EFFECT OF MINERAL NITROGEN ,FARM YARD MANURE AND BACTERIAL INOCULATION ON TWO SOYBEAN CULTIVARS

S.A.S, Mehasen[*] and N.A. Saeed[**]

* Dept. of Agron., Fac. of Agric., Moshtohor, Benha Univ.

** Dept. of Agron., Fac. of Nasser Agric Sci., Aden Univ.

ABSTRACT

Two field experiments were conducted during 2004 and 2005 seasons in the Research and Experimental Center of the Faculty of Agriculture at Moshtohor, Benha Univ. to study the response of two soybean cultivars to bacterial inoculation, mineral nitrogen and organic fertilization on yield and yield components. Two soybean cultivars (Giza 22 and Giza 111) were selected to five treatments which were the combination of mineral nitrogen fertilizer, farm yard manure (FYM) and inoculation with Rhizobia, i.e (Control, 40 Kg N/ fed, 20 Kg N/ fed + inoculation, 15 t FYM/fed, 7.5 t FYM/fed + inoculation).

The results could be summarized from the combined analyses of the two seasons as follows :

Giza22 soybean cultivar surpassed Giza 111 in pods weight/plant, seed weight/plant, 100 – seed weight, seed yield/fed and oil yield/fed .

Number of seeds/pod, pods weight/plant, seed weight/plant, 100-seed weight, oil percentage and seed, biological and oil yields/fed were significantly increased by N fertilization and manuring singly or combined with inoculation as compared with the control treatment .

There was a significant effect for the interaction between soybean cultivars and fertilization treatments on seed weight /plant only

Seed yield per feddan was high positively and significantly correlated with, weight of pods and seeds/plant and 100-seed weight of soybean.

Key words: Soybean, Cultivars, Fertilization, Bacterial inoculation, Manuring, Yield, Yield components.

INTRODUCTION

Soybean (*Glycin max (L.) Merr.*) is one of the most important world legume crops for feed and food. Soybean oil is recommended to be consumed for diseases and diabetes. The pharmaceutical industry widely uses soybean in the manufacture of antibiotics. The vegetative soybean mass is extensively used as silage mixed with maize in production of grass meal and hay. Soybean as a good green manure crop. Using good soybean cultivars, bacterial inoculation and different nitrogen sources (mineral or organic) matter as a source of nitrogen are necessary for economical soybean yield. Same researches stated that the differences among soybean cultivars were significant in yield and yield component **(Ahmed and Twafic, 1991; Hefni *et al.*, 1994; Hassanein *et al.*, 1996; Hassanein and Ahmed, 1996 and Hamed, 2003).**

Furthermore, soybean plant as a leguminous crop can obtain same of its nitrogen requirement from fixation of atmospheric N_2 through symbiosis with Rhizobia. Inoculation is essential for increasing soybean yield and yield components

(Salwau, 1989 and Mehasen *et al.*, 2002). Soybean yield and yield components were affected by increasing N levels as reported by **Salwau (1989); Hanna and Eisa (1998); Hamed (2003).**

Recently, mineral fertilizers are not available in some critical periods due to its shortage in production, and consequently the prices are increasing continuously. To face this situation, the use of organic manures, in general, and farm yard manure (FYM) in particular may help in solving this problem. Use of FYM for soybean may be reduce a considerable part of mineral fertilizers which in turn will reduce the hazards of soil pollution resulting from the intensive use of mineral fertilizers.

The present study was canducted to find out the best combination from mineral N and organic manure in association with bacterial inoculation for two soybean cultivars.

MATERIALS AND METHODS

Two field experiments were carried out at the Agricultural Research and Experimental Center of Fac. Agric. Moshtohor, Benha Univ., during summer 2004 and 2005 seasons to study the response of yield its components of two soybean cultivars to bacterial inoculation, mineral nitrogen and organic fertilization. Each experiment included 10 treatments which were the combination of: Two soybean cultivars (Giza 22 and Giza 111) and five treatments which were the combinations of nitrogen fertilizers, farm yard manure (FYM) and inoculation with Rhizobia, i.e (Control, 40 Kg N/ fed, 20 Kg N/ fed + inoculation, 15 t FYM/fed, 7.5 t FYM/fed + inoculation).

