

EFFECT OF BIOFERTILIZER ON BARLEY PRODUCTIVITY IN NEW RECLAIMED SANDY AND SILTY CLAY LOAM SOILS.

Abdel-Hamid, M. * and G.A. Mohamed **

*** Field Crops Res .Ins., A.R.C. , Egypt .**

**** Soils Water Res . Inst. and Environment , A.R.C., Egypt .**

ABSTRACT

Four field experiments were conducted at EL- Minia Governorate in new reclaimed sandy (samalout District , west bank of the Nile) and Mallawi Agricultural Research station , during the two successive seasons in 1999/ 2000 and 2000 / 2001 to study the effect of biofertilizer on barley productivity under new reclaimed sandy and silty clay loam soils . The studied characters were number of spikes / m² , plant height in cm , spike length in cm , number of kernels / spike , weight of kernels / spike in gm , 1000 - kernels weight in gm , grain yield in ardab / fed and straw yield in ton / fed

Results showed that the application of biofertilizer with the recommended doses of nitrogen and phosphate fertilizers under new reclaimed sandy and Silty clay soils in middle Egypt increased significantly the most characters of barley crop compared with the control without the application of biofertilizer. Also application of biofertilizer significantly increased plant height , number of spikes / m² , grain yield (ardab / fed) and straw yield (ton / fed) in both seasons compared with the treatment of control without application of biofertilizer. while spike length and number of kernels / spike were significantly increased in the second season and the first season , respectively , The increases of spikes/ m² with application of biofertilizer compared with control in new reclaimed sandy soil were 40.90 % in the first season and 25.58 % in the second one while in silty clay soils the percentage of increases reached 15.32% in the first season and 15.30 % in the second one However the average increase percentages in new reclaimed sandy and silty clay loam soils were 25.52 % in the first season and 20.02% in the second one

The increases in grain yield due to using biofertilizer compared with control in sandy soil were 47.36 % in the first season and 26.49% in the second one but in silty clay loam the increase percentages were 19.50 in the first season and 20.18 in the second one while the mean percentages in sandy and silty clay were 33.45% and 23.39% in the first and the second seasons respectively . The increases of straw yield as a result of using biofertilizer in sandy soil were 61.79% in the first season and 33.33% in the second one while in silty clay loam increase the percentages were 8.58% in the first season and 16.79% in the second one. However the average increase percentages in sandy and silty clay loam were : 28.25 % in the first season and 23.69% in the second one . The percentages of increases due to using biofertilizer with nitrogen and phosphate recommend on number of spikes / m² , grain and straw yields obtained more amount in new reclaimed sandy than the silty clay . Thus , it can be concluded that application of biofertilizer with the recommended doses of nitrogen and phosphate fertilizers gave the maximum productivity of barley crop in new sandy more amount than silty clay loam under EL-Minia governorate conditions .

INTRODUCTION

Barley (*Hordeum vulgare L.*) is considered one of the most important cereal crops in Egypt to be used for many Purposes such as bread making or by mixing with wheat floure in some places , human food and beverages, animal feeding and many other uses . In Egypt , most of barley production areas are located in marginal areas where adverse conditions exist Such as in rainfed areas , poor soil and saline soils and new reclaimed sandy soil. These new reclaimed areas have characteristics of containing small proportion of clay and organic matter as well as deficiency in macro and micro elements . In addition , due to the structureless of sandy soil, drought and loss of both irrigation water and nutrients are expected problems .

Inoculating seeds with biofertilizers are easier and less costs than the use of fertilizers, and in the same time increased yield crop and decreased pollutant environment , especially under rainfed condition . Intensive research on a symbiotic nitrogen fixation has cocentrated on the positive role of the plant - microbe relationship in an effort to increase plant growth and grain yield, Several reports have been published by many researchers (Hassan *et al.*, 1985 ; Nur *et al.* , 1980 ; Balte nsperger *et al.* , 1978 , ; Hassouna , 1973 Madkour , 1972 and Indicated that the inoculation of seeds or seedling of various c3 and c4 Plants with associative N2 - fixing bacteria such as Azotobacter spp and Azospirillum brasiliens led to changes in plant growth and sometimes to yield increases . investigations to the effect of biofertilizer has been heavily ivestigated by many researchers (Said 1998; Mitkees *et al* , 1996; Belimov *et al* , 1995 ; Abou El Naga , 1993 ; Zaid ,(1992) ; Edit *et al.* , 1986 ; Eid , 1982 ; Pohlman and Mccoll , 1982 ; Oken , (1982). They reported that the biofertilization is very important for increasing grain yield of barley in reclaimed sandy soils . However , Hassanein , and Hassouna ;1997 El -Kawas ; 1990 ; Fayez ,. 1990 , indicated that biofertilizers increase the yield by increasing number of spikes / m² and number of grains per spike .The objective of this study the effect of biofertilizer on productivity of barley under in new reclaimed sandy and silty clay loam .

