Minufiya J. Agric. Res. Vol. 32 No.5: 1387 - 1401 (2007)

THE RELATIVE IMPORTANCE OF YIELD COMPONENTS OF SOME FENUGREEK GENOTYPES AS AFFECTED BY SEEDING RATE IN OLD AND NEWLY RECLAIMED LANDS

Z. S. El-Sayad, Kh. M. Yamani, G. A. Abd El-Hafez and M.M. Omran

Food Legumes Res. Dep., Field Crops Res. Inst., ARC, Giza, Egypt.

(Received: Aug. 12, 2007)

ABSTRACT: *Four field experiments were carried out at Mallawi, and New Valley Research Stations, representing the old and new lands, respectively during 2005/2006 and 2006/2007 growing seasons. The major objective was to study the effect of three seeding rates (30,40 and 50 kg/fed.) on days to maturity, seed yield and its components of four fenugreek genotypes (Giza-2, Giza-30, Local-16 and Local-29). Simple correlation and stepwise regression analysis were used to find out the relationship between yield and its components and to assess their relative contributions to the seed yield.*

Results revealed little effect of seeding rate on days to maturity. Plant height was markedly increased by increasing seeding rate from 30 to 40 and 50 kg/fed. while, increasing seeding rate significantly decreased number of branches, pods and seed yield per plant at both locations of the study. While, 1000-seed weight was significantly reduced by increasing the seeding rate in the old land of Mallawi, it was significantly increased in the new land at New Valley. Concerning seed yield per feddan, it was significantly increased by increasing seeding rate up to 40 kg/fed. at Mallawi and up to 50 kg/fed. at New Valley. The genotype Local-16 recorded the highest values of seed yield and its components and outyielded Giza-2, Giza-30 and Local-29 by 14.6, 6.8 and 10.2%, respectively, indicating its superiority under the environmental conditions of Mallawi. At New Valley, the genotype Local-29 gave the highest values of seed yield and most of its components and outyielded Giza-2, Giza-30 and Local-16 by 14.6, 6.9 and 7.3%, respectively. Moreover, Local 29 was the earliest genotype in maturity at both locations. The optimal seeding rate was 40 kg/fed. for Local-16 and Local-29 at Mallawi and New valley, respectively.

There was highly significant and positive correlation between seed yield/plant and both number of branches and pods per plant at both locations. Number of seeds/pod and 1000-seed weight were highly significantly and positively correlated with seed yield/plant at Mallawi. On the other hand, days to maturity and plant height were found to be negatively correlated with seed yield/plant. At Mallawi, number of pods/plant, number of seeds/pod and 1000-seed weight were the significant contributing components to the variability of seed yield (R^2=78.4%).At New Valley, number

of pods/plant, number of seeds/pod, 1000-seed weight and number of branches/plant were the most important contributing characters to the seed yield (R^2 = 95.4%). It could be concluded that the number of pods/plant was the most important contributor character to fenugreek seed yield.

Key words: *Fenugreek, Genotype, Seeding rate, Correlation, Stepwise regression analysis.*

INTRODUCTION

Fenugreek (*Trigonela foenum graecum* L.) is an ancient crop and widely cultivated in warm temperature and tropical regions in the Mediterranean, Europe and Asia. It has two of origin: the Indian subcontinent and the Eastern Mediterranean Region. The agricultural and nutritional value of fenugreek is mainly due to the high protein content and its ability to fix nitrogen via symbiosis with Rhizobium, thus being not only almost self supplying with one of the most expensive fertilizers, but also leaving nitrogen for the following crop (McCormick *et al.*,2001). Nevertheless, the cropped area to fenugreek in Egypt has been declined from about 60,000 feddan in 1966 to about 16,000 feddan in 2006. Therefore, increasing crop production is one of the major targets of the agricultural policy which can be achieved by developing high yielding and early maturing varieties adapted to dry climatic conditions as well as by improving the agronomic practices to increase the cultivated area through newly reclaimed lands.

