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RESPONSE OF SOME BARLEY VARIETIES TO BIOFERTILIZERS IN MIDDLE EGYPT

DBDEL–HAMID M.[1] AND G.A. MOHAMED[2]

1 Field Crops Res. Inst.

2 Soils, Water and Environoment Res. Inst.

A.R.C. Egypt.

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Abstract

Two field experiments were conducted at the Mallawi Agricultural Research station . A.R. C ., El-Minia Goveranorte , during the two successive season of 1997/98 and 1998/99 to study the effect of Biofertilizer B1-Biogen and B_2 –Cerealin and the rate of application recommended for nitrogen fertilizer] 0 (control) , - 20% – 40% and 60% of recommended

N rate] on yield and yield components of two barley cultivars , Giza 126 and Giza 123 . A split- split plot design with four replications was used . Barley varieties were the main plots , Biofertilizer in the sub – plots while the nitrogen fertilizer treatments were alloted to the sub – sub plots .

The results indicated that :

1. Giza 126 gave the highest number of plants / m^2 and was later in heading than Giza 123 variety .
2. The application of the biofertilizer " biogen " significantly increased grain ytield of barley by 25.53 % and 12.34 % compared to application of the biofertilizer , cerealin.
3. The application of biofertilizer (biogen) significantly increased straw yield of barley by 17.51 % and 31.85 % compared to the application of cerealin .
4. Biogen significantly improved number of plants / m^2 , plant height and number of kernels / spike compared to cerealin .
5. There were no differences among nitrogen fertilizer treatments on grain yield in both seasons .
6. The highest grain yield was produced from biofertilizer biogen using 20% of the recommended nitrogen fertilizer rate in the first season . while the highest number of plants / m^2 , number of kernels / spike and plant height were obtained from Biogen on Giza 126 variety in the second season –But the highest number of kernels/ spike resulted from using 60% of the recommended N rate and Biogen in the second season.

INTRODUCTION

Barley *(Hordeum vulgare L.)* is an important cereal crop in Egypt , especially in the marginal areas due to its ability to cope with stress conditions in such areas such as limited rainfall and poor soils of newly reclaimed lands . These areas suffer mainly from moisture strees and nutrient deficienies (El-Sayed and Noaman , 1992 ; El-Sayed and Abd El-Hadi , 1991 ; and El-Sayed *et al* ., 1991 b ;) . Increased fertilizer costs and increased interest in environmental safety led to the enhanced use of biological N_2 –fixation and the use of biofertilizers . In addition incoulating seeds with biofertilizers is easier and less costly than mineral fertilizers , especially under rainfed conditions where farmers are used to grow barley without fertilization in order to minimize production costs . Intensive research on asymbiotic nitrogen fixation has focused on the positive side of the plant – microbe relationship in an effort to increase plant growth and grain yield . Several reports indicated that the incoculation of seeds or seedlings of various C_3 and C_4 plants with associative N_2 –fixing bacteria led to changes in plant growth and some times to yield increases (Said 1998 ; Mitkees *et al* 1996; Belimov *et al* , 1995 ; Abou El Naga , S.H . 1993 ;Edit *et al* ., 1986 ; Eid , 1982 and ; Pohlman and Mc Coll , 1982) . These workers reported that biofertilizer is very important for increasing grain yield and decreasing Nitrogen fertilizer for barley plants . However, Hassanein , and Hassouna . 1997, EL- kawas, 1990 and Fayez , 1989 reported that biofertizers cause increases in yield by increasing number of spikes / m^2 and number of grain / spkie. Some studies showed that the effect of N fertilization and varieties under different soils . Results of Gonzales *et al.* (1993) indicated that N fertilization rates did not increase grain yield . Clancy *et al* (1991) oboserved that higher N level did not affect test weight and 1000 – kernel weight of barley . Drlik and Proplawski (1991) revealed that nitrogen rate had no significant effect on grain yield of spring barley. Pecoi (1989) showed that cultivars of barley under study did not differ significantly in grain and protein yields. Knapp and Knapp (1980) found that nitrogen alone had no effect compared to no fertilizer on grain yield and yield components of barley .