The treatments were arranged in a split- plot design with four replicates, in which soybean cultivars were allocated in the main plots, while the sub-plots were devoted for fertilization treatments. The sub plot area was 1/400 fed, 10.5 m^2 (3X3.5 m) with five ridges which were 60 cm width and 3.5 m long.

Soil samples were taken before sowing. Mechanical and chemical analysis were done as shown in Table (1). The preceding crop was wheat in both seasons. Manure was produced by the cattle hold in the faculty and prepared as traditionally done by the farmers. The manure was applied and during soil preparates before soybean sowing. The chemical analysis of FYM is shown in Table (2). N fertilizers was splitted into two equal doses applied in form of ammonium nitrate (33.5%) before the first and the second irrigation in both seasons.

Table 1. Mechanical and chemical analyses of the experimental soil .

Property.	2004season	2005 season
Coarse sand %	5.20	5.50
Fine sand %	17.30	18.50
Silt %	25.60	24.20
Clay %	51.90	51.80
Texture	Clay	Clay
Ec (m mohs/cm)	0.96	0.95
OM %	2.25	2.00
Total N %	0.112	0.100
pH(1:2.5suspension)	7.91	8.10

Table 2. Chemical analysis of the FYM .

Seasons	Total N %	Available N %	OM %	P %	K %	pH
2004	1.1	0.36	20.17	0.006	0.70	9.49
2005	0.96	0.31	18.20	0.003	0.67	9.64

Soybean seeds were inoculated with the specific *Bardyrihizobium japonicum* strain just before sowing. Soybean seeds was planted on May 27th and 30th in 2004 and 2005 seasons, respectively. The distance between hills was 10 cm apart and soybean plants were thinned to two plants per hill. Agronomic practices were followed according to the standard recommendation for soybean in the region.

At harvest, ten guarded plants from each experimental unit were chosen randomly and the following traits were estimated. Plant height (cm) number of branches/plant, number of pods/plant, number of seeds/pod, weight of pods/plant (g), weight of seeds/plant (g), shilling % and 100- seed of weight (g). The seed and biological yields/fed were determined from the whole subplot of the four replications. Moreover, samples of soybean seeds were over dried at 70°C for 24 hours, and oil content % was determined using the procedure described by **A.O.A.C (1980)**. Oil yield (Kg/fed) was calculated by multiplying oil percentage by the seed yield/fed.

Data were statistically analyzed according to **Steel and Torrie (1980).** Combined analysis for the data of the two growing seasons and simple correlation were carried out according to procedures outlined by **Gomez and Gomez (1983).** L.S.D. test at 0.05 level was used for comparison between treatments means.

RESULTS AND DISCUSSION

A-Effect of growing seasons:

Results in Table (3) show that the seasonal affect was significant for all of the traits under study except plant height, number of branches/plant, seed weight/plant, shilling and oil percentage. Highest values for all character were detected in the first season except number of seed/pod and biological yield/fed. It could be concluded that the increase of seed yield in the first season may be due to the significant increase in number of pods/plant, weight of pods/plant and 100 – seed weight.