Seeding rate plays a major role on yield improvement of fenugreek. Changes in plant density, as a result of changing seeding rate, alter the structure and size of the canopy and affect seed yield and its components. The obtained results by Ata-Allah (1985) indicated that increasing seeding rate from 25 to 55 kg/fed. tended to decrease number of branches/plant, pods/plant, seeds/pod and seed yield/fed but seeding rate had insignificant effect on 1000-seed weight. El-Wakil (1987) reported that increasing seeding rate from 15 to 30 kg/fed. decreased number of branches, pods, seeds and seed yield per plant but the highest seeding rate gave taller plants and higher seed yield/feddan. In Upper Egypt, when the variety Giza-30 was planted at Assiut with 35 kg/fed., it gave the highest number of branches/plant, pods/plant and seeds/pod, while, the tallest plants and the highest seed yield/fed. were obtained with 45kg/fed.seeding rate (El-Lithy, 1991).

Yield is a complicated character because it is the end product of number of components. Therefore, finding out the components having the greatest effect on the yield and their relative contributions to the variability in the yield is of major importance. Correlation coefficient is not enough to construct a prediction equation because several yield components have high association with the yield but may contribute little to precision of the prediction equation. Stepwise multiple regression might be the appropriate approach due to its sequence in analyzing data of such genotypes. The basis

for accepting or eliminating an independent variable could be stated equivalently in terms of error sum of squares reduction coefficient of partial correlation or F statistic (Draper and Smith, 1981). In India, Kole and Ananye Banerjee (2004) reported that seed yield was positively correlated with number of branches/plant, pods/plant and seeds/pod, and they added that number of pods/plant, pod length and seeds/pod are the important characters determining seed yield of fenugreek.

The objectives of this study were to investigate: (1) The effect of seeding rate on the performance of some fenugreek genotypes in old and new lands. (2) The relationship between seed yield and its attributes as well as to estimate the relative contribution of these attributes.

MATERIALS AND METHODS

Four field experiments were carried out in 2005/2006 and 2006/2007 winter seasons at Mallawi Research Station, as an old land, and New Valley Research Station , as a new reclaimed land, ARC, Egypt. The mechanical and chemical analysis of the soil of both locations is presented in Table (1). Four fenugreek genotypes including two promising landraces (Local-16 and Local-29) were assessed and selected from a previous study (El-Sayad *et al.*, unpubl. data) along with the two commercial cultivars (Giza-2 and Giza-30). They were grown under the seeding rates 30,40 and 50 kg/fed. Seeds were drilled by hand in both sides of the ridge and the seeding depth was 2-3 cm.

A split plot design with four replications was used. Seeding rates were assigned to the main plots, while genotypes were arranged in the sub-plots. Each sub-plot consisted of 5 ridges of 3 m long and 0.6 m width (9 m^2). All agricultural practices were applied as usual in fenugreek fields. The number of days from sowing to 90% maturity were recorded in each plot (X_1).

At harvest, 15 individual plants were randomly taken from the central area of each plot to determine the following characters:

1-Plant height in cm (X_2). 2-Number of branches/plant (X_3).
3-Number of pods/plant (X_4). 4-Number of seeds/pod (X_5).
5-1000-seed weight in gm (X_6). 6-Seed yield/plant in gm (Y).
7-Seed yield in ard/fed was estimated on plot basis (9 m^2).

Statistical procedures:

The combined data of the two seasons 2005/2006 and 2006/2007 for each location were subjected to statistical analysis of variance as described by Sendecor and Cochran (1981). Significant differences of means were detected using least significant difference test (LSD) at 0.05 level of significance.

Simple correlation coefficients between pairs of traits were computed to find out the relationship between the studied characters as outlined by Steel and Torrie (1987).

Table (1): The mechanical and chemical analysis of soils used in experiments over both seasons.

Properties	Mallawi	New Valley
Mechanical:		
Sand%	7.90	71.50
Silt%	54.50	9.00
Clay%	37.60	19.00
Textural grade	Silty clay loam	Sandy loam
Chemical:		
PH	8.20	7.60
E.C. (ds/m)	1.35	0.89
Organic matter%	1.18	0.25
Soluble cations		
Ca^{++}	6.25	1.12
Mg^{+}	0.76	0.90
K^{+}	0.20	2.50
Na^{+}	2.85	3.30
Soluble anions		
CO_3^{-}	0.00	0.00
HCO_3	2.05	1.19
Cl^{-}	2.25	1.25
SO_4^{-}	5.85	2.40
Available N (ppm)	20.35	12.32
Available P (ppm)	8.15	7.18
Available K (ppm)	183.00	105.00

Stepwise multiple regression analysis was used to identify the effective yield components, as independent variable, which significantly contribute to the total variability in the seed yield as a dependent variable. This procedure develops as a sequence of multiple regression model in a stepwise manner, where one variable is added to the regression model at each step. The added variable is the one that causes the greatest reduction in the error sum of squares, it is also the variable which has highest partial correlation with the dependent variable for fixed values of those variables already added, and is

the variable that has the highest F value. Analysis of stepwise regression was applied according to the method outlined by Draper and Smith (1981).