The objectives of this work were to study the effect of biofertilizer on barley yield when N fertilizer is applied at rates lower than recommended to reduce the hazardous effects on environment under Middle Egypt conditions .

MATERIALS AND METHODS

Two field experiments were conducted at Mallawy Agricultural Research station – El – Minia governorate during the two successive seasons of 1997/1998 and 1998/ 1999 to study the response of two barley varieties to biofertilizers under reduced N fertilizer rate in Middle Egypt . Soil type of the experimental farm was silty clay loam ; physical and chemical analyses of the soil are given in table (1) . Cotton was the preceding crop .

A-Barley varieties *(Hordeum vulgare)* :a-Giza 123 a_2 –Giza 126
B-Biofertilizers : b_1 –Biogen b_2 – cerealin

Rate of N fertilizer application :

C_1 – control (no nitrogen fertilizer) .
C_2 – Application of 20 % of recommended N rate i.e 9 kg N/ fed
C_3 – Application of 40 % of recommended N rate i.e 18 kg N/ fed
C_4 – Application of 60 % of recommended N rate i.e 27 kg N / fed

Nitrogen ferilizer was applied as urea (46 % N) at the treatemnt rate in two equal doses ; at sowing and at tillering . Phosphorus fertilizer was applied at a rate of 15 kg P_2O_5 in the form of calcium superphosphate (15.5% P_2O_5) . The biofertilizer was prepared by adding equal amounts of the microorganisms to a carrier material . Arabic gum was melted in amount of warm water and was addded to the Biogene .Barley seeds were added to the mixture of Biogene and gum , mixed carefully and spread over a plastic sheet away from direct sun for a short time before planting . The other biofertilizer (cerealin) was used the same way .

A split- plot design with four replications was used in both seasons .

Barley varieties were randomly distributed in the main plots , biofertilizer were distributed in the sub plots and the N rate treatments in the sub– sub – plots .

The sub – sub plot area was 3.0 x 3.5 m (10.5m_2 = 1/400 fed) . Barley cultivars were sown on November 20 and 25 in the two seasons , respectively , at the rate of 50 kg seed / fed . Data of each season were statistically analyzed according to Steel and Torrie (1980) .

The following characters were studied :

1. plant height in cm at harvest .
2. Days from planting to 50% heading .
3. Nmber of spikes /m^2 .
4. Spike length (cm)
5. Number of kernels/ spike
6. Weight of kernels / spike (gm) .
7. 1000- kernels weight (gm) .
8. Grain yield (ardab / fed)
9. Straw yield (tons / fed)

Table 1. Physical and chemical analysis of the experimental site in the two seasons.

	1997/98	1998/99
Physical analysis		
Sand %	8.65	7.25
Silt %	58.92	56.49
Clay %	32.43	36.26
Chemical analysis		
A vailable nitrogen , ppm	47.70	39.00
A vailable phosphorus ppm	8.00	10.00
A vailable potassium (meq/100g Soil)	0.80	0.90
PH (1 : 2.5)	8.20	8.10
Salinity (m mhos / cm at 25 c)	0.33	0.23

RESULTS AND DISCUSSION

Plant height :

Data in tables (2 and 3) showed that the differences between the two cultivars were insignificant in both seasons . The effect of biofertilizer was insignificant in the first season but significant in the second season . Plant height increased from Biogen application in both seasons . Nitrogen fertilizer treatments were insignificantly different in both seasons .

Number of days to 50 % heading

Data in tables (2 and 3) indicate that there were significant differences between Giza 126 and Giza 123 in the first season , where Giza 123 headed earlier. Biofertilizer and nitrogen rates had no effect on heading in both seasons .

Number of spikes / m^2

The differences between the two cultivars were significant in the first season only . The highest number of spikes / m^2 was obtained from Giza 126 variety . The effect of biofertilizer on this trait was significant in the first season only . The highest number of spikes / m^2 was produced from using Biogen .

