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EFFECT OF PLANT DENSITY, PHOSPHORUS AND NITROGEN FERTILIZATION LEVELS ON YIELD AND ITS COMPONENTS OF LUPIN

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ABSTRACT

Two field experiments were carried out at the Agric. Exp. and Res. Stat., Fac. Agric., Cairo Univ., during 2004/2005 and 2005/2006 seasons to study the effect of three plant densities (33 , 44 and 55 plants/m^2), three phosphorus levels (15.5 , 31 and 46.5 kg P_2O_5/fed) and three nitrogen levels (25 , 40 and 55 kg N/fed) on yield and its components of lupin (Giza 1). The main effects could be summarized as follows:

The results revealed that the lowest density i.e. 33 plants/m^2 gave significantly the highest number of branches and pods/plant, seed yield/plant and seed index , but the shortest plants with the fewest number of seeds/ pods and the lowest averages of seed yield/fed and seed protein content.

Increasing phosphorus from level 15.5 to 46.5 kg P_2O_5/fed increased yield and its components. The seed yield/fed was increased as applied P_2O_5 level was increased up to the highest level i.e. 46.5 kg P_2O_5/fed. Adding phosphorus at a level of 46.5 kg P_2O_5/fed increased seed yield/fed over the plants fertilized by 15.5 or 31 kg P_2O_5/fed levels by 20.23 and 3.89 %, respectively as average of the two seasons.

Increasing nitrogen from 25 to 55 kg N/fed increased all studied components. Application of 40 kg N/fed increased seed yield/fed., over the 25 kg N/fed level by 39.72 % where the further increase of N level caused insignificant increase in seed yield/fed.

The interaction between the three studied factors had significant effects on seed yield/plant and per feddan in both seasons. The highest significant seed yield/fed was recorded from sowing at plant density of 55 plants/m^2 and fertilization with 31.0 kg P_2O_5/fed and 40 kg N/fed.

Keywords: Lupin (*Lupnus termis*, L), plant density, phosphorus and nitrogen fertilization.

INTRODUCTION

Lupin (*Lupnus termis*, L.) seeds have been used for human usage because of its high protein content. The efficiency of plant canopy to intercept solar energy and accumulate photosynthates increase as the soil coverage increased. This is quite expected since utilization of edaphic and aboveground environmental factors in below competition limits. Plant density, N and P fertilization are among factors affecting considerably soil coverage.

Previous studies have shown that plant density is an important factor affecting yield and yield components of lupine (Clapham and Elbert-May, 1989). Increasing plant density in lupin decreased some morphological characters such as number of branches and pods, weight of pods and seeds/plant, dry matter/plant and seed index (Herbert, 1977; Abo- Shetaia, 1990; HobAllah *et al*., 2001 and Mokhtar,2002).Sharief (1997) reported that increasing plant population density to 140000 plants/ fed significantly decreased stem diameter, number of branches, pods, seeds per plant and seed yield per plant and significantly increased plant height and seed yield/ fed. On the other hand, higher densities increased seed yield/fed (Abo-Shetaia, 1990; Lopez-Bellido *et al*., 2000; Hob-Allah *et al*., 2001 and Mokhtar, 2002).

Phosphorus plays a vital role in the metabolism of the cell, protein synthesis, photosynthesis and other catabolic pathways (Bieleski, 1973). Many investigators have examined the response of the lupin to P fertilizer. Abo-Shetaia (1990) observed that the number of seeds/pods and branches/plant were increased with increasing the level of P_2O_5 and reached the maximum values at 46.5 kg P_2O_5 /fed. Also, Hussein and El- Zeiny (1990) found that phosphorus application up to 48 kg P_2O_5/fed increased growth, number of pods, weight of seeds/plant and weight of 100 seeds. Mousa (1990) showed that phosphorus application up to 31 kg P_2O_5 /fed significantly increased plant height, number of branches, number of pods, number of seeds, seed yield/plant and seed yield/fed. Abdel-Mottaleb (1997) stated that the phosphorus application up to 46.5 kg P_2O_5/fed increased all yield characters. Sharief *et al*. (1997) reported that increasing phosphorus fertilizer rates up to 31 kg P_2O_5/ fed increased plant height, stem diameter, number of branches and pods per plant, 100- seed weight, seed yield per plant and feddan. Hafiz and El-Kholy (2000) and Mokhtar (2002) reported that increasing phosphorus from 15.5 to 31 kg/fed increased lupin yield components and seed /fed.

