Zagazig J. Agric. Res., Vol. 32 No. (5) 2005 **1381 - 1401**

EFFECT OF NITROGEN AND MICRONUTRIENTS FERTILIZATIONS ON YIELD OF SOME BARLEY CULTIVARS GROWN UNDER SANDY SOIL CONDITIONS

Abd El-Hameed, I.M. and Salwa M.A.I. Ash-Shormillesy

Agronomy Dept., Fac. of Agric., Zagazig Univ., Egypt.

Accepted 10/ 8 / 2005

ABSTRACT: Two field experiments were carried out in the Experimental Farm, El-Khattara region Faculty of Agriculture, Zagazig University, Sharkia Governorate, Egypt during two winter successive seasons (2002/2003 – 2003/2004) to study the effect of two nitrogen fertilizer levels and micronutrients on yield determinations of five barley cultivars. The obtained results could be summarized as follows:

1- Barley cultivars were significantly differed in all characters during both seasons and their combined were found. Where Giza124 as well as Giza2000 cultivars recorded the highest values of regarding plant height (cm) and spike length (cm). Whereas Giza125 and Giza126 cultivars recorded the highest values number of spikelets/spike, number of grains/spike, grain weight/spike, grain yield (kg/fad.), stover yield (ton/fad.) and biological yield (ton/fad.).And Giza126 recorded the heaviest weight of grain. While Giza123cultivar gave the lowest values in all aforementioned traits except harvest index and crop index.

2- The increase of N level from 35 to 70 kg N/fad. was followed by a significant increase in aforementioned characters. in both seasons and their combined analysis.

3- Application of Coatengeen as a micronutrients mixture of (Fe+ Mn+ Zn) caused a significant increase in plant height (cm), number of spikelets/spike, number of grains/spike, grain weight/spike, grain yield (kg/fad.), biological yield, harvest index and crop index (ton/fad.)as shown in the combined analysis.

4- The significant interaction between the studied factors indicated that the best yield and yield attributes could be obtained by Giza125 orGiza126 cultivar fertilized with 70kg N/fad. and treated with Coatengein (combined analysis).

5- Grain yield/fad. was positively and significantly correlated with each of number of spikelets / spike (0.4670**), number of grains/spike (0.5967**),grain weight/spike (0.6162**)and 1000-grain weight (0.6677**).

Key words: Barley, cultivars, nitrogen, micronutrients, cotengeen and sandy soil conditions.

INTRODUCTION

Barley (*Hordium vulgare* L.) is considered to be one of the most important cereal crops in the world as well as in Egypt. In Egypt, barley is mainly used for animal feeding (including both grain and straw) and bread making by Bedowin people living in the desert and dry areas. Many workers showed that barley cultivars differ in growth characters, yield and yield components. Noaman *et al.* (1996) detected a significant differences between the three barley cultivars grown in sandy reclaimed soil. Giza124 variety surpassed Giza123and C.C.89 variety. Allam (1997) indicated that the highest grain yield and yield components of barley were resulted from sown Brefix cultivar followed by Desert variety grown under new reclaimed soil (sandy soil). El-Bawab (1998) indicate that Giza124cv. showed the highest grain yield at most localities (high frequency). Therefore,it could be considered as a wide adopted genotype. Giza126, which was developed and released mainly for drought stress(rainfed conditions), proved to be suitable for the North coast of Egypt.Giza123 barley cultivar is stable and has high yielding productivity in upper Egypt. Meanwhile L6R93/1 was more adopted for Suez Canal area. El-Hadi *et al.* (1998) revealed that Giza124 surpassed the other cultivars (Giza121, Giza123 and composite cross89) in plant height, flag leaf area, number of spikes/m^2, number of grains/ spike, weight of grains/ spike, 1000-grain weight and grain yield/fad. Moreover, El-Kholy and El-Bawab (1998) reported that Giza124 and

Giza125 barley cultivars gave the highest above mentioned characters except number of spikes/m^2 followed by Giza126 and Giza128 under newly reclaimed soils.

Nitrogen plays an important role in plant life and is considered an indispensable element for several vital functions.

Glelah *et al.* (1992) found that grain and straw yields responded significantly to spraying micronutrients Zn, Fe, Cu, Mn, P and Mo)singly or in combinations and applied N up to 60kg N/fad. They concluded that spraying micronutrients along with N fertilization could be enhanced plant and yield of barley grown in sandy soil. Barley yield and yield attributes were increased with increasing nitrogen levels in newly reclaimed or sandy soils (Noaman *et al.*,1996;El-Hady *et al.*,1998;El-Kholy and El-Bawab 1998 and Ghulan and Al-Joloud1998). El-Habbal *et al.* (1995) found that coating the grains of wheat with coatengeen mixture prepared from three individual chelating micronutrients each contained 12% of Fe, Mn and Zn obtained the highest grain and straw yields compared to soil fertilizer or foliar application. Anton *et al.* (1999) found that, coating method of grains of barley with micronutrients mixture (Fe, Mn and Zn) increased significantly spike length, grain weight/spike, 1000-grain weight as well as grain, straw and biological yields/fad. and had no significant effect on harvest index. Grain and straw yields of barley were increased significantly with application of Fe and Zn (Madlain *et al.*, 2002) or Zn (Mahmoud *et. al.*, 1987). Kandel (2003) obtained that plant height and dry weight of barley were increased significantly with addition of Zn and Cu as a foliar with rate 0.2-0.6% after 50 days from planting. Bassyouny (2004) found that increasing of dry matter of barley with addition Fe, Mn, Zn, and Cu with rate 5 ppm as a form EDTA with S. Therefore, the present investigation was planned to find out the influence of nitrogen fertilizer levels and micronutrients in mixture on yield and yield components of five barley cultivars.