The effect of percentage nitrogen fertilizer was insiginficant in both seasons . These results are in agreement with those obtained by Hassanein and Hassouna (1997) who reported that biofertilizers enhanced the number of spikes/ m^2. El- kawas (1990) also revealed that biofertilizer increased the number of spikes / m^2

Spike length :

The difference between cultivars were insignificant in both seasons. Biofertilizer and N rates had no effect in both seasons . These results are similar to those obtained by Knapp and Knapp (1980)

Number of kernels / spike :

Cultivars did not differ in number of kernels / spike in both seasons . The biofertilizer had insignificant effect in the first season but significantly affected this trait in the second season . Higher number of kernels / spike was obtained from Biogen .

The N fertilizer rates had insignificant effect in both seasons . These results were similar to those obtained by Hassouna and Hsassouna (1997) reported that Biofertilizer enhanced the number of krnels / spike . El-Kawas (1990) stated that bacteria of biofertilizer increased the number of kernels / spike . Hassanein and, Knapp and Knapp (1980) revealed that nitrogen alone had no effect on components of yield in barley .

Weight of kernels / spike :

Data in tables (2 and 3) show that the differences between cultivars were insignificant in both seasons .

The effect of biofertilizers and N rates were insignificant in both seasons . These results are in harmony with El- Kawas (1990) and Fayez (1989) and that biofetilizers increased the yield by increasing number of spikes / m^2 and number of grains / spike . Knapp and knapp (1980) reported that nitrogen a lone had no effect on barley when compared to no fertilizer on components of yield .

1000-kernels weight :

The difference between cultivars was insignificant in both seasons . The heavier weight of kernels was obtained from Giza 123 . The effect of biofertilizer and N rates were insignificant in both seasons . The results were similar to Clancy *et al* (1991) who observed that high N level did not affect test weight and 1000 – kernel weight .

Grain yield (ardab /fed) :

It is obious from tables (2 and 3) that the difference between Giza 126 and Giza 123 was insignificant in both seasons . The effect of biofertilizer was significant only in the first season . The highest grain yield was produced from Biogen in both season . The increase of grain yield with Biogen was 25.53% in the first season and 12.34 % in the second season compared with cerealin . These results are in agreement with those obtained by Said (1998) who concluded that the application of biofertilizer caused an increase in grain yield of barley . Hassanein and Hassouna (1997) and El-kawas (1990) concluded that Bacteria of biofertilizer increased the grain yield of barley . Okon (1982) reported that biofertilizes increased the plant growth and grain yield.

The effect N rates was insignificant in both seasons because increased N fertilization caused lodging of barley . These results are in agreement with those obtained by Gonzalez *et al* . (1993) who indicated that N fertilization rates did not increase grain yield . Drlik and Roplawski (1991) and Knapp and Knapp (1980) also reported that nitrogen alone had no effect on grain yield of barley .

Straw yield (ton / fed):

Data in tables (2 and 3) revealed that the differences between the two cultivars were insignificant in both seasons . The highest straw yield was produced from Giza 123 in both seasons .

The results were similar with Virender Kumar and Agarwal (1991) who stated that varieties did not differ in straw yield in both seasons .

The effect of biofertilizer was significant in the first season only . However straw yield was produced from Biogen in both seasons . The increase of straw yield with Biogen was 17.51 % in the first season and 31.85% in the second season compared with cerealin . The effect N rates was insignificant in both seasons .

Interaction effects :

The data in table (4) show that biofertilizer X N rates fertilizer interactions had a significant effect on grain yield (ardab/fed) in 1997/98 season and number of kernels / spike during 1998/99 season . The highest grain yield of (22.75 ardab/ fed) and number of kernels / spike (51.56) were obtained from the combination of Biogen and N rate 60% recommended rate . The data presented in table (5) show that varieties X Biofrtilizer interactions had significant effect during 1998/99 season on number of plants / m^2 , plant height and number of kernels / spike . The highest number of plants / m^2 (346) , the tallest plants (103.33) and the highest number of kernels / spike (50.67) were produced from Giza 126 given Biogen.