Nitrogen is an essential element for plant growth as it is a constituent of all proteins, nuclei acids and hence of the protoplasm (Russel, 1973). Concerning the effect of N fertilization, previous studies showed increases in seed yield/fed and yield components of lupin crop due to N fertilization (Abo-Shetaia, 1990; El- Zeiny, 1990; Adams and Pate, 1992; Bolland, 1995; El-Far *et al*., 2001; Hob Allah *et al.*, 2001 and Mokhtar, 2002). Increasing nitrogen from 30 to 45 kg N/fed increased yield components. Whereas, adding nitrogen fertilization at a rate of 45 kg N/fed increased seed yield/fed over the plants which fertilized by 30kg and 60 kg N /fed by 190 and 100 kg/fed, respectively.

The present study was carried out to find out the effect of planting density and the level of P and N fertilization on lupin yield and some its components.

MATERIALS AND METHODS

The present study was carried out at the Agric. Exp. and Res. Stat., Fac. Agric., Cairo Univ., Giza, during 2004/05 and 2005/06 seasons to study the effect of plant density, phosphorus and nitrogen fertilization levels on yield and yield components of lupin cv. Giza 1.

The soil of the experimental site was clay loam in texture. Values of pH, organic matter %, available nitrogen (ppm) and phosphorus (ppm) were 7.8, 1.9, 48 and 16.1, respectively. The preceding crop was maize in both seasons.

The experimental design was split- split- plot with three replications. The main plots were specified for plant density treatments (33, 44 and 55 plants/ m^2). The sub- plot was assigned to three levels of $P_2 O_5$ (15.5, 31 and 46.5 kg $P_2 O_5$/fed). The levels of nitrogen fertilization (25, 40 and 55 kg N/fed) were randomly distributed in sub- sub plots. The experimental unit consisted of 5 ridges, 4m long and 0.60 m width (12 m^2). The three plant densities (33, 44 and 55 plants/ m^2) were achieved through varying the spaces between hills (20, 15 and 12 cm) on both sides of the ridge.

Seeds of Egyptian lupin cv. Giza 1 were planted on November 18^{th} and 24^{th} in the first and second seasons, respectively. Nitrogen was added as urea (46.5 % N) at 25 days from sowing. Calcium superphosphate (15.5 % $P_2 O_5$) was applied before sowing in both seasons.

At harvest, ten plants were randomly sampled from each sub-plot to determine plant height, number of branches /plant, number of pods/plant, number of seeds/pod, 100- seed weight and seed yield/plant. Seed yield in kg was determined form the whole area of each experimental unit and then adjusted to yield per feddan. Seed nitrogen content was determined using the micro-kjeldahl's method apparatus. The seed protein content was calculated by multiplying seed nitrogen content by 6.25 according to A.O.A.C. (1990).

All data were statistically analyzed according to Steel and Torrie (1980) and means were compared by LSD test at 5% level of significance.

RESULTS AND DISCUSSION

A. Effect of plant density:

The results in Table 1 showed that plant density significantly affected plant height and branching in both seasons. Increasing plant density from 33 up to 55 plants/m^2 increased plant height but decreased branching. Such effect may be due to mutual shading among dense sown plants and hence a possible increase in the proportion of invisible solar radiation which has an elongating effect on crop plants (Chang, 1974). Dense sown plants are, always, forced for an apical dominance where their pushing up growth is against branching. This explains the decrease in the number of branches/ plant caused by the increase of plant density. These results are in general agreement with those obtained by Abo-Shetaia (1990), El- Morsi and Osman (1991), Sharief (1997), Lopez – Bellido *et al.* (2000) and Mokhtar (2002). However, HobAllah *et al*. (2001) found that dense population did not affect lupin branches per plant.