MATERIALS AND METHODS

Two field experiments were carried out in the Experimental Farm, El-Khattara region, Faculty of Agriculture, Zagazig University, Sharkia Governorate, Egypt during two winter successive seasons (2002/2003 - 2003/2004). The experiment aimed to study the effect of two nitrogen fertilizer levels and micronutrient on yield attributes and yield of five barley cultivars.

The experimental field soil was sandy in texture, had an average pH value of 7.6 ;0.47organic matter and had 10.4, 2.6 and 129 ppm available N, P and K, respectively (averaged over of the two seasons for the upper 30 cm of soil depth). Each experiment included 20 treatments which were the combination of five barley cultivars (Giza123, Giza124, Giza125, Giza126 and Giza2000), two levels of nitrogen fertilization (35 and 70kg N/ faddan) and two levels of Coatengeen (micronutrients mixture of Fe, Mn and Zn)

A split-split plot design with three replicates was followed, cultivars were assigned to the main plots, whereas nitrogen fertilizer levels and Coatengeen were allocated in the 1st and 2nd sub plots, respectively. The area of plot was 4.0m² (2.0m. in length and 2.0m. in width) included 10 rows, 20 cm apart. Seeds (400 grains /m²) were hand drilled on November 30th and 10th in the first and second seasons, respectively .after Fallow in both seasons. Phosphorous fertilizer was applied during soil preparation in the form of calcium super phosphate (15.5% P_2O_5) with 31.0 kg P_2O_5/faddan, normal cultural practices of barley were applied properly as recommended for the region.

The studied five barley cultivars *(Hordium vulgare* L.) used were: 1-Giza123 2-Giza124 3-Giza125 4-Giza126 5- Giza2000. Nitrogen fertilizer levels were 35 kg N and 70 kg N/ fad., whereas Coatengeen treatments were untreated and treated.

Nitrogen in form of ammonium sulfate (20.5% N) were supplied in seven equal doses at 10, 20, 30, 40, 50, 60 and 70 days after sowing. Coatengeen treatments used at 0.3g /kg grains for each of zinc, iron and manganese were applied, such micronutrients were treated in chelated form before sowing. Coatengeen, is commercially produced by General Organization for Agricultural Equalization Fund (G. O. A. E. F.), Ministry of Agriculture, Egypt.

Harvest was made during the first week of May in the first season and in the last week of April in the second one, sample of ten guarded plants were taken from each plot to measure: (1) height of barley plant (from soil surface up to spike tip).Ten spikes were randomly selected from each treatment to measure: (2)Spike length (cm). (3) Number of spikelets/spike. (4) Number of grains / spike. (5) Grain weight / spike (g). (6) Grain weight / spikelet (mg). (7)Thousand grains weight (g).The inner seven rows of each sub-sub plot by a long of 1.5 m (2.10 m^2) were harvested to determine: (8) Grain yield (kg/ fad.). (9) Straw yield (ton/ fad.). (10)Above ground biomass yield (ton/ fad.). (11) Harvest index = Economical yield/Biological yield. (12) Crop index = Grain yield / straw yield.

Statistical analysis of each experiment was performed as the methods outlined by Steel and Torrie (1980). Significancy of differences between the various means of different characters under study were compared with the help of Duncan's multiple range test (1955). In the interaction tables, capital and small letters were used for the comparison among row and columns means, respectively.

RESULTS AND DISCUSSION

A. Plant Height (cm), Spike Length (cm) and Number of Spikelets/spike

A.1. Cultivar differences As shown in Table1 significant differences could be detected among the five barley cultivars regarding plant height, spike length and number of spikelets/spike. Since, Giza124 cultivar followed by Giza2000 produced the taller plants and spikes, whereas, Giza126 cultivar one produced the highest number of spikelets/spike compared with other cultivars otherwise Giza123 cultivar produced lowest values. The differences in plant height, spike length and number of spikelets/spike among the evaluated five barley cultivars might be attributed to the genetically variations. Similar observations were found by Noaman *et al.* (1996), Allam (1997), El-Bawab (1998) and El-Hadi *et al.* (1998).

A.2. Nitrogen level effect Regarding the influence of nitrogen fertilization the results revealed highly significant differences through the seasons and the combined analysis. Meanwhile, raising nitrogen fertilizer level from 35 to 70 kg N/fad, increased plant height, spike length and number of spikelets/spike. As in the combined analysis, increasing N levels from 35 to 70 kg N/fad. increased plant height, spike length and number of spikelets/spike by

Table 1: Plant height (cm), spike length (cm) and number of spikelets/spike of barley as affected by cultivars, nitrogen fertilizer levels and micronutrients mixture(Fe+Mn+Zn) during two successive seasons and their combined

Main effects and interactions	Plant height(cm)			Spike length(cm)			Number of spikelets/spike		
	2002/2003	2003/2004	Comb.	2002/2003	2003/2004	Comb.	2002/2003	2003/2004	Comb.
Cultivars (C)									
Giza123	86.18c	83.77c	84.97c	7.63b	7.41b	7.52b	48.75c	44.45c	46.60d
Giza124	89.58b	91.98a	90.78a	8.93a	8.10a	8.52a	53.00b	46.54b	49.77b
Giza125	89.43b	86.18b	87.80a	7.66b	8.19a	7.92b	52.04b	44.30c	48.17c
Giza126	86.33c	84.95bc	85.64c	7.61b	7.81ab	7.61b	57.10a	52.76a	54.93a
Giza2000	92.15a	91.15a	91.65a	8.71a	8.20a	8.46a	51.60b	47.75b	49.67bc
F-test	**	**	**	**	*	**	**	**	**
L.S.D$_{05}$	2.000	1.319	1.206	0.564	0.466	0.432	2.560	1.631	1.512
Nitrogen fertilization (N)									
35 kg N/fad.	86.70	84.98	85.84	7.67	7.48	7.57	48.85	45.16	47.01
70 kg N/fad.	90.77	90.23	90.50	8.55	8.41	8.48	56.15	49.16	52.66
F-test	**	**	**	**	**	**	**	**	**
L.S.D$_{05}$	1.109	1.075	0.864	0.318	0.298	0.185	1.712	0.971	0.878
Micronutrients mixture (M)									
Untreated	88.46	85.67	87.07	8.02	7.51	7.76	51.44	46.44	48.94
Treated	89.01	89.54	89.27	8.20	8.38	8.29	53.56	47.88	50.72
F-test	NS	*	**	NS	*	NS	NS	**	*
L.S.D$_{05}$	----	2.840	0.748	----	0.490	----	----	0.337	1.12
Interactions									
C.N.	NS	NS	NS	*	NS	NS	NS	**	*
C.M.	**	**	**	NS	NS	NS	**	NS	**
N.M.	NS	NS	NS	NS	NS	NS	NS	NS	NS