MATERIALS AND METHODS

Four field experiments were conducted in new reclaimed sandy soil of Minia governorate (samalout District , west bank of the Nile) and silty clay loam soil at Mallawy Agricultural Research station during the two successive seasons (1999 / 2000 and 2000 / 2001) to study the effect of biofertilizer on barley productivity under different lands . Physical and chemical analyses of two locations are given in Table 1 . The experimental treatments were : -

C1 - The first treatment in the new reclaimed sandy and silty clay loam (without application biofertilizer) application the recommended dosed of nitrogen and phosphate fertilizers .

C2 - The Second treatment in the new reclaimed sandy and silty clay soil is Application biofertilizer with nitrogen and phosphate fertilizers recommended in new reclaimed sandy and silty clay .

Nitrogen fertilizer was applied as ammonium nitrate (20.6 %) at the rate of 60 kg N / fed in new reclaimed lands in five equal doses every dose after ten days from irrigation in silty clay loam soil 45 kg N / fed in two equal doses was done , one before planting irrigation and the other just before the second irrigation. However phosphate fertilizers were added at a rate of 30 kg P_2O_5 / fed in the form of calcium superphosphate (15.5% P_2O_5)

At new reclaimed sandy and 15 kg P_2O_5 / fed at silty clay before planting. The experimental design was randomized complete blocks with four replicates .plot area was 12.6 m² , with 30 cm between rows and 3.5 m long. Seeding rate was 50 kg / fed of barley cultivar (Giza 124) which sown on the 20th of November in both seasons. The biofertilizer were prepared by adding equal amounts of microorganisms. Microbin was commercial multi - strains produced by the general organization for Agricultural Equalization fund , Ministry of agricultural to a carrier material . Arabic gum was melted in suitable amounts of warm water and mixed with each biofertilizer . Barley seeds were mixed carefully to this mixture and spread over a plastic sheet and kept in shade for a short time before seeding . The experiments were harvested on 15 of April in new reclaimed sandy soil and 1 May in silty clay in the two growing seasons. Farmyard manure was applied to this sandy soil year after year . At harvest time , the following characters were studied:

- 1- Plant height (cm)
- 2- Number of spikes / m² .
- 3- spike length (cm)
- 4- Number of kernels / spike (gm)
- 5- Weight of kernels / spike (gm)
- 6- 1000 - kernels weight (gm)
- 7- Grain yield (Ardab / fed)
- 8- straw yield (ton / fed)

Experimental data were subjected to statistical analysis using analysis of variance and the mean values were compared using L.S.D test according to steel and Torrie (1980) .

Table 1 : Mechanical and chemical analysis of the experimental site in new reclaimed sandy at samalout and silty clay loam soil at Mallawi , in 1999 / 2000 and 2000 / 2001 seasons .

Mechanical properties	New reclaimed sandy	Silty clay loam	Chemical properties	New reclaimed sandy	Silty clay loam
Sand %	86.29	7.95	PH	8.17	8.15
Silty %	8.98	57.70	Available nitrogen(ppm)	0.017	43.35
Clay %	4.73	34.31	Available phosphorus(ppm)	7.25	9.00
Texture grade	loamy sand	silty clay	Available potassium meg / 100 g soil	0. 80	0.95

RESULTS AND DISCUSSION

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Effect of Biofertilier in new reclaimed sandy soils

1- yield attributes :

The data of Table 2 indicate that biofertilizer treatments had positive significant effects on plant height , number of spikes / m² in both seasons , but spike length and number of kernels / spike are significant in the second and the first season respectively. While the weight of kernels / spike and 1000 - kernels weight are insignificant in both seasons . , The increase in number of spikes / M² with using biofertilizer was 40.90 % in the first season and 25.58 %in the second one compared without using biofertilizer . Similar results were obtained by Hassanein and Hassouna (1997) who observed that biofertilizers caused an increase in number of spikes / m² . Belimov *et al* (1995) stated that combination of inoculation with biofertilizers and fertilization treatment were more growth promoting , also , yield components responed positively to biofertilizer ; EL - kawas (1990) concluded that bacteria of biofertilizers caused increases in number of spikes / m² and number of grains per spike .

Okon (1982) reported that biofertilizers exhibited about 30 - 50 % graeter uptake nitrate , phosphate and potassium compared with control without application of biofertilizers and he reported that Biofertilizers enhancing mineral absorbiton of the cell which is reflected on the plant growth .

