EFFECT OF PLANT DENSITY ON YIELD AND IT COMPONENTS OF SOME LUPIN (LUPINUS ALBUS L) VARIETIES

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Abstract

These investigations were conducted at the Agric. Exp. and Res .Stat., Fac. Agric., Cairo Univ., Giza Egypt durin 2005/2006 ,and 2006/2007 seasons to study the performance of two lupin varieties (Giza-1 and Dijon-2) under two plant densities(22 and 33 plants/m^2).

Giza-1 variety was the earlier in flowering, pod filling and maturity. Also Giza-1 recorded the highest values of plant height, number of seeds/pod and harvest index (%). Dijon2 variety recorded the highest values for number of branches/and pods/ plant, pods weight / plant, seed weight /pod , 100 seed weight, seed yield / plant, number of plants at harvest and seed yield (kg/ fed).

Increasing plant density from 22 to 33 plants / m^2 decreased number of days to flowering, pods filling and mature, and caused a significant increase in 1001 seed weight. Plant density of 22 plants/ m^2 was superior than 33 plants/ m^2 in plant height, number of branches/plant, pods weight / plant, number of seeds/pod , seed yield/plant, harvest index (%) , number of plants at harvest and seed yield /fed .

Dijon 2 yielded the highest seed yield/ fed when planted with 22 plants/ m^2 .

The present results showed positive and highly significant correlation between seed yield/ plant and it components.

According to path coefficient analysis, number of pods/ plant and 100- seed weight had the greatest direct and indire t effect towards seed yield .

Key words: Lupin, plant density, varieties, path coefficient.

INTRODUCTION

Lupin (*Lupinus albus* L.) is one of the leguminous crops, containing high protein content of it seeds. Morover, Lupin has high adaptation to poor soils and dry climates. Lupin seeds can be used on a large scale after getting rid of its poisonous alkaloids. Investigations of human feeding indicated that the alkaloid-free lupins have a nutritional quality which is as good as soybean and superior to that of other legumes. Plant density plays a major role in yield production of white lupin. Chages in plant density after the structure and size of the canopy and affect seed yield and its cm points. The results obtained by Reiad et ai, (1993) indicated that, number of branches/plant and number of seeds/pod increased by increasing the distance between rows up to 40 cm, while planting at a distance of20 and 30cm produced more pods/ plant and yield/ fed. In addintion, Lopez-Bellido et al (2000) found that seed yield of lupin exhibited no significant diffrences among the studied densities (20, 40 and 60 plants/ m). They also found that number of pods/ plant decreased with increasing plant density. Direct selection of yield on individual plant basis mostly did misleading. Hence, the plant breeder attempts to improve yield indirectly through the improvement of characters associated with it. Correction between yield and its factors is usually practiced in this regard. Positive association was observed between seed yield/ plant and each of number of seeds/pod, number of branches/plant and plant height (1991 ; Khattab et al ,1992; Espinoza et ai, 2000; and EI-sayad et al , 2002) .

Khattab *et al.* (1992), and Rao and Kumar (2003), reported that seed yield of lupin is the result of positive direct effects of number of seed/pod, number of pods/plant and 1000seed/ weight .

The present investigation aims to: 1- Compare yielding ability of two lupin varieties (Giza-1 and Dijon-2) as affected by Plant densities relationship between yield components in lupin . 2- Assist the dependent relationships between yield and

its components in lupin, which would be helpful to plan an appropriate selection program .

MATERIALS AND METHODS

Two field experiments were conducted in 2005/2006 and 2006/2007 seasons, at the Agricultural Experimental and Research Station, Faculty of Agriculture, Cairo University, Giza to study the response of some lupin varieties to plant density. Also to find out the relationships between yield coefficient and its components to asses the relative contributors to seed yield, using simple correlation coefficient, and path analysis .