Correlation and stepwise analysis were computed over both seasons for each location (Mallawi and New Valley). The dependent variable was seed yield/plant (Y) and the predictor variable (Xi) were as mentioned above.

RESULTS AND DISCUSSION

Data of days to maturity, seed yield and its components for fenugreek as affected by seeding rate, genotype and their interactions over both seasons of 2005/2006 and 2006/20007 at Mallawi and New Valley are presented in Tables (2). and (3).

Effect of seeding rates:

Seeding rate had significant effects on all studied characters, except days to maturity and number of seeds per pod at Mallawi. Little effects of seeding rate on days to maturity were recorded at New Valley. Plant height was markedly increased with increasing seeding rate from 30 to 40 and 50 kg/fed. Such effect may be attributed to that in dense plant population more competition exists among the plants for light, resulting in taller plants searching for light through the elongation of internodes. These results are in accordance with those obtained by El-Lithy (1991) and Tuncturk & Celen (2005).

On the other hand, increasing seeding rate significantly decreased number of branches, pods and seed yield per plant at both locations of the study. Similarly, 1000-seed weight at Mallawi was significantly reduced as a result of increasing seeding rate. While, 1000-seed weight at New valley was significantly increased by increasing seeding rate. The results of both seasons indicated that increasing seeding rate from 30 to 40 and 50 kg/fed. decreased number of branches/plant by 11.4 and 17.6 %, respectively, at Mallawi and by 11.2 and 20.8 %, respectively at New Valley. Number of pods/plant was decreased by 11.4 and 20.2 %, respectively at Mallawi and by 16.6 and 26.2 %, respectively at New Valley. The corresponding reductions in seed yield/plant were 11.6 and 21.8 % at Mallawi, being 11.4 and 16.6 % at New Valley by increasing the seeding rate from 30 to 40 and 50 kg/fed., respectively. This may be due to the competition exists among plants for nutrients and moisture at dense populations. The obtained results of branches, pods and seed yield/plant are in harmony with those obtained by Abd El-Aziz (1987), El-Wakil (1987) and Tuncturk &Celen (2005).

Concerning fenugreek seed yield, it was increased with increasing seeding rate. At Mallawi, the values of seed yield/fed. were 7.14, 8.66 and 8.34 ardab for 30,40 and 50 kg/fed. respectively. The increase percentages in seed yield/fed at 40 and 50 kg/fed. over 30 kg/fed. were 21.3 and 16.8%, respectively. At New valley, the increase percentages in seed yield/fed. at 40

Table (2): Effect of seeding rates, genotypes and their interactions on maturity, yield and yield components of fenugreek at Mallawi (combined data over 2005/2006 and 2006/2007 seasons).

Treatment	Days to maturity	Plant height (cm)	No. of branches/plant	No. of pods/plant	No. of seeds/pod	1000-seed weight (gm)	Seed yield/plant (gm)	Seed yield (ard/fed)
Seeding rate(S)								
30 kg/fed.	143.72	92.88	6.52	44.75	10.16	16.74	6.25	7.14
40 kg/fed.	143.81	111.34	5.78	39.67	9.99	15.08	5.52	8.66
50 kg/fed.	143.63	121.59	5.37	35.73	9.82	13.91	4.89	8.34
L.S.D at 0.05	NS	9.88	0.51	3.51	NS	0.38	0.57	0.55
Genotype (G)								
Giza-2	143.87	110.46	5.55	37.81	9.64	14.65	5.15	7.56
Giza-30	144.33	114.58	5.96	40.40	9.84	15.41	5.62	8.11
Local-16	143.50	110.92	6.29	42.69	10.79	15.98	6.07	8.66
Local-29	143.17	98.46	5.75	38.93	9.54	14.93	5.38	7.86
L.S.D at 0.05	0.78	12.40	0.44	3.69	0.72	0.67	0.48	0.41
Interaction								
S1 x G1	144.13	92.63	6.06	41.54	9.23	15.38	5.18	6.10
S1 x G2	144.75	98.87	6.59	44.91	10.56	17.58	6.41	7.51
S1 x G3	143.00	97.13	7.14	48.75	11.00	17.86	6.75	7.81
S1 x G4	143.00	82.88	6.28	42.87	9.86	16.14	6.13	7.16
S2 x G1	144.13	115.37	5.61	37.90	9.51	14.45	5.05	8.31
S2 x G2	144.13	118.13	5.87	39.71	9.64	14.92	5.50	8.62
S2 x G3	143.87	112.50	5.99	41.95	11.06	16.06	6.19	9.35
S2 x G4	143.13	99.38	5.66	39.10	9.26	14.90	5.34	8.36
S3 x G1	143.38	123.37	4.99	33.99	10.18	14.14	4.69	8.29
S3 x G2	144.13	126.75	5.41	36.57	9.31	13.74	4.94	8.19
S3 x G3	143.63	123.13	5.74	37.54	10.30	14.01	5.28	8.83
S3 x G4	143.38	113.12	5.33	34.81	9.50	13.74	4.67	8.06
L.S.D at 0.05	NS	NS	NS	NS	1.32	1.16	NS	0.71