Table 2. Plant chacteristics , grain and straw yields of barley varieties as influenced by biofertilizer application in 1997/98 Season .

Treatments	No. of plant (M^2)	Plant height (cm)	No. days to 50% heading	Spike length (cm)	Kernels /spike	Weight of kernels / spike (gm)	1000-kernels weight gm	Gra in yield ardab/fed	Straw yield ton / fed
Giza 126	402.75	105.62	89.95	6.40	46.75	2.45	53.86	19.31	3.75
Giza 123	414.08	99.37	86.29	6.21	46.90	2.46	54.41	18.41	4.30
L.S.D 5%	N.S	N.S	0.95	N.S	N.S	N.S	N.S	N.S	N.S
Biogen	437.75	107.50	88.12	6.18	45.55	2.37	54.01	21.00	4.58
Cerealin	379.08	97.50	88.12	6.44	48.09	2.55	54.26	16.72	3.47
L.S.D 5%	32.35	N.S	N.S	N.S	N.S	N.S	N.S	3.29	0.96
Nitrogen ferilizer Rates									
C_1 (zero- N)	412.33	107.08	87.91	6.43	46.03	2.47	54.06	19.00	4.11
C_2 (20%- N)	413.00	102.08	88.00	6.36	46.47	2.48	53.65	18.66	4.01
C_3 (40%- N)	405.66	97.91	8.25	6.09	46.56	2.39	53.95	18.87	4.02
C_4 (60% -N)	402.66	102.91	88.33	6.35	48.23	2.50	54.87	18.91	3.98
L.S.D 5%	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

Table 3. Plant chacteristics , grain and straw yields of barley varieties as influenced by biofertilizer application in 1998/99 Season .

Treatments	No. of plant (M^2)	Plant height (cm)	No. days to 50% heading	Spike length (cm)	Kernels /spike	Weight of kernels / spike (gm)	1000-kernels weight gm	Gra in yield ardab/fed	Straw yield ton / fed
Giza 126	317.33	99.58	90.12	6.28	48.00	2.46	53.34	16.56	5.61
Giza 123	275.00	97.91	87.08	6.40	46.30	2.45	53.94	17.14	6.91
L.S.D 5%`	42.92	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S
Biogen	308.33	100.20	88.45	6.35	48.37	2.47	53.76	17.83	6.77
Cerealin	284.00	97.29	88.75	6.33	45.94	2.44	53.52	15.87	5.76
L.S.D 5%	N.S	1.93	N.S	N.S	1.16	N.S	N.S	N.S	N.S
Nitrogen ferilizer Rates									
C_1 (zero- N)	292.00	97.50	88.33	6.38	45.38	2.35	53.82	17.50	6.59
C_2 (20%- N)	285.66	98.75	88.16	6.45	46.68	2.46	53.35	17.41	6.18
C_3 (40%- N)	301.00	97.50	89.08	6.17	47.73	2.49	53.59	15.79	6.16
C_4 (60% -N)	306.00	101.25	88.83	6.35	48.83	2.51	53.80	16.70	6.12
L.S.D 5%	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

Table 4. Effect of interaction between biofertilizer and rate of N application on grain yield (ardab / fed) in 1997 and 98 season and number of kernels / spike in 1998/99 season .

Biofertilizer	Rate of N application			
	C1	C2	C3	C4
Grain yield (ardab / fed) in 1997 and 98 season				
Biogen	19.41	20.00	21.83	22.75
Cerealin	18.58	17.33	15.91	15.08
L.S.D 5%	3.42			
Number of kernels / spike in 1998 /99 season				
Biogen	48.16	46.63	47.13	51.56
Cerealin	42.60	46.73	48.33	46.10
L.S.D 5%	4.27			

Table 5. Effect of interaction between varieties and biofertilizer on number of plants / m^2 , plant height and number of kernels / spike in 1998/99 season .