NS, * and **: indicate Not significant, significant and highly significant at 0.05 and 0.01 level, respectively.

about 5.42%,12.02% and 12.01%. Such increment in plant height, spike length and number of spikelets/spike accompanied with increasing N level might be attributed to the stimulation of internodes elongation and enhancing growth. The positive role of nitrogen in plant height, spike length and number of spikelets/spike of barley is extensively reported in the literature where many authors got significant increase in that traits due to addition of nitrogen up to 60kg N/fad.. These results are similar with those obtained by Glelah *et al.* (1992), Allam (1997), El-Hadi *et al.* (1998), El-Kholy and El-Bawab (1998) and Ghulan and Al-Joloud (1998).

A.3.Micronutrients effect Treated with micronutrients reflected by a significant increase in each of plant height, spike length and number of spikelets/ spike of barley in the combined. but the differences between the two levels of micronutrients did not reach the level of significance for the spike length in the combined. Treated plants were taller by 2.52% and increase in number of spikelets/spike by 3.63% than the untreated ones (combined data). Mahmoud *et al.* (1987), Anton *et al.* (1999), Madlain *et al.* (2002), Kandel (2003) and Bassyouny (2004), came to similar results.

A.4. Interaction effect As shown in the combined analysis, the interactions effects between cultivars and micronutrients on both plant height and number of spikelets/spike and cultivars with N fertilization on no. of spikelets/spike were significant. But, as seen in Figures 1-6, no additional information could be obtained other than the main effects. Therefore, interaction tables are not discussed.

B. Number of Grains/Spike and Grain Weight/Spike (gm)

B.1. Cultivar differences It was evident, from Table2, that Giza125 or Giza126 cultivars produced the highest values for number of grains/spike and grain weight/ spike. The differences in number of grains/spike and grain weight/spike (gm) among the evaluated barley cultivars might be attributed to the genetically variations. Similar results were reported by Noaman *et al.* (1996), Allam (1997), El-Bawab (1998) and El-Hadi *et al.* (1998).

B.2.Nitrogen level effect Regarding the influence of nitrogen fertilization, the results revealed highly significant differences through the seasons

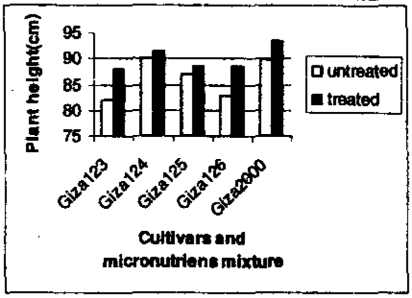

Figure 1: plant height of barley as affected by cultivars and micronutrients mixture (combined)

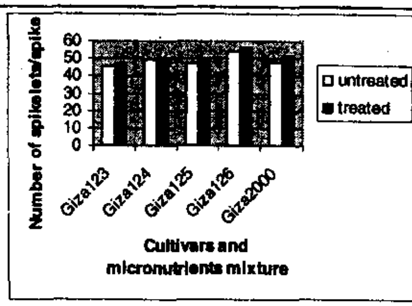

Figure 2: Number of spikelets/ spike of barley as affected by cultivars and micronutrients mixture (combined)

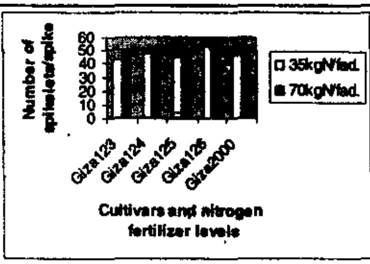

Figure 3: Number of spikelets/ spike of barley as affected by cultivars and nitrogen fertilizer levels (combined)

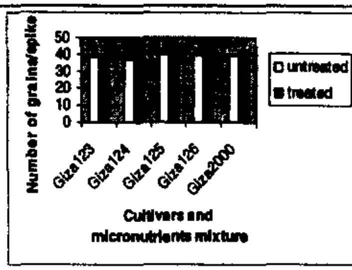

Figure 4: Number of grains/ spike of barley as affected by cultivars and micronutrients mixture (combined)

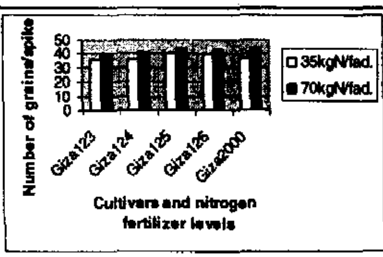

Figure 5: Number of grains/ spike of barley as affected by cultivars and micronutrients mixture (combined)

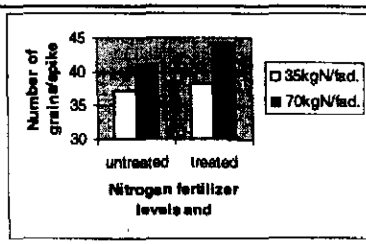

Figure 6: Number of grains/ spike of barley as affected by nitrogen fertilizer levels and micronutrients mixture (combined)

