Response of some Faba Bean varieties to Biofertilization and Soil Nitrogen Application

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ABSTRACT

The present investigation was carried out at the Agricultural Experimental Station, Faculty of Agriculture, Alexandria University, during 2003 and 2004 seasons, to study the effect four different biofertilizer treatments (Control, Halex, Rhizobactrein and control Microbein) and three different levels of nitrogen (Zero, 24 and 48 kg N/ ha) on yield and yield components of two faba bean cultivars (Giza 461 and Giza Blanca).

Generally, seed of faba bean varied greatly from season to season. While, the average seed yield/ ha reached 6.03 t/ha in the first season, it drastically, dropped to 2.76 t/ha in the second season. The two studied cultivars were not statistically different in the first season, while, Giza 461 tended to surpass Giza Blanca in the seed yield/ ha under different biofertilizer treatments. Giza 461 showed a significant response to biofertilizer application which increased its seed yield by about 0.46 t/ha over control (without inoculation) in the first season. While Giza Blanca seed yield/ ha significantly decreased with inoculation treatments.

The symbiotic biofertilizer (rhizobactrein and microbein) tended to increase the seed yield by 0.27 t/ha compared with asymbiotic biofertilizer (Halex) in the second season. However, the difference did not reach the level of significance. The nitrogen application had not expressed any significant effect on seed yield/ ha. The two biofertilizers, Halex and rhizobactrein, tended to increase straw yield/ ha as compared with control and microbein, while applying 24 kg N/ha insignificantly increased straw yield by about 0.62 t/ha over control. Giza 461 cultivar gave significantly higher seed yield/ plant with Halex biofertilizer at nitrogen level of 48 kg N/ha in 2004 season. It may be concluded that the moderate level of 24 kg N/ ha with biofertilizer inoculations gave the highest yield/ plant and per hectare.

INTRODUCTION

Faba bean (*Vicia faba*) is one of the important food legume crops in Egypt. It constitutes a major part of daily food, as well as, an important source of protein for a majority of Egyptian people. The importance of faba bean in Egypt is not limited by its use in food and feed, but also lies in its important role in the Egyptian crop rotation. The occupied area by faba bean in Egypt, reached 127,000 hectare with an average yield of 3.15 t/ha in 2004/2005 (F.A.O., 2005).

Therefore, increasing faba bean production has become one of the most urgent and important goals for solving one of the food security problems in Egypt. Increasing faba bean production in Egypt could be achieved by means of adopting more promising cultivars, together with applying most optimum agricultural practices and crop requirements. Nitrogen is probably the most common limitation to growth for both plants and animals. Faba bean, as well as other legumes, is able to fix enough atmospheric nitrogen to supply its own needs and to contribute to subsequent crops needs. The limitation and the higher expense of petroleum products, needed for producing manufactured inorganic nitrogen, give the huge potential of biological nitrogen fixation more considerable importance. Moreover, replacing chemical fertilizers by biofertilizer application results in reducing environmental pollution caused by mineral nitrogen fertilization (Hussein *et al.*, 1997)

Most of the recommendations encourage the use of biofertilizers such as Halex, rihizobactrein and microbein to conserve the environment from pollution and reduce the starting dose from nitrogen fertilizer (Said, 1998).

Among the factors affecting nitrogen fixation is the fertility status of the soil. Several studies showed that increasing mineral nitrogen level applied to legumes, in general, tends to reduce the efficiency of biological nitrogen fixation process (Richards and Soper, 1979; Heyland and Puhl, 1986 and Hanna, 1999).

The present study was carried out to evaluate the response of the two faba bean cultivars Giza 461 and Giza Blanca, to bio-and nitrogen fertilization on yield and its components.