Table (3): Effect of seeding rates, genotypes and their interactions on maturity, yield and yield components of fenugreek at New Valley (combined data over 2005/2006 and 2006/2007 seasons).

Treatment	Days to maturity	Plant height (cm)	No. of branches/plant	No. of pods/plant	No. of seeds/pod	1000-seed weight (gm)	Seed yield/plant (gm)	Seed yield (ard/fed)
Seeding rate(S)								
30 kg/fed.	134.47	71.88	3.93	18.76	12.12	16.92	4.82	7.93
40 kg/fed.	135.19	79.22	3.49	15.64	11.98	17.19	4.27	9.09
50 kg/fed.	135.69	83.75	3.11	13.85	12.60	17.43	4.02	9.58
L.S.D at 0.05	0.53	4.76	0.19	1.00	0.56	0.32	0.23	0.34
Genotype(G)								
Giza-2	137.63	77.29	3.20	13.29	12.23	17.27	3.81	8.29
Giza-30	135.42	77.29	3.64	17.66	12.46	16.67	4.61	8.88
Local-16	138.46	78.54	3.59	16.33	11.90	17.03	4.33	8.85
Local-29	128.96	80.00	3.63	17.05	12.34	17.75	4.73	9.50
L.S.D at 0.05	0.67	NS	0.25	1.01	0.57	0.49	0.29	0.63
Interaction								
S1 x G1	137.00	70.00	3.59	14.99	13.01	16.65	4.25	7.37
S1 x G2	134.75	75.00	4.04	20.33	11.91	16.60	5.01	7.85
S1 x G3	137.50	71.25	4.08	19.40	11.56	17.35	4.87	8.04
S1 x G4	128.63	71.25	4.04	20.33	11.98	17.09	5.16	8.63
S2 x G1	137.63	76.88	3.10	13.23	11.45	17.66	3.67	8.49
S2 x G2	135.50	76.25	3.75	17.60	12.00	16.69	4.52	9.11
S2 x G3	138.89	80.00	3.58	15.20	11.96	16.52	4.11	8.93
S2 x G4	128.75	83.75	3.55	16.53	12.51	17.91	4.76	9.82
S3 x G1	138.25	85.00	2.90	11.65	12.23	17.50	3.50	8.99
S3 x G2	136.00	80.63	3.13	15.05	13.48	16.73	4.31	9.68
S3 x G3	139.00	84.38	3.11	14.38	12.16	17.23	4.01	9.58
S3 x G4	129.50	85.00	3.30	14.31	12.53	18.25	4.27	10.05
L.S.D at 0.05	NS	7.35	NS	1.74	0.98	0.84	0.50	NS

and 50 kg/fed. over 30 kg/fed. were 14.6 and 20.8%, respectively. Data showed that the highest seed yield at Mallawi was 8.66, which produced by planting fenugreek at 40 kg/fed. Moreover, the highest seed yield at New Valley was 9.58, which produced by planting fenugreek at 50 kg/fed. The response of fenugreek seed yield to the high seed rate in the new land of New Valley may be attributed to high plant population per unite area, that overcome the lower yield of a single plant. Shalaby and Mohamed (1976) stated that seed yield of fenugreek increased significantly by increasing seeding rate from 20 to 40 kg/fed. Meanwhile, El-Lithy (1991) reported that the maximum fenugreek seed yield/fed. was obtained from 45 kg/fed. seeding rate.