Increasing number of plants/unit area decreased the number of pods/plant where the greatest number of pods/plant was obtained with 33 plants/m^2 in both seasons (Table 1). It seems evident that planting lupin at lower density (33 plants/m^2) through the increase of distances between plants might have favored them better use of soil and other environmental resources which in turn increased the number of well developed pods/ plant. Similar results were reported by Abo-Shetaia (1990), El- Morsi and Osman (1991), Sharief (1997), HobaAllah *et al*. (2001) and Mokhtar (2002). Regarding the number of seeds /pod, results in Table 1 showed that this number was increased due to the increase of plant density. This could be attributed to the decrease of the number of pods/ plant caused by dense planting. Similar results were reported by HobAllah *et al*. (2001). On the other hand, Mokhtar (2002) found that number of seeds/pod was increased with decreasing plant density. Whereas Lopez- Bellido *et al* (2000) reported that plant density had insignificant effect on the number seeds/pod. Finally, the lowest values of seed index and seed yield/plant were obtained from the highest plant population (55 plants/ m^2). This may be due to the decrease in number of branches and hence number of pods per plant as a result of increasing the number of plants per unit area. Which increased the number of seeds per pod and led to a greater competition among seeds for photosynthatec. This intra-seed competition decreased the seed index. The decrease in number of pods/ plant certainly caused a significant decrease to the seed yield/ plant. These results are in general agreement with those obtained by Herbert (1977), Abo-Shetaia (1990), El- Morsi and Osman (1991), HobAllah *et al* (2001) and Mokhtar (2002).

Results in Table 1 showed that seed yield/ fed was significantly increased with increasing plant density indicating that the increase in number of plants/m^2 could compensate the reduction in number of branches and pods, seed index and seed yield/plant. Increasing plant density from 33 through 44 to 55 plants/m^2 increased seed yield/fed from 647.39 to 763.30 and 889.87 kg, respectively as averages of both seasons. Such increases in seed yield/fed at the higher population densities was mainly due to more number of plants per unit area at harvest. Abo- Shetaia (1990), El- Morsi and Osman (1991), Shield *et al* (1996), Sharief (1997), HobAllah *et al*. (2001) and Mokhtar (2002) reported that seed yield of lupin unit area was increased with increasing plant density. Results in Table 1 cleared that increasing plant density caused significant increase in seed protein content which may be associated with decreased seed yield per plant.

Table 1: Effect of pant density on some agronomic traits, seed yield and seed protein content of lupin in 2004/ 05 and 2005/ 06 seasons.

Plant density (Plants/ m^2)	Plant height (cm)	Branches/ plant (No)	Pods/plant (No)	Seeds/ pod (No)	100-seed weight (gm)	Seed yield/ plant (gm)	Seed yield (kg/ fed)	Seed protein content (%)
2004 / 2005 season								
33	91.0	4.1	16.5	3.1	35.0	12.2	655.9	28.2
44	94.0	3.6	13.0	3.6	33.0	10.7	771.6	30.6
55	108.3	2.2	10.5	3.8	28.8	7.9	899.9	31.3
LSD at 0.05	4.4	0.4	0.5	0.1	0.9	0.4	16.4	0.6
2005 / 2006 season								
33	95.2	4.5	15.8	3.3	35.5	11.7	638.8	28.7
44	104.1	4.2	12.3	3.9	33.5	10.2	755.0	31.2
55	112.3	2.7	9.7	4.1	29.4	7.3	879.7	36.8
LSD at 0.05	3.9	0.2	0.5	0.2	0.8	0.4	19.7	0.3

B. Effect of phosphorus level:

The results in Table 2 showed that plant height, seed yield/fed and its components and seed protein content were significantly increased with increasing P levels from 15.5 to 46.5 kg P_2O_5/fed in both seasons, except number of branches/ plant in the second season. Fertilizing with 46.5 kg P_2O_5 /fed gave the highest number of pods/plant, number of seeds/pods and heavier seed weight/plant and seed index than those fertilized by 15.5 or 31 kg P_2O_5/ fed. Phosphorus fertilization enhances growth of plants, pod setting and seed filling. This might interpret the increase in weight of seeds/plant and account for good seed filling and subsequently higher seed index.

Table 2: Effect of phosphorus levels on some agronomic traits, seed yield and seed protein content of lupin in 2004/ 05 and 2005/ 06 seasons.

