001, 32: 2, 285 – 293

El-Agroudy, N.; S. Mokhtar; E. A. Zaghlol and M. El Gebaly (2011): An economic study of the production of soybean in Egypt. Cairo, Egypt. Agric. Biol. J. N. Am., 2 (2): 221-225.

El-Wahab, M.A.A; Yousef, M.A; Hussein, T.A and El-Sherbiny, A.A. (1984): Development of pods in soybean as influenced by sowing dates, nitrogen fertilization levels and its time of application. : Annals of Agric Sci, Moshtohor. 1984; 21(1): 113-140

Eman, S.S. (2002): Response of growth, yield and attributes of soybean plants (Glycin max (L.) Merr.) to late soil nitrogen fertilization. Arab Universities Journal of Agric Sci. 2002; 10(1): 165-172

Fayed, M.T; Mostafa, M.T; Abdrabou, R.Tand Osman, A.M.(1986) Nitrogen content and photosynthetic pigments in soybean cultivars as affected by nitrogen fertilization. Annals of Agric Sci, Moshtohor. 1986; 24(3): 1281-1297 .

Herridge DF, Brockwell J (1988). Contributions of fixed nitrogen and soil nitrate to the nitrogen economy of irrigated soybean. Soil Biol. Biochem. 20: 711-717.

Hoeft, R. G.; Nafziger, E. D; Johnson,R. R. and Aldrich,R. (2000): Modern corn and soybean production, MCSP Publications, USA, pp 353.

Iqbal,Z.;Arshad,M.;Ashraf,M.;Mahmood,T.andWaheed,A.(2008) Evaluation of soybean(Glycine max(L.) Merrill) germplasm of some important morphological traits using multivariate analysis.Pakistan J. Botany 40 (6): 2323-2328

Jain-xin, Z.; Rong, S. ; Hong, S. C;Guany,lu (2011): Nitrogen effects vertical didtribution of yield components of high yield soybean. Soybean Sci 2011-3

Lee – Sungkyu; Choi – Il; You - JaeYeul; Lee – SK; Choi – I; You – JY (1999) Comparison of growth characteristics and yield of soybean varieties grown as green forage . J. of the Korean Society of Grassland Sci . 1999, 19 : 4, 309 - 316 .

Malik, M. F. A; Ashraf,M ; Qureshi, A. S. and Abdul Ghafoor, (2006). Utilization of diverse germplasm yield improvement. Asian J. Plant Sci, 5 (4) : 663- 667.

Malik, M. F. A; Ashraf,M ; Qureshi, A. S. and Abdul Ghafoor, (2007): Assessment of genetic variability, correlation and path analyses for yield and its components in soybean. Pak. J. Bot., 39 (2): 405- 413 (2007)

Mandal, R. and Sikder, B.C. (1999): Response of soybean to nitrogen and sulphur fertilization in saline soil. J. Phytological Res., 12(1/2): 31-34.

Mehasen,-S-A-S; Saeed,-N-A (2005) : Effect of mineral nitrogen, farm yard manure and bacterial inoculation on two. Annals of Agric Sci, Moshtohor. 2005; 43(4): 1391-1399 .

Mehmet OZ (2008) :Nitrogen rate and plant population effects on yield and yield components in soybean. African J. Biotechnology. Vol. 7 (4): 4464- 4470 (2008).

Nawar, F.R.R. and Abdel-Galil, A.M. (2008): Effect of tillage systems and nitrogen fertilization on yield and yield components of intercropped soybean to sunflower in calcareous soils. Annals Agric. Sc., Cairo, 53(1): 145-156.

Ogburia, M.N.; Atabaeva, H.N. and Hassanshin, R.U. (1999): Evaluation of varietal response of soybean (Glycine max L. Merrill) to nitrogen (N) fertilization in Tashkent, Central Asia. Acta Agronomica Hungarica, 47(3): 329-333.

Olsen, F. J.; G. Hamilton and D. M. Elkins (1975): Effect of nitrogen on nodulation and yield of soybean. Exper Agric, 11: 289-294.

Osborne,-S-L; Riedelle,-W-E (2006): Starter nitrogen fertilizer impact on soybean yield and quality in the northern Great Plains. Agron J. 2006; 98(6): 1569-1574 .

Pedersen,P. and Lauer, G.J. (2004): Response of soybean yield com ponents to management system and planting date. Agron. J. 96: 1372-1381 (2004).