MATERIALS AND METHODS

The present investigation was carried out during the two successive winter seasons of 2002/2003 and 2003/2004 at the Agriculture Experimental Station of Alexandria University, Alexandria, Egypt. One factorial experiment was designed to assess the response of two faba bean cultivars, Giza 461 (G. 461) and Giza Blanca (G. Blanca), to different biofertilizers along with inorganic nitrogen applications. Three different kinds of biofertilizers, containing symbiotic or asymbiotic nitrogen-fixing bacteria, in addition to control, were used. These tested biofertilizers were:

1- Halex, including non-symbiotic nitrogen fixing bacteria, *Azotobacter* and *Klebsiella* spp.
2- Rhizobacterin, which includes a symbiotic (*Rhizobium* sp.) and non-symbiotic (*Azotobacter* sp.) nitrogen-fixing bacteria.
3- Microbein, which includes a mixture of symbiotic (*Azospirillium* spp. and *Rhizobium leguminosarum*) and non-symbiotic (*Azotobacter*) nitrogen-fixing bacteria, in addition to a phosphate solubilizing bacteria, *Pseudomonas sp.* and *Bacillus polymyxo*.

Bioferilizer (*Rhizobacterin* . *Microbein*) are a commercial multistrains produced by the General Organization for Agricultural Equalization Fund, Ministry of Agriculture. It is constituted of a mixture of P dissolving and N2-fixing bacteria, e.g. *Azospirillum Azotobacter*, *Kebsiella* and *Bacillus* sp. etc. (El-Khawas, 1990)

Three nitrogen levels of 0.0, 24 and 48 kg N/ha were also studied. A split-plot design with six replications was used. The two studied cultivars randomly occupied the main plots, while all possible combinations, of the three levels of mineral nitrogen and the four biofertilizer applications, were randomly assigned to sub-plots. The twelve sub-plot treatments were:

1- Control plots were completely left without any application of either mineral nitrogen or biofertilizer treatment.
2- Nitrogen application of 24 kg N/ha.
3- Nitrogen application of 48 kg N/ha.
4- Halex only. (1.2 kg/ ha)
5- Halex + 24 kg N/ha.
6- Halex + 48 kg N/ha.
7- Rhizobactrein only. (0.24 kg/ ha)
8- Rhizobactrein + 24 kg N/ha.
9- Rhizobactrein + 48 kg N/ha.
10- Microbein only. (0.24 kg/ ha)
11- Microbein + 24 kg N/ha.
12- Microbein + 48 kg N/ha.

Each sub-plot consisted of five ridges. The ridges were six meters long and 0.60 meter apart. The seeds were sown in hills 0.20 meter apart at both sides of the ridge and thinned to 2 plants/ hill. Sowing dates were during the first week of November in both seasons. Seeds of inoculation treatments were coated with Arabic gum, as an adhesive carrier. The mineral nitrogen fertilizer was side dressed, in the form of ammonium nitrate (33.5%), at 21 days after planting. The preceding crop in both years was maize. Soil analysis for the two experimental sites, in both seasons, is presented in Table (1).

Data on seed and straw yields at harvest were taken from the inner two guarded ridges in each sub-plot and then transformed in terms of ton/ha. Ten guarded plants were randomly taken from each sub-plot for further detailed studies on seed yield per plant. Data were statistically analyzed according to Steel and Torrie (1980).

RESULTS AND DISCUSSION

A. Yield and yield components

The data obtained on faba bean yield will include both seed and straw weight, while those on yield components will include seed weight/plant, only.

1- Seed yield t/ha

The analysis of variance for this trait is shown in (Table 2), while the mean seed yields per hectare are presented (Table 3). The only significant difference detected was for the interaction between cultivars and biofertilizer treatments (V×B) in 2004 season only (Table 2). The orthogonal single-degree of freedom comparisons, i.e.; C_1, C_2 and C_3, were performed among the different biofertilizer treatments for yield characteristics.