P levels (kg P_2O_5/fed)	Plant height (cm)	Branches /plant (No)	Pods/ plant (No)	Seeds/ pod (No)	100- seed weight (gm)	Seed yield/ plant (gm)	Seed yield (kg/fed)	Seed protein content (%)
2004/05 season								
15.5	95.2	3.1	11.2	3.4	31.6	8.6	692.4	29.4
31	97.6	3.3	13.6	3.5	32.2	10.4	797.5	30.0
46.5	100.6	3.5	15.3	3.6	33.0	11.8	837.7	30.8
LSD at 0.05	1.0	0.1	0.3	0.1	0.5	0.4	33.8	0.3
2005/06 season								
15.5	100.7	3.7	10.9	3.6	32.2	8.2	677.2	29.8
31	103.7	3.8	12.8	3.8	32.8	9.9	787.4	30.4
46.5	107.4	3.9	14.1	3.9	33.5	11.1	809.0	31.4
LSD at 0.05	2.0	n.s	0.3	0.1	0.4	0.4	32.7	0.2

The stimulatory effect of phosphorus plays a role in enhancing metabolic processes such as photosynthesis, starch synthesis, glycolysis and synthesis of fats and proteins.

Also, phosphorus at a level of 45.6 kg P_2O_5 /fed significantly increased seed yield/fed comparing with 15.5 or 31 kg P_2O_5 /fed levels by 20.99 and 5.04% in the first season and by 19.46 and 2.74% in the second season, respectively (Table 2). This may be attributed to phosphorus favorable effects on nodulation and plant growth as expressed in plant height and number of branches/ plant which in turn increased pods/ plant, number of seeds/ pod, 100- seed weight and seed yield/ plant. Such
results are supported by those of Moursi *et al.* (1976), Abo-Shetaia. (1990), Hussein and El-Zeiny (1990), Mousa (1990), Abdel- Mottaleb (1997), Sharief *et al*. (1997), Hafiz and El-Kholy (2000) and Mokhtar (2002). Also, the highest values of seed protein content was produced by applying 46.5 kg P_2O_5 /fed. The increase of seed protein content by applying phosphorus may be due to the role of phosphorus in plant metabolism where phosphorus is considered as a part of molecular structure of DNA and RNA forms. These results are in agreement with those obtained by Hafiz and El-Kholy (2000).

C. Effect of nitrogen level:

Results in Table 3 showed that yield and its components and seed protein content were significantly affected by nitrogen fertilizer level in both seasons. The results demonstrated that there was a progressive and consistent increase in number of branches and pods/plant, number of seeds/ pod, seed index and seed yield/plant significantly with increasing level of nitrogen from 25 to 55 kg N/fed. The increases in number of pods/plant may be due to the favorable effect of nitrogen on pod set. The increases in number of seeds/pod might owe much to the increase in the rate of photosynthesis due to the increase in the amount of metabolites synthesized by plant and this in true might furnished enough photosynthates to face the requirements of greater number of seeds/pod. Seed index and seed yield/plant became greater with adding 55 kg N/fed. This may be due to higher dry matter accumulation and hence partition to seeds associated with addion of 55 kg N/fed and this resulted in a significant increase in seed weight. These results agreed with those of Abo- Shetaia (1990), El- Zeiny (1990), Adams and Patc (1992), El- Far *et al*. (2001) and Mokhtar (2002).

For seed yield, data revealed that increasing N level up to 40 kg N/fed caused insignificant increase in seed yield/fed in both seasons.
However, the further increase of N level to kg N/fed did not add a further significant increase in this respect. These increases amounted to 38.78 and 0.51 % in the first season and to 40.66 and by 1.80 % in the second season, respectively (Table 3). The increases in seed yield/fed were due to the increases in number of pods/plant, number of seeds/pod, 100-seed weight and seed yield/plant. These results are in agreement with those obtained by Abo- Shetaia (1990) and Mokhtar (2002). Seed protein content was significantly increased with increasing the level of nitrogen fertilization in both seasons (Table 3). The highest percentages of seed protein were recorded with 55 kg N/fed application. These results may be due to the favorable effect of nitrogen on plant growth and total N in seeds. Similar trend was recorded by Abo- Shetaia (1990) and El- Far *et al* (2001) who reported that protein content in lupin seeds was increased with increasing N fertilizer level.

Table 3: Effect of nitrogen levels on some agronomic traits, seed yield and seed protein content of lupin in 2004/ 05 and 2005/ 06 seasons.