Effect of genotypes:

Data presented in Tables (2) and (3) showed significant differences among genotypes at Mallawi and New valley for all studied characters, except plant height at New valley. The genotype Local-16 recorded the highest values of seed yield and its components and outyielded Giza-2, Giza-30 and Local-29 by 14.6, 6.8 and 10.2%, respectively, indicating its superiority under the environmental conditions of Mallawi. But at New Valley, the genotype Local-29 had the highest values of seed yield and most of the studied characters and outyielded Giza-2, Giza-30 and Local-16 by 14.6, 6.9 and 7.3 %, respectively. This may be due to more adaptation of this genotype to New Valley region conditions. Additionally, Local-29 behaved as the earliest genotype in maturity at both locations and it was 8.7 and 6.5 days earlier than Giza-2 and Giza-30, respectively, at New Valley. It could be concluded that the above mentioned genotypes Local-16 and Local-29 would be interesting and prospective for the future in fenugreek breeding program for improving the maturity date and productivity.

Interaction effect:

Interaction between seeding rate and genotypes were not statistically significant in some studied characters at each location as shown in Tables (2) and (3) which indicated similar response in the four tested genotypes to varying population density on these characters. Plant height was gradually increased by increasing seeding rate for all tested genotypes at New Valley. Meanwhile, number of pods and seed yield/plant, at Mallawi, as well as 1000-seed weight, at both locations, were gradually decreased by increasing seeding rate for all tested genotypes. These results are in accordance with those obtained by Ashmawy *et al.*, (1998) in faba bean. Response of number of seeds/pod to seeding rate varied among genotypes at both locations of the study.

Seed yield/fed. has been significantly increased with increasing the seed rate from 30 to 40 kg/fed. over all tested genotypes at Mallawi. The genotypes

local-16 produced the highest seed yield (9.35 ard/fed) at 40 kg/fed. seeding rate. However, Giza-2 produced the lowest yield (6.10 ard/fed) at the seeding rate of 30 kg/fed. On the other hand, at New Valley, seed yield/fed has been insignificantly and gradually increased by increasing seeding rate from 30 to 40 and 50 kg/fed. over all tested genotypes. As a trend, genotype Local-29 gave higher values of seed yield (ard/fed) when planted with 50 or 40 kg/fed. followed by Giza-30 and Local-16 when planted with 50 kg/fed.

Correlation study:

Simple correlation coefficient among the studied characters in fenugreek over two seasons at Mallawi and New Valley are presented in Tables (4) and (5), respectively. The results indicated that the number of pods/plant was highly significant and positively correlated with seed yield/plant (r = 0.822 and 0.894). High association with number of pods is interesting in plant breeder, because it is relatively an easily identifiable character in the field . Also, the number of branches/plant was highly significant and positively correlated with seed yield /plant (r=0.616 and 0.736). Obviously, seed producing advantage of more branches results from giving more pods/plant. This association was a result of the tillering plants with leaf surface were capable of greater photosynthetic activity, hence more photosynthetates are directed into seed formation. Number of seeds/pod and 1000-seed weight were highly significantly and positively correlated with seed yield/plant at Mallawi with r value being 0.421 and 0.667, respectively. On the other hand, days to maturity and plant height were found to be significant or insignificant and negatively correlated with seed yield/plant with r values being –0.071 and –0.433 as well as –0.318 and –0.256 at Mallawi and New Valley, respectively. Similar results were reported by many investigators who studied the relationship between seed yield/plant and its attributes in fenugreek (Sade *et al.*, 1996; Kole & Ananya Banerjee; 2004; Jat, 2004 and Mert *et al.*,2004).

Table (4): Simple correlation coefficients between the studied characters of fenugreek genotypes over 2005/2006 and 2006/2007 seasons at Mallawi Research Station.

Character	X_1	X_2	X_3	X_4	X_5	X_6
No. of days to maturity X_1	1.000					
Plant height X_2	0.574**	1.000				
No. of branches/plant X_3	0.111	-0.255*	1.000			
No. of pods/plant X_4	-0.128	-0.337**	0.585**	1.000		
No. of seeds/pod X_5	-0.008	-0.022	0.293**	0.135	1.000	
1000-seed weight X_4	-0.282**	-0.539**	0.539**	0.605**	0.372**	1.000
Seed yield/plant Y	-0.071	-0.318**	0.616**	0.822**	0.421**	0.667**

* and** significant at 0.05 and 0.01 level of significance, respectively.