Although the three different contrasts did not show any significance in both seasons, yet the interaction between cultivars and biofertilizers (V×B), in 2004 season, was confined to the first contrast, $V \times C_1$ (Table 3). The mean square shown in that table indicated that the only significant differences were detected for the first contrast (C_1) within each of the two cultivars. The mean seed yields for the three comparisons for the two studied cultivars, for 2004 season, are presented in (Table 4). With respect to the first comparison (C_1), Giza 461 showed a significant response to biofertilizer application, while a reverse trend was noticed with the other cultivar, Giza Blanca in which the inoculation significantly decreased seed yield by 0.47 t/ha. Madkour *et al.* (1987) stated that the magnitude of the effect of inoculation on growth varied according to the used cultivar and type of nitrogen-fixing bacteria.

Regarding the second comparison (C_2), asymbiotic versus symbiotic nitrogen-fixation system, data in (Table 4) showed that the symbiotic biofertilizers tended to increase the seed by 0.21 t/ha., as an average of the two cultivars, as compared with Halex. Yet the difference within each of the two cultivars did not reach the level of significance. The third comparison (C_3) illustrated that rhizobactrein tended to increase the seed yield of both cultivars, compared to microbein, yet the difference did not reach the level of significance. It could be concluded that biofertilization treatment promoted the production of bean seeds. Once roots emerge at seed germination and are microorganisims energetic pathway such as glycolsis and conversion of conjugate IAA to Active IAA and stimulated growth plants (Monib *et al.* 1994). The superiority of rhizobactrein to microbein, which contains phosphate was confirmed by El-Akabawy (2000) on Egyptian clover. Similar result was also obtained by Sherif, Fatma *et al.* (1997), on lentils, who found that the application of rhizobium led to an increase in seed yield.

Regarding the effect of nitrogen fertilizer on seed yield, faba bean in the present study did not respond to nitrogen application. Similar results were obtained by Dissouki (1982) at Nubaria, who stated that application of nitrogen did not lead to any significant effect on seed yield of faba bean. It may be finally concluded that the magnitude of the effect of inoculation, on seed yield per hectare, is affected by the used cultivar. Moreover, the present results showed some insignificant superiority of rhizobactrein to microbein on faba bean yield, while mineral fertilization had no effect on such studied characteristic in both seasons.

2- Straw yield t/ha

The analysis of variance for this character is presented in (Table 2), while the mean yields of straw per hectare are shown in (Table 4). Data in that table did not reveal any significant differences for any of the three studied factors or their interactions in both seasons on that trait. Giza 461 cultivar tended to exceed Giza Blanca in straw yield per hectare by 1.74 ton, as an average of the two seasons, yet, the differences between both cultivars did not reach the level of significance in both seasons (Table 4). It seems that there is no common trend relating seed yield to straw yield.

The two biofertilizers, Halex and rhizobactrein tended to increase straw yield compared with either control or the microbein application However, the differences were not significant. The mean yields of straw, averaged over the two seasons, were 12.66, 13.23, 13.12 and 12.66 t/ ha for the four biofertilizer treatments, control, Halex, rhizobacterin and microbein, respectively. The results obtained by Hussein *et al.* (1997), Sherif, Fatma *et al.* (1997) and Hanna (1999) showed that rhizobium inoculation of faba bean increased straw yield compared with control.

Data in (Table 4) also showed that the application of nitrogen fertilizer increased straw yield from 12.86 with unfertilized plots to 13.48 t/ha with application of 24 kg N/ha, as an average of the two seasons. This means that applying 24 kg N/ha caused an increase in straw yield by about 0.62 t/ha over the control. The further increase in nitrogen level up to 48 kg N/ha had an adverse effect on straw yield. The reduction in straw yield, due to the application of 48 kg N/ha was 1.06 t/ha lower than the level of 24 kg N/ha. The differences did not reach the level of significance. Monib *et al.* (1994) concluded that both nitrogen fertilizer and rhizobium inoculation increased straw yield.