B- Varietal differences:

Results in Table (4) indicated clearly that there were significant differences between soybean cultivars in 100- seed weight, and seed yield/fed in each of the two growing seasons and combined analysis, and number of seeds/pod, seed weight/plant and shelling in the first season and their combined analysis. However differences in plant height, number of branches/plant, number of pods/plant , biological yield/fed and oil percentage were not significantly different. Moreover, combined data cleared that G22 cultivar significantly exceeded G111 cultivar in pods weight/plant, seed weight/plant, 100 – seed weight, seed yield/fed and oil yield/fed. Meanwhile, G111 cultivar surpassed significantly G22 cultivar in number of seeds/pod and shelling%. The genetic makeup variation of the cultivars may play prime role in the detected variations in plant height and number of branches. The superiority of G22 cultivar over G111 in seed yield/fed may be attributed to the increase in pods weight/plant,

seed weight/plant and 100- seed weight. Similar variations among soybean cultivars were obtained by **(Ahmed and Twafic, 1991; Hefni *et al.*, 1994; Hassanein *et al.*, 1996; Hassanein and Ahmed, 1996 and Hamed, 2003).**

Table 3. Mean values of seasonal effect.

Traits	Growing seasons		F test
	2004	2005	
Plant height (cm).	82.60	80.5	NS
Number of branches/plant.	2.39	2.20	NS
Number of pods / plant.	40.80	36.80	**
Number of seeds / pod.	2.25	2.53	**
Pods weight / plant (g).	29.30	27.52	*
Seed weight / plant (g).	17.73	16.98	NS
Shelling%.	60.82	61.97	NS
100-seed weight (g).	17.84	16.78	**
Seed yield / fed. (kg).	1117	954	**
Biological/fed (kg).	3106	3309	**
Oil percentage.	22.55	22.16	NS
Oil yield/fed (kg).	254	212	**

*,** indicates significant at $P<0.05$ and 0.01,respectively ; n.s = non significant

Table 4.Yield and its components as affected by soybean cultivars.

Characters	soybean cultivars								
	2004			2005			Combined analysis		
	G_{22}	G_{111}	LSD	G_{22}	G_{111}	LSD	G_{22}	G_{111}	LSD
Plant height (cm).	85.11	80.10	NS	80.22	80.72	NS	82.67	80.41	NS
No. of branches/plant.	2.47	2.32	NS	2.18	2.21	NS	2.33	2.26	NS
No. of pods / plant.	40.25	41.35	NS	37.08	36.2	NS	38.67	38.96	NS
No. of seeds / pod.	2.12	2.38	0.19	2.53	2.54	NS	2.33	2.46	0.13
Pods weight / plant (g).	32.61	25.98	NS	28.38	26.66	NS	30.50	26.32	1.46
Seed weight / plant (g).	18.68	16.78	1.42	17.52	16.45	NS	18.10	16.61	0.98
Shelling%.	57.22	64.42	3.63	62.06	61.88	NS	59.64	63.15	1.65
100-seed weight (g).	19.28	16.39	0.66	17.79	15.77	0.59	18.54	16.08	0.34
Seed yield / fed. (kg).	1185	1049	54	987	921	46.52	1086	985	27.47
Biological/fed (kg).	3123	3090	NS	3297	3323	NS	3300	3206	NS
Oil percentage.	22.26	22.86	NS	21.80	22.52	NS	22.02	22.68	NS
Oil yield/fed (kg).	264	245	7.67	217	208	NS	240	226	5.21

C- Effect of nitrogen, FYM fertilization and bacterial inoculation.

Data of soybean yield and its components as affected by fertilization and inoculation treatments in 2004 and 2005 seasons as well as their combined analysis are presented in Table (5).

Results indicate that number of seeds/pod, pods weight/plant, seed weight/plant, 100-seed weight, oil percentage and seed, biological and oil yields/fed of soybean in the seasons and their combined average, as well as plant height and shelling% in the first season and number of pods/plant in the second one were significantly increased by fertilization treatments singly or combined with inoculation as compared with the control treatment . However differences in the number of branches/plant were not significant in the first and second seasons as well as their combined analysis. Adding 20 Kg N/fed+inoculation gave maximum values for the studied characters. The results showed that application of 20 Kg N/fed combined with inoculation significantly increased seed, biological and

oil yields/fed over the control by 34.0, 14.9 and 43.2% respectively in the combined average. Also, applying 7.5 t FYM/fed combined with inoculation increased seed , biological and oil yield/fed by 31.5 , 13.3 and 41.0% over the cheek treatment , respectively in the combined average. These results may be do to the role of N and inoculation that led to a successful nodulation and consequently an active N fixation for soybean plants and increased the fruiting zone by increasing plant height, number of branches/plant, number of seeds/pod,
pods weight/plant, seed weight/plant and 100-seed weight, which consequently increased yield values. Similar results were obtained by**(Salwau, 1989; Hanna and Eisa 1998; and Mehasen *et al..*, 2002; Hamed ,2003).**