Table (5): Simple correlation coefficients between the studied characters of fenugreek genotypes over 2005/2006 and 2006/2007 seasons at New Valley Research Station.

Character	X_1	X_2	X_3	X_4	X_5	X_6
No. of days to maturity X_1	1.000					
Plant height X_2	-0.029	1.000				
No. of branches/plant X_3	-0.214*	-0.447**	1.000			
No. of pods/plant X_4	-0.307**	-0.373**	0.860**	1.000		
No. of seeds/pod X_5	-0.079	0.153	-0.284**	-0.164	1.000	
1000-seed weight X_6	-0.295**	0.276**	-0.189	-0.213*	-0.136	1.000
Seed yield/plant Y	-0.433**	-0.256*	0.736**	0.894**	0.184	-0.051

* and** significant at 0.05 and 0.01 level of significance, respectively.

Stepwise multiple regression analysis was used to identify the accepted yield factors and their relative contributions to seed yield of fenugreek over both seasons of 2005/2006 and 2006/2007 at Mallawi and New Valley are presented in Tables (6) and (7).

Table (6): Characters explaining seed yield/plant of fenugreek using stepwise multiple liner regression analysis over both seasons (2005/2006 and 2006/2007) at Mallawi Research Station.

Character	Regression Coefficient	Standard error	Cumulative R^2%	Partial R^2%
No. of pods/plant X_4	0.106**	0.009	67.50	67.50
No. of seeds/pod X_5	0.224**	0.043	77.30	9.80
1000-seed weight X_6	0.072*	0.033	78.40	1.10

Intercept =-2.02
R^2 for accepted characters = 78.40%
R^2 for eliminated characters = 0.70%
R^2 for studied characters = 79.10%
Standard error of estimate = 4.14
* and** significant at 0.05 and 0.01 level of significance, respectively.

Table (7): Characters explaining seed yield/plant of fenugreek using stepwise multiple liner regression analysis over both seasons (2005/2006 and 2006/2007) at New Valley Research Station.

Character	Regression Coefficient	Standard error	Commutative R^2%	Partial R^2%
No. of pods/plant X_4	0.181**	0.009	80.00	80.00
No. of seeds/pod X_5	0.246**	0.015	91.20	11.20
1000-seed weight X_6	0.171**	0.018	95.40	4.20
No. of branches/plant X_3	0.111*	0.055	95.60	0.20

Intercept =-5.88
R^2 for accepted characters = 95.40%
R^2 for eliminated characters = 0.20%
R^2 for studied characters = 95.60%
Standard error of estimate = 2.18
* and** significant at 0.05 and 0.01 level of significance, respectively.

Stepwise analysis:

At Mallawi, the results clearly indicated that three characters out of six were accepted as significant contributing characters to seed yield/plant variation. These accepted characters were number of pods/plant (X_4), number of seeds/pod (X_5) and 1000-seed weight (X_6). The results showed that 79.10% of the total variability in the seed yield could be linearly related to the studied characters, 78.40% of the total yield variation could be attributed to the characters included into the model, and 0.70% could be due to eliminated characters which are number of days to maturity, plant height and number of branches/plant. The characters included into the model could be arranged according to their partial R^2 in a descending order as follows: number of pods/plant (R^2 = 67.50%), number of seeds/pod (R^2 = 9.80%) and 1000-seed weight (R^2 = 1.10%). The best prediction equation that had highest value of R^2 being 78.40% and lowest standard error of estimate (4.14) was:

$$Y=-2.02+0.106X4 + 0.224X5 + 0.072X6$$

At New Valley, the accepted factors had the highest coefficient of multiple determination either the yield adjusted for factors already added. The best prediction equation with the lowest standard error of estimate (2.18) is formulated as follows:

$$Y=-5.88 + 0.111X3 + 0.181X4 + 0.246X5 + 0.171X6$$

According to this equation 95.40% of the total variability in seed yield could be linearly related to the accepted yield factors. Those factors were number of pods/plant (X_4), number of seeds/pod (X_5), 1000-seed weight (X_6) and number of branches/plant (X_3). Those variable were responsible for 80%,

11.2%, 4.2% and 0.2%, respectively of yield variances. The other two variable were removed because their contribution were insignificant. Those variables were number of days to maturity and plant height. The obtained results agreed with Kole & Ananya Banerjee, (2004).