2- Straw and grain yields :

Data of Table 2 show that biofertilizer treatments had significant effects on grain and straw yields , in both seasons .Grain and straw yields of barley significantly increased with using biofertilizer compared without using biofertilizer .

The increases in grain yield with using biofertilizer were 47.36 % in the first season and 26.49 % in the second one compared without using biofertilizer , while the increases in straw yield with using biofertilizer were 61.79 % in the first season and 33.33 % in the second one .

The results are similar with those obtained by Said (1998) concluded that response of barley to biofertilizer for increasing the yield in reclaimed lands ; Hassanein and Hassouna (1997) reported that using biofertilizer for barely caused an increases in grain yield by increasing number of spikes and number of grains / spike ; Madkour *et al* (1997) observed that inoculation with N₂ -fixing bacteria increased yield for barley ; Belimov *et al* (1995) who found that the biofertilization is very important for increasing grain yield .

Zaid (1992) and Fayez (1989) reported that biofertilizers increased the yield by increasing number of spikes / m² ; okon (1982) found that biofertilizer increased yield of barley .

In can be concluded from these results that biofertilizer caused increases in grain and straw yields by increasing the number of spikes / m² in both seasons because the nitrogen fixing bacteria of biofertilizer may increase the synthesis of endogenous phytohormones i.e Gibberlic acid (GAA) and cytokinous (cks) which plays an important of abig active root system . Also the temperature during cultural was very suitable to bacteria and irrigation every ten day helps to in actual the bacteria .

Effect of biofertilizer in silty clay loam soil :-

1- Yield attributes :-

Yield attributes of barley as affected by biofertilizer treatments are shown in the Table 3 Values show that the biofertilizer treatments gave significant increases in most characters . However , plant height and number of spikes / m² were significant in both seasons , while spike length was significant in the second season and number of kernels was significant in the first season . on the other hands weight of kernels / spike and 1000 - kernels weight were insignificant in both seasons . the taller plants , spike length , the highest number of spikes / m² and number of kernels / spike were produced from using biofertilizer with the addition of the recommended doses Nitrogen and phosphate fertilizers .

The increase in number of spikes / m² with (C₂) using biofertilizer with Nitrogen and phosphate fertilizers were 15.32 % in the first season and 15.32 % in the second one compared (C₁) without using biofertilizer . The results were similar with those obtained by Hassanein and Hassouna (1997) ; Belimov *et al* (1995) ; EL -kawas (1990) okon (1982) .They concluded that combination of inoculation with biofertilizer and fertilization treatments were mor growth promoting .

2- Straw and grain yields :

Data of Table 3 show that (C₂) using biofertilizer with nitrogen and phosphate fertilizers had a significant effect on grain and straw yields in both seasons .

The increases in grain yield as a result of using biofertilizer were 19.50 % and 20.18 % in the first and the second one, respectively . However the increases in straw yield with using biofertilizer were 8.58 % in the first season and 16.79 % in the second one .

Similar results were obtained by Said (1998) concluded that barley responded to biofertilizer leading to increasing the yield in reclaimed lands ; Hassanein and Hassouna (1997) observed that biofertilizers caused an increased in number of spikes/ m² ; Madkour etal (1997) ; Zaid (1992) and fayez (1989) they reported that biofertilizers increase the yield by increasing number of spikes / m²

Effect of biofertilizer under new reclaimed sandy and silty clay loam soils :

1- Yield attributes :

The data of Table 4 show that the combined effects of biofertilizer treatments under new reclaimed sandy and silty clay loam soils were significant on plant height and number of spikes / m² in two growing seasons. While spike length was significant in the second season and numer of kernels/spike was significant in the first season - However weight of kernels/ spike and 1000- kernels weight were insignificant in both seasons- under new reclaimed sandy and silty clay loam soils.

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The taller plants and length spike and the highest number of spikes / m² and number of kernels / spike were produced from using biofertilizer compared the control treatment which without using biofertilizer. The increases of spikes/m² with using biofertilizer were 25.52 % in the first season and 20.02 % in the second one. The results were similar with those reported by Hassanein and Hassouna (1997); Belimov *et al* (1995); El - kawas (1990); okon (1982), who observed that biofertilizers caused increases in number of spikes/m² and number of grains/spike .