It could be finally concluded that Giza 461 cultivar tended to surpass Giza Blanca in straw yield. Halex and rhizobactrein showed the same insignificant superiority, in straw yield, to either microbein or control, while, the moderate level of 24 kg N/ha gave the highest, but not significant, straw yield compared with control or the level of 48 kg N/ha.

B- Yield component

Seed yield per plant

The analysis of variance and the mean seed yields/ plant are presented in (Tables 5 and 7), respectively. Data in Table (5) indicated that the effects due to either cultivars (V) or biofertilizers (B) were not significant in the two seasons. However, the (V×B) interaction was significant. The third studied factor, nitrogen levels (N), revealed a significant effect in 2004 season only. In addition, the second order interaction (V×B×N) was also significant in the same season of 2004.

The partitioning of the interaction between cultivars and biofertilizer (V×B), (Table 6), indicated that significant effects were detected for the interaction between variety and the first comparison (($V \times C_1$) in both seasons, in addition to the second comparison ($V \times C_2$) in 2004 season. The further partitioning of (V×C) interaction in 2003 season, presented in (Table 6), illustrated that the significant differences were only confined to the first comparison (C_1) with Giza Blanca cultivar and the second comparison (C_2) with Giza 461.

Mean of seed yield/plant for the different contrasts for each studied cultivar are presented in (Table 8). Data indicated that Giza Blanca cultivar significantly responded to biofertilizer application by about 14% more than the control. A reverse trend was noticed with the other cultivar, Giza 461, yet, the difference was not significant.

Regarding the second contrast (C_2), Giza 461 had higher seed yields/plant with asymbiotic biofertilizer (40.37g), while this difference was not significant for Giza Blanca cultivar. Again, these findings may emphasize what was stated by Madkour *et al.*, (1987), who attributed the magnitude of the inoculation effect to the used cultivar and the type of nitrogen fixing bacteria. With respect to the third contrast (C_3), both rhizobactrein and microbien did not affect seed weight/plant in 2003 season for both studied cultivars. The second-order interaction had a significant effect on seed weight/plant in 2004 season (Table 8). The analysis of variance of the data of biofertilizer contrast, for cultivars within nitrogen levels is presented in (Table 7). Data in this table indicated that the significant difference only confined with the first and second contrasts, C_1 and C_2 only.

(Table 9) shows the effects of biofertilizer comparisons for each cultivar at each nitrogen level. Although, Giza 461 tended to gave more seed yield/plant with biofertilizer application, at each nitrogen level, than control, yet the difference was significant under 48 kg N/kg only. Generally, the seed yield/plant for Giza 461, average over the three levels of nitrogen, were 21.28 g for the biofertilizer application, compared with 18.83 g for control.

Giza Blanca cultivar showed a reverse trend at zero kg N/ha only, where the difference between biofertilizer application and the non-inoculation treatment was significant. Regarding the second comparison, Giza 461 gave the highest seed yield/plant of 25.52g at 24 kg N/ha, when plants were inoculated with symbiotic biofertilizer compared with 18.28 g with Halex (Table 9). These results match with findings of many authors (Amer *et al.*, 1992; Said, 1998 and Shams *et al.*, 2001).

It may be finally concluded that the two cultivars responded differently to the application of inoculation according to the type of N-fixing bacteria. Moreover, the moderate level of nitrogen fertilization at 24 kg N/ha seemed to be the convenient level for achieving the higher yield/plant in most of biofertilizer inoculations.