Comparing the results of stepwise at Mallawi (Table 6) and New Valley (Table 7). It could be concluded that number of accepted characters included into the model and the value of R^2 at New Valley were higher than that of Mallawi. This is might be due to the environmental condition since the soil of the New valley is new reclaimed soil and still poor in nutritional elements and organic matter but Mallawi has more fertile soil, (Table 1).

Generally, it could be concluded that Local-16 is the most promising genotype for productivity at Mallawi (Middle Egypt), while Local-29 seemed to be a superior genotype in yielding ability and earliness of maturity under New Valley region. On the other hand, the optimal seeding rate was 40 kg/fed. for Local-16 and Loca-29 at Mallawi and new valley, respectively. Moreover, the efficient selection to obtain higher seed yield of fenugreek should be based mainly on higher number of pods per plant.

REFERENCES

Abd El-Aziz, E. A. (1987). Growth and yield of fenugreek as affected by some agronomic practices. M.Sc. Thesis, Fac. of Agric., Zagazig Univ., Egypt.

Ashmawy, F., S. A. S. Mehasen and M. S. A. Mohamed (1998). The relative contribution of some characters to seed yield in some faba bean varieties grown under three population densities. Bull. Fac. Agric. Univ., Cairo, 49 (4):517-532.

Ata Allah, S. A. A. (1985). Effect of some agricultural treatments on growth, yield and yield components of fenugreek (*Trigonela foenum graecum* L.). M.Sc. Thesis, Fac. of Agric., El-Menia Univ., Egypt.

Draper, N. R. and H. Smith (1981). Applied regression analysis. John Wiley and Sons, NY, PP 407.

El-Lithy, R. E. (1991). Effect of some agricultural practices on yield and yield components of fenugreek. Ph.D. Thesis, Fac. of agric., El-Menia Univ., Egypt.

El-Wakil, N. A. (1987). Agronomic studies on fenugreek. M.Sc. Thesis, Fac. of Agric., Zagazig Univ., Egypt.

Jat, P. L. (2004). Correlation nad regression studies in fenugreek (*Trigonela foenum graecum* L.). Haryana J. of agro., 20 (1/2):99-100.

Kole, P. C. and Ananye Banerjee (2004). Genetic variability, correlation and path analysis in fenugreek (*Trigonela foenum graecum* L.). J. of Spices and Aromatic Crops, 13 (1):44-48.

McCormick, K. M., R. M. Norton, M. B. Peoples and H. A. Eagles (2001). Fenugreek (*Trigonela foenum graecum* L.)compared to five temperate legume species in Wimmera farming system. Proceedings of 13th

Australian Agronomy conference 10-15 Sep. 2006, Perth, Australia. (C.F. Computer Res. Internet).

Mert, A., M. Arslan and F. Ayanoglu (2004). Correlation and path analysis of the relationship between yield and yield components in fenugreek (*Trigonela foenum graecum* L.). Turkish J. of field Crops, 9 (1):11-15.

Sade, B., F. Akinerdem, A. Tamkoc, A. Topal, R. Acar and S. Soylu (1996). The correlation and path analysis of yield and yield components on fenugreek lines (*Trigonela foenum graecum* L.) Turk. J. Agric. For., 20:153-156.

Shalaby, Y. Y. and L. K. Mohamed (1976). Effect of seeding rate, inculcation and nitrogen fertilization on yield of fenugreek. (Annals of Agric. Sci. Moshtohor, 6:71-78,1991).

Snedecor, G. W. and W. G. Cochran (1981). Statistical Methods. 7th Ed., Iowa State Univ. Press, Ames, Iowa, USA.

Steel, R. G. D. and J. H. Torrie (1987). Principles and procedures of statistics. A biometrical approach, 2th Ed. 6 th printing., Mc. Graw. Hill Book Company. USA:272-277.

Tuncturk, M. and A. E. Celen (2005). The effect of different seeding rates on the yield and some yield characteristics of fenugreek (*Trigonela foenum graecum* L.). Turkish J. of Field Crops, 10 (1):37-42.