2- Straw and grain yields :

Statistical analysis of the combined effects of the treatments in new reclaimed sandy and silty clay loam soils in Table 4 indicate that the straw and grain yields in both seasons were significantly increased . The increases in grain yield due to using biofertilizer compared with the control were 33.45 % and 23.39 % in the first season and the second one . respectively . However the increases in straw yield were 28.25 % in the first season and 23.69 % in the second one . Similar results were obtained by said (1998) ; EL -kawas (1990) concluded that bacteria of biofertilizers caused in increases in number of spikes / m² and number of grains per spike ; okon (1982) reported that biofertilizers exhibited about 30- 50% greater uptake nitrate , phosphate and potassium compared with control. Belimov *et al.* (1985) stated that combination of inoculation with biofertilizer and fertilization treatment were mor growth promoting also yield components responded positively to biofertilizer.

It can be concluded from the data of new reclaimed sandy and silty clay loam soil that using biofertilizer with adding the recommended doses of Nitrogen fertilizers this regions in Middle Egypt comparing control increased the grain and straw yield by increasing the number of spikes / m² and yield components.

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تأثير السماد الحيوى على انتاجية محصول الشعير فى الاراضى الرملية حديثة الاستصلاح والسلتية الطينية .

محفوظ عبد الحميد * - جمال عبد الله **

* معهد بحوث المحاصيل الحقلية - مركز البحوث الزراعيه - الجيزه

** معهد بحوث الاراضى والمياه والبيئه - مركز البحوث الزراعيه - الجيزه

اقبمت اربعة تجارب حقلية فى الاراضى الرملية الجديدة المستصلحة بصحراء شمالووط والاراضى السلتية الطينية بمحطة بحوث ملوى بمحافظة المنيا خلال موسمى النمو 2000 / 1999 ، 2000 / 2001 لدراسة تأثير السماد الحيوى على انتاجية الشعير فى الاراضى الجديدة المستصلحة والسلتية الطينية ، وتم دراسة عدد السنابل بالمتر المربع - طول النبات بالسلم - طول السنبله بالسلم - عدد حبوب السنبله - وزن حبوب السنبله بالجرام - وزن الالف حبه بالجرام - محصول الحبوب بالاردب للفدان - محصول القش بالطن للفدان.

واوضحت النتائج ما يلى :-

- 1- اضافة السماد الحيوى مع السماد النيتروجينى والفوسفاتى الموصى به فى الاراضى الجديدة المستصلحة والسلتية الطينية فى مصر الوسطى ادى الى زيادة معنويه فى معظم الصفات التى تم دراستها لمحصول الشعير بالمقارنه بعدم اضافة السماد الحيوى مع السماد النيتروجينى والفوسفاتى الموصى به .
- 2- أثر اضافة السماد الحيوى زيادة معنويه على طول النبات وعدد السنابل بالمتر المربع ومحصول الحبوب بالاردب لكل فدان ومحصول القش بالطن لكل فدان خلال موسمى النمو بالمقارنه بعدم اضافة السماد الحيوى فى الاراضى الجديدة المستصلحة والسلتية الطينية .
- 3- اثر اضافة السماد الحيوى تأثير معنويا على طول السنبله فى الموسم الثانى وعدد حبوب السنبله فى الموسم الاول فى الاراضى الجديدة المستصلحة والسلتية الطينية .
- 4- زادت عدد السنابل بالمتر المربع مع اضافة السماد الحيوى بالمقارنه بعدم الاضافة للسماد الحيوى فى الاراضى الجديدة المستصلحة بنسبة 40.9 % فى الموسم الاول و 25.58% فى الموسم الثانى بينما نسبة الزيادة فى الاراضى السلتية الطينية 15.32 فى الموسم الاول و 15.30 % فى الموسم الثانى ، اما نسبة الزيادة فى الاراضى الجديدة والسلتية الطينية 25.52 % فى الموسم الاول و 20.02 % فى الموسم الثانى .
- 5- زاد محصول الحبوب باضافة السماد الحيوى بالمقارنه بعدم الاضافة للسماد الحيوى فى الاراضى الجديدة المستصلحة بنسبة 47.36% فى الموسم الاول و 26,49 % فى الموسم الثانى ، لكن نسبة الزيادة فى الاراضى السلتية الطينية 19.5 % فى الموسم الاول و 20.18 فى الموسم الثانى ، اما نسبة الزيادة فى الاراضى الجديدة والسلتية الطينية 33.45 % فى الموسم الاول و 23.39 % فى الموسم الثانى .
- 6- زاد محصول القش باضافة السماد الحيوى بالمقارنه بعدم الاضافة للسماد الحيوى فى الاراضى الجديدة المستصلحة بنسبة 61.79% فى الموسم الاول و 33.33% فى الموسم الثانى ، اما نسبة الزيادة فى الاراضى السلتية الطينية 8.58 % فى الموسم الاول و 16.79 فى الموسم الثانى ، بينما نسبة الزيادة فى الاراضى الجديدة المستصلحة والسلتية الطينية 28.25 % فى الموسم الاول و 23.69 % فى الموسم الثانى .
- 7- كانت النسب المنوية للزيادة فى (عدد السنابل بالمتر المربع - محصول الحبوب - محصول القش) الناتجة باضافة السماد الحيوى مع السماد النيتروجينى والفوسفاتى الموصى به فى الاراضى الرملية اكثر من النسب المنوية للزيادة فى الاراضى السلتية الطينية .
- 8- يمكن القول بأن اضافة السماد الحيوى مع السماد النيتروجينى والفوسفاتى الموصى به اعطى اعلى انتاجية لمحصول الشعير فى الاراضى الرملية الجديدة المستصلحة اكثر من الاراضى السلتية الطينية تحت ظروف محافظة المنيا .