Table (1): Soil analysis for the two experimental sites, in both seasons 2003-2004:

Seasons	pH	Nitrogen (%)	Phosphours (%)	Potassium (%)
2002/2003	8.04	0.18	0.067	0.086
2003/2004	8.35	0.12	0.321	0.074

Table (2): Mean squares of the analysis of variance of seed and straw yields (t/ha) as affected by cultivars, biofertilizers and nitrogen levels in 2003 and 2004 seasons

Source of variation (S.O.V.)	d.f	Characteristic			
		Seed yield (t/ha)		Straw yield (t/ha)	
		2003	2004	2003	2004
Replication	3	3.61	1.69	20.74	6.91
Cultivars (V)	1	3.54	4.90	49.55	8.45
Error (a)	3	4.09	6.37	39.03	2.98
Biofertilizers (B)	3	1.09	0.49	7.82	0.19
V × B	3	3.53	1.55*	0.71	0.87
V × C_1 (1)	1		3.87*		
V × C_2 (2)	1		0.37		
V × C_3 (3)	1		0.43		
Nitrogen levels (N)	2	0.25	0.61	3.46	2.30
V × N	2	0.97	0.47	3.04	2.20
B × N	6	0.87	0.48	1.05	1.66
V × B × N	6	1.36	0.67	7.96	1.64
Error (b)	66	1.85	0.44	3.99	0.75

* Significant at 0.05 level.
(1) C_1 Control vs. biofertilizer application.
(2) C_2 Asymbiotic vs. symbiotic system.
(3) C_3 Rhizobacterin vs. microbein.

Table (3): Mean squares for the partitioning of biofertilizer contrasts (C) within cultivars (V) for faba bean seed yield/ha 2004 seasons

S.O.V.	d.f.	M.S.
Biofertilizer within cultivar	6	1.02*
C_1 within Giza 461	1	1.91*
C_1 within Giza Blanca	1	1.96*
Remainder	4	0.56
Error	66	0.44

* Significant at 0.05 level.
(1) C_1 Control vs. biofertilizer application.

Table (4): Mean of faba bean seed and straw yields (t/ha) as affected by cultivars, biofertilizers and nitrogen levels and their interactions in 2003 and 2004 seasons

Factor		Seed yield (t/ha)		Straw yield (t/ha)	
		2003	2004	2003	2044
Cultivar V_1 G. 461	V_1	5.83[a]	2.98[a]	17.73[a]	9.85[a]
(V) V_2 G. Blanca	V_2	6.22[a]	2.53[a]	15.75[a]	8.34[a]
Biofertilizer B, Control	B_1	6.17[a]	2.76[a]	16.88[a]	8.43[a]
Halex	B_2	6.18[a]	2.62[a]	17.08[a]	8.43[a]
Rhizobactrein	B_3	5.78[a]	2.95[a]	16.45[a]	9.79[a]
Microbein	B_4	6.02[a]	2.69[a]	16.53[a]	8.79[a]
Nitrogen level (kg/ha)	0	6.09[a]	2.63[a]	16.95[a]	8.76[a]
	24	5.92[a]	2.91[a]	17.50[a]	9.45[a]
	48	6.06[a]	2.73[a]	15.76[a]	9.08[a]
V × B V_1 ×	B_1	---	2.64[b]	---	---
	B_2	---	2.86[b]	---	---
	B_3	---	3.44[a]	---	---
	B_4	---	2.99[ab]	---	---
V_2 ×	B_1	---	2.88[a]	---	---
	B_2	---	2.37[a]	---	---
	B_3	---	2.47[a]	---	---
	B_4	---	2.40[a]	---	---

Table (5): Mean squares of the analysis of variance of seed yield per plant (g) as affected by cultivars, biofertilizers and nitrogen levels in 2003 and 2004 seasons

S.O.V.	d.f.	Season	
		2003	2004
Replication	5	297.60	251.69
Cultivars (V)	1	328.98	246.30
Error a	5	195.35	247.23
Biofertilizer (B)	3	60.87	20.69
V × B	3	349.27*	77.47*
C_1 × V	1	652.6*	105.68
C_2 × V	1	299.9	114.4*
C3 × V	1	95.3	12.41
Nitrogen levels (N)	2	6.02	78.51*
V × N	2	6.98	28.38
B × N	6	71.54	35.15
V × B × N	6	58.59	57.35*
Error (b)	110	96.54	25.64

* : Significant at 0.05 level.