الاهميه النسبية لمكونات المحصول فى بعض التراكيب الوراثية للحلبة تحت تأثير معدل التقاوي فى الأراضي القديمة والجديدة

زغلول سيد الصياد ، خالد محمد يماني ، جمال عبد العزيز عبد الحافظ ، محمود موسى عمران

قسم بحوث المحاصيل البقولية- معهد بحوث المحاصيل الحقلية-مركز البحوث الزراعية-الجيزة-مصر.

الملخص العربي

أقيمت أربعة تجارب حقلية خلال موسمي ٢٠٠٥/٢٠٠٦، ٢٠٠٦/٢٠٠٧ فى محطتي البحوث الزراعية بكل من ملوي ممثلة للأراضي القديمة والوادي الجديد ممثلة للأراضي الجديدة وذلك لدراسة تأثير ثلاث معدلات تقاوي مختلفة وهى ٣٠، ٤٠، ٥٠ كيلو جرام/فدان على بعض الصفات الاقتصادية لاربعة تراكيب وراثية للحلبة وهى جيزة ٢، جيزة ٣٠، محلى-١٦ ، محلى-٢٩ باستخدام تصميم القطع المنشقة مرة واحدة فى أربع مكررات، وقد درست العلاقة بين المحصول واهم عوامله باستخدام معامل الارتباط البسيط كما درست المساهمة النسبية لمكونات محصول البذور باستخدام أسلوب الانحدار المتعدد المرحلي.

أوضحت النتائج أن زيادة معدل التقاوي أدى الى انخفاض معنوي فى كل من عدد الفروع وعدد القرون ومحصول البذور للنبات بينما زاد طول النبات معنويا. أما محصول البذور للفدان قد زاد زيادة معنوية بزيادة معدل التقاوي حتى ٤٠ كيلو جرام/فدان بملوي، وحتى ٥٠ كيلو جرام/فدان بالوادي الجديد.

أعطت السلالة محلى-١٦ أعلى قيمة من محصول البذور للفدان مسجلة زيادة قدرها ١٤,٦، ٦,٨، ١٠,٢٪ مقارنة بالصنف جيزة ٢، جيزة ٣٠، ،محلى-٢٩ على التوالي.بينما أعطت السلالة محلى-٢٩ أعلى إنتاجية بزيادة قدرها ١٤,٦، ٦,٩، ٧,٣٪ مقارنة بالصنف جيزة ٢، جيزة ٣٠، محلى-١٦ على التوالي. كما تشير النتائج أن افضل معدل تقاوي هو ٤٠ كيلو جرام/فدان لكلا من السلالة محلى-١٦ بملوي والسلالة محلى-٢٩ بالوادي الجديد للحصول على أعلى إنتاجية لمحصول الحلبه.

دلت نتائج تحليل الارتباط البسيط على وجود ارتباط موجب عالي المعنوية بين محصول البذور للنبات وكل من عدد الفروع وعدد القرون للنبات ووزن الـ ١٠٠٠ بذرة وعدد البذور للقرن بملوي بينما كان الارتباط موجب وعالي المعنوية بين محصول البذور للنبات وكلا من عدد الفروع وعدد القرون للنبات فقط بالوادي الجديد، وقد كان الارتباط سالبا بين محصول البذور للنبات وكلا من عدد الأيام من الزراعة حتى النضج وطول النبات بكلا الموقعين.

أوضحت نتائج تحليل الانحدار المتعدد المرحلي أن اكثر الصفات إسهاما فى تباين محصول بذور النبات فى منطقة ملوي هي عدد قرون النبات وعدد بذور القرن ووزن الـ ١٠٠٠ بذرة حيث ساهمت هذه الصفات بحوالي ٧٨,٤ ٪ فى تباين المحصول بينما كانت صفات عدد قرون النبات وعدد بذور القرن ووزن الـ ١٠٠٠ بذرة وعدد فروع النبات هي أعلى الصفات إسهاما فى المحصول بالنسبة لمنطقة الوادي الجديد حيث ساهمت هذه الصفات بحوالي ٩٥,٤٪ فى تباين محصول بذور النبات. كما أوضحت نتائج تحليل الانحدار المتعدد المرحلي أن صفة عدد قرون النبات أعلى الصفات إسهاما فى تباين المحصول حيث ساهمت بحوالي ٦٧,٥٪، ٨٠٪ فى ملوي والوادي الجديد على الترتيب لذا يجب أن تؤخذ هذه الصفة فى الاعتبار عند الانتخاب لتحسين إنتاجية محصول الحلبة .