Split plot design with three replications was used. 1- Two varieties of white lupin; (Giza 1) a commercial variety and (Dijorn 2) obtained from France were allocated in the main plots. 2- Plant densities were 22 plants/m^2 were obtained by seeding two seeds on both sides of the ridge in hills spaced 30 cm. and 33 plants / m^2; by seeding two seeds on the two sides / of the ridges in hills spaced 20 cm) in the sub plots. Each experimental sub plot consisted of 5 ridges, 3 meters long and 60 cm width. The experimental site was clay loam in texture with pH 7.65 and low organic mater (2.43%). Planting date was 24/11 and 20/11 in the first and second season, respectively. Data on number of days from sowing (DAS) to early flowering (number of days from seeding until the first flowering of the plants in the plot) , 50% flowering (number of days from seeding until 50% flowering of the plants in the plot) , pods filling (number of days from seeding until 50% pods filling (green pods stage) of the plants) and maturity (number of days from seeding until 50% maturity of the plants) , that estimated according to *(UPOY) were obtained and number of plants at harvest on sub plot basis. Five individual plants were randomly taken from each plot to estimate the following characters .

* (UPOV): INTERNATIONAL PROTOCL FOR THE PROTECTION OF NEW VARIETIES OF PLANTS

Plant height, branches/plant (no), pods/ plant (no), pods / plant (gm),seeds weight/pod (gm), seeds/ pod (no), 100- Seed weight (gm), seed yield/ plant (gm), harvest index (seed yield / biological yield), plants at harvest/fed, no and seed yield kg/fed was estimated on the basis of plot area ($10.5m^2$).

Statistical procedures:

1- Data of two seasons 2005/2006 and 2006/2007 were subjected to statistical analysis as described by Snedecor and Cochram (1981). Significant differences of means were detected using least significant differences test (L.S.D) at 0.05 level of significance .

2- Simple correlation coefficients, means and standerd error were calculated among the studied characters as outlined by Steel and Torrie (1987) .

3- Path coefficient analysis was used as applied by Duarte and Adams (1972). A path coefficient is simply a standardized partial regression coefficient as it measures the direct influence of independent variables upon dependent variable and permits the separation of the correlation coefficient into components of direct and indirect effects .

RESULTS AND DISCUSION

1- Performance of variety:

Data in Table (1) shows significant differences on all in measured characters between the two lupin varieties, except harvest Index (HI). Giza 1 was earlier in flowering, pod filling and maturity. Also, Giza 1. recorded the highest values of plant height. Dijon 2 variety recorded higher number of branches and pods/plant, pods weight/ plant seed weight/pod, 100- seed weight, seed yield/ plant, number of plants/feddan at harvest and seed yield (ard/fed). While, Giza 1 recorded the higher number of seeds/ pod. Several workers reported that lupin varieties widely differed in their seed yield per plant and per feddan. (Hoballah,

1991; Khattab *et al*; 1992; EL-Sayad, 1997 and EL-Sayad *et al*; 2002 found similar results.

Table (1): Means of yield and yield attributes as affected by lupin variety, combined data of (2005/2006 and 2006/2007) seasons.

Varieties			
Characters			F Test
	Giza 1	Dijon 2	
1-Days to 50% flowering	82.74	83.65	*
2- Days to Pods filling	144.27	144.76	*
3-Days to maturity	166.94	167.36	*
4-plant height (cm)	117.64	101.28	*
5-No. of branches/plant	3.46	4.24	*
6-No.ofpods/plant	13.37	21.03	*
7-Pods weight/ plant	27.47	39.60	*
8-Seed weight/ pod (gm)	1.17	1.66	*
9- No. of seeds/ pod	4.25	3.44	*
10-lOO-seed weight	29.70	35.09	*
11-Seed yield/ plant (gm)	20.01	28.23	*
12- Harvest index(%)	29.99	29.79	n.s
13-Number of plants at harvest/fed	67756	69641	*
14 -Seed yield/(kg/fed)	667.5	750	*

2- Effect of plant density :

Signifant differences between the two pant in all studied characters, Table (2), the density of 33 plants/m^2 was earlier as respect flowering, pod filling and maturity. While the lower plant density of 22 plants/m^2 produced taller plants . Lopez-Bellido et al (2000) reported similar findings .