(1) C_1 : Control vs. biofertilizer application.

(2) C_2 : Asymbiotic vs. symbiotic system.

(3) C_3 : Rhizobactrein vs. microbein.

Table (6): Mean squares for the partitioning of biofertilizer contrasts (C) within cultivars (V) on seed yield/plant in 2003 season

S.O.V.	d.f.	M.S.
Biofertilizer within cultivar	6	205.07
C_1 within Giza 461	1	207.45
C_1 within Giza Blanca	1	472.06*
C_2 within Giza 461	1	434.16*
Remainder	3	38.89
Error	110	96.54

* : Significant at 0.05 level.
(1) C_1 : Control vs. biofertilizer application.
(2) C_2 : Asymbiotic vs. symbiotic biofertilizer.

Table (7): Mean squares for the partitioning of biofertilizer contrasts (C) on seed yield/ plant within cultivars (V) within nitrogen levels (N) in 2004 season

S.O.V.	d.f.	M.S.
C/V/N	18	205.07
C_1 within Giza 461 / 48 kg N	1	136.58*
C_1 within Giza Blanca / 0 kg N	1	165.01*
C_2 within Giza 461 / 24 kg N	1	210.26**
Remainder	15	22.51
Error	110	25.64

*, ** : Significant at 0.05 level.
(1) C_1 : Control vs. biofertilizer application.
(2) C_2 : Asymbiotic vs. symbiotic biofertilizer.

Table (8): Means of faba bean seed yield per plant (g) as affected by cultivars, biofertilizers and nitrogen levels and the interaction in 2003 and 2004 seasons

Factor	Treatment	Season	
		2003	2004
Cultivar (V)	Giza 461	43.349[b(1)]	20.669[a]
	Giza Blanca	46.372[a]	18.053[b]
Biofertilizer (B)	Control	44.111[b]	19.009[b]
	Halex	46.764[a]	19.134[b]
	Rhizobactrein	43.949[b]	20.481[a]
	Microbein	44.620[b]	18.819[b]
Nitrogen levels (N) (kg/ha)	Zero N/ha	45.211[a]	18.399[b]
	24 kg N/ha	44.503[a]	20.812[a]
	28 kg N/ha	44.868[a]	18.871[b]
V × B	$V_1 \times B_1$	46.29[a]	N.S
	B_2	46.38[a]	N.S
	B_3	38.88[c]	N.S
	B_4	41.85[b]	N.S
	$V_2 \times B_1$	41.94[b]	N.S
	B_2	47.15[a]	N.S
	B_3	49.02[a]	N.S
	B_4	47.39[a]	N.S

N.S : not significant

(1) means followed by the same letter, within each year, were insignificantly different at $LSD_{0.05}$

Table (9): Means of seed yield per plant (g) as affected by the interaction between cultivars, nitrogen and biofertilizer comparisons in 2004 season

Cultivars	Nitrogen levels kg N / ha	Biofertilizers comparisons					
		Control vs. biofertilizer application		Asymbiotic vs. symbiotic		Rhizobactrein vs. microbein	
		Control	Application	Halex	Symbiotic biofertilizer	Rhizobactrein	Microbein
Giza 461	Zero	18.67	19.86	19.39	20.1	20.19	20.0
	24	22.47	23.12	18.28	25.52	27.44	23.6
	48	15.36	20.87	20.78	20.92	22.64	19.19
Mean		18.83	21.28	19.48	22.19	23.43	20 94
Giza Blanca	Zero	21.78	15.72	15.86	23.74	16 17	15 14
	24	16.86	19.29	21.89	17.99	20.56	17.89
	48	18.94	18.02	18.61	17.73	20 56	14.89
Mean		19.19	17.68	18.79	17.12	17.54	16 70