Table 2: Number of grains/spike and grain weight spike (gm) of barley as affected by cultivars, nitrogen fertilizer levels and micronutrients mixture (Fe+Mn+Zn) during two successive seasons and their combined

Main effects and interactions	Number of grains/spike			Grain weight spike (gm)		
	2002/2003	2003/2004	Comb.	2002/2003	2003/2004	Comb.
Cultivars (C)						
Giza123	39.08c	37.67b	38.37c	1.707c	1.376d	1.541c
Giza124	39.85c	37.80b	38.82c	1.849b	1.544c	1.696b
Giza125	44.11a	40.07a	42.09a	2.182a	1.888a	2.035a
Giza126	43.61a	39.05ab	41.33ab	2.160a	1.746ab	1.952a
Giza2000	42.18b	38.56ab	4037b	1.826b	1.600bc	1.713b
F-test	**	*	**	**	**	**
L.S.D$_{05}$	1.208	1.12	1.165	0.050	0.154	0.082
Nitrogen fertilization (N)						
35 kg N/fad.	38.91	36.60	37.76	1.776	1.345	1.560
70 kg N/fad.	44.62	40.66	42.64	2.114	1.916	2.015
F-test	**	**	**	**	**	**
L.S.D$_{05}$	1.130	0.957	0.774	0.036	0.165	0.087
Micronutrients mixture (M)						
Untreated	40.08	38.11	39.10	1.889	1.595	1.742
Treated	43.45	39.16	41.30	2.001	1.667	1.833
F-test	**	NS	*	*	NS	*
L.S.D$_{05}$	1.148	-----	1.170	0.087	-----	0.042
Interactions						
C.N.	NS	*	*	**	NS	*
C.M.	**	NS	**	**	NS	**
N.M.	*	*	**	**	NS	NS

NS, * and **: indicate Not significant, significant and highly significant at 0.05 and 0.01 level, respectively.

and the combined. Meanwhile, raising nitrogen fertilizer level from 35 to 70 kg N /fad, increased number of grains/spike and grain weight/spike (gm). Since, as in the combined analysis, the relative increase was 12.9% for no. of grains/spike and 29.1%for grain weight/spike, respectively. Such increments might be attributed to the positive role of nitrogen in increasing photosynthesis activity which cause more flower fertility and setting per spike, and stimulation the plant capacity in building more metabolites which translocate to develop grains to increase grain weight. Several investigators, came to the same conclusion; included Galelh *et al.* (1992), El-Sayed *et al.* (1996), Noaman *et al.* (1996), Allam (1997), El-Hadi *et al.* (1998), El-Kholy and El-Bawab (1998) and Ghulan and Al-Joloud (1998).

B.3.Micronutrients effect Treated barly plants with micronutrients reflected by a significant increase in each of number of grains/spike and grain weight/spike (gm) in the combined analysis. by 5.62% and 5.22% in the same order than the untreated ones. Mahmoud *et al.* (1987), Anton *et al.* (1999), Madlain *et al.* (2002), Kandel (2003) and Bassyouny (2004), came to similar results.

B.4.Interaction effect As shown in the combined analysis, the interactions effects between cultivars and micronutrients on both no. of grains/spike and grain weight/spike and cultivars with N fertilization on both no. of grains/ spike and grain weight/spike were significant. But, no additional information could be obtained other than the main effects. Therefore, interaction tables are not discussed.

C. 1000-Grain Weight (gm), Grain Yield (kg/fad.) and Straw Yield (ton/fad.)

C.1.Cultivar differences Data given in Table 3 clearly indicate that Giza125 cv. produced the heaviest grains expressed as 1000-grain weight, while, Giza125 or 126 cultivars produced the highest grain yield (kg/fad.) and straw yield (ton/fad.) The differences in 1000-grain weight (gm), grain yield (kg/fad.) and straw yield (ton/fad.) among the evaluated five barley cultivars might be attributed to the genetically variations. Similar observations were found by others (Noaman *et al.*, 1996, Allam1997, El-Bawab 1998 and El-Hadi *et al.*, 1998).

C.2.Nitrogen level effect Regarding the influence of nitrogen fertilization, the results

Table 3: 1000-grain weight(gm), grain yield (kg/fad.) and stover yield (ton/fad.) of barley as affected by cultivars, nitrogen fertilizer levels and micronutrients mixture (Fe +Mn +Zn)during two successive seasons and their combined

Main effects and interactions	1000-grain weight(gm)			Grain yield (kg/fad.)			Straw yield (ton/fad.)		
	2002/2003	2003/2004	Comb.	2002/2003	2003/2004	Comb.	2002/2003	2003/2004	Comb.
Cultivars (C)									
Giza123	41.011d	36.480d	38.743d	1556.50e	1631.70c	1594.00c	2.541c	2.445d	2.493c
Giza124	45.134c	40.372cd	42.750c	1616.50d	1642.50b	1629.50b	2.617b	2.486d	2.552c
Giza125	52.396a	46.845a	49.660a	1685.50a	1711.60a	1698.50a	2.927a	2.905b	2.916a
Giza126	48.134b	44.650ab	46.389b	1662.00b	1673.80b	1684.50a	2.882a	3.031a	2.956a
Giza2000	45.318c	41.45bc	43.383c	1639.63c	1644.50c	1642.00b	2.660b	2.730c	2.725b
F-test	**	**	**	**	**	**	**	**	**
L.S.D$_{05}$	0.795	4.025	2.124	13.159	24.318	25.812	0.071	0.118	0.078
Nitrogen fertilization (N)									
35 kg N/fad.	44.612	36.784	40.713	1579.70	1624.60	1608.70	2.657	2.631	2.651
70 kg N/fad.	48.185	47.135	47.675	1684.30	1697.10	1690.70	2.793	2.807	2.806
F-test	**	**	**	**	**	**	**	**	**
L.S.D$_{05}$	0.511	4.465	2.280	7.717	11.155	16.749	0.048	0.084	0.060
Micronutrients mixture (M)									
Untreated	45.826	41.768	43.795	1606.80	1632.10	1619.40	2.695	2.706	2.701
Treated	46.971	42.151	44.575	1657.30	1689.60	1680.00	2.756	2.732	2.749
F-test	**	NS	NS	**	**	**	*	NS	NS
L.S.D$_{05}$	0.308	-----	-----	12.255	28.687	18.709	0.039	----	----
Interactions									
C.N.	**	NS	*	*	**	*	NS	NS	NS
C.M.	**	NS	*	**	**	*	NS	**	**
N.M.	**	NS	NS	**	**	**	NS	NS	NS