D- Interaction effects:

There is a significant effect for the interaction between soybean cultivars and fertilization treatments on weight of seeds/plant only (Table 6). Supplying G22 or G111 soybean cultivars with (20 Kg N/fed + inoculation) recorded the maximum value of weight seeds/ plant. However, the rate of increase for the two soybean cultivars were different. Results indicated that application of this treatment increased seed weight per plant of Giza22 by 22.5%and Giza111 by 44.6% over the control treatment.Similar results were obtained by**(Mehasen *et al.*,2002and Hamed ,2003).**

Table 6. Effect of interaction between soybean cultivars and fertilization treatments on weight of seeds/plant of soybean (combined over two seasons 2004 and 2005).

Treatments	Control	40kg N/fed	20kgN/fed+ Inoc.	15 t FYM/fed	7.5 t FYM/fed+ Inoc.
G_{22}	16.33	17.99	20.01	17.28	18.88
G_{111}	13.53	15.84	19.56	15.86	18.28
LSD at 5%	1.12				

E- Correlation study :

The simple correlation coefficients between some possible pairs of the studied soybean traits of the combined analysis are presented in Table (7). Seed yield per feddan was positively significant correlated with weight of pods and seeds/plant and 100-seed weight. Therefore, these traits, may be more attributed for higher yielding soybean. Also, significant positive phenotypic correlations were observed between weight of seeds/plant and each of the its yield components except shelling percentage . Similar results were obtained by **Ashoub et al.,(1994) and Hamed (2003).**

Table 7. Correlation coefficient between yield and some yield components of soybean combined over two seasons 2004 and 2005.

Variables	1	2	3	4	5	6	7	8	9
Seed yield / fed.	0.339**	0.292**	0.341**	0.022	0.723**	0.693**	0.148	0.720**	0.302**
1-Plant height	1.000	0.088	0.262**	0.019	0.304**	0.260**	-0.100	0.396**	0.258**
2-No. of branches/plant.		1.000	0.003	-0.119	0.151	0.247*	0.122	0.173	0.093
3-No. of pods / plant.			1.000	-0.012	0.173	0.276**	0.164	0.177	0.095
4-No. of seeds / pod.				1.000	0.120	0.252**	0.162	-0.189	0.518**
5-Pods weight / plant.					1.000	0.825**	-0.419	0.664**	0.391**
6-Seed weight / plant .						1.000	0.159	0.515**	0.500**
7-Shelling%.							1.000	0.333**	0.137

8-100-seed weight .		1.000	0.097
9-Biological/fed .			1.000

*,** indicates significant at $P<0.05$ and 0.01, respectively

REFERENCES

A.O.A.C.(1980). Official tentative methods of Analysis of Association of Official Analytical Chemists. Washington.D.C., 15th Ed.

Ahmed, M.A. and M.A. Tawfic (1991). Response of soybean yield and its contributing characters to vareital differences and time of nitrogen application. Egypt. J. Apple. Sci., 6(11): 563 – 572.

Ashoub, M.A.; H.A.EL-Zeiny; M.E.EL-Bially; A.A.EL-Noemani and O.M.Kassab (1994). The relative importance of yield components in the soybean variety Clark. Annals Agric. Sci., Ain- Shams Univ., Cairo, 39 (1): 219- 226.

Gomez, k.A. and A.A. Gomez (1983): Statistical procedures for agricultural research. 2nd Ed. John Wiley & Sons., Inc., New York.