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الملخص العربى

استجابة بعض أصناف الفول البلدي إلى التسميد الحيوي والمعدنى النيتروجيني

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أجريت هذه الدراسة بمحطة البحوث الزراعية بكلية الزراعة – جامعة الإسكندرية – مصر. أقيمت هذه التجربة لدراسة استجابة صنفين من الفول البلدي (جيزة ٤٦١ وجيزة بلانكا) لثلاثة أنواع مختلفة من التسميد الحيوي (الهالكس وريزوبكترين وميكروبين) تحت مستويات مختلفة من النيتروجين (صفر، ٢٤، ٤٨ كجم نيتروجين/ هكتار) ويمكن تلخيص أهم النتائج المتحصل عليها فيمايلي :

١- وجدت اختلافات كبيرة في محصول البذور من موسم لآخر حيث كان متوسط محصول البذور ٦,٠٣ طن/هكتار في الموسم الأول انخفض إلى ٢,٧٦ طن/هكتار في الموسم الثاني.

٢- لم تسجل أي اختلافات معنوية خلال الموسم الأول فى صفة المحصول البذرى بين أى من الأصناف أو المعاملات السمادية ولكن الصنف جيزة ٤٦١ تفوق على الصنف جيزة بلانكا في محصول البذور/هكتار تحت المعاملات المختلفة للتسميد الحيوي.

٣- اظهر الصنف جيزة ٤٦١ استجابة معنوية خلال الموسم الأول للمعاملة بالأسمدة الحيوية والتي أدت إلى زيادة محصول البذور بحوالي ٠,٤٦ طن/ هكتار بالمقارنة بالكنترول (عدم المعاملة بالأسمدة الحيوية).

٤- سجل الصنف جيزة بلانكا الملقح بالأسمدة الحيوية انخفاضاً معنوياً في محصول البذور للهكتار.

٥- المعاملة بالأسمدة الحيوية التكافلية (الريزوبكترين والميكروبين) أدت إلى زيادة محصول البذور إلى ٠,٢٧ طن/هكتار مقارنة بالسماد الحيوي التكافلي (هالكس) خلال موسم ٢٠٠٤ ولكن هذه الفروق لم تصل إلى مستوى المعنوية.

٦- السماد الحيوي ريزوبكترين أدى إلى زيادة غير معنوية في محصول البذور للهكتار حوالي ٠,٢٧ طن/ هكتار بالمقارنة بالميكروبين.

٧- توضح النتائج الحالية أن حجم تأثير التلقيح على محصول البذور للهكتار يتأثر بطبيعة الصنف المعامـــل بـــالتلقيح بالسماد الحيوي.

٨- المعاملة بالسماد النيتروجيني لم تعطي أي تأثير معنوي على محصول البذور للهكتار.

٩- الصنف جيزة ٤٦١ أظهر تفوق على الصنف جيزة بلانكا في محصول القش بحوالي ١,٧٣ طن للهكتار ولكن هذه الاختلافات لم تصل لمستوى المعنوية.

١٠- أدى التسميد الحيوي بالسمادين الهالكس والريزوبكترين إلى زيادة محصول القش للهكتار بالمقارنة بـــالميكروبين والكنترول.

١١- إضافة ٢٤ كجم نيتروجين للهكتار أعطت زيادة غير معنوية في محصول القش بحـــوالي ٠,٦٢ طـــن للهكتـــار بالمقارنة بعدم التسميد ولكن الزيادة عن ٢٤ كجم نيتروجين أعطى تأثير معاكس على محصول القش.

١٢- الصنف جيزة ٤٦١ أعطى أعلى زيادة معنوية لمحصول البذور للنبات عند استخدام الهالكس مع إضافة ٤٨ كجم نيتروجين للهكتار خلال موسم ٢٠٠٤.

١٣- من الممكن استنتاج أن مستوى ٢٤ كجم نيتروجين للهكتار مع التلقيح بالأسمدة الحيوية يعطي أعلـــى محـــصول بذور للهكتار وكذلك أعلى محصول بذور للنبات الفردي.