NS, * and **: indicate Not significant, significant and highly significant at 0.05 and 0.01 level, respectively.

revealed highly significant differences through the seasons and the combined analysis. Meanwhile, raising nitrogen fertilizer level from 35 to 70 kg N/fad, increased1000-grain weight (gm), grain yield (kg/fad.) and straw yield (ton/fad.). As shown in the combined analysis the increment produced a significant increase in1000-grain weight, grain yield (kg/fad.), and straw yield (ton/fad.) by about 17.10%, 5.09% and 5.84%, respectively. The increased grain yield (kg/fad.) as a result of N application up to 70 kg N/fad. can be explained that N fertilization had favorable effect on yield components as seen in spike length and no. of spikelets/spike (Table 1), no. of grains/spike and grain weight/ spike (Table2)and thousand grain weight (Table3). Similar trend was also found by Glelah *et al.* (1992), Ryan *et al.* (1992), Noaman *et al.* (1996), Allam (1997), El-Hadi *et al.* (1998) El-Kholy and El-Bawab (1998) and Ghulan and Al-Joloud (1998).

C.3. Micronutrients effect It is of interest to note that GY (kg/ fad.) was greater in treated plants than untreated ones. but the differences did not reach the level of significance for both 1000-grain weight (gm) and straw yield (ton/fad.) The increase percentage was 3.74% for the grain yield (kg/fad.) in the combined, These results are in accordance with those reported by others (Mahmoud *et al.*, 1987, El-Habbal *et al.*, 1995, Anton *et al.*, 1999, Madlain *et al.*, 2002, Kandel 2003 and Bassyouny 2004).

C.4.Interaction effect Regarding interactions effects of cultivars with N fertilization on yield determinations, again, it can be concluded that the higher dose of 70 kg N/fad. produced the higher values of 1000-grain weight (g)as well as grain yield GY (kg/fad.) compared to the lower level of 35 kg N/fad.(Tables 3-a and 3-c, respectively illustrated graphically in Figures 7-12), this was true for all cultivars. On the other side, it was found that Giza123 cv. gave the lightest weight of grain (g) as well as GY (kg/fad.) when it was fertilized with the 1st dose of 35 kg N/fad. But, under 70 kg N level, Giza125 cv. surpassed the others in GY/fad.

With respect to interactions effects of cultivars with micronutrients on those two characters, the results clearly indicated that plants received a mixture of Fe, Mn and Zn micro-

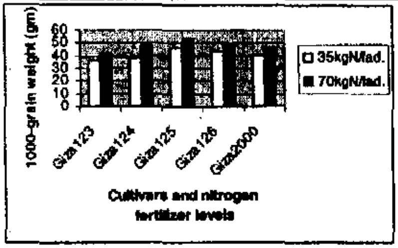

Figure 7: 1000- grain weight(gm) of barley as affected by cultivars and nitrogen fertilizer levels (combined)

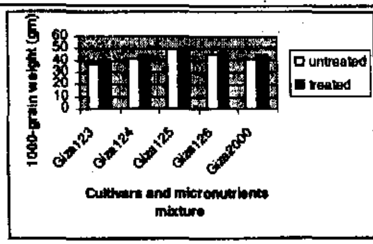

Figure 8:1000-grain weight (gm) of barley as affected by cultivars and micronutrients mixture (combined).

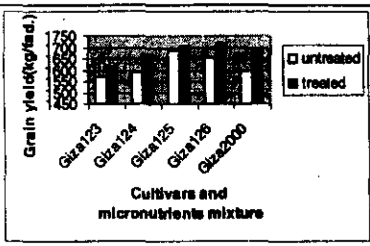

Figure 9: Grain yield (kg/fad.) of barley as affected by cultivars and micronutrients mixture (combined)

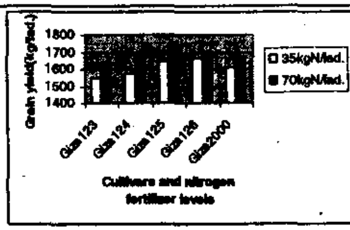

Figure10: Grain yield (kg/fad.) of barley as affected by cultivars and nitrogen fertilizer levels (combined)

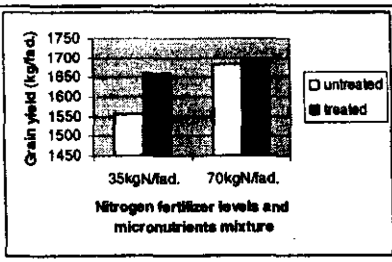

Figure 11: Grain yield(kg/fad.) of barley as affected by N- levels and micronutrients mixture (combined)

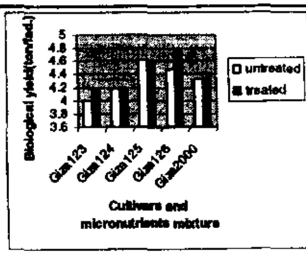

Figure 12: Above-ground biomass yield (ton/fad.) of barley as affected by cultivars and micronutrients mixture

elements surpassed those untreated ones (Table3-b), this was clear for all cultivars. On the other direction, Giza125 cv. produced the heaviest grains (g) whether it was treated or untreated with micro-nutrients. Whereas, plants of Giza126 cv. treated with Coatengeen gave the highest GY(kg/fad.).