N levels (kg / fed)	Plant height (cm)	Branches /plant (No)	Pods/plant (No)	Seeds/ pod (No)	100-seed weight (gm)	Seed yield/ plant (gm)	Seed yield (kg/ fed)	Seed protein content (%)
2004/05 season								
25	96.0	3.1	11.0	3.4	31.7	8.7	617.6	29.5
40	98.1	3.3	14	3.5	32.3	10.4	852.8	30.0
55	99.4	3.5	15.1	3.7	32.9	11.6	857.1	30.7
LSD at 0.05	0.7	0.1	0.3	0.1	0.3	0.2	19.5	0.3
2005/06 season								
25	99.5	3.5	10.2	3.6	32.3	8.2	600.1	30.0
40	102.8	3.8	13.3	3.8	32.8	9.9	829.3	30.5
55	109.4	4.0	14.3	3.9	33.4	11.1	844.2	31.1
LSD at 0.05	1.5	0.2	0.2	0.1	0.4	0.2	19.8	0.3

D. Effect of significant interactions:

D.1- Plant density × phosphorus levels interaction:

The results in Table 4 revealed that plant height in the first season and number of pods/plant and seed yield/fed in both seasons were significantly influenced by the interaction between plant density and P fertilization levels. Planting with the plant density with 55 plants/m^2 and fertilization by 46.5 kg P_2O_5 /fed gave the tallest plants whereas, the shortest plants were obtained from the plant population density of 33 plants/m^2 and fertilization with 15.5 kg P_2O_5 /fed. Maximum number of pods/plant and seed yield/plant were obtained from using plant population of 33 plants/m^2 and fertilization using 46.5 kg P_2O_5 /fed. In contrast, sowing with 55 plants/m^2 and fertilization of 15.5 kg P_2O_5 /fed gave the lowest number of pods/plant and seed yield/plant in both seasons.

Table 4: Effect of the interaction between plant density and phosphorus level on pods/plant and seed yield/plant in 2004/05 and 2005/2006 seasons and plant height in the first season.

Plant Density (plants/m^2)	P levels (kg P_2O_5 /fed)	Plant height (cm)	Pods/ plant (No)		Seed yield/ plant (gm)	
		2004/ 05	2004/ 05	2005/ 06	2004/ 05	2005/ 06
33	15.5	90.0	14.1	13.7	10.3	9.9
	31	91.0	16.9	16.3	12.0	11.6
	46.5	92.1	18.5	17.3	14.2	13.5
44	15.5	91.7	10.5	10.3	8.7	8.2
	31	93.9	13.4	12.5	11.2	10.7
	46.5	96.6	15.3	14.2	12.3	11.7
55	15.5	104.0	8.9	8.6	6.8	6.4
	31	107.8	10.4	9.5	8.0	7.5
	46.5	113.2	12.1	10.9	8.8	8.1
LSD at 0.05		1.8	0.6	0.3	0.7	0.7

D.2. Plant density × Nitrogen levels interaction:

The interaction between plant density and nitrogen levels significantly affected on number of pods/plant, seed yield/plant and seed yield/fed in both seasons (Table 5). Highest number of pods/plant and seed yield/plant were obtained from plant density of 33 plants/m^2 and fertilization with 55 kg N /fed, while the lowest values of the same traits were recorded for plant density of 55 plants/m^2 and fertilization with 25 kg N/fed in both seasons. Concerning seed yield/fed the results cleared that the first N increment produced the highest seed yield/ fed when lupin was dense planted (55 plants/ m^2). The second N increment was followed by a significant decrease in seed yield/ fed. This was not true for the lower planting densities where the seed yield continued to increase with the increase of N level up to 55 kg N/ fed. These results clearly indicated, that the use of the highest planting density (55 plants/ m^2) played a good role in maximizing the use and hence the efficiency of added nitrogen.

Table 5: Effect of the interaction between plant density and nitrogen level on pods/plant, seed yield/plant and seed yield/fed in 2004/05 and 2005/2006 seasons.