Variety	Biofertilizer	
	Biogen	Cerealin
Number of plants / m^2 in 1998/99 season		
Giza 126	346.66	270.00
Giza 123	288.00	280.00
L.S.D 5%	36.54	
Plant height in 1998/99 season		
Giza 126	103.33	95.83
Giza 123	97.08	98.75
L.S.D 5%	2.59	
Number of kernels / spike in 1998/99		
Giza 126	50.67	45.25
Giza 123	45.98	46.63
L.S.D 5%	1.65	

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استجابة بعض اصناف الشعير للتسميد الحيوى بمصر الوسطى

محفوظ عبد الحميد[1] - جمال عبد الله محمد[2]

١ معهد بحوث *المحاصيل الحقلية*
٢ معهد بحوث *الاراضى والمياه والبيئة*
مركز البحوث الزراعية

أقيمت تجربتان حقليتان فى مزرعة محطة بحوث ملوى - محافظة المنيا خلال موسمى ١٩٩٨/٩٧ ، ١٩٩٩/٩٨ لدراسة تأثير التسميد الحيوى بمستحضرى بيوجين - سيريالين مع إضافة تشبة من كمية السماد النيتروجينى الموصى بها وهى ٤٥ وحدة نتروجين للفدان . بدون سماد نيتروجين ، ٢٠٪ من الكمية الموصى بها (٩ وحدة نتروجين للفدان) ، ٤٠٪ من الكمية الموصى بها (١٨ وحدة نتروجين للفدان) ، ٦٠ ٪ من التوصية (٢٧ وحدة نتروجين للفدان) على صنفى الشعير (جيزة ١٢٦-جيزة ١٢٣) من حيث المحصول ومكونات المحصول -استخدم تصميم القطع المنشقة مرتين فى أربع مكررات حيث تم توزيع الاصناف فى القطع الرئيسية والسماد الحيوى فى القطع الشقية الاولى بينما تم توزيع معاملات التسميد النيتروجينى فى القطع الشقية الثانية .

ويمكن تلخيص النتائج المتحصل عليها كالآتى :

١- أعطى الصنف جيزة ١٢٦ أعلى عدد سنابل بالمتر المربع وكان أكثر تأخيراً فيالوصول إلى ٥٠٪ عن جيزة ١٢٣ .

٢- زاد محصول الحبوب بالاردب لكل فدان زيادة معنوية عند استخدام السماد الحيوى (بيوجين) بالمقارنة مع السماد الحيوى (سيريالين) وكانت نسبة الزيادة فى محصول الحبوب ٢٥,٥٣ ٪ ، ١٢,٣٤٪ فى الموسمين الاول والثانى على الترتيب .

٣- زاد وزن القش بالطن للفدان زيادة معنوية مع السماد الحيوى (بيوجين) بالمقارنة مع السماد الحيوى (سيريالين) وكانت نسبة الزيادة فى وزن القش ١٧,٥١ ٪ ، ٣١,٨٥ ٪ فى موسمى الزراعة على الترتيب .

٤- أدى التسميد الحيوى (بيوجين) إلى زيادة معنوية فى عدد السنابل بالمتر المربع- طول النبات - عدد حبوب السنبلة بالمقارنة مع السماد الحيوى (سيريالين) .

٥- لم يكن للسماد النيتروجينى بالمعدلات المستخدمة تأثير معنوى على محصول الحبوب لكلا الموسمين .

٦- امكن الحصول على أعلى محصول حبوب من استخدام السماد الحيوى (بيوجين) مع اضافة ٢٠ ٪ من كمية النيتروجين الموصى بها فى الموسم الاول بينما أمكن الحصول على أعلى عدد سنابل

بالمتر المربع وعدد حبوب السنبلة وأطول النباتات من السماد الحيوى (بيوجن) والصنف جيزة ١٢٦ فى الموسم الثانى لكن أعطى أعلى عدد حبوب للسنبلة من ٦٠٪ السماد النيتروجينى المقرر والسماد الحيوى (بيوجين) بالموسم الثانى .