It is known that micro-nutrients plays an important role in enzyme reactions. For example, as reported in literature, carbonic anhydrase CA contains a single Zn atom which catalyzes the hydration of CO_2, so there is direct relationship between CA activity and photosynthetic CO_2 assimilation. The activity is closely related the Zn content.

Table3-a: 1000-grain weight (gm) of barley as affected by the interaction between cultivars and nitrogen fertilizer levels (combined)

Cultivars and nitrogen fertilizer levels	Giza123	Giza124	Giza125	Giza126	Giza2000
	C	C	A	B	BC
35kgN/faddan.	35.80b	37.28b	46.54b	43.28b	40.64b
	C	AB	A	AB	BC
70kgN/faddan.	41.68a	48.21a	52.77a	49.49a	46.12a

Table3-b: 1000-grain weight (gm) and grain yield (kg/fad.) as affected by the interaction between cultivars and micronutrients mixture (combined)

Cultivars and micronutrients	Giza123	Giza124	Giza125	Giza126	Giza2000
			1000- Grain weight (gm)		
	D	C	A	B	C
Untreated	37.21b	41.37b	49.41a	45.90a	42.01b
	D	C	A	B	C
Treated	40.26a	44.12a	49.90a	46.87a	44.75a
			Grain yield (kg/fad.)		
	D	C	A	B	C
Untreated	1568.68b	1589.75b	1687.94a	1653.28b	1597.71b
	D	C	B	A	C
Treated	1619.5a	1669.33a	1709.2a	1715.88a	1686.41a

Table3-c: Grain yield (kg/fad.) of barley as affected by the interaction between cultivars and nitrogen fertilizer levels (combined)

Cultivars and nitrogen fertilizer levels	Giza123	Giza124	Giza125	Giza126	Giza2000
	D	C	AB	A	B
35kgN/faddan.	1550.91b	1573.61b	1643.03b	1664.53b	1611.86b
	C	B	A	B	BC
70kgN/faddan.	1637.26a	1685.46a	1754.10a	1704.63a	1672.26a

D. Above- Ground Biomass Yield (ton/fad.), Harvest Index and Crop Index

D.1. Cultivar differences It was evident, from Table4, that Giza125 as well as Giza126 cultivar produced the highest biomass yield (ton/fad.) Significant varietals differences were reported in the literature regarding that traits by (Noaman *et al.*, 1996, Allam1997, El-Bawab 1998 and El-Hadi *et al.*, 1998). Meanwhile, Giza123 or 124 cultivars produced the highest values regarding harvest index and crop index. The differences in biological yield, harvest index and crop index among the evaluated five barley cultivars might be attributed to the genetically variations.

D.2. Nitrogen level effect Results revealed highly significant differences through the two seasons and the combined only on biomass yield, harvest index and crop index Meantime, raising nitrogen fertilizer level from 35 to 70 kg N/fad, increased biological yield. But, the differences did not reach the level of significance regarding harvest as well as crop index through the two seasons and the combined. The increment of N produced a significant increase in biological yield (ton/fad.) about (5.74%) in the combined. Such increment in biological yield (ton/fad.) accompanied with increasing N level might be attributed to the positive role of nitrogen with increasing each of grain yield components in the combined (Tables 1, 2 and3). Several investigators came to the same conclusion included Glelah *et al.* (1992), Ryan *et al.* (1992), Authman, Fatma (1994), El-Sayed

Table 4: Above- ground biomass yield (ton/fad.), harvest index and crop index of barley as affected by cultivars, nitrogen fertilizer levels and micronutrients mixture (Fe+Mn+Zn) during two successive seasons and their combined

Main effects and interactions	Above- ground biomass yield (ton/fad.)			Harvest index			Crop index		
	2002/2003	2003/2004	Comb.	2002/2003	2003/2004	Comb.	2002/2003	2003/2004	Comb.
Cultivars (C)									
Giza123	4.098c	4.076c	4.087d	37.975a	40.171a	39.037a	61.25a	67.38a	64.33a
Giza124	4.234b	4.128c	4.181c	38.173a	39.807a	38.972a	61.79a	66.30a	64.04a
Giza125	4.612a	4.616a	4.614a	36.550b	37.238b	36.795c	57.59b	58.97b	58.28c
Giza126	4.544a	4.704a	4.624a	36.582b	35.680c	36.111c	57.73b	55.63c	56.67c
Giza2000	4.292b	4.375b	4.333b	38.195a	37.630b	37.900b	61.84a	60.49b	61.16b
F-test	**	**	**	**	**	**	**	**	**
$L.S.D_{05}$	0.078	0.075	0.111	0.635	1.185	0.707	1.636	3.251	1.949
Nitrogen fertilization (N)									
35 kg N/fad.	4.237	4.256	4.246	37.322	38.358	37.810	59.59	62.53	61.06
70 kg N/fad.	4.475	4.504	4.490	37.668	37.853	37.717	60.49	60.98	60.73
F-test	**	**	**	NS	NS	NS	NS	NS	NS
$L.S.D_{05}$	0.051	0.077	0.055	-----	-----	-----	-----	-----	-----
Micronutrients mixture (M)									
Untreated	4.302	4.338	4.320	37.363	37.838	37.543	59.69	60.95	60.332
Treated	4.410	4.422	4.416	37.627	38.372	37.983	60.39	62.55	61.468
F-test	*	NS	**	NS	**	**	NS	*	*
$L.S.D_{05}$	0.046	-----	0.025	-----	0.132	0.155	-----	0.809	0.631
Interactions									
C.N.	NS	*	*	NS	*	NS	NS	*	*
C.M.	NS	**	**	**	**	**	*	**	**
N.M.	*	**	**	NS	NS	NS	NS	NS	NS

NS, * and ** :indicate Not significant, significant and highly significant at 0.05 and 0.01 level, respectively.

et al. (1996), Noaman *et al.* (1996), Allam (1997), El-Hadi *et al.* (1998) El-Kholy and El-Bawab (1998) and Ghulan and Al-Joloud (1998).