Plant Density (plants/m^2)	N levels (kg/fed)	Pods/ plant (No)		Seed yield/ plant (gm)		Seed yield/ fed (kg)	
		2004/05	2005/06	2004/05	2005/06	2004/05	2005/06
33	25	14.1	13.4	10.6	10.1	493.4	479.0
	40	17.1	16.4	12.2	11.7	720.1	696.1
	55	18.4	17.6	13.8	13.3	754.3	741.4
44	25	10.3	9.6	8.8	8.3	637.6	624.6
	40	13.7	13.1	11.0	10.4	794.5	770.6
	55	15.1	14.2	12.3	11.8	882.7	869.7
55	25	8.5	7.7	6.7	6.2	721.9	696.8
	40	11.1	10.4	8.1	7.5	1043.6	1021.0
	55	11.8	11.0	8.8	8.3	934.4	921.5
LSD at 0.05		0.4	0.4	0.3	0.3	33.8	34.2

D.3. Nitrogen levels × phosphorus levels interaction:

The results in Table 6 showed that in both seasons the number of pods/plant was significantly influenced by the interaction between P levels × N levels. The highest number of pods/plant was obtained from application of 46.5 kg P_2O_5/ fed with fertilization using 55 kg N /fed whereas, the lowest number was obtained from application of 15.5 kg P_2O_5/ fed with fertilization using 25 kg N/fed.

Table 6: Effect of the interaction between phosphorus levels and nitrogen levels on number of pods/plant in 2004/05 and 2005/2006 seasons.

P levels (Kg P_2O_5 /fed)	N Levels (Kg/fed)	Pods /plant (No)	
		2004 / 05	2005 / 06
15.5	25	9.1	8.7
	40	11.8	11.7
	55	12.6	12.2
31	25	11.2	10.4
	40	13.9	13.2
	55	15.6	14.8
46.5	25	12.6	11.5
	40	16.2	15.1
	55	17.1	15.8
LSD at 0.05		0.4	0.4

D.4. Plant density × P levels × N levels interaction:

The results in Table 7 showed that seed yield/plant and seed yield/fed were significantly affected by the 2nd order interaction in both seasons. Results indicated that the highest values of seed yield/plant was recorded for 33 plants/m^2 with 46.5 kg P_2O_5 /fed and 55 kg N/fed, while the lowest values of the same trait was obtained from sowing with density of 55 plants/m^2 and fertilization using 15.5 kg P_2O_5/ fed and 25 kg N /fed. Regarding seed yield/ fed, the highest average was produced due to dense planting (55 plants/ m^2) and fertilization with medium levels of P (31.0 kg P_2O_5/ fed and N (40 kg N/ fed) However, the combination of 55 plants/m^2 X 46.5 kg P_2O_5/ fed X 40 kg N/fed were produced greatest seed yield/fed, in both seasons. The differences in seed yield/fed with sown by 55 plants/m^2 X 31.5 kg P_2O_5/ fed X 40 kg N/ fed and of sowing with 55 plants/m^2 X 46.5 kg P_2O_5/ fed X 40 kg N /fed did not reach the significance level. Preference one of these two combination will depends on the economic of phosphorus fertilizer compared to the price of the additional 15.5 Kg P_2O_5 when 55 plants/m^2 and 40 Kg N/fed treatment used.

Table 7: Effect of the interaction between plant density, phosphorus levels and nitrogen levels on seed yield/plant and seed yield/fed in 2004/05 and 2005/2006 seasons.

Plant density (plants/ m^2)	P levels (kg P_2O_5/ fed)	Seed yield / plant (gm)			Seed yield (kg/fed)		
		N levels (kg/fed)			N levels (kg/fed)		
		25	40	55	25	40	55
2004/ 2005 season							
33	15.5	8.4	10.3	12.1	399.1	653.7	737.9
	31	10.3	12.0	13.9	534.7	751.9	753.8
	46.5	13.0	14.3	15.3	546.4	754.8	771.3
44	15.5	6.9	9.0	10.0	566.4	717.8	775.0
	31	9.3	11.5	12.7	654.5	796.6	892.6
	46.5	10.4	12.6	14.0	691.8	869.2	980.4
55	15.5	6.3	6.8	7.3	623.8	973.9	783.7
	31	6.8	8.2	9.2	720.2	1073.3	999.7
	46.5	7.0	9.3	10.0	821.7	1083.7	1019.9
L.S.D at 0.05		0.5			58.6		
2005 / 2006 season							
33	15.5	8.0	9.9	11.7	387.9	631.5	726.8
	31	9.9	11.5	13.3	529.2	735.2	748.2
	46.5	12.3	13.7	14.7	519.9	721.6	749.2
44	15.5	6.4	8.4	9.7	555.3	695.8	763.9
	31	8.9	11.0	12.3	648.9	780.0	887.0
	46.5	9.7	11.9	13.4	669.7	836.1	958.3
55	15.5	6.0	6.3	7.0	612.7	948.1	772.6
	31	6.3	7.5	8.6	714.6	1049.6	994.1
	46.5	6.4	8.5	9.4	763.0	1065.3	997.8
L.S.D at 0.05		0.6			59.3		