Table (2): Effect of biofertilizer on yield and yield attributes of barley in new reclaimed sandy soil in 1999/ 2000 and 2000 / 2001 seasons

Treatment	Plant Height (cm)		Numer of spikes / m ²		Spike length (cm)		Number of kernels /spike		Weight of kernels /spike (gm)		1000-kernels weight(gm)		Grain yield ardab /fed		Straw yield Ton / fed	
	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
C ₁ -control without using biofertilizer with the recommended doses of nitrogen and phosphate fertilizers	89.93	92.1	264	344	7.01	6.93	47.06	48.82	2.40	2.53	49.93	51.70	14.80	18.34	3.35	3.66
C ₂ – using biofertilizer with recommended doses of nitrogen and phosphate fertilizers	96.24	102.4	372	432	7.43	7.36	49.69	50.33	2.60	2.43	51.76	51.93	21.81	23.20	5.42	4.88
L.S.D 5%	4.36	6.11	68.04	19.79	N.S	0.34	2.51	N.S	N.S	N.S	N.S	N.S	3.05	1.77	0.49	0.55
% increasing by using biofertilizer comparing without using biofertilizer			40.90 %	25.58 %									47.36 %	26.49 %	61.79 %	33.33 %

Table (3): Effect of biofertilizer on yield and yield attributes of barley under silty clay loam soil in 1999/ 2000 and 2000 / 2001 seasons

Treatments	Plant height (cm)		Number of spikes / m ²		Spike length (cm)		Number of kernels /spike		Weight of kernels /spike (gm)		1000-kernels weight (gm)		Grain yield ardab /fed		Straw yield ton / fed	
	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
C ₁ -control without using biofertilizer with the recommended doses of nitrogen and phosphate fertilizer	96.4	85	398	405	6.43	6.60	53.60	56.30	2.33	2.56	44.63	45.13	17.07	17.74	5.71	5.12
C ₂ -using biofertilizer with recommended doses of nitrogen and phosphate fertilizers	109.4	106.2	459	467	7.03	7.47	55.93	57.86	2.27	2.59	44.43	45.43	20.40	21.32	6.20	5.98
L.S.D 5%	10.87	5.01	23.75	38.64	N.S	0.71	2.01	N.S	N.S	N.S	N.S	N.S	1.74	3.36	0.22	0.65
% increasing by using biofertilizer comparing without using biofertilizer			15.32 %	15.30 %									19.50 %	20.18 %	8.58 %	16.79 %

Table (4): Effect of biofertilizer on yield and yield attributes of barley under new reclaimed sandy and silty clay loam soils in 1999/ 2000 and 2000 / 2001 seasons

Treatments	Plant height (cm)		Nuner of spikes / m ²		Spike length (cm)		Number of kernels /spike		Weight of kernels /spike (gm)		1000-kernels weight(gm)		Grain yield ardab/fed		Straw yield ton / fed	
	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
C ₁ -control without using biofertilizer with the recommended doses of nitrogen and phosphate fertilizer	93.16	88.55	331	374.5	6.76	6.76	50.33	52.56	2.36	2.55	47.28	48.41	15.93	18.04	4.53	4.39
C ₂ -using biofertilizer with recommended dosesof nitrogen and phosphate fertilizers	102.82	104.30	415.5	449.5	7.23	7.41	52.81	54.09	2.43	2.51	48.09	48.68	21.26	22.26	5.81	5.43
L.S.D 5%	8.34	9.80	16.54	49.97	N.S	0.51	2.32	N.S	N.S	N.S	N.S	N.S	1.81	1.91	0.58	0.36
% increasing by using biofertilizer comparing wiyhout using biofertilizer			25.52 %	20.02 %									33.45 %	23.39 %	28.25 %	23.69 %