Plant densities on Table (2) shows significant differences between the two lupin varieties on all measured characters except harvest Index. Bellido *et al* (2000) and EI-sayad et af (2002), found that decreasing plant density increased the different yield components.

Table (2): Means of lupin yield and yield components as affected by plant density, combined data of (2005/2006 and 200612007) seasons .

Characters	Plant density		F Test
	22 plantsl m^2	33 plantsl m2	
I- Days to 50% flowering	83.90	82.49	*
2- Days to Pods filling	145.12	143.91	*
3-Days to maturity	167.83	166.77	*
4-plant height (cm)	113.65	105.27	*
5-No. of branches/plant	3.91	3.79	*
6-No.ofpods/plant	13.37	21.03	*
7-Pods weight/ plant	27.47	39.60	*
8-Seed weight/ pod (gm)	1.17	1.66	*
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3- Effect of interaction:

The interaction between variety and plant density effect was significant on days to early flowering, No. of seeds/pod, 100- seed weight and seed yield/fed, (Table3). In spite of decreasing days to early flowering and seed yieldl fed with increasing plant density from 22 to 33 plants/m^2 for Giza-l and Dijon-2 varieties had been occurred in both seasons. Dijon-2 gave the highest seed yield/fed when planted by 22 plants m^2.

Table (3): Means of the significantly affected interactions between variety (V) x plant density (D), combined data of (200512006 and2006/2007) seasons .

Characters	Days to early, flowering		Seed weight/pod (gm)		No. of seeds/ pod		100 seed weight (gm)		seed yield (kg/ fed)	
Variety (V)	Giza 1	Dijon 2	Giza 1	Dijon 2	Giza 1	Dijon 2	Giza 1	Dijon 2	Giza 1	Dijon 2
Plant density (D) 22 plant/ m^2	70.7	71.8	1.13	1.68	4.22	3.60	31.06	35.29	729.0	909.0
33 plant/ m^2	69.6	70.2	1.21	1.63	4.29	3.31	34.33	34.89	606.0	591.0
L.S.D (5%)	0.13		0.06		0.12		0.23		52.5	

4- Simple correlation :

Simple correlation coefficients between seed yield/ plant and its components over the two seasons are presented in Table (4). Data clearly show that plant height, number of branches/ plant, number of pods/ plant, pods weight/ plant, seed weight/pod and 100- seed weight had highly significant and positive influence on seed yield/ plant. Correlation coefficient values were 0.331, 0:765, 0.903, 0.976, 0.721 and 0.509 respectively. The results showed that these characters have the most prominent effects on seed yield/ plant. Their total contribution to the variation in seed yield/ plant was 97.9%. It appears from table (4) that all characters were highly significant and positive associated except between number of seeds/ pod and each of number of pods/ plant and pods weight/ plant. There was positive and significant correlation coefficients between plant height and number of branches/ plant. Also, there was a negative and highly significant association between seed weight/pod and number of seeds/ pod and between 100- seed weight and each of plant height and number of seeds/ pod. In addition,

there was a negative correlation coefficients between plant height and each of seed weight/pod and 100-seed weight. These results are in agreement with those obtained by Khattab *et al* 1992 and EI-sayad *et al*, 2002.

Table (4): Simple correlation coefficients between seed yield/ plant and its components over the two seasons .

characters	X1	X2	X3	X4	X5	X6	X7
Plant height (X1)	———						
No. Of branches (X2)	0.136*	———					
No. Of pods/plant (x3)	0.263**	0.797**	----------				
Pods weight/ plant (x4)	0.328**	0.764**	0.916**	———			
Seed weight/pod (x5)	-0.011**	0.699**	0.737**	0.710**	———		
No .of seeds/pods(x6)	0.616**	0.248**	0.012	0.084	-0.110*	———	
100 seed weight/plant (x7)	-0.314**	0.532**	0.570**	0.506**	0.815**	-0.624**	———
"Seed yieldlplant (x8)	0.331 **	0.765**	0.930**	0.976**	0.721**	0.096	0.509**

* and ** indicate 0.05 and 0.01 levels of significance, respectively.