Ruhul Amin,A.K.M. ; Jahan, S.R.A. and Hasanuzzaman,M. (2009): Yield components and yield of three soybean varieties under different irrigation management. American- Eurasian J. of Scientific Res 4 (1) : 40-46 (2009).

Sable, R.N. and Khuspe, V.S. (1977) : Response of soybean (Glycine max (L.) Merrill) variety Clark-63 to application of bacterial culture, nitrogen and phosphate fertilization. J. Maharashtra, Agric. Univ.; 2 (1): 65-67.

SAS Institute (1988): SAS/STAT User`s Guide, Ver. 6.03. SAS Institute Inc., Cary, North Carolina.

Taylor RS, Weaver DB, Wood CW, van Santen E (2005). Nitrog application increases yield and early dry matter accumulation in lateplanted soybean. Agron. J. 45: 854-858

William, T.; S. W. Pettigrew and S. A. Schjorring (2008): Potassium influences on yield and quality production for maize, wheat, soybean and cotton. Physiologic plantarum, 133 (4): 670- 681.

Xiang,D. ;Tai-wen, Y. ;Wen-yu, Y. ; Yan-wan ; Wan-zhao, G.;Liang,C. and Ting (2012) : Effect of phosphorus and potassium nutria tion on growth and yield of soybean in relay strip intercropping system. Scientific Res and Essays 2012 Vol. 7 (3) : 342 - 351

Xiao-hui, L.; H. Xiao-zeng and J. Yan (2009): Effect of fertilization yield of soybean in rotation and continuous cropping in Northeast China. The Proceedings of the International Plant Nutrition XV1, UC-Davis.

Ying JF, Herridge DF, Peoples MB, Rerkasem B (1992). Effects of N fertilization on N2 fixation and N balances of soybean grown afte lowland rice. Plant Soil 147: 235-242

Ying, L.; Ming-yi, Z. ; Guang, H. ;Wei, W. ; Yu-ying, LI; Shuang-quan, L. ; Jing-hong, J. And Yu-xin, T. (2011): Effect of potassium on soybean leaf protective enzymes and yield under drought stress. Soybean Sci 2011 – 02.

Zayed, M. E. (2007) : Improvement of soybean plants by genetic engineering technology. Ph.D. Thesis, Fac. Agric., Minufyia Univ. , Shebin El Kom, Egypt.

تأثير مستويات مختلفة من البوتاسيوم والنيتروجين علي نمو ومحصول بعض أصناف فول الصويا

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أجريت تجربتين حقليتين في محطة التجارب والبحوث الزراعية ، كلية الزراعة ، جامعة القاهرة، الجيزة مصر خلال عامى 2005 و 2006 لدراسة تأثير مستويين من أسمدة البوتاسيوم (24 و 48 كجم بو 2أ/ فدان) وثلاث مستويات من النيتروجين (15و30 و45كجم ن/ فدان) على مكونات محصول فول الصويا لأربعة أصناف (جيزة 111، كروفورد .جيزة 35 ، وجيزة 22).

أشارت النتائج إلى ان ارتفاع النبات فى الموسمالأول كانت أكثر مما كانت عليه في الموسم الثانى (2006). بينما كان محتوى الكلوروفيل وعدد القرون/ نبات و وزن القرون /النبات و محصول النبات ودليل البذره ودليل الحصاد و محصول الفدان في الموسم الاول اقل مما كان عليه في الموسم الثاني . زيادة مستويات التسميد البوتاسيوم ادي إلى زيادة في كل مكونات فول الصويا في جميع الأصناف تحت الدراسه. عند زيادة مستوي التسميد النيتروجيني من 15 الي 30 كجم ن /الفدان ذادت كل مكونات فول الصويا في جميع الأصناف التي تم اختبارها، في حين ان زياده مستوي التسميد النيتروجيني من 30 الي 45 كجم ز/ الفدان أدي الي الزياده في بعض الصفات دون اخري. كما اشارت النتائج الي وجود فروق معنوي بين جميع الاصناف تحت الدراسه في جميع الصفات المدروس.وخلصت النتائج الي ان الحصول علي اعلي محصول من البذور للفدان عند زراعه الصنف جيزه 22 مع التسميد 30 كجم ن و48 كجم بو2 أ/فدان .

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