Hamed, M.F. (2003). Response of two soybean cultivars to methanol and nitrogen fertilizers. Annals of Agric. Sci., Moshtohor, 41(3): 1097-1107.

Hanna, A.M. and M.S. Eisa (1998). Effect of Rhizobium inoculation, nitrogen and molybdenum application on soybean production. J. Agric. Sci., Mansura Univ., 23: 953-960.

Hassanein, M.S. and M.A.Ahmed (1996). Growth and yield response of two soybean cultivars to some micronutrients. Annals of Agric. Sci., Moshtohor, 34 (4) 1389- 1403.

Hassanein, M.S.; D.M. El- Hariri and M.A.Ahmed (1996). Growth and yield response of soybean cultivars to application methods for nitrogen and potassium fertilizers. Annals Agric. Sci., Ain- Shams Univ., Cairo, 41 (2): 713- 724.

Hefni, El.S. H.M.; D.M. El. Hariri; A.A. El- Hosary; M/A. Ahmed and M.S. Hassanein (1994). Productive efficiency of some soybean cultivars in relation to sowing dates. Proc. 6th Conf. Agron. Al- Azhar univ., Cairo, Egypt . Sept. Vol.11:539-553.

Mehasen,S.A.S.;R.A. Zaghloul and M.A. El-Ghozoli (2002). Effectiveness of dual inoculation with bradyrhizobium and endomycorrhizae in presence of different phosphatic fertilizer sources on growth and yield of soybean.. Annals Agric. Sci., Ain Shams Univ., 47 (2): 477-500

Salwau, M.I.M. (1989). Response of soybean to nitrogen levels, molybdenum and inoculation. Annals of Agric. Sci., Moshtohor, 27(2): 771-781.

Steel, R.G.D. and J.H., Torrie (1980): Principals and Procedures of Statistic S:A Biometrics approach, Second Ed. McGraw-Hill. New York.

الملخص العربى

تأثير التسميد الازوتى والعضوي والتلقيح البكتيرى على صنفين من فول الصويا.

*** صديق عبد العزيز صديق محيسن * ناصر عبادى سعيد**

* قسم المحاصيل - كلية الزراعة بمشتهر – جامعة بنها.

** قسم المحاصيل - كلية ناصر للعلوم الزراعية – جامعة عدن .

أقيمت تجربتان حقليتان بمركز البحوث الزراعية بكلية الزراعة بمشتهر خلال موسمي ٢٠٠٤ و ٢٠٠٥ م لدراسة استجابة صنفين من فول الصويا(جيزة ٢٢-جيزة١١١) باستخدام خمس معاملات من التسميد الازوتى المعدنى والعضوي والتلقيح البكتيرى (بدون- ٤٠كجم ازوت/فدان-٢٠كجم ازوت/فدان+تلقيح البذور بالريزوبيم- ١٥طن سماد بلدى/فدان- ٧.٥طن سماد بلدى/فدان+تلقيح البذور بالريزوبيم)علي صفات المحصول ومكوناته

<u>ويمكن تلخيص النتائج المتحصل عليها فيما يلى :</u>

- تفوق الصنف جيزة ٢٢ على الصنف جيزة١١١ في وزن قرون وبذور النبات و وزن ال١٠٠بذرة و محصول البذور والزيت للفدان للتحليل التجميعى لموسمى الزراعة.
- ادت معاملات التسميد والتلقيح البكتيرى و خاصة المزدوجة إلى الحصول على اعلى القيم لجميع الصفات تحت الدراسة في موسمى الزراعة و التحليل التجميعى.
- كان التفاعل معنوى لصفة وزن بذور النبات للتحليل التجميعى لموسمى الزراعة.
- اتضح من النتائج وجود ارتباط موجب وعالى المعنوية بين محصول البذور للفدان وكل من وزن قرون وبذور النبات و وزن ال١٠٠بذرة للتحليل التجميعى لموسمى الزراعة.