D.3. Micronutrients effect The combined analysis indicated that addition of Coatengeen reflected by a significant increase in biological yield (ton/fad.), harvest index and crop index This increase percentage was 2.22 %,1.17% and 1.88% for the biological yield (ton/fad.), harvest index and crop index, respectively. These results are in accordance with those reported by other regarding aforementioned traits Mahmoud *et al.* (1987), Anton *et al.* (1999), Madlain *et al.* (2002), Kandel (2003) and Bassyouny (2004).

Yield Analysis

1. The correlation coefficient The inter relationships among grain yield of barley and its attributes as affected by the studied factors as simple correlation are shown in Table (5). It is evident that correlation between grain yield and all yield attributing characters was positive and not significant [plant height (0.1965), spike length (0.1459) and positive and highly significant regarding number of spikelets per spike (0.4670), number of grains/ spike (0.5967) grain weight/ spike (0.6162) and 1000-grain weight (0.6677)].

Table 5: Simple correlation coefficient among barley grain yield/faddan and some of its attributes (combined)

Characters	2	3	4	5	6	7
1. Grain yield (kg/faddan)						
2. Plant height (cm)	0.1965^{NS}	0.1459^{NS}	0.4670^{**}	0.5967^{**}	0.6162^{**}	0.6677^{**}
3. Spike length (cm)		0.6668^{**}	0.1810^{NS}	0.1531^{NS}	0.4263^{**}	0.4042^{**}
4. Number of spikelets/spike			0.3336^{**}	0.2488^{NS}	0.3332^{**}	0.3308^{**}
5. Number of grains /spike				0.6191^{**}	0.5604^{**}	0.5165^{**}
6. Grain weight/spike (g)					0.6191^{**}	0.5371^{**}
7. 1000-grain weight (g)						0.7721^{**}

2.Multiple linear regression analysis Data presented in Table 6 show that, the partial regression coefficients found to be highly significant for all the studied variables, reinforcing the importance role in predicting barley grain yield. It can be noticed that, the relative contribution (R^2%) for yield variables explained that, 53.59% of the total variation in grain yield could be linearly related to variations in all variables and 46.41% could be due to residual. regression coefficient and standard error. Examining this table indicate that the combined effects of number of spikelets/spike, number of grains/spike, grain weight/spike and 1000-grain weight in the manner described by regression equation, contribute significantly to the variation in yield number of spikelets/spike (R^2= 21.81%) number of grains/ spike (R^2= 59.67%), grain weight/spike (R^2 = 61.62%) and 1000- grain weight (R^2=66.77%) were the most variables contributing toward grain yield/fad. The best prediction equation for grain yield Y is formulated as follows = 401.903 + $14.903X_1 + 6.128X_2 + - 400.043X_3 + 5.896X_4$.

Where: X_1=number of spiklets/spike, X_2=number of grains/ spike, X_3= grain weight/spike and X_4=1000-grain weight.

Table 6: Relative contribution (R^2), partial regression coefficient and standard error for four characters in predicting grain yield on barley (combined of both seasons).

Variables	Partial regression coefficient	Standard error	Relative contribution (R^2%)
Number of spikelets/spike	14.903	1.908	0.2181
Number of grains/spike	6.128	2.120	0.5967
Grain weight/spike	-400.043	22.429	0.6162
1000-grain weight	5.896	1.200	0.6677

Y- intercept = 401.903 **Multiple R^2 = 0.5395.**

REFERENCES

Allam, A.Y. 1997. Response of some barley cultivars to nitrogen fertilization in sandy calcareous soil. Assiut J.Agric.Sci.28(1): 89-98.

Anton, N.A., A. Sh. Abdel-Nour and A. El-set. 1999. Response of barley to ascorbic acids and micronutrients mixture under sandy soil conditions. Zagazig, J. Agric. Res. 26(6): 1553-1563.

Authman, Fatma, A.A. 1994. Soil fertility management for production of some field crops. Ph.D.Thesis, Zagazig Univ., Fac. Agric., Egypt.

Bassyouny, E.A. 2004. Response of barley cultivar growth on calcareous soil to fertilization with chelated micronutrients combined with sulfur organic manures. Egypt. J. Appl. Sci. 19(1): 22-29.

Duncan, B.D. 1955. Multiple range and multiple F test. Biometrics, 11: 1-42.

El-Bawab, A.M.O. 1998. Yield stability of some newly released barley cultivars in Egypt. Proc. 8th Conf. Agron, Suez Canal Univ. ,Egypt.

El-Habbal, M.S., A.O. Osman and M.B. Madiha. 1995. Effect of some micronutrients fertilizer and transplanting on wheat productivity in newly reclaimed saline soil. Annals,Agric. Ain Shams Univ. Cairo, 40 (1): 145-152.

El-Hadi, M.H., A.T. El-Kassaby, A.E. El-Sharif and K.A. Amer. 1998. Yield of barley as affected by different sources and levels of nitrogen fertilization under the environmental conditions of newly reclaimed soils at northern Delta of Egypt. Proc. 8th Conf. Agron,Suez Canal Univ. Egypt.

El-Kholy, M.A. and A.M.O. El-Bawab. 1998. Response of some barley cultivars to nitrogen fertilization and Stimophol as foliar application. Proc. 8th Conf. Agron,Suez Canal Univ. Egypt.