Coefficient of determination R^2 = 97.9. %

standard error of estimate = 1.462 .

5- Path coefficient analysis :

Path coefficient analysis was used to determine the relative importance of direct and indirect effect for accepted yield contributors. Number of pods/ plant showed maximum direct effect towards seed yield/ plant followed by100- seed weight. The results also cleared that, number of pods/ plant and 100- seed weight had highest indirect effect. While, number of branches/ plant had the lowest value. These results are in line with those reported by Lapez-Bellido *et al* (2000) and El-Sayad *et al* (2002) .

Table (5): Direct and indirect effect for yield contributors of lupin according to path analysis .

Characters \ Effect	Direct	Indirect	Total
No. of branches/plant	0.0026	0.0053	0.0079
No. of pods/plant	0.7185	0.1190	0.8375
-100seed weight	0.0205	0.1132	0.1337
Coefficient of determination R^2			0.979

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تأثير كثافة النباتات على ناتج المحصول ومكوناته فى بعض أصناف الترمس

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أجرى هذا البحث بمحطة التجارب الزراعية بكلية الزراعة – جامعة القاهرة بالجيزة خلال الموسمين الزراعيين ٢٠٠٥/٢٠٠٦ ، ٢٠٠٦/٢٠٠٧ لدراسة سلوك صنفى الترمس (جيزة١ ، ديجون ٢) تحت كثافتين نباتيين (٢٢ و٣٣ نبات / م^2).

أظهرت النتائج أن الصنف جيزة ١ كان الأكثر تبكيرا فى التزهير ، امتلاء القرون والنضج وأعطى أعلى القيم لكل من طول النبات وعند بذور القرن . لكن الصنف ديجون ٢ سجل أعلى القيم بالنسبة لعدد الأفرع ، عدد القرون / النبات ، وزن القرون / النبات ، وزن بذور القرون ، وزن المائة بذرة ، محصول البذور / النبات ، عدد النبات عند الحصاد/فدان ومحصول البذور / فدان . أدت زيادة الكثافة النباتية من ٢٢ الى ٢٣ نبات /م^2 إلى التبكير فى التزهير ، امتلاء القرون ، النضج ، كما أدت إلى زيادة معنوية لكل من وزن بذور القرن ووزن المائة بذرة . وتفوقت الكثافة النباتية ٢٢ نبات /م^2 على الكثافة النباتية ٣٣ / م^2 من حيث طول النبات ، عدد الأفرع ، عدد القرون / النبات ، ووزن القرون / النبات ، وزن بذور القرون ، محصول البذور / النبات ، دليل الحصاد ، عدد النبات ومحصول البذور / فدان . أظهرت نتائج التفاعل بين الأصناف والكثافة النباتية أن الصنف ديجون ٢ سجل أعلى محصول من البذور / فدان عند زراعته تحت كثافة نباتية ٢٢ نبات / م^2 .

دلت نتائج تحليل الارتباط البسيط على وجود ارتباط موجب عالى المعنوية بين محصول بذور النبات وجميع الصفات المدروسة . واتضح فى تحليل معامل المرور ، أن صفات عدد القرون / النبات ووزن ١٠٠ بذرة لها التأثيرالمباشر وغير المباشر الأكبر على محصول البذور، ومن ثم يجب أن تؤخذ هذه الصفة فى الاعتبار عند الانتخاب لتحسين محصول الترمس .

ومن النتائج السابقة يمكن التوصية بزراعة صنف الترمس المستورد ديجون ٢ حيث أثبت تفوقه بكثافة نباتية ٢٢ نبات / م^2 .

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