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تأثير الكثافة النباتية ومستويات التسميد الفوسفاتي والأزوتي علي المحصول ومكوناته في الترمس

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أجري هذا البحث بمحطة التجارب والبحوث الزراعية بكلية الزراعة – جامعة القاهرة بالجيزة موسمي ٢٠٠٥/٢٠٠٤ ، ٢٠٠٦/٢٠٠٥ لدراسة تأثير ثلاث كثافات نباتية (٣٣ ، ٤٤ ، ٥٥ نبات/م٢) وثلاث مستويات من التسميد الفوسفاتي (١٥,٥ ، ٣١ ، ٤٦,٥ كجم فو٢ أ٥ / الفدان) وثلاث مستويات من التسميد الأزوتي (٢٥ ، ٤٠ ، ٥٥ كجم ن /الفدان) علي المحصول ومكوناته في صنف الترمس جيزة ١ . تم تنفيذ التجارب فى تصميم القطع المنشقة مرتين فى ثلاث مكررات. يمكن تلخيص النتائج المتحصل عليها كما يلي:

١- أظهرت النتائج أن الكثافة النباتية المنخفضة ٣٣ نبات/ م٢ أدت إلي زيادة معنوية في عدد الفروع وعدد القرون / النبات ووزن الـ ١٠٠ بذرة ومحصول البذور / النبات ، بينما أدت الكثافة النباتية العالية (٥٥ نبات/ م٢) الى زيادة معنوية لكلاً من طول النبات ومحصول البذور/الفدان وكذلك محتوي البذور من البروتين حيث أدت زيادة الكثافة النباتية من ٣٣ إلي ٤٤ و ٥٥ نبات /م٢ الي زيادة محصول البذور/ الفدان من ٥٨٨,٥٤ إلي ٦٩٣,٩٠ و ٨٠٨,٩٨ كجم للفدان علي الترتيب وذلك كمتوسط للموسمين.

٢- أشارت النتائج الى أن زيادة التسميد الفوسفاتي من ١٥,٥ إلي ٤٦,٥ كجم فو٢ أ٥ / الفدان أدى الى زيادة كل الصفات المدروسة كما أن آضافة ٤٦,٥ كجم فو٢ أ٥ / الفدان أدت إلي زيادة محصول البذور/ الفدان بنسبة ٢٠,٢٢ و ٣,٨٩ % عن النباتات المضاف إليها ١٥,٥ و ٣١ كجم فو٢ أ٥ / الفدان علي الترتيب وذلك كمتوسط للموسمين .

٣- أوضحت النتائج الى أن زيادة التسميد الأزوتي من ٢٥ إلي ٥٥ كجم ن/الفدان أدت إلي زيادة كل الصفات المدروسة .سجل آضافة ٥٥ كجم ن / الفدان إلي زيادة محصول البذور/ الفدان بنسبة ٣٩,٧٢ و ١,١٦ % عن آضافة ٢٥ و ٤٠ كجم ن / الفدان علي الترتيب وذلك كمتوسط للموسمين الا أن زيادة معدل التسميد النتيروجيني من ٤٠ الي ٥٥ كجم ن /فدان لم تؤثر معنويا علي محصول البذور/ الفدان.

٤- كان التفاعل بين العوامل الثلاث تحت الدراسة معنوياً بالنسبة لصفة محصول البذور/ النبات ومحصول البذور/الفدان في الموسمين .

توصى هذة الدراسة بزراعة الترمس صنف جيزة ١ بمعدل ٥٥ نبات/م٢ والتسميد الفوسفاتى بمعدل ٣١ كجم فو٢ أ٥ والتسميد النيتروجيني بمعدل ٤٠ كجم نيتروجين للفدان لتعظيم إنتاجية وحدة المساحة تحت ظروف اجراء هذة الدراسة.