El-Sayed, A.A., W. Kadry, M.M. Noaman and M. Megahed. 1996. Response of barley N,P and K under sprinkler irrigation in poor sandy soil. Proc. 7th Conf. of Agron. Mansoura Univ. Egypt, 31-40.

Ghulan, H. and A.A. Al-Joloud. 1998. Effect of nitrogen and irrigation on yield components and water use efficiency of barley in Soudi Arabia, Agr. Water Management. 36 (1) :55-70.

Glelah, A.A., E.E. Shalaby and M.A. Mourad. 1992. Effect of micronutrients and nitrogen fertilizer on barley growth, yield and yield components. J.Agric. Res.Tanta Univ. 18(3):445-459.

Kandil, N.H. 2003. Effect of soil amendments and micronutrients fertilization on barley plant growth on calcareous soil and its chemical composition. Egypt. J. appl. Sci. 18 (4B): 712-726.

Madlain, M. Salib, R.N. Zaki and M.A. Negm. 2002. a comparative study on the significance of applied farmyard manure and other affording materials for barley growth on saline soil. Zagazig, J.Agric. Res. 29 (4): 185-198.

Mahmoud, M.H., I.M. Abdel-Aziz, A. El-Sayed and M.A. Ashoub. 1987. Effect of soil and foliar application of zinc on yield components and mineral content of two varieties of barley in different soil. Annals Agric. Sci. Ain Shams Univ. Cairo, 32 (1): 199-213.

Noaman, M.M., M. Abd El-Hamid and M.A. Salem. 1996. Effect of nitrogen and sowing methods on barley productivity in new reclaimed lands. Assiut, J.Agric. Sci., 27(2): 197-208.

Ryan, J., M. Mergoum, M. El-Gharous and J.P. Shroyer. 1992. Nitrogen fertilization and seeding rate of barley at diverse dry land. Moroccun sites. Raschis 11 (1-2): 24-29.

Steel, R.G.D. and J.H. Torrie. 1980. Principles and Procedures of Statistics .A biometrical Approach 2nd Ed. Mac Gaw Hill book company, New York .

تأثير التسميد بالنيتروجين و العناصر الصغرى على محصول بعض أصناف الشعير المنزرع تحت ظروف الأراضى الرملية

اسماعيل محمد عبد الحميد – سلوى محمد اليمانى إبراهيم الشرملسى

قسم المحاصيل – كلية الزراعة – جامعة الزقازيق – مصر.

اقيمت تجربتان حقليتان خلال موسمى ٢٠٠٢/٢٠٠٣ و٢٠٠٣/٢٠٠٤ بالمزرعة التجريبية بكلية الزراعة- جامعة الزقازيق بمنطقة الخطارة - بمحافظة الشرقية، لدراسةتأثير مستويين من السماد النيتروجينى (٣٥ ، ٧٠ كجم ن/فدان) و مخلوط العناصر الصغرى الكوتنجين بمعدلين (معامل وغير معامل) على المحصول ومساهماته لخمسة أصناف من الشعيرالسداسى(جيزة ١٢٣ ،جيزة ١٢٤ ،جيزة ١٢٥ ،جيزة ١٢٦ وجيزة ٢٠٠٠).

ويمكن تلخيص اهم النتائج التى تم التحصل عليهاعلى النحو التالى:

١-اختلفت اصناف الشعير معنويا فى جميع الصفات تحت الدراسة حيث تفوق الصنفان جيزة ١٢٤ وجيزة ٢٠٠٠ فى ارتفاع النبات و طول السنبلة بينما الصنفان جيزة ١٢٥ او جيزة ١٢٦ سجلوا أعلى القيم لصفات عدد السنيبلات بالسنبلة، عدد حبوب السنبلة، وزن حبوب السنبلة، محصول الحبوب (اردب للفدان) محصول القش والمحصول البيولوجى(طن للفدان) أما الصنف جيزة ١٢٦ فقد أعطى أعلى القيم لوزن الألف حبة،بينما الصنف جيزة ١٢٣ سجل اقل القيم لجميع الصفات تحت الدراسة فيما عدا صفتى دليل الحصاد ودليل المحصول خلال موسمى الدراسة و التحليل المشترك.

٢- أدت اضافة السماد النيتروجينى حتى٧٠ كجم للفدان الى زيادة معنويةلجميع الصفات السابق ذكرها. خلال موسمى الدراسة و التحليل المشترك.

٣-أدت المعاملة بمخلوط العناصر الصغرى (الكوتنجين) الى زيادة معنوية لكل من ارتفاع النبات، عدد السنيبلات بالسنبلة، عدد حبوب السنبلة، وزن حبوب السنبلة، محصول الحبوب(بالكجم للفدان) و المحصول البيولوجى(طن للفدان) ودليل الحصاد ودليل المحصول خلال موسمى الدراسة و التحليل المشترك.

٤-أوضحت نتائج التحليل التجميعى للموسمين التاثير المعنوى لتداخل الفعل بين الاصناف ومستويات السماد النيتروجينى ومخلوط العناصر الصغرى على كل من ارتفاع النبات، عدد السنيبلات بالسنبلة ، وعدد حبوب السنبلة ، وزن الألف حبة، ومحصول الحبوب وتبين ان استخدام الصنف جيزة ١٢٥ او جيزة ١٢٦ وباضافة ٧٠ كجم نيتروجين للفدان والمعاملة بمخلوط العناصر الصغرى (الكوتنجين) هى افضل معاملة تم التوصل اليها (التحليل المشترك).

٥-أظهر محصول الحبوب/فدان ارتباط موجب ومعنوى مع كل من عدد السنيبلات بالسنبلة، عدد حبوب السنبلة، وزن حبوب السنبلة و وزن الألف حبة.